COMMONWEALTH OF MASSACHUSETTS
Energy Facilities Siting Board

In the Matter of the Petition of New England Power Company for Approval of its Occasional Supplement and Conversion of Two Existing 69 kV Transmission Lines to 115 kV Transmission Lines in Uxbridge, Massachusetts	EFSB 94-1

FINAL DECISION

Robert P. Rasmussen
Hearing Officer
October 17, 1995

On the Decision:
Phyllis Brawarsky
William s. Febiger

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FOR: New England Power Company
Petitioner

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The Energy Facilities Siting Board hereby APPROVES the petition of New England Power Company to convert the existing 69 kV supply to the Uxbridge #321 substation to 115 kV by looping an existing 115 kV line into the Uxbridge substation, utilizing the Company's proposed route.

I. INTRODUCTION

A. Summary of the Proposed Project and Facilities

New England Power Company ("NEPCo" or "Company") is the wholesale generation and transmission subsidiary of the New England Electric System ("NEES"), a public utility holding company (Post-Hearing Brief of Petitioner New England Power Company ("Brief") at n.1). NEPCo supplies almost all of the electricity distributed by the Massachusetts Electric Company ("MECo"), the NEES retail subsidiary serving customers in the Commonwealth (id.). New England Electric System, 18 DOMSC 229, 230 (1989).

NEPCo has proposed to convert the existing 69 kilovolt ("kV") supply to the Uxbridge #321 substation ("Uxbridge substation") in Uxbridge to 115 kV by looping an existing 115 kV line, located within NEPCo's Millbury-Woonsocket Right-of-Way ("ROW"), into the Uxbridge substation (Exhs. NEP-7, at 1-1; NEP-10 at 3).[1] For its primary route, NEPCo has proposed to convert two existing, 1.3 mile long, double circuited overhead 69 kV transmission lines, which extend from the Millbury-Woonsocket ROW to the Uxbridge substation, to 115 kV (Exh. NEP-7, at 1-1, 2-4). NEPCo has identified two alternative routes from the Millbury-Woonsocket ROW to the Uxbridge substation including (1) two new, 1.8 mile long, overhead, 115 kV transmission lines that would follow a railroad ROW and a new private ROW, and (2) two new, 1.7 mile long, underground 115 kV transmission lines that would follow public streets and an existing private ROW (id. at 1-1).

In addition to the proposed 115 kV transmission lines, NEPCo has proposed to install

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[1] The Company indicated that looping the existing 115 kV line refers to the extension of the 115 kV line from its mainline location to the substation and then back out to the mainline such that the 115 kV line runs through the substation (Exh. NEP-10, at 3). See Figure 2.

two new 115/13.8 kV transformers, circuit breakers and associated equipment at the Uxbridge substation (id. at 1-2).

Pursuant to G.L. c. 164, § 69J, no electric company shall commence construction of a jurisdictional energy facility (See Section 1.C, below) unless a petition for approval of construction has been approved by the Massachusetts Energy Facilities Siting Board ("Siting Board"). In addition, in the case of an electric company which is required by G.L. c. 164, § 69I to file a long-range forecast with the Department of Public Utilities ("Department"), the facility must be consistent with the electric company's most recently approved long-range forecast. G.L. c. 146, § 69J. NEES' Massachusetts retail subsidiary, i.e., MECo, is required to make such a filing. After reviewing MECo's most recent long-range forecast filing, the Department approved MECo's forecast. Massachusetts Electric Company, D.P.U. 94-112 (1994).

B. Procedural History

On December 15, 1994, NEPCo filed with the Siting Board its petition to convert two existing 1.3 mile, 69 kV, double-circuited, overhead transmission lines to 115 kV and to upgrade related facilities as described herein. On April 3, 1995, the Siting Board conducted a public hearing on the petition in the Town of Uxbridge. In accordance with the direction of the Hearing Officer, NEPCo provided notice of the public hearing and adjudication. No petitions to intervene or to participate as an interested person were submitted.

The Siting Board conducted evidentiary hearings on July 11 and 12, 1995. NEPCo presented three witness: Francis R. Barys, an engineer in the Protection and Planning Department of the New England Power Service Company ("NEPSCo"), who testified regarding the need for the proposed facility and alternatives thereto; Mark S. Browne, a senior engineer in the Transmission Line Engineering Department of NEPSCo, who testified regarding cost and environmental impacts of the proposed facility; and Dr. Deborah E. Weil, an independent scientist employed by Bailey Research Associates, who testified regarding electric and magnetic fields.

The Hearing Officer entered 110 exhibits into the record, consisting primarily of NEPCo's responses to information and record requests. NEPCo entered 12 exhibits into the record.

NEPCo filed its Brief on August 9, 1995. The Siting Board issued supplemental information requests to clarify the Company's responses to record requests on that same day. The Company completed its responses to the supplemental information requests on August 16, 1995.

C. Jurisdiction

The Company's petition is filed in accordance with G.L. c. 164, § 69H, which requires the Siting Board "to implement the energy policies … to provide a necessary energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost," and pursuant to G.L. c. 164 § 69J, which requires electric companies to obtain Siting Board approval for construction of proposed facilities at a proposed site before a construction permit may be issued by another state agency.

The Company's proposal to construct a 1.3 mile, 115 kV electric transmission line falls squarely within the second definition of "facility" set forth in G.L. c. 164, § 69G. That section states, in part, that a facility is:

> (2) any new electric transmission line having a design rating of sixty-nine kilovolts or more and which is one mile or more in length except reconductoring or rebuilding of existing transmission lines at the same voltage.

The Company also proposes to install two new 115/13.8 kV transformers at the Uxbridge substation. The third definition of facility set forth set forth in G.L. c. 164 § 69G is pertinent in determinating whether the transformers are jurisdictional facilities. In that third definition a facility is defined as:

> (3) any ancillary structure including fuel storage facilities which is an integrated part of the operation of any electric generating unit or transmission line which is a facility.

In Commonwealth Electric Company, 17 DOMSC 249, 263 (1988) ("1988 ComElectric

Decision"), the Energy Facilities Siting Council ("Siting Council")[2] established a two-part standard for determining whether a structure is a facility under the third definition of facility set forth in G.L. c. 164, § 69G. In that case the Siting Council determined that a structure is a facility if (1) the structure is subordinate or supplementary to a jurisdictional facility, and (2) the structure provides no benefit outside of its relationship to the jurisdictional facility. Id.

With regard to the first part of the definition, the transformers are clearly subordinate to the proposed transmission line.[3]

With regard to the second part of the definition, the Company asserted that the transformers would provide benefit independent of the proposed facilities (Exh. HO-N-7; Tr. 1, at 67-68; Brief at n.3). The Company stated that, even without installation of the proposed transmission line, replacement of the two transformers at the Uxbridge substation with increased transformer capacity is necessary to provide firm capacity for the Uxbridge substation load (Exh. HO-N-7). The Company explained that each of the existing transformers will exceed its summer emergency capability with the outage of either transmission line or the other transformer at the Uxbridge substation (id.; Exh. HO-N-15). See Section II.A.3, below.

The Siting Board accepts the Company's argument that increased transformer capacity is necessary to provide firm capacity for the Uxbridge substation load. The need for increased transformer capacity, however, does not create a situation in which every option to meet that need would necessarily provide a benefit outside of the relationship of that option to the jurisdictional facility. The Siting Board notes that the proposed transformers, which would step voltage down from 115 kV to 13.8, could not be used at the Uxbridge substation without the

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2 The Siting Council was the predecessor agency of the Siting Board. Chapter 141 of the Acts of 1992 ("Reorganization Act"). The Reorganization Act maintains decisions of the Siting Council as precedent for the Siting Board. Reorganization Act, § 46.

3 The Company stated that the transformers may be considered supplementary to the proposed transmission line due to the relationship of the transmission line to the transformers – transformers step down the voltage of the power delivered via the transmission line so that the power can be delivered at a distribution voltage level (Exh. HO-N-17). The Company defined supplementary as "something that makes an addition" (Exh. HO-N-17).

installation of a 115 kV transmission line to the substation. Therefore, the proposed 115/13.8 kV transformers would not be capable of providing a benefit outside of their relationship to the proposed transmission line.

Accordingly, pursuant to the definition of facility set forth in the 1988 ComElectric Decision, the Siting Board finds that the proposed 115/13.8 kV transformers are facilities within the meaning of the third definition of facility in G.L. c. 164, § 69G.

D. Scope of Review

In accordance with G.L. c. 164, § 69H, before approving an application to construct facilities, the Siting Board requires applicants to justify facility proposals in three phases. First, the Siting Board requires the applicant to show that additional energy resources are needed (see Section II.A, below). Next, the Siting Board requires the applicant to establish that its project is superior to alternative approaches in terms of cost, environmental impact, reliability, and ability to address the previously identified need (see Section II.B, below). Finally, the Siting Board requires the applicant to show that its site selection process has not overlooked or eliminated clearly superior sites, and that the proposed site for the facility is superior to a noticed alternative site[4] in terms of cost, environmental impact, and reliability of supply (see Section III, below).

II. ANALYSIS OF THE PROPOSED PROJECT

A. Need Analysis

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[4] When a facility proposal is submitted to the Siting Board, the petitioner is required to present (1) its preferred facility site or route, and (2) at least one alternative facility site or route. These sites and routes often are described as the "noticed" alternatives because these are the only sites and routes described in the notice of adjudication published at the commencement of the Siting Board's review. In reaching a decision in a facility case, the Siting Board can approve a petitioner's preferred site or route, approve an alternative site or route, or reject all sites and routes. The Siting Board, however, may not approve any site, route, or portion of a route which was not included in the notice of adjudication published for purposes of the proceeding.

1. Standard of Review

In accordance with G.L. c. 164, § 69H, the Siting Board is charged with the responsibility for implementing energy policies to provide a necessary energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. In carrying out this statutory mandate with respect to proposals to construct energy facilities in the Commonwealth, the Siting Board evaluates whether there is a need for additional energy resources[5] to meet reliability, economic efficiency, or environmental objectives. The Siting Board must find that additional energy resources are needed as a prerequisite to approving proposed energy facilities.

2. Description of the Existing System

The Company indicated that the Uxbridge Power Supply Area ("PSA") is supplied by three bulk transmission substations – the Uxbridge substation,[6] the Whitins Pond substation in Northbridge and the Depot Street substation in Milford (Exh. HO-N-19; Brief at 7). The Uxbridge substation is supplied at 69 kV from the Millbury #1 substation ("Millbury substation") in Millbury via two 69 kV transmission lines, the K-11 and L-12 lines, which extend along NEPCo's existing Millbury-Woonsocket ROW (Exhs. NEP-10, at 2; NEP-7 at 2-4). Two 69 kV tap lines, the K-11T and L-12T lines, connect the K-11 and L-12 lines to the Uxbridge substation along a 1.3-mile ROW known as the Uxbridge spur (Exh. NEP-7, at 2-1, 2-2, 3-3). See Figure 1. The K-11/K-11T and L-12/L-12T lines are supported on a single line of double circuit steel towers for the entire distance of 12.4 miles from the Millbury substation to the Uxbridge substation (Exh. NEP-10, at 3). Two 69/13.8 kV transformers at the Uxbridge substation step the power down from 69 kV to 13.8 kV (Exh. NEP-7, at 2-1). The

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5 In this discussion, "additional energy resources" is used generically to encompass both energy and capacity additions, including, but not limited to, electric generating facilities, electric transmission lines, energy or capacity associated with power sales agreements, and energy or capacity associated with conversation and load management ("C&LM").

6 The Uxbridge substation serves load in Uxbridge, Millville, and parts of Blackstone, Douglas, Northbridge and Sutton, Massachusetts (Exh. NEP-10, at 2).

Company indicated that there are also two 13.8 kV distribution lines on single poles that extend along the Uxbridge spur ROW (id. at 3-16; Tr. 1, at 97).

The Company stated that prior to 1990, the Uxbridge substation was supplied by both the Millbury substation and Narragansett Electric Company's Woonsocket, Rhode Island substation ("Woonsocket substation") via the K-11/K-11T and L-12/l-12T lines, with half the load being served by each substation (Exh. NEP-7, at 2-1, 2-2; Tr. 1, 35). The Company explained that in 1990, the 115/69 kV transformer at the Woonsocket substation failed and the supply to the Uxbridge substation was changed to its present configuration (Exhs. NEP-7, at 2-1; HO-N-10b).[7] The Company asserted that in 1990 the present configuration was the only course available to maintain two 69 kV supplies to the Uxbridge substation and that there were no alternative sources that could have been immediately utilized to supply the Uxbridge substation (Exh. HO-N-26).

The Company stated that the Millbury-Woonsocket ROW also is occupied by two 115 kV transmission lines, the Q-143 and R-144 lines, which connect Millbury and Woonsocket substations and extend south to a substation in Providence, Rhode Island (Exh. NEP-7, at 2-4; HO-RR-3b; Brief at 7). The Company noted that the Whitins Pond substation is served by the Q-143 line (Exh. HO-N-11b).[8,9] The Company indicated that, in addition to supplying area loads, the Q-143 and R-144 lines provide a valuable bulk power transfer path to the central Massachusetts areas from the southeast Massachusetts/Rhode Island region (Exhs. HO-A-16;

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[7] The Company indicated that although the K-11 and L-12 lines extend between the Woonsocket and Millbury substations, the K-11 line is open and there is an open switch on the L-12 line between the tap point and the Woonsocket substation (Exh. NEP-7, at 2-2).

[8] The Company noted that the Whitins Pond substation is located between the Millbury and Uxbridge substations; there are no transmission or subtransmission lines connecting the Whitins Pond and Uxbridge substations (Exh. HO-N-11b). Distribution feed ties which link the two substations are normally open (id.).

[9] The Q-143/R-144 lines also supply two substations in Providence, Rhode Island (Exh. HO-RR-3b, attach.; Brief at 7).

HO-A-19).

The Company also noted that the Depot Street substation is located seven miles to the northeast of the Uxbridge substation and is served by two 115 kV transmission lines that extend between the Millbury substation and the Medway substation in Medway (Exhs. NEP-7, at 2-1, 2-4; HO-N-14a). Two 13.8 kV subtransmission lines, designated as the 7U and 8J lines, connect the Uxbridge substation and the Depot Street substation (Exhs. NEP-7 at 2-4; NEP-10, at 2).[10] See Figure 1.

3. Reliability of Supply

The Company asserted that the proposed project is needed in order to provide a reliable supply of electricity to the area served by the Uxbridge substation (Exh. NEP-7, at 2-1). The Company identified two problems with the present supply to the Uxbridge substation such that the existing supply configuration does not meet the reliability criteria of the Company (id.; Exh. NEP-10, at 2-3). The Company stated that the current demand from the Uxbridge area exceeds the firm capability of equipment under contingency conditions (id.). The Company further stated that the location of the two transmission lines serving the Uxbridge substation on a single line of double-circuit towers makes both lines susceptible to a simultaneous fault which would result in an outage for the customers served by the Uxbridge substation (id.).

In this Section, the Siting Board first examines the reasonableness of the Company's system reliability criteria. The Siting Board then evaluates: (1) whether the Company uses reviewable and appropriate methods for assessing system reliability based on load flow analyses; (2) whether existing and projected loads, under certain contingencies, exceed the Company's reliability criteria, thereby requiring additional energy resources; and (3) whether acceleration of C&LM programs could eliminate the need for such additional energy resources.

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[10] The 7U line supplies a distribution substation in Milford and the 8U line supplies the Mendon #332 substation, which is a distribution substation in Mendon (Exh. NEP-10, at 2).

a Reliability Criteria

In regard to reliabilit6y objectives, the Company described three classes of service reliability and system design criteria applicable to the classes of transmission and distribution found in the proposed project area (Exh. NEP-7, app. B-2). First, with regard to reliability of service to customer load, the Company indicated that the indices of the level of service reliability are frequency and duration of customer outages (id., sec. 2.5). The Company stated that its system design criteria for firm supply require that, in the event of the outage of any one major facility, the remaining system must be capable of serving the customer load within a time period no longer than that required for automatic switching (id.). The Company's system design criteria require that "nonfirm peak load in a contiguous area … not exceed 30 MW" and that "a 3-hour outage once in three years or a 24-hour outage once in ten years … not [be] exceeded for load above 20 MW" (id., sec. 2.5.1).

The system design criteria also require that "the development of supply facilities should preclude equipment loadings above emergency capabilities, and voltage regulations beyond acceptable limits": (id., app. B-2, Exh. NEP-10, at 2-3). Specifically, emergency equipment capabilities must not be exceeded for the loss of a transformer or the loss of an overhead line (Exh. NEP-7, app. B-2, sec. 2.3).[11]

Second, the Company indicated that the system design criteria provide that:

> simultaneous outages of both circuits on overhead double circuit structure may result in the loss of an entire area load, but … it is reasonable to assume that both circuits will not be permanently faulted, and that at least one circuit can be restored to service quickly by a successful reclosure (Exh. HO-N-13a).

In order to confirm to the above assumption, the Company stated that the system should be designed so that both circuits will not be permanently faulted (Brief at 10, citing, Exh. HO-N-13a).

Third, the Company indicated that maintaining the availability of bulk power transfer capability, such as that provided by the Q-143 and R-144 lines, also is a reliability factor when

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[11] The Company indicated that acceptable limits on voltage fluctuation are ten percent for normal and 15 percent for emergency conditions (Exh. NEP-7, App. B-2, sec. 2.4).

designing facilities that may affect such availability (Exhs. HO-A-16; HO-A-19).[12] The Company did not provide reliability criteria, based on the level of bulk power transfer operations or other indicators, that justify particular reliability levels for bulk power corridors.

The Company indicated that its present service reliability criteria were established in 1975, in order to minimize overall cost of supply while maintaining service reliability (Exh. HO-N-13c).[13] The Company indicated that the current reliability standards of four other utilities provide for a threshold for firm supply in the range of its 30 MW level (Exh. HO-N-28).[14]

The Siting Council consistently found that if any loss of any single major component of a supply system would cause significant customer outages, unacceptable voltage levels, or thermal overheads on system components, then there is justification for additional energy resources to maintain system reliability. New England Power Company, 21 DOMSC 325, 339 (1991) ("1991 NEPCo Decision"); Middleborough Gas & Electric Department, 17 DOMSC 197, 206-219 (1988); Holyoke Gas and Electric Department, 3 DOMSC 1, 7 (1978).

With respect to the specific load levels reflected in the Company's reliability criteria for area loads, the Company has provided a summary of the reasons for its establishing the firm supply threshold of 30 MW and, in addition, has provided comparable reliability standards of other utilities serving the Northeast. Although the record in this case does not address the

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12 The Company explained that facilities that supply area loads, such as tap or loop extensions, can increase the exposure of bulk power transfer lines to outage contingencies (Exh. HO-A-19).

13 The Company stated that a study completed in 1975 concluded that increasing the normal maximum loading on 15 kV feeders and increasing the firm supply threshold to distribution substations from 5 MW to 30 MW would reduce overall costs by over 40 percent (Exh. HO-N-13c). The Company added that the study also determined that existing levels of customer service could be maintained by installing automatic sectionalizing devices on each 15 kV distribution feeder (id.).

14 The Company noted that the threshold for firm supply is: (1) 25 to 30 MW for Boston Edison; (2) 30 MW for Northeast Utilities and Public Service of New Hampshire; and (3) 40 to 45 MW for Pennsylvania Power and Light (Exh. HO-N-28).

factors that support its use of a firm supply threshold of 20 MW where longer outages have been experienced, the Siting Council has previously held, in a review of a transmission line proposed by the Company, that "the approach of establishing a threshold for firm supply based on the size of contiguous load, with a lower threshold where outage experience gives rise to customer dissatisfaction, is reasonable."[15] 1991 NEPCo Decision, 21 DOMSC at 339. Consequently, the Siting Board finds that the Company's criteria regarding firm service to area loads are reasonable.

With respect to the Company's criterion regarding simultaneous loss of overhead double-circuit lines, the Siting Board notes that concern about such a loss is warranted if the need for a two-line supply is clear, e.g., if the lines provide a needed firm capability or if the combined capacity of the lines is needed to meet peak load under normal operations. The criterion may be inappropriate, however, if the need for a two-line supply is clearly unsupported based on the Company's other reliability criteria. Thus, the Siting Board finds that the Company's criterion regarding simultaneous loss of overhead double-circuit lines is reasonable, provided that said criterion is considered in conjunction with other reliability criteria of the Company that relate to the need for two lines.

