CONNECTICUT SITING COUNCIL

FINDINGS OF FACT

~FOR~

DOCKET NO. 370 – Consolidated proceeding pursuant to the Connecticut Energy Advisory Board (CEAB) Request for Proposal (RFP) process under C.G.S. §16a-7c. **Original application:** The Connecticut Light & Power Company application for Certificates of Environmental Compatibility and Public Need for the Connecticut Valley Electric Transmission Reliability Projects which consist of (1) The Connecticut portion of the Greater Springfield Reliability Project that traverses the municipalities of Bloomfield, East Granby, and Suffield, or potentially including an alternate portion that traverses the municipalities of Suffield and Enfield, terminating at the North Bloomfield Substation; and (2) the Manchester Substation to Meekville Junction Circuit Separation Project in Manchester, Connecticut. **Competing application**: NRG Energy, Inc. application pursuant to C.G.S. §16-50*l*(a)(3) for consideration of a 530 MW combined cycle generating plant in Meriden, Connecticut.

March 16, 2010

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Findings of Fact

I. INTRODUCTION

1. Pursuant to Connecticut General Statutes (CGS) §16-50g et seq., on October 20, 2008, The Connecticut Light and Power Company (CL&P) applied to the Connecticut Siting Council (Council) for Certificates of Environmental Compatibility and Public Need (Certificate) for the construction, operation and maintenance of the Connecticut portion of "The Connecticut Valley Electric Transmission Reliability Projects." These projects include the Greater Springfield Reliability Project (GSRP) and the Manchester to Meekville Junction Circuit Separation Project (MMP). The proposed CL&P projects were designated as Docket No. 370A. (CL&P 1, Vol. 1, p. ES-1)

2. Pursuant to CGS §16-50*l*(a)(3), on March 19, 2009, NRG Energy, Inc. (NRG) submitted an application to the Council for consideration of a 530 megawatt (MW) (nominal) combined cycle generating plant located off South Mountain Road in Meriden, Connecticut (the Meriden power facility) as a competing project to the GSRP/MMP proposed by CL&P in Docket No. 370A. The NRG proposal was assigned as Docket No. 370B. NRG proposed the Meriden power facility following review of the project by the Connecticut Energy Advisory Board (CEAB) pursuant to CGS § 16a-7c. (NRG 1, pp. 1, 12)

3. Pursuant to CGS §16a-7c, the Council designated the consolidated proceeding Docket No. 370. Docket No. 370 consists of Docket No. 370A and Docket No. 370B. (record)

4. The proposed GSRP involves the siting of facilities in both Connecticut and Massachusetts, which requires a decision by both state siting authorities. The Western Massachusetts Electric Company (WMECO) proposed the Massachusetts component of the GSRP to the Massachusetts Energy Facilities Siting Board (EFSB). The Massachusetts EFSB has jurisdiction over siting the Massachusetts portion of the proposed project. (CL&P 1, Vol., 1, pp. ES-18, ES-21)

5. CL&P and WMECO are wholly-owned subsidiary operating companies of Northeast Utilities (NU). The Northeast Utilities Service Company (NUSCO) is another wholly-owned subsidiary of NU that provides centralized and coordinated management and technical services to NU companies. (CL&P 1, Vol. 1, p. ES-1)

6. Parties and Intervenors to these proceedings include CL&P (the Applicant), NRG (the Competing Applicant), Connecticut Attorney General Richard Blumenthal, Town of East Granby, Town of Suffield, ISO New England Inc. (ISO-NE), Connecticut Office of Consumer Counsel (OCC), ICE Energy, Inc., Town of Enfield, City of Meriden, The United Illuminating Company (UI), the Connecticut Energy Advisory Board (CEAB), Connecticut Department of Transportation (CDOT), Farmington River Watershed Association, Citizens Against Overhead Power Line Construction (CAOPLC) and the Massachusetts Municipal Wholesale Electric Company (MMWEC). (Record)

7. Pursuant to CGS §16-50*l*(b), CL&P provided service and legal notice of the application. This included notice to municipalities along the route of the proposed project and alternative; municipalities within 2,500 feet of the proposed line; federal, state, local and regional agencies, and elected officials; published notice in The Hartford Courant and The Journal Inquirer on September 12, September 16, 2008, October 8 and October 10, 2008; and a separate "Notice of Proposed Construction of a High Voltage Electric Transmission Line" included in one or more monthly bills to CL&P customers within Bloomfield, East Granby, Enfield, Manchester and Suffield. (CL&P 1, October 20, 2008 filing of notice)

8. Pursuant to CGS §16-50*l*(e), on June 16, 2008, CL&P provided municipal consultation documents to the Chief Elected Official of the four towns that may potentially be affected by the proposed project, as well as the four towns located within 2,500 feet of the proposed project. The GSRP may traverse Bloomfield, East Granby, Suffield and Enfield. The proposed MMP would be located entirely within Manchester. Granby, Simsbury, Somers and South Windsor are within 2,500 feet of the proposed project routes. (CL&P 1, Vol. 1, Section II, p. 3; CL&P 2, CL&P Affidavits, October 28, 2008)

9. During the municipal consultation process three "open houses" were held in Connecticut including:
   - Tuesday, June 24, 2008 in Suffield
   - Wednesday, June 25, 2008 in East Granby
   - Thursday, June 26, 2008 in Enfield

   (CL&P 5, R. CSC-046)

10. Each open house consisted of four information stations. The first station provided visitors with project information, an explanation on how to participate in the siting process, and a Route Locator that allowed residents to find the transmission line route on Google Earth maps. The second station included information on the need for the GSRP/MMP due to electricity demand. The third station included photosimulations of the proposed structures, and information on the construction process. The fourth station included information on environmental management of the transmission line right-of-way (ROW); an electric and magnetic field (EMF) video; and specific information on how the project would affect existing easements on properties. (CL&P 5, R. CSC-046)

11. Pursuant to CGS §16-50*l*(b), CL&P provided notice to landowners abutting the North Bloomfield Substation in Bloomfield, Connecticut. Community organizations and water companies were also provided notice consistent with the Council's Application Guide for Terrestrial Electric Transmission Line Facilities. (CL&P 1, October 20, 2008 filing of notice)

12. In accordance with CGS §16-50*l*(b), NRG provided service and notice of its application. A copy of the application was sent to municipal officials of the City of Meriden, Town of Berlin, state and federal officials and agencies, and community organizations. Notice of the application was sent to the abutting landowner (the City of Meriden) and published in the Hartford Courant on March 18 and 19, 2009. (NRG 1, Tab D)

13. NRG did not consult with the City of Meriden and Town of Berlin 60 days prior to the filing of its application as specified in CGS §16-50*l*. NRG provided its application to the municipalities on March 19, 2009, the same day as filing its application with the Council. The City of Meriden waived its right for a municipal consultation. NRG met with Town of Berlin officials on April 20, 2009 to discuss the application. The Town of Berlin left it up to the Council to determine the completeness of the application. (Record)

14. Pursuant to General Statutes §16-50j (h), on April 28, 2009 and December 21, 2009, the following state agencies were requested to submit written comments regarding the proposed GSRP/MMP and the Meriden Power Facility: Department of Environmental Protection (DEP); Department of Agriculture (DOA); Department of Public Health (DPH); Council on Environmental Quality (CEQ); Department of Public Utility Control (DPUC); Office of Policy and Management (OPM); Department of Economic and Community Development (DECD); and CDOT. (Record)

15. On June 24, 2009, the CDOT submitted comments pertaining to Docket 370B. The DEP provided comments on Docket 370A on July 15, 2009. The DPH provided comments on Docket 370A on October 8, 2009. The United States Department of the Interior, National Park Service, submitted comments regarding Docket 370A dated July 28, 2009. (State Agency Comments, CDOT comments, dated June 24, 2009; DEP comments dated July 15, 2009; DPH comments dated October 8, 2009; Federal Agency Comments, U.S. Department of the Interior, National Park Service comments, dated July 28, 2009)

16. Pursuant to CGS §16-50m, the Council held public hearings for citizen comment on June 9, 2009 at the East Granby Community Center, East Granby; June 11, 2009 at the Suffield High School, Suffield; June 16, 2009 at the Lincoln Center, Manchester; and June 25, 2009 at Lincoln Middle School, Meriden. Each hearing commenced at approximately 6:30 p.m. (Transcript 1, June 9, 2009 [Tr. 1], p. 6; Transcript 2, June 11, 2009 [Tr. 2], p. 6; Transcript 3, June 16, 2009 [Tr. 3], p. 6; Transcript 4, June 25, 2009 [Tr. 4], p. 6)

17. The Council and its staff conducted public field reviews of the proposed Northern Route, the Southern Route Alternative, the MMP and the Meriden Power Plant. Each of the public field reviews were held on the same day as the public hearing in the associated municipality. (Council Hearing Notice)

18. The Council held public evidentiary hearings on July 21, 22, 28, and 29, 2009; August 13, 2009; September 2, 2009; October 21, 22, 27, and 28, 2009; and November 4, and 5, 2009 at Central Connecticut State University, Institute of Technology and Business Development, 185 Main Street, New Britain, Connecticut. The Council also held a limited joint evidentiary hearing with the Massachusetts Energy Facilities Siting Board (EFSB) on September 22, 2009 to hear evidence relating to the environmental impacts and relative costs and reliability concerns of the Northern Route and Massachusetts Southern Route Alternative, exclusive of need. The joint hearing with the Massachusetts EFSB was held at the Crowne Plaza Hotel, 1 Bright Meadow Boulevard, Enfield, Connecticut. (Transcript 5, July 21, 2009 [Tr. 5], p. 6; Transcript 6, July 22, 2009 [Tr. 6], p. 6; July 28, 2009 [Tr. 7], p. 6; Transcript 8, July 29, 2009 [Tr. 8], p. 6; Transcript 9, August 13, 2009 [Tr. 9], p. 6; Transcript 10, September 2, 2009 [Tr. 10], p. 6; Transcript 11, September 22, 2009 [Tr. 11], p. 8, 9; Transcript 12, October 21, 2009 [Tr. 12], p. 6; Transcript 13, October 22, 2009 [Tr. 13], p. 6; Transcript 14, October 27, 2009 [Tr. 14], p. 6; Transcript 15, October 28, 2009 [Tr. 15], p. 6; Transcript 16, November 4, 2009 [Tr. 16], p. 6; Transcript 17, November 5, 2009 [Tr. 17], p. 6)

II. PROPOSED ROUTE

GSRP

19. The CL&P and WMECO preferred option for the GSRP is called the Northern Route. The GSRP Northern Route proposal consists of a new overhead 345-kV line over approximately 35 miles within Massachusetts and Connecticut. The GSRP Northern Route would begin at Ludlow Substation in Ludlow, Massachusetts and extend southwesterly around Springfield to Agawam Substation in Agawam, Massachusetts. From Agawam Substation, the Northern Route would extend south into Connecticut and terminate at the North Bloomfield Substation in Bloomfield, Connecticut. Several underground options and variations to the Northern Route have also been proposed. Refer to Figure 1 and Figure 2. (CL&P 1, Vol. 1, pp. ES-3, ES-5, ES-12, ES-13, ES-19)

20. In addition to the Northern Route, CL&P also proposed the Connecticut portion of the Southern Route Alternative for a Ludlow to Agawam 345-kV line, which connects with the WMECO-proposed Massachusetts portion of this line. The Southern Route Alternative of the proposed Ludlow to Agawam line would begin at Ludlow Substation and extend south to Hampden Junction in Hampden, Massachusetts. From Hampden Junction the route would travel west through Enfield and Suffield before heading north into Massachusetts to the South Agawam Switching Station. At this point, the Southern Route Alternative would be connected to the North Bloomfield Substation by the new 345-kV Agawam to North Bloomfield line, the proposed GSRP – Northern Route in Connecticut. Refer to Figure 1 and Figure 2. (CL&P 1, Vol. 1, pp. ES-3, ES-7, ES-18)

21. The Northern Route has fewer environmental impacts and costs less than the Southern Route. The Northern Route would also offer a better opportunity for future system improvement and expansion. Since a portion of the Southern Route Alternative would be located in Connecticut, however, CL&P seeks approval for the Connecticut portion of the route in the event that is the route approved by the Massachusetts EFSB. (CL&P 1, Vol. 1, pp. H-54, H-55)

22. The 12-mile Connecticut portion of the proposed GSRP Northern Route begins at the North Bloomfield Substation and traverses Bloomfield, East Granby and Suffield to the Connecticut/Massachusetts border. The Connecticut portion of the Southern Route Alternative begins with the 12-mile Northern Route and adds 5.4 additional miles in Connecticut through Suffield and Enfield. Refer to Figure 1 and Figure 2. (CL&P 1, Vol. 1, pp. ES-7, ES-18)

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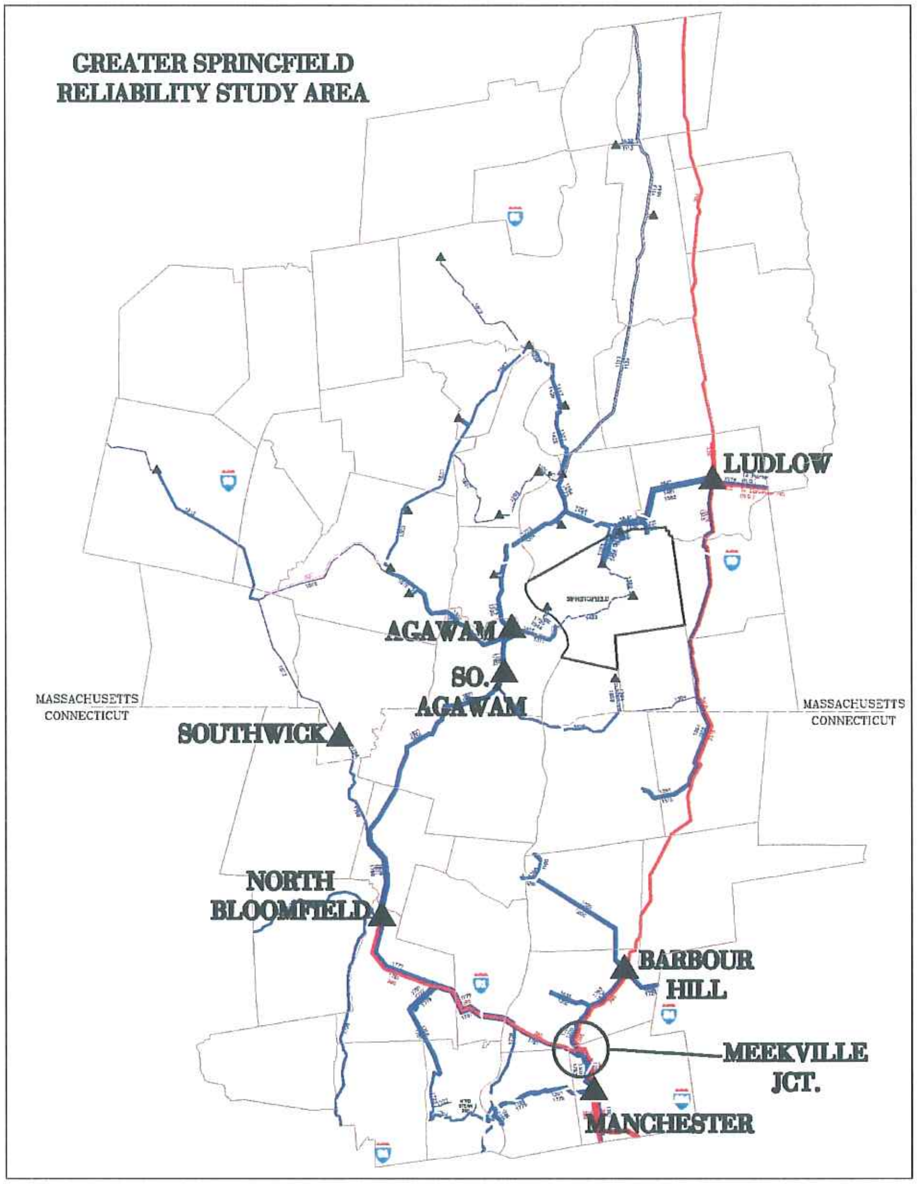
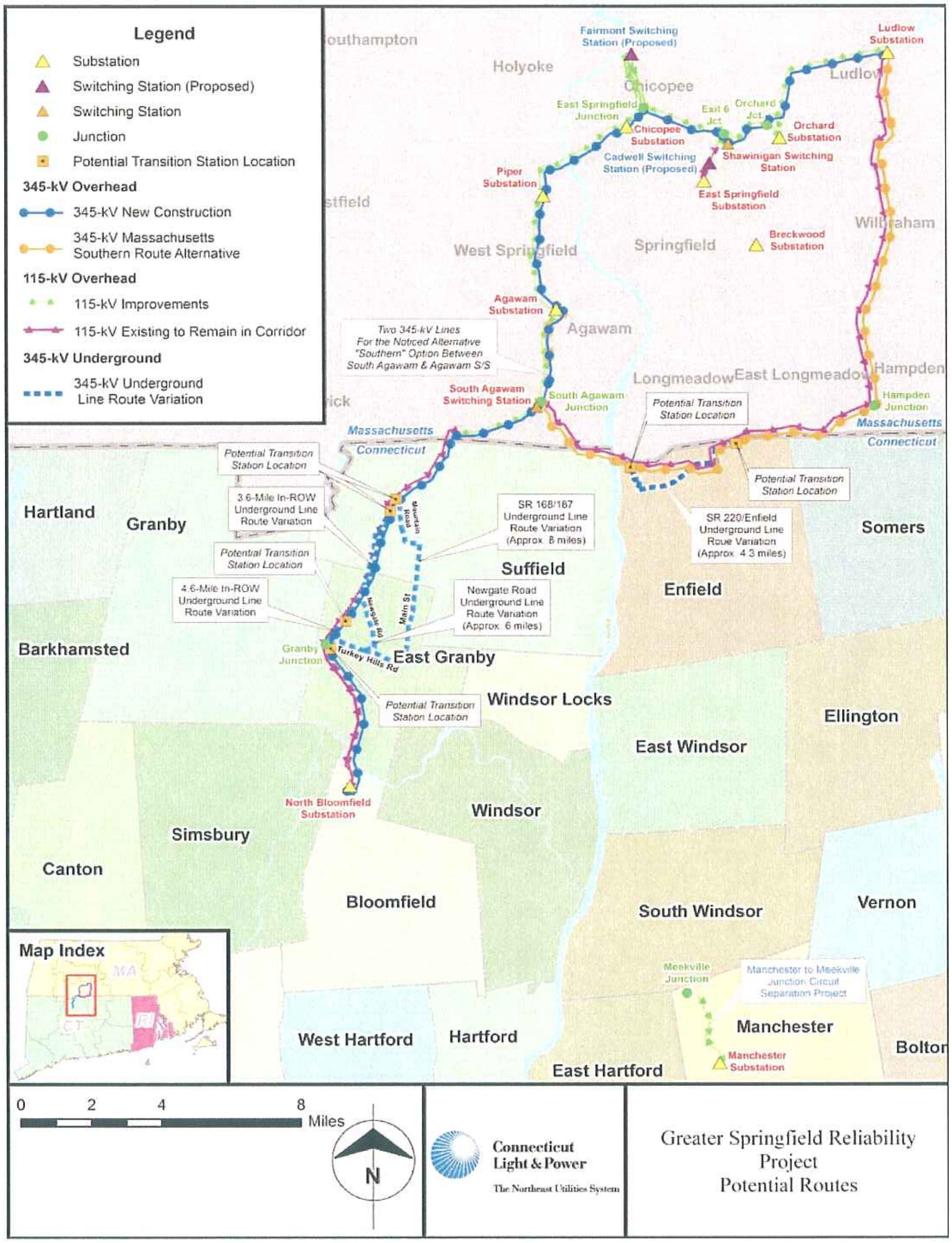
Figure 1. Greater Springfield Reliability Project Area. The red lines represent 345-kV transmission lines and the blue lines represent 115-kV transmission lines.



(CL&P Ex. 15, Exhibit AWS-1)

Figure 2. Greater Springfield Reliability Project and Associated Alternatives.

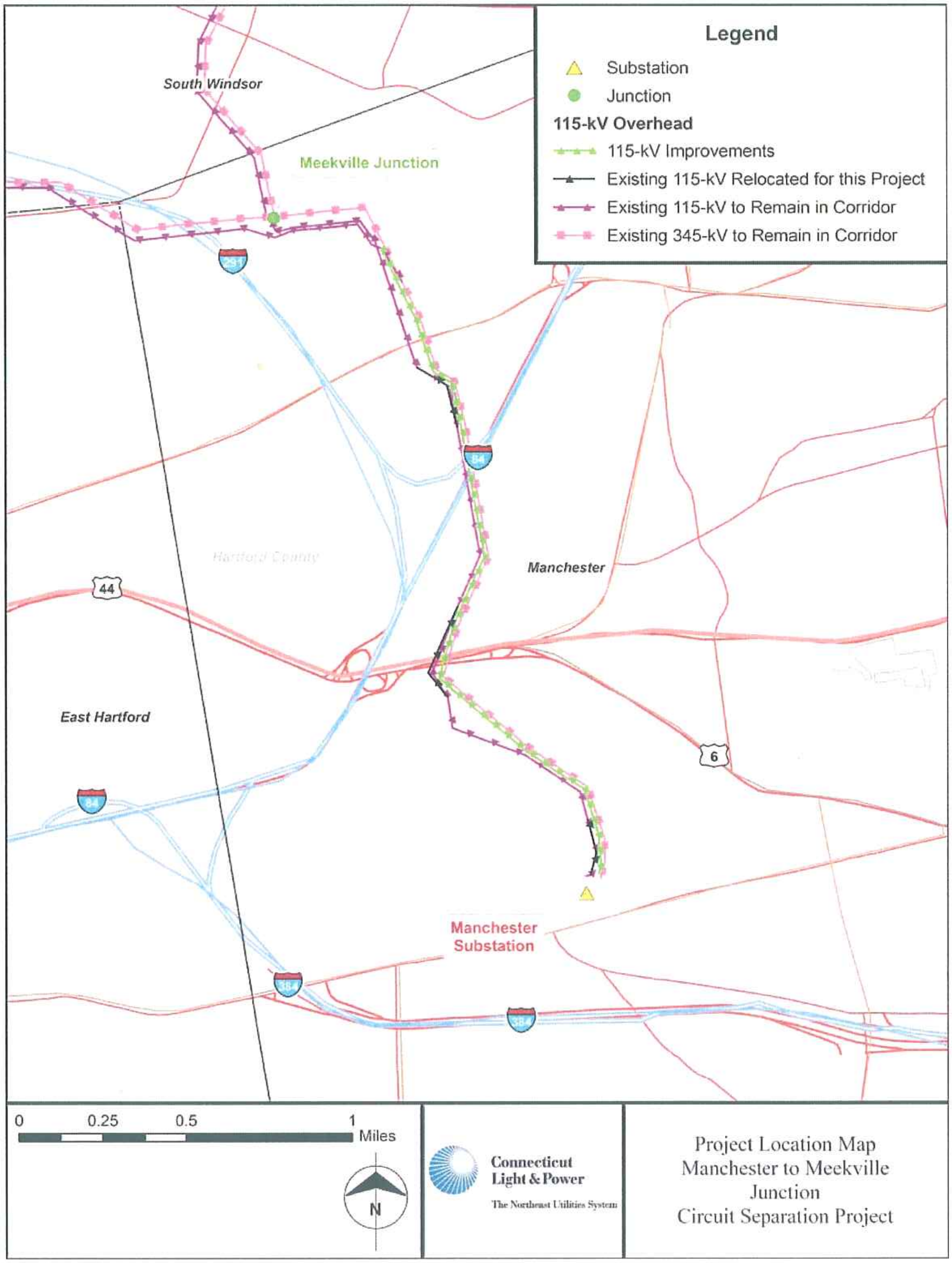


(CLP 1, p. ES-3)

MMP

23. The MMP would consist of the separation of a 345-kV and a 115-kV circuit for 2.2 miles between Manchester Substation and Meekville Junction, Manchester, Connecticut. Refer to Figure 3. (CL&P 1, Vol. 1, p.ES-5)

Figure 3. Meekville Junction to Manchester Substation Project.



