150. Connecticut, like most of the Northeast states, has deregulated electric generation. The competitive generation marketplace can demand a very high price for energy in a generation-deficit area such as SWCT. By increasing supply options, the proposed 345-kV loop would foster competition in the power markets in SWCT and the rest of Connecticut. A strong transmission system that can reliably deliver bulk energy is critical for the success of a competitive electric market. For a truly competitive marketplace, SWCT customers should have access to all economic generation in New England. The 345-kV loop improves the capability for such a competitive marketplace by providing higher deliverability to the area, by eliminating the conditional dependency that currently prevents the concurrent operation of all existing generation in SWCT, and by enabling the interconnection of new generation in SWCT. *Companies' Ex. 1* (Application, Vol. 1, pp. F-30 to F-31, F-34).

151. The 345-kV transmission system is inherently more efficient than transmission systems that operate at a lower voltage. Losses on a 345-kV system are only 1/9 of those on a 115-kV system for the same energy transfer. This reduction in losses displaces generation in Connecticut or elsewhere that otherwise would have to operate to serve the load. Reducing the generation requirement both lowers costs and reduces air emissions. In the ISO-NE study (SCERS), base power flow cases that were modeled for the peak loading periods showed that losses were approximately 35 MW lower with the 345-kV system than with the 115-kV system. These savings are enough to power about 35,000 homes. *Companies' Ex. 1* (Application, Vol. 1, F-34).

8.0 Regional Support for Project Costs

152. ISO-NE, with input from the NEPOOL Reliability Committee, will decide whether and to what extent the costs of the Project will be treated as a Pool Transmission Facility ("PTF") to be included in regional transmission rates paid by all New England transmission customers under the NEPOOL Tariff. The procedure for this cost allocation review process is set forth in Schedule 12C of the NEPOOL Tariff. FERC has jurisdiction over any appeals from the decision of ISO-NE with regard to cost allocation of the Project. *ISO-NE's Administrative Notice Item 12* (NEPOOL Tariff, Schedule 12C); *ISO-NE Ex. 8* (Testimony of Whitley, dated June 7, 2004, p. 5); *ISO-NE's Ex. 13* (Power Point Presentation at the FERC Technical Conference, dated January 6, 2005, p. 12); *ISO-NE's Ex. 13* (Power Point Presentation at the FERC Technical Conference, dated January 6, 2005, p. 12); 2/23/04 Tr. at 142 (Kowalski); 6/17/04 Tr. at 36-37 (Whitley).

153. For projects that qualify for inclusion in regional transmission rates, the costs are shared based on each state's approximate share of the network load and are imposed upon the distribution companies in each state. Connecticut's current share of the network load is approximately 27%. 3/23/04 Tr. at 51-52 (Zaklukiewicz).

154. FERC has identified two classes of projects eligible for regional cost support: (1) Regional Benefit Upgrades (RBUs); and (2) projects listed in Schedule 12B of the NEPOOL Tariff from the Regional Transmission Expansion Plan (RTEP02 Upgrades). The Middletown-Norwalk Project is listed in Schedule 12B as an RTEP02 Upgrade. *ISO-NE's Administrative Notice Item 5* (New England Power Pool & ISO-NE, 103 FERC ¶ 61,304, dated December 18, 2003). *ISO-NE's Administrative Notice Item 12* (NEPOOL Tariff, Schedule 12B).

155. Even if a project qualifies for regional cost support as either an RTEP02 Upgrade or an RBU, ISO-NE conducts a review of the cost of a project pursuant to Schedule 12C of the NEPOOL tariff to determine whether any portion of the project costs should be treated as Localized Costs. Localized Costs are not included in regional transmission rates and would have to be recovered through each utility's local transmission rates charged to customers in their service territories. The Companies believe the Project qualifies for regional cost support (as both an RBU and an RTEP02 Upgrade) but cannot predict the result of the Schedule 12C determination of Localized Costs. *ISO-NE's Administrative Notice Item 12* (NEPOOL Tariff Schedule 12C); 3/23/04 Tr. at 177 (Whitley); 7/29/04 Tr. at 72-74 (Kowalski); *Companies' Ex. 54* (Testimony of Zaklukiewicz, April 8, 2004, p. 38); 3/23/04 Tr. at 50 (Zaklukiewicz); 4/20/04 Tr. at 42-43 (Zaklukiewicz).

156. In its Schedule 12C review of a project, ISO-NE will apply the criteria set forth in Planning Procedure No. 4 ("PP-4"), which provides detailed guidance with respect to the cost review of PTF additions and modifications that are eligible for regional cost allocation. PP-4 provides that, in making its determination of whether Localized Costs exist, ISO-NE will consider the reasonableness of the proposed design and construction method with respect to: (a) Good Utility Practice; (b) current engineering design and construction practices in the area in which the project is proposed to be built; (c) allowance for appropriate expansion and load growth; (d) alternate feasible and practical transmission alternatives; and (e) the relative costs, operation, efficiency, reliability and timing of implementation of the proposed project. *Companies' Administrative Notice Item 30* (NEPOOL Planning Procedure No. 4, p. 9); *ISO-NE's Ex. 8* (Testimony of Whitley, June 7, 2004); 6/17/04 Tr. at 36-37 (Whitley).

157. PP-4 includes the following non-exclusive list of examples of types of projects that would be considered to contain Localized Costs: (a) the project costs more than a feasible or practical transmission alternative and has equal or less robust bulk power system performance than the transmission alternative; (b) the project does not address a bulk power system need; (c) the project includes underground transmission cable which is selected either at the direction of a local or state siting board or to address other local concerns, and the cost of overhead transmission lines is less expensive; (d) the project is a gas-insulated or covered substation when an open-air substation would be feasible and practical for lower cost.

Companies' Administrative Notice Item 30 (NEPOOL Planning Procedure No. 4, Attachment A).

158. PP-4 requires that an applicant for regional cost allocation include a discussion of why the project was selected over other feasible and practical transmission alternatives, which it defines as an alternative "that is feasible and practical from an engineering design and construction perspective." PP-4 further notes that "(a)n alternative that is or may not be approved by a Siting or local review board may still be considered a feasible and practical alternative." *Companies' Administrative Notice Item 30* (NEPOOL Planning Procedure No. 4, pp. 8-9).

159. ISO-NE, which has responsibility for both the cost allocation decision pursuant to the Schedule 12C process and for approval of the project for interconnection to the grid pursuant to section 18.4 of the Restated NEPOOL Agreement, has concluded that any additional undergrounding beyond the 24 miles included in the Proposed Route, as modified in the Final ROC Report, is not technologically feasible and has indicated that it would not approve the project for interconnection with the grid if it included additional undergrounding beyond the 24 miles. *Companies' Ex. 176* (Final ROC Report, dated December 20, 2004, pp. 7-8); Tr. 1/13/05 at 79-80 (Whitley).

160. It is unlikely that the additional costs associated with low magnetic field designs would be considered prudent or good utility practice for the purposes of cost regionalization. *Companies' Ex. 172* (Testimony of Bartosewicz et al., December 28, 2004, pp. 2-3 & Appendix A); *Companies' Ex. 195* (Response to restated question of Chairman Katz, dated February 3, 2005, p. 2).

9.0 <u>Energy System Alternatives</u>

9.1 "No Transmission" Alternative

161. A "no transmission" alternative is not acceptable because it would provide none of the reliability benefits that the proposed project would. *OCC's Ex. 1* (Testimony of Montalvo, March 9, 2004, pp. 3-4, 11); 3/24/04 Tr. at 47-59 (Montalvo); *Companies' Ex. 1* (Application, Vol. 1, p. G-2).

162. Even integrated solutions involving demand-side management, distributed generation ("DG"), large-scale generation, and/or small-scale transmission projects would require parallel construction of upgraded transmission facilities. 3/24/04 Tr. at 37 (Montalvo).

163. Because the current transmission system in Southwest Connecticut violates national (NERC) and regional (NPCC and NEPOOL) reliability standards, failure to upgrade it will leave Southwest Connecticut vulnerable to electrical outages. *Companies' Ex. 1* (Application, Vol. 1, p. G-2); *ISO-NE's Ex. 1* (Testimony of Whitley, March 9, 2004, pp. 11-13); 3/23/04 Tr. at 118-119 (Whitley).

164. Accordingly, a solution that does not include transmission would provide none of the reliability and congestion cost benefits that the proposed project would provide, and would expose the Southwest Connecticut electric grid to imprudent risks. *Companies' Ex. 1* (Application, Vol. 1, p. G-2); *ISO-NE's Ex. 1* (Testimony of Whitley, 3/9/04, pp. 13-15); 3/23/04 Tr. at 118-119 (Whitley).

9.2 Distributed Generation/ Demand Response Programs/Conservation and Load Management as Project Alternatives

165. Although distributed generation ("DG") should be part of a rational response to Southwest Connecticut's electricity needs, DG cannot be the exclusive solution. Transmission relief is necessary to ensure reliable electric service in Southwest Connecticut. *Companies' Administrative Notice Item 13* (Comprehensive Assessment and Report Part 1, Energy Resources and Infrastructure of Southwest Connecticut, Working Group on Southwest Connecticut and the Long Island Sound Pursuant to Public Act 02-95 and Executive Order No. 26, January 1, 2003, pp. xiii-xiv).

166. The barriers to DG installation and penetration into the marketplace include air quality degradation caused by oil-fired generators, coordination with grid operations, constraints on the existing infrastructure for cleaner fuel supplies, limits on distribution interconnection capacity, cost of backup service and rate structure, lack of technology maturation and manufacturing economies of scale for emerging technologies, interconnection standards, and financial barriers. *Companies' Administrative Notice Item 13* (Comprehensive Assessment and Report Part 1, Energy Resources and Infrastructure of Southwest Connecticut, Working Group on Southwest Connecticut and the Long Island Sound Pursuant to Public Act 02-95 and Executive Order No. 26, January 1, 2003, p. xiii).

167. In addition, although market forces, technological advances, and industry restructuring contribute to the growth of DG, DG's growth has been extremely slow. For example, in a January 2003 study prepared for the Institute for Sustainable Energy, Xenergy determined that only 21 MW to 186 MW of new DG is expected to be installed in Southwest Connecticut by 2013. *Companies' Administrative Notice Item 12* (Institute for Sustainable Energy, <u>An Assessment and Report of Distributed Generation Opportunities in Southwest Connecticut</u>, Jan. 10, 2003, prepared by Xenergy); *Companies' Administrative Notice Item 14* (Task Force on Long Island Sound, <u>Comprehensive Assessment and Report, Part II, Environmental Resources and Energy Infrastructure of Long Island Sound</u>, prepared pursuant to Public Act No. 02-05 and Executive Order No. 26, June 3, 2003).

168. In the near- to mid-term, DG is not expected to reduce load significantly, and ISO-NE's RTEP03 indicates that DG will not expand significantly for 10-15 years. *Companies' Ex. 32* (Testimony of Coretto, March 9, 2004, p. 12); *ISO-*

NE's Administrative Notice Item 11 (ISO-NE 2003 Regional Transmission Expansion Plan, November 13, 2003).

169. The ISO-NE 2002 and 2003 Regional Transmission Expansion Plans recognized that, although demand response programs can play an important role in reducing load and meeting reliability goals on a short-term basis, they are not sufficient to replace the transmission solution required in Southwest Connecticut. *ISO-NE's Ex. 1* (Testimony of Whitley, March 9, 2004, pp. 11-15); *ISO-NE's Administrative Notice Item 10* (ISO-NE 2002 Regional Transmission Expansion Plan, dated Nov. 8, 2002); *ISO-NE's Administrative Notice Item 11* (ISO-NE 2003 Regional Transmission Expansion Plan, dated Nov. 13, 2003).

170. The Companies currently spend, through a statutorily mandated 3-mil surcharge on rates, and under the auspices of the independent Energy Conservation Management Board, upwards of 50 million dollars each year on conservation and load management ("C&LM") programs. *Companies' Administrative Notice Item 10* (Energy Conservation Management Board, Report of the Energy Conservation Management Board, Energy Efficiency: Investing in Connecticut's Future, Year 2003 Programs and Operations, dated Jan. 21, 2004, prepared for the Energy and Technology and the Environment Committees of the General Assembly). The Conservation and Load Management Fund was created by the Legislature under the Electric Restructuring Act passed in 1998. The Companies' expenditures on C&LM programs, including decisions regarding the allocation of such funds and program design, are subject to review and approval by the DPUC. *Companies' Ex. 1* (Application, Vol. 1, p. G-8).

171. In May 2003, the DPUC approved a $78 million budget for C&LM initiatives ($61 million for CL&P customers and $17 million for UI customers). *Companies' Ex. 1* (Application, Vol. 1, p. G-8).

172. The OCC has deemed Connecticut's C&LM programs to be the leading programs in New England, but C&LM cannot provide a complete solution to the capacity and reliability problems that exist in Southwest Connecticut. 3/24/04 Tr. at 19 (Montalvo); *Companies' Ex. 1* (Application, Vol. 1, p. G-9).

173. The market has not provided a solution to Southwest Connecticut's reliability problems, and no such solution is likely to materialize in the near future. 3/24/04 Tr. at 19-20 (Montalvo); *Companies' Administrative Notice Item 12* (Institute for Sustainable Energy, <u>An Assessment and Report of Distributed Generation Opportunities in Southwest Connecticut</u>, January 10, 2003, prepared by Xenergy).

174. The hypothetical integrated solution that the OCC advocates is not based on any formal studies or hard data. Moreover, the additional studies that the OCC would like the Companies to undertake will not address existing reliability problems in Southwest Connecticut and will take a significant amount of time to complete. 3/24/04 Tr. at 39-40, 52-54 (Montalvo).

175. In sum, a combination of demand-side management, DG, large-scale generation, and/or smaller scale transmission projects would provide none of the reliability and congestion cost benefits that the proposed project would provide, and would expose the Southwest Connecticut electric grid to imprudent risks and reliability problems. *Companies' Ex. 31* (Testimony of Zaklukiewicz, March 9, 2004, pp.3-5); *Companies' Ex. 32* (Testimony of Coretto, March 9, 2004, p. 13); 3/23/04 Tr. at 32-34 (Zaklukiewicz); 3/23/03 Tr. at 29-31, 35-36 (Brandien).

9.3 Transmission System Alternatives

176. The design of a transmission solution to the problems of SWCT involves identifying the best strong source of available power into Southwest Connecticut; selecting which terminal points (e.g., junction points, substations, switching stations) to connect to address reliability criteria violations in Southwest Connecticut; and choosing a transmission technology (e.g., AC v. HVDC and 115-kV v. 345-kV) to use. *Companies' Ex. 1* (Application, Vol. 1, p. G-11).

9.3.1 Strong Source and Selection of Terminal Points

177. The Companies evaluated three sources of power availability from outside the Southwest Connecticut region, the Southington Substation, the Frost Bridge Substation, and the Middletown Area. *Companies' Ex. 1* (Application, Vol. 1, p. G-11); *Companies' Ex. 31* (Testimony of Zaklukiewicz, March 9, 2004, pp. 15-19).