With respect to the Company's identification of bulk power transfer capability as an additional reliability factor in the design of system modifications that may affect such capability, the Siting Board agrees that bulk power transfers can be essential for avoiding significant customer outages, unacceptable voltage levels or thermal overloads. Absent more specific criteria, however, it is unclear whether and how the Company considers indicators of the importance of such transfers – for example the purpose of the transfers or thresholds as to the size or frequency of transfers – in applying particular reliability standards. Further, it is unclear whether the reliability standard to be applied for bulk power transfers which exceed the threshold or other indicator of importance is the same as, or more or less stringent than, the

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[15] In that review, the Siting Council found that the Company's reliability criteria, including both the 30 MW and the 20 MW criteria, were reasonable. 1991 NEPCo Decision at 339.

reliability standard to be applied for serving area loads that exceed particular thresholds. In future reviews where the reliability of bulk power transfer capability is a factor, applicants will be required to identify quantitative or other specific criteria that allow the importance of such capabilities to be established on a case-specific basis.

Accordingly, based on the foregoing, the Siting Board finds that the Company's reliability criteria are reasonable for purposes of this review.

b. Load Forecasts

i. Description

For the Uxbridge PSA, the Company provided information regarding historical system-coincident peak demand for 1980 through 1994[16] and forecasted base-case and high-case system-coincident peak demand for the years 1995 through 2013 (Exh. HO-N-1b). The Company stated that its PSA forecasts are statistical forecasts of seasonal system-coincident peak demand that are used for purposes of system transmission and area supply planning (Exh. HO-N-1a).

The Company indicated that the PSA forecasts are developed by allocating to the PSA its proportional share of the long-term load forecast of MECo peak demand, developed in the Companies' Integrated Resource Plan ("IRP") (id.). Specifically, the Company projects allocated PSA load by (1) regressing historical coincident PSA peaks for both summer and winter against the historical peak for MECo, and (2) applying coefficients from the regressions to the IRP forecast of MECo seasonal peak (id.). The Company added that the PSA forecast is then (1) calibrated so that the growth of the sum of the PSAs matches the MECo IRP forecast, and (2) adjusted to reflect the gain or loss of large customers or other events which are not reflective of the historical pattern of the PSA load (id.). The Company noted that, in order to reflect uncertainties inherent in system-coincident and peak-day weather, a high-case forecast of seasonal peaks is also developed for each PSA by adding two standard errors of the regression

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[16] NEPCo indicated that the seasonal coincident historic peaks attributed to a PSA are calculated as the total of meter readings at substations within the PSA (Exh. HO-N-1a).

to each year's base case PSA forecast (id.).

The Company also provided Uxbridge substation loads coincident with the system peak for the years 1988 through 1994 (Exh. HO-N-3).[17] The Company indicated that the Uxbridge substation load, coincident with system peak, was 23.5 MW in 1993 and 19.4 MW in 1994 (id.).[18] The Company explained that the PSA is the smallest unit for which forecasts are developed and that it does not prepare separate forecasts of load growth at specific distribution substations (Exh. HO-N-2b, 2c). However, the Company estimated that the Uxbridge substation accounts for approximately 11 percent of the combined load of the Uxbridge and Webster PSAs, based on its historical percentage of 8.4 percent to 11.3 percent over the 1988 to 1994 time period (Exhs. NEP-7, revised app. B-1; HO-N-3).[19]

ii. Analysis

In forecasting load for the Uxbridge substation, the Company first prepared the PSA forecast and then derived the Uxbridge substation forecast from the PSA forecast, based on the historical relationship of Uxbridge substation peak to the PSA peak. In presenting its PSA forecast, the Company adequately explained its derivation of historic trends in order to prorate the MECo system forecast into separate PSA forecasts. While the Company described certain PSA-specific adjustments that would be applied to the PSA forecast, the Company did not provide a systematic methodology for the adjustment of the PSA forecast either to account for PSA-specific information, or to conform to the system forecast. Thus, the Company relied on both quantitative and judgmental techniques in its forecast of PSA load growth.

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17 The Company indicated that the Uxbridge substation, coincident with system peak, load ranged from 17.0 MW to 23.5 MW during the 1988 to 1994 period (Exh. HO-N-3).

18 The Company noted that the non-coincident 1994 summer peak at the Uxbridge substation reached 29.6 MW (Exh. HO-N-15).

19 The company indicated that until 1993 the Uxbridge area was included in the Millbury PSA (Exh. HO-N-1c). In 1993, the Millbury PSA was separated into the Uxbridge PSA and the Webster PSA (id.).

In an earlier review of a transmission line proposed by the Company, the Siting Council stated that, in future facility reviews, when a company projects load growth for a portion of its service territory, the Siting Council will require such company to use quantitative techniques, where sufficient data is available, or other systematic techniques, and to document all pertinent assumptions to support the allocation of system-wide growth to service areas and to individual substations within the service areas. 1991 NEPCo Decision, 21 DOMSC at 344.

Here, the Company has relied on quantitative techniques with adjustments for forecasting load at the PSA level, and has provided a reasonable explanation for its estimation of load growth at the substation level, based on the PSA forecast. Further, as will be discussed in Section.II.A.3.c.i, below, the proposed facilities are needed based on existing load levels. Accordingly, the purposes of this review, the Siting Board finds that the Company's load forecast methodology is reasonable and acceptable.

c. Contingency Analysis

In this Section, the Siting Board considers whether there is a need for additional energy resources based either on (1) the Company's reliability criteria with regard to equipment loadings, or (2) its reliability criteria with regard to double circuit outages.

i. Exceedance of Firm Capability of Equipment

The Company asserted that under 1993 summer peak load and foreseeable contingencies, existing facilities would be loaded in excess of summer emergency capabilities (Exhs. HO-N-6; HO-N-15). In support of its assertion, the Company provided a set of load flow analyses, based on 1993 and 1994 system-coincident peak loads at the Uxbridge substation, to simulate system operation under normal conditions and with each major component out of service (Exhs. HO-N-14; HO-N-15). The proposed facilities were not included in this set of load flow analyses (Exhs. HO-N-14; HO-N-15). As the basis for assessing system adequacy, the Company explained that these load flow diagrams identify system problems such as equipment loading above designated ratings for emergency conditions

and voltage below designated minimum levels (Exhs. HO-N-14; HO-N-15).

The Company provided the summer emergency capabilities of equipment serving the Uxbridge substation load as follows: (1) the K-11/11T and L-12/12T transmission lines, 18 megavoltamperes ("MVA"); (2) transformer T1, 25.9 MVA; and (3) transformer T6, 18.2 MVA (Exh. HO-N-12). The Company provided load flow analyses, assuming the 1993 summer peak load of 23.5 MW and the 1994 summer peak load of 19.4 MW, for the outage of each of the existing 69 kV transmission lines and transformers with normal load operation on the distribution system (Exhs. HO-N-14b to 14e; HO-N-15b to 15e). In addition, the Company provided a second set of load flow analyses for 1993 and 1994 summer peak loads under the same contingencies, assuming an alternative operating configuration for the distribution system ("alternative distribution configuration") (Exhs. HO-N-15g to 15k; HO-N-29a to 29e). The Company explained that, under peak load conditions, it currently uses the alternative distribution configuration in order to prevent overloading on the 7Uand 8U distribution lines in the event of an outage of the K-11/11T or L-12/12T lines (Exh. HO-N-15).[20]

With normal load operation of the distribution system,[21] the Company's load flow analyses demonstrate exceedances of equipment capabilities under 1993 summer peak load as follows: (1) the outage of the L-12/12T transmission or the T1 transformer would cause the K-11 line to be loaded at 18.7 MVA, the K-11T line to be loaded at 18.4 MVA and the T6

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20 The Company indicated that the alternative distribution configuration would involve switching a large industrial customer from the 7P line, which normally supplies a distribution substation and said large industrial customer, to the 8U line in order to prevent an overload of the 7P line (Exh. HO-N-15e). In addition, the Company indicated that it would open the 7U and 8U lines between the Uxbridge and Depot Street substations in order to supply the Mendon #332 substation exclusively from the Uxbridge substation (Exh. HO-N-15).

21 The Company indicated that the 7U and 8U lines are not opened between the Uxbridge substation and Depot Street substation under normal load operation of the distribution system (Exh. HO-N-15b through 15e).

transformer to be loaded at 18.3 MVA[22]; (2) the outage of the K-11/11T transmission line or the T6 transformer would cause the L-12 line to be loaded at 18.7 MVA and the L-12T line to be loaded at 18.3 MVA[23] (Exh. HO-N-15b to 15e; Tr. 1, at 52-56). The Company indicated that there are no equipment overloads under 1994 summer peak load of 19.4 MW and the aforementioned operating conditions (Exh. HO-N-14c).

With the use of the alternative distribution configuration, the Company indicated that exceedances of emergency summer capabilities would be greater during peak load conditions for the Uxbridge substation and the Depot Street substation (Exh. HO-N-15). The Company provided load flow analyses assuming the 1993 summer peak load of 23.5 MW, the outage of each of the 115 kV transmission lines and transformers, and the alternative distribution configuration (Exh. HO-N-15h to 15k). These load flow analyses demonstrate that (1) the outage of the L-12/12T transmission line or the T1 transformer would cause the K-11 line to be loaded at 30.0 MVA, the K-11T line to be loaded at 29.1 MVA and the T6 transformer to be loaded at 29.0 MVA,[24] and (2) the outage of the K-11/11T transmission line or the T6 transformer would cause the L-12 line to be loaded at 29.9 MVA, the L-12T line to be loaded at 29.1 MVA and the T1 transformer to be loaded at 28.9 MVA[25] (Exh. HO-N-15h to 15k; Tr. 1, at 52-56).

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22 Under this contingency, loadings would be 3.9, 2.2, and 0.5 percent above emergency capabilities for the K-11 line, K-11T line and transformer T6, respectively (Exhs. HO-N-12; HO-N-15b, 15d; Tr. 1 at 52-56).

23 Under this contingency, loadings would be 3.9 and 1.7 percent above emergency capabilities for the L-11 line and L-11T line, respectively (Exhs. HO-N-12; HO-N-15c, 15e; Tr. 1 at 52-56).

24 Under this contingency, loadings would be 66.7, 61.7 and 59.3 percent above emergency capabilities for the K-11 line, K-11T line and transformer T6, respectively (Exhs. HO-N-12; HO-N-15h; HO-N-15); Tr. 11, at 52-56).

25 Under this contingency, loadings would be 66.1, 61.6 and 11.6 percent above emergency capabilities for the L-12 line, L-12T line and transformer T1, respectively (Exhs. HO-N-12, HO-N-15; HO-N-15k; Tr. 1, at 52-56).

The Company stated that under the alternative distribution configuration and the aforementioned contingencies, equipment loadings also exceeded emergency ratings under the 1994 peak load of 19.4 MW (Exh. HO-N-29). In support, the Company provided load flow analyses which demonstrate that: (1) the outage of the L-12/12T transmission line or the T1 transformer would cause the K-11 line to be loaded at 25.9 MVA, the K-11T line to be loaded at 25.1 MVA and the T6 transformer to be loaded at 25.0 MVA[26], and (2) the outage of the K-11/11T transmission line or the T6 transformer would cause the L-12 line to be loaded at 25.9 MVA and the L-12T line to be loaded at 25.1 MVA (Exh. HO-N-29; Tr. 1, at 52-56).[27] The loading on the T1 transformer would be 25.0 MVA, 96 percent of its emergency summer capability (Exh. HO-N-29).

The Company stated that the maximum safe loading level at the Uxbridge substation, assuming the alternative distribution configuration, is 12.5 MW (Exh. HO-RR-2). The Company provided load flow analyses, assuming a 12.5 MW load and the alternative distribution configuration, which demonstrated that under the contingency of losing the K-11 or L-12 transmission lines or the T1 or T6 transformers, remaining equipment would be loaded to 98 percent of its summer emergency capability (Exh. HO-RR-2b to 2e). In addition, the Company provided load flow analyses, assuming a 13.0 MW load and the aforementioned conditions, which demonstrated that under said contingencies, remaining equipment would be loaded to 101 percent of summer emergency capabilities (Exh. HO-RR-2f to 2j).

The Company stated that under contingency conditions, 5.6 MW of the Uxbridge substation load could be transferred to adjacent substations through distribution feeder ties (Exh. HO-RR-5). However, the Company stated that, even with such a transfer, equipment loadings would exceed summer emergency capabilities at the 1994 summer peak level of 19.4 MW

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[26] Under this contingency, loadings would be 43.9, 39.4, and 37.4 percent above emergency capabilities for the K-11 line, K-11T line and transformer T6, respectively (Exhs. HO-N-12; HO-N-29b; HO-N-29d; Tr. 1, at 52-56).

[27] Under this contingency, loadings would be 43.9 and 39.4 percent above emergency capabilities for the L-12 line and L-12T line, respectively (Exhs. HO-N-12; HO-N-29c; HO-N-29e; Tr. 1, at 52-56).

under certain contingencies (Exh. HO-N-25).[28]

In its load flow studies, the Company consistently related its assumptions and conclusions to its reliability criteria. The Siting Board finds that the Company used reviewable and appropriate methods for assessing the reliability of supply based on load flow analysis.

Further, the Siting Board finds that the Company's load flow analyses demonstrate that under 1994 peak load conditions, each of four contingencies – the loss of the K-11/11T transmission line, the L-12/12T transmission line, the T1 transformer, and the T6 transformer – would cause remaining equipment to be loaded above emergency summer capabilities. The Siting Board, therefore, finds that the supply to the Uxbridge substation currently does not meet the Company's reliability criteria in the event of the loss of the K-11/11T transmission line, the L-12/12T transmission line, the T1 transformer, or the T6 transformer. Consequently, the Siting Board finds that there is a need for additional energy resources based on the Company's reliability criteria with regard to equipment loadings.

ii. Double Circuit Outage

The Company asserted that providing firm supply to the Uxbridge substation in the form of two adequate supplies is justified based on past outage experience and the Company's commitment to providing reliable electrical service to the customers supplied from that substation (Exh. HO-RR-16). The Company stated that its Guide for Area Supply Planning specifies that, to avoid the problem of simultaneous outage of both circuits on overhead double circuit structures which could lead to the loss of an entire area load, the system should be designed so that both circuits will not be permanently faulted at the same time (Brief at 10, citing, Exh. HO-N-13a). The Company further indicated that, as a result of the loss of the Woonsocket transformer in 1990, the 69 kV supply configuration to the Uxbridge substation

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[28] The Company provided a load flow analysis, assuming the loss of both the K-11/11T and L-12/12T lines and an Uxbridge substation load of 19.4 MW, which demonstrated that the load on the 7U line would exceed its summer emergency capability and the 8U line would be loaded to 98 percent of its summer emergency capability (Exh. HO-N-25).

has been diminished and the exposure of the remaining supply to a double circuit outage has become unacceptable based on the Company's reliability criteria (Exhs. HO-N-8a).

The Company explained that the K-11/11T and L-12/12T transmission lines extending from the Millbury substation, which are Uxbridge substation's only supply source under the current supply configuration, are supported on a single line of double circuit steel towers for their entire length of 12.4 miles between Millbury and Uxbridge substations (Exhs. NEP-7, at 2-1; NEP-10, at 3). The Company noted that on February 16, 1990, there was a permanent double circuit outage of the K-11 and L-12 lines due to lightning that resulted in the loss of supply to the Uxbridge substation and a customer outage lasting seven hours (Exh. HO-N-8a).[29] The Company maintained that the proposed project would decrease the risk of double circuit outages by 89 percent (Exh. HO-RR-16).

Based on the Company's record of supply system outages since 1990, including a seven-hour outage in 1990, the Siting Board agrees it is reasonably likely that a double circuit outage could occur, resulting in the loss of supply to the Uxbridge substation. Further, based on the double-circuit outage criteria as set forth by the Company, the present supply system does not meet the Company's reliability criteria relative to overhead double circuit structures.

However, the Siting Board found in Section II.A.3.a, above, that the Company's criterion regarding simultaneous loss of overhead double-circuit lines should be considered in conjunction with any other reliability criteria of the Company that relate to the need for two lines. We note that, because the Uxbridge substation load has reached 20 MW,[30] the Company's criteria related to providing firm supply to contiguous load of 20 MW or more is potentially applicable.

The Company's Guide for Area Supply Planning states that changes to the supply

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29 The Company noted that there have been eight other outages of both lines since 1990 where both lines were out of service for up to one minute (Exh. HO-N-22).

30 The Company stated that the Uxbridge substation coincident peak load exceeded 20 MW in 1988, 1991, and 1993 and that the non-coincident substation peak exceeded 20 MW in 1994 (Exhs. HO-N-3; HO-N-19).

system can be justified if a three-hour outage once in three years or a 24-hour outage once in ten years is exceeded if the load served is at least 20 MW (Exh. HO-RR-16).[31] The Siting Board notes that the seven-hour outage experienced in February 1990 significantly exceeded the three-hour threshold for an outage that would warrant changes to provide firm supply for a 20 MW load. At the same time, it is unclear whether the recurrence frequency for such outages is sufficient for the Company's 20 MW load firm supply criteria to apply.

Nevertheless, the outage experience under the current supply configuration for Uxbridge substation, which includes an outage of considerable duration just five years ago, appears to be at least close to a level of outage experience that would warrant changes to provide firm supply based on the Company's reliability criteria for a substation load of 20 MW or more. Thus, it is reasonable for the Company to maintain the integrity of its two-line supply by ensuring that such supply is not subject to double circuit outages, consistent with its reliability criteria.

Accordingly, based on the foregoing, the Siting Board finds that the Company has established that supply to the Uxbridge substation does not meet the Company's reliability criteria with respect to overhead double circuit structures, considered in conjunction with other applicable criteria. Consequently, the Siting Board finds that there is a need for additional energy resources based on the Company's reliability criteria with regard to double circuit outages.

d. Accelerated Conservation and Load Management

G.L. c. 164 §69J requires a petitioner to include a description of action planned to be taken to meet future needs and requirements, including the possibility of reducing requirements through load management. The Company asserted that acceleration of both its conservation

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31 The Company explained that the three-hour or 24-hour outage refers to the amount of time a facility is out of service due to a single event rather than the accumulation of outage time due to a number of events within the three-or ten-year time period (Exh. HO-RR-16).

and its load management[32] programs would not address the need for additional energy resources based on equipment loadings given the large amount of load reduction that would be required (Exh. HO-A-1; Brief at 13). The Company stated that it would not be feasible to reduce the present 23.5 MW peak load at the Uxbridge substation to 12.5 MW in order to maintain existing facilities within their emergency ratings (Brief at 13).

The Company provided a list of its current DSM programs (Exh. HO-N-4a). In addition, the Company provided projections of avoided summer MW for the MECo system due to incremental DSM above the 1993 levels for the years 1994 through 1996 as follows: (1) 1994, 12 MW; (2) 1995, 37 MW; and (3) 1996, 64 MW (Exh. HO-N-4b). The Company stated that it does not prepare forecasts of DSM savings at the PSA level but estimated the incremental DSM savings applicable to the Uxbridge/Webster PSA for the years 1994 to 1996 by multiplying the total projected MECo DSM savings by the share of Company load represented by the Uxbridge/Webster PSA (id.). The Company indicated that allocated DSM savings for the Uxbridge/Webster PSA are as follows: (1) 1994, 0.85 MW; (2) 1995, 3.45 MW; and (3) 1996, 4.49 MW (id.). The Company acknowledged that DSM savings would not necessarily be evenly apportioned to the Company load as assumed under its method of

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[32] Load management is a measure or action designed to modify the time pattern of customer electricity requirements, for the purpose of improving the efficiency of an electric company's operating system. 220 CMR § 10.02. For example, a utility may reach an agreement with a manufacturer that uses electricity whereby that manufacturer will curtail its use during peak times when the utility's system, as a whole, is facing increasing demands for electricity for cooling or heating purposes. During non-peak times the manufacturer may then resume its use of electricity. The utility providing electricity has, therefore, managed its load, thereby decreasing its need for additional peak capacity.

Conservation, on the other hand, is a technology, measure, or action designed to decrease the kilowatt or kilowatthour requirements of an electric end-use, thereby reducing the overall need for electricity. Id. Both conservation and load management are demand side management ("DSM") measures.

allocation (id.).[33]

As noted in Section II.A.3.b.i, above, the Uxbridge substation load is approximately 11 percent of the Uxbridge/Webster PSA load. The Siting Board notes that even if the entire Uxbridge/Webster PSA 1996 DSM savings were applied to the 1994 summer coincident Uxbridge substation peak load, which was less than the 1993 summer peak, facilities would still be loaded above emergency capabilities in the event of the outage of major substation equipment. Thus, even if DSM savings were allocated differently, or if existing programs could be accelerated by increased personnel or effort, it is not likely that the Uxbridge substation load could be reduced to 12.5 MW in order to maintain equipment loadings within summer emergency capabilities under contingency conditions. In addition, the Siting Board notes that accelerated C&LM would not eliminate the need for additional energy resources based on double circuit outage exposure.