(CL&P 1, p. ES-10)

III. NEED

Background (Southern New England Region)

ISO-NE Authority for Planning and Reliability

24. The southern New England (SNE) area includes Massachusetts, Rhode Island and Connecticut and accounts for approximately 80 percent of the entire New England electrical load. The SNE load areas are concentrated in Boston and its suburbs, central Massachusetts, Greater Springfield, Rhode Island, Greater Hartford and southwest Connecticut. (CL&P 1, Vol. 1, p. F-19)

25. The electric power system in New England became regionalized during the 1960s, when the electric utility companies in New England, including CL&P, developed a plan for a 345-kV transmission grid that would integrate the dispatch of electricity from strategically located generating stations serving loads within and between the New England States and other regions. (CL&P 1, Vol. 1, p. F-1)

26. ISO-NE is responsible for managing the New England region's bulk electric power system, operating the wholesale electricity market, administering the region's open access transmission tariff, and conducting centralized electrical power planning. (Council Admin. Notice No. 45, FOF #19)

27. Since the 1960s, transmission planning and reliability standards have become more closely integrated on a regional basis. Due to events such as the Northeast blackout of 1965 and extensive electric industry restructuring during the 1990s, regulators and legislators created and strengthened a clear chain of authority for both planning and reliability from the federal down to the regional level. The most recent significant development for New England came on February 1, 2005, when the Federal Energy Regulatory Commission (FERC) designated ISO-NE as a Regional Transmission Organization, with consolidated authority to both plan transmission systems and maintain system reliability. (CL&P 1, Vol. 1, pp. F-1 to F-3)

28. Failure to address known violations of mandatory North American Electric Reliability Corporation (NERC) reliability standards is subject to federal fines. However, fines are not imposed if the utility company has a plan to adequately address modeled violations and is actively pursuing such a plan. (CL&P 15, Scarfone p. 44, Tr. 5, p. 165)

29. Long-term system planning for New England is conducted by ISO-NE through an annual, comprehensive Regional System Plan (RSP). A regional transmission plan is developed and reviewed by interested parties, including state regulators and the New England Power Pool (NEPOOL) market participants. (Council Admin. Notice No. 45, FOF #20)

30. In 2004, ISO-NE began a study on deficiencies and interrelated needs throughout the SNE electric supply system and in 2006 released a draft report later referred to as the "Southern New England Transmission Reliability Report (SNETR) – Needs Analysis, January 2008." Developed by the planning staffs of NUSCO and National Grid USA (National Grid), SNETR was the genesis of the New England East-West Solution (NEEWS). (CL&P 1, Vol. 1, pp. F-8, F-13, F-14)

31. NEEWS consists of four separate but related projects that would alleviate the deficiencies in the SNE transmission grid. The projects include:
   a. The GSRP and MMP – the subject of Docket No. 370A
   b. The Interstate Reliability project – a new 345-kV line from Millbury Switching Station in Massachusetts owned by National Grid to its West Farnum Substation in North Smithfield, Rhode Island, to CL&P's Lake Road Substation in Killingly, Connecticut and Card Street Substation in Lebanon, Connecticut.
   c. The Central Connecticut Reliability Project – a new 345-kV line from CL&P's North Bloomfield Substation to its Frost Bridge Substation in Watertown, Connecticut.
   d. The Rhode Island Reliability Project – A National Grid project entirely within the State of Rhode Island. This project would not come before the Council.
   (CL&P 1, Vol. 1, pp. F-10, F-11)

32. Following its "Needs Analysis," the SNETR working group analyzed transmission solutions to satisfy the identified needs for every concentrated load area of SNE. Their draft report, which discussed detailed solution options for each area, was published by ISO-NE on its website in April 2008 with the title "New England East-West Solutions (Formerly SNETR) Report 2, Options Analysis." (CL&P 1, Vol. 1, pp. F-8, F-13, F-14)

Planning Criteria and Reliability Standards

33. CL&P is obliged by binding tariff provisions to design and propose transmission improvements that will assure the bulk power supply system complies with applicable reliability standards. (CL&P 1, Vol. 1, p. F-5)

34. ISO-NE's definition of reliability is governed by NERC. NERC's definition of reliability encompasses two concepts: adequacy and security. Adequacy is defined as the "ability of the system to supply the aggregate electric power and energy requirements of the consumers at all times." Security is defined as "the ability of the system to withstand sudden disturbances." (CL&P1, Vol. 1, p. F-4)

35. ISO-NE does not determine whether resource adequacy, that is the amount and availability of generation and load management resources, could solve a given reliability problem more cost-effectively than transmission security. It leaves that "choice" up to the market. If the market fails to bring forward a solution, then ISO-NE is obligated, per NERC planning criteria and reliability standards, to plan a transmission security solution. (CL&P 1, Vol. 1, p. F-4; Tr. 15, pp. 37-40)

36. A key element in planning for and testing transmission reliability (in the sense of transmission security) is the concept of "contingency" events, wherein certain generation and/or transmission facilities are assumed to be out of service or otherwise unavailable. (CL&P 1, Vol. 1, p. F-5)

37. In accordance with ISO-NE Planning Procedure 3 (PP3), planners use the terms "N-1" and "N-1-1" to designate the contingency conditions in which the transmission system must be capable of reliable operation. N-1 designates the state of the transmission system following the occurrence of a single contingency. N-1-1 designates the condition of the transmission system following the occurrence of a second contingency, assuming that one element is already out of service. (CL&P 1, Vol. 1, p. F-6)

38. To evaluate compliance with the PP3 reliability criteria, these 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 specified limits under one or more contingencies, the electric system is judged to be unreliable, and the system must be brought back into compliance within 30 minutes of a first contingency, so that it will be able to operate reliably in the event of a second contingency. (CL&P 1, Vol. 1, p. F-6)

39. The particular contingencies modeled are simulated for normal loads forecast for the future, extreme weather peak loads, inter-regional power transfers, and "reasonably stressed" conditions, which are generally considered to be the unavailability of generation proximate to load—often with multiple units being unavailable. Requiring the transmission system to operate effectively under such "reasonable stress" recognizes that generation units may be unavailable for many reasons, such as economics, equipment failure, lack of fuel, maintenance requirements, and environmental restrictions. (CL&P 1, Vol. 1, pp. F-5, F-7, F-8)

40. Major unplanned outages of generating units have occurred in the electric industry. In Connecticut, for instance, outages involving thousands of MWs at a time have happened in 1996, 2003, and 2008. Transmission failures have also occurred recently, affecting Connecticut. In November 2002, cables running underwater from Norwalk Harbor to Northport, New York were broken by a dragged anchor and out of service for eight months. (CL&P 1, Vol. 1, pp. F-6, F-7)

41. Notwithstanding such actual occurrences, the contingencies selected for any given planning simulation are "deterministic," that is, determined by planners' judgments of "reasonable stress," not calculated per statistical probability or on the basis of historical evidence. (Tr. 14, pp. 87-90)

42. Contingency modeling under "reasonably stressed" conditions is meant to test the strength of the system in general. Planners design improvements to the system that address more than just the specific conditions and contingencies tested in power-flow simulations. Events represented in the simulations serve as proxies for multiple other potential future events that cannot be defined or predicted, but that the system should be able to survive. (Tr. 5, p. 67; Tr. 12, pp. 60, 61; Tr. 14, pp. 210, 211; Tr. 15, pp. 211, 212)

Background (GSRP/MMP)

Load Area

43. The proposed GSRP/MMP is a stand-alone project that would meet the identified reliability needs regardless of whether the other components of NEEWS are undertaken. This has been established by several studies, the latest of which is the "2009 Addendum", which takes into account the forecasted loads in ISO-NE's 2009 Capacity, Energy, Loads and Transmission (CELT) Report; relevant new resources that cleared the second ISO-NE Forward Capacity Auction (December 2008); and new and proposed resources for which procurement contracts have been ordered by the DPUC. (CL&P 1, Vol. 1, p. F-15; CL&P 5, R. OCC-01-009-SP01, attached "2009 Addendum Report"; CL&P 15, Scarfone, pp. 4-21)

44. The proposed GSRP/MMP is the first of the Connecticut NEEWS projects filed with the Council because ISO-NE planning has determined the Greater Springfield/north-central Connecticut load area has the greatest need for improved transmission reliability. (Tr. 14, pp. 160, 161)

45. The proposed GSRP/MMP is designed to address transmission security deficiencies in Greater Springfield and the adjacent portion of north-central Connecticut, which extends to Hartford and its suburbs, including Manchester, East Hartford, Hartford, West Hartford, Avon, South Windsor, Windsor, Bloomfield, Simsbury, East Windsor, Windsor Locks, East Granby, Enfield, Suffield, and Granby. (CL&P 1, Vol. 1, p. F-20)

46. From the point of view of transmission, Greater Springfield and the adjacent portion of north-central Connecticut are effectively the same load area. Since key transmission lines in the system serving Greater Springfield terminate at substations in Connecticut, the resolution of Springfield area problems necessarily involves improvements to parts of Connecticut's electric grid as well. At the same time, the need to resolve these Springfield area problems offers an opportunity to reinforce the reliability of electric supply within north-central Connecticut, and improve the power transfer capacity between Massachusetts and Connecticut. (CL&P 1, Vol. 1, pp. G-2, F-20, F-21)

47. The need for improvements to the transmission system such as will be provided by the GSRP/MMP has been recognized for a long time. As early as 1977, Council Docket No. 11 discussed long-range plans for the Greater Springfield/north-central Connecticut transmission system and specifically stated that "a new 345-kV circuit between North Bloomfield, Connecticut and Agawam, Massachusetts" is needed. (Council Admin. Notice 61, FOF #45)

Deficiencies

48. CL&P used the PP3 conditions and contingencies to "reasonably stress" the transmission infrastructure in establishing the system reliability deficiencies and need for the proposed GSRP/MMP. The conditions and contingencies were initially established by the SNETR Working Group and approved by ISO-NE. (Tr. 5, p. 90)

49. The existing 115-kV lines that serve the Greater Springfield/north-central Connecticut load area were found out of compliance with national and regional reliability criteria. The existing system has transmission security deficiencies even under normal conditions, which will be exacerbated as electricity usage increases and as older power generating plants are retired. (CL&P 1, Vol. 1, p. ES-2)

50. Generalized transmission security deficiencies in the Greater Springfield/north-central Connecticut load area are:
    a. thermal overloads, voltage issues – to the point of possible widespread voltage collapse – and short-circuits on 115-kV lines throughout the Greater Springfield area in Massachusetts; and
    b. associated thermal overloads at various points in Connecticut.
    (Tr. 5, pp. 51-52; Tr. 15, pp. 75-78, 80)

51. Deficiencies at the North Bloomfield Substation are of particular concern. The North Bloomfield Substation serves an area of Connecticut with higher-than-average load growth. It is a major source of bulk power supply to north-central Connecticut. The Substation has three 115-kV transmission circuits that extend into the Greater Hartford area, and that interconnect with different substations. (CL&P 1, Vol. 1, pp. F-22, F-24, G-21)

52. Under contingency conditions, planners find that many of the 115-kV circuits in the Greater Springfield area would be above emergency ratings, including the lines to the North Bloomfield Substation. (Tr. 6, pp. 20, 21)

53. Contingency modeling predicts that, even under normal conditions, the 115-kV line from North Bloomfield Substation to the South Agawam Switching Station would be forced to carry loads approximately 17 percent above its long-time emergency (LTE) rating. The LTE rating is the load that a line can carry for 12 hours before overheating. Overheating could cause sagging to the point that the line would arc and short out. (Tr. 12, pp. 105, 106; Tr. 15, p. 92)

54. Generalized transmission security deficiencies constrain power transfers between Connecticut and Massachusetts. Under certain contingencies modeled by SNETR and subsequent CL&P studies, the transfer capacity would be too limited to serve load in Connecticut. (CL&P 1, Vol. 1, pp. F-11, F-12; CL&P 14, R. OCC-009-SP01, "2009 Addendum Report")

Improvements

55. The proposed GSRP would create a new 345-kV loop in the north-central Connecticut and western Massachusetts areas. The new 345-kV line would connect the North Bloomfield Substation in Connecticut to the Agawam Substation in Massachusetts, and then to Ludlow Substation in Ludlow, Massachusetts. The remainder of the loop consists of the existing 345-kV line running from the North Bloomfield Substation to the Barbour Hill Substation in South Windsor, and then north to Ludlow. Refer to Figure 1. (CL&P 1, Vol. 1, pp. E-1, E-4; Tr. 14, p. 170)

56. The new 345-kV loop would greatly enhance reliability by reducing power flow on the 115-kV lines in the Greater Springfield Greater Springfield/north-central Connecticut load area and addressing the security insufficiencies in both Connecticut and Massachusetts. It would also establish a new 345/115-kV hub west of the Connecticut River and north of the North Bloomfield Substation at the Agawam Substation, which would improve the ability of both substations to handle contingencies and, in the process, make the established transfer capacity between Connecticut and Massachusetts more reliable. (ISO-NE 1, p. 16)

57. The new 345-kV loop would support an increase of the maximum transfer limits into Connecticut, as determined by ISO-NE, from the present 2,500 MW to between 2,700 and 2,800 MW. (CL&P 10, R. OCC-027)

58. The increased transfer capacity into Connecticut associated with the proposed GSRP may aid CL&P in achieving environmental and statutory compliance with state renewable portfolio standards (RPS) by enabling access to renewable and/or low emission power-supply sources. (CL&P 1, Vol. 1, pp. F-11, F-12)

59. The GSRP/MMP is not proposed for the purpose of increasing Connecticut's import capacity. System planners consider the 200-300 MW transfer capacity increase a marginal benefit. The main benefit is that, under contingency modeling, the GSRP/MMP transmission system would maintain the reliability of Connecticut's existing import capacity at 2500 MW. (Tr. 8, p. 67; Tr. 14, pp. 114, 124-130, 165; Tr. 15, p. 185, 186)

60. The proposed GSRP would satisfy transmission reliability requirements in the Springfield area (including north-central Connecticut) for at least 20 years without further expansion of the 345-kV system, assuming no significant changes occur in projected future load growth or generation location and availability. (CL&P 4, R. 17)

Economic Benefits

61. Using Fall of 2008 data, London Economics International, LLC (LEI) performed an analysis forecasting that New England ratepayers can expect energy market benefits attributable to GSRP over ten years of $35 million per year in the Base Case, of which Connecticut would receive 25 percent or $8.75 million per year. (CL&P 15, Frayer, pp. 9, 10, 14, 15)

62. GSRP is likely to create economic benefits of $5.5 million per annum in the Locational Forward Reserve Market (LFRM) that will be shared by all New England ratepayers, with Connecticut receiving 40 percent, or $2.2 million. (CL&P 15, Frayer, p. 12)

63. Increased gas and oil prices raise the economic value of the GSRP because an increase in fuel prices translates to increased energy prices, which magnifies the energy price reduction that could be achieved by GSRP and thus increases the energy market benefits from the project. (CL&P 15, Frayer, p. 39)

64. Connecticut ratepayers would receive a ten-year present value benefit stream in the range of $54 million to $72 million with a 95-percent confidence (at a 10 percent discount rate), given projected energy price reductions in Connecticut combined with Connecticut load and the application of the ISO-NE Market Rules for the settlement of LFRM charges. (CL&P 15, Frayer, p. 15)

IV. PROJECT ALTERNATIVES TO GSRP

System Alternatives

Non-Transmission Alternatives

65. One non-transmission alternative is no action: that is, making no transmission improvements. Planners rejected this alternative because it would not correct NERC, NPCC and NEPOOL reliability violations. Additionally, import capacity to Connecticut would not be increased. (CL&P 1, Vol. 1, p. G-2)

66. The other non-transmission alternatives are resource alternatives: demand-side management (DSM), which includes load reduction and distributed generation; large scale generation; and combined heat and power. (CL&P 1, Vol. 1, p. G-3)

67. The non-transmission alternatives were tested by ICF Resources, LLC (ICF), per certain determined scenarios, to measure their capability of providing reliability benefits compared with the proposed GSRP. (CL&P 1, Vol. 1, pp. G-3, G-4, G-5)

68. Certain specific resource alternatives modeled by ICF were:
    a. Reduce Connecticut zonal demand by 1,000 MWs;
    b. Reduce Western Massachusetts zonal demand by 1,000 MWs;
    c. West Springfield and Berkshire power plants operational and a new 400-MW facility located at Berkshire Power for a total of 854 MW in Greater Springfield;
    d. West Springfield and Berkshire power plants operational, a new 200-MW facility located at Berkshire Power, and a new 200-MW facility at Mount Tom for a total of 854 MW in Greater Springfield;
    e. West Springfield and Berkshire power plants operational, a new 400-MW facility located at Berkshire Power, and a new 200-MW facility at Mount Tom for a total of 1,054 MW in Greater Springfield;
    f. West Springfield and Berkshire power plants operational, Connecticut zonal demand reduced by 500 MWs, and limit load at Chicopee, Clinton, East Springfield, Agawam and Breckwood Substations; and
    g. Reduce Connecticut zonal demand by 500 MWs, and limit load at Chicopee, Clinton, East Springfield, Agawam and Breckwood Substations.

    (CL&P 1, Vol. 1, p. G-9)

DSM

69. An aggressive DSM reduction modeled at approximately 1,000 MWs in the Springfield area and western Massachusetts would not resolve all the Greater Springfield and north-central Connecticut overloads. (Admin. Notice 45, FOF #113, FOF #121; CL&P 1, Vol. 1, p. G-11)

70. It is unlikely that an actual reduction of more than the modeled 1,000 MWs could be made in the Greater Springfield load area within the planned time horizon for GSRP, since the ISO-NE Forward Capacity Auction (FCA) indicates only 4,200 MW of DSM will be available through all of New England for 2011-2012. (CL&P 1, Vol. 1, p. G-5)

Large Scale Generation

71. The establishment of generation alone would not eliminate the reliability need for the GSRP, partially because the reliability problem exists throughout the transmission system in the Greater Springfield area. (Tr. 6, p. 78)

72. Large scale generation that is proposed north of Ludlow, Massachusetts would intensify the system reliability problems in Greater Springfield and north-central Connecticut, such that ISO-NE would require transmission system improvements in order for the proposed generation to be built. Any potential generation resources located in downtown Springfield would have the same effect. (CL&P 1, Vol. 1, p. G-14)

73. When ICF modeled the transmission system under contingent conditions, the operation of existing and new generators within Connecticut but outside of the north-central region had little impact on the need to import into Connecticut. (CL&P 4, R. 4)

74. CL&P performed an additional analysis specifically focusing on power flows in modeled cases of contingencies where either the NRG plant in Meriden, Connecticut or the GE Financial Services' plant in Oxford, Connecticut were producing electricity. The results of the study indicated that neither case resolved the transmission reliability problems in the Greater Springfield load area. (CL&P 4, R. 18)

75. Overall, no non-transmission alternatives to the GSRP were found to be satisfactory or sufficient to replace or defer the need for the proposed project. Many transmission facility overloads were shown to occur under modeled contingencies such that the electric transmission system would not fully comply with the mandated NERC, NPCC and NEPOOL reliability criteria. (CL&P 1, Vol. 1, p. G-10)

Transmission Alternatives

76. Practical routes for transmission projects in the Greater Springfield/north-central Connecticut area are defined by the locations of the existing substations, with the shortest paths between them being existing transmission line ROWs. No other existing linear corridors in this area would be suitable. In particular, no railroad or pipeline corridors are available that are suitably aligned. (CL&P 1, Vol. 1, pp. H-1, H-16)

Options A, B and C

77. In its Options Analysis, the ISO-NE Working Group identified two potential 345-kV connections other than the proposed GSRP to resolve the Greater Springfield load area reliability issues. The options were:
    a. The proposed GSRP (Option A);
    b. a 345-kV line between North Bloomfield and Ludlow Substations without a tie into the Agawam Substation (Option B); and
    c. a 345-kV line from Manchester Substation in Manchester, Connecticut to the Ludlow Substation (Option C).

    (CL&P 1, Vol. 1, pp. G-18, G-19)

78. Like Option A (the proposed GSRP), Options B and C would each provide a new 345-kV connection between western Massachusetts and Connecticut, but they were rejected by CL&P on the grounds that they each had disadvantages in terms of reliability, length, and cost. (CL&P 1, Vol. 1, pp. G-18, G-19)

High Voltage Direct Current (HVDC)

79. An HVDC option to deal with reliability problems in the Greater Springfield load area, among others in the tri-state area covered by NEEWS, was examined and rejected in the ISO-NE "Options Analysis," June 2008. (CL&P 1, Vol. 5, "Options Analysis", pp. 20-22)

80. HVDC transmission lines usually are not introduced into the middle of an existing grid because they have different electrical characteristics from typical transmission lines that carry Alternating Current (AC). Every connection point between HVDC and AC lines requires a converter station, and these are expensive, both because of the technical equipment and the extra space involved. Also, if a line is out of service in an AC system, the electricity immediately and automatically flows on the remaining AC lines to get to the customer, whereas an HVDC line has to be manually operated to change its loading. For these reasons, HVDC systems limit flexibility, and tend to be used only in special cases, such as the connection of power systems that differ operationally, asynchronous systems, and underwater cables. (Tr. 7, p. 84; Tr. 10, p. 118)

81. Each HVDC converter station would cost approximately $200 million. Three or four converter stations would be needed along the GSRP – Northern Route. (Tr. 7, pp. 85, 86)

82. A conventional HVDC system from Ludlow to Agawam to North Bloomfield with 1,200 MW of capacity would cost approximately $2.3 billion. An HVDC "Lite" system from Ludlow to Agawam to North Bloomfield would provide up to approximately 1,000 MW of capacity and would cost approximately $2.4 billion. The cost of either HVDC technology would be directly comparable to the GSRP cost of $714 million – and far higher. (Tr. 10, pp. 74-76)

83. Estimated costs of an HVDC system include installation of 35 miles of HVDC underground cables, the 115-kV overhead work that would still be required in Greater Springfield, and three converter stations. The estimate also includes spare HVDC transformers because lag time in acquiring these transformers is more than a year. The spare transformers would cost approximately $62 million. (Tr. 10, p. 103)

84. CL&P has concerns about whether an HVDC converter station could fit into the available land at Ludlow, Agawam, and North Bloomfield Substations. (Tr. 10, p. 117)

V. PROJECT ROUTE AND DESIGN

A. Overhead In-Right-of-Way

GSRP – Northern Route

85. The Connecticut portion of the proposed GSRP would run from the North Bloomfield Substation to the Connecticut/Massachusetts border—approximately 12 miles. It would be located predominantly within an existing right-of-way (ROW) (36 percent of the existing ROW is on land owned by CL&P; the remaining 64 percent is along CL&P easements over properties) that has been occupied by power lines for about 80 years. (CL&P 1, Vol. 9, Vol. 11; CL&P 15, Carberry/Newland, p. 4)

86. The conductors for the new 345-kV overhead line would consist of three bundles of two 1,590-kcmil aluminum conductors with steel reinforcement (ACSR). Two overhead lightning shield wires would be installed above the line for protection, and one of these wires would contain optical glass fibers for communication. (CL&P 1, Vol. 1, p. I-2)

87. The proposed base line design supports for the new lines would be steel or wood-pole H-frame structures with the conductors configured horizontally. They would be approximately 90 feet in height, and spaced 570 feet apart, on average, although the spans would vary, due to the terrain. The maximum span length proposed is 1,166 feet. (CL&P 1, Vol. 1, p. I-4; CL&P 5, R. CSC-036)

88. The length of the Connecticut portion of the proposed GSRP is divided into two segments consisting of:
    a. Segment 1 (North Bloomfield to Granby Junction); and
    b. Segment 2 (Granby Junction to the Connecticut/Massachusetts State Border).
    (CL&P 1, Vol. 1, pp. I-2, I-3)

Segment 1

89. The Segment 1 ROW is 4.7 miles long and generally 385 feet wide. The existing electric line facilities along the Segment 1 ROW consist of: a) wood-pole H-frame structures, typically 60 feet in height that support one 115-kV circuit; b) existing lattice-steel towers, typically 70 feet in height that support two 115-kV circuits; and c) wood poles, typically 40 feet in height, that carry a 23-kV distribution line. A distribution line operates below 69-kV and transports electricity from the transmission system (69-kV and above) to consumers. Distribution lines are not under Council jurisdiction. (CL&P 1, Vol. 1, p. I-2, O-16)

90. The existing Segment 1 ROW is 385 feet wide with approximately 195 feet currently being maintained for the existing transmission and distribution lines. The addition of the proposed new 345-kV line would increase the maintained width of the ROW to approximately 290 feet. The remaining approximately 95 feet of the ROW would not be affected by the proposed project. (CL&P 1, Vol. 1, pp. I-3, O-19)

91. The proposed 345-kV line would be placed approximately 75 feet east of the lattice towers in the existing ROW. The existing 115-kV line would remain in-service during the construction of the proposed 345-kV line to maintain continuity of service. Following completion of the GSRP, CL&P would petition the Council to remove the 115-kV circuits from North Bloomfield Substation to Granby Junction if CL&P determines that the lines would not be useful in the near future. (CL&P 1, Vol. 1, pp. I-3, O-17; Tr. 6, pp. 156-158)

92. Land adjacent to the Segment 1 portion of the ROW is predominately forested and agricultural with residences located south and east of the ROW along Holcomb Street in East Granby. (CL&P 1, Vol. 1, p. L-39; Vol. 9, Vol. 11)

Segment 2

93. The Segment 2 ROW is 7.2 miles long and approximately 305 feet wide. The existing transmission line facilities along the Segment 2 ROW consist of lattice-steel towers approximately 70 feet in height supporting two existing 115-kV circuits. (CL&P 1, Vol. 1, p. I-3)

94. Currently, the portion of the ROW being maintained for the existing transmission line is 110 feet wide. The addition of the proposed new 345-kV line would increase the maintained width of the ROW to approximately 205 feet. The remaining approximately 100 feet of the ROW would not be affected by the proposed project. (CL&P 1, Vol. 1, p. I-4)