178. Of the possible sources, placing a new switching station at Beseck Junction in Wallingford (i.e., the Middletown area) will provide the strongest source. First, eastern Connecticut has an abundance of generation resources that can be consolidated by reconfiguring the existing 345-kV lines located in the Middletown-Meriden area at Beseck. Second, this reconfiguration would connect Beseck to all the existing 345-kV tie lines to Massachusetts through the Scovill Rock Switching Station and Manchester Substation; to Rhode Island through the Millstone, Card, and Lake Road Substations; and to New York through the existing Frost Bridge, Southington, and Long Mountain Substations. *Companies' Ex. 1* (Application, Vol. 1, p. G-12); *Companies' Ex. 31* (Testimony of Zaklukiewicz, March 9, 2004, pp. 15-19).

179. In contrast to the robust 345-kV supply from multiple sources that the Beseck Junction switching station will provide, the Frost Bridge and Southington alternatives would be fed by a single source (New York) following the loss of the 345-kv line from Eastern Connecticut. *Companies' Ex. 1* (Application, Vol. 1, pp. G-11 to G-12); *Companies' Ex. 31* (Testimony of Zaklukiewicz, March 9, 2004, pp. 15-19).

180. Like Beseck Switching Station in Wallingford, the other terminal points (Norwalk Substation, in Norwalk, East Devon Substation in Milford, and Singer Substation in Bridgeport) will help rectify the reliability criteria violations in Southwest Connecticut. The Norwalk Substation will be located in the heart of the Norwalk-Stamford and Southwest Connecticut areas, which will soon be supplied by the Bethel to Norwalk line, a 345-kV source. *Companies' Ex. 1* (Application, Vol. 1, p. G-13). In addition, the East Devon and Singer Substations will be located in areas in which ISO-NE has identified particularly severe violations of national reliability standards, including thermal overloads on the 115-kV network and short circuit fault duty limitations at Pequonnock Substation. *Id.* The East Devon and Singer Substations will provide relief to the Devon and Pequonnock Substations and eliminate the conditional dependency constraint of the generation on the existing 115-kV network. *Id.*; *Companies' Ex. 31* (Testimony of Zaklukiewicz, March 9, 2004, p. 28).

9.3.2 Transmission Technology

181. Using HVDC technology to connect the line's termination points would not be a technologically viable alternative to the proposed alternating current ("AC") solution because an HVDC solution: (i) would present additional operational complexities; (ii) would not resolve existing system constraints, such as short circuits and conditional dependency; (iii) could not be readily modified once in place; (iv) would weaken the AC system; (v) would be more expensive; (vi) would require more land; (vii) would result in greater energy loss; and (viii) would hinder the development of a competitive generation market. *Companies' Ex. 1* (Application, Vol. 1, pp. G-13 to G-14); *Companies' Ex. 54* (Testimony of Zaklukiewicz, April 8, 2004, pp. 19-23); *Companies' 123* (Testimony of Zaklukiewicz, July 19, 2004, pp. 2-4); *Companies' 123 (Appendix)* (Preliminary Evaluation of the System Compatibility of an HVDC Transmission Alternative for the Beseck-East Devon Segment of the Middletown-Norwalk Transmission Project, July 2004); *Companies' Ex. 176* (Reliability and Operability Committee (ROC) Report, December 20, 2004, pp. 29-33).

182. AC is the norm in the United States. Incorporating DC elements into an AC grid presents operational complexities that are not present in AC transmission facilities. *Companies' Ex. 1* (Application, Vol. 1, p. G-14); *Companies' Ex. 54* (Testimony of Zaklukiewicz, April 8, 2004, pp. 19-20); *Companies' Ex. 123* (Testimony of Zaklukiewicz, July 19, 2004, p. 2); 7/29/04 Tr. at 31-32 (Kowalski); *Companies' Ex. 176* (Reliability and Operability Committee (ROC) Report, December 20, 2004, p. 30); *Council's Ex. 24* (KEMA, Inc., Observations on the Reliability and Operating Committee's Final Report, January 18, 2005, pp. 6-7).

183. There has been little integration of HVDC within AC systems because HVDC lines do not automatically respond to changing system conditions. In contrast, AC lines respond to changing conditions and automatically support the system

during contingency events and load cycling without operator intervention. *Companies' Ex. 176* (Reliability and Operability Committee (ROC) Report, December 20, 2004, p. 30); *Council's Ex. 24 (*KEMA, Inc., Observations on the Reliability and Operating Committee's Final Report, January 18, 2005, pp. 6-7).

184. Due to their complexity and their large number of components, HVDC facilities generally have lower availability and reliability than AC facilities. Converter station failure modes can also be quite extensive and can result in lengthy outages. *Companies' Ex. 176* (Reliability and Operability Committee (ROC) Report, December 20, 2004, pp. 30-31); *Council's Ex. 24* (KEMA, Inc., Observations on the Reliability and Operating Committee's Final Report, January 18, 2005, pp. 6-7).

185. HVDC, including voltage source converter HVDC ("VSC-HVDC"), solutions cannot include intermediate termination points. *Companies' Ex. 1* (Application, Vol. 1, p. G-14).

186. An HVDC solution would not resolve existing short circuit problems in Southwestern Connecticut, and it would not resolve the conditional dependencies that limit generation output at Bridgeport and Devon generating stations. *Companies' Ex. 54* (Testimony of Zaklukiewicz, April 8, 2004, p. 20); *Companies' Ex. 123 (Appendix)* (Preliminary Evaluation of the System Compatibility of an HVDC Transmission Alternative for the Beseck-East Devon Segment of the Middletown-Norwalk Transmission Project, July 2004, pp. 2-6).

187. An additional limitation of HVDC technology is that, once built, such systems cannot be easily modified to address changing load patterns. An HVDC line could not be tapped to add new generation or to add new transformation to serve growing load pockets. In addition, the HVDC terminals would have to be oversized to permit upgrading the transport capabilities of the HVDC line in the future. Companies' *Ex. 54 Companies'* Ex. 54 (Testimony of Zaklukiewicz, April 8, 2004, pp. 20-21); *Companies' 123 (Appendix)* (Preliminary Evaluation of the System Compatibility of an HVDC Transmission Alternative for the Beseck-East Devon Segment of the Middletown-Norwalk Transmission Project, July 2004, pp. 6-7); 7/29/04 Tr. at 28-29 (Kowalski); *Companies' Ex. 176* (Reliability and Operability Committee (ROC) Report, December 20, 2004, p. 31); *Council's Ex. 24* (KEMA, Inc., Observations on the Reliability and Operating Committee's Final Report, January 18, 2005, pp. 6-7).

188. HVDC, including VSC-HVDC, would have significant electric system resonance impacts, leading to system resonances at extremely low multiples of the normal frequency. These effects contribute to performance and design issues associated with conventional HVDC. Although a converter could potentially be used to mitigate AC system resonance problems in a VSC-HVDC system, implementing such a solution for a project on the scale of the proposed Middletown to Norwalk line would be unprecedented and would involve substantial risk. *Companies' Ex.*

123 (Appendix) (Preliminary Evaluation of the System Compatibility of an HVDC Transmission Alternative for the Beseck-East Devon Segment of the Middletown-Norwalk Transmission Project, July 19, 2004, pp. 8-14); Tr. 7/29/04 at 37-46 (Walling).

189. The cost of constructing the configuration incorporating ABB's VSC HVDC Option 1 would be between $1.73 billion and $2.0 billion. *Companies' Ex. 178* (Testimony of Bartosewicz and Prete, December 28, 2004, pp. 6-7). This is nearly twice as much as an AC solution, and because of the unique characteristics of a DC line relative to the definition of a Pool Transmission Facility, there is a significant risk that none of the cost of a DC alternative would qualify for regional cost support. *ISO-NE's Ex. 13* (Power Point Presentation at the FERC Technical Conference, January 6, 2005, p. 11); 1/11/05 Tr. at 35 (Whitley).

190. Construction of HVDC converter stations is extremely expensive. *Companies' Ex. 1* (Application, Vol. 1, p. G-14); *Companies' Ex. 176* (Reliability and Operability Committee (ROC) Report, December 20, 2004, pp. 32-33); *Council's Ex. 24* (KEMA, Inc., Observations on the Reliability and Operating Committee's Final Report, January 18, 2005, pp. 6-7).

191. An HVDC termination facility would require approximately 15 acres of land for equipment and facilities, and potentially an additional buffer for noise attenuation. *Companies' Ex. 1* (Application, Vol. 1, p. G-14).

192. HVDC systems have significant transmission system losses. The system losses for VSC-HVDC would be much greater than conventional HVDC. *Companies' 123 (Appendix)* (Preliminary Evaluation of the System Compatibility of an HVDC Transmission Alternative for the Beseck-East Devon Segment of the Middletown-Norwalk Transmission Project, July 19, 2004, pp. 13-14); 7/29/04 Tr. at 96-97 (Walling); 7/29/04 Tr. at 30-31 (Kowalski); *Council's Ex. 24* (KEMA, Inc., Observations on the Reliability and Operating Committee's Final Report, January 18, 2005, pp. 6-7).

193. The Council's consultant, KEMA Inc., agrees with the conclusion of the ROC Group regarding VSC HVDC. *Council's Ex. 24* (KEMA Inc. white paper, entitled "Observations on the Reliability and Operability Committee's Final Report," dated January 18, 2005. p. 7).

194. The total losses for a 1200 MW system between Beseck and East Devon would be approximately 1.92% for conventional HVDC and 6.5% for VSC-HVDC. 7/29/04 Tr. at 96 (Walling). In contrast, an AC system would experience losses of approximately 1.2% for the same transmission path. 7/29/04 Tr. at 96-97 (Walling). *See also Council's Ex. 24* (KEMA Inc. white paper, entitled "Observations on the Reliability and Operability Committee's Final Report," dated January 18, 2005).

195. If HVDC were used, generation interconnection costs would increase significantly in SWCT. Generators would need to pay for and utilize DC converter stations in order for their power to be delivered to the grid. These additional costs would place generators at a competitive disadvantage and hinder the development of a competitive generation market. 7/29/04 Tr. at 139 (Zaklukiewicz); *Companies' Ex. 176* (Reliability and Operability Committee (ROC) Report, December 20, 2004, p. 31); *Council's Ex. 24* (KEMA Inc. white paper, entitled "Observations on the Reliability and Operability Committee's Final Report," dated January 18, 2005. p. 7).

9.3.3 Voltage Level

196. SWCT is the only part of Connecticut not served by 345-kV transmission lines. *Companies' Ex. 31* (Testimony of Zaklukiewicz, March 9, 2004, pp. 6-7).

197. 345-kV is the backbone of New England's bulk power system. The proposed Project will complete a 345-kV loop connecting Southwest Connecticut with that bulk power system. Moreover, completion of the loop will permit the transfer of power to and within Southwest Connecticut from both the north and the east, which will enable the flow of power into the region to continue even if there is service interruption on the underlying 115-kV lines or if there is an outage on one "leg" of the loop. *Companies' Ex. 31* (Testimony of Zaklukiewicz, March 9, 2004, pp. 6-7); *ISO-NE's Ex. 1* (Testimony of Whitley, March 9, 2004, pp. 4; 31-32).

198. A 345-kV transmission line will also permit existing local generation units to run at full capacity and enable the installation of new generation units. *ISO-NE's Ex. 1* (Testimony of Whitley, March 9, 2004, p. 31).

199. A 345-kv solution is cheaper, will entail less construction and right-of-way expansion, and can be constructed in significantly less time than a 115-kV system. There are also fewer line losses associated with moving power on 345-kV lines rather than 115-kV lines. *Companies' Ex. 1* (Application, Vol. 1, pp. G-15 to G-16).

200. Expanding the 345-kV system will allow all existing generation in the Southwest Connecticut region to operate simultaneously, allowing the siting of new generation facilities. This is not possible if only a 115-kV system is utilized. *Companies' Ex. 1* (Application, Vol. 1, p. G-17).

9.3.4 Generation Alternatives

201. Absent upgrades to the transmission system, it is unlikely that any new large generation plants will be constructed in Southwest Connecticut in the near future. Constraints on the 115-kV system do not allow the concurrent operation of all existing generation units in Southwest Connecticut. The ability to connect new

generation to the existing 115-kV system in this area is severely limited by a combination of thermal, voltage, stability and short-circuit constraints. There would have to be significant modification and upgrades to the 115-kV system to allow any significant additional generation. In addition, there has been a significant amount of turmoil in the deregulated energy marketplace. A cash and credit crisis has caused the energy trading markets to collapse and has dramatically reduced the number of players and projects that will be brought to completion. Finally, there are difficulties in siting large generation facilities in this densely populated part of the state. Even if new generation plants were to be built, the construction of new generation, without transmission upgrades, is not a complete alternative to the proposed line. *Companies' Ex. 31* (Testimony of Zaklukiewicz, March 9, 2004, pp. 28-36); 3/24/04 Tr. at 33-36 (Montalvo); *Council's Administrative Notice Item 15* (Docket 217, Findings of Fact, July 14, 2003, ¶¶ 90-93).

202. The current excess supply of generation in New England has made it difficult for developers of generation plants to obtain financing for the construction of new plants. This difficulty in obtaining financing would also hinder the ability of developers to acquire existing plants in Norwalk-Stamford and build new plants on the sites. *Council's Administrative Notice Item 15* (Docket 217, Findings of Fact, July 14, 2003, ¶¶ 90-93).

203. The Companies are prohibited from owning, operating, controlling, leasing, and building generation facilities. Additional generation in SWCT would create additional emissions. 3/24/04 Tr. at 9, 44-47 (Montalvo); *Council's Administrative Notice Item 15* (Docket 217, Revised Opinion, September 9, 2003, pp. 3-4).

9.3.5 Technology Alternatives

204. Although various types of Flexible AC Transmission Systems ("FACTS") could increase the capabilities of the existing transmission system, FACTS devices cannot eliminate Southwest Connecticut's reliability problems without transmission improvements. *Companies' Ex. 31* (Testimony of Zaklukiewicz, March 9, 2004, p. 36); 3/23/04 Tr. at 75-80 (Zaklukiewicz).

10.0 <u>Transmission Line Routing Objectives and Technology Considerations</u>

10.1 Routing Objectives

205. When identifying and evaluating either overhead or underground transmission line alternatives, the Companies' primary routing objectives were to:

- Maintain system operability.
- Minimize the need to acquire (by condemnation or voluntary sale) homes and commercial buildings.
- Maximize the use of existing linear corridors (e.g., transmission line, highways, railroad, pipeline), consistent with the long-established siting guidelines of the Federal Energy Regulatory Commission (*Guidelines for the Protection of Natural, Historic, Scenic, and Recreational Values in the Design and Location of ROWs and Transmission Facilities*, Docket No. R-365, Appendix A).
- Minimize the need to expand existing ROWs to accommodate the proposed 345-kV facilities.
- Minimize impacts to sensitive environmental resources, including inland and tidal wetlands, steep slopes, erodible soils, parks, watercourses, and biological resources of concern (vegetation/wildlife/fisheries).
- Minimize impacts to significant cultural resources (archaeological and historic).
- Minimize or avoid conflicts with local, state, and federal land use plans and resource policies.
- Minimize aesthetic impacts on scenic resources.
- Maintain public health and safety.
- Achieve an economic solution, consistent with good engineering practice, while balancing the consideration of the above routing factors. *Companies' Ex. 1* (Application, Vol. 1, pp. H-2 to H-3); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, p. 4-5; *Companies' Ex. 54* (Testimony of Zaklukiewicz, April 8, 2004, p. 7); *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 9-12); *Council's Administrative Notice Item 9* (FERC Guidelines); 4/22/04 Tr. at 68 (Bartosewicz).