Based on the foregoing, the Siting Board finds that acceleration of C&LM programs could not eliminate the need for additional energy resources based on the Company's reliability criteria.

e. Conclusions on Reliability of Supply

The Siting Board has found: that the Company's criteria regarding firm service to area loads are reasonable; that the Company's criterion regarding simultaneous loss of overhead double-circuit lines is reasonable, provided that said criterion is considered in conjunction with other reliability criteria of the Company that relate to the need for two lines; and that therefore the Company's reliability criteria are reasonable for purposes of this review. The Siting Board has also found that the Company's load forecast methodology is reasonable and acceptable, and that the Company used reviewable and appropriate methods for assessing the reliability of supply based on load flow analysis.

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[33] The Company indicated that the MECo system load is 37 percent residential and 63 percent commercial/industrial while the Uxbridge area load is 61 percent residential and 39 percent commercial/industrial (Exh. HO-N-5a).

In addition, the Siting Board has found that the Company's load flow analyses demonstrate that under 1994 peak load conditions, each of four contingencies – the loss of the K-11/11T transmission line, the L-12/12T transmission line, the T1 transformer, and the T6 transformer – would cause remaining equipment to be loaded above emergency summer capabilities. Further, the Siting Board has found that the supply to the Uxbridge substation currently does not meet the Company's reliability criteria in the event of the loss of the K-11/11T transmission line, the L-12/12T transmission line, the T1 transformer, or the T6 transformer. Accordingly, the Siting Board has found that there is a need for additional energy resources based on the Company's reliability criteria with regard to equipment loadings.

The Siting Board also has found: that the Company has established that supply to the Uxbridge substation does not meet the Company's reliability criteria with respect to overhead double circuit structures, considered in conjunction with other applicable criteria; and that there is a need for additional energy resources based on the Company's reliability criteria with regard to double circuit outages. Finally, the Siting Board has found that acceleration of C&LM programs could not eliminate the need for additional energy resources based on the Company's reliability criteria.

Based on the foregoing, the Siting Board finds that the Company has demonstrated that the existing supply system is inadequate to satisfy existing load supplied by the Uxbridge substation. Accordingly, the Siting Board finds that additional energy resources are needed for reliability purposes in the Uxbridge area.

B. Comparison of the Proposed Project and Alternative Approaches

1. Standard of Review

G.L. c. 164, §69 H requires the Siting Board to evaluate proposed projects in terms of their consistency with providing a necessary energy supply to the Commonwealth with a minimum impact on the environment at the lowest possible cost. In addition G.L. c. 164, §69 J requires a project proponent to present "alternatives to planned action" which may include: (a) other methods of generating, manufacturing, or storing; (b) other sources of electrical or

natural gas; and (c) no additional electric power or natural gas.[34]

In implementing its statutory mandate, the Siting Council has required a petitioner to show that, on balance, its proposed project is superior to alternative approaches in terms of cost, environmental impact, and ability to meet the previously identified need. 1991 NEPCo Decision, 21 DOMSC at 359-375; Boston Edison Company/Massachusetts Water Resources Authority, 19 DOMSC 1, 18-30 (1989) ("BECo/MWRA Decision"); Boston Edison Company, 13 DOMSC 63, 67-68, 73-74 (1985).

In addition, the Siting Council has required a petitioner to consider reliability of supply as part of its showing that the proposed project is superior to alternative project approaches. 1991 NEPCo Decision, 21 DOMSC at 374-375; BECo/MWRA Decision, 19 DOMSC at 25; Massachusetts Electric Company, 18 DOMSC 383, 404-405 (1989).

2. Project Approaches

In its initial filing the Company identified two approaches to meeting the identified need (1) the proposed project – the conversion of the Uxbridge substation supply to 115 kV by looping the Q-143, 115 kV transmission line into the substation (see Figure 2), and (2) an alternative approach – the upgrade of the existing 69 kV system ("69 kV upgrade") (see Figure 3) (Exh. NEP-7, at 2-1, 2-6).

During the course of the proceedings one additional approach to meet the identified need was identified and evaluated. This approach is the conversion of the Uxbridge substation supply to 115 kV by tapping both the Q-143 and R-144, 115 kV transmission lines to the substation ("115 kV double tap alternative") (see Figure 4). The Siting Board's analysis of project approaches will include the proposed project, the alternative approach identified by the

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[34] G.L. c. 164, §69J, also requires a petitioner to provide a description of "other site locations." The Siting Board reviews the petitioner's proposed site, as well as other site locations, in Section III.B, below.

Company and the project approach identified during the course of the proceeding.[35]

3. Ability to Meet the Identified Need

In its analysis of the ability of each of these approaches to meet the identified need, the Siting Board evaluates whether each approach (1) would provide a reliable supply to the area served by the Uxbridge substation in the event of a loss of a transmission line or Uxbridge substation transformer, and (2) would meet the Company's double-circuit outage criteria.

a. Proposed Project

The Company asserted that the proposed project would meet the identified need (Exh. NEP-7, at 2-1, 2-6). In support thereof, the Company provided analyses of equipment loadings under the contingencies of a loss of each of the transmission lines and transformers supplying the Uxbridge substation (Exh. HO-N-16k to 16o). In its load flow analyses, the Company assumed a 23.5 MW peak load as actually experienced in 1993 and the alternative distribution configuration described in Section II.A.3.c.i, above (id.).[36] The load flow analyses demonstrate that equipment would be loaded well within emergency summer capabilities under each contingency (id.). Accordingly, the Siting Board finds that the proposed facilities would provide a reliable supply to the area served by the Uxbridge substation in the event of a loss of a transmission line or Uxbridge substation transformer.

With regard to the Company's double-circuit outage criteria, the Company stated that

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35 G.L. c. 164, § 69J requires the Company to consider the alternative of "no additional electrical power." However, the Siting Board has found that the Company's existing supply system is inadequate to satisfy the existing load supplied by the Uxbridge substation (see Section II.A.3.c, above). Consequently, the Siting Board finds that the alternative of "no additional electric power" would be unable to meet the need identified in Section II.A.3.c, above. A more detailed analysis of this alternative is therefore unnecessary.

36 The Company indicated that in 1997, the expected in-service date for the proposed facilities, the load level for the Uxbridge area is forecast to be the same as the 1993 level (Exh. HO-N-16).

the Q-143 line currently is a single circuit occupying its own set of towers from the Woonsocket to the Millbury substations (Exhs. NEP-10, at 3; NEP-7, at 2-2; HO-RR-3b). The Company stated that, with the proposed looping of the Q-143 line, double circuit exposure would be limited to the Uxbridge spur ROW – the 1.3-mile distance from the Q-143 mainline to the Uxbridge substation – thereby reducing the likelihood of a double circuit outage (Exh. NEP-10, at 3). In addition, to protect against a double circuit outage, Mr. Browne stated that design features of the proposed transmission line would include installation of (1) a shield wire at the peak of the towers to intercept lightning strikes, and (2) a different number of insulators on each of the sides of the towers ("differential insulation") (Tr. 2, at 56-57).[37] The Company indicated that differential insulation would reduce potential double circuit outages along the Uxbridge spur ROW from once per six years to once per 22 years (Exh. HO-RR-3a, at 2).[38] The Company added that a circuit breaker would be installed at the Uxbridge substation in order to electrically separate the 115 kV supply connection provided by each of the proposed lines (Exh. NEP-10, at 3). Based on the foregoing, the Siting Board finds that the proposed project would meet the Company's double-circuit outage criteria.

Accordingly, the Siting Board finds that the proposed project would meet the identified need.

b. 69 kV Upgrade

The Company asserted that the 69 kV upgrade also would meet the identified need (Brief at 11, 14). The Company stated that under the 69 kV upgrade approach, the Uxbridge

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37 Mr. Browne stated that if there was a lightning strike on the shield wire, the lightning would either go to the ground, or take the line out of service by traveling along the arm of the tower across the insulators to the conductors (Tr. 2, at 56). He stated that the installation of differential insulation would cause a lightning strike to go the side of the tower with fewer insulators, and take just one side out of service (id. at 57).

38 The Company calculated the potential double circuit outage of proposed 115 kV lines on the Uxbridge spur ROW when it first considered the 115 kV double tap alternative in 1990 (Exh. HO-RR-3a).

substation would be supplied by both the Millbury and Woonsocket substations (Exh. NEP-7, at 2-6, 2-7). The Company stated that the existing K-11 and L-12 lines would remain at 69 kV and would be combined into a single circuit, designated as the K-11N/L-11N lines from the Millbury substation to the Uxbridge substation tap point[39] and the K-12S/L-12S lines from the Woonsocket substation to the Uxbridge substation tap point (id.).[40] See Figure 3. The Company indicated that the K-11T and L-12T lines would be reconstructed to occupy single towers along the Uxbridge spur ROW (id. at 2-7; Exh. HO-A-9). The Company stated that the 69 kV upgrade also would include a new 115kV/69kV transformer at the Woonsocket substation and replacement of the two existing transformers at the Uxbridge substation with two new 69kV/13.8 kV transformers (Exh. NEP-7, at 2-6). The Company noted that the two new transformers at the Uxbridge substation would be needed in order to provide adequate transformation capacity (Exh. HO-A-8).

In order to demonstrate that the 69 kV upgrade would meet the identified need, the Company provided load flow analyses assuming a 23.5 MW peak load, the alternative distribution configuration and the contingencies of the loss of the K-11N/L-12N line, the loss of the K-11S/L-12S line and the loss of one Uxbridge substation transformer (Exh. HO-A-12e to 12h). The Company indicated that there were no capacity or voltage problems associated with these load flow analyses (Exh. HO-A-12).

The Company stated that the proposed project and the 69 kV upgrade would be comparable with respect to meeting future load growth at the Uxbridge substation (Exh. HO-A-

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39 The Company explained that a tap point is where a connection is made to the circuit mainline path to supply a separate location (Exh. NEP-10, at 4).

40 The Company indicated that the existing K-11 and L-12 lines would be made into a single circuit by connecting like phases (Exh. NEP-7, at 2-6). The Company stated that the single circuit would increase the current carrying capability of the 69 kV lines from the Millbury and Woonsocket substations to the Uxbridge substation (id.; Exh. HO-A-8). The Company noted that the heights of some towers along the Millbury-Woonsocket ROW would be increased in order to allow the conductors to operate at a higher temperature (Exh. HO-A-10).

6).[41] However, the Company stated that the proposed project would address existing capacity concerns at the Depot Street and Millbury substations while the 69 kV upgrade would not address those concerns (Exh. HO-A-7).[42]

Accordingly, the Siting Board finds that the 69 kV upgrade would provide a reliable supply to the area served by the Uxbridge substation in the event of a loss of a transmission line or Uxbridge substation transformer.

With regard to a double outage, the Company indicated that, like the proposed project, double-circuit exposure would be limited to the 1.3 mile distance along the Uxbridge spur ROW, thereby reducing the likelihood of a double circuit outage (Exhs. NEP-7, at 2-6, 2-7; HO-A-9; HO-A-11). The Siting Board notes that the design features of the proposed transmission line that would protect against a double-circuit outage also could be installed in conjunction with the 69 kV upgrade. Based on the foregoing, the Siting Board finds that the 69 kV upgrade would meet the Company's double-circuit outage criteria.

Accordingly, the Siting Board finds that the 69 kV upgrade would meet the identified need.

c. 115 kV Double Tap Alternative

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41 Mr. Barys stated that the transformer ratings would be the same under both approaches but that the 115 kV line would provide more capability over a longer period of time than the 69 kV line (Tr. 1, at 76-77).

42 Mr. Barys asserted that keeping the Uxbridge substation on the 69 kV system would accelerate the need to address capacity problems at the Depot Street and Millbury substations (Exh. NEP-10, at 4). He explained that the 7U and 8U lines would provide more contingency support to the Depot Street substation under the 115 kV option, such that, with the outage of one 115/13.8 kV transformer at the Depot Street substation, the remaining transformer would not exceed its summer emergency capability until the year 2003 under the proposed 115 kV options, but would exceed its summer emergency capability in 1996 under the 69 kV alternative (Exh HO-A-7). With respect to the Millbury substation, he explain3d that transferring the Uxbridge load to 115 kV would make available more 69 kV capacity from the Millbury substation to service other system needs in the area (id.).

The Company stated that the 115 kV double tap alternative also would meet the identified need (Exh. HO-RR-3a). The Company stated that the 115 kV double tap alternative would convert the existing 69kV K-11T and L-12T lines to 115 kV by connecting one of the tap lines to the Q-143 line and the other to the R-144 line (Exh. HO-RR-3a).[43] See Figure 4. The Company stated that, like the proposed project, the K-11T and L-12T lines would be reconductored and two new 115/13.8 kV transformers would be installed at the Uxbridge substation (Exh. HO-RR-7). However, the Company stated that circuit breakers would be required on both the K-11T and L-12T lines under the 115 kV double tap alternative in order to maintain the capability of the Q-143 line and R-144 line to provide reliable substation supply and to transfer power southeastern Massachusetts/Rhode Island to central Massachusetts (Exh. HO-A-19).[44,45] During the course of the proceeding, the Company also considered the 115 kV double tap alternative with only one circuit breaker, on either the Q-143 line or the R-144 line (see Section II.B.4, below) (Exhs. HO-RR-8; HO-RR-9; HO-RR-15; HO-CL-1). The Company stated that development of a new substation at the intersection of the Millbury-Woonsocket and Uxbridge spur ROWs would be required under the 115 kV double tap alternative to accommodate either one or two circuit breakers (Exh. HO-A-19).

The Siting Board notes that by converting the existing K-11T and L-12T lines to 115

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43 The Company indicated that when the 115/69 kV transformer at the Woonsocket substation failed in 1990, a Company analysis of supply options recommended the 115 kV double tap alternative (Exh. HO-RR-3a). The recommendation was later changed to the proposed project due to concerns regarding a potential double-circuit outage on the Q-143/R-144 lines (Exh. HO-RR-3b).

44 The Company indicated that, in 1994, the level of total power flow from the Woonsocket substation to the Millbury substation along the Q-143 and R-144 lines ranged from 45 MW during off-peak periods to 98 MW during peak or near-peak periods (Exh. HO-A-15).

45 In the Company's original analysis of the 115 kV double tap alternative, the Company did not include any circuit breakers on the Q-143 or R-144 lines (Exh. HO-RR-3a at 2). In that analysis, the Company indicated that the installation of differential insulation in the 115 kV lines along the Uxbridge spur ROW would reduce the potential for a double circuit outage along these lines from once in six yards to once in 22 years (id. at 2-3).

kV, installing 115/13.8 kV transformers at the Uxbridge substation and limiting double-circuit exposure to 1.3 miles along the Uxbridge spur ROW, the 115 kV double tap alternative would be comparable to the proposed project in meeting the identified need.

Based on the foregoing, the Siting Board finds that the 115 kV double tap alternative would provide a reliable supply to the area served by the Uxbridge substation in the event of a loss of a transmission line or Uxbridge substation transformer. In addition, the Siting Board finds that the 115 kV double tap alternative would meet the Company's double-circuit outage criteria.

Accordingly, based on the foregoing, the Siting Board finds that the 115 kV double tap alternative would meet the identified need.

d. Conclusions on Ability to Meet the Identified Need

The Siting Board has found that the Company has demonstrated that the proposed project, the 69 kV upgrade and the 115 kV double tap alternative would provide a reliable supply to the area served by the Uxbridge substation in the event of a loss of a transmission line or Uxbridge substation transformer and would meet the Company's double-circuit outage criteria. Therefore, the Siting Board has found that the proposed project, the 69 kV upgrade and the 115 kV double tap alternative would meet the identified need.

Accordingly, the Siting Board evaluates the reliability, cost and environmental impacts of the proposed project, the 69 kV upgrade and the 115 kV double tap alternative.

4. Reliability

In this Section, the Siting Board compares the proposed project with each alternative with respect to providing a reliable supply of electricity to the Uxbridge substation. In addition, the Siting Board compares the proposed project and the 115 kV double tap alternative with respect to their impact on the reliability of the Q-143 and R-144 transmission lines.

The Company asserted that the proposed project is essentially equivalent to the 69 kV upgrade with respect to providing a reliable supply of electricity to the Uxbridge substation

(Brief at 12). The Company stated that the predicted average customer outage would be slightly higher for the 69 kV upgrade (0.04 minutes per year) than for the proposed project (0.02 minutes per year) based on historical outage rates which are higher for the K-11/L-12 lines than for the Q-143 line (Exhs. NEP-7, 2-6; HO-A-4).[46] However, the Company maintained that, because the difference in unavailablility between the two approaches is very small, the reliability of the two plans would be equivalent (Brief at 21).

Based on the foregoing, the Siting Board finds that the proposed project and the 69 kV upgrade are comparable with respect to reliability.

The Company also asserted that the proposed project and the 115 kV double tap option would be equivalent in terms of reliability of supply to the Uxbridge substation (id. at 19). However, the Siting Board notes that the two approaches would differ in their impact on the reliability of the Q-143 and R-144 lines, based on the number and location of circuit breakers that would be installed under the double tap alternative. The Company assessed the impact of the two approaches on two segments of the Q-143 and R-144 lines: (1) the segment between the Millbury substation and Whitins Pond substation, and (2) the segment between the Whitins Pond substation and the 143-4/144-4 switch, which is normally open and is located to the south of the Woonsocket substation (Exhs. NEP-7, at 2-4; HO-RR-15).[47] See Figure 4.

With respect to the proposed project, the Company indicated that a double circuit outage along the Uxbridge spur ROW would interrupt power flow along both segments of the Q-143

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46 The Company explained that the higher outage rate for the K-11/L-12 lines is due to the fact that the K-11/L-12 lines are mounted on structures that are higher than the Q-143 pole structures (Exh. HO-A-17). Therefore, the Company stated that lightning would strike the K-11/L-12 lines more often, while the Q-143 line would be shielded from lightning by the K-11/L-12 lines (id.).

47 The 143-4/144-4 switch is located between the Woonsocket substation and the Clarkson Street substation (Exh. HO-RR-15). The Clarkson Street substation is supplied by both the Q-143 and R-144 lines (id.).

line, but would have no impact on the power flow along the R-144 line (Exh. HO-RR-15d).[48] With respect to the double tap alternative with one circuit breaker, the Company indicated that a double circuit outage along the Uxbridge spur ROW would interrupt power flow (1) to the same extent as the proposed project if the circuit breaker was installed on the R-144 line, and (2) to a slightly greater extent than the proposed project if the circuit breaker was installed on the Q-143 line (Exh. HO-RR-15).[49] Finally, the Company's calculations indicate that, under the aforementioned contingency, power flow would not be interrupted along either segment of the Q-143/R-144 line with installation of two circuit breakers on the double tap option (Exh. HO-RR-14d).[50]

Accordingly, based on the foregoing, the Siting Board finds that the proposed project and the 115 kV double tap alternative with one circuit breaker are comparable with respect to reliability. The Siting Board also finds that the 115 kV double tap alternative with two circuit breakers would be preferable to the proposed project with respect to reliability.

5. Environmental Impacts

In this Section the Siting Board compares the proposed project to the 69 kV upgrade

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48 The Company indicated that under this contingency, a switch between the Whitins Pond and Uxbridge substations would be opened and the line re-energized from the Millbury substation to the Whitins Pond substation within five minutes, resulting in unavailability of supply to the Whitins Pond substation of one minute/year over a five year period (Exh. HO-RR-15). Based on historical interruption data over a five year period, the Company calculated that the Q-143 line between the 143-4/144-4 switch and the Whitins Pond substation would be unavailable for 88.6 minutes per year (id.).

49 Based on historical interruption data over a five year period, the Company calculated that both segments of the R-144 line would be unavailable for 88.6 minutes per year (Exh. HO-RR-15). There would be no impact on the Q-143 line (id.).

50 The Company indicated that under this contingency, there would be no outage on the R-144 line if a circuit breaker were installed on the R-144 line and no outage on the Q-143 line if a circuit breaker were installed on the Q-143 line (Exh. HO-RR-14d).

and the 115 kV double tap alternative with respect to the environmental impacts resulting from (1) facility construction, and (2) magnetic field levels.[51]

a. Facility Construction Impacts

In comparing the proposed project to the 69 kV upgrade, the Company stated that impacts related to transmission tower construction on the Uxbridge spur ROW for both approaches would be minor, but the need for fewer structural alterations for the 69 kV upgrade would result in less impact (Exh. HO-A-11). The Company explained that, along the Uxbridge spur ROW, (1) the 69 kV upgrade would require an increase in height of five existing towers, located in upland areas and accessible by an existing access road, and (2) that the proposed project would require replacement of three towers, and reinforcement with an increase in height of the eleven remaining towers, two of which are located in wetland areas (id.; Exh. HO-E-25b at 5).[52]

The Company added that both approaches would require tower construction along the Millbury-Woonsocket ROW (Exh. HO-A-11). The Company stated that along that ROW, the 69 kV upgrade would require an increase in the height of some towers, possibly within wetland areas, while the proposed project would require installation of two new wood structures and removal of two existing wood structures (Exhs. HO-A-10; NEP-7, at 1-2). Finally, with respect to substation construction, the Company stated that, under the 69 kV upgrade, the two new transformers would be installed at the Uxbridge substation in the same location as the existing transformers and that the physical size of both the Woonsocket substation and the Uxbridge substation would not be increased (Exh. HO-A-14). In comparison, the Company

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[51] In this case the Siting Board focuses on magnetic field levels rather than electric field levels because perceived health impacts generally relate to magnetic field levels. See, Brief at 17-18.