95. As in Segment 1, the new support structures would be centered approximately 75 feet east of the existing lattice towers. In this segment, however, the lattice towers would remain in place. They would continue to support the existing double-circuit 115-kV lines, except that these two lines would be reconfigured as a split-phase line for a single circuit operating from Granby Junction to the Southwick Substation in Massachusetts. (CL&P 1, Vol. 1, pp. I-4, O-24)

96. The existing 115-kV line is approximately 50 feet from the western edge of the ROW. The proposed 345-kV line is 125 feet from the western edge. (CL&P 1, Vol. 1, p. H-28; Tr. 10, pp. 81, 82)

97. In Segment 2, CL&P has identified a "Focus Area" approximately 3.2 miles in length – between the point where Country Club Lane in East Granby comes closest to the ROW and a point where Phelps Road in Suffield intersects with the ROW – where the Council's Electric and Magnetic Field Best Management Practices (EMF BMPs) may need to be applied. See below under the "Electric and Magnetic Fields" Section for further facts. (CL&P 1, Vol. 1, p. I-4)

98. CL&P would expand the Segment 2 ROW by approximately three acres. This acreage would consist of two easements, each a strip 100 feet wide. One easement is 1,000 feet long and would extend between Phelps Road and Mountain Road in Suffield; the other is 400 feet long and would lie east of Ratley Road in Suffield. Both easements would be acquired from private landowners. (CL&P 1, Vol. 1, pp. I-4; N-37)

Cost

99. The estimated capital cost of the Connecticut portion of the overhead 345-kV line from the state border to North Bloomfield Substation associated with the proposed GSRP is approximately $41,290,000, not including substation improvements. The total cost of the GSRP – Northern Route within Connecticut and Massachusetts is approximately $714 million. (CL&P 1, Vol. 1, p. I-15)

Schedule

100. Construction of the proposed GSRP would take approximately three years to complete and an additional approximately three months would be required to make it operational. (CL&P 1, Vol. 1, p. F-37, P-1; CL&P 15, Carberry/Newland, p. 16)

GSRP - Southern Route Alternative

101. The Connecticut portion of the Southern Route Alternative for the Agawam to Ludlow 345-kV line would be approximately 5.4 miles long. This route would cross the Massachusetts border into Connecticut in Suffield, traverse Suffield for approximately 1.1 miles, cross the Connecticut River back into Massachusetts for approximately 0.5 miles, and then cross back into Connecticut again in Enfield, going east for approximately 4.3 miles before crossing back into Massachusetts to continue on to the Ludlow Substation. (CL&P 1, Vol. 1, p. E-5, Fig.E-3, p. E-8); CL&P Ex. 15, Carberry/Newland, p. 18)

102. The Connecticut portion for the Southern Route Alternative for the Agawam to Ludlow 345-kV line would lie entirely within an existing CL&P ROW that varies between 280 and 300 feet in width. It is occupied by a 115-kV line supported on wood-pole H-frame structures, 60 feet in height. (CL&P 1, Vol. 1, p. O-38, Fig. O-12, p. O-39 and Fig. O-13, p. O-41; p. I-7)

103. The design for the new overhead 345-kV line would be steel or wood-pole H-frame structures, typically 90 feet tall, supporting 1,590-kcmil ACSR conductors, two per phase, which would be protected by an Optical Ground Wire cable and a second shield wire. (CL&P 1, Vol. 1, p. I-7; CL&P 15, Carberry/Newland, p. 18)

104. The existing ROW is wide enough to accommodate the new line of H-frames proposed. The existing 115-kV line on its wood-pole H-frame structures would remain. Of the 280 to 300-foot wide ROW, approximately 110 feet are currently being maintained for the existing facilities. With the addition of the new line, approximately 205 feet would be maintained. The remainder of the ROW (approximately 75-95 feet) would not be affected. (CL&P 1, Vol. 1, pp. I-7, I-8)

105. The new 345-kV line would span Interstate 91 as well as 11 state and local roads in Connecticut. (CL&P 1, Vol. 1, p. N-74)

106. The Southern Route Alternative would traverse approximately 3.7 miles of densely developed neighborhoods in Enfield, which begin west of Interstate 91 and extend east past North Maple Street (Route 192) to Mayfield Road. In this area, the Council's EMF BMPs may need to be applied. See below under the "Electric and Magnetic Fields" Section for further facts. (CL&P 1, Vol. 1, p. H-55, H-57)

Cost

107. The Southern Route Alternative would be approximately $52 million more than the Northern Route, assuming an all overhead line configuration, for a total of approximately $766 million. The choice of the Southern Route Alternative over the proposed Northern Route would increase the overall project costs of GSRP, because improvements to 115-kV circuits along the Northern Route in Massachusetts would need to be made even if the Southern Route were approved. (CL&P 1, vol. 5, Ex. 4, Solution Report, p. 3-25, Table 3-28; Tr. 11, pp. 40, 51, 93, 94)

Schedule

108. Selection of the Southern Route Alternative would likely delay the GSRP schedule by 12 months, due to additional design and permitting efforts. This would mean beginning construction in the third quarter of 2011, with a completion and in-service date at the end of 2014. (Tr. 11, Carberry, pp. 41, 83)

North Bloomfield Substation

109. The existing North Bloomfield Substation is located in the northwest portion of a 34-acre CL&P-owned parcel near the intersection of Hoskins Road and Tariffville Road. The proposed GSRP (Northern Route or Southern Route Alternative) would require the construction of a new 345-kV switchyard to interconnect the existing 345-kV line that extends into the substation from the south with the proposed 345-kV line that would extend into the substation from the north. It would also require a 345/115-kV, 600 megavolt ampere (MVA) autotransformer; space for future 345-kV connections, and expansion of the existing relay and control enclosure. (CL&P 1, Vol. 1, pp. E-2, I-13; CL&P 1, Vol. 7, site map)

110. The proposed substation modifications would require maintenance of existing secondary containment structures as well as the installation of a new secondary containment structure for the proposed autotransformer. The new autotransformer would have insulating fluid that requires the use of a secondary containment system. (CL&P 1, Vol. 1, p. N-48)

111. Within the 115-kV switchyard, a bus tie would be removed and the proposed new autotransformer would be connected to the bus via an existing circuit breaker. (CL&P 1, Vol. 1, p. I-13)

112. The existing seven-acre substation would be expanded by approximately 2.7 acres within the existing CL&P property. The existing substation fence would be relocated approximately 32 feet to the northwest, 292 feet to the southeast, and 193 feet to the southwest. (CL&P 1, Vol. 1, p. I-14)

Cost

113. The estimated capital cost of the proposed substation construction is $92,080,000. This amount added to the cost of the overhead transmission line listed in Finding of Fact #99 - $41,290,000 – would bring the total cost of the Connecticut portion of the proposed GSRP – Northern Route to $133,370,000. (CL&P 1, Vol. 1, p. 1-15)

Schedule

114. The proposed additions to the North Bloomfield Substation would take approximately 18 months to complete. (CL&P 15, Carberry/Newland, p. 11)

B. Underground Alternatives

Underground Cable Systems

Technical Features

115. Underground High Voltage Alternating Current (HVAC) transmission systems consist of buried alternating current electric cables, splice vaults installed at specific intervals, and transition stations at each end. Transition stations typically occupy two to four acres and contain switching equipment necessary to isolate the underground cables from the overhead line conductors. Underground electric cables may be used in situations when overhead transmission lines are undesirable or impractical due to environmental, social, construction, or regulatory issues. (CL&P 1, Vol. 1, pp. H-7, H-9)

116. While underground electric distribution lines are relatively easy to install, underground transmission lines are more problematic. There are several differences between the technologies of overhead lines and underground cables for electric transmission:
    a. Underground cables are typically installed over short distances in urban environments with strong electrical sources. Underground cables installed over long distances or in suburban and rural settings require design consideration to prevent damage and disruptions to the transmission system and potential damage to customer equipment.
    b. Underground 345-kV cables have a much lower current-carrying capacity than overhead 345-kV lines. Therefore, multiple underground cables are required to achieve the same power-transfer capacity as a 345-kV overhead line.
    c. The capacitive charging currents of an underground cable system (the currents necessary to maintain a high level of power transfer) are significantly higher than those of overhead lines. The higher capacitive currents, in turn, are associated with higher voltages. For medium and long length underground 345-kV cable systems, special switching devices and large shunt reactors may be required to prevent unacceptably high system voltages from disrupting power flows during normal operating conditions.
    d. Also, in such hybrid transmission circuits, the special devices necessary for managing the underground segments may affect the overall dynamics of power flow such that excessive voltages build up and damage the cable itself, other electrical equipment associated with the overhead portion of the system, and potentially customer equipment.
    e. The special charging and dynamic characteristics of underground and hybrid systems mean that whenever underground cables are contemplated for use in a given location special studies must be conducted to determine the maximum length of cable feasible to install without adverse effects on the New England transmission system overall.
    (CL&P 1, Vol. 1, pp. H-8 to H-11; CL&P 4, R. CSC-016; CL&P 15 Carberry/Newland, p. 25)

117. The complexity of underground transmission cables by themselves, and especially when integrated with overhead lines in "hybrid" systems, merits special attention to system reliability. (CL&P 15, Carberry/Newland, p. 25)

118. The failure of an underground cable results in extended repair time, because such a fault typically damages the cable. Following identification of the fault, the repair time for a cable can take weeks to complete, compared to hours or a few days for most overhead lines. For this reason, a 345-kV underground circuit would be constructed with two cables per phase plus a spare cable per phase that would be available if one was out of service. (CL&P 1, Vol. 1, p. H-11; Tr. 7, pp. 84, 85; CL&P 15, Carberry/Newland, p. 25)

Environmental Impacts

119. The construction of a new 345-kV underground cable system would require a 40-foot to 60-foot wide work area. Additionally, splice vaults (approximately 10 feet wide x 10 feet deep x up to 32 feet long) would have to be located at approximately 1,600 foot intervals. (CL&P 1, Vol. 1, p. H-13)

120. Each transition station would require a minimum fenced area of 270 feet by 270 feet (approximately 1.7 acres) for the placement of equipment. The size of the fenced area would increase if the capacitive charging of the underground cables requires shunt reactors to be installed for compensation on the system. The additional transition station property outside of the fenced area would provide setback from property lines, access into the station and site-specific requirements. (CL&P 4, R. 5)

121. Additional clearing at each transition station site would be required for construction activities, equipment and material laydown, access and maintenance roads, drainage, and grading. (CL&P 5, R. CSC-038)

122. While an overhead transmission line may span steep slopes, rock outcroppings, vegetation, wetlands and watercourses, an underground system requires a continuous trench and permanent access—that is, permanent vegetation clearing, including shrubs—along the entire length of the line during operation for maintenance and repairs. A 20-foot wide permanent, continuous access road along an in-ROW underground system is required. (CL&P 1, Vol. 1, pp. H-12, H-13, H-24, H-50)

123. Transmission engineers now prefer Cross-linked Polyethylene (XLPE) cable technology over high-pressure fluid-filled technology (HPFF), at one time a standard technology, in large part because XLPE does not use insulating fluid, which can leak into the environment around the cables. (CL&P 1, Vol. 6, pp. 8-15; Administrative Notice Item 45)

124. Soil resources are significantly disturbed by the installation of an underground cable system. Underground cables are installed in a trench in duct banks, and during the process the soil in the trench itself is amended to help make the cable work efficiently. The base of the trench and the area around the duct banks is filled with "flowable fill," a type of concrete material used for heat dissipation; then construction-grade backfill and native soil are placed on top. (Tr. 8, p. 117)

125. Underground cable systems installed in steep terrain may result in down-hill migration and overstress on the cables and splices. (CL&P 1, Vol. 1, p. H-13)

126. The installation of an underground cable system, no matter what the setting, typically requires some in-water construction. Subsurface techniques, such as jack and bore or horizontal directional drill (HDD) may be used for some larger watercourse crossings. However, these techniques are costly and time-consuming and have significant temporary and permanent impacts on water resources, including impacts to water quality. (CL&P 1, Vol. 1, p. N-55)

127. Most access roads will need to remain in place across existing wetlands and be properly maintained to provide access to splice vaults and transition stations, causing permanent impacts to wetlands. Also, where large embankments are needed for constructing wetland crossings, the width of wetland impacts may be 50 feet or greater. (CL&P 1, Vol. 1, p. H-51)

128. Underground transmission facilities, in any setting, have fewer visual impacts than overhead lines. However, the transition stations that are necessary for underground facilities do add visual impact. (CL&P 1, Vol. 1, p. H-51)

Underground Alternative Routes and Designs

All Underground In-ROW

Route and Design

129. An all-underground route along CL&P's existing overhead transmission line ROW was investigated and is technically feasible. (CL&P 1, Vol. 1, p. H-23)

130. An all-underground transmission facility would consist of cables and splice-vaults buried entirely within the existing ROW (305-385 feet wide), adjacent to the existing 115-kV overhead transmission line. The splice-vaults are typically 1,600 feet apart with PVC conduits running between them along a trench 5-7 feet wide and 7-10 feet deep. There are nine 8-inch conduits for the 345-kV XLPE cables; three 2-inch conduits for the grounding conductors; three 2-inch conduits for the fiber-optic relaying cables; and three 2-inch conduits for the temperature-sensing fiber cables. (CL&P 1, Vol. 1, pp. H-23, H-58)

Environmental Impacts

131. An all-underground in-ROW alternative would typically involve disturbance to a 40-to-60-foot-wide section of the ROW along the 12 miles between the North Bloomfield Substation and the Connecticut/Massachusetts state border, as well as the excavation of a continuous trench and associated splice-vaults and would:
    a. Traverse numerous wetlands and watercourses, including the Farmington River;
    b. Disturb a total of about 100 acres of land;
    c. Adversely affect six acres of water resources by grading and trenching the permanent access road;
    d. Convert an additional two to four acres at the Massachusetts border end of the underground cable system segment to utility use for the development of a transition station to interconnect the overhead and underground components of the transmission line;
    e. Alter the vegetative community through a permanent increase in clearing for the trench and access roads;
    f. Decrease wildlife habitat (permanent vegetation removal affects birds and others, particularly less mobile wetland species such as amphibians; water resource disturbance affects fisheries).

    (CL&P 1, Vol. 1, pp. H-51, N-58 to N-60)

132. Approximately 3.6 to 4.6 miles of permanent access roads would be required for the in-ROW underground cable variations, compared to approximately 3.4 miles of access roads for the overhead route. Compared to overhead transmission systems, underground cable systems require wider access roads that are able to accommodate special permit vehicles needed to transport the reels of cable to each splice vault along the underground route. (CL&P 1, Vol. 1, pp. H-50, H-51)

133. An all-underground in-ROW alternative will eliminate the visual effects of overhead transmission structures. However, clear-cutting the ROW for a continuous trench and an associated permanent access road along the entire ROW will significantly alter the ROW's appearance. Also, the required new transition stations will have direct visual impacts in their immediate area. (CL&P 1, Vol. 1, pp. H-43, H-44)

134. Installation of a 12-mile underground cable along the transmission ROW would require an estimated two years to complete. Final restoration of all disturbed areas might require an additional year. (CL&P 1, Vol. 1, p. H-25)

All Underground In-Street

Route and Design

135. An all underground in-street route was investigated for the installation of a 345-kV transmission cable system between North Bloomfield Substation and the Connecticut/Massachusetts border. The route would leave the North Bloomfield Substation, follow Tariffville Road east for approximately 600 feet; continue north along the existing transmission line ROW, crossing the Farmington River at Route 187/Main Street; then continue north along Route 187/Main Street for approximately 5.7 miles to Sheldon Street; east along Sheldon Street for approximately 0.5 miles to Grand Street; and north along Grand Street for approximately 4.5 miles to the Connecticut/Massachusetts border. Grand Street becomes Pine Street once it crosses the state border into Massachusetts; the route would continue north along Pine Street for approximately 0.2 miles to Barry Street; west along Barry Street for approximately 0.5 miles; and then terminate at a potential transition station south of Barry Street on WMECO property. (CL&P 1, Vol. 1, p. H-25)

136. An all-underground in-street transmission facility typically consists of three splice-vaults (one per each set of three XLPE cables), 10 feet wide by 10 feet deep by 32 feet long, buried approximately 1,600 feet apart along the route; nine 8-inch PVC conduits for the 345-kV XLPE cables running between them; three 2-inch PVC conduits for the grounding conductors; three 2-inch PVC conduits for the fiber-optic relaying cables; and three 2-inch conduits for the temperature-sensing fiber cables. This equipment would be placed in a trench normally 5-7 feet wide and 7-10 feet deep, although the large amount of infrastructure usually already in streets makes these dimensions particularly variable. (CL&P 1, Vol. 1, pp. H-58, N-55)

137. CDOT requires splice vaults be built outside of the travel ROW wherever possible. Any underground installation involving state highways would require substantial construction of such vaults on adjacent private property. (Tr. 16, pp. 80-82; CL&P 1, Vol. 1, pp. H-37, H-38)

Environmental Impacts

138. Installing in-street underground transmission lines reduces damage to natural resources to a certain extent. However, associated water crossings cannot be avoided. (CL&P 1, Vol. 1, p. N-55)

Other Underground Route Variations for the GSRP Northern Route

General

139. There are four technically feasible underground line variations to a portion of the proposed overhead line GSRP—Northern Route between North Bloomfield and the Connecticut/Massachusetts state border. Each of the four would avoid locating the new 345-kV transmission line in an overhead line configuration on the existing ROW in the vicinity of certain residences, while leaving the existing 115-kV line on that section of ROW unchanged. Each of the four is an alternative to the others: that is, building more than one of them would be duplicative. (CL&P 1, Vol. 1, p. H-37)

140. CL&P investigated underground route variations that would substitute for the proposed overhead line along the ROW between Country Club Lane and Phelps Road. Potential route variations for this area include installation of an underground cable within the existing ROW for a distance of 3.6 to 4.6 miles or installation within or adjacent to public road ROWs for a distance of 6 to 8 miles. These route variations would replace a section of the proposed overhead 345-kV line over a distance of 3.6 to 5.1 miles. (CL&P 1, Vol. 1, pp. H-28, H-29)

141. The two underground line variations within or adjacent to road ROWs are referred to as the Newgate Road Underground Line Route Variation and the State Route 168/187 Underground Line Route Variation. The two underground line variations within portions of the existing transmission line ROW are referred to as the 4.6-Mile in-ROW Underground Line Route Variation and the 3.6-Mile in-ROW Underground Line Route Variation. Each variation is an alternative to the proposed overhead line and to the other underground variations. (CL&P 1, Vol. 1, p. H-37)

Newgate Road Underground Line Route Variation

Route and Design

142. The Newgate Road Underground Line Route Variation would include the installation of cables within the existing transmission line ROW for a distance of approximately 1,000 feet and then within or along Turkey Hills Road (Route 20), Newgate Road and Phelps Road. Transition stations would be located adjacent to the ROW near Granby Junction (on CL&P property) and near the ROW intersection with Phelps Road (partially on CL&P property, partially on private land). This variation would replace a 4.6 mile section of overhead line. Refer to Figure 4. (CL&P 1, Vol. 1, p. H-39)

143. Additional ROW would be required at the northern transition station near Phelps Road; temporary and permanent easements could also be required at the splice-vault locations due to conflicts with existing utility facilities or requirements of the CDOT. (CL&P 1, Vol. 1, p. H-39; CL&P 15, Carberry/Newland, pp. 46-47)

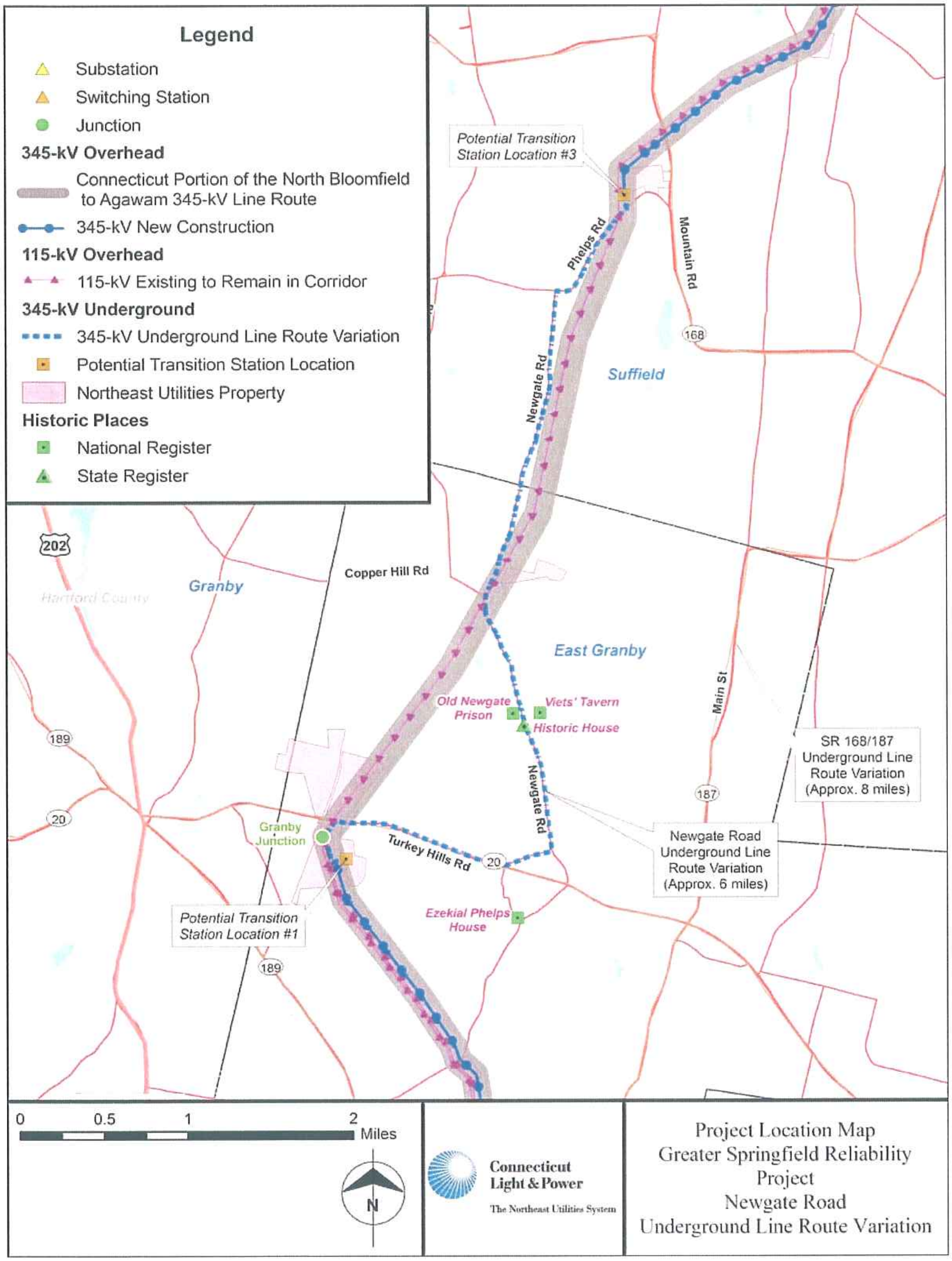
Environmental Impacts

144. A portion of the Newgate Road Variation route would pass by Old Newgate Prison, which is listed on the National Register of Historic Places and designated as a National Historic Landmark. Underground copper mining tunnels that extend under Newgate Road are part of the historic site. Additionally, stone walls that comprise Old Newgate Prison are within ten feet of the edge of the Newgate Road pavement and may be affected by vibrations associated with construction. The variation would also pass Viet's Tavern, which is also listed on the National Register of Historic Places. Both Old Newgate Prison and Viet's Tavern are within approximately ten feet from the edge of Newgate Road. Viet's Cemetery is designated as an ancient burying ground and is also located near the Variation. (CL&P 1, Vol. 1, p. H-41, M-2, M-13, M-14; Tr. 7, pp. 181, 182)

145. The Clark Farm Tenant House, which is approximately 3,800 feet from the Variation, is listed on the National Register of Historic Places. (CL&P 1, Vol. 3, p. 31)

146. Old Newgate Prison operated from 1773 to 1782 and 1790 to 1827; it is the first prison in the United States operated by a state government. The copper mine located beneath the prison was the largest of its time in the early 18^{th} century. (CL&P 1, Vol. 1, p. M-13)

Figure 4. Newgate Road Underground Line Route Variation.