206. Because of the inherent differences between overhead and underground transmission line construction and operation, the emphasis placed on some of the route evaluation criteria varied in the analysis of feasible route options for overhead vs. underground configurations. *Companies' Ex. 1* (Application, Vol. 1, p. H-3); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, p. 5); *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 11-12).

10.1.1 Overhead Transmission Line Route Evaluation Criteria

207. Provided that a continuous ROW of adequate width is available, the configuration of overhead transmission lines allows flexibility since individual structures can often be located to avoid or span conductors over sensitive environmental areas (e.g., wetlands, streams, steep slopes). However, overhead lines require relatively wide ROW, within which certain land uses and tall growing vegetative community types are precluded. *Companies' Ex. 1* (Application, Vol. 1, p. H-3); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, p. 5).

208. The potential co-location of the 345-kV transmission facilities along existing ROWs was a primary routing consideration because an entirely new 345-kV overhead line would require a minimum 120-foot-wide ROW (based on a steel monopole configuration). Aligning the same 345-kV facilities on an existing corridor (parallel to existing transmission lines) could entail an 85 foot or less expansion of an existing ROW. Rebuilding existing transmission lines can avoid the need for new ROW in many cases. *Companies' Ex. 1* (Application, Vol. 1, p. H-4); *Companies' Ex. 90* (Testimony of Zaklukiewicz, May 25, 2004, pp. 11-12).

209. Given the density of development in SWCT, a primary routing concern was avoidance of conflicts with residential, commercial and industrial land uses such as homes, businesses and airport approach zones. A principal routing criteria was to avoid having to acquire homes or businesses. *Companies' Ex. 1* (Application, Vol. 1, p. H-4); *Companies' Ex. 90* (Testimony of Zaklukiewicz, May 25, 2004, pp. 11-12).

210. Because 345-kV structures, as a rule, are taller than 115-kV facilities, structure visibility is also a design consideration. The Companies devoted considerable effort during the alternatives evaluation process to avoid areas of visual or historic sensitivity; identify designs for minimizing structure height; and take into consideration the potential effects of removing mature trees that presently serve as visual buffers. *Companies' Ex. 1* (Application, Vol. 1, p. H-4, M-30 to M-31); *Companies' Ex. 90* (Testimony of Zaklukiewicz, May 25, 2004, pp. 11-12).

211. In evaluating potential alternatives, construction feasibility constraints were considered, including whether the facilities could be designed to avoid or minimize the location of structures along steep slopes or embankments, in areas of rock outcroppings, or within environmentally sensitive areas, such as wetlands.

Companies' Ex. 1 (Application, Vol. 1, p. H-4); *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 11-12).

212. An overhead route must be accessible for both construction and maintenance purposes. Access to structure locations is of primary importance. However, access to all locations along an overhead route is typically not required. *Companies' Ex. 1* (Application, Vol. 1, p. H-4); *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 11-12).

10.1.2 Underground Transmission Line Route Evaluation Criteria

213. Although the vast majority of transmission circuits in Connecticut (and the United States) consist of overhead lines, underground transmission cables may warrant consideration when overhead configurations are impractical or undesirable due to environmental, social, or construction factors (e.g., lack of sufficient ROW through a densely populated area or avoidance of significant impacts to environmental, cultural, or historic resources). *Companies' Ex. 1* (Application, Vol. 1, p. H-5).

214. As part of the alternatives evaluation process, the Companies examined the status of AC high voltage underground electric transmission line technology and retained cable consulting experts (Power Delivery Consultants, Inc. ("PDC") and Cable Consulting International ("CCI") to assess the technical viability and world-wide experience of undergrounding options for both 345-kV and 115-kV facilities. *Companies' Ex. 1* (Application, Vol. 1, p. H-5; Vol. 6, "Tutorial – Underground Electric Power Transmission Cable Systems" (by CCI) and "Evaluation of Potential 345-kV and 115-kV Cable Systems as Part of the Middletown-Norwalk Project" (by PDC)).

215. Because an underground cable system typically requires the excavation of a continuous trench, environmentally sensitive areas (e.g., steep slopes, rock outcroppings, greenery/vegetation, wetlands, and watercourses) cannot be spanned. As a result, careful siting is required to avoid or minimize significant impacts to environmental resources and buried utilities, as well as to ensure that the cable is immediately accessible in the event that maintenance is required during the operation of the facility. *Companies' Ex. 1* (Application, Vol. 1, p. H-5); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, p. 5); 4/20/04 Tr. at 48- 49, 203-04 (Zaklukiewicz and Prete).

216. Primary engineering objectives for an underground cable are to identify routes that are relatively straight, direct, and have gradual slopes and inclines to minimize construction and maintenance costs. Steep terrain poses serious problems for underground construction and may cause down-hill migration and overstressing of the cable and splices. *Companies' Ex. 1* (Application, Vol. 1, p. H-6); 4/20/04 Tr. at 53-54 (Zaklukiewicz).

217. Because cable installation requires continuous trenching, alignment of a cable system along some existing transmission, pipeline, and railroad ROWs could result in potential impacts to environmental resources located within or adjacent to such areas. Consequently, a primary routing option for underground cable alternatives was the potential for alignment along existing road corridors, which typically are relatively level and avoid most natural resources. *Companies' Ex. 1* (Application, Vol. 1, p. H-6).

218. Because of these physical and environmental constraints, use of existing overhead ROW is not viable for the underground segments of the proposed line. *Companies' Ex. 1* (Application, Vol. 1, Table H-1, p. H-21 to H-25).

219. The proposed route for the underground segments of the line is primarily along existing roads, where installation is physically and environmentally feasible. *Companies' Ex. 1* (Application, Vol. 1, Table H-1, p. H-21 to H-25); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, p. 14); 4/20/04 Tr. at 205 (Mango); 6/1/04 Tr. at 72-73 (Mango); Companies' Ex. 173 (Maps, with cover letter dated December 28, 2004, showing facilities and areas along segments 3 and 4, the underground portions of Alternative A within segments 3 and 4, and the underground portion of Alternative B within segment 3).

220. In evaluating potential underground alignment alternatives, the Companies attempted to minimize, where possible, the length of cable installation through residential areas and central business districts. *Companies' Ex. 1* (Application, Vol. 1, p. H-6).

221. Underground cable systems require transition stations at locations where the underground cable must interconnect to overhead transmission systems. Such transition stations require approximately 2-4 acres of land. *Companies' Ex. 1* (Application, Vol. 1, p. H-6; Vol. 7, Alternative Transition Station Drawings); *Companies' Ex. 33*, Response to CSC-01, Q-CSC-024.

10.2 Technology Considerations

10.2.1 Alternative Overhead Configurations

222. Overhead transmission structure height and configurations were evaluated based on conformance to applicable standards and requirements (i.e., National Electric Safety Code, DPUC and The Companies' standards), as well as on the characteristics of ROWs and terrain. Within the context of these standards, the Companies have some flexibility with respect to the engineering design of the facilities. *Companies' Ex. 1* (Application, Vol. 1, pp. H-26, I-7, I-21).

223. The Companies considered various structure configurations, including wood or steel H-frames or self-supporting tubular steel monopoles in vertical or delta configurations. Structure heights were considered based on topography and site-

specific clearance requirements. *Companies' Ex. 1* (Application, Vol. 1, p. I-7; Vol. 10, "Typical Cross Sections" and "Typical Cross Section Details").

224. At the request of the Council, the Companies also considered overhead configurations with low magnetic field designs. Such configurations would entail the use of steel monopoles, in vertical or delta configurations, with typical height ranges of between 80 and 150 feet. *Companies' Ex. 191* (Aerial Mapping, Segment 1 and 2, dated January 28, 2005).

10.2.2 Underground Cable Configurations

225. Underground transmission lines can be very reliable with proper selection of the specific technology, proper construction methods, and attention to necessary operation and maintenance procedures. *Companies' Ex. 1* (Application, Vol. 1, p. H-6).

226. CCI reviewed and compared underground cable configurations in general. PDC evaluated cables types used at 345 kV, determined the types that would be suitable for the Project, and performed a conceptual design of cable systems that would meet the Companies' requirements. *Companies' Ex. 1* (Application, Vol. 1, pp. H-6 to H-7; Vol. 6, "Tutorial – Underground Electric Power Transmission Cable Systems" (CCI) and "Evaluation of Potential 345-kV and 115-kV Cable Systems as Part of the Middletown-Norwalk Project" (PDC)).

227. XLPE and HPFF are the principal types of 345-kV cables evaluated for the Project. HPFF cable is a paper insulated cable that requires an insulating fluid under pressure (approximately 200 psi) to operate correctly. HPFF cable is installed in steel pipes. XLPE is a cable type that is surrounded by a plastic type insulating material and is typically installed in a plastic duct bank. 4/20/04 Tr. at 55 (Zaklukiewicz); April 20, 2004 Tr. 56-57 (Williams). Is there a more recent document to cite?

228. There are several factors that constrain the connection of 345-kV underground cables to a predominantly overhead transmission system. When long lengths of underground cable are installed in suburban or rural settings, which usually are remote from strong sources, the large amounts of cable charging capacitance associated with the long cable lengths, combined with the moderate short-circuit strengths relative to the cable charging currents, is of concern and requires careful consideration. Proposed extra high voltage cable installations must therefore be carefully analyzed by power system engineers taking into account design limitations of the cable and substation equipment at the cable termination. *Companies' Ex. 1* (Application, Vol. 1, p. H-8).

229. Switching Transients. Unacceptably high sustained and distorted overvoltages can occur when switching an all-underground transmission circuit or a circuit

comprised of both underground and overhead sections. These conditions arise because an underground cable in a predominantly overhead transmission system has the electrical characteristics of a giant capacitor in series with a giant reactor. Moreover, because a cable is designed to transfer high currents while generating minimal heat, the conductor is large and has very low resistance. The cable and the transmission system to which it connects can therefore simplistically be modeled electrically as a tuned inductive – capacitive circuit with little resistance or damping. Therefore, whenever it is energized or de-energized, high voltages can occur. *Companies' Ex. 1* (Application, Vol. 1, p. H-8).

230. Steady State Voltage Issues. Upon the loss of an adjacent transmission line or generating unit, power flows on an underground cable could change dramatically, increasing by a factor of 3 to 5 or greater, or decreasing to extremely low levels approaching zero. Because shunt reactors at the cable terminals cannot be connected or disconnected instantaneously to compensate for the change in power flow on the cable, system voltages in proximity to the cable could increase or decrease to unacceptable levels, until the fault is isolated from the electrical system. *Companies' Ex. 1* (Application, Vol. 1, p. H-9).

231. Underground lines, particularly HPFF cables, have significantly more capacitance than overhead lines. *Companies' Ex. 44*, Response to CSC-01, Q-CSC-028.

232. Operability and reliability limitations must be considered in evaluating the amount of underground cable that can be added to the Connecticut system as part of the Project. The level of capacitance on Connecticut's existing transmission system, although it is almost all overhead, is already significantly higher than it has been in the past and is higher than that of other utilities in the region. Connecticut's high capacitance transmission system is a result of historical changes (i.e., generation retirements, generation shutdowns, and load growth) that began in the 1990s, which led to the state's current status as an importer of electricity. *Companies' Ex. 44*, Response to CSC-01, Q-CSC-028).

233. In considering cable configurations, system engineers must consider the magnification of harmonics, which are predominately generated by customer loads and upon energization of transformers. Cable capacitive charging is not only at 60 Hertz, but also at harmonic frequencies, and shunt reactors do not provide reactive compensation for the harmonic charging capacitance as they do at 60-Hertz charges. When the overall system characteristics resonate at a 3rd, 4th, or 5th harmonic frequency, any harmonic distortion may be amplified and transmitted throughout the system. Of predominant concern is the third harmonic, which is associated with transformer exciting currents and non-linear loads. The amplified voltage distortions propagate down to the customer level, and may have a detrimental effect on equipment and processes. IEEE Standards for sources of harmonic currents on the system could be exceeded if not appropriately addressed. *Companies' Ex. 1* (Application, Vol. 1, p. H-9; *Companies' Ex. 44*, Response to CSC-01, Q-CSC-028).

11.0 <u>Alternative Transmission Routes and Facilities Locations</u>

11.1 Introduction

234. The Companies identified and evaluated both alternative routes for the transmission facilities and alternative sites for new switching and substation facilities. These analyses led to the Companies' selection of the proposed route and station facilities as the best configuration for the Project. *Companies' Ex. 1* (Application, Vol. 1, pp. ES-4 to ES-6, H-1, H-9 to H-10, H-18 to H-25 (Tables H-1 through H-4), H-26 to H-27, H-43; Vol. 6, "Singer Substation Site Selection Study'); *Companies' Ex. 64 (*Sound Evaluation for Revised Site and Location); *Companies' Ex. 188* (Singer Substation Relocation from Site 1 to Site 8 as Proposed to Accommodate PSEG Power); *Companies' Ex. 65*, Response to CSC-01, Q-CSC-029-SP01 (Middletown to Norwalk 345-kV Transmission Line Project Route 15 Corridor Study, April 2004); *Companies' Ex. 66* (Railroad Corridor PowerPoint Presentation, April 26, 2004); *Companies' Ex. 86* (Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center, May 19, 2004); *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 12–19 and errata, June 1, 2004); *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, East Shore Route); *Companies' Ex. 152* (Updated "Homework Assignment" Regarding Proposed Route and East Shore Routes Comparison at the Hearing on June 3, 2004 and Corrected Page to the East Shore Presentation Made at the Hearing on June 2, 2004, September 20, 2004).

11.1.1 Alternatives Analysis: Transmission Routes

235. To identify and investigate potential overhead and underground routes for the transmission facilities that would meet Project objectives, the Companies and their consultants used an iterative process, whereby a variety of potential alternatives for the location of the transmission facilities were identified and then evaluated based on: operability and reliability considerations; technical feasibility; property impacts; environmental impacts; and cost. *Companies' Ex. 1* (Application, Vol. 1, pp. H-1, H-9 to H-10); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, pp. 4-5); *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 10-11).

236. The alternatives identification and evaluation process was performed by the Companies' engineering and environmental/land planning staff, assisted by specialized engineering and environmental consultants. The Companies' engineering consultant, Burns & McDonnell Engineering Inc., conducted the principal routing analyses. In addition, Power Delivery Consultants, Inc. ("PDC")

evaluated underground cable types used at 345-kV and assisted in identifying and evaluating underground routes for potential cable systems. ESS Group, Inc. ("ESS"), an environmental consulting firm, reviewed the environmental feasibility of marine routes for portions of the Project. Soil Science and Environmental Service, Inc. ("SSES") and Raber Associates ("Raber") conducted biological studies (wetlands, watercourses, soils, amphibians) and cultural resource analyses, respectively, for some of the alternatives. *Companies' Ex. 1* (Application, Vol. 1, pp. H-10, L-16, L-59; Vol. 3, Cultural Resources Assessment of Middletown–Norwalk 345-kV Transmission Project: Proposed Route with Supported Changes and Alternative Routes); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, pp. 4 to 5, 19); *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 2, 10-11); 6/1/04 Tr. at 10-17 (Prete).