[52] The Company noted that, in order to maintain continuous electric service during construction, the 69 kV upgrade would require the installation of five temporary poles while the proposed project would require the installation of 14 temporary poles (Exh. HO-A-11).

stated that the two new transformers for the proposed project would be installed in a different location at the Uxbridge substation for the proposed project, requiring some expansion of the existing fenced area (id.).

The record demonstrates that the extent of transmission line and substation construction for the 69 kV upgrade would be slightly less than that required for the proposed project. Accordingly, based the foregoing, the Siting Board finds that the 69 kV upgrade would be slightly preferable to the proposed project with respect to facility construction impacts.

In comparing the proposed project to the 115 kV double tap alternative, the Company stated that the extent of construction along the Uxbridge spur ROW and at the Uxbridge substation would not differ significantly for the two approaches (Exh. HO-RR-7).

However, the Company stated that the 115 kV doble tap alternative would require a new substation at the intersection of the Uxbridge spur ROW and the Millbury-Woonsocket ROW in order to house circuit breaker equipment (Exhs. HO-A-16; HO-A-19). The Company noted that the 115 kV double tap alternative also would require two additional structures at the tap location which would not be required for the proposed project (Exh. HO-CL-1).[53]

The Company sated that there was sufficient Company-owned land at this location to construct a substation for either the one circuit breaker or the two circuit breaker option (Exh. HO-RR-9).[54] The Company further stated that the maximum height of any new substation equipment would be approximately 15 feet and that screening with evergreens would be

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53 The Company also considered the use of a smaller conductor in conjunction with the double tap alternative (Exh. HO-RR-8). See Section II.B.6, below. The smaller conductor would allow the Company to reuse one tower instead of replacing it with a single pole steel structure (Exh. HO-CL-1). The Company indicated that there would be no substantial difference in construction impacts if the smaller conductor were used (Tr. 1, at 61).

54 The Company noted that the land area for a new substation with two circuit breakers would be approximately 130 feet by 60 feet while 70 feet by 60 feet would be required for a substation with one circuit breaker (Exh. HO-RR-9).

possible (Exh. HO-CL-2).[55] The Company noted that the distance from this substation location to the closest residence would be approximately 500 feet (Exh. HO-RR-9).

The record demonstrates that the extent of transmission line construction would be comparable for both the proposed project and the 115 kV double tap alternative. However, in addition to the transmission line construction, the 115 kV double tap alternative also would require construction of a new substation. Although the Company owns sufficient land for construction of a substation, the required land area is relatively small, and new substation structures could be screened, development of a new substation at this site would have potential long-term land use impacts. Accordingly, based on the foregoing, the Siting Board finds that the proposed project would be preferable to the 115 kV double tap alternative with respect to facility construction impacts.

b. Magnetic Field Levels

In order to compare magnetic field levels along the Uxbridge spur ROW for the three project approaches, the Company calculated magnetic field levels under expected maximum normal loading conditions at the residence closest to the ROW, at edge-of-ROW locations where magnetic field levels would be highest including the left edge of the ROW (the north side of the ROW) and the right edge of the ROW (the south side of the ROW), and at the location within the ROW where magnetic field levels would be highest (Exhs. HO-RR-10; NEP-7, at 3-2). See Table 1. In addition, the Company provided the testimony of Dr. Deborah Weil, a cell biologist who has analyzed biological responses to electromagnetic fields such as those associated with the proposed project (Tr. 1, at 107-166).

Dr. Weil testified that, although scientific organizations have examined the issue of potential health risks associated with exposure to power frequency magnetic fields in the range of the field levels of the proposed project, none has identified a particular field level as

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55 The Company stated that the cost of screening of the substation withe evergreens was not included in its cost estimate of the double tap alternative because of the low residential density in the vicinity of the substation (Exh. HO-CL-2).

hazardous (id. at 127-128). In addition, she testified that research to date has not established "that exposure to power frequency fields, such as those associated with this project, causes cancer or other health problems" (id. at 129).

However, Mr. Barys stated that, in developing options to address a problem in reliability, the Company tries to minimize magnetic field levels (id. at 96). He stated that the Company does not have a standard for maximum magnetic field levels, but that, if in comparing two project alternatives the Company determined that all other aspects of the projects were equal, lower magnetic field levels of one alternative would be a reason to choose that alternative (id. at 96-97).[56]

With respect to the magnetic field levels of the proposed project, the Company indicated that, under the proposed project, maximum magnetic field levels would decrease from the current level of 4.01 milligauss ("mG") to 3.5 mG at the residence located closest to the ROW,[57] and from the current level of 13.8 mG to 12.4 mG at the left edge of the ROW (see Table 1) (Exhs. HO-RR-10; NEP-10, exh. FRB-7; HO-E-15a). Mr. Barys explained that the phases in the two proposed 115 kV lines, as well as two existing 13.8 kV lines which are located at the left edge of the ROW, would be arranged in order to provide as much cancellation of magnetic fields as possible (Tr. 1, at 97-98).

However, the Company also indicated that under the proposed project, magnetic field levels would increase along the right edge of the ROW, reaching a maximum of 3.4 mG, and within the ROW, reaching a maximum of 92.9 mG (see Table 1) (Exhs. HO-RR-10; NEP-10, exh. FRB-7). The Company stated that the maximum magnetic field level of 92.9 mG would occur directly under the power lines at one point where the lowest 115 kV conductor would be

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[56] The Company stated that it recognizes that some members of the public are concerned about magnetic field levels and for this reason, it incorporated design features into the proposed transmission lines that would reduce magnetic field levels (Brief at n.15). The Company asserted that such an approach is reasonable where field reduction can be achieved at low or no cost to customers, as was the case with the proposed project (id.).

[57] The residence located closest to the ROW is located along the left edge of the ROW (Exh. HO-CL-3).

23 feet above the ground, and added that an area of maximum magnetic field levels above 50 mG would occur at all locations where a 115 kV conductor would be less than approximately 30 feet above ground (Exh. HO-CL-3). The Company further stated that conductor heights in the range of 23-30 feet would occur near mid span at approximately eight locations along the ROW (id.). The Company noted that where the maximum magnetic field would reach 92.9 mG within the ROW, magnetic field levels would decrease (1) to 11.6 mG at the pole location, 225 feet from the mid-span, and (2) to 8.7 mG at the left edge of the ROW, 63 feet away (id.). The Company noted that the land use in the vicinity of the ROW where the maximum magnetic field level would reach 92.9 mG within the ROW is open field within the ROW and low density residential use outside the ROW (id.). The Company added that the closest residence to this area is located 150 feet from the point of the maximum magnetic field (id.).

In comparing the magnetic field levels of the proposed project to the 69 kV upgrade, the Company asserted that although the magnetic field levels for the proposed project are somewhat higher, these small differences in field levels do not provide a basis for selecting one alternative over the other (Brief at 21-22). The Company noted that the differences at the closest residence are less than one mG (id.). See Table 1.

The Siting Board notes that under the 69 kV upgrade, the magnetic field levels at the closest residence, left ROW edge, right ROW edge and on the ROW would be decreased from existing levels and would be less than the magnetic field levels associated with the proposed project (Exhs. HO-RR-8; NEP-10, exh. FRB-7; HO-E-15). Although the difference between magnetic field levels at the closest residence under the two approaches would be less than one mG, the difference in magnetic field levels would be greater at the other locations, most notably within the ROW (see Table 1). Accordingly, based on the foregoing, the Siting Board finds that the 69 kV upgrade would be preferable to the proposed project with respect to magnetic fields.

In comparing the magnetic field levels of the proposed project to the 115 kV double tap alternative, the Company stated that the magnetic field levels would be higher for the proposed

project than for the double tap alternative (Exh. HO-RR-10).[58] However, the Company concluded that, because magnetic field levels have not been proven to be a health hazard and there is no particular level that would be unsafe, magnetic field levels do not provide the basis for choosing one alternative over another (Brief at 18).

The record demonstrates that under the 115 kV double tap option, the magnetic field levels at the closest residence, left ROW edge, right ROW edge and on the ROW would be decreased from existing levels and would be less than the magnetic field levels associated with the proposed project (Exhs. HO-RR-8; NEP-10, exh. FRB-7; HO-E-15). Although the difference between magnetic field levels under the two approaches would be less than one mG at the closest residence, the difference in magnetic field levels would be greater at the other locations, most notably within the ROW (see Table 1). Accordingly, based on the foregoing, the Siting Board finds that the 115 kV double tap alternative would be preferable to the proposed project with respect to magnetic fields.

c. Conclusions on Environmental Impacts

In comparing the overall environmental impacts of the proposed project to the 69 kV upgrade, the Company asserted that there would be no significant difference between the two approaches (Brief at 21, citing, Exh. NEP-7, at 2-6). However, the Siting Board has found that the 69 kV upgrade would be slightly preferable to the proposed project with respect to facility construction impacts and preferable to the proposed project with respect to magnetic fields. Accordingly, the Siting Board finds that the 69 kV upgrade is preferable to the proposed project with respect to environmental impacts.

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[58] Mr. Barys explained that magnetic field levels along the Uxbridge spur ROW would be higher for the proposed project because magnetic field levels are related to the amount of current flowing through the line and there would be a higher current with the proposed project (Tr. 1, at 77). He stated that, for the proposed project, all the current on the Q-143 line would flow along the Uxbridge spur ROW, while for the 115 kV double tap alternative, only the current that was needed at the Uxbridge substation would flow along the Uxbridge spur ROW (id. at 77-78).

In comparing the overall environmental impacts of the proposed project to the double tap alternative, the Company concluded that the two approaches have essentially equivalent environmental impacts (Brief at 17-18). The Siting Board has found that the proposed project would be preferable to the 115 kV double tap alternative with respect to facility construction impacts. In addition, the Siting Board has found that the 115 kV double tap alternative would be preferable to the proposed project with respect to magnetic field.

The Siting Board notes that the advantage of the proposed project with respect to construction impacts was based on potential long-term land use impacts associated with the construction of a new substation. However, given that: (1) the land area required for substation construction is relatively small; (2) new substation structures could be screened; (3) the nearest residence is located 500 feet from the substation site; and (4) the Company owns sufficient land for substation development, the advantage of the proposed project with respect to construction impacts is somewhat limited.

In considering the advantage of the 115 kV double tap alternative with respect to magnetic field impacts, the Siting Board notes that such advantage was based on the considerably lower field levels that would be associated with the 115 kV double tap alternative, most notably within the ROW. Although magnetic field levels would be less for the 115 kV double tap alternative at all locations considered, the magnetic field levels also would decrease from existing levels under the proposed project at two locations considered – the residence closest to the ROW and the left edge of the ROW. Further, the difference in magnetic field levels at the residence closest to the ROW under both of the project approaches would be small.

With respect to the increase in magnetic field levels at the right edge of the ROW, the Siting Board notes that, in the Siting Council review of the Hydro Quebec project, which included 450 kV direct current and 345 kV alternating current transmission facilities, the Siting Council addressed in detail the expected electrical effects of such facilities, notably the health implications of electric and magnetic fields. Massachusetts Electric Company, 13 DOMSC 119, 228-242 (1985). In that case, the petitioner estimated that the magnetic field would not

exceed 85 mG along the edge of the 345 kV ROW. Id. at 228-229. The Siting Council found those edge-of-ROW field levels to be acceptable. Id. at 241. Here, even though field levels at the right edge of the ROW would increase under the proposed project, the maximum magnetic field levels at this location would remain considerably lower than 85 mG. In addition, the field levels on the left edge of the ROW, which would be higher than those on the right edge of the ROW, also would be considerably below the 85 mG level.

Finally, with respect to the maximum magnetic field levels within the ROW, the Siting Board notes that field levels at this location would increase substantially from current levels under the proposed project and would be significantly higher than the magnetic field levels associated with the 115 kV double tap alternative. Within the ROW, the maximum magnetic field levels would reach 92 mG at one mid-span location and would exceed 50 mG at and near a number of other mid-span locations. Although the magnetic field levels are considerably reduced at the edge of the ROW, the Siting Board notes the potential for residential and recreational uses of the ROW.

The Siting Board acknowledges that the record in this case does not support a conclusion that potential health risks are associated with exposure to power frequency magnetic fields in the range of the fields levels of the proposed project. The Siting Board further agrees that the Company's approach to addressing public concern -- incorporating design features into proposed transmission lines to reduce field levels where such reduction can be achieved at low or no cost to customers -- is reasonable. The Company has incorporated design features to minimize field levels at the edge of the ROW. We also suggest that the Company implement feasible and cost-effective measures to discourage access to the ROW in general.

In sum, the record demonstrates that with appropriate mitigation neither the proposed project approach nor the double tap alternative would have a clear advantage with respect to environmental impacts. The greater construction-related impacts of the 115 kV double tap alternative and greater magnetic field impacts of the proposed project can each be mitigated to some extent. Accordingly, based on the foregoing, the Siting Board finds that the environmental impacts of the proposed project and the 115 kV double tap alternative are

comparable.

6. Cost

The Company asserted that the proposed project would be the least-cost alternative to meet the identified need (Brief at 19, 22). In support of its assertion, the Company compared the capital cost and net present worth of revenue requirements ("NPWRR"), including line loss cost differences for the proposed project and each of the alternative approaches (Exhs. NEP-7, at 2-6, 2-8, 2-9; HO-RR-7).

In comparing the proposed project to the 69 kV upgrade, the Company stated that the capital cost of the proposed project would be greater than the capital cost of the 69 kV upgrade, but that the lower line loss costs of the proposed project would make it more economical than the 69 kV upgrade (Exh. NEP-7, at 2-8, app. B). The Company indicated that the capital cost, in 1995 dollars, would be (1) $6,500,000 for the proposed project, including $2,000,000 for transmission line work and $4,500,000 for substation work, and (2) $5,700,000 for the 69 kV upgrade, including $300,000 for transmission line work and $5,400,000 for substation work (id. at app. B-8). However, the Company stated that the NPWRR line losses with the proposed project would be less than with a 69 kV supply, providing an effective NPWRR cost savings with the proposed project (id. at 2-8, app. B).[59] The Company calculated that the cumulative NPWRR over 20 years, including incremental line losses,[60] would be $8,739,000 for the proposed project and $10,497,000 for the 69 kV upgrade, which is $1,758,000 or 20 percent more than the proposed project (id., at 2-8).

The Company stated that the cost advantage of the proposed project relative to the 69 kV upgrade would be even greater because the cost analysis did not include potential additional

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59 The Company indicated that 20-year NPWRR line loss costs would be $2.3 million less under the proposed project than under the 69 kV upgrade (Exh. NEP-7, at 2-8).

60 The Company attributed a zero line loss cost to the project, and included the differences between line loss costs of the proposed project and each alternative in calculating the cost of each alternative (Exhs. NEP-7, at app. B-8; HO-RR-7e).

costs associated with the 69 kV upgrade including (1) costs to upgrade the existing 69 kV facilities at the Woonsocket substation,[61] and (2) costs to address capacity problems at the Depot Street substation in 1996, rather than in 2003 (see Section II.A.3, above) (Exh. NEP-10, at 4).

The record demonstrates that the proposed project has a significant cost advantage relative to the 69 kV upgrade. Accordingly, based on the foregoing, the Siting Board finds that the proposed project would be preferable to the 69 kV upgrade with respect to cost.

In assessing the cost of the 115 kV double tap alternative, the Company indicated that the size of the conductor along the Uxbridge spur ROW could be smaller than under the proposed project without increasing line losses and without other disadvantages (Exh. HO-RR-8; Tr. 2, at 60-61).[62] Therefore, the Siting Board reviews the cost of the 115 kV double tap alternative for each of the circuit breaker options assuming use of the smaller conductor (see n.53, above).

In order to compare the costs of the proposed project with the 115 kV double tap alternative, the Company provided capital cost differences between the two approaches in 1995 dollars, both for the substation and transmission line (Exhs. HO-CL-1; HO-RR-8). The capital cost in 1995 dollars for the proposed project would be $6,500,000, including $2,000,000 for transmission line work and $4,500,000 for substation work, while the cost of the 115 kV double tap alternative would be (1) $7,300,000 with one circuit breaker including $1,900,000 for transmission line work and $5,400,000 for substation work, and (2) $7,550,000 with two circuit breakers including $1,900,000 for transmission line work and $5,650,000 for substation work (Exhs. NEP-7, at app. B-8; HO-CL-1).

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61 The Company noted that the 69 kV facilities have not been in service or maintained since the Woonsocket transformer failed in 1990 (Exh. NEP-10, at 4).

62 The loop design of the proposed project would require a larger conductor to accommodate bulk power transfers and power delivery to other tap points along the Q-143 line (see n.53, above). The Company indicate that a 795 thousand circular mils ("kcmil") aluminum conductor steel-reinforced ("ACSR") conductor would be used for the proposed project and that a 477 kcmil ACSR conductor would be used for the 115 kV double tap alternative (Exh. HO-RR-8; Tr. 1, at 60-61).

The Company indicated that the line loss savings associated with the 115 kV double tap alternative, relative to a 69 kV supply, would be greater than those associated with the proposed project (Exh. HO-A-18).[63] The Company's analysis indicates that the cumulative NPWRR over 20 years, including incremental line loss costs, would be $9,156,000 for the 115 kV double tap alternative with one circuit breaker, which is $417,000 or five percent more than the $8,739,000 NPWRR cost of the proposed project, and $9,625,000 for the 115 kV double tap alternative with two circuit breakers, which is $886,000 or 10 percent more than the $8,739,000 NPWRR cost of the proposed project (Exhs. HO-N-7, at 208; HO-CL-1c).[64]

The record demonstrates that the proposed project has a cost advantage relative to the 115 kV double tap alternative with one or two circuit breakers. Accordingly, based on the foregoing, the Siting Board finds that the proposed project would be preferable to the 115 kV double tap alternative with respect to cost.[65]

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63 The Company indicated that 20-year NPWRR line loss costs under the 115 kV double tap alternative would be $1,134,444 less than those under the proposed project (Exh. HO-CL-1a). The Company indicated that the proposed project would result in higher current and therefore higher line losses than the 115 kV double tap alternative along the Uxbridge spur ROW (id.; Tr. 2, at 60). See also, n.58, above.

64 Over 30 years, the cumulative NPWRR cost of the 115 double tap alternative would be $9,669,000 with one circuit breaker and $10,198,000 with two circuit breakers – three percent and eight percent more, respectively than the $9,400,000 NPWRR cost of the proposed project (Exhs. NEP-7 at 2-9; HO-CL-1c).

65 In making this finding, the Siting Board notes that the 115 kV double tap alternative without a circuit breaker on either the Q-143 or R-144 line would have a cost advantage compared to the proposed project with respect to capital costs and line loss savings. Assuming installation of a circuit breaker at the Uxbridge substation for the 115 kV double tap alternative without circuit breakers on the Q-143 or R-144 lines, the capital cost of this 115 kV double tap alternative would be $100,000 less than the proposed project due to reduced transmission line costs (Exh. HO-CL-1). In addition, the NPWRR over 20 years of line loss savings of the 115 kV double tap alternative relative to the proposed project would be $1,134,444 (Exh. HO-CL-1a). The Company questions the reliability of this alternative with respect to the interruption of power flow on both the Q-143 and R-144 lines in the event of a double outage along the Uxbridge

(continued…)

7. Conclusions: Weighing Need, Cost, Environmental Impacts and Reliability

In comparing the proposed project to the 69 kV upgrade, the Siting Board has found that: (1) the proposed project and the 69 kV upgrade would meet the identified need; (2) the proposed project and the 69 kV upgrade are comparable with respect to reliability; (3) the 69 kV upgrade is preferable to the proposed project with respect to environmental impacts; and (4) the proposed project is preferable to the 69 kV upgrade with respect to cost.