(CL&P 1, p. ES-14)

Route 168/187 Underground Line Route Variation

Route and Design

147. The Route 168/187 Underground Line Route Variation would include the installation of cables within the existing transmission line ROW for approximately 1,000 feet and then within or along Turkey Hills Road (Route 20), North Main Street, South Stone Street (Route 187) and Mountain Road (Route 168). This variation would replace a 4.6 mile section of overhead line. Refer to Figure 5. (CL&P 1, Vol. 1, p. H-41)

Environmental Impacts

148. See Findings of Fact above for "All Underground In-Street."

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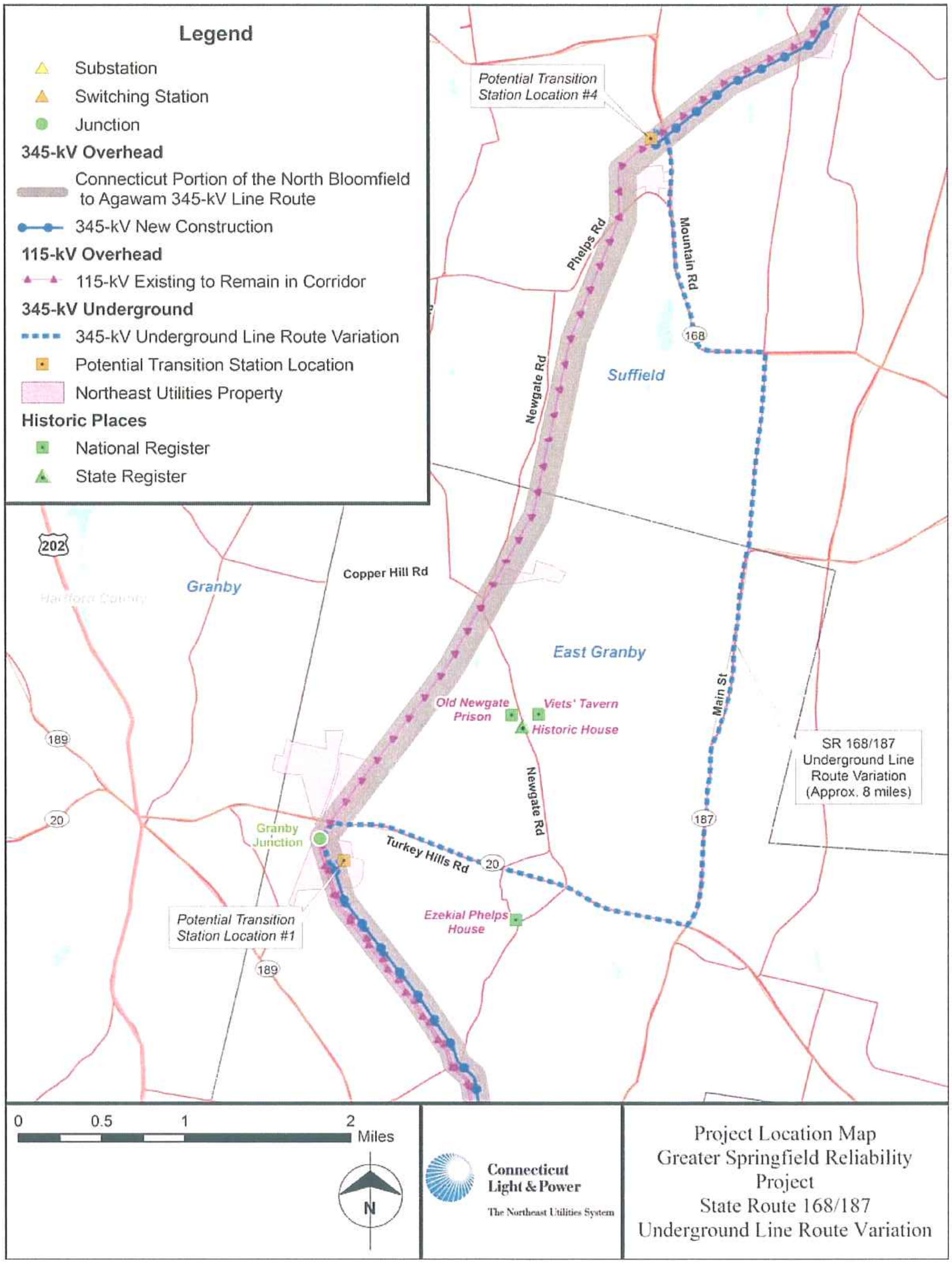
Figure 5. State Route 168/187 Underground Line Route Variation.



(CL&P 1, p. ES-15)

4.6 Mile In-ROW Underground Line Route Variation

Route and Design

149. The 4.6-mile In-ROW Underground Line Route Variation would begin at a new transition station at Granby Junction in East Granby and extend north within the existing overhead transmission line ROW for 4.6 miles to a new transition station site north of Phelps Road in Suffield. Refer to Figure 6. (CL&P 1, Vol. 1, pp. H-43, H-44)

Environmental Impacts

150. See Findings of Fact above for "All Underground In-ROW."

151. Environmental impacts to resources, such as upland vegetation, wetlands, watercourses, habitat and cultural resources occur throughout the life of the project since a permanent access road would be required along the ROW to provide access to the entire cable system. (CL&P 1, Vol. 1, pp. H-43, H-44)

152. The variation would cross a wetland that is approximately 1,500 feet long, located north of Turkey Hills Road. Crossing this wetland using HDD may be possible but would depend on subsurface conditions in the area. Also, HDDs are costly and there is a risk of the drilling fluid returning to the surface and affecting the wetland. (CL&P 1, Vol. 1, pp. H-43, N-55)

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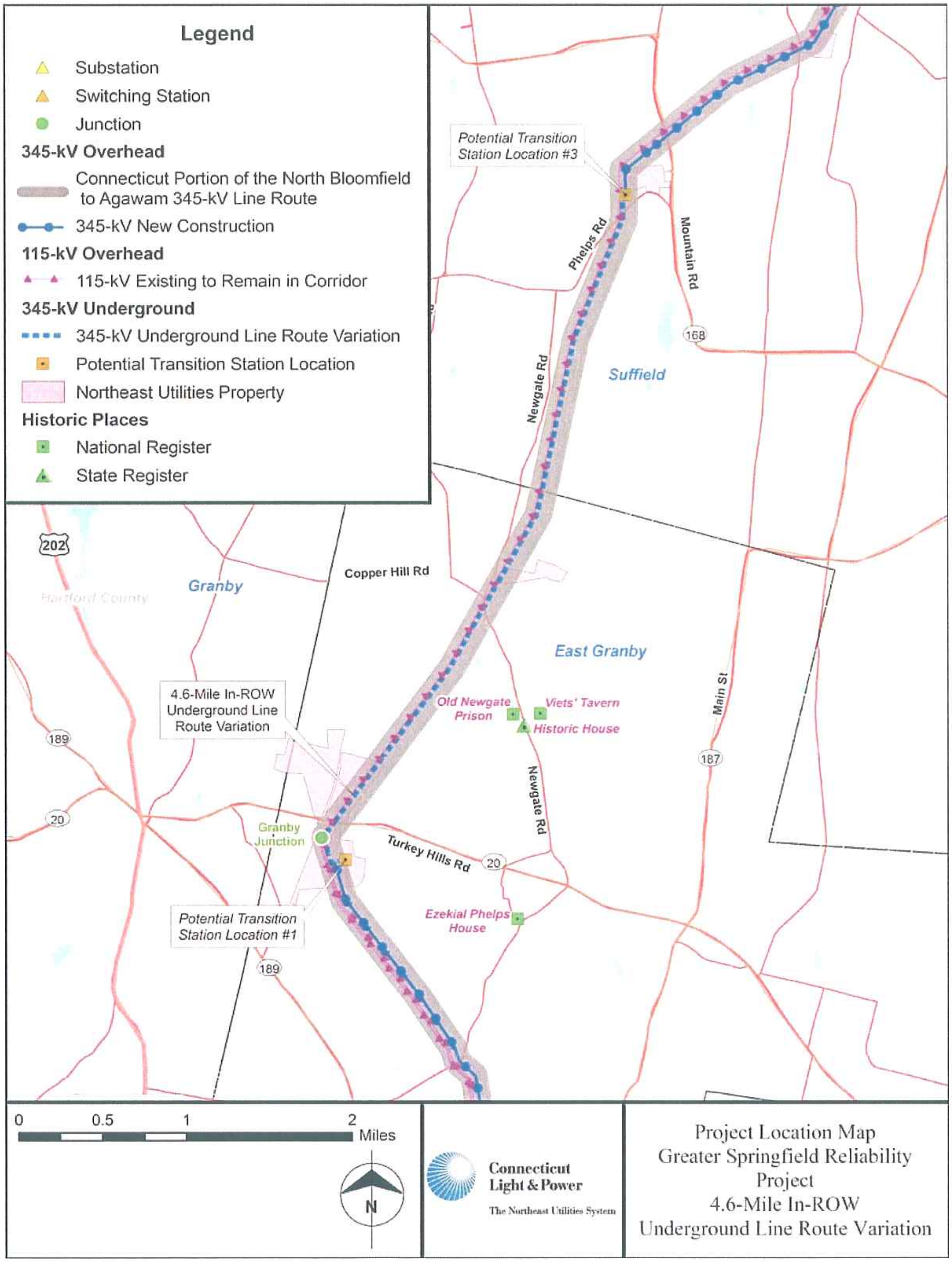
Figure 6. 4.6 Mile In-Road Underground Line Route Variation.



(CL&P 1, p. ES-17)

3.6 Mile In-ROW Underground Line Route Variation

Route and Design

153. The 3.6-Mile In-ROW Underground Line Route Variation was developed to reduce the wetland impacts that would be associated with the 4.6-Mile in-ROW variation. This variation would extend from a potential transition station site approximately 0.8 miles south of Newgate Road to a potential transition station north of Phelps Road in Suffield. The transition station north of Phelps Road would be located partially within the transmission line ROW and partially on land owned by the State of Connecticut (Newgate Wildlife Management Area). Refer to Figure 7. (CL&P 1, Vol. 1, p. H-46)

154. This variation could not be built unless CL&P were able to obtain the necessary rights to build a transition station on this state land. (CL&P 1, Vol. 1, p. H-46)

Environmental Impacts

155. See Findings of Fact under the "All Underground In-ROW" section.

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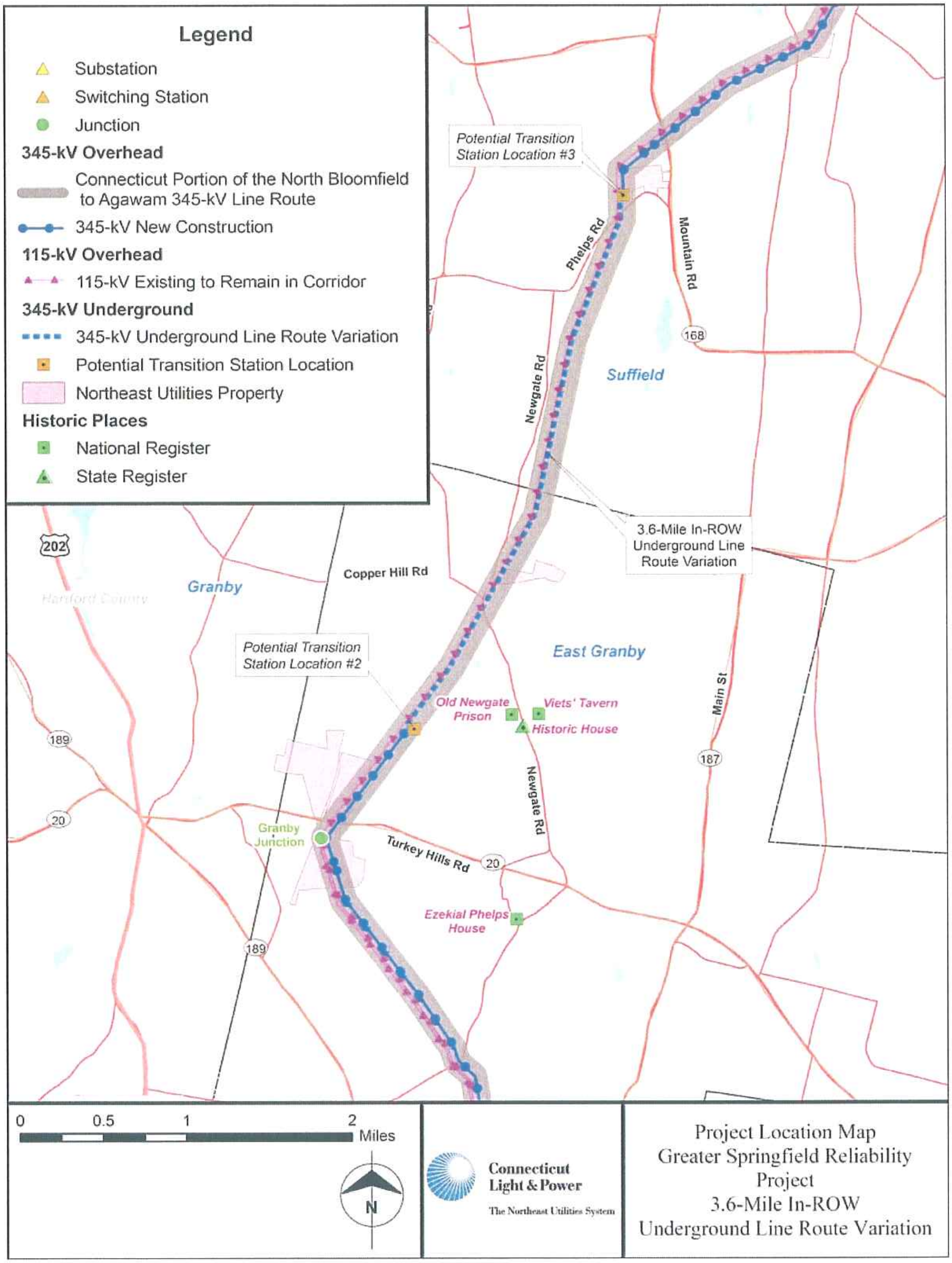
Figure 7. 3.6 Mile In-ROW Underground Line Route Variation.



(CL&P 1, p. ES-16)

Southern Route Alternative Variation (Hybrid Variation)

Route and Design

156. A hybrid overhead-underground line route was investigated that would substitute an underground cable segment for the section of overhead line adjacent to the residential areas in Enfield. A 3.7-mile portion of the overhead 5.4 mile Southern Route Alternative in Connecticut would be replaced by an approximately 4.3 mile section of cable. Refer to Figure 8. (CL&P 1, Vol. 1, p. H-57; CL&P 15, Carberry/Newland, p. 53)

157. The hybrid variation would be installed primarily in and adjacent to state and local public roads. It would branch off from the existing overhead line ROW at Campania Road (west of Interstate 91) in Enfield, traverse Campania Road, Manning Road, U.S. Route 5, Brainard Road, and Mayfield Drive, and rejoin the ROW at its intersection with Mayfield Drive, also in Enfield. A 0.4-mile segment also would be located underground within the existing transmission line ROW. (CL&P 1, Vol. 1, pp. H-57, H-58)

158. The hybrid variation would require a transition station at each end. Each of the two would require two to four acres of fenced and graded area with above-ground termination facilities, and could be located primarily on CL&P property, but would also require some additional acquisition of private land. (CL&P 1, Vol. 1, pp. H-57, H-58)

Environmental Impacts

159. See Findings of Facts under the "All Underground In-ROW" and "All Underground In-Street" sections.

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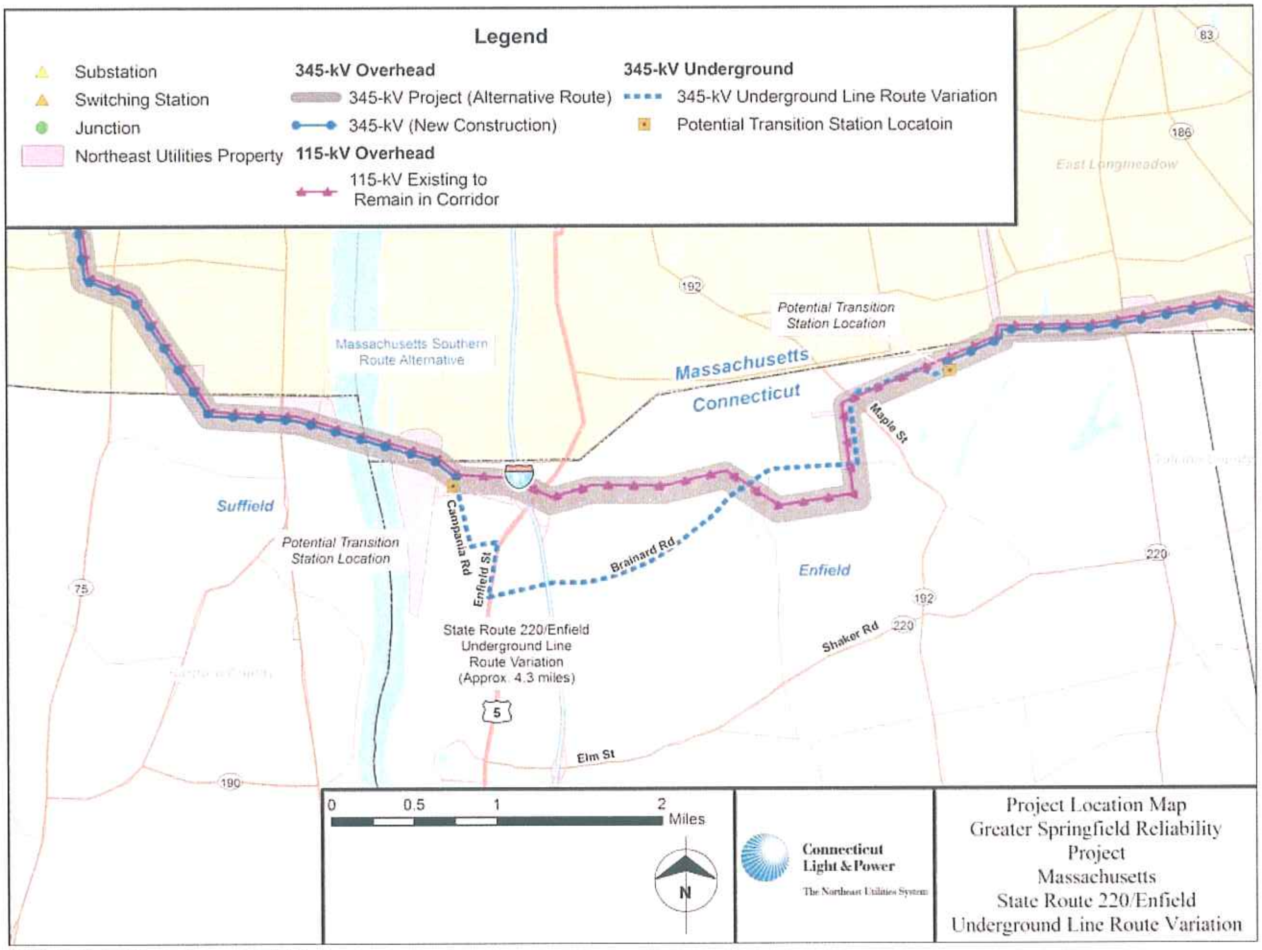
Figure 8. Southern Route Alternative Variation (Hybrid Variation)



(CL&P 1, Vol. 1, p. H-59)

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Cost Comparisons: Overhead Vs. Underground

160. The initial capital cost of an all overhead H-frame design transmission facility within Connecticut is approximately $41 million (2008 dollars). The estimated life-cycle costs of the facility would be approximately $85 million (2008 dollars), not including substation improvements. (CL&P 1, Vol. 1, p. H-25)

161. The initial capital cost of an all underground in-ROW transmission cable route within Connecticut is approximately $455 million (2008 dollars). The estimated life-cycle costs of the facility would be approximately $648 million (2008 dollars) including transition stations but not substation improvements. (CL&P 1, Vol. 1, p. H-25)

162. The initial capital cost of an all underground in-street transmission cable route along or adjacent to public roads within Connecticut is approximately $479 million (2008 dollars). The estimated life-cycle costs of the facility would be approximately $682 million (2008 dollars) including transition stations but not substation improvements. (CL&P 1, Vol. 1, p. H-26)

163. Transmission systems that contain both underground and overhead segments require transition stations wherever the cables and lines meet. Each one would cost approximately $15 million. (Tr. 6, p. 173)

164. The cost of the proposed overhead transmission line project including costs associated with modification of the North Bloomfield Substation versus the underground variations is shown in the table below.

Route	Total CT project Cost	Difference in Cost
CT portion of North Bloomfield to Agawam 345-kV overhead route (as proposed)	$133,370,000.	–
CT portion of North Bloomfield to Agawam 345-kV route (incl. 3.6-mile in-ROW variation)	$286,957,000.	$153,587,000.
CT portion of North Bloomfield to Agawam 345-kV route (incl. 4.6-mile in-ROW variation)	$317,817,000.	$184,447,000.
CT portion of North Bloomfield to Agawam 345-kV route (incl. Newgate Road variation)	$380,631,000.	$247,261,000.
CT portion of North Bloomfield to Agawam 345-kV route (incl. Route 168/187 variation)	$455,306,000.	$321,936,000.

(CL&P 1, Vol. 1, p. H-49)

165. The cost of the Southern Route Alternative Hybrid Variation including two transition stations is $184,000,000. The 3.7 mile section of overhead transmission line that would be replaced by the Hybrid Variation is $15,000,000. The Hybrid Variation would cost $169,000,000 more than the 3.7 mile section of transmission line it would replace. (CL&P 15, Carberry/Newland, p. 54)

166. The actual costs to Connecticut electricity consumers would be higher than those listed in the table because of the federal tariff provisions governing large-scale transmission projects such as GSRP. In general terms, the GSRP is expected to qualify for the New England regional transmission rates, meaning the costs of the GSRP would be "regionalized", or shared throughout New England, based on each state's proportion of load. More specifically, however, ISO-NE has the authority to determine which portions of a project are eligible for regionalization and which are not. (CL&P 5, R. CSC-031; Tr. 6, p. 44)

167. ISO-NE may decide that if it would be feasible for a portion of the GSRP in Connecticut to be constructed overhead and it is instead installed underground at an additional cost, the excess cost of this portion of the GSRP would not be regionalized, but instead would be "localized" to ratepayers in Connecticut. (CL&P 5, R. CSC-031; Tr. 6, p. 44)

168. Since Connecticut uses approximately 27 percent of the New England load, if ISO-NE decides to regionalize all portions of the GSRP Connecticut consumers would pay approximately 27 percent of the project's entire costs, regardless of how much of the project is located in Connecticut. If ISO-NE decides not to regionalize the underground portion of GSRP, however, Connecticut consumers would pay 27 percent of the cost for whatever part of the whole project is constructed overhead, plus 100 percent of the difference between what the underground portion costs, including transitions stations, and what it would have cost if constructed overhead. Depending on ISO-NE's decision, potential costs to Connecticut consumers for each underground variation are displayed in the table below.

Variation	**Cost of Variation**	**Cost (> overhead section)**	**27% of overhead section**	**Cost to CT consumers**
3.6 miles in-ROW	$166,000,000.	$153,600,000.	$3,348,000.	$156,948,000.
4.6 miles in-ROW	$200,300,000.	$184,800,000.	$4,185,000.	$188,985,000.
Newgate Road	$262,800,000.	$247,300,000.	$4,185,000.	$251,485,000.
Route 167/187	$337,500,000.	$322,000,000.	$4,185,000.	$326,185,000.

(CL&P 5, R. CSC-031; Tr. 6, p. 44)

169. Construction costs of 345-kV underground cables along the ROW would range from approximately $37,260,000/mile to $46,104,000/mile. Installation of 345-kV underground cables within roads would cost approximately $37,742,500/mile. Construction of the proposed H-frame overhead line would cost approximately $3,440,800/mile. These cost estimates do not include substation or transition station costs. (CL&P 18, R. Suffield-002, Suffield-005)

170. The following Findings of Fact, which are cost estimates of rates passed on through customer bills, are calculated in 2014 U.S. dollars, and are assumed over one year. Customers would pay for the transmission lines through electric bills over 40 years, which is the estimated life of the line. The costs would decline over time with depreciation of the assets and increase with the addition of capitalized operation and maintenance costs. (Tr. 8, pp. 306, 307)

171. Currently, the typical CL&P residential customer pays 20.3 cents per kilowatt hour. The construction of the proposed overhead GSRP would increase the rate by about an eighth of a cent – 0.13 cents – to 20.43 cents per kilowatt hour. An underground variation would increase the rate by about half a cent – 0.49 cents – to 20.79 cents per kilowatt hour. (Tr. 8, pp. 276, 277)

172. An all-overhead GSRP transmission line would increase a typical residential customer's monthly bill (700 kWh) by about $0.88 per month. An all-underground variation would increase a typical residential customer's monthly bill by $3.37. (CL&P 18, R. Suffield-013; Tr. 8, p. 277)

173. A manufacturing or large-use electric customer (900,000 kWh) has a different rate from a residential customer. Under this rate, the electric bill would increase by $1,053 per month if the GSRP were built overhead and $4,000 per month if it were built underground. (Tr. 8, p. 278)

VI. ENVIRONMENT

General

174. Terrain in the GSRP project area is characterized by ground elevations ranging from 50 feet above mean sea level (amsl) to greater than 500 feet amsl at the point where the ROW crosses the West Suffield Mountain range. (CL&P 1, Vol. 1, p. L-3)

Wetlands and Watercourses

175. Construction practices for wetlands and watercourses include:

    1. Installation, inspection and maintenance of erosion and sediment controls.
    2. Limiting grading to the amount necessary to provide a safe workspace.
    3. Installation of temporary timber matting to cross wetlands and watercourses.
    4. Restoration of wetlands to pre-construction conditions to the extent practicable.
    5. Compliance with the conditions of federal and state permits
    6. Avoidance of piling woody wetland vegetation.
    7. Cutting of forested wetland vegetation without removing stumps.
    8. Avoidance or minimization of access through wetlands.
    9. Refueling construction equipment 100 feet or more from a wetland.
    10. Storage of petroleum products 100 feet or more from a wetland.
    11. Restoration of work sites and temporary access roads through wetlands.