237. The Companies identified and reviewed the following types of alternative routes for the 345-kV transmission line: use and/or expansion of existing transmission line ROWs; new ROW alternatives; railroad alternatives; highway alternatives; combination overhead and underground/marine route; combinations of use or expansion of existing overhead transmission line ROWs and underground cable along streets; and are all underground cable, either within existing transmission corridors or within road ROWs. *Companies' Ex. 1* (Application, Vol. 1, pp. H-10 to H-11); 6/1/04 Tr. at 10- 17 (Prete); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004); 6/1/04 Tr. at 11-22, 26-28 (Prete), 22-26, 28-44 (Bartosewicz).

238. The alternative routes that the Companies initially identified and evaluated are depicted on the Route Analysis Map. This map illustrates the 52 different route "links" (or segments), including overhead, underground, and undersea options, that were reviewed. *Companies' Ex. 1* (Application, Vol. 1, pp. H-11 to H-12; Appendix H.1, Route Analysis Map (Drawing No. RA-001, Sheets 1 & 2)); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004); 6/1/04 Tr. at 10- 22 (Prete).

239. Many of the alternative alignments initially identified were eliminated from detailed consideration because they were found to be unsuitable for transmission line development due to unacceptable engineering constraints or unacceptable levels of potential environmental, social, or economic impacts. For example, alignment of the 345-kV facilities along existing pipeline corridors was quickly determined to be infeasible because most of the existing pipeline ROWs in the Project region are too narrow to accommodate either underground or overhead transmission facilities and are not located near the required 345-kV interconnection points. Other alternatives were determined to be not viable after closer investigation of potential impacts or engineering considerations. *Companies' Ex. 1* (Application, Vol. 1, p. H-11); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004); 6/1/04 Tr. at 10- 22 (Prete).

240. The alternatives identified as potentially feasible then were analyzed in greater detail by conducting field reviews; evaluating aerial photography; and compiling and comparing data regarding features such as land uses, water resources, public facilities, existing ROW characteristics (e.g., width of roads and existing transmission line corridors), and terrain. Alternative routes were specifically analyzed and compared for each of the four segments that comprise the Project. *Companies' Ex. 1* (Application, Vol. 1, pp. H-11, H-18 to H-25 (Tables H-1 through H-4)); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004);

241. As a result of the Companies' analyses, in addition to the proposed route, two alternative routes (Alternative A and Alternative B) were identified as technically feasible. However, the Companies determined that either of these alternatives would cause greater impacts than the proposed route. *Companies' Ex. 1* (Application, Vol. 1, pp. ES-6, H-26); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, pp. 20-23); *Companies' Ex. 59* (Errata Pages for Testimony of Mango, April 20, 2004); 4/20/04 Tr. at pp. 13–14).

242. During the Council proceedings, the Companies conducted supplemental analyses of the alternative routes or route segments listed below. For the most part, these options were initially identified by the Companies, but subsequently eliminated from consideration as viable routes. They were reevaluated at the request of the Council or the municipalities involved in the Council's proceeding. *Companies' Ex. 1* (Application, Vol. 1, pp. H-11 to H-12; Appendix H.1, Route Analysis Map (Drawing No. RA-001, Sheets 1 & 2)); *Companies' Ex. 7,* Supplemental Filing, December 16, 2003, pp. 1-14; *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 3 and errata, June 1, 2004); *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 1-4, 8); *Companies' Ex. 65*, Response to CSC-01, Q-CSC-029-SP01 (Middletown to Norwalk 345-kV Transmission Line Project Route 15 Corridor Study, April 2004); *Companies' Ex. 66* (Railroad Corridor PowerPoint Presentation, April 26, 2004); *Companies' Ex. 86* (Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center, May 19, 2004); *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, East Shore Route); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004); *Companies' Ex. 152* (Updated "Homework Assignment" Regarding Proposed Route and East Shore Routes Comparison at the Hearing on June 3, 2004 and Corrected Page to the East Shore Presentation Made at the Hearing on June 2, 2004, September 20, 2004).

- Railroad route alternatives, which consisted of feasibility studies of alignments along the main Metro-North / Amtrak Railroad corridor between Bridgeport and Norwalk, as well as the Airline (formerly Conrail) and Amtrak railroad corridors in New Haven County. The two rail corridors in New Haven County were considered as alternatives for segments of the East Shore Route. 4/22/04 Tr. at 20–21 (Bartosewicz); *Companies' Ex. 66* (Railroad Corridor PowerPoint Presentation, April 26, 2004); 4/22/04 Tr. at 53 (Bartosewicz) *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 11, 16-20).

- Highway corridor routes, which would involve aligning the transmission line (either overhead or underground) along limited access highways in the region, including I-95, I-91, and State Route 15 (i.e., the Merritt Parkway / Wilbur Cross Parkway). Companies' *Ex. 65*, Response to CSC-01, Q-CSC-029-SP01, Middletown to Norwalk 345-kV Transmission Line Project Route 15 Corridor Study, April 2004; *Companies' Ex. 66* (Railroad Corridor PowerPoint Presentation, April 26, 2004); *Companies' Ex. 86* (Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center, May 19, 2004); 4/22/04 Tr. at 19 - 20 (Bartosewicz).

- Marine route between New Haven and East Devon, which was included in the analyses of options for the portion of the "East Shore" Route between the East Shore and East Devon substations. *Companies' Ex. 7* (Supplemental Filing, 12/16/03, pp. 10-11); *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 11, 20-22).

- The Northerly Route, which was suggested as an alternative to the use of the proposed ROW between Oxbow Junction and the Beseck Switching Station. *Companies' Ex. 7* (Supplemental Filing, December 16, 2003, pp. 8-10); *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 12-14).

- The Black Pond Alternative, which would involve the development of a new switching station at Black Pond Junction (Meriden), rather than at Beseck Junction (Wallingford). *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 3, 17-19).

- "East Shore" Routes, which encompass route alternatives (including the use of the existing 345-kV 387 Line) for a transmission line alignment between Beseck, UI's East Shore Substation in New Haven, and the proposed East Devon Substation in Milford. *Companies' Ex. 7* (Supplemental Filing, December 16, 2003, pp. 10-14); *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 1-2); *Companies' Ex. 152* (Updated "Homework Assignment" Regarding Proposed Route and East Shore Routes Comparison at the Hearing on June 3, 2004 and Corrected Page to the East Shore Presentation Made at the Hearing on June 2, 2004, September 20, 2004).

243. During the course of the Council proceeding, the CDOT also stated a preference for the location of the underground cable system to be outside of state road

ROWs. The Companies met with the CDOT and municipal representatives to determine if any agreements could be reached among the parties regarding route deviations off of Route 1. However, no agreements were reached. *DOT's Ex. 1* (Testimony of Gruhn, dated April 8, 2004); *DOT's Ex. 3* (Testimony of Gruhn, dated May 25, 2004 and June 16, 2004 update); 9/29/04 Tr. at 9-11 (Bartosewicz).

11.2 Alternative Transmission Line Routes Considered and Rejected

11.2.1 New Corridors

244. The development of the 345-kV transmission facilities, either overhead or underground, along an entirely new corridor is impractical, given the population density and development in SWCT. *Companies' Ex. 1* (Application, p. H-12).

245. A new overhead corridor for a 345-kV transmission line would require a minimum 120-foot-wide ROW, whereas a new cross-country (non-street) underground transmission cable would require a minimum 40-foot-wide ROW. Factors adding to the difficulty of developing a new corridor include steep slopes, wetlands, designated natural areas, and the high costs of acquiring a new easement. *Companies' Ex. 1* (Application, p. H-12).

11.2.2 Railroad Corridors

246. The railroad alternatives that the Companies reviewed for the 345-kV transmission line routing were the Metro-North / Amtrak railroad corridor between Bridgeport and Norwalk, as well as Airline Railroad (Conrail) and Amtrak corridors in New Haven County. *Companies' Ex.* 1 (Application, Vol. 1, pp. H-12 to H-13); *Companies' Ex. 4* (Municipal Consultation Filing, Assessment of the New York – New Haven Railroad Corridor between Bridgeport and Norwalk for a 345-kV Transmission Facility); *Companies' Ex. 90* (Testimony of Zaklukiewicz et al. Regarding East Shore Routes, pp. 11, 16-20); 4/22/04 Tr. at 27 (Prete); 6/1/04 Tr. at 26-28 (Prete); *Companies' Ex. 98* (Visual Presentation of Segment 1 and Segment 2, presented June 1, 2004).

247. Although multiple railroads traverse SWCT, many were found to be impractical for the location of the 345-kV line because there is insufficient space along the rail corridor to install transmission facilities or because they would not provide a direct route between Middletown and Norwalk. *Companies' Ex. 1* (Application, Vol. 1, p. H-12).

248. Installing the 345-kV transmission facilities along railroad ROWs would pose construction difficulties because work on rail ROWs is governed by the operating railroad, in accordance with criteria established by the Federal Railway Administration. Such criteria specify worker safety requirements (e.g., training, flagging), permitting, and the performance of activities within the confines of the railroad schedule and operations. 4/22/04 Tr. at 151-152 (Harris).

Metro-North / Amtrak Railroad Corridor

249. Only certain Metro-North /Amtrak rail corridors were considered as having the potential to accommodate the co-location of the 345-kV facilities. In particular, the Companies closely investigated the potential for aligning the 345-kV line along the New York – New Haven Metro-North / Amtrak corridor between Bridgeport and Norwalk. Other portions of the rail corridor (i.e., between New Haven and Bridgeport) were not considered potentially viable because the corridor traverses highly urbanized portions of New Haven. *Companies' Ex. 1* (Application, Vol. 1, pp. H-12 to H-13); *Companies' Ex. 4* (Municipal Consultation Filing, Assessment of the New York – New Haven Railroad Corridor between Bridgeport and Norwalk for a 345-kV Transmission Facility); 4/20/04 Tr. at 20 (Bartosewicz); 4/22/04 Tr. at 27-41 (Prete); *Companies' Ex. 66* (Railroad Corridor PowerPoint Presentation by John Prete, April 26, 2004); 4/21/04 Tr. at 20 (Bartosewicz).

250. Along the Metro-North / Amtrak alternative route, the Companies' investigated whether the 345-kV transmission line could be aligned along the railroad corridor from the proposed Singer Substation in Bridgeport to Rowayton Junction in Norwalk. From Rowayton Junction, the alternative route would turn north to the Norwalk Substation, following an existing CL&P 115-kV ROW. *Companies' Ex. 1* (Application, Vol. 1, p. H-13).

251. CL&P and UI presently operate two 115-kV lines that were built either parallel to or on top of the catenary structures along this Metro-North / Amtrak corridor. The existing 115-kV lines along the railroad tie into five UI bulk substations (Devon Tie, Ash Creek, Barnum, Baird, and Pequonnock); each of these substations feeds a municipality and, as such, are critical. Homes and businesses closely abut the railroad, leaving no space to expand the ROW without having to acquire and remove buildings. *Companies' Ex. 1* (Application, Vol. 1, p. H-13); *Companies' Ex. 4* (Municipal Consultation Filing, Assessment of the New York – New Haven Railroad Corridor between Bridgeport and Norwalk for a 345-kV Transmission Facility); 4/22/04 Tr. at 27-30 (Prete); *Companies' Ex. 66* (Railroad Corridor PowerPoint Presentation by John Prete, April 26, 2004).

252. The Companies assessed whether one of the existing 115-kV overhead lines along the Metro-North / Amtrak railroad corridor could be replaced by the new 345-kV line. The Companies assessed whether the 115-kV line that would have to be removed could be rebuilt underground. However, this alternative was determined to be infeasible because it would decrease the reliability of the system, result in significant impacts (displacement of up to 113 homes and businesses in order to expand the ROW), and pose impractical construction conditions (e.g., existing transmission line support structures could not be rebuilt from the existing single to a double-circuit configuration because the catenaries could not withstand the mechanical loads of the new larger structures and conductors). Other constraints

to the use of this railroad ROW include potential conflicts with the railroad feeder wire clearances; the need to install overhead structures outside of railroad catenary abutments, creating further land use issues; and the need for structures with typical heights of about 120 feet (about 30 feet taller than the existing 115-kV lines). *Companies' Ex. 1* (Application, Vol. 1, p. H-13); 4/22/04 Tr. at 29-38, 48 (Prete); *Companies' Ex. 66* (Railroad Corridor PowerPoint Presentation by John Prete, April 26, 2004).

253. In addition, aligning the 345-kV transmission facilities along the Metro-North / Amtrak corridor poses concerns with respect to the impacts of electromagnetic fields on the railroad signaling system; extensive studies would have to be performed of this issue. Further, none of the existing catenary structures or foundations along the rail line could be used for the 345-kV. 4/22/04 Tr. at 49-53 (Zaklukiewicz).

254. If the 345-kV line were aligned overhead along the Metro-North / Amtrak corridor, for clearance reasons, the supporting arms of the monopole structures would likely have to face toward the railroad tracks or the conductors would overhang the tracks. In a vertical monopole configuration, a minimum of 25 feet clearance from the railroad track would be required. Short span lengths (e.g., in the 400-foot-range) would be necessary to minimize the amount of conductor movement and blow out. Maintaining such clearances creates conflicts with about 100 buildings. 4/22/04 Tr. at 54-55 (Zaklukiewicz) and at 55-56 (Prete).

255. Based on the Companies' previous experience in constructing the 115-kV Pequonnock / Ely line (including constructability issues and the constrained schedule allowed by the railroad for work), the cost for installing an overhead line along the railroad would be approximately three times greater than the cost of a normal overhead transmission line, or about the same as an underground line. Further, the construction schedule would be significantly extended due to the work hour constraints imposed by the railroad. 4/22/04 Tr. at 140-141 (Prete), 141-142 (Zaklukiewicz).

256. Underground cable system installation along the Metro-North / Amtrak railroad corridor also was determined to be infeasible for similar reasons, and because of the construction methods that would be needed to prevent undermining the railroad catenaries and the existing transmission structures. *Companies' Ex. 1* (Application, Vol. 1, p. H-13) ; 4/22/04 Tr. at 30-31(Prete); *Companies' Ex. 66* (Railroad Corridor PowerPoint Presentation by John Prete, April 26, 2004).

257. Bridgeport opposes an overhead route along the railroad ROW through the city. *Bridgeport's Ex. 1* (City of Bridgeport's Comments dated May 25, 2004); 6/03/04 Tr. at 112 (Nidoh).

258. Given the significant amount of adjacent development, the narrow railroad ROW, and the presence of the existing 115-kV transmission lines, no available space

remains for a new 345-kV transmission line along the Metro-North / Amtrak corridor. As a result, the Metro-North / Amtrak railroad route between Bridgeport and Norwalk was eliminated from further consideration as an alternative. *Companies' Ex. 1* (Application, Vol. 1, pp. H-13 to H-14); 4/22/04 Tr. at 29-39, 41 (Prete); *Companies' Ex. 66* (Railroad Corridor PowerPoint Presentation by John Prete, April 26, 2004).