Thus, in comparing the two project approaches, the Siting Board must weigh the environmental benefit of the 69 kV upgrade against the cost benefit of the proposed project. In assessing the environmental benefit of the 69 kV upgrade, the Siting Board has found that the 69 kV upgrade would be slightly preferable to the proposed project with respect to facility construction impacts and preferable to the proposed project with respect to magnetic fields. As noted in Section II.B.5.b, above, the preferability of the 69 kV upgrade with respect to magnetic fields was based on the lower calculated field levels at all identified locations, most notably within the ROW. In Section II.B.5.c, above, the Siting Board noted that the Company should implement feasible and cost-effective measures that would discourage access to the areas within the ROW. With such mitigation, the advantage of the 69 kV upgrade with respect to magnetic fields would be less significant. Thus, the overall environmental advantage of the 69 kV upgrade relative to the proposed project is limited.

In assessing the cost benefit of the proposed project relative to the 69 kV upgrade, the Siting Board has acknowledged that the proposed project has a significant cost advantage. As noted in Section II.B.6, above, the cumulative NPWRR over 20 years would be at least 20 percent greater for the 69 kV upgrade.

In sum, in comparing the proposed project to the 69 kV upgrade, the environmental

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65 (…continued)
spur ROW (see Section II.B.4, above). However, the Siting Board further notes that the Company indicated that installation of differential insulation on the 115 kV lines along the Uxbridge spur ROW would reduce the frequency of a double outage to once per 22 years (Exh. HO-RR-3a at 3).

advantage of the 69 kV upgrade is limited while the cost advantage of the proposed project is significant. Accordingly, based on the foregoing, the Siting Board finds that, on balance, the proposed project is preferable to the 69 kV upgrade.

In comparing the proposed project to the 115 kV double tap alternative, the Siting Board has found that: (1) the proposed project and the 115 kV double tap alternative would meet the identified need; (2) that proposed project and the 115 kV double tap alternative are comparable with respect to reliability; (3) the proposed project and the 115 kV double tap alternative are comparable with respect to environmental impacts; and (4) the proposed project is preferable to the 115 kV double tap alternative with respect to cost.

The record shows that the NPWRR cost disadvantage of the 115 kV double tap alternative would be greatest after a few early years of operation, and decline to less significant levels in the long run as a result of the higher level of line losses under the proposed project. The NPWRR cost of the double tap alternative is only $417,000, or five percent greater than that of the proposed project after 20 years, and only $269,000, or three percent greater after 30 years. Nonetheless, based on the Company's cost comparison using accepted methods of long-term cost analysis, the Siting Board has found a cost advantage for the proposed project.

The record also shows that the looping design of the proposed project, and the requirement that there be circuit breakers on the 115 kV double tap alternative, both are premised on the Company's perceived need to protect the 115 kV bulk power transfer capability between Woonsocket and Millbury substations from exposure to a double circuit outage arising from simultaneous faults along the two proposed lines between the Uxbridge substation and the 115 kV system. The record further indicates that the expected frequency of such a double circuit outage is once in 22 years. As discussed in Section II.A.3.a, above, the Company has not provided reliability criteria, based on the level of bulk power transfer operations or other indicators, that justify particular reliability levels for bulk power corridors.

We note that, in 1994, the actual levels of use of the bulk power transfer capability which the Company seeks to protect ranged from 45 MW during off-peak periods to 98 MW

during peak or non-peak periods.[66] We further note that, if the Company were to implement the 115 kV double tap alternative without any circuit-breaker protection at the tap points, that alternative would cost $100,000 less than the proposed project, and provide 20-year NPWRR line loss savings of $1,134,000 relative to the proposed project. In addition, as discussed in Section II.B.5.b, above, a 115 kV double tap approach would result in lower magnetic field impacts than the proposed project.

Thus, to protect a bulk power transfer capability which the Company currently utilizes at a level of 45-98 MW from a contingency arising once in 22 years, the Company would incur an additional 20-year NPWRR cost of at least $1,234,000,[67] and produce greater magnetic field impacts. The Company has not identified the need for the bulk power transfers or the quantitative or other specific criteria that support its commitment to the reliability level provided for the bulk power transfers. We also note that, given that the Uxbridge substation supply would be subject to interruption under the identified double-outage contingency, the Company would incur the aforementioned higher costs and environmental impacts in order to maintain a reliability standard for the Q-143/R-144 line bulk power transfer capability that is in fact higher than the standard it is applying for serving the Uxbridge substation load.

In sum, the 115 kV double tap alternative without circuit breakers has a marginal cost and environmental advantage over the proposed project, and the Company has not supported in detail its reasons for protecting the bulk power transfer capability of the Q-143/R-144 lines by requiring circuit breakers. However, we recognize that bulk power transfers provide regional benefits and, for the purposes of this review, accept the Company's judgment that those benefits outweigh marginal cost and environmental benefits. In the future, applicants will be required to provide quantitative or other specific criteria to support all reliability objectives on which they

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66 The Siting Board notes that such bulk power transfers may provide power needed for reliability purposes or may provide power needed for economic efficiency purposes.

67 Additional NPWRR fixed carrying costs related to the additional $100,000 in capital cost, for example, interest and taxes, also would be incurred with the proposed project.

rely in designing and choosing between project alternatives.

Based on the foregoing, the Siting Board finds that, on balance, the proposed project is preferable to the 115 kV double tap alternative.

III. Analysis of the Proposed and Alternative Facilities

The Siting Board has a statutory mandate to implement the policies of G.L. c. 164 §§ 69H-69Q to provide necessary energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. G.L. c. 164 §§ 69H and J. Further, G.L. c. 164, § 69J requires the Siting Board to review alternatives to planned projects, including "other site locations." In its review of other site locations, the Siting Board requires a petitioner to show that its proposed facilities' siting plans are superior to alternatives and that its proposed facilities are sited at locations that minimize costs and environmental impacts while ensuring supply reliability. Cabot Power Corporation, 2 DOMSB 241, 371 (1994) ("Cabot Power Decision"); Boston Edison Company (Phase II), 1 DOMSB 1, 35 (1993) ("1993 BECo (Phase II) Decision"), 1991 NEPCo Decision, 21 DOMSC at 376.

A. Description of the Proposed Facilities and Alternative Facilities

1. Proposed Facilities

NEPCo proposes to construct two 115 kV transmission lines that would loop NEPCo's existing Q-143 line, a 115 kV transmission line which is located within NEPCo's Millbury-Woonsocket ROW, into the Uxbridge substation (Exhs. NEP-7, at 2-1; NEP-11, at 3). The proposed transmission line along the primary route would be located within the Town of Uxbridge and would be placed within an existing electric utility ROW for its entire route (Exh. NEP-12). The primary route for the transmission line would begin at the intersection of the Uxbridge spur ROW and the Millbury-Woonsocket ROW and would travel in a northeast direction, within the Uxbridge spur ROW, for 1.3 miles to the Uxbridge substation (Exhs. NEP-7, at 1-1; NEP-11, at 2-3). The primary route would cross the Providence and Worcester Railroad, State Route 122, and two local roadways (Exhs. NEP-4; NEP-8, exh. C). See

Figure 5.

The Uxbridge spur ROW is 165 feet wide and is currently occupied by two 69 kV transmission lines, the K-11T and L-12T lines,[68] and two 13.8 kV distribution lines (Exhs. NEP-7, at 3-16; NEP-10, at 4). The 13.8 kV distribution lines are located between the K-11T and L-12T lines and the north (left) edge of the ROW (Exhs. NEP-7, at 3-16; NEP-8, exh. C).

In order to construct the proposed 115 kV transmission line along the primary route, the Company stated that it would convert the existing 69 kV transmission lines to 115 kV by replacing the existing conductor with a 795 kcmil ACSR conductor (Exh. NEP-11, at 2-3). The Company stated that in order to accommodate the new conductor and to allow for operation at 115 kV, it would modify or replace the fourteen existing steel lattice towers as follows: (1) reinforce eleven existing towers; (2) increase the height of three of those eleven towers by three feet and eight of those towers by eight feet; and (3) remove and replace the three remaining towers with six single-circuit, single-draft wood pole structures and one double-circuit, single-shaft steel pole structure (id. at 3).[69] The Company indicated that the proposed tower and pole structures would range in height from 79 feet to 90 feet and that the average structure spacing would be approximately 500 feet (id.). The Company noted that two existing wood pole structures on the Q-143 line also would be replaced with new two-pole wood structures (id.).

In addition, the Company's proposal includes the installation of two new 115/13.8 kV transformers at the Uxbridge substation, requiring some expansion of the existing fenced area of the substation (Exhs. NEP-7, at 2-1; HO-A-14).

2. Alternative Facilities

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68 As noted in Section II.A.2, above, the K-11T and L-12T lines are supported on single structure double circuit steel towers (Exh. NEP-10, at 3).

69 In addition, the Company stated that it would construct temporary poles to house the 69 kV line while construction was in progress in order to maintain service (Exh. NEP-7, at 3-15).

The Company proposed two alternative routes — Alternative Route B, a 1.8 mile overhead route and Alternative Route G, a 1.7 mile underground route (Exh. NEP-7, at 3-17, 3-18). Both alternative routes also are located within the Town of Uxbridge and would extend from the Millbury-Woonsocket ROW in the Uxbridge substation (id. at 3-8).

From a point on the Millbury-Woonsocket ROW to the southeast of its intersection with the Uxbridge spur ROW, Alternative Route B would travel east along 0.9 miles of new ROW across private land, then turn to the north for 0.8 miles along the Providence and Worcester railroad ROW[70] and then turn to the east to follow a 0.1 mi section of the Uxbridge spur ROW in the Uxbridge substation (id. at 3-3, 3-17). Alternative Route B would cross the Providence and Worcester Railroad ROW, State Route 122, State Route 146, one local roadway, and a tributary to the Blackstone River (id. at 3-8, 3-23). See Figure 5. The Company indicated that two single-circuit 115 kV lines would be installed on single-shaft poles with davit arms (id. at 3-17). The Company noted that the steel poles, approximately 95 feet in height, would be used along the railroad ROW and that wood and steel poles, approximately 75 feet in height, would be used along the new ROW across private land (id.).

From a point on the Millbury-Woonsocket ROW to the northwest of its intersection with the Uxbridge spur ROW, Alternative Route G would travel underground, 1.4 miles to the west along High Street, then turn to the south for 0.1 miles along State Route 122, and then turn to the east along a 0.2 mile section of the Uxbridge spur ROW (id. at 3-8, 3-9). See Figure 5. The Company indicated that Alternative Route G would consist of (1) two underground 115 kV, high pressure, gas-filled, pipe-type cables that would be installed in a four-foot wide by five-foot deep trench, (2) two transition stations,[71] one at the Uxbridge substation and one near High Street on the Millbury-Woonsocket ROW (id. at 3-17). The Company indicated that a

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70 The Company indicated that poles would be constructed on both sides of the railroad tracks (Exh. NEP-7, at 3-18).

71 The Company explained that a transition station consists of specialized equipment required to transfer the wires from overhead to underground (Tr. 2, at 52). Each transition station would require approximately 0.25 acres of fenced area to isolate equipment (Exh. NEP-7, at 3-17).

three-inch diameter, polyvinylchloride conduit for communication and relaying requirements also would be installed in the trench (id.).

B. Site Selection Process

1. Standard of Review

In order to determine whether a facility proponent has shown that its proposed facilities' siting plans are superior to alternatives, the Siting Board requires a facility proponent to demonstrate that it examined a reasonable range of practical facility siting alternatives. Cabot Power Decision, 2 DOMSB at 373; 1991 NEPCo Decision, 21 DOMSC at 376; Northeast Energy Associates, 16 DOMSC 335, 381-409 (1987) ("NEA Decision"). In order to determine that a facility proponent has considered a reasonable range of practical alternatives, the Siting Board requires the proponent to meet a two-pronged test. First the facility proponent must establish that it developed and applied a reasonable set of criteria for identifying and evaluating alternatives in a manner which ensures that it has not overlooked or eliminated any alternatives which are clearly superior to the proposal. Cabot Power Decision, 2 DOMSB at 373; 1991 NEPCo Decision, 21 DOMSC at 376-377; Berkshire Gas Company (Phase II), 20 DOMSC 109, 148-149, 151-156 (1990). Second, the facility proponent must establish that it identified at least two noticed sites or routes with some measure of geographic diversity. Cabot Power Decision, 2 DOMSB at 373; 1991 NEPCo Decision, 21 DOMSC at 379; NEA Decision, 16 DOMSC at 381-409.

In the sections below, the Siting Board reviews the Company's site selection process, including NEPCo's development and application of siting criteria as part of its site selection process.

2. Development of Siting Criteria

a. Description

The Company indicated that, in order to investigate potential routing options for the proposed transmission line, it first identified a study area that would encompass all viable

routing options between the Uxbridge substation and the Millbury-Woonsocket ROW (Exh. NEP-7, at 3-1). The Company indicated that the potential study area in the vicinity of the Uxbridge substation and the Millbury-Woonsocket ROW was limited in size due to land use and topographical features that would preclude transmission line routing (id.; Tr. 2, at 25). The Company stated that the specific study area was selected based on a field visit and review of areas maps, and includes the area bounded by: (1) the commercial area of Uxbridge Center to the north; (2) an existing 345 kV transmission line ROW to the south; (3) the Providence and Worcester railroad ROW to the east; and (4) the Millbury-Woonsocket ROW to the west (Exh. NEP-7, at 3-1; Tr. 2, at 25).

In order to identify potential routes within the selected study area, the Company stated that it next established two types of siting criteria (1) opportunities – factors which favor the placement of a transmission line by minimizing potential impacts, and (2) constraints – factors which could be adversely affected by routing of a transmission line (Exh. NEP-7, at 3-1). The Company stated that routing opportunities consist of existing active and abandoned utility and transportation corridors (id., at 3-1, 3-3, 3-4). The Company explained that generally, constraints relate to environmental impacts, construction difficulties and licensability (id. at 3-1, 3-3).[72] The Company identified 25 constraints and classified each as high, medium or low level based on its significance for or impact on routing (id., at 3-1, 3-4; Exh. HO-S-3; Tr. 2, at 19-20).[73]

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[72] The Company stated that the list of environmental constraints was developed based on the Company's experience with environmental issues associated with similar transmission line studies in the Northeast and was compiled by a group that included transmission engineers and environmental and land use specialists (Exh. HO-S-3; Tr. 2, at 19).

[73] The Company explained that: (1) routes with high level constraints should be used only where circumstances preclude avoidance; (2) roues with medium level constraints should be used only in areas where circumstances precludes the use of routing opportunities, areas without constraints or areas with low level constraints; and (3) routes with low level constraints should be used only in areas where circumstances preclude the use of routing opportunities or areas without constraints (Exh. NEP-7, at 3-

(continued…)

Using information from state and local agencies and field reconnaissance, the Company then identified and mapped the specific constraints and opportunities that exist within the selected study area (Exh. NEP-7, at 3-3). The Company indicated that the specific constraints in the study area include: (1) sensitive cultural or historical resources, significant wildlife habitat and a cemetery, classified as high level; (2) non-spannable wetlands,[74] medium/high density residential area, recreation areas, Federal and State Park/forest/dedicated land, and very erodible soils, classified as medium level; and (3) active farmland, spannable river and wetland, woodlands, aquifer, 100-year floodplain, road or railroad crossing, and low density residential area, classified as low level (id. at 3-5 to 3-7). The Company indicated that specific routing opportunities in and near the study area included: (1) the Uxbridge spur ROW and the Millbury-Woonsocket ROW: (2) a 345 kV transmission line ROW; (3) a gas pipeline ROW; (4) the Providence and Worcester Railroad ROW; and (5) roadways (id. at 3-7).

Assuming a 120-foot wide ROW,[75] the Company then identified six potential overhead

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[73] (…continued)
1, 3-3).

Constraints classified as high include: (1) home relocation; (2) sensitive cultural or historical resource; (3) federal or state endangered or threatened specifies location; (4) significant wildlife habitat; (5) significant natural plant community; (6) non-spannable lake, reservoir or river; and (7) cemetery (id. at 3-4). Constraints classified as medium include: (1) navigable airspace around airport; (2) medium to high density residential area, school or business adjacent to edge of ROW; (3) recreation area; (4) federal and state park/forest/other dedicated land; (5) very erodible soil; (6) major ridgeline; (7) wildlife refuge; (8) scenic area/road; and (9) conservation/watershed protection land (id.). Constraints classified as low include: (1) active farmland or agricultural district; (2) spannable lake, reservoir, river or wetland; (3) woodland; (4) aquifer or aquifer protection district; (5) 100-year floodplain or floodplain protection district; (6) erodible soil; and (7) low density residential area adjacent to the edge of the ROW (id.).

[74] The Company defined a non-spannable wetland as greater than the typical span length of 700 feet of the proposed transmission line (Exh. NEP-7, at 3-5).

[75] The Company noted that a 120-foot ROW, which is the width of the Company's normal ROW for two 115 kV lines constructed using single-pole davit-arm structures, would
(continued…)

routes following existing utility and/or transportation corridors for at least part of the route, and one potential underground route along public roads (id. at 3-3, 3-8 3-9).[76] The Company noted that all routes, with the exception of the primary route, would require land rights acquisition (id. at 3-3).

In order to assess the environmental impacts of the seven identified routes, the Company assigned a weighting factor to each of the constraints and opportunities used to identify the routes (id., at 3-10, 3-12, 3-13).[77] The Company stated that the weights reflected the importance of the constraint in the study area and indicated that generally the weights were higher for high level constraints than low level constraints, ranging from 1.5 for low level constraints such as road/railroad crossing and 100-year floodplain to 7.5 for high level constraints such as sensitive cultural/historical resources and significant wildlife habitat (id. at 3-5, 3-6, 3-13; Tr. 2 at 29, 36). However, the Company noted that the weight for a specific constraint category was not dependent on its classification as a high, medium or low level constraint and that the weights for specific low level constraints could be higher or equal to the weight for specific medium level constraints (id. at 3-13). In addition, the Company assigned a weight of 19 to the opportunity of existing utility/transportation corridors (id. at 3-13). The Company explained that weight for this category was determined in the same way as weight factors for the environmental constraints and then doubled to reflect the importance of avoiding

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75 (…continued)
provide adequate clearances for the safe operation and maintenance of its lines (Exh. HO-S-5).

76 The Company indicated that it did not find an acceptable overhead transmission line route on public streets because such a line would: (1) be difficult to bring into compliance with required clearances; (2) require significant tree trimming and removal along public streets; (3) have greater impact than construction along other evaluated routes; and (4) have decreased reliability due to greater potential for vehicular damage (Exh. NEP-7, at 3-9).

77 Mr. Browne stated that weights represent an average of weights assigned individually by a group that included two transmission line engineers, a land-use specialist and a natural resources specialist (Tr. 2, at 26-27).

the creation of new utility corridors in transmission line routing (id.; Tr. 2, at 32-33).[78]

The Company also assessed the seven identified routes based on costs and reliability (Exh. NEP-7, at 3-12). In preparing a cost estimate for each of the identified routes, the Company included the cost of the transmission line materials and construction, engineering, licensing, and ROW acquisition (id.). The Company also considered the impact of line losses on the cost of the identified routes (id.). With respect to reliability, the Company computed the minutes per year of unavailability ("UA") for each identified route based on: (1) the type of construction (overhead or underground); (2) the total of line length exposure; (3) the mean time between failures; and (4) the mean time to repair (id.).

b. Analysis

The Company has developed a set of site selection criteria that include the general categories of land use compatibility, physical and topographical constraints, environmentally sensitive areas, cost and reliability – general categories that the Siting Council has found to be appropriate for the siting of transmission lines. See, 1991 NEPCo Decision, 21 DOMSC at 386. After selecting an area that would encompass all viable routing options, the Company identified a comprehensive list of the specific environmental criteria that exist within this area in order to identify and evaluate potential routes. The Company also appropriately assigned weights to the specific environmental criteria that were based on the importance of these criteria. In addition, the Company's weighting of environmental factors appropriately stresses the importance of siting transmission lines within existing corridors where possible.

The Company provided a separate analysis of the cost and reliability of each identified route and adequately explained the factors that were considered in preparing the cost and

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78 The Company noted that, for this particular case, the weight was the same for all types of existing corridors within the study area, i.e., use of an existing utility ROW had the same weight as use of an existing railroad ROW (Exh. NEP-7, at 3-13; Tr. 2, at 33-34). The Company explained that the type of existing corridor would not be significant from an environmental perspective, but that the type of existing corridor could affect cost and reliability (Tr. 2, at 33-34).

reliability analyses. However, the Company did not fully explain how cost and reliability were considered in the identification of potential routes. Further, although the Company's weighting methodology provides for a quantitative comparison among competing environmental criteria, the Company did not provide overall weights for the cost, environmental impact and reliability categories and thus, did not explain how it would balance the potentially competing criteria of cost, environmental impact and reliability.