    (CL&P 1, Vol. 1, pp. N-15, N-16)

176. New transmission structures would be located in upland areas, and access road crossings in wetland areas would be limited, where possible, in order to limit wetland impacts. However, where wetland impact is unavoidable, CL&P would make an effort to reduce the size of the crane pad or reconfigure the crane pad, if practical, to avoid placement of temporary fill in wetlands. (CL&P 1, Vol. 1, p. N-14)

177. New wetland crossings would be constructed using either gravel underlain by geotextile fabric or a series of timber mats. In wetland areas where there is a deep organic soil layer or where the wetlands are prone to extended inundation, permanent gravel access roads would be used to provide a firm base for future access. (CL&P 1, Vol. 1, p. N-16)

178. Temporary poles may have to be installed within wetlands during conductor stringing to prevent the wires from sagging into the road travel lanes. The poles would be installed along the ROW at road crossings and would be removed when the operation is complete. (CL&P 1, Vol. 1, p. N-11)

179. Vernal pools are small bodies of standing freshwater that coincide with spring snowmelt and precipitation but typically become completely dry in other seasons due to evaporation and infiltration. Some amphibian species can reproduce only in vernal pools. (CL&P 1, Vol. 1, p. L-16)

180. Potential temporary impacts to vernal pool-obligate amphibians may occur during construction, particularly if work activities are performed during amphibian breeding or migration periods. Permanent impacts may result from the placement and maintenance of access roads. (CL&P 1, Vol. 1, p. N-28)

181. The spring migration and breeding period for the adult male spotted salamander and the Jefferson salamander is approximately from March 1st through May 1st. The migration and breeding period for the marbled salamander is approximately from September 1st through October 31st. (CL&P 1, Vol. 1, p. N-29)

182. Some new structures may be placed in amphibian breeding areas that exist within large wetland systems currently containing one or more transmission line structures. Additionally, access to the structures is necessary, which may result in temporary effects to amphibian breeding habitat. (CL&P 1, Vol. 1, p. N-28)

Wildlife

183. There are no federally-listed or proposed threatened or endangered species or critical habitats in the proposed project area. (CL&P 1, Vo. 1, p. L-28, Vol. 4, Ex. 4, USFWS letter dated November 8, 2007)

184. Construction of the proposed project may temporarily displace wildlife from the area due to the initial disturbance from vegetation clearing and the operation of construction equipment. (CL&P 1, Vol. 1, p. N-23)

185. Impacts to birds from the proposed projects would result primarily from habitat modification due to vegetation clearing during construction and ROW vegetation management activities. The nesting season for a majority of breeding birds extends from May 1st through July 31st. Tree clearing during the nesting season could result in the loss of a breeding season for those species that have established nests within the proposed work area. (CL&P 1, Vol. 1, p. N-31)

Habitat and Vegetation

186. Eight habitat types occur either within the maintained portions of the exiting ROW, or in adjacent, unmaintained portions, where some additional clearing would be required for construction of the proposed project. These eight habitat types include:
    1. Old Field/Shrub Land –abandoned fields, natural shrub lands and early successional forests.
    2. Mature Mixed Forest –deciduous/coniferous forests, typically tree species common to the area.
    3. Forested Wetland – generally red maple swamps dominated by a mature tree canopy.
    4. Scrub-Shrub Wetland – typically emergent marsh where shrub coverage is substantial.
    5. Emergent Wetland – marshes dominated by herbaceous wetland plant species.
    6. Open Water – substantial areas of open water such as lakes, ponds, etc.
    7. Agricultural Lands – cultivated fields, croplands, hayfields, pastures and orchards in active use.
    8. Urbanized Areas – suburban and urban residential developments, subdivisions, and other maintained areas.

    (CL&P 1, Vol. 1, pp. L-18, L-19)

187. Conversion of the land on the proposed ROW to old field and shrubland habitat would benefit wildlife species that are currently declining in the state and region. Much of the old field and shrubland habitat is gone because former agricultural land is being developed or allowed to revert to woodland. Application of herbicide and mechanical clearing of vegetation should be conducted outside of nesting season for potential resident species. (DEP comments dated July 15, 2009, p. 7; CL&P 1, Vol. 1, p. N-22)

ROW Clearing

188. Vegetative clearing is performed every four years to allow for removal of plants before they grow to a large height or density. (Tr. 8, p. 103)

189. Vegetative clearing involves the selective removal of identified species within the ROW. Clearing practices specifically target tall-growing tree species and occasionally some state listed invasive shrub species. Removal of the targeted species is done through cutting or herbicide applications. (Tr. 8, pp. 102, 103)

190. Generally, all tall-growing tree species would be removed from the ROW, while low-growing tree species and taller shrub species would remain in the areas outside of the conductor zones. The conductor zone extends from the area directly below the lines to 15 feet past the most outward conductors. (CL&P 1, Vol. 1, p. N-26)

191. Vegetation within the conductor zone is required to be eight feet or less. Outside the conductor zone the height of the vegetation could be up to 30 feet. (Tr. 8, p. 176)

192. Vegetation along the ROW would be maintained along the banks of the watercourses to provide shade. Vegetation would only be removed if required to maintain safe clearances and access to and from the transmission facilities. (CL&P 1, Vol. 1, p. N-27)

Noise

193. Noise emissions associated with the construction of the proposed projects would be short-term and would generally be due to truck traffic, earth-moving vehicles, cranes, jackhammers and other construction equipment. The impact of construction-related noise emissions would vary depending on the location of the noise source due to sound attenuation with distance and with the presence of vegetative buffers or other barriers. (CL&P 1, Vol. 1, p. N-46)

194. The proposed GSRP lines would not be a significant source of audible noise. Such noise typically is caused by an aspect of electric fields called "corona." The conductors proposed for the GSRP have a larger diameter than those used on other 345-kV transmission lines, which reduces coronas. Generally, the operation of a 345-kV transmission line would create noise that ranges from inaudible levels during fair weather to barely audible levels in relatively dry snow or light fog to distinctly audible levels in rain or wet snow. (CL&P 1, Vol. 1, p. N-46; CL&P 23, R. CAOPLC-013)

Air Quality

195. Properly maintained construction equipment and vehicles would limit vehicular emissions. (CL&P 1, Vol. 1, p. N-45)

196. Fugitive dust emissions during construction of the proposed projects would be suppressed by watering on access roads. Crushed stone aprons would be installed at access road entrances to public roads to minimize tracking of soil onto the pavement. (CL&P 1, Vol. 1, p. N-45)

197. No long-term effects on air quality are associated with the operation of the transmission lines. (CL&P 1, Vol. 1, p. N-45)

Visual Resources

198. The National Park Service has expressed concern about the proposed GSRP's environmental and scenic/recreational impacts to the recently designated New England National Scenic Trail (Metacomet Trail) and the Wild and Scenic River Study of the Lower Farmington River and Salmon Brook, authorized by Congress. (NPS comments dated July 28, 2009)

199. Although portions of the Farmington River in Connecticut have been classified as Wild and Scenic, the proposed GSRP route would not cross any of the currently classified portions. The National Park Service, however, is currently studying designation of the Lower Farmington River. (CL&P 1, Vol. 1, p. L-10; DEP Comments dated July 15, 2009)

200. Where residences are in close proximity to the ROW, the DEP recommends limiting clearing of vegetation to the extent possible and adding landscaping in the area between structures 3208 and 3207 along Newgate Road. (DEP comments dated July 15, 2009)

Safety

201. The design of the proposed project incorporates protective relaying equipment to automatically detect abnormal system conditions and send a protective trip signal to the associated circuit breaker(s) at each end of a line to isolate the faulted section of the transmission system. (CL&P 1, Vol. 1, p. K-1)

202. Carrier signals are impressed upon the overhead conductors to provide electronic communications between substations with overhead transmission facilities. (CL&P 1, Vol. 1, p. K-2)

203. Fire/smoke detection systems would be installed within the proposed control and relay enclosure at the North Bloomfield Substation. These systems would automatically activate an alarm at Connecticut Valley Electric Exchange (CONVEX). (CL&P 1, Vol. 1, p. K-2)

Compliance with other State and Federal Agencies

204. An Individual Permit from the USACE-New England District is needed to construct the proposed GSRP pursuant to Section 404 of the federal Clean Water Act and Section 10 of the Rivers and Harbors Act. The USACE would review the proposed project jointly with the DEP regarding the issuance of an individual water quality certification pursuant to Section 401 of the Clean Water Act. As part of this permit application, CL&P developed an "invasive species control plan", which was submitted to the USACE on June 19, 2009. (CL&P 1, Vol. 1, p. N-9; CL&P 18, R. FRWA-001)

205. The applications for the Water Quality Certification and Stream Channel Encroachment Line (SCEL) Permit were filed with the DEP in 2009. Permits are expected to be issued in the second quarter of 2010. (CL&P 5, R. CSC-033)

206. A General Permit Registration for the Discharge of Storm Water and Dewatering Wastewaters from Construction Activities is required from the DEP, and an associated project-specific Storm Water Pollution Control Plan would be prepared. Both would be developed during and in conjunction with the preparation of the D&M Plans, as required by the Council if GSRP is approved. (CL&P 1, Vol. 1, p. N-9)

207. An SCEL permit may be required for the Connecticut River crossing at Suffield, if the Southern Route Alternative is approved. (DEP comments dated July 15, 2009, pp. 2, 3)

Mitigation

208. Along Segment 1 of the proposed GSRP – Northern Route, the existing 115-kV line could temporarily be taken out of service for short periods to allow for construction of the proposed 345-kV line. Temporary outages of the 115-kV line would allow the proposed 345-kV line to be moved up to 25 feet closer to the existing 115-kV line. This would reduce clearing requirements by up to 25 feet for 4.7 miles along the ROW, which equates to 14 acres. (Tr. 8, p. 202)

209. Compensatory wetland mitigation options would be coordinated with the DEP and United States Army Corps of Engineers (USACE). These options may include wetlands restoration and/or enhancement along the project ROWs, mitigation banking, wetlands creation, wetlands preservation, and conservation restrictions. (CL&P 1, Vol. 1, p. N-17)

210. Currently, to prevent the use of ROWs by unauthorized all-terrain vehicles, CL&P has installed fences, gates, barricades and berms at public access points along transmission line ROWs. If CL&P holds an easement in an area, rather than ownership in fee, they must receive landowner approval prior to installing fences or gates along the ROW. Landscape plantings may limit views of the ROW, thereby deterring unauthorized access. (CL&P 1, Vol. 1, pp. N-42, N-43; Tr. 5, pp. 166, 167, 174, 175)

<u>Northern Route</u>

Wetlands and Watercourses

211. Wetlands along the GSRP proposed route were identified and described by registered soil scientists during 2007 and 2008. (CL&P 1, Vol. 1, p. L-5)

212. Approximately 11 existing transmission structures along the Connecticut portion of the GSRP – Northern Route are located in wetlands. (CL&P 1, Vol. 1, pp. N-9, N-10)

213. The GSRP – Northern Route would require the removal of 26 acres of forested vegetation to clear an average of an additional 100 feet along the existing ROW. The forested wetland would be converted to scrub-shrub or emergent wetland. (CL&P 1, Vol. 1, p. N-11)

214. Vernal pool/amphibian breeding habitat surveys were performed in March and April of 2008. Eighteen wetlands functioning as vernal pools were identified along the Connecticut portion of the GSRP – Northern Route. Of the identified vernal pools, one, which is in Suffield, would be impacted by construction due to the installation of a new pole structure and temporary access road. Three, located in East Granby, may be impacted by vegetative clearing. (CL&P 1, Vol. 1, p. L-16; CL&P 18, R. FRWA-007)

215. Amphibian species identified within the vernal pools along the GSRP – Northern Route ROW include spotted salamanders, marbled salamanders, Jefferson salamanders, wood frogs, spring peepers and green frogs. A breeding population of the Jefferson salamander, which is a state-listed species of special concern, was confirmed in two wetlands along the ROW. (CL&P 1, Vol. 1, p. N-28)

216. The proposed GSRP route and existing ROW span seven perennial watercourses, the largest being the Farmington River, and 16 intermittent watercourses. (CL&P 1, Vol. 1, p. L-9)

217. The Connecticut portion of the GSRP ROW is within the 100-year Federal Emergency Management Agency (FEMA) floodplain of Griffin Brook, the Farmington River and Muddy Brook. The loss of floodplain storage along Griffin Brook would occur near the North Bloomfield Substation. CL&P would mitigate this by creating new floodplain storage within the affected area. (DEP comments dated July 15, 2009, p. 2; CL&P 1, Vol. 1, p. L-17)

218. The GSRP – Northern Route is not above or in the vicinity of public wells, aquifer protection areas, or aquifer protection public supply wells. (CL&P 1, Vol. 1, p. L-17)

Wildlife

219. The GSRP – Northern Route traverses the Newgate Wildlife Management Area (WMA) in East Granby, a state-designated wildlife management area managed by the DEP. The proposed route would cross approximately 0.7 miles through the management area. (CL&P 1, Vol. 1, p. L-22)

220. The Connecticut portion of the proposed GSRP traverses 0.3 miles through property owned by the Suffield Sportsman's Association in Suffield. (CL&P 1, Vol. 1, pp. L-22, L-23)

221. Seven state-listed endangered, threatened and special concern species have been reported to occur within the vicinity of the proposed GSRP. State-listed species include:
   1. eastern box turtle (*Terrapene carolina*) – State Special Concern;
   2. Jefferson salamander (*Ambystoma jeffersonianum*) – State Special Concern;
   3. arrow clubtail dragonfly (*Stylurus spiniceps*) – State Special Concern;
   4. eastern pearlshell mussel (*Margaritifera margaritifera*) – State Special Concern;
   5. dwarf wedge mussel (*Alasmidonta heterodon*) – Federal Endangered and State Endangered;
   6. eastern pond mussel (*Ligurnia nasuta*) – State Special Concern; and
   7. Bush's sedge (*Carex bushii)* – State Special Concern.

   (CL&P 1, Vol. 1, p. L-30)

222. Two additional state-listed special concern species are the eastern hognose snake (*Heterodon platirhinos*); and wood turtle (*Clemmys insculpta)*. (DEP Comments dated July 15, 2009, p. 4)

Eastern Box Turtle

223. The DEP recommended the daily presence of a DEP approved turtle ecologist during the eastern box turtle active period (June through October) whenever construction activities take place in mapped eastern box turtle habitats and any eastern box turtles encountered shall be removed from the work area; contractor awareness training for identification and handling of eastern box turtles; parking all construction vehicles and equipment on roadways and not in eastern box turtle habitat to the extent possible; installing turtle exclusion fencing around work areas prior to construction; minimizing the removal of low growth vegetation in all mapped eastern box turtle habitats during ROW clearing; and implementing an effective erosion and sedimentation control plan to limit the deposition of sediment into wetland habitats. (CL&P 1, Vol. 1, pp. L-32, N-34; DEP comments dated July 15, 2009, p. 5)

224. CL&P would not agree to comply with the DEP recommendation of staging all equipment on roadways rather than in eastern box turtle habitat. CL&P would comply with that recommendation to the extent feasible; however, it may not be feasible to mobilize certain pieces of equipment, such as cranes supporting new structures, multiple times a day to locate them outside potential turtle habitat. (CL&P 1, Vol. 1, p. N-35)

Jefferson Salamander

225. CL&P, in accordance with recommendations from the DEP, performed Jefferson salamander surveys along the ROW in East Granby. The presence of the salamanders has been confirmed within a portion of the existing ROW. (CL&P 1, Vol. 1, pp. L-30, L-31)

226. The CT DEP recommendations for construction within the vicinity of the Jefferson salamander include: seasonal restrictions on tree clearing work, which would be performed in September and October in the affected areas of the ROW; avoiding the installation of new structures within amphibian breeding pools; using temporary timber mats rather than constructing new gravel access roads in the vicinity of amphibian breeding habitat; limiting the removal of low-growth vegetation surrounding breeding pools; making the protection and maintenance of low-growth vegetation within and around breeding pools part of CL&P's vegetation maintenance program for the ROW; using effective erosion and sedimentation controls to minimize deposition of sediment into breeding areas; and placing wood-chip ramps on either side of sediment and erosion controls and/or openings in the erosion control barriers to allow amphibian access to and from vernal pool habitat. Additionally, all silt fencing should be removed from the area following soil stabilization so movement of the species between uplands and wetlands is not restricted. (CL&P 1, Vol. 1, pp. N-32, N-33; CL&P 4, R. 14; DEP comments dated July 15, 2009, p. 4)

227. CL&P has committed to comply with the seasonal restriction concerning the Jefferson salamander for the clearing of the ROW. However, all other construction activities would continue, due to outage constraints and other engineering and construction limitations. (CL&P 1, Vol. 1, p. N-33)

Arrow Clubtail Dragonfly

228. The arrow clubtail dragonfly, which may occur in certain areas near the proposed GSRP – Northern Route, is not expected to be directly affected by the project because no in-water work activities for these areas are proposed. The DEP has emphasized the importance of proper installation and maintenance of erosion and sediment controls and maintenance of an undisturbed riparian buffer zone to the waterbodies. (CL&P 1, Vol. 1, p. L-33)

229. A reduction in water quality of the watercourses that are used by the arrow clubtail dragonfly may affect the species. To mitigate impacts to the arrow clubtail dragonfly, dwarf wedge mussel and eastern pond mussel, which are found near the proposed crossing of the Farmington River, the DEP recommends: performing a rare mussel survey and relocating any rare mussels found to a suitable habitat; performing tree removal activities on the banks of the Farmington River and on an associated island using crews on foot rather than with mechanized equipment; minimizing the removal of low-growth vegetation adjacent to the river during clearing; and installing erosion and sedimentation controls to minimize the deposition of sediment into riverine habitats. (CL&P 1, Vol. 1, pp. N-35, N-36; DEP comments dated July 15, 2009, p. 5)

Eastern Pearlshell Mussel, Dwarf Wedge Mussel, and Eastern Pond Mussel

230. DEP recommends mitigation measures to protect the eastern pearl shell mussel by minimizing removal of low-growth vegetation in wetland areas that are tributary to Muddy Brook during initial vegetative clearing; and applying effective erosion and sedimentation controls to minimize the deposition of sediments into wetland areas. (DEP comments dated July 15, 2009, p. 5)

231. The three species of mussels identified on the Connecticut Natural Diversity Database (NDDB) as potentially occurring near the area of the proposed project are not expected to be impacted because the proposed GSRP does not necessitate in-water work within the major watercourses where these species may occur. (CL&P 1, Vol. 1, p. L-32)

232. The preservation of vegetated riparian buffer zones and the proper installation and maintenance of erosion and sediment controls would avoid and/or minimize effects on watercourses that support the freshwater mussel species. (CL&P 1, Vol. 1, p. N-35)

Eastern Hognose Snake

233. Mitigation measures for the eastern hognose snake include a DEP-approved snake ecologist/monitor present on the ROW between Tunxis Avenue and Hatchett Hill Road during the active period of the species whenever construction takes place; removal of any snakes encountered from the area where construction is ongoing; and contractor awareness training to ensure proper identification of the snakes, along with proper handling and care. (DEP comments July 15, 2009, p. 6)

Wood Turtle

234. To mitigate impact on the wood turtle the DEP recommends the daily presence of a DEP approved turtle ecologist during the wood turtle active period whenever construction activities take place in mapped wood turtle habitats and any wood turtles encountered shall be removed from the work area; contractor awareness training for identification and handling of wood turtles; minimizing the removal of low growth vegetation in all mapped wood turtle habitats during ROW clearing; and implementing an effective erosion and sedimentation control plan to limit the deposition of sediment into wetland habitats. (DEP comments dated July 15, 2009, pp. 5, 6)

Habitat and Vegetation

235. The GSRP – Northern Route has an approximately 485-acre footprint, of which approximately 102 acres are forested (upland and wetland). The dominant habitat type along the Connecticut portion of the GSRP ROW is comprised of open field/shrub land within the maintained portion of the ROW (comprising approximately 131 acres), and upland forest along unmaintained portions of the ROW (comprising approximately 211 acres). The remaining approximately 41 acres is comprised of various habitat types as listed in Finding #186. (CL&P 1, Vol. 1, p. L-20)

236. The GSRP – Northern Route would require widening the maintained portion of the existing ROW by approximately 100 feet, which includes approximately 103 acres of upland deciduous and coniferous forest. Additionally, removal of approximately 26 acres of palustrine forested wetland would be required. The proposed projects would have long-term, but incremental and localized effects on vegetation and associated wildlife habitats in areas of vegetation removal. (CL&P 1, Vol. 1, pp. N-21, N-22)

237. The primary vegetation within the non-maintained portions of the Northern Route ROW is deciduous (hardwood) and mixed hardwood forest, intermixed with agricultural areas, maintained lawns and wetlands. (CL&P 1, Vol. 1, p. L-18)

238. Bush's Sedge, a state species of special concern, is a plant species that may be in the vicinity of the proposed GSRP Northern Route. CL&P would comply with the DEP recommendation to conduct a pre-construction sweep of the area to identify any Bush's Sedge plant locations and mark them for avoidance during construction. If CL&P could not avoid the plants, the affected plants would be transplanted to a suitable location outside of the construction area. (CL&P 1, Vol. 1, pp. L-33, N-36)

239. Communities of Bush's Sedge could potentially be damaged or destroyed through the expansion of the existing access roads or by equipment travel over the ROW. However, CL&P asserts that periodic disturbances associated with management and maintenance of the ROW can create early successional habitats that might encourage the further establishment of Bush's Sedge on the ROW. (CL&P 1, Vol. 1, p. N-36)

Open Space

240. Marion Wilcox Park, located in Bloomfield and owned by the town, is approximately 740 feet west of the North Bloomfield Substation and approximately 1,200 feet from the proposed transmission line. Expansion of the North Bloomfield Substation would extend south to accommodate new equipment and is not expected to impact the park. Vegetation clearing associated with the proposed construction would allow a buffer of trees to remain between the park, the substation and the transmission lines. (CL&P 1, Vol. 1, p. L-36; CL&P 4, R. 10)

241. The Newgate WMA is located in East Granby and is bisected by the transmission line corridor north of Turkey Hills Road. The area is also crossed by land owned by CL&P and leased to the CT DEP on the north and south sides of Turkey Hills Road. Clearing of an approximately 100-foot width of vegetation for approximately 8,300 linear feet through the Newgate WMA would be required for the construction of an overhead transmission line. Construction of an in-ROW underground transmission cable would require the clearing of at least a ten-foot width of vegetation through the Newgate WMA. (CL&P 1, Vol. 1, p. L-36; CL&P 4, R. 10)

242. The Farmington Valley Greenway in East Granby is located west of Granby Junction (south of Turkey Hills Road). The nearest portion of the proposed GSRP line is approximately 280 feet west of the greenway. Vegetation removal associated with the construction of the proposed project would not impact the existing tree buffer between the 115-kV transmission lines and the trail. (CL&P 1, Vol. 1, p. L-36; CL&P 4, R. 10)

243. Spencer Woods Wildlife Preserve is located east of the transmission line ROW near Phelps Road in Suffield. It is owned and maintained by the Suffield Land Conservancy. The property is approximately 120 feet from the edge of the existing ROW and approximately 300 feet from the centerline of the proposed transmission line. Vegetation clearing associated with the construction of the proposed transmission line would not affect the existing tree buffer between the transmission line ROW and the Spencer Woods property. (CL&P 1, Vol. 1, p. L-37; CL&P 4, R. 10)

244. The Fox Run at Copper Hill Golf Course is located west of the transmission line ROW on Copper Hill Road in East Granby. The edge of the golf course property is approximately 340 feet from the west edge of the ROW at its closest point and approximately 460 feet from the proposed transmission lines. Vegetation clearing associated with the construction of the proposed transmission line would not affect the existing tree buffer between the ROW and the golf course. (CL&P 1, Vol. 1, p. L-37; CL&P 4, R. 10)

Air Quality

245. All ambient background air concentrations are less than the National Ambient Air Quality Standard for all pollutants and averaging periods with the exception of 8-hour ozone (O_3). East Granby, Suffield and Bloomfield are within a non-attainment area for 8-hour O_3. However, non-attainment is considered to be moderate in the area. GSRP would not increase 8-hour O_3 significantly. (CL&P 1, Vol. 1, p. L-47)

Visual Resources

246. Talcott Mountain State Park in Bloomfield is located approximately 0.3 miles west of the Connecticut portion of the proposed GSRP. The proposed GSRP facilities are not expected to be visible from Talcott Mountain State Park due to topography obstructions. (CL&P 1, Vol. 1, p. L-35; CL&P 4, R. 8)