Airline (Conrail) and Amtrak Railroad Corridors: New Haven County

259. As part of the East Shore Route Alternatives, the Companies also investigated the feasibility of aligning the 345-kV line along two railroad corridors in New Haven County: the Airline Railroad (formerly owned by Conrail) and the Amtrak corridor. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 11, 16-20).

260. The Companies reviewed and dismissed the Airline and Amtrak corridors during the initial alternatives evaluations for the Project. Both corridors extend through urbanized areas of greater New Haven, where existing developed land uses would pose severe constraints to the alignment of the 345-kV transmission line. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 11, 16-20); 4/22/04 Tr. at 133-135 (Welter and Prete).

261. During the April 2004 Council hearings, the Council requested additional reviews of this rail corridor, as well as of the Airline Railroad corridor. (Refer to Section 10.2.7, East Shore Routes, of this Findings of Fact for further discussion of these rail options). Companies' *Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 11, 16-20); 4/22/04 Tr. at 135 (Prete); 6/1/04 Tr. at 26-28 (Prete); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

11.2.3 Highway Corridor

262. The Companies evaluated various highway corridors to determine if portions of the Project could be constructed (either overhead or underground) within or adjacent to such corridors. In addition to U.S. Route 1 (within which the Companies propose to locate the underground portion of the Project), the principal highway corridors investigated are Interstate 95 ("I-95") from New Haven to Norwalk, Interstate 91 ("I-91") from Meriden to New Haven, U.S. Route 7 in Norwalk, and State Route 15 (Wilbur Cross / Merritt parkways ["CT-15"] between Meriden and Norwalk. Potential underground routes along and in the vicinity of U.S. Route 1 between New Haven and Norwalk also were reviewed. *Companies' Ex. 1* (Application, Vol. 1, p. H-14; Appendix H.1, Route Analysis Map (Drawing No. RA-001, Sheets 1 & 2)); *Companies' Ex. 4* (Municipal Consultation Filing, Middletown to Norwalk 345-kV Transmission Line Project Highway Corridor Study); 6/1/04 Tr. at 15 (Prete); *Companies' Ex. 65*, Response to CSC-02, Q-CSC-029 –SP01 (Middletown to Norwalk 345-kV

Transmission Line Project Route 15 Corridor Study, April 2004); *Companies' Ex. 86* (Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

263. CDOT policy prohibits the construction of a new transmission line within and parallel to the ROW of any controlled access highway, including I-91, I-95, U.S. Route 7 and CT-15. CDOT's policy has been and continues to be that utilities may be located longitudinally at the highway ROW line, but not in the center or in the median of limited access highways, due to safety concerns. *Companies' Ex. 1* (Application, Vol. 1, p. H-15; *Companies' Ex. 7* (Attachment A to Supplemental Filing of 12/16/03, p. 1); 6/16/04 Tr. at 301 (Gruhn).

264. Notwithstanding CDOT's policy, to evaluate the feasibility of using these highway corridors for the proposed 345-kV transmission facilities, the Companies reviewed aerial photography, USGS topographic maps, and CDOT highway drawings, and conducted field reconnaissance. *Companies' Ex. 1* (Application, Vol. 1, p. H-15); *Companies' Ex. 4* (Municipal Consultation Filing, Middletown to Norwalk 345-kV Transmission Line Project Highway Corridor Study, p.1); *Companies' Ex. 65*, Response to CSC-02, Q-CSC-029 –SP01 (Middletown to Norwalk 345-kV Transmission Line Project Route 15 Corridor Study, April 2004); Companies' *Ex. 86* (Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

265. In general, the primary determinant of construction feasibility is adequate space for the transmission ROW (i.e., about 120 feet for an overhead 345-kV line and about 40 feet for an underground cable [including 15 feet for a permanent cable easement and an additional 25 feet for temporary easement to be used during construction and maintenance]). In addition, a transition station, occupying about 2 – 4 acres, would be required at locations where overhead and underground transmission configurations must be linked. Further, steep sideslopes, embankments, elevated portions of the highways, rock outcrops, and long water crossings or wetlands pose construction feasibility constraints. *Companies' Ex. 1* (Application, Vol. 1, p. H-14); *Companies' Ex. 4* (Municipal Consultation Filing, Middletown to Norwalk 345-kV Transmission Line Project Highway Corridor Study, p. 2-3); *Companies' Ex. 7* (Attachment A to Supplemental Filing of 12/16/03, p. 4); *Companies' Ex. 65*, Response to CSC-02, Q-CSC-029 –SP01 (Middletown to Norwalk 345-kV Transmission Line Project Route 15 Corridor Study, April 2004); *Ex. 86* (Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center).

266. Only limited areas along I-91, I-95, and U.S. Route 7 meet the requirements for either an underground or an overhead transmission ROW. The highways all pass through SWCT urban centers, where existing residential, commercial, or industrial land uses would constrain Project development. In addition, the

highways are elevated in various locations, either on support structures or steep-sloped earthen embankments; have narrow medians; and traverse areas of rock outcroppings or shallow depth to bedrock, which would make underground cable installation difficult and costly. *Companies' Ex. 1* (Application, Vol. 1, p. H-15); *Companies' Ex. 7* (Supplemental Filing of 12/16/03, pp. 2-3); *Companies' Ex. 4* (Municipal Consultation Filing, Middletown to Norwalk 345-kV Transmission Line Project Highway Corridor Study, p. 6); 4/22/04 Tr. at 22 (Bartosewicz); 4/22/04 Tr. at 25-26 (Hogan); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

267. Due to limited space for the installation of a transmission line ROW, the development of the Project along any of the limited access highway corridors would require the acquisition of homes and businesses. Along I-91 / I-95, approximately 100 structures would be affected, whereas along the Merritt Parkway, approximately 24 structures would be impacted. 4/22/04 Tr. at 54 (Bartosewicz).

268. No significant length of highway corridor was found that would provide a complete linear connection between the transmission substations and switching stations that must be interconnected to effectively tie SWCT into the 345-kV New England electric grid. Although there are sections of highway ROWs that could be used to construct either an overhead or underground line, these sections are short and discontinuous. Moreover, additional ROW would need to be acquired to connect these sections. *Companies' Ex. 1* (Application, Vol. 1, p. H-15); *Companies' Ex.* 7 (Attachment A to Supplemental Filing of 12/16/03, p. 3); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

11.2.4 I-91

269. The Companies assessed the feasibility of aligning the eastern portion of the 345-kV line along I-91 between Meriden and New Haven. These studies determined that there are only limited sections of potentially usable ROW along I-91. As a result, the alignment of the transmission line along I-91 is not a practical alternative. *Companies' Ex. 1* (Application, Vol. 1, Appendix H.1, Route Analysis Map (Drawing No. RA-001, Sheets 1 & 2)); *Companies' Ex. 7* (Attachment A to Supplemental Filing of 12/16/03, pp. 3, 4, 6); 4/22/04 Tr. at 22 (Bartosewicz); 4/22/04 Tr. at 25-26 (Hogan).

270. The portion of I-91 between Meriden and Wallingford could accommodate either overhead or underground transmission lines. However, south of Murdock Avenue (Meriden), homes adjacent to the highway corridor would have to be acquired. Further, routing the line west from Black Pond Junction to I-91, south along I-91, and then east to the Beseck Switching Station would require property acquisition for ROW. Accordingly, this section of I-91 is not a more practical option than

other routes that require no property or home acquisitions. *Companies' Ex. 7* (Attachment A to Supplemental Filing of 12/16/03, pp. 3, 4).

271. In Wallingford, existing land use developments and shallow depth to bedrock would make installation of the 345-kV transmission line (either overhead or underground) along I-91 impractical. Due to developments adjacent to the highway corridor, additional ROW acquisition would be required. Further, for overhead-to-underground transmission configurations, two sites (2-4 acres each) would have to be acquired for transition stations next to I-91. *Companies' Ex. 7* (Attachment A to Supplemental Filing of 12/16/03, p. 3).

272. In the North Haven and New Haven areas, the development of the 345-kV transmission facilities along I-91 is not feasible due to environmental features, urban land uses, and serious construction constraints (including steep sideslopes). Commercial/industrial facilities and large water/wetland complexes associated with the Quinnipiac River floodplain border I-91 from Route 5 south through North Haven. Additionally, two large cemeteries abut the east side of I-91, south of U.S. Route 5. *Companies' Ex. 7* (Attachment A to Supplemental Filing of 12/16/03, p. 4); 6/1/04 Tr. at 18-19 (Prete); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

273. In New Haven, I-91 is unsuitable for any type of transmission facility as the highway is elevated in many places, the area is congested and there are residential developments. *Companies' Ex. 7* (Attachment A to Supplemental Filing of 12/16/03, p. 4); 6/1/04 Tr. at 19-20 (Prete); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

11.2.5 I-95

274. The Companies evaluated the feasibility of aligning the 345-kV line along the portion of I-95 between New Haven and Norwalk. *Companies' Ex. 1* (Application, Vol. 1, Appendix H.1, Route Analysis Map (Drawing No. RA-001, Sheets 1 & 2)); *Companies' Ex. 7* (Attachment A to Supplemental Filing, 12/16/03, pp. 1, 4-5); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

275. Like I-91, I-95 does not provide a viable alternative route for the 345-kV line because only limited sections of the highway corridor could potentially accommodate the transmission ROW (either overhead or underground). *Companies' Ex. 7* (Attachment A to Supplemental Filing of 12/16/03, p. 5); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

276. Specifically, I-95 traverses through the center of cities and towns where very congested residential and commercial developments abut the highway. In addition, the I-95 corridor has physical limitations that would make the

development of a transmission line impractical. These limitations include elevated sections of highway, steep sideslopes, rock outcrops or areas of shallow depth to bedrock, and abutting water/wetlands. *Companies' Ex. 7* (Attachment A to Supplemental Filing of 12/16/03, p. 5); 6/1/04 Tr. at 20-21 (Prete); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

11.2.6 CT-15

277. The Companies investigated both the Merritt Parkway and the Wilbur Cross Parkway (i.e., State Route 15) as part of the CT-15 Route option. *Companies' Ex. 1* (Application, p. H-14); *Companies' Ex. 65*, Response to CSC-01, Q-CSC-029-SPO1, Middletown to Norwalk 345-kV Transmission Line Project Route 15 Corridor Study, April 2004, p. 1); ; *Companies' Ex. 86* (Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center, May 19, 2004); 6/1/04 Tr. at 22-26 (Bartosewicz); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

278. The Merritt Parkway is a 37.5-mile highway that extends from the New York State line to the Housatonic River. The Merritt Parkway is unique in that it is listed on the National Register of Historic Places and is also designated as a National Scenic Byway by the U.S. Department of Transportation, Federal Highway Administration. *Companies' Ex. 4* (Municipal Consultation Filing, Middletown to Norwalk 345-kV Transmission Line Project Highway Corridor Study, p. 6); *Companies' Ex. 65*, Response to CSC-01, Q-CSC-029-SPO1 (Middletown to Norwalk 345-kV Line Project Route 15 Corridor Study," April 2004, p. 4); 4/22/04 Tr. at 57-58 (Hogan).

279. The Merritt Parkway is not a viable route alternative due to its national historic significance, as well as engineering and environmental constraints. The median of the Parkway is very narrow (typically about 20-24 feet wide) and is vegetated. The location of the transmission line within the median, even if not limited by land availability, would pose construction and maintenance hazards. The Companies evaluated whether the transmission line could be installed adjacent to the paved travel lanes, within the Parkway's 300-foot-wide ROW. However, construction of an overhead transmission line along the Merritt Parkway would result in an adverse visual impact on both the highway and its historic bridges that could not be mitigated. Approximately 125 acres of trees would have to be cleared. Similar adverse visual impacts would result from the vegetation removal that would be required for underground transmission cable construction. Further, the bridges (approximately 24) would pose engineering constraints for underground cable installation along the parkway. *Companies' Ex. 1* (Application, Vol. 1, p. H-14); *Companies' Ex. 65*, Response to CSC-01, Q-CSC-029-SPO1 (*Middletown to Norwalk 345-kV Line Project Route 15 Corridor Study*, April 2004, pp. 8, 10); 4/22/04 Tr. at 59, 63 (Hogan), at 60-62 (Zaklukiewicz), and at 83, 94 (Welter).

280. The Wilbur Cross Parkway was constructed in the 1940s as an extension of the Merritt Parkway. Like the Merritt, the Wilbur Cross Parkway has a 300-foot-wide ROW. The median of the Parkway is generally less than 20 feet wide. The Parkway begins at the Housatonic River (Sikorsky Bridge) in Milford and extends northeast approximately 29 miles to Meriden. This parkway generally has a narrower median, traverses more urbanized areas, and has fewer vegetative buffers than the Merritt Parkway. *Companies' Ex. 65*, Response to CSC-01, Q-CSC-029-SPO1 (Middletown to Norwalk 345-kV Line Project Route 15 Corridor Study, April 2004, p. 4); 4/22/04 Tr. at 63-64 (Hogan) and at 82-93 (Welter).

281. The use of the Wilbur Cross Parkway corridor for the 345-kV transmission line is infeasible for a variety of factors. The parkway has a very narrow vegetated median, which is not sufficiently wide enough to accommodate a transmission line. Additionally, the highway is constructed through various severe rock cuts, including the West Rock Tunnel and a large rock cut south of the tunnel in New Haven and Woodbridge. Various commercial and residential uses also abut the parkway. Other constraints include steep terrain, steep sideslopes, the Quinnipiac River, Quinnipiac River State Park, and raised roadbeds. *Companies' Ex. 7* (Attachment A to Supplemental Filing of 12/16/03, p. 6); *Companies' Ex. 65*, Response to CSC-01, Q-CSC-029-SPO1 (Middletown to Norwalk 345-kV Line Project Route 15 Corridor Study, April 2004, pp. 1); 4/22/04 Tr. at 65-67 (Hogan); 6/1/04 Tr. at 22-24 (Bartosewicz); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004).

282. The installation of an overhead 345-kV line along the Wilbur Cross Parkway, even if possible, would require clearing about 180 acres of trees within the CDOT ROW. Approximately 520 residences, 138 commercial/industrial buildings, and seven outbuildings are adjacent to the parkway, and are separated from the roadway by trees that would have to be cleared for the transmission line ROW. Approximately 16 businesses and eight residences would have to be acquired and removed. *Companies' Ex. 7* (Attachment A to Supplemental Filing of 12/16/03; *Companies' Ex. 65*, Response to CSC-01, Q-CSC-029-SPO1 (Middletown to Norwalk 345-kV Line Project Route 15 Corridor Study, April 2004, pp. 4, 6); 6/1/04 Tr. at 23 (Bartosewicz).

283. Because the parkway is not close to the Scovill Rock Switching Station or Oxbow Junction, about 10.5 and 9 miles of transmission ROW, respectively, would be required to reach these locations. 6/1/04 Tr. at 22 (Bartosewicz).