Here, the reliability of all identified routes is essentially the same, and the primary route has the lowest environmental impact and lowest cost (see Section III.C.3.c.3, below). Therefore, in this case, the balancing of cost, environmental impact and reliability is not essential. However, in future reviews, applicants should provide overall weights for the categories of cost, environmental impact and reliability or fully explain how they would balance potentially competing cost, environmental impact and reliability criteria.

Accordingly, based on the foregoing the Siting Board finds that the Company has developed a reasonable set of criteria for identifying and evaluating alternative routes.

3. Application of Siting Criteria

a. Description

In order to evaluate the seven identified routes, the Company ranked the routes in three separate categories – environmental impact, cost and reliability (Exh. NEP-7, at 3-9 to 3-12). With respect to environmental impact, the Company indicated that it applied its environmental criteria to the identified routes using a two-step paired analysis (id.). The Company asserted that for this case, where the study area was small and fairly homogeneous and where many of the environmental constraints and opportunities were applicable to all the routes, a paired analysis rather than a quantitative analysis of each individual route was the best technique to differentiate the routes and establish their relative rankings (Exh. HO-S-4;Tr. 2, 34).

The Company first performed an unweighted paired analysis which compared each route to each other route for each environmental criterion (Exh. NEP-7, at 3-9 to 3-11). To perform the unweighted paired analysis, the Company compared each route to each of the other

routes for each environmental category, by scoring a "one" to the route with the least impact and a "zero" to the route with the greater impact (id.). The Company stated that scores were based on "judgments … regarding which route would have the least impact on each constraint and would maximize the use of each opportunity" (id. at 3-9). The Company then computed an overall score for each route for each category by totalling the comparative scores within each category (id. at 3-10). Thus, scores for each route for each category ranged from zero to six and a route that received a score of "six"(i.e., a "one" when compared to each other route) would have the least impact in that category as compared to the other routes (id.).

As the second step of its analysis, the Company used the results of the unweighted paired analysis to perform a weighted analysis (id. at 3-10 to 3-12). The Company computed a weighted value for each environmental constraint and opportunity for each route by multiplying the weight factor derived for each environmental constraint and opportunity by the unweighted total (id.). The Company then added together the weighted values for each environmental constraint and opportunity to derive the total score for each route with a higher score signifying lower environmental impact (id. at 3-11, 3-12). However, the Company noted that this assessment provided an approximate assessment of the environmental impacts of the identified routes and that small disparities in total scores did not signify a difference in overall environmental impacts (id. at 3-12).

The Company identified three groups of routes based on their environmental impacts (id.). The Company identified two routes as having the least environmental impact, including the primary route, with a score of 350, and Alternative Route G, with a score of 328 (id.). The Company identified four routes, with scores ranging from 123 to 144, as falling in the middle range of environmental impacts, including Alternative Route B with a score of 134 (id.). The Company identified one route, with a score of 80, as having the greatest environmental impact (id.).

The Company next compared the identified routes on the basis of cost (id.). The Company prepared cost estimates of each of the routes which included the cost of line materials and construction, engineering, licensing, and ROW acquisition (id.). The Company indicated

that cost estimates ranged from $2.0 million for the primary route to $5.7 million (id.). The Company further indicated that Alternative Route B was the second least expensive route at $3.2 million and that Alternative Route G was one of the most expensive routes at $5.4 million (id. at 3-12, 3-14).[79]

The Company also compared the six routes with respect to reliability based on the calculated "UA" for each route (id. at 3-12). The Company concluded that the UA of all routes was essentially zero and that, therefore, there was no difference in reliability between the routes (id.).

Based on the results of the environmental, cost and reliability analyses, the Company selected three alternative routes for further evaluation: the primary route, Alternative Route B, and Alternative Route G, which are described in Section III.A.1 and 2, above.

The Company stated that the primary route was selected because it had low environmental impacts and the lowest cost (id. at 3-12). With respect to the selection of an alternative route, the Company stated that the route selection process did not identify a route that was clearly second-best (id.). Therefore, in order to evaluate a full range of alternatives, the Company compared the primary route with two alternative routes with significantly different characteristics. The Company noted that Alternative Route B has the second lowest cost but greater environmental impacts than the primary route or Alternative Route G and that Alternative Route G has essentially the same environmental impacts as the primary route but significantly higher cost than the primary route or Alternative Route B (id.).

In a response to a Staff request, the Company also conducted a paired analysis incorporating only the three routes selected for further consideration – the primary route, Alternative Route B and Alternative Route G (Exh. HO-S-6). The relative scoring in the three route analysis – 69.75 for the primary route, 67.75 for Alternative Route G, and 8.0 for

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[79] The Company noted that the primary route would have the lowest line losses among all routes because it was the shortest in length (Exh. NEP-7, at 3-12). The Company further noted that inclusion of losses would have only a slight impact on the relative cost of the study routes (id.).

Alternative Route B – was comparable to the results of the Company's original paired analysis of all seven routes (id.; Exh. NEP-7, at 3-13).

b. Analysis

In this Section, the Siting Board examines whether NEPCo applied its siting criteria to its siting options in a consistent and appropriate manner that ensured that no clearly superior routes were overlooked or eliminated.

The record demonstrates that the Company identified and evaluated a considerable number of potential routes within a specified area based on a comprehensive set of criteria. To evaluate the routes with respect to environmental impacts, the Company compared each route to each other route for each environmental criterion and incorporated a quantitative scoring and weighting methodology.

Although the Company developed a numerical score for each route for each environmental criteria based on the Company's judgment as to which route would involve the least environmental impact or the maximum use of opportunity, the Company did not fully explain how such judgments were made. For instance, for the environmental constraint of "school/business/medium-high density residential," the Company did not specify whether or how its judgment of least environmental impact reflected more specific factors relevant to that category, such as distance from buildings, number of buildings, or use of buildings. Likewise, for the environmental constraint of "woodland," the Company did not specify how or whether its judgments reflected more specific factors such as woodland type or length of route through woodland. In future filings, applicants should fully explain the basis for judgmental scoring of routes including any specific factors that affected the judgments.

Nevertheless, the Company performed a comprehensive quantitative comparison of the identified routes based on weighted environmental criteria as well as quantitative cost data. Thus, in evaluating routes, the Company applied its siting criteria in a consistent manner.

Accordingly, based on the foregoing, the Siting Board finds that the Company has applied its site selection criteria consistently and appropriately and in a manner which ensures

that it has not overlooked or eliminated any siting options which are clearly superior to the proposal.

The Siting Board has found that the Company has developed a reasonable set of criteria for identifying and evaluating alternative routes and that the Company has applied its site selection criteria consistently and appropriately and in a manner which ensures that it has not overlooked or eliminated any siting options which are clearly superior to the proposal.

Accordingly, based on the foregoing, the Siting Board finds that the Company developed and applied a reasonable set of criteria for identifying and evaluating alternatives in a manner which ensures that it has not overlooked or eliminated any alternatives which are clearly superior to the proposal.

4. Geographic Diversity

In this Section, the Siting Board considers the second prong of our site selection test – whether the Company's site selection process included consideration of route alternatives with some measure of geographic diversity.

The Company considered three different routes for the proposed transmission line. Although the three routes overlap for a short distance when entering the Uxbridge substation,[80] the routes are clearly distinct. They each start at a different point along the Millbury-Woonsocket ROW and travel along a different corridor, each terminating at the Uxbridge substation. In addition, in considering both underground and overhead routes, and different types of corridors (an existing transmission line ROW, roadways, and a railroad ROW/new ROW), the Company considered routes with significantly different characteristics.

Based on the foregoing, the Siting Board finds that the Company has identified three practical routes that are geographically diverse.

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[80] All routes overlap for a distance of 0.1 miles along ROW from the railroad ROW to the Uxbridge substation (Exh. NEP-7, at 3-8, 3-17). In addition, the primary route and Alternative Route G overlap for an additional 0.01 miles from Route 122 to the railroad ROW (id.).

5. Conclusions on the Site Selection Process

The Siting Board has found that the Company developed and applied a reasonable set of criteria for identifying and evaluating alternatives in a manner which ensures that it has not overlooked or eliminated any alternatives which are clearly superior to the proposal. In addition, the Siting Board has found that the Company has identified at least two practical routes with some measure of geographical diversity.

Accordingly, the Siting Board finds that NEPCo has considered a reasonable range of practical siting alternatives.

C. Environmental Impacts, Cost and Reliability of the Proposed and Alternative Facilities

1. Standard of Review

In implementing its statutory mandate to ensure a necessary energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost, the Siting Board requires project proponents to show that proposed facilities are sited at locations that minimize costs and environmental impacts, while ensuring a reliable energy supply. In order to determine whether such a showing is made, the Siting Board requires project proponents to demonstrate that the proposed site for the facility is superior to the noticed alternative on the basis of balancing cost, environmental impact and reliability of supply. 1993 BECo (Phase II) Decision, 1 DOMSB at 37-38; Berkshire Gas Company, 23 DOMSC 294, 324 (1991).

An assessment of all impacts of a facility is necessary to determine whether an appropriate balance is achieved both among conflicting environmental concerns as well as among environmental impacts, cost and reliability. Cabot Power Decision, 2 DOMSB at 389; Eastern Energy Corporation, 22 DOMSC 188, 334, 336 (1991) ("EEC Decision"). A facility which achieves that appropriate balance thereby meets the Siting Board's statutory requirement to minimize environmental impacts at the lowest possible cost. Cabot Power Decision, 2 DOMSB at 389; EEC Decision, 22 DOMSC at 334, 336.

An overall assessment of the impacts of a facility on the environment, rather than a

mere checklist of a facility's compliance with regulatory standards of other government agencies, is consistent with the statutory mandate to ensure a necessary energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. Cabot Power Decision, 2 DOMSB at 389; EEC Decision, 22 DOMSC at 334, 336. The Siting Board previously has found that compliance with other agencies' standards clearly does not establish that a proposed facility's environmental impacts have been minimized. Id. Furthermore, the levels of environmental control that the project proponent must achieve cannot be set forth in advance in terms of quantitative or other specific criteria, but instead, must depend on the particular environmental, cost and reliability trade-offs that arise in respective facility proposals. Cabot Power Decision, 2 DOMSB at 389; EEC Decision, 22 DOMSC at 334-335.

The Siting Board recognizes that an evaluation of the environmental, cost and reliability trade-offs associated with a particular review must be clearly described and consistently applied from one case to the next. Therefore, in order to determine if a project proponent has achieved the appropriate balance among environmental impacts and among environmental impacts, costs and reliability, the Siting Board must first determine if the petitioner has provided sufficient information regarding environmental impacts and potential mitigation measures in order to make such a determination. Cabot Power Decision, 2 DOMSB at 389-390; 1993 BECo (Phase II) Decision, 1 DOMSB at 39-40. The Siting Board can then determine whether environmental impacts would be minimized. Similarly, the Siting Board must find that the project proponent has provided sufficient cost information in order to determine if the appropriate balance among environmental impacts, costs, and reliability would be achieved. Cabot Power Decision, 2 DOMSB at 390; 1993 BECo (Phase II) Decision, 1 DOMSB at 40.

Accordingly, in the sections below, the Siting Board examines the environmental and cost related impacts of the proposed facilities at the Company's primary and alternative routes to determine (1) whether environmental impacts would be minimized along each route, and (2) whether an appropriate balance would be achieved along each route among conflicting

environmental concerns as well as between environmental impacts and cost.[81] In this examination, the Siting Board then conducts a comparison of the primary and alternative routes to determine which is preferable with respect to providing a necessary energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost.

2. Analysis of the Proposed Facilities along the Primary Route

a. Environmental Impacts of the Proposed Facilities along the Primary Route

In this Section, the Siting Board evaluates the environmental impacts of the proposed facilities along the primary route and potential mitigation for such impacts, including the proposed mitigation and, as necessary, any identified options for additional mitigation. As part of its evaluation, the Siting Board addresses whether the petitioner has provided sufficient information for the Siting Board to determine (1) whether environmental impacts would be minimized, and (2) whether the appropriate balance among environmental impacts and among environmental impacts, cost and reliability would be achieved. The Siting Board also addresses whether the environmental impacts of the proposed facilities along the primary route would be minimized.

i. Water Resources

(A) Wetlands and Surface Water

The Company asserted that construction of the proposed facilities along the primary route would have no adverse impact on the freshwater wetlands on and near the primary route (Exh. NEP-7, at 3-21). Based on field surveys, the Company identified four shrub-emergent, bordering vegetated wetlands along the existing ROW (id. at 3-20).[82] The Company added that

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81 The Company indicated that there was no difference in the reliability between the primary and alternative routes (Exh. NEP-7, at 3-12). See Section III.B.3.a, above.

82 The Company stated that there were also forested "bordering vegetated wetlands," associated with the ROW wetlands, along the edges and within 100 feet of the ROW

(continued…)

the length of wetland crossings wold vary from approximately 15 feet to 475 feet and would total approximately 720 feet (id. at 3-21).

The Company indicated that two existing towers would be reinforced within the largest wetland area along the route, identified as Wetland #4, located between Route 122 and the Providence and Worcester railroad ROW (Exhs. HO-E-25b, at 5; HO-E-20, att.). The Company indicated that both of the towers are located near the edge of Wetland #4; one of the towers is located close to Route 122 and the other is located close to the Providence and Worcester railroad ROW (Exh. HO-E-20, att.). NEPCo stated that access to the two towers would be from existing access roads and the Providence and Worcester railroad ROW, if possible (Exh. NEP-7, at 3-21; Tr. 2 at 39-40). NEPCo added that if access through wetland is necessary, swamp mats or temporary gravel roads would be used to reduce the effect of any vehicular traffic on wetland vegetation and substrate and that no permanent access roads would be maintained within wetlands (Exh. NEP-7, at 3-21; Tr. 2 at 41). In addition, the Company stated that all disturbed surface wetland and would be restored and that erosion and sedimentation control devices would be used to protect wetland areas (Exh. NEP-7, at 3-21).[83]

With respect to surface water, the Company indicated that the primary route crosses a tributary of the Blackstone River which borders the southern edge of Wetland #4 and which is comprised of two small headwater streamlets on the ROW that become one stream south of the ROW (Exhs. NEP-7, at 3-22, 3-23; HO-E-20, att.). In addition, the Company stated that, during its field surveys, it identified two additional streamlets associated with wetlands located along the ROW (Exh. NEP-7, at 3-23).[84] The Company asserted that construction of the

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82 (…continued)
(Exh. NEP-7, 3-21).

83 The Company indicated that proposed work in wetland areas would be subject to an Order of Conditions under the Wetlands Protection Act (Exh. NEP-7, at 3-21).

84 The Company indicated that of the four streamlets that were identified along the primary route, two had flowing water with a maximum depth of 6 inches, one streamlet bed had intermittent patches of water and one streamlet bed was dry (Exh. NEP-7, at 3-23).

proposed facilities along the proposed route would have little impact on any of these streamlets (id.). NEPCo stated that construction equipment would use an existing access road that fords the streamlets and that construction would include stream protection measures to reduce disturbance and sedimentation of all streams (id.). The Company further stated that construction would not alter the ROW terrain or local drainage patterns (id.).

The record demonstrates that construction of the proposed facilities along the primary route would require a minimal amount of construction within wetland areas and in the vicinity of surface water. Further, the Company would use existing access roads where possible and would use appropriate mitigation measures. Based on the foregoing, the Siting Board finds that, with the utilization of the proposed mitigation measures in wetland areas and around stream beds, the environmental impacts of the proposed facilities along the primary route would be minimized with respect to wetlands and surface water.

(B) Groundwater and Wells

The Company asserted that construction of the proposed facilities along the primary route would not impact the Blackstone River aquifer or the Town of Uxbridge's existing or proposed well fields (Exh. NEP-7, at 3-24). The Company stated that the primary route crosses a 0.3-mile section of the Blackstone River aquifer, an underground water supply source in Uxbridge, which extends from the Uxbridge substation to a short distance west of Route 122 (id.). In addition, the Company stated that the Town of Uxbridge's well fields are located approximately 1,000 feet to the southeast of the Uxbridge substation and that a proposed well field is located along the Blackstone River, approximately 1.9 miles to the south of the primary route (id.; Exh. HO-E-7b).

The Company stated that the existing well fields are located within the 100-year floodplain area and the Groundwater Protection Overlay District of the Town's zoning bylaw (Exh. HO-E-7b). The Company indicated that the Uxbridge substation and 400 feet of the primary route also are within the 100-year floodplain and that approximately 1700 feet of the

primary route is located within the Groundwater Protection Overlay District (Exh. HO-E-7b).[85]

The Company indicated that no herbicides would be used in clearing or trimming vegetation from the primary route as part of the construction of the proposed facilities (Exh. HO-E-3). However, the Company stated that the use of herbicides is an integral part of NEPCo's vegetative management program for existing ROWs and that herbicides were used on the Uxbridge spur ROW in 1986 and in 1991 and likely would be used again in 1996 or 1997 (id.; Exh. HO-E-4). NEPCo indicated that herbicides will be applied in compliance with 333 CMR 11.00 which prohibits application of herbicides within 400 feet of municipal water supply wells and in accordance with commitments made to the Town of Uxbridge in 1991 (Exh. HO-E-26). The Company stated that in 1991 Uxbridge officials raised questions regarding herbicide use near public water supplies and that in response, the Company has agreed to expand the no-herbicide zone surrounding public wells beyond the 400-foot radius, extending it to the entire portion of the route between the Uxbridge substation and Route 122 (id; Exhs. HO-E-5a, at 17-23; HO-E-6).[86]

With respect to the transformer replacement at the Uxbridge substation, the Company provided documentation from the Massachusetts Department of Environmental Protection ("MDEP") that the Uxbridge substation is located within a designated aquifer recharge area, known as the Zone II area for Uxbridge's Bernat Wells (Exh. HO-RR-11). The MDEP indicated that, in order to protect said wells, the Company should minimize the possibility of

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85 The Company provided a copy of the Zoning Bylaw of the Town of Uxbridge that establishes groundwater protection districts, "consisting of municipal wellfields, aquifers and/or aquifer recharge areas" (Exh. HO-E-2a, sec. XIX). The Zoning Bylaw prohibits specific uses in such districts without a special permit, and allows all uses allowed by underlying Zoning Regulations (id. at sec. XIX.3.A, sec. XIX.3.B). The Company stated that since public utility uses are not permitted uses in the underlying districts, they would not be permitted uses in the groundwater protection district (Exh. HO-E-2b). Thus, the Company has requested that the Department grant an exemption from this section of the Zoning bylaw (Exh. NEP-9; D.P.U. 94-182).

86 The Siting Board notes that the aquifer boundary extends a short distance to the west of Route 122 (Exh. HO-E-20, att.).

spills from the transformers during transformer replacement and that preparation of an emergency response plan prior to transformer replacement may be warranted (id.).[87]

The record demonstrates that a portion of the primary route crosses both the aquifer used for the Town of Uxbridge's water supply and the Town of Uxbridge's Groundwater Protection Overlay District and that the Uxbridge substation is located within a Town well area. The Company has responded to concerns of the Town regarding use of herbicides near public water supplies by limiting herbicide use along the portion of the Uxbridge spur ROW between the Uxbridge substation and Route 122. The Siting Board notes that the boundary of the aquifer extends a short distance beyond Route 122; however, the record does not specify whether the herbicide limitation extends to the boundary of the aquifer or to Route 122. The Siting Board suggests that the Company also limit or avoid herbicide application within the portion of the ROW between Route 122 and the boundary of the aquifer. In addition, the Siting Board suggests that the Company prepare an Emergency Response Plan to address possible spills during the transformer replacement at the Uxbridge substation.

Based on the foregoing, the Siting Board finds that the environmental impacts of the proposed facilities along the primary route would be minimized with respect to groundwater and wells.

(C) Conclusions

The Siting Board has found that (1) with the utilization of the proposed mitigation measures is wetland areas and around stream beds, the environmental impacts of the proposed facilities along the primary route would be minimized with respect to wetlands and surface water, and (2) the environmental impacts of the proposed facilities along the primary route

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87 In the Certificate on the Company's Environmental Notification Form, which determined that an Environmental Impact Report was not required for the proposed project, the Secretary of Environmental Affairs suggested that its Town of Uxbridge require the Company to prepare an Emergency Response Plan to ensure protection of the town's water supply in the event of transformer replacement within Zone II (Exh. HO-RR-11).

would be minimized with respect to groundwater and wells. Accordingly, based on the foregoing, the Siting Board finds that, with the utilization of the above noted mitigation measures, the environmental impacts of the proposed facilities along the primary route would be minimized with respect to water resources.

ii. Land Resources

In this Section, the Siting Board reviews the impact of the proposed facilities along the primary route with respect to tree clearing and upland vegetation, potential soil erosion and wildlife habitat. With respect to tree clearing and vegetation, the Company stated that construction of the proposed transmission line along the primary route would not require additional ROW acquisition or clearing (Exh. HO-E-25b, at 1). The Company indicated that the existing ROW has been adequately maintained in the past and that, therefore, only minimal tree trimming would be required during construction (Exh. NEP-7, at 3-15, 3-26). The Company added that ongoing maintenance of the ROW would sustain existing vegetative conditions (id. at 3-26). The Company noted that there are no rare or endangered plant species or natural communities in the vicinity of the primary route (Exh. HO-E-25b).