247. The Metacomet Trail is part of the Metacomet-Monadnock-Mattabesett Trail System, which was designated as the New England National Scenic Trail in March of 2009. (NPS letter dated July 28, 2009; CL&P 37, p. 2)

248. The existing ROW is parallel to the Metacomet Trail for approximately 9.2 miles through East Granby and Suffield. The distance between the edge of the ROW and the Metacomet Trail ranges from approximately 400 feet to 1.5 miles. (CL&P 37, p. 1)

249. The Metacomet Trail crosses the ROW in two locations: at Hatchett Hill Road in East Granby; and at Mountain Road in Suffield. (CL&P 37, pp. 1, 2; Tr. 8, p. 19)

250. The 90-foot H-frame structures for the proposed 345-kV line would be more visible from the Metacomet Trail than the existing 70-foot 115-kV line H-Frame structures. The 110-foot structures associated with the delta configuration would be more visible than the proposed 90-foot structures. (CL&P 1, Vol. 1, pp. I-2, I-3; Tr. 10, pp. 83, 84, 86)

Historic and Cultural Resources

251. Three historic cemeteries, which began use between c.1740-1784, were identified within approximately 0.25 miles of the proposed GSRP – Northern Route. They include St. Andrew's Cemetery in Bloomfield, and a smallpox cemetery and Newgate Prisoners Cemetery, both in East Granby. There would be no known or likely adverse visual impact on these cemeteries. (CL&P 1, Vol. 1, pp. L-46, N-45, Vol. 3, p. 33)

252. There are no documented archaeological sites along the Northern Route; however, five Native American archaeological sites are within one mile of the proposed line. (CL&P 1, Vol. 1, pp. L-45, N-45, Vol. 3, pp. 28, 29)

253. Approximately 6.7 miles of the proposed GSRP – Northern Route appear sensitive for undocumented Native American archaeological resources. Any sites determined to be eligible for the National Register of Historic Places would be avoided, to the extent possible. If avoidance is not possible, a mitigation strategy would be developed for review and approval by the State Historic Preservation Office (SHPO). (CL&P 1, Vol. 1, p. N-45)

254. Old Newgate Prison is a national landmark and is listed on the National Register of Historic Places. The proposed overhead structures would not be distinctly visible from the prison. (Tr. 7, pp. 179, 180)

Southern Route Alternative for the Ludlow to Agawam Line

Wetlands and Watercourses

255. Lying entirely within the established ROW, the Southern Route Alternative traverses five perennial watercourses, the largest of which is the Connecticut River. The Connecticut River is part of the DEP SCEL program. (CL&P 1, Vol. 1, pp. M-36, M-37)

256. The Southern Route Alternative would traverse an undeveloped area within the existing ROW with many wetlands and would require a second overhead crossing of the Connecticut River. This crossing would be in Massachusetts, near the Connecticut border, and would require cutting riparian vegetation in an area called the Enfield Cove, which has contiguous habitat extending from Massachusetts into Connecticut. (Tr. 8, p. 71)

257. Twenty-seven wetlands and three vernal pools have been identified along the Southern Route Alternative. (CL&P 1, Vol. 1, p. M-37)

258. The Southern Route Alternative would traverse the 100-year FEMA floodplains of the Connecticut River, Four Mile Brook and Waterworks Brook. (CL&P 1, Vol. 1, p. M-39)

259. CL&P would attempt to locate new structures in upland areas to avoid the permanent alignment of access roads through wetlands; however, this may not be possible in some cases. In these cases the structure footings and access roads would represent permanent fill, which would be mitigated or compensated for. (CL&P 1, Vol. 1, p. N-72)

Wildlife

260. Four state-listed species on the NDDB are associated with the Connecticut River: the endangered Shortnose sturgeon (*Acipenser brevirostrum*), the endangered Bald Eagle (*Haliaeetus leucocephalus*), the threatened Riverine clubtail dragonfly (*Stylurus amnicola*) and the species of special concern Arrow clubtail dragonfly (*Stylurus spiniceps*). Since in-water activities are not associated with this area of the proposed project, the above-referenced species are not expected to be impacted. However, DEP requires erosion and sediment controls, as well as maintenance of an undisturbed riparian buffer zone to the subject waterbody. (CL&P 1, Vol. 1, pp. M-41, M-42)

261. If construction activities were to involve tree clearing within 300 feet of the Connecticut River, pre-construction field surveys would be required to determine if potential roost trees and nest sites for bald eagles are present in the area and, if so, appropriate mitigation measures would be taken. (CL&P 1, Vol. 1, p. N-73)

Habitat and Vegetation

262. Land use along the existing ROW in the vicinity of the Southern Route Alternative is predominately agricultural, forested and residential. The Southern Route Alternative would be aligned near various residential subdivisions and multiple dwelling units, such as condominiums and apartment complexes. (CL&P 1, Vol. 1, p. M-42)

263. Construction of the Southern Route Alternative in the existing ROW within Connecticut would require approximately 36 acres of vegetation clearing and approximately 6.8 acres of wetland impact. Currently, approximately 110 feet of the 280-foot to 300-foot ROW is cleared. The construction of the proposed transmission line along the existing ROW would require an additional approximately 95 feet of clearing. (Tr. 11, p. 154)

Historical and Cultural Resources

264. Two Native American archaeological sites are located within approximately one mile of the Southern Route Alternative. One is a surface find and the other a cemetery that appears to have been located in Longmeadow, Massachusetts. Two Euro-American archaeological sites are located within approximately one mile of the alternative route, the nearest of which is 4,500 feet away. Neither site would be eligible for the National Register of Historic Places. (CL&P 1, Vol. 1, pp. M-45, M-51, M-52)

Air Quality

265. Air Quality in the vicinity of the Southern Route Alternative is similar to that found along the Northern Route, as stated in Finding of Fact # 245. (CL&P 1, Vol. 1, p. M-45)

<u>North Bloomfield Substation</u>

General

266. The existing seven-acre substation would be expanded by approximately 2.7 acres within the existing CL&P property. The existing substation fence would be relocated approximately 32 feet to the northwest, 292 feet to the southeast, and 193 feet to the southwest. (CL&P 1, Vol. 1, p. I-14)

Wetlands and Watercourses

267. There are four inland wetlands in the vicinity of the North Bloomfield Substation. Two of these wetlands would be impacted by the proposed substation expansion. CL&P would install temporary erosion and sedimentation controls around disturbed areas within the station to minimize potential sedimentation into nearby water resources. (CL&P 1, Vol. 1, p. N-47)

268. The proposed substation expansion would permanently affect approximately 0.78 acres of wetland area, including 0.76 acres of forested/scrub-shrub wetland and 0.02 acres of isolated forested wetland. The majority of the wetland area that would be affected by the expansion is in areas of previous disturbance associated with an approved expansion of the original substation to its current configuration. (CL&P 1, Vol. 1, pp. N-47, N-48)

269. Approximately 400 cubic yards of flood storage capacity within the 100-year FEMA floodplain of Griffin Brook would be permanently displaced as a result of the proposed substation expansion. The loss of flood storage would be offset by the creation of compensatory flood storage volume along Griffin Brook, which would also mitigate for the loss of wetland function and value. Additional wetland mitigation would be incorporated into a wetland mitigation plan for the GSRP, as mentioned in finding of fact #209. (CL&P 1, Vol. 1, p. N-48)

Wildlife

270. During field investigations, a wood turtle and an eastern box turtle were observed in the vicinity of the North Bloomfield Substation. (CL&P 1, Vol. 1, p. N-49)

271. To mitigate impact on the wood turtle the DEP recommends the daily presence of a DEP approved turtle ecologist during the wood turtle active period whenever construction activities take place in mapped wood turtle habitats and any wood turtles encountered shall be removed from the work area; contractor awareness training for identification and handling of wood turtles; minimizing the removal of low growth vegetation in all mapped wood turtle habitats during ROW clearing; and implementing an effective erosion and sedimentation control plan to limit the deposition of sediment into wetland habitats. (DEP comments dated July 15, 2009, pp. 5, 6)

272. The DEP recommended the daily presence of a DEP approved turtle ecologist during the eastern box turtle active period (June through October) whenever construction activities take place in mapped eastern box turtle habitats and removing any eastern box turtles from the work area; contractor awareness training for identification and handling of eastern box turtles; parking all construction vehicles and equipment on roadways and not in eastern box turtle habitat to the extent possible; installing turtle exclusion fencing around work areas prior to construction; minimizing the removal of low growth vegetation in all mapped eastern box turtle habitats during ROW clearing; and implementing an effective erosion and sedimentation control plan to limit the deposition of sediment into wetland habitats. (CL&P 1, Vol. 1, pp. L-32, N-34; DEP comments dated July 15, 2009, p. 5)

Habitat and Vegetation

273. Approximately two acres of mostly deciduous upland forest would have to be removed for the expansion of the substation. (CL&P 1, Vol. 1, p. N-49)

Visual Resources

274. The visual impact of the proposed substation modifications would be minor. The new 345-kV line structure would be approximately 90 feet tall, which is similar to the height of the existing structures. The substation is not visible from private residences or public areas. (CL&P 1, Vol. 1, pp. N-49, N-50)

Historic and Cultural Resources

275. The St. Andrews Cemetery, which is a protected historic cemetery, is located across the street from the North Bloomfield Substation. There is not expected to be a significant adverse visual effect on the cemetery from the proposed substation modifications. (CL&P 1, Vol. 1, N-50)

Noise

276. Noise emissions from the substation would be generated by the transformers, the transformer cooling fans, and the control house air conditioning units. All three pieces of equipment would not be expected to operate simultaneously because such operation would represent an overload condition on the system. CL&P would incorporate measures to minimize noise into the design of the modified substation. (CL&P 1, Vol. 1, pp. N-50, N-51)

277. Sound-level measurements were taken at two locations around the existing fenceline of the North Bloomfield Substation. The locations were selected because they are representative of existing environmental conditions, are located near sensitive noise receivers, and are accessible. Ambient A-weighted sound levels ranged from a low of 36.4 decibels during the night to a high of 49.6 decibels during the early evening. (CL&P 1, Vol. 1, p. L-52, L-55)

278. The State of Connecticut noise control regulations for residential areas are 61 dBA during the day and 51 dBA at night. (CL&P 1, Vol. 1, p. L-52, L-55)

279. The proposed transformer is the only equipment at the North Bloomfield Substation that would be a new source of noise. The estimated noise level following the addition of the proposed equipment at the substation (including ambient noise from existing sources) would be no higher than 50 dBA during the day and 43 dBA at night. (CL&P 1, Vol. 1, p. L-58)

VII. ELECTRIC AND MAGNETIC FIELDS

General

280. The Council's *"Electric and Magnetic Field Best Management Practices for the Construction of Electric Transmission Lines in Connecticut"* (EMF BMPs) were revised in December 2007 to address concerns regarding potential health risks from exposure to electric and magnetic fields (EMF) from transmission lines. (Council Admin. Notice 3; CL&P 1, Vol. 1, p. K-3)

281. Electric fields (EF) and magnetic fields (MF) are two forms of energy that surround an electrical device. Transmission lines are a source of both EF and MF. (CL&P 1, Vol. 1, p. K-3)

282. EF is produced whenever voltage is applied to electrical conductors and equipment. For the purpose of engineering transmission projects, electric fields are typically measured in units of kilovolts/meter. As the weight of scientific evidence indicates that exposure to electric fields, beyond levels traditionally established for safety, does not cause adverse health effects, and as safety concerns for electric fields are sufficiently addressed by adherence to the National Electrical Safety Code, as amended, health concerns regarding EMF focus on MF rather than EF. (Council Admin. Notice 3)

283. MF is produced by the flow of electric currents. The magnetic field at any point depends on the characteristics of the source, including the arrangement of conductors, the amount of current flow through the source, and the distance between the source and the point of measurement. For the purpose of engineering transmission projects, magnetic fields are typically measured in units of milligauss (mG). (CL&P 1, Vol. 1, p. O-2)

284. International health and safety agencies, including the World Health Organization (WHO), the International Agency for Research on Cancer (IARC), and the International Commission on Non-Ionizing Radiation Protection (ICNIRP), have studied the scientific evidence regarding possible health effects from MF produced by non-ionizing, low-frequency (60-Hertz (Hz)) alternating currents in transmission lines. Two of these agencies attempted to advise on quantitative guidelines for mG limits protective of health, but were able to do so only by extrapolation from research not directly related to health: by this method, the maximum exposure advised by the International Committee on Electromagnetic Safety (part of IARC) was 9,040 mG, and the maximum exposure advised by the ICNIRP was 833 mG. Otherwise, no quantitative exposure standards based on demonstrated health effects have been set world-wide for 60-Hz MF, nor are there any such state or federal standards in the U.S. (Council Admin. Notice 3, pp. 2-3; Tr. 7, p. 108)

285. "EMF and Health: Review and update of the Scientific Research 2007 – June 2008", a report by Exponent, Inc., systematically evaluates peer-reviewed research and reviews by scientific panels published from December 14, 2007 through June 16, 2008 to determine if there are new developments that might alter the current scientific consensus as articulated in the Council's 2007 EMF BMPs. The review concluded that no recent studies or consensus-group reports provide evidence to alter the conclusion that the research evidence is insufficient to suggest EF or MF cause cancer or any other disease process, at the levels we encounter in our everyday environment. (CL&P Vol. 1, pp. O-57 to O-58, Appendix O-6)

286. The Connecticut DEP, Radiation Division, concurred with the conclusions of the Exponent Update Review. (DEP Comment Letter dated July 15, 2009)

287. Studies conducted since the Exponent Update Review have not changed the conclusions of the Review. (Tr. 8, p. 131)

288. Burying transmission lines underground reduces but does not eliminate MF as a source of exposure. Measurements of magnetic fields for cables are normally in the vicinity of duct banks, and show reductions for undergrounding. In the vicinity of splice vaults, however, due to the wider spacing of the cables, the magnetic fields are comparable to that of overhead lines. Directly above cables in a duct bank the magnetic field levels are the same as directly below overhead lines – in some cases greater. (Council Admin. Notice 3; Tr. 8, pp. 8, 81, 188)

289. Electrical engineers have numerous options for mitigating the effects of EMF. The Council's EMF BMPs support the use of effective no-cost and low-cost technologies and management techniques to reduce MF exposure to the public while allowing for the development of electric transmission line projects. (Council Admin. Notice 3; CL&P 1, Vol. 1, p. K-3)

290. The Council requires transmission-line planners to provide a baseline design (the Field Management Design Plan) – with cost estimates – against which effective mitigations can be measured. The Council defines "significant reduction" as an approximately 15 percent reduction from baseline MF; and "low cost" as approximately four percent of the project's baseline cost (including related substation work). (Council Admin. Notice 3; CL&P 1, Vol. 1, p. O-8)

291. CL&P calculated pre- and post-construction EMF levels for a baseline GSRP design. Such calculations necessarily begin by estimating an amount of current running through the lines, which in turn demands certain assumptions about the overall shape of the electric system and the size of the load it is carrying. The pre-construction system model was for 2012. The post-construction system model was for 2017; it included all four of the NEEWS projects. Other assumptions built into the calculations are the heights of the lowest conductors, per engineering standards: 30 feet above ground for 115-kV lines, and 35 feet for 345-kV lines. Finally, calculations are run for three different load conditions: maximum peak load, peak daily average load, and average annual load. (CL&P 1, Vol. 1, p. O-11, O-12; CL&P 23, R. CAOPLC-002)

292. EMF levels with the 2017 annual average load case for the proposed baseline design H-frame configuration at ROW edges along the section of ROW between North Bloomfield and Granby Junction (GSRP - Northern Route, Segment 1) were calculated to be:

	Magnetic Fields (mG)		Electric Fields (kV/m)	
	west/north ROW	east/south ROW	west/north ROW	east/south ROW
Pre-construction (2012)	16.0	0.5	0.46	0.00
Post-construction (2017)	10.2*	13.4	0.01	0.18

(CL&P 1, Vol. 1, p. O-20)
* Post-construction MF levels along the west/north edge of the ROW are less than pre-construction due to de-energizing the existing 115-kV line.

293. Underground line variations have been described that would replace portions of Segment 2. (See the "Underground Alternatives" section for further facts). Magnetic fields (in mG) associated with a generic underground variation were modeled at a distance of 25 feet from the cable centerline, and were calculated to be:

	West/north ROW	East/south ROW
Pre-construction (2012)	8.7	0.1
Post-Construction (2017)	23.5	12.6
Post-construction with delta configuration (2017)	17.9	9.8
In-ROW Variations (2017)	3.2	0.5
In-Street Variations (2017)	2.6	5.6

(CL&P 1, Vol. 1, pp. O-30, O-38)

294. Predictions for underground MF, as shown in the table in Finding #293 above, are for the duct banks only. MF levels would be higher in the vicinity of splice vaults because of the wider spacing of the cables. Near splice vaults, MF levels would be comparable to levels directly beneath the overhead lines. (Tr. 8, p. 81)

Statutory Facilities

295. CGS Section 16-50p(i) designates a group of land uses (called "Statutory Facilities") that the Council must pay particular attention to in its review of new electric transmission facilities. "Statutory Facilities" include: private or public schools; licensed child day-care facilities; licensed youth camps; public playgrounds; residential areas. (CL&P 1, Vol. 1, pp. H-26, H-27)

296. CGS Section 16-50p(i) states that electric transmission lines with a voltage of 345-kV or greater shall be constructed underground if they are adjacent to Statutory Facilities, unless burying the lines is infeasible for technical or economic reasons. If undergrounding the transmission lines is deemed infeasible, the Council may approve overhead construction provided that it is installed within an area that is adequate to protect health and safety. (CL&P 1, Vol. 1, pp. H-27, H-28)

297. Wherever the project is adjacent to statutory facilities, or other locations that might be deemed by the Council to warrant precautionary measures, CL&P, as required, has modified the baseline GSRP design to show various options for reducing MF. (Council Admin. Notice 3; CL&P 1, p. K-4)

GSRP-Northern Route

298. At this time, the proposed GSRP route would not be adjacent to any established public or private school, licensed child day-care facility, licensed youth camp or public playground. (CL&P 1, Vol. 1, pp. H-28, O-62, O-63)

299. Along one 3.2-mile section of the existing ROW – in Segment 2, between the point where Country Club Lane in East Granby comes closest to the ROW and the point where Phelps Road in Suffield intersects with the ROW – 25 homes are within 100 feet of the edge of the ROW and an additional 50 homes are within 101 to 300 feet of the edge of the ROW. (CL&P 1, Vol. 1, p. O-62; Tr. 10, pp. 79, 80)

300. To reduce EMF levels along this section of Segment 2, CL&P proposes a modified design for constructing the line in a delta configuration. Further in accordance with the EMF BMPs, CL&P has described other modified design options for EMF reduction. (Council Admin. Notice 3; CL&P 1, Vol. 1, pp. H-28, O-62, O-63)

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301. EMF levels at annual average loading at ROW edges for the section of ROW between Granby Junction and the Connecticut/Massachusetts state border (Segment 2) are calculated to be:

	Magnetic Fields (mG)		Electric Fields (kV/m)		Guidelines (mG)				
	west/ north ROW	east/ south ROW	west/ north ROW	east/ south ROW	IARC[1]	ICNIRP[2]	MA[3]	NY[4]	FL[5]
Pre-construction (2012)	8.7	0.1	0.09	0.00	9,040.0	833.0	85.0	200.0	150.0 to 250.0
Post-construction (2017)	23.5	12.6	0.11	0.15	9,040.0	833.0	85.0	200.0	150.0 to 250.0
Post-construction with delta configuration (2017)	17.9	9.8	0.15	0.14	9,040.0	833.0	85.0	200.0	150.0 to 250.0
Post-construction with delta +20 configuration (2017)	15.7	9.2	n/a	n/a	9,040.0	833.0	85.0	200.0	150.0 to 250.0
Post-construction with split-phase configuration (2017)	2.4	1.9	n/a	n/a	9,040.0	833.0	85.0	200.0	150.0 to 250.0

(Council Admin. Notice 3, pp. 3, 7; CL&P 1, Vol. 1, p. O-30; CL&P 19, R. OCC-001-SP02)

[1] and [2] Refer to finding #284. IARC is the International Agency for Research on Cancer. ICNIRP is the International Commission on Non-Ionizing Radiation Protection.

[3] The Massachusetts Energy Facilities Siting Board established an edge-of-ROW benchmark for comparing different design alternatives. A magnetic field level above this benchmark is not prohibited but it may trigger a more extensive review of alternatives.

[4] The New York Public Service Commission established an interim policy in 1991 requiring new high-voltage transmission lines to be designed not to exceed 200 mG at the edge of the ROW when the line is operating at its highest continuous current rating.

[5] The Florida Environmental Regulation Commission established a maximum magnetic field limit for new transmission lines and substations. The maximum varies depending on the voltage of the new transmission line and whether a 500-kV line is already present)

Delta

302. The modified proposed design, or delta configuration, would include 110-foot steel monopoles centered 75 feet east of the centerline of the existing 115-kV line. (CL&P 1, Vol. 1, pp. O-62, O-63)

303. The delta configuration would reduce magnetic field levels under modeled system average loading conditions by 24 percent to 22 percent at ROW edges, as compared to the magnetic field levels of the proposed H-frame line design. (CL&P 1, Vol. 1, p. O-63)

304. The delta configuration would cost approximately $2.2 million more than the proposed H-frame configuration. This expenditure is approximately 1.6 percent greater than the cost of the H-frame configuration for the 3.2-mile section it would replace. (CL&P 1, Vol. 1, p. O-64)

Other Options

305. Further modified design options for this 3.2-mile section at average annual load case in 2017 include:

Configuration	Max. level on ROW* (mG)	% reduction-west edge	% reduction-east edge	% cost increase**	Cost of 3.2-mile section ($)	Incremental increase in cost ($)
Baseline	269.2	-	-	-	$11,293,000.	-
H-Frame +20'	179.5	3%	2%	0.4%	$11,795,000.	$502,000.
Delta	173.4	24%	22%	1.6%	$13,454,000.	$2,161,000.
Delta +20'	82.8	33%	27%	3.0%	$15,303,000.	$4,010,000.
Vertical	149.7	34%	24%	2.6%	$14,794,000.	$3,501,000.
Vertical +20'	72.5	45%	29%	3.5%	$16,000,000.	$4,707,000.
Split phase	77.0	90%	85%	10.1%	$24,776,000.	$13,483,000.
345/115-kV composite	132.0	20%	34%	11.0%	$25,960,000.	$14,667,000.

(CL&P 1, Vol. 1, Appendix O-1, p. 12; CL&P 19, R. OCC-001-SP02)
*Typical location on the ROW for maximum magnetic field levels is directly underneath the conductors, midspan between the structures.
**The project percent cost increase resulting from design modification. (For example: H-frame + 20' has an incremental cost increase of $502,000. $502,000 divided by the Connecticut portion of the total project cost of $133,370,000 equals approximately 0.4 percent.)