284. At the Council's request, the Companies and their engineering consultant, Burns & McDonald, reviewed the West Rock Tunnel and a large rock cut south of the tunnel on the Wilbur Cross Parkway to determine if the transmission line could be installed in this area. Initial evaluations determined that this portion of the parkway was not practical due to the steep terrain, adjacent commercial/residential uses, the presences of West Ridge State Park on the ridge

that would have to be crossed, and the high visibility of the transmission line. *Companies' Ex. 86*, "Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center," p. 1).

285. The Companies subsequently conducted a more detailed review of potential 345-kV overhead routes and designs through the West Rock tunnel and rock cut areas. One route investigated would cross the parkway near the north tunnel entrance, proceed over the ridge at the lowest point (crossing the hiking trail in the state park), and descend over the CDOT maintenance yard. The conductors would cross over the maintenance building. The route then would cross the parkway over the on/off ramp on the northwest side and then follow the side entrance to the Amity Shopping Center. The route would continue west from the back of the shopping center, ascending a hill (deviating from the parkway ROW) and then would rejoin the parkway ROW. 6/1/04 Tr. at 25-26 (Bartosewicz); *Companies' Ex. 86*, "Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center" , p. 2).

286. Building the 345-kV line around the tunnel would involve several different line designs. To the east of West Rock Ridge, vertical monopoles (typically 130 feet high), on a 120-foot-wide ROW would be required to avoid clearance violations to the homes and businesses adjacent to the parkway. Assuming the use of part of CDOT's ROW, approximately 75 feet of clearing would be required. To cross West Rock Ridge, compact delta structures, which are shorter and therefore less visible, would be used. These structures would range in height from 85 to 130 feet, but would require a wider ROW (approximately 135 feet). After crossing over the ridge, vertical monopoles (typical height of 150 feet) on a compressed 80-foot wide ROW would be used due to the limited available space for ROW near the Amity Shopping Center. 6/1/04 Tr. at 25 (Bartosewicz); *Companies' Ex. 86* (Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center, pp. 1-2).

287. In the West Rock Tunnel and rock cut area, about 8.8 acres of trees would have to be cleared, mostly within West Rock Ridge State Park and south of the shopping center. The Companies would have to acquire about 10.5 acres of new ROW; approximately 7.5 acres within the West Rock Ridge State Park and the CDOT maintenance yard, as well as about 3 acres of near the shopping center. The transmission line crossing of the wooded ridge would be highly visible on both sides of the tunnel. The ridge's hiking trail would be crossed by the Project as it traverses the ridge. *Companies' Ex. 86*, "Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center," p. 3).

288. The Companies' additional studies confirmed that construction of the 345-kV line in the West Rock Tunnel / rock cut area would be difficult and could result in significant impacts to the businesses, residents, and the traveling public, as well as adverse effects to West Rock State Park and the CDOT maintenance area.

Companies' Ex. 86 (Supplemental Review of Crossing the West Rock Tunnel and Rock Cut by Amity Shopping Center, p. 3).

11.2.7 Marine Route

289. As part of the initial Project planning and alternatives evaluations, the Companies conducted reviews of the feasibility of a marine routing for the 345-kV transmission line, generally between Millstone and Norwalk. Factors involved in these initial examinations included federal and state legislation pertaining to the coastal zone and water quality; Connecticut policies regarding the protection of Long Island Sound; engineering / cable design considerations; and environmental resources (e.g., shellfish beds, coastal features). 4/22/04 Tr. at 102-106, 120-121, 123 (Mango).

290. Because of the availability of existing, upland ROWs to follow between Middletown and East Devon, a marine route for the eastern portion of the Project was eliminated from consideration due to significant environmental and engineering constraints. 4/22/04 Tr. at 105-106 (Mango).

291. The Companies subsequently commissioned ESS to study the feasibility of routing a marine cable between Bridgeport (Singer Substation) and Norwalk. This alternative, which would be about 23 miles long (compared to a 15-mile upland route), was evaluated as an option to the installation of a new transmission line through the densely developed urban areas in the western portion of the Project area. It would involve about a 15.4 mile marine cable installation through Long Island Sound between Bridgeport and Norwalk, as well as about 7.6 miles of upland cable installation between the marine landfalls and the two substations. *Companies' Ex. 1* (Application, Vol., 1, pp. H-15 to H-16); Appendix H.1, Route Analysis Map (Drawing No. RA-001, Sheets 1 & 2)); *Companies' Ex. 4 (Municipal Consultation Filing,* Middletown-Norwalk 345-kV Transmission Line Submarine Routing Study); 4/22/04 Tr. at 71 (Bartosewicz), 101-106 (Mango); 4/22/04 Tr. at 107-110 (Kleiman).

292. As part of the East Shore Routes analyses the Companies' commissioned ESS to re-assess the feasibility of a marine cable route between New Haven Harbor and East Devon. *Companies' Ex. 95a*, ("Middletown – Norwalk Project: New Haven Harbor to East Devon Marine Route Review," May 2004).

293. Both marine studies reflect ESS' established knowledge base regarding Long Island Sound, as well as the consideration of published information and personal communications with key agency environmental managers regarding land use and natural resources in the coastal areas. Information regarding marine resources in Long Island Sound that was developed as a result of studies from other projects also was considered. *Companies' Ex. 1* (Application, Vol. 1, p. H-16); 4/22/04 Tr. at 101-104 (Mango).

294. Due to the substantial distance between interconnection points and other installation and operational constraints, the only currently available technology for a 345-kV marine transmission line would be self-contained fluid-filled ("SCFF") cable, which would consist of six cables, each approximately 8 inches in diameter with a 1-inch-diameter interior core containing dielectric fluid. To minimize the potential for interference with shipping and fishing activities and damage to the cable system, the cables would have to be buried 10-15 feet deep in most areas, and a corridor of 90 to 200 feet wide would be required. The Companies recognize that SCFF technology is not preferred by Connecticut resource agencies due to the potential for leaks of dielectric fluid. Companies' Ex. 1 (Application, Vol. 1, p. H-17); 4/22/04 Tr. at 104 to 105 (Mango); 4/22/04 Tr. at 108 (Kleiman); 4/22/04 Tr. at 114-117 (Zaklukiewicz).

295. Given the State of Connecticut's objectives for protecting Long Island Sound's resources, a marine cable alignment for the Project would pose regulatory, environmental, and engineering challenges. Any potential route in Long Island Sound would raise significant environmental and regulatory concerns with respect to compliance with federal and state laws, including the federal Clean Water and Coastal Zone Management acts, the Connecticut Coastal Management Act, and other laws governing the protection of water, marine, and coastal resources so long as upland options for the Project are available (i.e., the Project is not "water dependent"). Potential impacts to shellfish beds and other marine resources also would be of concern. Any potential marine route from Bridgeport to Norwalk would have to traverse shellfish lease areas. *Companies' Ex. 1* (Application, Vol. 1, pp. H-16 to H-17); *Companies' Ex. 4* (Bulk Filing, "Middletown-Norwalk 345-kV Transmission Line Submarine Routing Study"); 4/22/04 Tr. at 104-105, 118-119 (Mango), 117 (Kleiman); *Companies' Ex. 95* (Letter from Anne Bartosewicz and John J. Prete to Pamela B. Katz Regarding the Federal Navigation Channel, dated May 28, 2004); *Companies' Ex. 95a* ("Middletown – Norwalk Project: New Haven Harbor to East Devon Marine Route Review," May 2004); State of Connecticut, DOA, Bureau of Aquaculture Comment Letter dated May 24, 2004).

296. To link a marine transmission cable to the rest of the 345-kV line, upland routing through densely developed upland urban areas would be required to reach substations. *Companies' Ex. 1* (Application, Vol. 1, p. H-17).

11.2.8 Northerly Route

297. The "Northerly Route" was originally suggested by the Town of Durham as an alternative to the use of the proposed ROW between Oxbow Junction and the proposed Beseck Switching Station. This alternative, which would cross portions of Middletown, Middlefield, Meriden, and Wallingford, would be aligned along existing CL&P ROWs. It would traverse west from Chestnut Junction, through Hans Brook Junction, to Black Pond Junction, and then would extend south, pass by East Meriden Substation, then to Beseck. *Companies' Ex. 7* (Supplemental Filing, 12/16/03, pp. 8-10); *Companies' Ex. 90* (Testimony of Zaklukiewicz et

al., May 25, 2004, p. 12); *Companies' Ex. 102* (Visual Presentation of a Northerly Route, presented June 2, 2004); 6/1/04 Tr. at 228-230 (Zaklukiewicz) and at 230-232 (Bartosewicz); 6/2/04 Tr. at 23-27 (Bartosewicz).

298. Between Chestnut Junction and Black Pond Junction, the existing ROW contains three 345-kV lines (the 387, 362, and 348 lines). From Hans Brook Junction to Chestnut Junction, a 115-kV line is also located on this ROW. The Northerly Route would require the addition of a fourth 345-kV line along these ROWs. *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 12); *Companies' Ex. 102* (Visual Presentation of a Northerly Route, presented June 2, 2004).

299. Between Black Pond Junction and Beseck, the Northerly Route would follow the same existing ROW as the proposed route, which is presently occupied by one 345-kV line (the 387 Line). However, for the Northerly Route, three additional 345-kV lines would be added to the ROW, which would place four 345-kV lines on a common ROW. *Companies' Ex.* 90 (Testimony of Zaklukiewicz et al., May 25, 2004, p. 12); *Companies' Ex.* 102 (Visual Presentation of a Northerly Route, presented June 2, 2004).

300. The Companies conducted a comparative analysis of the Northerly Route and the portion of the proposed route that it would replace (i.e., the proposed route between Oxbow Junction and the Beseck Switching Station). These analyses demonstrated that the Northerly Route would pose system reliability issues, construction issues, and environmental and social impacts. *Companies' Ex. 7,* pp. 8-10; *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 14); *Companies' Ex. 102* (Visual Presentation of a Northerly Route, presented June 2, 2004).

301. The location of four 345-kV circuits along common ROWs, as would be required for the Northerly Route, poses reliability concerns should contingencies arise. *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 12); *Companies' Ex. 25,* Response to D-W-01, Q-D-W-002; 6/2/04 Tr. at 26 -27 (Bartosewicz); *Companies' Ex. 102* (Visual Presentation of a Northerly Route, presented June 2, 2004).

302. The NPCC code cautions against locating many 345-kV lines within the same ROW. Additionally, the transmission lines between Chestnut Junction and Black Pond Junction connect eastern and western Connecticut. This connection would be broken if the ROW between Chestnut Junction and Black Pond Junction were lost. As such, the Companies would have get power from New York to service SWCT. 6/1/04 Tr. at 31-32 (Zaklukiewicz); 6/2/04 Tr. at 26; *Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004); *Companies' Ex. 25,* Response to D-W-01, Q-D-W-002; *Companies' Ex. 102* (Visual Presentation of a Northerly Route, presented June 2, 2004).

303. Further, the Northerly Route (Configuration A) would be 50% longer than the portion of the proposed route that it would replace and, depending on structure configurations (e.g., trade-offs between shorter structures on a wider ROW vs. taller structures on the existing ROW), could require the expansion of the existing ROW by up to 80 feet; up to 47 acres of ROW clearing; and the acquisition of up to eight homes. *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 14-15, and errata, June 1, 2004); *Companies' Ex. 25*, Response to D-W-01, Q-D-W-002; *Companies' Ex. 102* (Visual Presentation of a Northerly Route, presented June 2, 2004).

304. Notwithstanding the operability issues that would be posed by the Northerly Route, the Companies investigated three possible structure design configurations for installing the Project along this alternative. These were:

- Configuration A: Install new 345-kV structures to match height of existing 345-kV lines, requiring expansion of the existing ROWs by 80 feet. New easements, totaling about 75 acres, would have to be acquired.

- Configuration B: Install the new 345-kV line in a vertical configuration, using steel monopoles typically 130 feet tall. This would require a 40-foot-wide expansion in the ROW between Chestnut Junction and Black Pond Junction and a 35-foot-wide expansion of the ROW between Black Pond Junction and Beseck. New easements, totaling about 38 acres, would have to be acquired.

- Configuration C: Completely reconstruct existing structures to allow the installation of the new 345-kV facilities without ROW expansion. The existing H-frame structures would be replaced with steel monopoles with a typical height of 130 feet. However, the reconstruction would require long-term outages, which would compromise the reliability of the electric system. *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 15-16 and errata, June 1, 2004); 6/1/04 Tr. at 31-32 (Bartosewicz); 6/2/04 Tr. at 23 (Zaklukiewicz).

305. The proposed route is preferable to any configuration of the Northerly Route, based on reliability issues, potential environmental and social impacts, property impacts, and increased cost. *Companies' Ex.* 90 (Testimony of Zaklukiewicz et al., May 25, 2004, p. 17 and errata, June 1, 2004).

306. The Towns of Middlefield, Durham, and Middlefield agreed that the portion of the Northerly Route west of Dooley Pond in Middletown should not be used for the installation of a fourth 345-kV overhead line. *Town of Middlefield's Response to June 4, 2004 Siting Council Homework Assignment Regarding Preferred Routes*, dated July 16, 2004. Absent such a fourth line, the Northerly Route does

not provide as strong a source at Beseck Switching Station as does the proposed route.

11.2.9 Black Pond

307. During the April 2004 hearings, the Council asked the Companies to investigate whether a new switching station could be developed at Black Pond Junction (in Meriden) rather than at Beseck, as proposed. The Companies subsequently provided additional information concerning the Black Pond Alternative. *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 3); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation, presented June 1, 2004)[2]; 6/2/04 Tr. at 30-39 (Zaklukiewicz); *Companies' Ex. 103* (345-kV Transmission Line Diagrams (3) Explaining Black Pond Substation Alternative vs. Beseck Substation, presented June 2, 2004).

308. Within the Middletown area, which meets the requirements for a "strong source" of power to serve SWCT, both Black Pond Junction and Beseck are electrically equivalent. However, the Companies selected Beseck as the site for a new switching station because: (1) to reach Black Pond Junction, the new 345-kV line would have to be aligned along the Northerly Route Alternative, which is not preferred; (2) land for a new switching station at Black Pond Junction would have to be acquired (whereas the Beseck site will be located on about 5.4 acres of a 52-acre site owned by CL&P); (3) the terrain at Black Pond Junction would require extensive earthwork to accommodate a switching station and the land around the site is zoned for rural residential use (whereas Beseck is zoned for industrial use); and (4) Black Pond Junction borders the Cockaponset Forest and is in proximity to Mt. Higby (a trap rock ridge and recreational area). *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 18-19); 6/1/04 Tr. at 228-230, 241-243 (Zaklukiewicz); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation, presented June 1, 2004); 6/2/04 Tr. at 30-39 (Zaklukiewicz).

309. Beseck was selected for the switching station, rather than Black Pond Junction, because it better meets the Companies' site selection criteria, including feeds from three strong electrical sources, minimizing the need to acquire private lands for the Project and utilizing sites zoned for industrial use. *Companies' Ex. 90* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 19); 6/1/04 Tr. at 234-235 (Zaklukiewicz); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation, presented June 1, 2004); 6/2/04 Tr. at 30-39 (Zaklukiewicz).