With respect to potential soil erosion, the Company indicated that the proposed facilities along the primary route would be constructed along slopes and would cross areas that are susceptible to soil erosion (Exh. NEP-7, at 3-27). However, the Company stated that erosion protection measures, including bay bales, siltation fences, seeding and mulching would be used to prevent erosion and sedimentation along the route (id.).

Finally, the Company noted that two state wildlife species of special concern exist in the proximity of the primary route, one confined to a wetland and aquatic habitat approximately one-half mile to the south of the primary route and one that could occur in many habitats (Exh. HO-E-25b).[88] The Company stated that construction of the proposed facilities along the

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[88] NEPCo stated that the Massachusetts Natural Heritage and Endangered Species Program office has requested that these two wildlife species not be publicly identified

(continued…)

primary route would not impact other species (id.).

The record demonstrates the construction of the proposed facilities along the primary route would not require tree clearing and would not change the existing vegetative conditions along the ROW. In addition, the record demonstrates that erosion control measures would be used during construction to prevent erosion and sedimentation along the ROW. With respect to wildlife habitat, the Siting Board notes that short-term disruption could occur during facility construction. However, due to the maintenance of existing vegetative conditions, erosion control measures and construction mitigation within wetlands described in Section III.C.2.a.i.(A) above, the proposed facilities along the primary route will not impact the habitat of any species of special concern that exists in close proximity to the proposed route. Based on the foregoing, the Siting Board finds that the environmental impacts of the proposed facilities along the primary route would be minimized with respect to land resources.

iii. Land Use

The Company asserted that the construction and operation of the proposed facilities along the primary route would have no impact on existing land uses adjacent to the route (Exh. NEP-7, at 3-25). NEPCo explained that the primary route is located within four Town of Uxbridge zoning districts as follows: (1) an industrial zone extending from the Uxbridge substation to the Providence and Worcester railroad tracks with adjacent uses including the substation, a mill complex, other businesses and undeveloped land; (2) a business zone extending from the railroad to just west of Route 122 with businesses and residences located along the Route 122 crossing; (3) a residential zone extending from just west of Route 122 to the west of Richardson Street, with adjacent residences, including a new 40-unit townhouse development, farmland and undeveloped woodland; and (4) an agricultural zone extending from west of Richardson Street to the existing Millbury-Woonsocket ROW with the adjacent worked and cleared farmland areas (id.). NEPCo indicated that public utility uses are not specifically

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88 (…continued)
(Exh. NEP-7, at 3-29).

permitted uses in any of these districts and, therefore, has petitioned the Department for an exemption from the Town of Uxbridge Zoning Bylaw (Exh. HO-E-2b; DPU 94-182).

NEPCo stated that the Uxbridge spur ROW has been continuously maintained as a transmission line ROW since 1914 (Exh. NEP-7, at 3-26). The Company indicated that there are 10 residences within 100 feet of the ROW along the primary route (Exh. HO-E-13A). The Company noted that it has no specific agreements with abutters to allow alternative uses of the primary route but that alternative uses of the primary route include walking and all-terrain vehicle paths and driveways (Exh. HO-E-22). The Company indicated that it has no record of complaints related to electrical noise from the existing facilities, communications interference from the existing facilities or off-road vehicle use or other unauthorized access along any portion of the existing ROW along the proposed route (Exh. HO-E-8).

The Company stated that during construction, noise mufflers would be used on construction equipment to reduce construction noise at nearby residences (Exh. NEP-7, at 3-25). The Company also indicated that there are no schools, day care centers, hospitals, nursing homes or other sensitive receptors within 100 feet of the edge of the ROW (Exh. HO-E-23).

With respect to historical resources, the Company noted that four National and State Historic Register sites are located near the primary route (Exh. NEP-7, at 3-28). However, the Company stated the proposed facilities would not impact these historic properties because the visual effect of the proposed facilities would not be noticeably different than that of the existing transmission line facilities (id.).[89]

With respect to the Uxbridge substation, the Company indicated that new transformers likely would be relocated to the northern section of the substation which is outside the floodplain (Exh. HO-A-14; Tr. 2, at 49). The Company stated that such relocation would

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89 The Company provided a letter from the Massachusetts Historical Commission which indicated that the proposed facilities would not have an adverse effect on historic resources (Exh. HO-RR-12).

require an expansion of the substation fence within Company-owned land (Tr. 2, at 49).[90] The Company indicated that the residence located nearest to the Uxbridge substation is located approximately 625 feet to the west of the nearest substation fence (Exh. HO-E-10; Tr. 2, at 43-45). The Company indicated that transformers are the source of noise within a substation and that low-noise transformers would be installed as part of the proposed project (Exh. HO-E-11). NEPCo added that it is not aware of any complaints about the existing noise levels at the Uxbridge substation (id.).[91]

The record demonstrates that land use along the primary route is varied with a small number of residences but no sensitive receptors in close proximity to the existing ROW. The proposed route has been maintained continuously for an extended period of time. Construction of the proposed facilities along the primary route would not interfere with existing land uses along the route. Further, any expansion of the Uxbridge substation would take place within Company-owned land. Accordingly, based on the foregoing, the Siting Board finds that the environmental impacts of the proposed facilities along the primary route would be minimized with respect to land use.

iv. Visual Impacts

The Company asserted that construction of the proposed facilities along the primary route would not result in significantly increased visibility of towers and conductors (Exh. NEP-7, at 3-27). The Company indicated that the existing 69 kV transmission lines within the Uxbridge spur ROW are constructed on 14 lattice steel towers which are approximately 75.5 feet in height (id. at 1-1, 3-16). In order to construct the proposed 115 kV transmission lines, the Company indicated that: (1) the height of three of the existing towers will be increased by approximately 13 feet; (2) the height of eight of the existing towers will be increased by

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90 The Company indicated that local permission, but not necessarily a zoning exemption, likely would be required for the substation work (Tr. 2, at 50).

91 The Company indicated that it has not prepared a noise analysis of current and anticipated conditions at the Uxbridge substation (Exh. HO-E-11).

approximately five feet; and (3) three of the existing towers will be replaced by seven poles ranging in height from 65 feet to 90 feet (id. at 3-16; Exh. HO-E-25b).[92] The Company added that, because no new vegetative clearing will be required to construct the proposed facilities, there will no significant change in the existing vegetative screening of the Uxbridge spur ROW (Exh. NEP-7, 3-28).

The record demonstrates that the incremental visual impacts of the proposed facilities would be minimal. Accordingly, based on the foregoing, the Siting Board finds that the environmental impacts of the proposed facilities along the primary route would be minimized with respect to visual impacts.

v. Magnetic Fields Levels

The Company calculated the highest magnetic field levels for the existing and proposed transmission lines along the Uxbridge spur ROW, based on estimated 1995 summer normal peak loads, at four locations including: (1) the left (north) ROW edge; (2) the right (south) ROW edge; (3) within the ROW; and (4) at the residence closest to the ROW (Exhs. HO-RR-10; HO-E-15a; NEP-10, exh. FRB-7). The Company's calculations indicated that magnetic field levels would decrease from current levels at the closest residence and at the left ROW edge, and would increase at the right ROW edge and within the ROW (Exhs. HO-RR-10; HO-E-15a, NEP-10, exh. FRB-7). See Table 1.

The Company stated that magnetic field levels increase with an increase in current and decrease as the distance from a transmission line increases (Exhs. HO-E-14b; HO-E-17). In addition, the Company stated that design features of a transmission line can lower magnetic field levels (Tr. 1, at 22-23). Mr. Barys explained that magnetic fields are lower if the three conductors that make up each circuit are arranged in certain configurations (id.).

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92 NEPCo stated that the towers would exceed the height restrictions set forth in Section IX of the Town of Uxbridge Zoning Bylaw (Exh. HO-E-2b). The Company has petitioned the Department for an exemption from Section IX (Exh. HO-E-2b; DPU 94-182).

With respect to the proposed project, the Company stated that magnetic field levels would be related to: (1) the magnitude of the current carried on the four transmission lines within the Uxbridge ROW, i.e., the two existing 13.8 kV lines and the two proposed 115 kV lines; (2) the distance from these lines; and (3) the conductor configuration of the four lines (id. at 21; Exh. HO-E-14b). The Company indicated that, in designing the proposed installation of the 115 kV lines on the ROW, it determined the optimum configuration of conductors on each circuit of both the existing 13.8 kV lines and the proposed lines to provide the lowest magnetic fields at the edge of the ROW, thus compensating for some of the increase in magnetic field due to increased current flow (Exh. HO-E-14b; Tr. 1, at 22-23, 97). However, the Company noted that as a consequence of optimizing conductor configuration, the magnetic field profile would be rearranged such that the magnetic field strength on portions of the ROW would be increased (Exh. HO-E-14b).

In addition, the Company calculated magnetic field levels for 1995 summer normal peak loads for the residence closest to the Uxbridge substation and the residence closest to the intersection of the Uxbridge spur ROW and Millbury-Woonsocket ROW (1) with the existing facilities, and (2) with the proposed facilities (Exhs. HO-E-12; HO-E-16b). The Company indicated that magnetic field levels would decrease at both locations with the operation of the proposed facilities (Exhs. HO-E-12; HO-E-16b). See Table 1.

The record demonstrates that with the operation of the proposed facilities, magnetic field levels would decrease at the closest residence to the ROW and at the left ROW edge, would increase at the right edge of the ROW, and would increase substantially within the ROW. The Company has incorporated features into the design of the proposed facilities that would decrease magnetic field levels at the edge of the ROW. The Siting Board also suggested that the Company implement feasible and cost-effective measures to discourage access to the ROW in general. See Section II.B.5.c, above. Accordingly, based on the foregoing, the Siting Board finds that, with the use of the above noted mitigation measures, the environmental impacts of the proposed facilities along the primary route would be minimized with respect to magnetic field levels.

vi. Conclusions on Environmental Impacts

In Section III.C.2.a, above, the Siting Board has reviewed the information provided by the Company regarding environmental impacts of the proposed facilities along the primary route and the potential mitigation measures. The Siting Board finds that the Company has provided sufficient information regarding environmental impacts of the proposed facilities along the primary route and potential mitigation measures for the Siting Board to determine whether environmental impacts would be minimized and whether the appropriate balance among environmental impacts and among environmental impacts, cost, and reliability would be achieved.

In Section III.C.2.a, above, the Siting Board has found that: (1) with the utilization of the above noted mitigation measures, the environmental impacts of the proposed facilities along the primary route would be minimized with respect to water resources; (2) the environmental impacts of the proposed facilities along the primary route would be minimized with respect to land resources; (3) the environmental impacts of the proposed facilities along the primary route would be minimized with respect to land use; (4) the environmental impacts of the proposed facilities along the primary route would be minimized with respect to visual impacts; and (5) with the use of the above noted mitigation measures, the proposed facilities along the primary route would be minimized with respect to magnetic field levels.

Accordingly, based on the foregoing, the Siting Board finds that the environmental impacts of the proposed facilities along the primary route would be minimized. In Section III.C.2.c, below, the Siting Board addresses whether an appropriate balance among environmental impacts and among environmental impacts, cost, and reliability would be achieved.

b. Cost

The Company asserted that the construction of the proposed transmission line along the primary route is the least-cost alternative based on construction cost, operation and maintenance ("O&M") costs, and line loss costs (Exhs. HO-C-1; HO-C-2; NEP-7, at 3-12). With respect to

construction costs, NEPCo estimated that the proposed transmission line along the primary route would cost $1,970,000 based on construction, materials, engineering, permitting, contingency, ROW and substation costs (Exh. HO-C-1). NEPCo stated that annual O&M costs would be $3,100 for the primary route (Exh. HO-C-2). The Company stated that this estimate was based on the average O&M cost per mile for all the Company's overhead lines (id.).[93] In addition, the Company stated that the primary route would have the lowest cost for line losses because it is the shortest route (Exh. NEP-7, at 3-2).

The Siting Board finds that the Company has provided sufficient cost information for the Siting Board to determine whether an appropriate balance would be achieved among environmental impacts, cost, and reliability.

c. Conclusions

The Siting Board has found that the Company has provided sufficient information regarding environmental impacts of the proposed facilities along the primary route and potential mitigation measures for the Siting Board to determine whether environmental impacts would be minimized and whether the appropriate balance among environmental impacts and among environmental impacts, cost, and reliability would be achieved. In addition, the Siting Board has found that the environmental impacts of the proposed facilities along the primary route would be minimized. The Siting Board also has found that the Company has provided sufficient cost information for the Siting Board to determine whether an appropriate balance would be achieved between environmental impacts and cost.

In Section III.C.2.a, above, the Siting Board reviewed the environmental impacts of the proposed facilities and proposed mitigation along the primary route with respect to water resources, land resources, land use, visual impacts, and magnetic field levels. For each category of environmental impacts, the Company demonstrated that, with the mitigation discussed above, the impacts would be minimized.

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93 Mr. Browne stated that the range of accuracy of the overall cost estimates was plus or minus ten percent for the primary route (Tr. 2, at 63).

Accordingly, based on the foregoing, the Siting Board finds that the proposed facilities along the primary route would achieve an appropriate balance among conflicting environmental concerns as well as among environmental impacts, cost, and reliability.

3. Analysis of the Proposed Facilities along the Alternative Routes and Comparison

a. Environmental Impacts of the Proposed Facilities along the Alternative Routes and Comparison

In this Section, the Siting Board evaluates the environmental impacts of the proposed facilities along the alternative routes and potential mitigation for such impacts, including the proposed mitigation and, as necessary, any identified options for additional mitigation. As part of its evaluation, the Siting Board addresses whether the petitioner has provided sufficient information for the Siting Board to determine (1) whether environmental impacts would be minimized, and (2) whether the appropriate balance among environmental impacts and among environmental impacts, cost and reliability would be achieved along each route. The Siting Board also addresses whether the environmental impacts of the proposed facilities along the alternative routes would be minimized. Finally, the Siting Board compares the environmental impacts of the primary route to the environmental impacts of each of the alternative routes.

i Water Resources

(A) Alternative Route B

NEPCo stated that construction of the proposed facilities along Alternative Route B would impact wetland areas and an associated stream, but would not impact groundwater or wells (Exhs. HO-E-21; NEP-7, at 3-23, 3-24). The Company stated that Wetland #4, which extends along the primary route, also extends along Alternative Route B at the edge of the rail bed (Exh. HO-E-21). The Company stated that up to 17 poles would be placed in this wetland area, affecting up to 1700 square feet of wetlands, but that all work along this segment would be conducted from the rail bed so that no new access roads would be required (id.). The

Company stated that Alternative Route B also would cross a forested "bordering vegetated wetlands" and an associated tributary of the Blackstone River[94] and that ROW clearing would convert the forest vegetation on both sides of the stream to open shrub (id.; Exh. NEP-7, at 3-21). The Company stated that the ROW clearing would have a long-term impact on the stream because, without the forest vegetation, the stream would be exposed to more sunlight, and its temperature potentially would increase (id. at 3-23). The Company also stated that, although structures would not be placed within this wetland, an access road might be constructed on either side of the stream, if needed (id. at 3-21, 3-22; Exh. HO-E-21). The Company stated that mitigation measures such as bay bales and siltation fences would be used to protect the stream and adjacent wetlands from construction sediment (Exh. NEP-7, at 3-23).

With respect to groundwater and wells, the Company stated that, although Alternative Route B crosses 0.5 miles of the Blackstone River aquifer related to Wetland #4, and could come within 1,000 feet of town well fields, construction of the proposed facilities along Alternative Route B would not impact groundwater or wells (id. at 3-8, 3-24; Exh. E-20, att.).

The record demonstrates that construction of the proposed facilities along Alternative Route B would impact wetland areas and one stream. A significant number of poles – several times the number under the primary route – would be installed within Wetland #4 and the related aquifer area. Forest vegetation would be cleared in another wetland, resulting in a change in vegetative cover and a potential temperature change to a stream. The Company has described certain construction methods that would be used to minimize construction-related impacts to those areas. However, if the Company were to pursue this route, the Siting Board would expect the Company to explore ways to reduce the overall extent of construction within wetlands. For instance, the Siting Board would expect the Company to consider constructing the transmission line on double-circuit pole structures rather than single-circuit pole structures in order to reduce both the number of structures that would be installed within sensitive areas, and the width of the ROW. Thus, the Siting Board finds that the Company has not demonstrated

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[94] The Company noted that the stream is also crossed by the primary route but is wider at the crossing point of Alternative Route B (Exh. NEP-7, 3-23).

that the environmental impacts of Alternative Route B would be minimized with respect to water resources.

(B) Alternative Route G

The Company stated that Route G also would cross Wetland #4 and a stream, and potentially would cross a second wetland area along High Street (Exh. NEP-7, at 3-23; 3-24). However, the Company stated that impacts to these resources would be construction-related, and that the extent of impacts would depend on the specific underground location of the transmission line (id.). The Company stated that construction impacts to Wetland #4 would result from trench excavation, transmission line installation and regrading, and would be temporary and confined to work areas (id.). The Company stated that to mitigate such construction impacts, it would: (1) use swamp mats for equipment; (2) segregate, stockpile and restore excavated soils; (3) crown the restored trench to allow for soil settlement to original grade; and (4) use erosion and sediment control devices along the entire trench length (id.). In addition, the Company stated that a bordering vegetative wetland surrounds a small pond located on the southern side of High Street but that construction would not impact that wetland if construction was confined to the existing road pavement (id.).

The Company stated that Alternative Route G also crosses a small stream that passes through a 16-inch concrete culvert beneath the roadway along the route (id. at 3-23). The Company indicated that impacts of the 115 kV transmission line crossing the stream would be dependent on the crossing location and construction methods used, but the impacts such as sedimentation could be maintained by boring, or, depending on alignment, the use of temporary flumes, and by limiting duration of construction activities within the stream (id. at 3-24).

Finally, with respect to groundwater, the Company stated that Alternative Route G crosses 0.15 mile of the Blackstone River aquifer, which is within Wetland #4, but the construction of the proposed facilities along this route would not impact groundwater resources (id. at 3-8, 3-22; HO-E-20, att.).

The record demonstrates that construction of the proposed facilities along Alternative

Route G would cross Wetland #4 and the related aquifer area, an underground culverted creek and possibly one additional wetland area, depending on the exact placement of the underground transmission line within the roadway. The record also indicates that potential impacts would be construction-related and thus short-term. The Company has described certain construction methods that would be used to minimize construction-related impacts to these areas. If the Company were to pursue this underground route, the Siting Board would expect the Company to consider minor route variations and adjustments to the alignment, depth and width of the transmission line trench to minimize impacts and maintain existing groundwater flows to the greatest extent possible. In addition, due to the location of Wetland #4 and the related aquifer close to the Uxbridge substation, the Siting Board would expect the Company to consider overhead construction across this area to the substation. Thus, the Siting Board finds that the Company has not demonstrated that the environmental impacts of Alternative Route G would be minimized with respect to water resources.

ii. Land Resources

(A) Alternative Route B

The Company stated that an 80-foot to 120-foot wide ROW would be required for the construction of the proposed facilities along Alternative Route B to allow for adequate clearances for line operation and maintenance (Exhs. NEP-7, at 3-18; HO-S-5).[95] The Company indicated that construction of the proposed facilities along Alternative Route B would require some side clearing along the upland forested edges of the railroad ROW (Exh. NEP-7, at 3-26). In addition, approximately 13 acres of oak forest and mixed forest along the new ROW as it crosses private land would be cleared and maintained with low-growing vegetation (id.). The Company added that there are no rare or endangered plant species or natural communities in the vicinity of Alternative Route B (id. at 3-29). The Company further stated that the same species of special concern that exist in the vicinity of the primary route exist in the

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95 The Company stated that 120 feet is its normal ROW width for two 115 kV lines constructed using single-pole davit arm structures (Exh. HO-S-5).

vicinity of Alternative Route B, but that construction of the proposed facilities along Alternative Route B should not impact either species (id.). The Company also indicated that much of Alternative Route B would be constructed along slopes and would cross areas which are susceptible to soil erosion, but that erosion protection measures could be used to prevent erosion and sedimentation (id. at 3-27).