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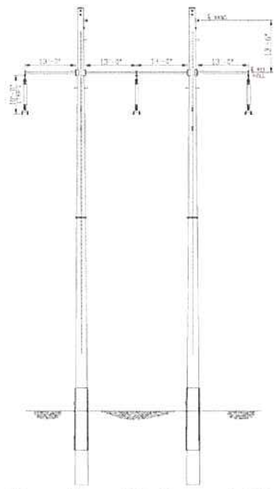
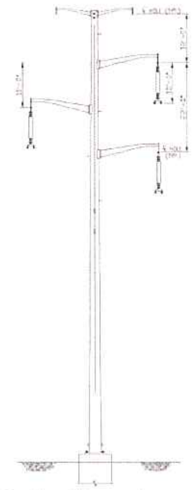
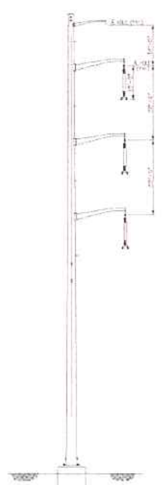
306. Configuration options listed in Finding of Fact #305 are illustrated below:



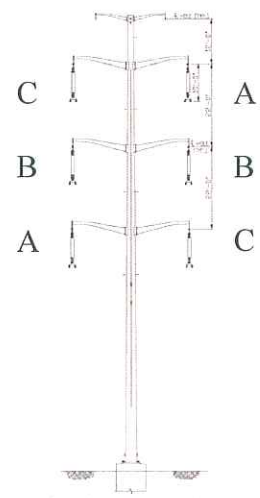
Baseline (H-frame) Structure



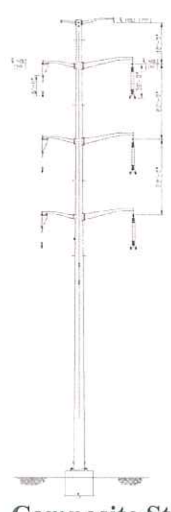
Delta Structure



Vertical Structure



Split-Phase Structure



Composite Structure
(CL&P 1, Vol. 1, Appendix O-1, pp. 5 to 9)

307. Of the configurations listed above, the split-phase design provides the greatest reduction in MF. Also, it would produce lower MF levels than undergrounding. (CL&P 1, Vol. 1, Appendix O-1, p. 13; CL&P 15, Carberry/Newland, p. 52)

308. DPH recommends installing the overhead lines in a split phase configuration between Country Club Lane and Phelps Road to reduce EMF levels at nearby residences. Alternatively, DPH recommends the delta configuration, along with increasing the distance from the residences to the proposed transmission lines by moving the lines farther east within the ROW in the area along which the homes are closest to the ROW edge. (DPH comments dated October 8, 2009)

Split-Phase

309. The split-phase design comprises three 345-kV vertically-configured conductors on one side of a structure and three on the opposite side of the same structure. The height of the structure is determined by the height above ground of the lowest conductor at its low point, a height mandated by the National Electrical Safety Code. The split-phase structures analyzed for this project would be 130 feet above ground level. (CL&P 1, Vol. 1, Appendix O-1, p. 8; Tr. 6, pp. 185, 191, 192)

310. The split-phase line configuration would use six conductors (twice as many as the delta line configuration), which allows the current on any one conductor to be half of that on the conductors for the delta line configuration. Reverse phasing can then be used for the six conductors to further reduce MF. Reverse phasing means aligning the set of conductors on one side of the pole as A, B, C and the set of the conductors on the other side of the pole as C, B, A. (CL&P 1, Vol. 1, Appendix O-1, p. 8)

311. Any decrease in the 130-foot height of the structures used in a split-phase design would necessitate shortening the conductor span so as to keep the conductors at the mandated heights. Transmission line structures are typically 500-800 feet apart. The trade-off would result in double the number of transmission structures, more access roads and a greater cost. (Tr. 6, p. 197; Tr. 8, pp 90, 91)

312. A transition to a split-phase design from an H-frame design would require additional poles. Also, at the transition point, additional pole structures would be required to dead-end the conductors. Both types of additions would increase the cost. (Tr. 8, pp. 76, 77)

GSRP-Southern Route Alternative

313. Over a 3.7-mile length of the Southern Route Alternative transmission ROW in Enfield, both sides of the ROW are bordered by dense residential development. CL&P developed overhead BMP line-design alternatives for these areas and evaluated an underground variation (the Hybrid Variation). (CL&P 1, Vol. 1, p. O-43; CL&P 5, R. CSC-048-Bulk)

314. The modified proposed design would be a delta configuration either with 110-foot steel monopoles or with 130-foot steel monopoles. At 110 feet, the delta configuration would reduce MF by 22 to 30 percent along the ROW edges at a 2.2 percent cost increase over the H-frame line design. At 130 feet, the delta configuration would reduce MF by 28 to 42 percent along the ROW edges at a 3.4 percent increase in cost over the H-frame line design. (CL&P 5, R. CSC-048-Bulk)

315. The underground variation for the Southern Route Alternative (the Hybrid Variation) would replace a portion of the overhead (baseline) route with an in-ROW or in-street underground cable and circumvent the densely-populated areas. (See "Underground Alternatives" Section for a description of the Hybrid Variation). (CL&P 1, Vol. 1, pp. O-43, O-46, O-47)

316. EMF levels with the 2017 annual average load case at ROW edges for the section of the Southern Route Alternative and Hybrid Variation (underground cable calculations at 25 feet from the centerline), were calculated to be:

	Magnetic Fields (mG)		Electric Fields (kV/m)	
	west/north ROW	east/south ROW	west/north ROW	east/south ROW
State border to CT River (XS-S05) – Pre (2012)	3.8	0.3	0.31	0.01
State border to CT River (XS-S05) – Post (2017)	12.5	15.2	0.42	0.22
CT River to Franconia Jct. (XS-S07) – Pre (2012)	7.0	0.3	0.66	0.01
CT River to Franconia Jct. (XS-S07) – Post (2017)	17.3	15.2	0.81	0.22
CT River to Franconia Jct. (XS –S07) In-ROW Underground Portion (2017)	17.4	4.6	None	None
CT River to Franconia Jct. (XS-S07) In-street Underground Portion (2017)	2.6	5.7	None	None

(CL&P 1, Vol. 1, pp. O-43 to O-49)

317. The cost of this underground EMF mitigation is $184 million, which is $169 million more than the section of the overhead project that would be replaced. See Finding of Fact #165. (CL&P 15, Carberry/Newland, p. 54)

VIII. MMP AND MMP-V

<u>MMP</u>

Need

318. By enabling greater power flows throughout north-central Connecticut, the proposed GSRP itself would create the need for MMP. (CL&P 1, Vol. 1, pp. F-28, F-29)

319. MMP improves reliability post-GSRP by eliminating a double-circuit contingency that is shown by planning studies to create overloads on a number of 115-kV underground cables in downtown Hartford. (A double-circuit contingency is the loss of a line where two circuits are carried by the same set of structures.) (ISO-NE 1, p. 16)

Route & Design

320. The two existing circuits to be separated by the proposed MMP are a 115-kV circuit (#1448) and a 345-kV circuit (#395). The separation would take place over a 2.2-mile-long section of CL&P's existing ROW between Manchester Substation and Meekville Junction. (CL&P 1, Vol. 1, pp. E-8, E-9, I-5)

321. Currently, there are two double-circuit lines on the ROW. Along the western portion of the ROW is one line of lattice-steel towers, typically 105 feet tall, supporting two 115-kV circuits. Toward the eastern side of the ROW is another line of similar towers supporting the 115-kV and 345-kV circuits. These towers range between 120 and 195 feet in height, averaging 155 feet. Over some of this distance, in between the two rows of towers on the east and west, lies a row of 40-foot wood poles supporting a distribution circuit. (CL&P 1, Vol. 1, p. I-5; CL&P 15, Carberry/Newland, p. 56)

322. The proposed circuit separation would include constructing a new line of steel monopoles down the middle of the ROW. These structures would be approximately 155 feet tall, with a vertical configuration of the conductors. The 115-kV circuit segment on the easterly set of towers would be inactivated, and a circuit segment replacing it, using bundled 1,590-kcmil ACSR conductors, would be put onto the new monopoles. The 345-kV circuit that is also currently on the eastern towers would be left where it is. (CL&P 1, Vol. 1, pp. O-49, O-55, Fig. O-18, O-51; CL&P 15, Carberry/Newland, pp. 56, 57)

323. The total distance along the ROW between Manchester Substation and Meekville Junction is 2.6 miles. The proposed MMP circuit separation is 0.4 miles shorter than the total distance because the #1448 circuit is already on separate structures along that section. (CL&P 26, p. 2)

324. The distribution line that currently occupies some of the middle area would be shifted within the ROW toward the existing row of towers on the west. To accommodate this shift, three to four of the western towers would have to be moved. (CL&P, Vol. 1, pp. I-6, O-64)

325. Most of the existing ROW is sufficiently wide to accommodate the relocated 115-kV line between the existing double-circuit transmission lines. However, CL&P proposes an expansion area of the existing ROW consisting of an approximately 2,400 square-foot area located within a commercial development north of Tolland Turnpike. The expansion area consists of a paved parking lot. (CL&P 1, Vol. 1, p. I-6; CL&P 17, R. OCC-001-SP01)

326. Although the new replacement line would be operated initially at 115-kV, it would be built with the capability to operate at 345-kV, thus facilitating system upgrades in the future. (CL&P 1, Vol. 1, p. I-10)

Environmental Impacts

For general findings of fact on the impacts of transmission development overhead in existing ROWs, CL&P clearing and maintenance practices and generic mitigations, see "Environment (General)" Section for each category below.

Wetlands and Watercourses

327. The MMP route spans five perennial waterbodies, the largest of which is the Hockanum River, and two intermittent watercourses. (CL&P 1, Vol. 1, p. L-61)

328. Existing structures associated with the MMP are within the SCEL of the Hockanum River. The DEP Bureau of Water Protection and Land Reuse's Inland Water Resources Division regulates the placement of structures within a river's SCEL to lessen risk of hazards to property due to flooding. (CL&P 1, Vol. 1, p. L-62)

329. There are 13 wetland systems along the MMP line route. Of the wetlands that exist along the ROW, two areas were identified and confirmed as amphibian breeding habitats/vernal pools. (CL&P 1, Vol. 1, p. L-64)

330. Amphibian species identified within the vernal pools along the MMP include the spotted salamander and wood frog. (CL&P 1, Vol. 1, p. N-28)

331. Approximately nine existing structures along the MMP ROW are located in wetlands. Some new structures would be located in wetlands, requiring permanent fill. Permanently disturbed wetland areas would be compensated for through mitigation efforts, such as wetland creation. (CL&P 1, Vol. 1, pp. N-10, N-17)

332. The MMP would require the conversion of approximately 1.4 acres of forested wetland vegetation along the existing ROW to shrub-scrub or emergent wetland. (CL&P 1, Vol. 1, p. N-11)

333. The MMP route traverses 2.1 miles of the Love Lane/New State Road Aquifer Protection Area. The nearest public water supply well associated with the Aquifer Protection Area is located near Love Lane, approximately 0.5 miles north of the Manchester Substation. (CL&P 1, Vol. 1, pp. L-64, L-65)

334. The proposed MMP line would cross the 100-year FEMA flood boundary of the Hockanum River. (CL&P 1, Vol. 1, p. L-65)

Habitat and Vegetation

335. Approximately 3.7 acres of forested upland vegetation would be cleared and maintained in shrub or grass cover types along the existing ROW. (CL&P 1, Vol. 1, p. N-22)

Wildlife

336. No designated wildlife management areas are found in the vicinity of the proposed MMP route; however, the Hockanum River corridor is a state-designated trout management area that is overseen by the DEP. (CL&P 1, Vol. 1, p. L-66)

337. The state-listed endangered species the barn owl (*Tyto alba*) has been documented in the vicinity of the MMP route. During the spring of 2008, an inspection of the entire length of the MMP was performed to search for potential barn owl nesting habitat. No active barn owl nest sites were found at that time; however, two areas along the MMP route were identified as potential foraging habitat for barn owls, one of which was located within the CL&P transmission line ROW. (CL&P 1, Vol. 1, pp. L-67, L-68)

338. The proposed construction activities along the MMP corridor may temporarily disturb potential foraging habitat of the barn owl; however, CL&P expects that re-establishment of vegetation on the ROW following the completion of construction would provide continued foraging habitat for the barn owl. CL&P would perform a nesting tree cavity survey along the ROW prior to removing any trees within the area. (CL&P 1, Vol. 1, pp. N-36, N-37; CL&P 4, R. 14; DEP comments dated July 15, 2009)

Historic and Cultural Resources

339. Eight Native American sites have been reported within approximately one mile of the proposed MMP route. None of the sites would be eligible to be listed on the National Register of Historic Places. Although no sites have been found within the ROW, there are sites within 500 feet of the MMP. (CL&P 1, Vol. 1, p. L-71)

340. The c. 1835 Charles Bunce House, located approximately 0.25 miles from the MMP route, is eligible for the National Register of Historic Places. (CL&P 1, Vol. 1, p. L-72)

Air Quality

341. All ambient background air concentrations are less than the National Ambient Air Quality Standard for all pollutants and averaging periods with the exception of 8-hour O_3. Manchester is within a non-attainment area for 8-hour O_3. (CL&P 1, Vol. 1, p. L-73)

EMFs

For general findings of fact on EMFs the Council's EMF-BMPs, measurement protocol, statutory facilities and mitigations, see the "Electric and Magnetic Fields (General) (Statutory Facilities)" Section for further facts.

Statutory Facilities

342. Three "statutory facilities" are to the east of the existing MMP ROW, including the Howell Cheney Vocational Training School, Leber Field/Playground and East Catholic High School. (CL&P 1, Vol. 1, p. O-55)

343. Calculated EMF associated with the MMP is shown in the pre- and post-construction rows of the table below in Finding #344. MMP's baseline design would reduce the pre-construction MF, by 33 percent and 55 percent at the west and east edges of the ROW, respectively, thus meeting the Council's EMF BMPs regarding MF at both edges of the ROW. (CL&P 1, Vol. 1, p. O-58; CL&P 15, Carberry/Newland, p. 58; Council Admin. Notice 3, p. 5)

344. Due to the presence of statutory facilities, CL&P evaluated modifications to the baseline design that would reduce MF. Options include:

Configuration	Max. level on ROW (MG)*	% reduction-west edge	% reduction-east edge	% cost increase**	Cost of MMP ($)	Incremental Increase in Cost ($)
Baseline	30.0	-	-	-	$13,728,000	-
Vertical +20'	29.0	3%	0%	23.7%	$16,980,000	$3,252,000
395 bundled circuit	34.4	-6%	13%	3.8%	$14,248,000	$520,000
395 split phase	34.1	25%	61%	3.8%	$14,248,000	$520,000
115-kV design	29.0	13%	1%	-18.6%	$11,171,000	$-2,557,000

(CL&P 1, Vol. 1, Appendix O-1, p. 40)

*Typical location on the ROW for maximum magnetic field levels is directly underneath the conductor midspan between the structures.

**The project percent cost increase resulting from design modification. (For example: Vertical + 20' has an incremental cost increase of $3,252,000. $3,252,000 divided by the Connecticut portion of the MMP of $13,728,000 equals approximately 23.7 percent.)

345. The option to reconfigure the existing 345-kV circuit as a split-phase would reduce the MF (calculated at average annual load) on the west edge of the ROW by 25 percent and on the east edge by 61 percent more than the post-construction MF for the baseline configuration. Calculated MF for the split-phase design compared with the calculated MF for the baseline design is shown in the table below.

	Magnetic Fields (mG)		Electric Fields (kV/m)	
	west/north ROW	east/south ROW	west/north ROW	east/south ROW
Pre-const. (2012)	4.8	27.4	0.06	0.15
Post-const. (2017)	3.2	12.2	0.07	0.15
Split-phase	2.4	4.8	0.05	0.14

(CL&P 1, Vol. 1, pp. O-56 to O-58, O-67)

346. The split-phase option would result in the greatest reduction in MF levels at the ROW edges and is less than a four percent increase in cost over the baseline design, which complies with the Council's EMF-BMP guidelines. (CL&P 1, Vol. 1, Appendix O-1, p. 41)

347. Reconfiguration of the 345-kV circuit for split-phasing would be accomplished without the need for new towers by making use of space left on the formerly double-circuit lattice towers after the 115-kV line is separated off of them. More specifically, approximately 3,500 feet along the lattice-tower line would be replaced with a bundled 954-kcmil ACSR conductor; the insulation for approximately three structures at each end of the project would be upgraded; and extra conductors would be installed in some locations to allow bundled circuit operation. (CL&P 1, Vol. 1, pp. O-66, O-67)

Cost

348. The proposed baseline design of the MMP would cost approximately $14 million. The split-phase option of the 345-kV line would cost an additional $520,000. (CL&P 1, Vol. 1, p. O-67; Carberry/Newland, p. 55)

Schedule

349. Construction on the proposed MMP would take approximately fifteen months to complete. (CL&P 15, Carberry/Newland, p. 55)

MMP Variation

350. The MMP Variation (MMP-V) would construct the same new set of steel monopoles and conductors in the middle of the Manchester-Meekville ROW as proposed in the MMP, but would extend the area involved in construction include a different configuration. Specifically, the proposed MMP-V would:
   a. Extend the new structures and conductors the entire distance from Manchester Substation to Meekville Junction;
   b. Place a new 345-kV circuit on the new structures, configured as a 2-terminal line;
   c. Reconfigure the 345-kV line currently existing on the double-circuit lattice towers (#395) to a 2-terminal line instead of a 3-terminal line;
   d. Make improvements at the Manchester Substation to establish the reconfiguration; and
   e. Leave the 115-kV circuit currently existing on the double-circuit lattice towers (#1448) as is.

(CL&P 26, pp. 2, 3)

Need

351. The MMP-V does not meet any reliability need beyond the need met by MMP. However, in power flow studies conducted by CL&P, the circuits were less heavily loaded under contingencies with the MMP-V than with the MMP, which indicates that MMP-V is a more robust and longer-lasting solution. (CL&P 26, p. 6)

352. The MMP-V might allow an increase in the Connecticut/Massachusetts transfer limit of up to 100 MW. ISO-NE has not studied this matter. (ISO-NE 6, R. CSC-1(a))

353. Two of the other NEEWS projects (CCRP and IRP), while meeting reliability needs of their own, would also provide reliability benefits similar to those offered by MMP-V, but greater. (ISO-NE 6, R. CSC-1; Tr. 5, pp. 175, 176)

354. CCRP addresses a particular reliability problem on the #395 circuit that has been identified under planning criteria. If this project does not go forward, CL&P would be required to formulate another plan, which would probably be the same as the MMP-V. (Tr. 5, pp. 175, 176)

Route and Design

355. The increase in the length of the MMP-V over the proposed MMP is 0.4 miles. (CL&P 26, p. 3)

356. The existing 345-kV circuit established in the Manchester-Meekville ROW (#395), branches in three different directions, like a Y: it runs from Meekville Junction to Barbour Hill Substation in South Windsor, from Meekville Junction to North Bloomfield Substation in Bloomfield, and from Meekville Junction to Manchester Substation (the branch involved in the proposed MMP). These three 345-kV branches comprise a 3-terminal circuit. The MMP-V would, in effect, split the existing 3-terminal circuit into two 2-terminal circuits, one extending between North Bloomfield Substation and Manchester Substation, and the other extending between Barbour Hill Substation and Manchester Substation. (CL&P 26, p. 3)

357. MMP-V includes the installation of a new 345-kV circuit-breaker and associated equipment at the Manchester Substation, which is not necessary as part of the proposed MMP. (CL&P 26, p. 3)

358. The reliability improvements to be achieved by the MMP-V design would allow the double-circuit line to remain. No circuit separation would be necessary. (ISO-NE 6, R. CSC-2; CL&P 43, R. 2)

359. MMP-V would follow the current trend of designing transmission "loops" throughout the ISO-NE system and eliminating 3-terminal circuits, which are particularly vulnerable to planning criteria contingencies. (CL&P 26, p. 8; CL&P 43, R. 1)

360. The second 345-kV circuit created by MMP-V would provide greater operating flexibility for the electric system, especially during maintenance periods. (CL&P 26, p. 9)

361. Constructing the extended line of new structures for MMP-V would require the crossing of several 115-kV lines, some of which are double-circuit. Many more existing 115-kV structures would have to be relocated for this crossing than are proposed to be relocated by MMP. This more extensive relocation would require line outages. (CL&P 26, p. 4)

Environmental Impacts

362. There are numerous wetland areas along the subject ROW. (See the heading on wetlands under the Findings of Fact on MMP above). The increased construction required by MMP-V would increase wetland impact. CL&P has not determined the extent of additional wetland impact. (CL&P 26, p. 4)

EMFs

363. No calculation of EMFs has been made for MMPV. (Record)

Cost

364. The additional MMP-V cost is approximately $10 million, bringing the total cost of construction of the MMP to approximately $24 million. The additional cost may not qualify for regionalization. (CL&P 26, p. 5)

Schedule

365. The MMP-V could cause some delay in the schedule compared to the MMP because additional environmental impacts may impact some permit applications that have already been filed. (CL&P 26, p. 2)

IX. NRG MERIDEN POWER PLANT

PROJECT DESCRIPTION

366. On April 27, 1999, the Council approved Docket 190 and issued a Certificate of Environmental Compatibility and Public Need to PDC-El Paso Meriden, LLC. (NRG 1, p. 36, Tab A)

367. NRG acquired the Meriden Facility in December 2000. Since that time, NRG has maintained contact with the municipal officials of Meriden and Berlin. (NRG 1, p. 36)

368. The Meriden Project is located on a 36-acre parcel off of South Mountain Road in Meriden. Approximately 11 of the 36 acres would be used for the footprint of the facility. Additionally, transmission corridors for gas and electricity would cross the site. (NRG 1, p. 12)

369. The original size of the NRG parcel was 821 acres. (Admin. Notice 44, Docket 190, FOF #11)

370. Additional ROWs would be acquired in the future for gas and water pipelines. (NRG 1, p. 12)

371. The facility would interconnect to two existing 345-kV electric transmission lines that cross the property. (NRG 1, p. 12)

PROJECT NEED

CEAB

372. Through the CEAB "Reactive RFP" process, NRG has proposed the 530 MW (nominal) Meriden Power Plant as an alternative to the CL&P-proposed GSRP and MMP. (Tr. 13, p. 187)

373. The reactive RFP process under which CEAB reviewed the NRG project is intended to encourage competing solutions that would meet the need identified by an applicant filing for a Certificate of Environmental Compatibility and Public Need. (NRG 1, p. 1)

374. CEAB determined that a resource solution to the need would be generally feasible. According to CEAB, each of the three RFP proposals for thermal storage or generation is situated near major load centers in Connecticut. Power flow assessments have suggested that additional generation in Southwest Connecticut may have an effect on the reliability conditions GSRP is designed to address by offsetting north-to-south power flows, particularly during peak summer hours. (CEAB 1, p. 2, 3)

375. CEAB found that the addition of new, efficient combined-cycle capacity in Connecticut would help lower marginal prices for electricity. (CEAB 1, p. 3)

376. In its report to the Council, CEAB did not consider the Meriden Plant by itself as an alternative to GSRP, but evaluated it as part of a potential portfolio of projects that would include the other projects proposed in the RFP responses. (CEAB 1, p. 3; CEAB 4, R. CL&P-01-007; Tr. 16, pp. 88, 89)

377. CEAB did not conduct an independent comparative reliability analysis comparing the GSRP and the Meriden plant. (CEAB 4, R. CL&P-01-032)

378. CEAB did not analyze the proposed GSRP as a whole and did not do an independent load flow analysis or stability studies to determine if any non-transmission alternatives in Connecticut could replace some portions of the GSRP. (Tr. 16, p. 22-24, 96, 101, 102, 107, 108)

379. CEAB reviewed need assessments done by CL&P and ISO-NE and determined that the identified reliability concerns demonstrate the need for mitigation measures. (CEAB 1, p. 24, Tr. 16, p. 23)

380. At the time of its February 2009 report to the Council, the CEAB determined that ISO-NE's Needs Assessment (January 2008), which had been used to support the need for GSRP, did not include new supply sources resulting from the ISO-NE Forward Capacity Market, Connecticut's Energy Independence Act (2005), or its Electricity and Energy Efficiency Act (2007). (CEAB 1, p. 2)

381. CEAB determined that further study was needed to ascertain if NRG or the other RFP respondents would address the needs identified by GSRP. (CEAB 1, p. 3)

ISO-NE and NUSCO

382. ISO-NE and NUSCO define the reliability need in terms of transmission security, not resource adequacy. See Finding of Fact # 34 and # 35. (CL&P1, Vol. 1, p. F-4)

383. Since the CEAB report was issued, ISO-NE has published updated assessments that continue to show a need for GSRP. (See above Finding of Fact # 43). (CL&P 1, Vol. 1, p. F-15; CL&P 5, R. OCC-01-009-SP01, attached "2009 Addendum Report"; CL&P 15, Scarfone, pp. 4-21)

384. Studies by NUSCO and ISO-NE have found that no resource (generation) solutions—in Connecticut or anywhere else—can solve the particular reliability problems addressed by GSRP. (CL&P 15, Scarfone, pp. 53, 54; CL&P 4, R. to CSC-018; Tr. 5, pp. 106-112)

385. The Meriden Power Plant is not located near the Springfield/Hartford load center. This would make it infeasible as an alternative to the GSRP/MMP. The power plant would not influence the system to eliminate the type of reliability issue that the GSRP/MMP would address. (Tr. 15, pp. 17, 18)

NRG

386. NRG has not analyzed the power-flow simulations provided in CL&P's application, and has not itself provided material demonstrating that its project would eliminate any of the modeled thermal overloads, voltage violations, or other transmission security issues that GSRP is proposed to solve. (NRG 4, R. to OCC-01-006, 007; Tr. 13, p. 193)

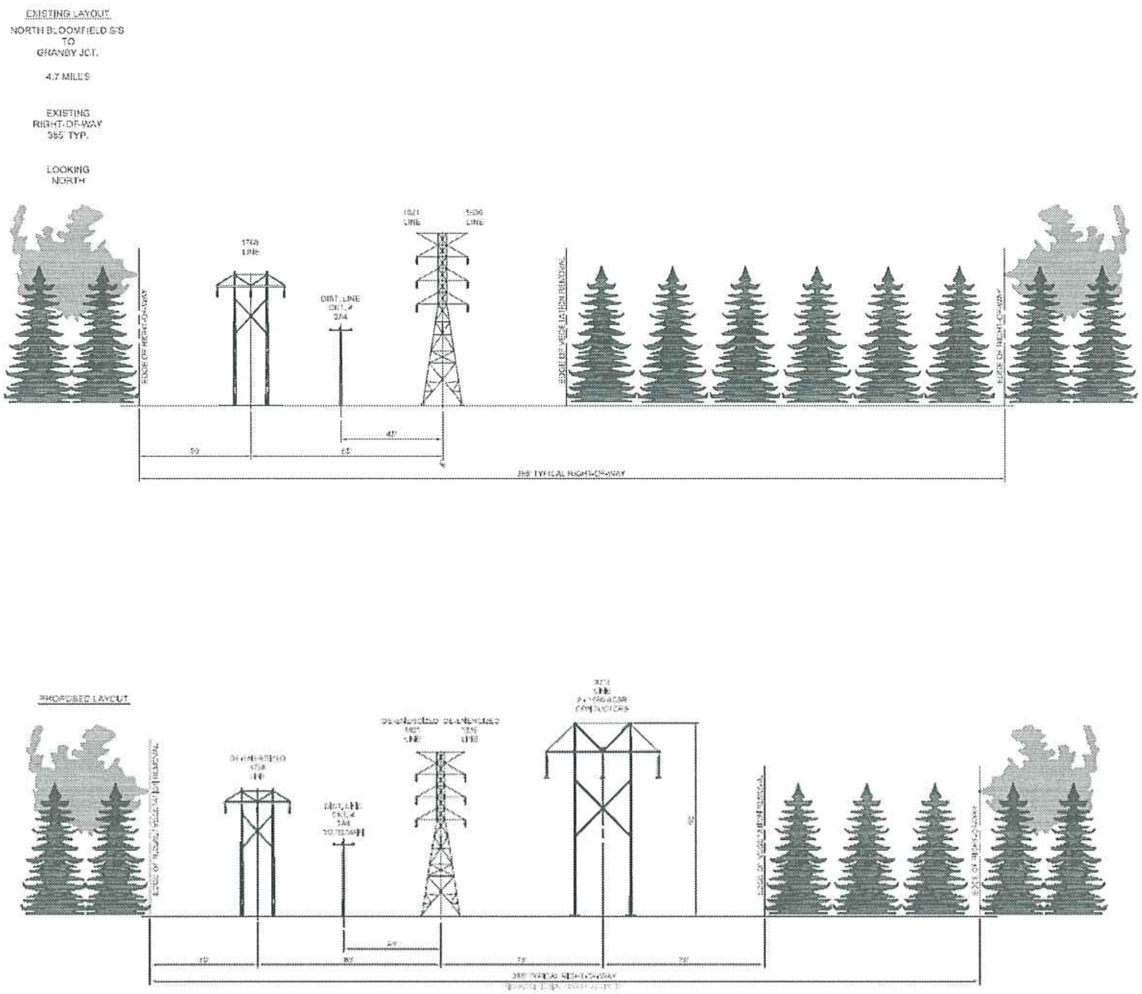
387. NRG did perform a "preliminary" in-house power-flow simulation to evaluate a Connecticut resource solution to GSRP. They modeled 750 MW of new generation in Middletown, 750 MW in Meriden, and 300 MW in Torrington. The results did not show any appreciable reliability criteria violations that would be eliminated by such generation. An ICF study confirmed this result. (NRG 5, R. to CL&P-01-010; Tr. 13, pp. 206-209; CL&P 15, Scheller, pp. 18, 19)

388. NRG estimates a net range of levelized costs for a 540 MW plant, on an annual basis, to be $26 million to $78 million. NRG is not pursuing capital financing for the Meriden project in the current market environment. (Tr. 13, pp. 225, 226, 243)

Appendix A

Cross Sections

Figure 9. Existing and proposed cross section for North Bloomfield S/S to Granby Junction.