---

[2] The East Shore and Black Pond presentation was actually provided on June 2, 2004, not June 1.

11.2.10 East Shore Route

11.2.10.1 Introduction and Summary

310. The term "East Shore Route" refers to any route configuration that would connect the following three terminal points: (1) the strong source at the proposed Beseck Switching Station; (2) a new termination facility (either a substation or a switching station containing overhead-to-underground transition facilities) adjacent to the East Shore Substation in New Haven; and (3) the proposed East Devon Substation in Milford. The existing East Shore Substation is the end point for an existing 345-kV line (i.e., the 387 Line) that extends from Scovill Rock Switching Station, through Black Pond Junction (Meridan), East Wallingford Junction (Wallingford), and Totoket Junction (Branford). *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 1-2); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation, presented June 1, 2004); 6/2/04 Tr. at 7-14 (Bartosewicz) and at 14-23 (Prete).

311. The Companies evaluated a number of potential routes and transmission configurations to connect these three terminal points. However, none would meet the statutory criteria for an alternative route to be considered by the Council (i.e., technical feasibility, environmental impact, and reasonable cost). Specifically, none of the East Shore routes would provide acceptable operability and reliability; none would result in fewer social or environmental impacts than the proposed route; and all would cost from approximately $125 - $350 million more than the proposed route. As a result, the Companies did not propose any such configurations for inclusion in the Project. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 2-3); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation, presented June 1, 2004); *Companies' Ex. 104* (Comparative Analysis of the Proposed and East Shore Routes, dated June 3, 2004); *Companies' Ex. 152* (Updated "Homework Assignment" Presented by Applicants Regarding the Proposed Route and East Shore Routes Comparison, dated September 20, 2004).

East Shore Alternatives Analysis History: The 387 Line "One Line" Option

312. During the initial Project planning, the Companies considered incorporating the existing 387 Line between Beseck and the East Shore Substation into the 345-kV loop as a means of minimizing the amount of new construction required for the Project. However, the Companies' studies determined that this option would not substantially reduce new 345-kV construction because, in order to meet national and regional reliability standards, a second 345-kV line would have to be constructed on separate structures along the 387 Line ROW. Further, in order to connect East Shore to East Devon, between 5.8 and 13 miles (depending on overhead vs. underground configurations) of three sets of underground cable would have to be installed, traversing the densely populated New Haven

metropolitan area. As a result of these factors, an "East Shore" route following the 387 Line was rejected. *Companies' Ex. 1* (Application, Vol. 1, p. G-18; *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 3-4).

313. During the municipal consultation process for the Project, the Mayor of Wallingford requested that the Companies Reanalyze the use of the 387 Line as part of the 345-kV loop. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 4).

314. Accordingly, the Companies took a "second look" at the 387 Line, specifically to determine whether the East Shore Substation could be reconfigured so as to increase the thermal rating of the 387 Line. Assuming the reconfiguration of the East Shore Substation, the Companies then commissioned PowerGEM (an electrical consulting firm) to conduct a series of thermal load flow studies to assess whether an East Shore route that incorporated the existing 387 Line (rather than the construction of a second, new 345-kV line) would satisfy national and regional reliability standards. PowerGem performed eight separate thermal load flow studies of the East Shore Route. *Companies' Ex 155,* Testimony of Zaklukiewicz et al., September 24, 2004, pp. 2-5); *Companies' Ex. 7* (Supplemental Filing, pp. 10-14); *Companies' Ex. 14* (Addendum # 1 to Supplemental Filing); *Companies' Ex. 18* (Addendum #2 to Supplemental Filing); *Companies' Ex. 21* (Addendum # 3 to Supplemental Filing); *Companies' Ex. 94,* Response to D-W-01, D-W-016-SP01; *Companies' Ex. 131* (Addendum #4 to Supplemental Filing); *Companies' Ex. 105a*, Response to D-W-01, Q-D-W-16-SP02 (Southwest Connecticut Transmission Expansion East Shore to Norwalk 345 kV East Shore to East Devon All Underground Alternative, PowerGEM, dated April 14, 2004). In addition, ISO-New England's SWCT Working Group evaluated the results of the PowerGEM studies. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 4-7).

315. The studies performed by PowerGEM and the ISO-NE SWCT Working Group confirmed the Companies' original determination that any East Shore Route using the existing 387 Line (even if reconductored) would not satisfy national and regional reliability criteria since a new source would not be extended into SWCT. As a result, the loss of the 387 Line would cause post-contingency overloads elsewhere on the transmission system. *Companies' Ex. 21* (Addendum #3 to December 16, 2003 Supplemental Filing, dated February 23, 2004); *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 7); *Companies' Ex. 155* (Testimony of Zaklukiewicz et al., September 24, 2004, pp. 2-5); 6/2/04 Tr. at 8 (Bartosewicz); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation, presented June 1, 2004).

11.2.10.2 East Shore Alternatives Analysis History: New 345-kV Facilities

316. Once it was determined that national and regional reliability criteria could not be satisfied by using the 387 Line alone, the Companies conducted further evaluations, at the request of the Council, of potential "East Shore" routes for the installation of a new 345-kV transmission line between Beseck and East Devon. These evaluations consisted of further analyses of some alternative routes that the Companies had initially considered but subsequently dismissed based on operational, cost, or environmental impacts. In addition, the Council specifically requested analyses of several other route options, such as the Amtrak and Airline Railroad corridors. *Companies' Ex. 1* (Application, Vol. 1, pp. H-11 to H-26; Appendix H.1, Route Analysis Map (Drawing No. RA-001, Sheets 1 & 2); Drawing No. RA-001, Sheets 1 & 2); *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 8); *Companies' Ex.* 101 (Visual Presentation on the East Shore Route and Black Pond Substation); 6/2/04 Tr. at 7-23 (Bartosewicz and Prete).

317. All of the "East Shore" routes investigated would involve not only the installation of the 345-kV line, but also the construction of a new termination facility – either a substation or a switching station – adjacent to UI's East Shore Substation. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 9); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation); 6/2/04 Tr. at 7 – 23 (Bartosewicz and Prete).

Beseck – to – East Shore Subsection Segments

318. The Companies evaluated various potential route options between Beseck and the East Shore Substation, as well as between the East Shore Substation and East Devon. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 10); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation).

319. Three primary route options were examined for the Beseck to East Shore Substation segment. For the northern portion of each of these segments (i.e., from Beseck to East Wallingford Junction, the Companies also investigated an overhead route and an underground route. For this segment, the overhead route would follow the proposed route along the 387 Line ROW, whereas the underground route would be within road ROWs or within a portion of the 387 Line ROW. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 16, 18-19); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation).

320. The three route options considered between Beseck and East Shore Substation are:

- 387 Transmission Line Route. This route option would involve the construction of the new 345-kV line along CL&P's existing 387 Line ROW (which also includes a 115-kV line) between Beseck and Totoket Junction. At Totoket Junction, the route would follow the UI portion of the same 345-kV / 115-kV ROW west to the East Shore Substation. Both overhead and underground options were investigated for the portion of the alternative between Beseck and East Wallingford Junction. The route would cross portions of the municipalities of Wallingford, North Haven, North Branford, East Haven, Branford, and New Haven.

- Airline Railroad Route. This route option would align a portion of the 345-kV line along the railroad corridor formerly owned by Conrail and referred to as the "Airline Railroad." The option would extend from Beseck to East Wallingford Junction following the same alignment as the "387 Line" route (i.e., 387 Line ROW overhead or underground configuration within streets from Beseck to Williams Street and then underground along the 387 Line ROW). About 1 mile south of East Wallingford Junction, the alternative route would diverge from the 387 Line ROW to follow the Airline Railroad ROW from Wallingford south through North Haven, East Haven, and New Haven. In New Haven, the route would diverge from the Airline Railroad to follow an Amtrak rail line to its intersection with the 387 Line ROW. The route then would follow the 387 Line ROW to the East Shore Substation. The route would cross portions of the municipalities of Wallingford, North Haven, East Haven, Branford, and New Haven.

- Amtrak Railroad Route. This route alternative would involve an alignment along the Amtrak Railroad, which is located parallel to, but west of, the Airline Railroad, generally in the vicinity of U.S. Route 5. From Beseck, the 345-kV line would follow the proposed route west to an intersection with the railroad. This option would diverge from the proposed route to follow the Amtrak corridor from Wallingford south through North Haven and Hamden to New Haven and then east, into East Haven. The southern portion of this option would follow the same railroad ROW as described for the Airline Railroad Route, and would follow the 387 Line ROW into the East Shore Substation. An underground option for the northern portion of the Amtrak route also was investigated; this option would involve the installation of underground 345-kV cable within local streets and U.S. Route 5 between Beseck and a new transition station near the Wallingford/New Haven border. The route would cross portions of the municipalities of Wallingford, North Haven, East Haven, Branford, and New Haven. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 11, 13-14, 16, 18-19); 6/1/04 Tr. at 8-14 (Bartosewicz) and at 14-21 (Prete); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation, presented June 1, 2004).

321. Each of these three options for the Beseck to East Shore Substation portion of the East Shore Route is characterized by factors (e.g., adjacent development, environmental issues, need to acquire homes and business) that would pose significant constraints to the location of the 345-kV transmission line. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 10-20; 6/2/04 Tr. at 8-14 (Bartosewicz) and at 14-21 (Prete), and at 204-205 (Mango); *Companies' Ex. 98* (Visual Presentation on Segment 1 and Segment 2, presented June 1, 2004); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation, presented June 1, 2004); *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 11, 16-20); 4/22/04 Tr. at 133-135 (Welter and Prete).

322. Specifically, all three Beseck to East Shore Substation routes are unsuitable for the 345-kV facilities because they pass through areas that are densely developed, would require the acquisition and removal of homes and businesses, or would involve additional environmental effects (e.g., vegetation clearing). For example, the 387 Line Route would require approximately 150 acres of vegetation clearing and there are 226 homes within 150 feet of the ROW. Likewise, the Airline Railroad segment would involve potentially 265 acres of clearing and the acquisition of nine homes and six commercial or industrial buildings. In addition, there are about 260 homes within 150 feet of the Airline rail corridor. The Amtrak Railroad route would potentially affect the Quinnipiac River floodplain and associated wetlands and would involve the acquisition of six homes and 50 businesses; in addition, 237 homes are within 150 of the route. 6/2/04 Tr. at 10-14 (Bartosewicz), 208 (Mango); *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 10-11, 18, 20); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation, presented June 1, 2004); 6/2/04 Tr. at 14 (Bartosewicz), 15-20 (Prete).

323. Alignment of the 345-kV transmission line along the Amtrak or Airline railroads would not be practical, due to the substantial social and environmental impacts that would result (i.e,. need to acquire ROW, take homes and businesses to accommodate the ROW, placement of the line through tidal wetlands along the Quinnipiac River). *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 14, 27-28); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation, presented June 1, 2004).

324. In North Haven, the Amtrak line is surrounded by businesses and residential areas. There are 237 houses within 150 feet of the Amtrak line and 18 sensitive locations as defined by the Connecticut legislature. 6/2/04 Tr. at 15-16, 18-19.

325. UI's existing overhead 115-kV lines along the Amtrak railroad corridor would have to be removed and placed underground to accommodate the Project's new 345-kV line because both lines cannot fit in the corridor due to clearance

requirements. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 20).

326. The Amtrak Railroad is aligned next to the Quinnipiac River floodplain for most of its length. Additionally, wetlands, including the Quinnipiac River Marsh Wildlife Area are next to the Amtrak corridor. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 14).

327. Along the Airline Railroad Route, 260 houses would be within 150 feet of the 345-kV line and 18 statutory facilities (as set forth in P.A. 04-246) would be within 1,200 feet of the 345-kV line. 6/2/04 Tr. at 18-19 (Prete); *Companies' Ex. 152* (Updated "Homework Assignment" re: Proposed Route and East Shore Routes Comparison at the Hearing on June 3, 2004 and Corrected Page to the East Shore Presentation Made at the Hearing on June 2, 2004, dated September 20, 2004).

East Shore – to- East Devon Substation Segment

328. For the East Shore Substation-to-East Devon Substation portion of the "East Shore" Route, both upland and marine routes were examined. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 11); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation, presented June 1, 2004.

329. The Companies commissioned ESS to review marine transmission cable routes that would extend from East Shore Substation, into New Haven Harbor and Long Island Sound, and then to East Devon Substation either via an alignment up the Housatonic River or via an alignment that would parallel the Iroquois Gas Transmission System pipeline ROW to a landfall at Silver Sands State Park in Milford. From the park, the route would be aligned underground along local streets to the East Devon Substation. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 11, 20-21).

330. ESS's analyses demonstrated that any submarine alignment between the East Shore and East Devon substations would result in significant environmental impacts, compared to upland option. For example, the submarine routes investigated would be 21 to 25 miles long; traverse Federal Navigation Channels; impact between 2.6 and 5 miles of shellfish lease areas; and affect a variety of other coastal resources and uses. Further, the Project is not "water dependent." A marine route aligned up the Housatonic River to reach East Devon Substation would affect seed oyster beds in the river. Given the potential substantial environmental impacts and additional costs, the need for a marine route between East Shore and East Devon cannot be justified. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 21-22); 4/22/04 Tr. at 117-119 (Mango); *Companies' Ex. 95* (Letter from Anne Bartosewicz and John J. Prete to Pamela B. Katz Regarding the Federal Navigation Channel, dated May 28, 2004);

Companies' Ex. 95a ("Middletown – Norwalk Project: New Haven Harbor to East Devon Marine Route Review," May 2004); State of Connecticut, DOA, Bureau of Aquaculture Comment Letter dated May 24, 2004).

331. Between the East Shore and East Devon substations, the Companies identified and reviewed the following potential upland routes for the transmission facilities:

- Underground options along road ROWs were U.S. Route 1 George Street / State Route 34 and Sargent Drive / State Route 162.

- A combined underground / overhead option that would involve an underground alignment through New Haven (via George Street / State Route 34) to the existing CL&P 115-kV ROW near Maltby Lakes on the West Haven / Orange border. Adjacent to the CL&P ROW, a transition station would have to be constructed on 2-8 acres of land owned by the South Central Connecticut Regional Water Authority. From this transition station, the route would be aligned overhead (following the proposed route) to East Devon. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 11-13, 22-27); 6/2/04 Tr. at 21 (Prete); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation); *Companies' Ex. 155* (Testimony of Zaklukiewicz et al., September 24, 2004, pp.8-10); *Companies' Ex. 152* (Updated "Homework Assignment" re: Proposed Route and East Shore Routes Comparison at the Hearing on June 3, 2004 and Corrected Page to the East Shore Presentation Made at the Hearing on June 2, 2004, dated September 20, 2004).

332. All of these alignments would require a crossing of New Haven Harbor or crossings of the Quinnipiac and Mill rivers. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 23); *Companies' Ex. 101* (Visual Presentation on the East Shore Route and Black Pond Substation).

333. The underground routes would vary in length from 16 miles to 12.7 miles, whereas the combined underground / overhead route would be about 14 miles. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, pp. 24 - 27).