The record demonstrates that, compared to the primary route, construction of the proposed facilities along Alternative Route B would require a significant amount of forest clearing. Were the Company to pursue this route, the Siting Board would expect the Company to consider possible means to reduce the width of the ROW and thereby reduce tree clearing. Thus, in comparing the primary route to Alternative Route B, the Siting Board finds that the Company has not demonstrated that the environmental impacts of Alternative Route B would be minimized with respect to land resources.

(B) Alternative Route G

The Company indicated that construction of the proposed facilities along Alternative Route G would require a minimum of selective tree removal and that, depending on the exact location of the underground line, up to 18 trees might be affected by construction (id. at 3-26, 3-27). In addition, the Company indicated that Alternative Route G would not be susceptible to soil erosion (id. at 3-27).

The record demonstrates that construction of the proposed facilities along Alternative Route G would require a minimal amount of tree removal and that tree removal might be further minimized by refining the alignment of the underground line. Accordingly, based on the foregoing, the Siting Board finds that the environmental impacts of Alternative Route G would be minimized with respect to land resources.

iii. Land Use

(A) Alternative Route B

The Company indicated that Alternative Route B is located within industrial, business

and residential zoning districts in the Town of Uxbridge and also passes through the Floodplain District and Groundwater Protection District (Exh. HO-E-2c).[96] NEPCo stated that there are 14 residences within 100 feet of the ROW for that route, one located at the ROW edge and the remaining 13 located from 65 feet to 100 feet from the ROW edge (Exh. HO-E-13b). There are also two sensitive receptors, i.e., two in-home day care centers within 100 feet of the edge of the ROW, one at the edge of the ROW and one approximately 100 feet from the edge of the ROW (Exh. HO-E-23). In addition, the Company noted that there are several historic sites, including one National and State Historic Register site, to the north and west of Alternative Route B (Exh. NEP-7, at 3-28). The Company noted that the proposed facilities along Alternative Route B might be visible from such historic sites at the Route 122 and Quaker Highway crossings and along the railroad ROW (id.).

The record demonstrates that land use along Alternative Route B is comparable to the land use along the primary route. However, there are two in-home day care centers within 100 feet of the ROW, one of which is right at the edge of the ROW. Were the Company to pursue this route, the Siting Board would expect the Company to evaluate potential impacts to sensitive receptors such as day care centers, and make minor route adjustments, if appropriate. Thus, the Siting Board finds that the Company has not demonstrated that the environmental impacts of Alternative Route B would be minimized with respect to land use.

(B) Alternative Route G

The Company stated that Alternative Route G is located within: (1) an industrial zone which is undeveloped; (2) a business zone which includes a mix of commercial businesses and single and two-family residences; (3) a residential zone which includes a medium density single-family neighborhood, a development of two family homes and single family homes on larger lots; and (4) an agricultural zone (id. at 3-26; Exh. HO-E-2c). In addition, the Company stated

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96 NEPCo indicated that construction of the proposed facilities along Alternative Route B would require comparable zoning exemptions to those required for the primary route (Exh. HO-E-2c).

that Alternative Route G traverses the Floodplain District and Groundwater Protection District (Exh. HO-E-2c).[97] The Company indicated that there are 87 residences within 100 feet of the ROW but no sensitive receptors such as schools, nursing homes or day care facilities (Exhs. HO-E-13g; NEP-7, at 3-26).

The Company indicated that Alternative Route G would pass near two historic buildings that are National and State Historic Register sites (Exh. NEP-7, at 3-28). However, the Company noted that, as the route would be constructed underground, Alternative Route G would have no significant impact on these sites, except during a relatively short construction period (id.).

The record demonstrates that Alternative Route G would traverse comparable zoning districts as the primary route but would be located within 100 feet of a significant number of residences. However, underground construction of the route will not conflict with any existing land uses except during a relatively short construction period. Accordingly, based on the foregoing, the Siting Board finds that the environmental impacts of the proposed facilities along Alternative Route G would be minimized with respect to land use.

iv. Visual Impacts

(A) Alternative Route B

The Company indicated that Alternative Route B would be constructed on (1) two lines of single circuit steel poles approximately 95 feet in height along the existing railroad corridor, and (2) two lines of single circuit wood poles, approximately 75 feet in height along the new ROW across private land (id. at 3-18). NEPCO stated that forest vegetation adjacent to the

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97 NEPCo indicated that if the proposed facilities were constructed along Alternative Route G, it would require comparable zoning exemptions to those required for the primary route (Exh. HO-E-2c). In addition, the Company stated that construction along Alternative Route G potentially would require an exemption from the Town of Uxbridge Zoning Bylaw that prohibits "[u]nderground storage of all petroleum products and toxic or hazardous materials without a permit" due to the dielectric fluid within the cable insulation (Exh. HO-E-2c).

ROW would screen much of the proposed facilities along Alternative Route B except at road crossings (id.). NEPCo further stated that where possible, vegetation buffers would be left at road crossings but that the transmission line would be visible to several residences and businesses along the roads adjacent to and near the ROW (id.).

The record demonstrates that the proposed facilities along Alternative Route B would be visible from a number of residences and businesses and at road crossings. However, a large part of the route would be screened by forest vegetation and, where possible, vegetative buffers would be left in place at road crossings. Accordingly, based on the foregoing, the Siting Board finds that the impacts of the proposed facilities along Alternative Route B would be minimized with respect to visual impacts.

(B) Alternative Route G

The Company indicated that there would be no visual impacts associated with the proposed facilities along Alternative Route G as the entire route would be placed underground (id.).

Accordingly, based on the foregoing, the Siting Board finds that the environmental impacts of the proposed facilities along Alternative Route G would be minimized with respect to visual impacts.

v. Magnetic Field Levels

The Company calculated the highest magnetic field levels for the proposed facilities along Alternative Route B and Alternative Route G based on estimated 1995 summer normal peak loads (Exh. HO-RR-10).

(A) Alternative Route B

With respect to Alternative Route B, the Company indicated that it would use a circuit phase configuration that would minimize magnetic field levels (Exh. HO-E-17). The Company calculated magnetic field levels at four locations including: (1) the left ROW edge; (2) the right

ROW edge; (3) within the ROW; and (4) at the residence closest to the ROW (Exhs. HO-E-17; HO-RR-10). See Table 1. In comparing the magnetic field levels of the proposed facilities along the primary route and Alternative Route B, the Company's calculations indicate that the magnetic field levels would be slightly less for Alternative Route B at the residence closest to the ROW but would be greater for Alternative Route B at the other locations (Exh. HO-RR-10). See Table 1. The Company explained that magnetic field levels would be greater along Alternative Route B because the 115 kV transmission lines would be closer to the edge of the ROW (Exh. HO-E-17). The Company further explained that, with optimal phase configuration, a reduction in the distance between two circuits can reduce magnetic field levels and that the distance between the two 115 kV circuits is greater for Alternative Route B (id.).

The record demonstrates that magnetic field levels would be higher along Alternative Route B than along the primary route at both edges of the ROW and within the ROW. Were the Company to pursue this route, the Siting Board would expect the Company to consider possible means to reduce the magnetic field levels such as installation of the transmission line on double-circuit poles which would reduce the distance between the circuits. Thus, the Siting Board finds that the Company has not demonstrated that the environmental impacts of Alternative Route B would be minimized with respect to magnetic field levels.

(B) Alternative Route G

With respect to Alternative Route G, the Company estimated magnetic field levels on the ROW and at the closest residence (Exh. HO-RR-10).[98] The Company's calculations provide that the magnetic field levels at these two locations would be lowest along Alternative Route G (id.; Exhs. HO-E-15a; NEP-10, exh. FRB-8). See Table 1.

Accordingly, based on the foregoing, the Siting Board finds that the environmental impacts of the proposed facilities along Alternative Route G would be minimized with respect

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98 The Company indicated that for Alternative Route G, the maximum ROW magnetic field level was calculated at one meter above the street and the closest residence was estimated to be approximately seven feet from the center trench line (Exh. HO-RR-10).

to magnetic field levels.

vi. Conclusions on Environmental Impacts

In Section III.C.3.a above, the Siting Board reviewed the information provided by the Company regarding the environmental impacts of the proposed facilities along the alternative routes and potential mitigation measures with respect to water resources, land resources, land use, visual impacts and magnetic field levels. For all categories, the Company provided sufficient information regarding the environmental impacts of the proposed facilities along the alternative routes for the Siting Board to compare the environmental impacts of the proposed facilities along the primary route to those of the proposed facilities along the alternative routes. In addition, the Company provided information regarding certain mitigation measures along the alternative routes. However, as noted above, for many of the environmental categories, the Siting Board determined that it would expect the Company to consider additional mitigation if the Company were to pursue one of the alternative routes.

In Sections III.C.3.a.i to v, above, the Siting Board has found that the Company has not demonstrated that the impacts of the proposed facilities along Alternative Route B would be minimized with respect to water resources, land resources, land use and magnetic field levels and has demonstrated that impacts of the proposed facilities would be minimized with respect to visual impacts. Accordingly, on balance, the Siting Board finds that the Company has not demonstrated that the environmental impacts of the proposed facilities along Alternative Route B would be minimized.

In Sections III.C.3.a.i to v, above, the Siting Board has found that the Company has not demonstrated that the impacts of the proposed facilities along Alternative Route G would be minimized with respect to water resources and has demonstrated that the impacts of the proposed facilities would be minimized with respect to land resources, land use, visual impacts and magnetic field levels. However, the impacts to water resources of the proposed facilities along Alternative Route G would be construction-related and short-term. Accordingly, on balance, the Siting Board finds that the Company has demonstrated that the environmental

impacts of the proposed facilities along Alternative Route G would be minimized.

The Siting Board next compares the environmental impacts of the primary route to each of the alternative routes. With respect to the primary route, the Siting Board has found that the environmental impacts of the proposed facilities along the primary route would be minimized with respect to land resources, land use, and visual impacts and, with the utilization of the above noted mitigation measures, would be minimized with respect to water resources and magnetic field levels.

The record demonstrates that, due, primarily to the creation of a new utility ROW, the impacts to water and forest resources would be significantly greater along Alternative Route B and the visual impacts along Alternative Route B also would be greater. Construction along Alternative Route B would require the installation of a number of new structures within a wetland area, clearing of a forested wetland on both banks of a stream and potential construction of an access road through a wetland, while the primary route would require modification to two existing structures within a wetland area and no new access road construction. In addition, construction along Alternative Route B would require clearing of a substantial amount of upland forest, while the primary route would not require tree clearing. Although the Siting Board has found that visual impacts of both routes have been minimized, the impacts of new poles along a new ROW along Alternative Route B would be greater than the incremental impacts of increasing the height of existing structures along the primary route. Finally, the magnetic field levels at the edge of the ROW and within the ROW would be greater for Alternative Route B.

Accordingly, based on the foregoing, the Siting Board finds that the proposed facilities along the primary route would be preferable to the proposed facilities along Alternative Route B with respect to environmental impacts.

In comparing the primary route to Alternative Route G, the record demonstrates that the impacts along Alternative Route G would be greater with respect to wetlands, while the impacts along the primary route would be greater with respect to visual impacts and magnetic field levels. Both routes would traverse Wetland #4. Construction of a trench for underground

transmission line installation through this area would have a greater potential effect on underground water flow and drainage patterns than the modification of two existing structures that would be required for the primary route. Although the Siting Board has found that magnetic field level impacts and visual impacts would be minimized for both routes, the magnetic field levels would be significantly lower within the ROW and at the edge of the ROW for Alternative Route G. In addition, the visual impacts of an underground route would be less than the incremental impacts of continuing the use of the overhead line and increasing the height of existing structures.

Accordingly, based on the foregoing, the Siting Board finds that, on balance, the proposed facilities along the primary route and Alternative Route G would be comparable with respect to environmental impacts.

b. Cost of the Proposed Facilities Along the Alternative Routes and Comparison

i. Description

As noted in Section III.C.2.b, above, the Company asserted that the construction of the proposed transmission line along the primary route is the least-cost alternative based on construction costs, O&M costs and line loss costs (Exhs. HO-C-1; HO-C-2; NEP-7, at 3-12). The Company provided a comparison of construction costs as follows:

Category	Primary Route	Alternative B	Alternative G
Construction labor and equipment	960,000	1,300,000	1,920,000
Materials	310,000	605,000	2,225,000
Engineering	205,000	250,000	350,000
Permitting	270,000	325,000	295,000
Contingency	225,000	280,000	850,000
ROW acquisition		400,000	25,000

Substation costs			1,180,000
TOTAL	1,970,000	3,160,000	6,575,000

(Exh. HO-C-1).

The Company indicated that construction costs were estimated based on total hours of construction labor and equipment time for recently completed, similar projects, and on established hourly rates (Exh. HO-C-1). The Company further indicated that prices for: (1) new material were based on prices for similar material; (2) engineering and permitting were based on prices for recently completed projects; and (3) ROW acquisition were based on on-going real estate transactions (id.).[99] The Company added that contingency costs were estimated as a percentage of the other categories (id.).[100]

NEPCo stated that annual O&M costs would be: (1) $3,100 for the primary route; (2) $4,300 for Alternative B; and (3) $18,000 for Alternative G (Exh. HO-C-2). The Company stated that the O&M costs for the overhead routes were estimated based on the average O&M cost per mile for all the Company's overhead lines and that the higher cost for Alternative B reflects its greater length, compared to the primary route (id.). The Company added that the higher O&M costs for Alternative G reflect requirements for an annual corrosion survey, weekly checks of pressure, and cathodic protection system operation and failure resolution (id.).[101] In addition, as noted in Section III.C.2.b above, the Company stated that the primary

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99 The Company indicated that costs were adjusted to reflect expected changes in prices between the time of the estimate and time of construction (Exh. HO-C-1).

100 The Company stated that percentages for overhead transmission line contingency were estimated at: (1) 15 percent for construction; (2) ten percent for materials; and (3) two percent for engineering and permitting (Exh. HO-C-1). The Company further stated that percentages for underground transmission line contingency were estimated at: (1) 25 percent for construction; (2) 15 percent for materials; and (3) five percent for engineering and permitting (id.).

101 Mr. Browne stated that the range of accuracy of the overall cost estimates would be (1) (continued…)

route would have the lowest cost of line losses because it is the shortest route (Exh. NEP-7, at 3-12).

ii. Analysis

The record demonstrates that the Company has provided sufficient information regarding the construction costs and O&M costs of the proposed facilities along the Alternative Routes for the Siting Board to compare such costs with the cost of the proposed facilities along the primary route.

In comparing the cost of the primary route to Alternative Route B, the Company's analysis indicates that: (1) the construction cost of Alternative Route B would be 60 percent greater; (2) O&M costs would be 39 percent greater; and (3) line loss costs would be greater. Accordingly, based on the foregoing, the Siting Board finds that the proposed facilities along the primary route are preferable to the proposed facilities along Alternative Route B with respect to cost.

In comparing the cost of the primary route to Alternative Route G, the Company's analysis indicates that: (1) the construction cost of Alternative Route G would be 234 percent greater; (2) the O&M costs would be 481 percent greater; and (3) line loss costs would be greater. Accordingly, based on the foregoing, the Siting Board finds that the proposed facilities along the primary route are preferable to the proposed facilities along Alternative Route G with respect to cost. The Siting Board notes that, compared to Alternative Route G, the cost advantage of the primary route is significant with respect to both construction costs and O&M costs.

c. Conclusions

In comparing the primary route to Alternative Route B, the Siting Board has found that

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101 (…continued)
ten percent for the primary route, and (2) 25 percent for each of the alternative routes (Tr. 2, at 63).

the proposed facilities along the primary route would be preferable to the proposed facilities along Alternative Route B with respect to (1) environmental impacts, and (2) costs.

In comparing the primary route to Alternative Route G, the Siting Board has found that (1) the proposed facilities along the primary route and Alternative Route G would be comparable with respect to environmental impacts, and (2) the proposed facilities along the primary route would be preferable to the proposed facilities along Alternative Route G with respect to cost. In addition, the record demonstrates that the cost advantage of the proposed facilities along the primary route would be significant with respect to both construction costs and O&M costs.

The Siting Board notes that its standard of review requires it to determine whether an appropriate balance would be achieved along each alternative route between conflicting environmental concern as well as among environmental impacts, costs and reliability. This analysis is intended to facilitate an accurate comparison of the environmental impacts, costs and reliability of the primary and alternative routes, particularly where trade-offs between cost and environmental impacts could affect the outcome of the comparison. However, in this case, the Company has demonstrated the clear advantage of the primary route over each of the alternative routes. Alternative Route G is significantly more costly than the primary route and has comparable environmental impacts. Further environmental mitigation would decrease the environmental impacts only slightly, while potentially adding to the cost advantage of the primary route. Alternative Route B is both more costly and has significantly greater environmental impacts than the primary route. Although the environmental impacts of Alternative Route B could be reduced with additional mitigation, such additional mitigation would likely increase the cost of Alternative Route B, thus increasing the cost advantage of the primary route. Further, since the primary route follows an existing ROW and Alternative Route B requires a new ROW, additional environmental mitigation along Alternative Route B would not significantly affect the environmental advantage of the primary route.

In Section III.C.2.c, above, the Siting Board found that the proposed facilities along the primary route would achieve an appropriate balance among conflicting environmental concerns

as well as among environmental impacts, cost and reliability. Based on that finding and the clear advantage of the primary route over each of the alternative routes as discussed above, the Siting Board finds that a balancing of environmental impacts, cost and reliability for the alternative routes is unnecessary for the purposes of this review.

Although the level of analysis provided by the Company is balancing the environmental impacts and cost of the alternative routes was acceptable in this review given the clear advantage of the primary route relative to the alternative routes, such a level of analysis would not be acceptable in a review of a proposed transmission line or gas pipeline where the advantages of the respective routes are less clear.

Accordingly, based on the foregoing, the Siting Board finds that the proposed facilities along the primary route would be preferable to the proposed facilities along both Alternative Route B and Alternative Route G with respect to providing a necessary energy supply to the Commonwealth with a minimum impact on the environment at the lowest possible cost.

IV. DECISION

The Siting Board has found that NEPCo has demonstrated that its existing supply system is inadequate to satisfy the existing load that is supplied by the Uxbridge substation, and, therefore, that additional energy resources are needed for reliability purposes in the Uxbridge area.

The Siting Board also has found that, on balance, the proposed project is preferable to the 69 kV upgrade and to the 115 kV double tap alternative.

The Siting Board further has found that NEPCo has considered a reasonable range of practical siting alternatives.

Finally, the Siting Board has found that the proposed facilities along the primary route would be preferable to the proposed facilities along Alternative Route B and the proposed facilities along Alternative Route G with respect to providing a necessary energy supply to the Commonwealth with a minimum impact on the environment at the lowest possible cost.

In addition, the Siting Board finds that the proposed project is consistent with the most

recently approved long-range forecast of NEPCo's affiliated supply company MECo.

Accordingly, the Siting Board approves NEPCo's petition to convert the existing 69 kV supply in the Uxbridge #321 substation to 115 kV by looping an existing 115 kV line, located within NEPCo's Millbury-Woonsocket Right-of-Way, into the Uxbridge substation utilizing the Company's proposed route.

The Siting Board notes that the findings in this decision are based on the record in this case. A project proponent has an absolute obligation to construct and operate its facility in conformance with all aspects of its proposal as presented to the Siting Board. Therefore, the Siting Board requires the Company to notify the Siting Board of any changes other than minor variations to the proposal so that the Siting Board may decide whether to inquire further into a particular issue. The Company is obligated to provide the Siting Board with sufficient information on changes to the proposed project to enable the Siting Board to make these determinations.

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Robert P. Rasmussen
Hearing Officer

Dated this 17th day of October, 1995

Unanimously APPROVED by the Energy Facilities Siting Board at its meeting of October 17, 1995 by the members and designees present and voting. Voting for approval of the Tentative Decision as amended: Janet Gail Besser (Commissioner, DPU); Mary Clark Webster (Commissioner, DPU); David L. O'Connor (for Gloria C. Larson, Secretary of Economic Affairs); Sonia Hamel (for Trudy Coxe, Secretary of Environmental Affairs); and William Sargent (Public Member).

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Sonia Hamel
Acting Chairman

Dated this 17th day of October, 1995

Appeal as to matters of law from any final decision, order or ruling of the Siting Board may be taken to the Supreme Judicial Court by an aggrieved party in interest by the filing of a written petition praying that the order of the Siting Board be modified or set aside in whole or in part.

Such petition for appeal shall be filed with the Siting Board within twenty days after the date of service of the decision, order or ruling of the Siting Board, or within such further time as the Siting Board may allow upon request filed prior to the expiration of the twenty days after the date of service of said decision, order or ruling. Within ten days after such petition has been filed, the appealing party shall enter the appeal in the Supreme Judicial Court sitting in Suffolk County by filing a copy thereof with the clerk of said court. (Massachusetts General Laws, Chapter 25, Sec. 5; Chapter 164, Sec. 69P).