(CL&P Vol. 10, XS-1)

Figure 10. Existing, proposed, and preferred EMF-BMP cross section for Granby Junction to CT/MA Border. (CL&P Vol. 10, XS-2 and XS-2 BMP)

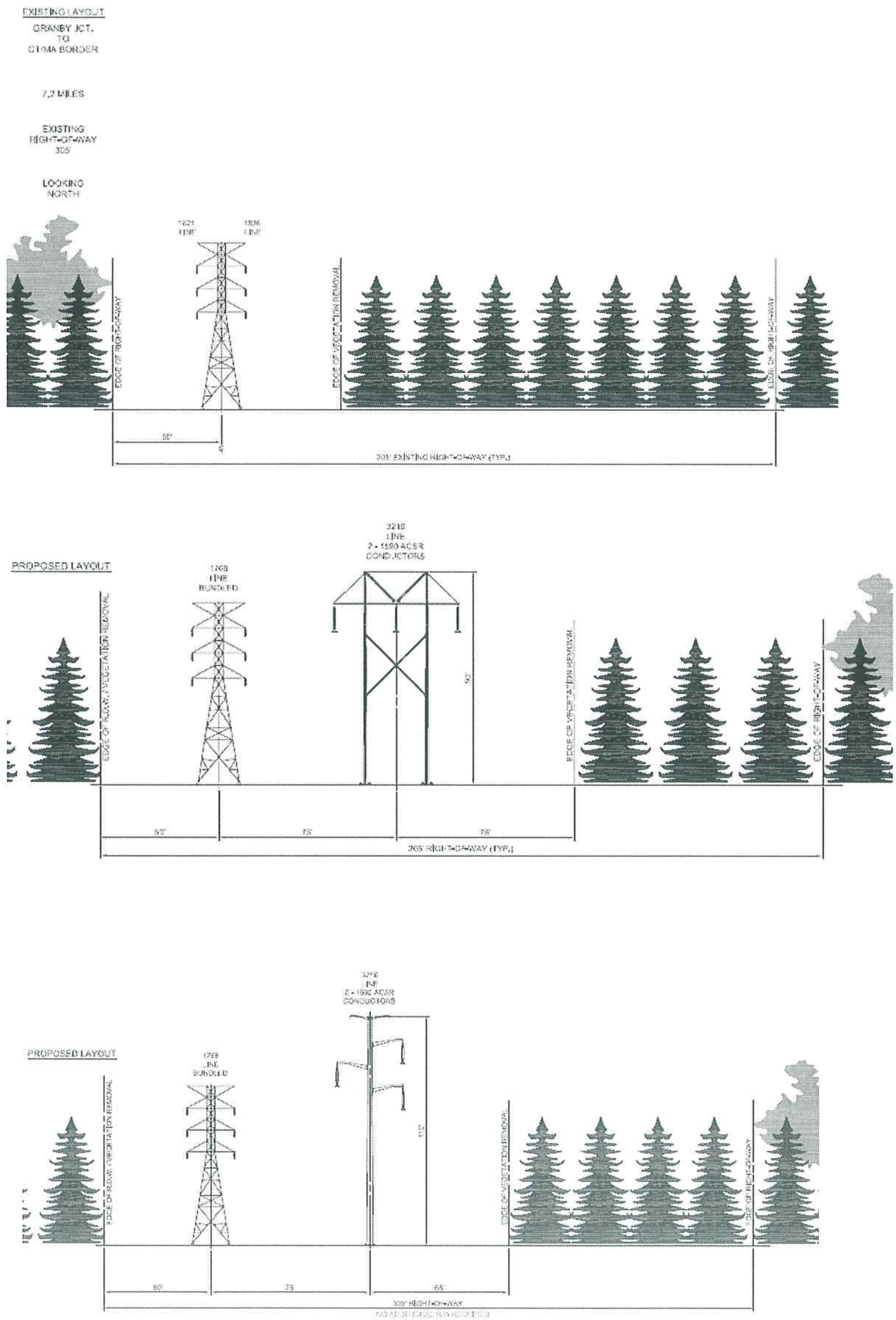


Figure 11. Existing, proposed, and preferred EMF-BMP cross-section for Meekville Junction to Manchester Substation. (CL&P Vol. 10, XS-21 and XS-21 BMP)

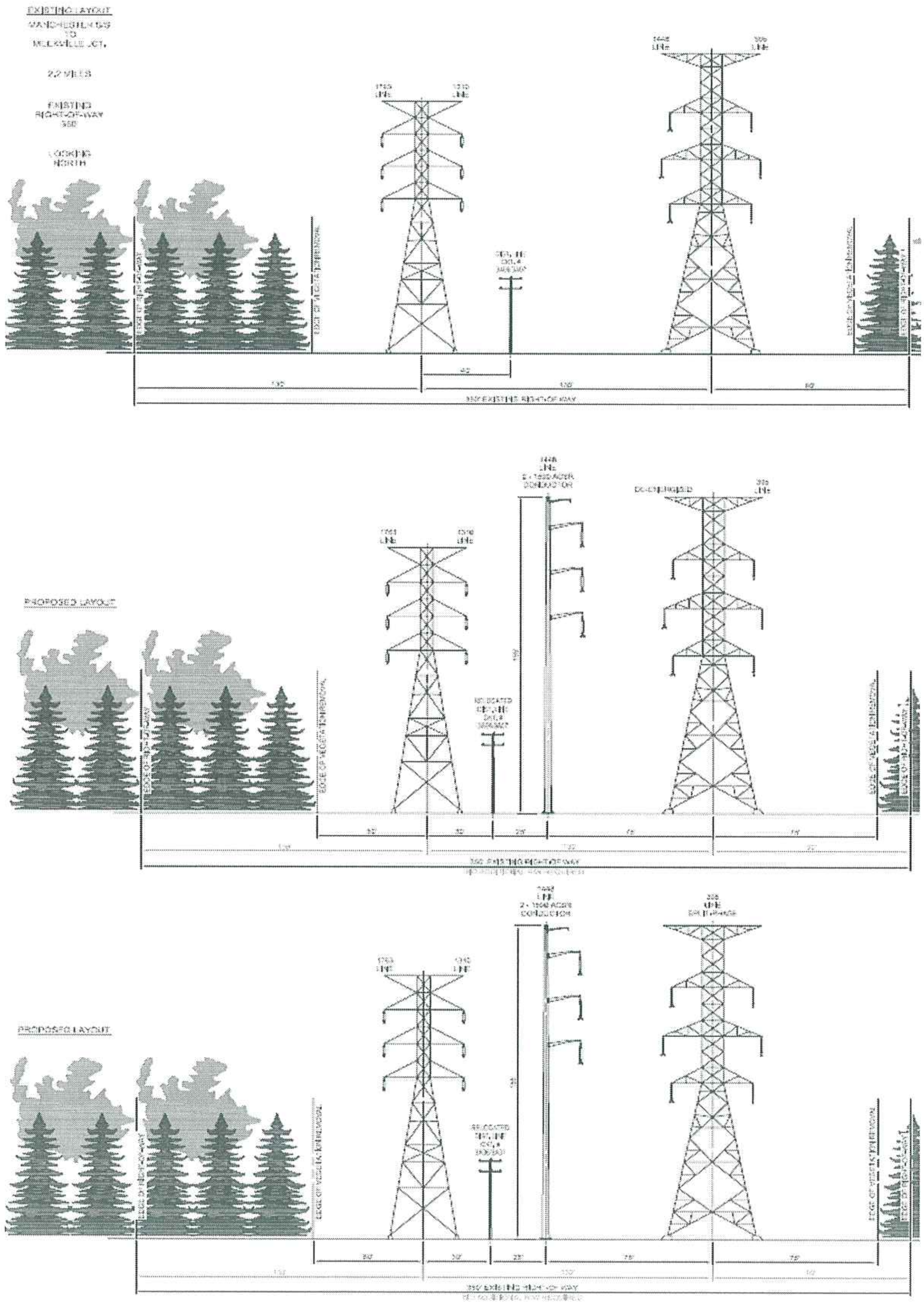
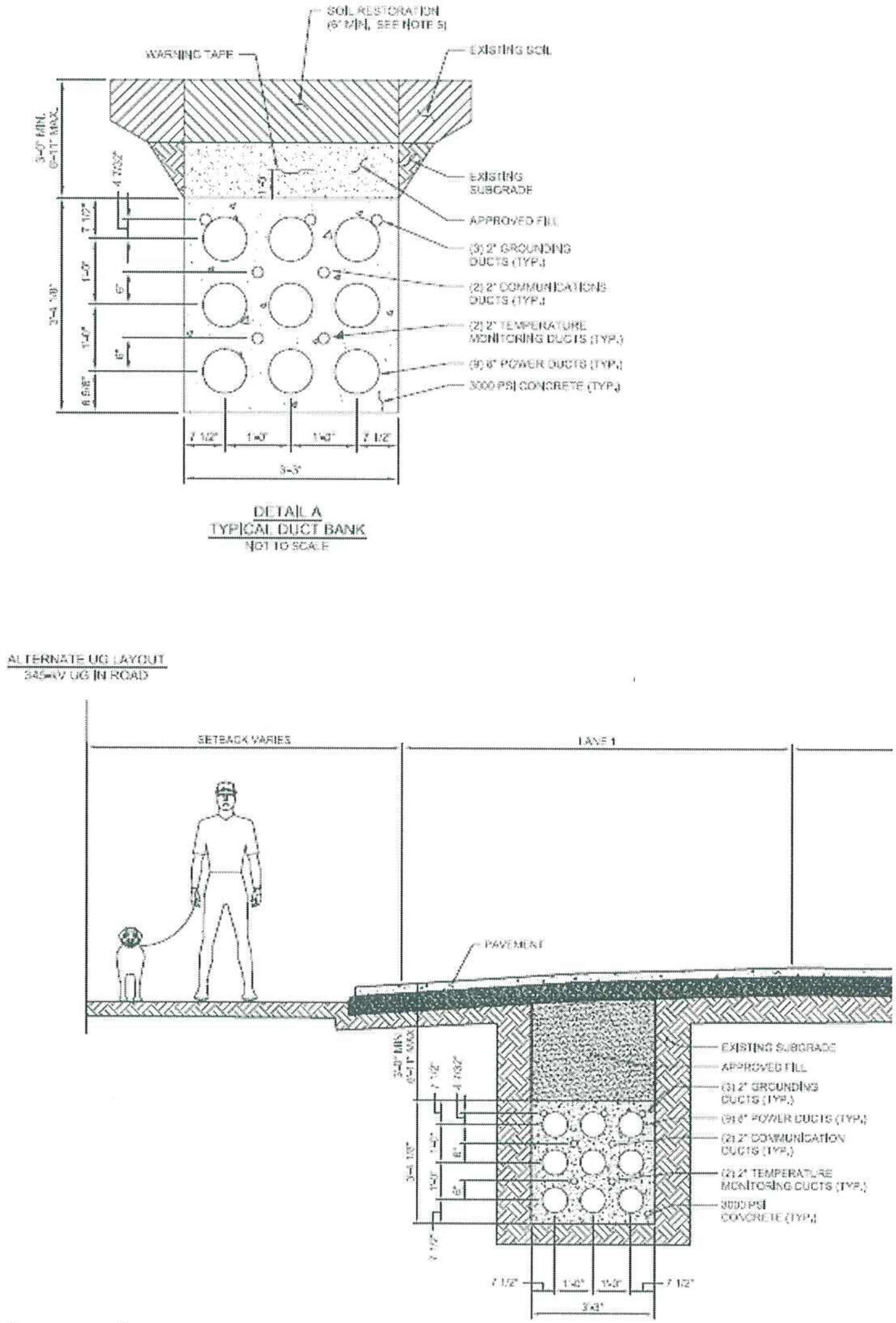
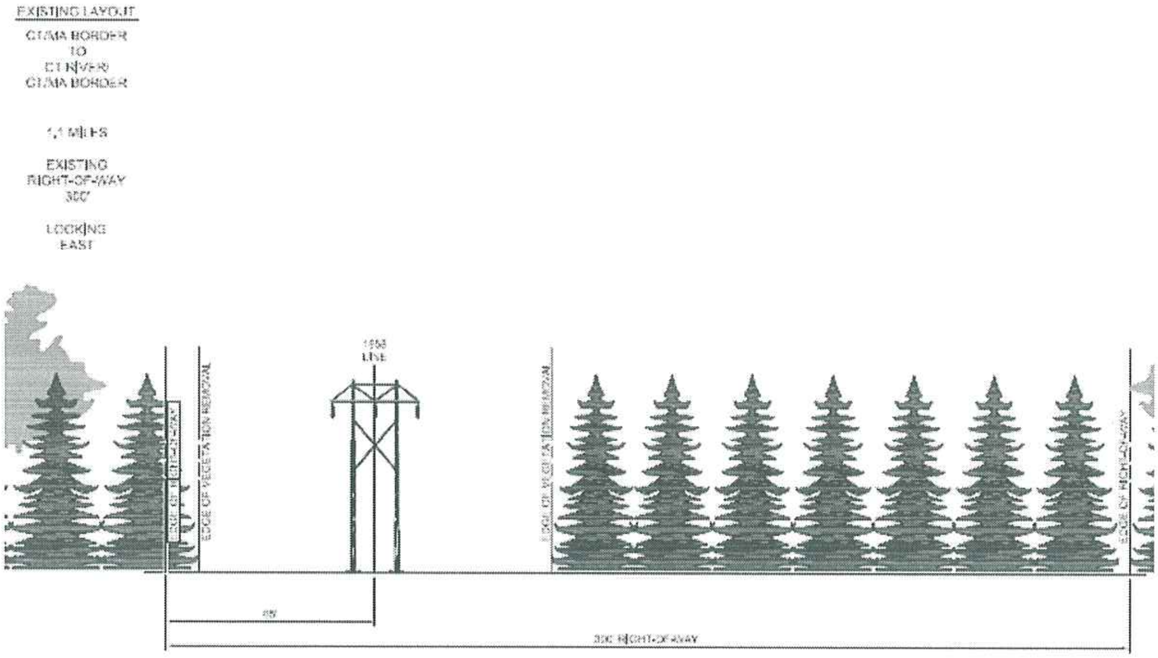


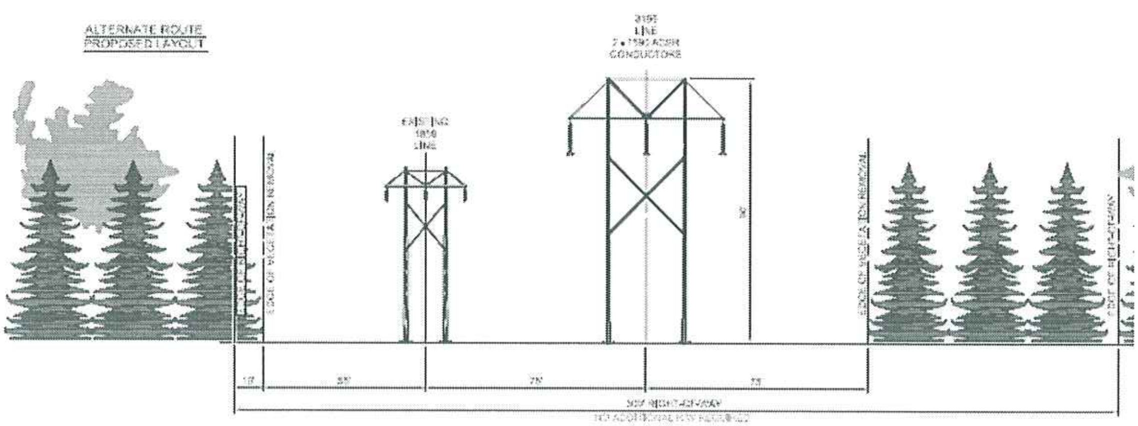
Figure 12. Proposed underground duct bank cross section for In-ROW and In-Road.



(CL&P Vol. 10, XS-UG Road and UG ROW)

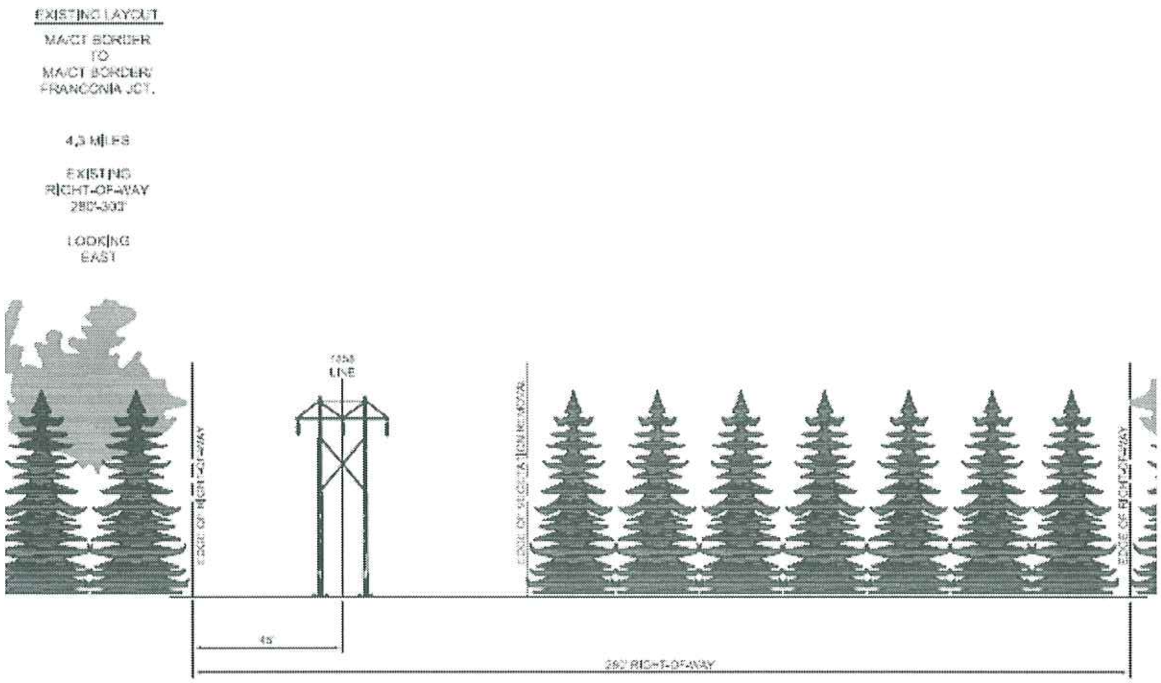
Figure 13. Existing and proposed cross section for Southern Route Alternative

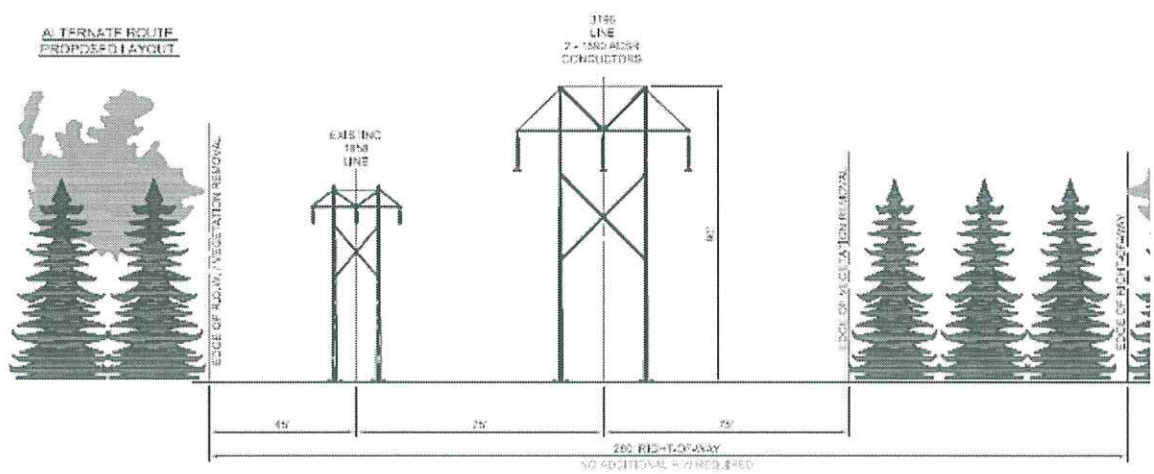




(CL&P Vol. 10, XS-SO5 and XS-SO7)

Figure 13. (Continued)





(CL&P Vol. 10, XS-SO5 and XS-SO7)

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.)

CONVEX: Connecticut Valley Electric Exchange.

Corona: A luminous discharge due to ionization of the air surrounding conductors, hardware, accessories, or insulators caused by a voltage gradient exceeding a certain critical value. Surface irregularities such as stranding, nicks, scratches, and semiconducting or insulating protrusions are usual corona sites, and weather has a pronounced influence on the occurrence and characteristics of overhead power-line corona.

Council: Connecticut Siting Council

CT DEP: Connecticut Department of Environmental Protection

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.

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.

DPU: (Massachusetts) Department of Public Utilities (formerly Department of Telecommunications and Energy)

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.

EFSB: Energy Facilities Siting Board (Massachusetts)

Electric Field: Produced by voltage applied to conductors and equipment. The electric field is expressed in measurement units of volts per meter (V/m) or kilovolts per meter (kV/m); 1 kV/m is equal to 1,000 V/m.

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

EPA: United States Environmental Protection Agency

Fault: A failure (short circuit) or interruption in an electrical 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

GSRP: Greater Springfield Reliability Project

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 the 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 currents; however, unlike electric fields, most materials do not readily block magnetic fields. The level of a magnetic field is commonly expressed as magnetic flux density in units called gauss (G), or in milligauss (mG), where 1 G = 1,000 mG.

Magnetic Flux Density: See Magnetic Field

Manhole: See Splice Vault

MHG: Material Handling Guidelines

mG: milligauss (see Magnetic Field)

MMP: Manchester to Meekville Junction Circuit Separation Project

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

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.

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.

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 cable