East Shore Route Summary

334. None of the potential East Shore Routes is "environmentally, technically, and economically practical" so as to merit consideration by the Council as an alternative route. The proposed route, the East Shore options would be significantly more expensive and have environmental and/or social impacts comparable to or greater than the proposed route. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 28).

335. Further, large amounts of underground construction would be required between East Shore and East Devon substations. Such additional undergrounding has

reliability and operability disadvantages that make it technically impractical. *Companies' Ex. 91* (Testimony of Zaklukiewicz et al., May 25, 2004, p. 28); *Companies' Ex. 152* (Updated "Homework Assignment" Regarding Proposed Route and East Shore Routes Comparison).

11.3 Transmission Line Route Alternatives Deemed Technically, Environmentally, and Economically Feasible: Alternatives A and B

336. As a result of the alternatives evaluation process, the Companies identified two potentially feasible alternatives to the proposed route, Alternative A and Alternative B. Both of these alternatives would have overhead and underground components. The overhead components would be along or adjacent to existing CL&P 115-kV ROWs, whereas the underground portions would be in public streets. Although neither represents the Companies' preferred option from an overall perspective, Alternative A or Alternative B could be constructed. However, both alternatives have less underground cable and more environmental impacts than the Proposed Route. *Companies' Ex. 1* (Application, Vol. 1, pp. ES-5 to ES-6, H-28, I-28 to I-57); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, pp. 17-18).

337. The ROC Group evaluated Alternative A as "Case 2," and found this option, along with the Companies' proposed route, to be a configuration that it could "stand behind." The ROC Group noted that compared to the proposed route, Alternative A would be less difficult to construct and operate and would have less risk. Companies' Ex. 176 (Reliability and Operability Committee (ROC) Report dated December 20, 2004, p. 2).

338. For both Alternative A and Alternative B, the Companies reviewed the option of installing an underground transmission cable along the existing ROWs, where underground easements would be acquired. However, various terrain (e.g., rock) and environmental features (e.g., wetlands) resulted in the elimination of this as a feasible option. 4/20/04 Tr. at 47-48 (Zaklukiewicz).

11.3.1 Alternative A

339. Alternative A would involve the installation of the 345-kV facilities using a combination of overhead and underground configurations. The overall route length of Alternative A would be approximately 73 miles, consisting of 60 miles of overhead facilities and 13 miles of underground facilities and would require approximately 61.6 acres of expanded ROW. *Companies' Ex. 1* (Application, Vol. 1, pp. H-28, H-34); *Companies' Ex. 59* (Errata Pages for Changes Read into the Record by Applicants' Witnesses during Hearing on April 20, 2004) pp. ES-6, H-41.

340. Alternate Route A is the same as the Proposed Route from Scovill Rock Switching Station in Middletown to the Singer Substation in Bridgeport. However, from Singer Substation to Norwalk Substation, Alternative A would involve the installation of the 345-kV facilities underground in roadways between Singer Substation and UI's existing Hawthorne Substation (in Fairfield). From Hawthorne Substation to Norwalk Substation, Alternative A would be constructed overhead along CL&P's existing transmission corridors. *Companies' Ex. 1* (Application, Vol. 1, pp. H-28, H-29, H-34 (Figure H-3)).

341. To accommodate the 345-kV line, the existing ROW between Hawthorne Substation and Norwalk Junction would have to be expanded by approximately 45 feet. Approximately 2-4 acres of land adjacent to Hawthorne Substation would have to be purchased to construct a transition station to accommodate the change from underground to overhead facilities. *Companies' Ex. 1* (Application, Vol. 1, p. H-30); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, p. 18).

342. Between Singer Substation and Hawthorne Substation (approximately 5.5 miles), Alternative A would be aligned underground within public roads (primarily State Route 59), through urbanized portions of Bridgeport and Fairfield. Primary land uses in this area include extensive residential areas and commercial developments, as well as Mt. Grove Cemetery, Brooklawn Country Club, and the Fairchild Wheeler Golf Course. The route would traverse the Rooster River, Horse Tavern Brook, and London Brook. The underground portion of the alternative would terminate at the Hawthorne Substation, which is located adjacent to General Electric Company (GE) property, just south of the Merritt Parkway. *Companies' Ex. 1* (Application, Vol. 1, p. H-29); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, p. 18).

343. To accommodate the transition station that would have to be built adjacent to the Hawthorne Substation, land would have to be acquired from or adjacent to GE. All of the available land in the vicinity is privately-owned and forested; a residential subdivision borders the Hawthorne Substation to the east and south, while GE property abuts the station to the north and west. *Companies' Ex. 1* (Application, Vol. 1, pp. H-29 to H-30); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, p. 18).

344. From Hawthorne Substation west to Norwalk Junction, Alternative A would be built overhead, following CL&P's existing 115-kV ROW for approximately 10.5 miles through Fairfield, Easton, Weston, and Wilton. *Companies' Ex. 1* (Application, Vol. 1, p. H-30); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, p. 18).

345. At Norwalk Junction, Alternative A would turn south, following another existing CL&P ROW for 3.6 miles to the Norwalk Substation. This existing corridor generally parallels U.S. Route 7 and the Metro-North Railroad's Norwalk-to-Danbury line. In this area, land use patterns consist of commercial/industrial uses

along U.S. Route 7 and residential areas. *Companies' Ex. 1* (Application, Vol. 1, p. H-30); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, p. 19).

346. Compared to the proposed route, Alternative A would result in:

- Overhead crossings of 49 more wetlands and watercourses, including four wetlands with high potential and five wetlands with moderate potential for productive amphibian habitat.
- Acquisition of 62 acres of privately-owned land for the expanded ROW and approximately 2-4 acres of privately-owned land for the Hawthorne Transition Station.
- Clearing of approximately 62 more acres of predominantly forested areas, assuming that the existing vegetation on virtually the entire expanded ROW would have to be cleared.
- Substantially longer alignment through residential areas and 15 more miles of overhead transmission line.

Companies' Ex. 1 (Application, Vol. 1, p. H-33); *Companies' Ex. 59* (Errata Pages for Changes Read into the Record during Hearing on April 20, 2004); *Companies' Ex.* 53 (Testimony of Mango, April 8, 2004, pp. 19 -20); 4/20/04 Tr. at 201-202, 206-210, 212-213 (Mango).

347. The construction of the 345-kV line along Alternative A would present challenges for avoiding outages on the existing 115-kV lines and continuing to serve load reliably. In order to maintain reliable service, the existing 115 kV lines would probably need to be rebuilt first underground or with wrap-arounds in place (i.e., temporary lines and line reconfigurations that would be capable of electrically serving the existing substations during construction), prior to construction of the 345-kV line; the Companies estimate the cost for the 115-kV undergrounding at $61 million. *Companies' Ex. 1* (Application, Vol. 1, p. H-42, I-30); 4/20/04 Tr. at 196-200, 202 (Zaklukiewicz).

11.3.2 Alternative B

348. Alternative B would involve the installation of most of the Project in an overhead configuration, primarily following existing overhead transmission line corridors. The only portion of Alternative B that would be underground would be in the vicinity of the Singer Substation in Bridgeport, where dense urban development precludes an overhead configuration. The overall route length of Alternative B would be approximately 74 miles, consisting of 72 miles of overhead facilities and 2 miles of underground facilities, and would require expansion of existing ROWs by approximately 121.8 acres. *Companies' Ex. 1* (Application, Vol. 1, p.

H-34, H-40 (Figure H-4)); *Companies' Ex. 59* (Errata Pages for Changes Read into the Record during Hearing on April 20, 2004, pp. ES-6, H-41).

349. The eastern portion of Alternative B (Scovill Rock to the East Devon Substation) would be the same as the proposed route, whereas the western portion of the alternative (between Hawthorne Substation and Norwalk Substation) would be the same as described for Alternative A. The nine municipalities along Alternative B (between East Devon and Norwalk substations) are Milford, Stratford, Bridgeport, Trumbull, Fairfield, Easton, Weston, Wilton, and Norwalk. *Companies' Ex. 1* (Application, Vol. 1, p. H-35, H-40 (Figure H-4)); *Companies' Ex. 53* (Testimony of Mango, April 8, 2004, p. 21).

350. From East Devon, Alternative B would be aligned overhead, traversing west along an existing 115-kV transmission line ROW to Trumbull Junction. At Trumbull Junction, Alternative B would turn south along another transmission line ROW to the existing Seaview Transition Station (Bridgeport). From Seaview to Singer Substation, the 345-kV line would be installed underground. Two 345-kV lines would be required to make a loop between Trumbull Junction and Singer Substation. The 345-kV line would then continue in an overhead configuration from Trumbull Junction to Hawthorne Substation; west of the Hawthorne Substation, Alternative B follows the same route as described for Alternative A. *Companies' Ex. 1* (Application, Vol. 1, pp. H-35 to H-36, H-40 (Figure H-4)).

351. Although Alternative B would follow existing transmission line ROWs between the East Devon and Norwalk substations, much of the existing easements ROW would need to be expanded to accommodate the 345-kV transmission line:

- Between the East Devon Substation and Trumbull Junction, the existing ROW easements would have to be expanded by approximately 15 feet.

- Between the Bridgeport/Stratford border and Seaview Transition Station, the existing ROW easements would have to be expanded by approximately 115 feet.

- Between Trumbull Junction and Norwalk Junction, the existing ROW easements would have to be expanded by approximately 45 feet. Companies' Ex. *1* (Application, Vol. 1, p. H-35).

352. To expand the existing transmission line ROWs to accommodate Alternative B, approximately 29 homes and businesses would have to be acquired in Milford, Stratford, Trumbull, Bridgeport and Fairfield. *Companies' Ex. 1* (Application, Vol. 1, p. H-35); *Companies' Ex. 59,* (Errata Pages for Changes Read into the Record during Hearing on April 20, 2004, pp. ES-6, H-41 (errata)); *Companies' Ex. 53, 59,* (Errata Pages for Changes Read into the Record during Hearing on April 20, 2004, p. 22-23); *Companies' Ex. 15,* Response to D-W-01, Q-D-W-031-SP01

353. Compared to the proposed route, Alternative B would result in:

- Construction and operation of approximately 6 more miles of transmission line.
- Potential acquisition of 29 homes and businesses for ROW expansion.
- Acquisition of about 122 acres of privately-owned land for the expanded ROW.
- Clearing of approximately 122 acres of predominantly forested areas, assuming that the existing vegetation on virtually all of the expanded ROW would have to be cleared.
- Substantially longer alignment through residential areas.
- Overhead crossings of 85 more wetlands and watercourses, including four wetlands with high potential and seven wetlands with moderate potential for productive amphibian habitat.
- Additional impacts to waterbirds and other coastal/estuarine-dependent wildlife species resulting from the overhead crossing of the Housatonic River.
- Minor benefits to shrubland birds and other wildlife species dependent on shrublands, but significantly greater adverse impacts to wildlife in general. *Companies' Ex. 1* (Application, Vol. 1, pp. H-39 to H-40).

Companies' Ex. 1 (Application, Vol. 1, pp. H-39 to H-40); 4/20/04 Tr. at 206-207 (Mango).

11.3.3 Route Selection

354. The proposed route is superior to either Alternative A or Alternative B. This is because:

- *Property Impacts/Acquisition of Homes and Commercial Buildings*: The proposed route will not require the acquisition of any homes or commercial structures, while Alternative B would require the acquisition of approximately 29 homes and commercial buildings in Bridgeport, Trumbull, Fairfield and Stratford.
- *ROW Expansion:* Between the East Devon and Norwalk substations, the proposed route and the alternatives have markedly different ROW requirements. The proposed route will be constructed underground primarily within road ROWs and will require only a minimal amount of easements. In

contrast, Alternatives A and B would follow existing transmission line ROWs, which would have to be expanded through densely developed areas (requiring new easements on approximately 62 acres for Alternative A and 122 acres for Alternative B).

- *Environmental Impacts*: Alternatives A and B both would result in comparatively greater environmental impacts than the proposed route, largely due to the need to acquire and clear vegetation along substantial areas of the expanded 115-kV ROWs. Further, both Alternative A and Alternative B would be longer that the proposed route, resulting in greater environmental disturbance overall.

- *Engineering/Construction Issues:* The proposed route can be developed with very few outages on existing circuits in SWCT during the construction period. Outages, which complicate the construction process, would be required if the 345-kV line were installed along either Alternative A or Alternative B route.

- *Route Length:* Compared to Alternatives A and B, the proposed route will minimize the length of the new 345-kV line by providing a more direct route between the East Devon, Singer, and Norwalk substations.

- *Capital Cost*: When the Companies initially identified the proposed route, they estimated that Alternative A and Alternative B would both cost more than the proposed route. Although underground construction is usually much more expensive than overhead construction, in this case the comparison was more favorable because of a shorter route length and the fact that the proposed route will not require either the taking of any homes and commercial structures or significant ROW expansion (thereby avoiding such real estate acquisition costs) *Companies' Ex. 1* Application, Vol. 1, pp. ES-5 to ES-6. However, because of a required change in underground cable technology from HPFF to cross linked polyethylene (XLPE) cable and other changes in the estimate of the cost of underground construction, the Companies now expect that the cost of the proposed route will be greater than that of both Alternative A and Alternative B, as follows:

Summary of Cost Estimates
Millions of 2004 Dollars

MN Project Cost Summary	Proposed Route (24 Miles UG; 45 Miles OH)	Alternative A (13 Miles UG; 60 Miles OH)	Alternative B (4 Miles UG; 72 Miles OH)
TOTAL	837 to 993	811 to 947	754 to 864

Companies' Ex. 172 (Testimony of Bartosewicz et al., December 28, 2004, pp. 2-3 & Appendix A).

- Reliability: From a strict engineering perspective, both Alternative A and Alternative B would be preferable to the proposed route, because they would be more reliable than the proposed route. *Companies' Ex. 181,* Response to OCC-03, Q-OCC-017-RV01.

- P.A. 04-246: During the pendency of this proceeding, the General Assembly enacted Public Act 04-246, which, as applied to this project, had the effect of requiring the Companies to use underground construction to the maximum extent technologically feasible.

- *Applicants' Balance:* The Companies continue to prefer the proposed route, as revised by the substitution of XLPE for HPFF cable, notwithstanding its greater cost and lesser reliability, as compared to Alternatives A and B, because the proposed route is sufficiently reliable to qualify as "technologically feasible," and therefore to allow compliance with P.A.04-24; and because the revised proposed route, like the original proposed route, has fewer social and environmental impacts than Alternatives A and B. 1/3/05 Tr. at 205 (Zaklukiewicz and Prete).

11.4 Other Route Modifications Considered During the Siting Proceedings

11.4.1 Royal Oak Bypass

355. In the Application, the Companies proposed to install the new 345-kV line on the existing 125-foot-wide-ROW adjacent to the Royal Oak subdivision in cross section 2 in Durham. During the course of the Council's proceedings, the Companies evaluated the Royal Oak Bypass as a potential route modification for this portion of cross section 2. *Companies' Ex. 1* (Application, Vol. 10, Typical Cross Sections, Drawing XS-110, Figure 2); *Companies' Ex. 175,* Response to CSC-03, Q-CSC-070; 6/2/04 Tr. at 27-28 (Bartosewicz).

356. This route modification would involve the alignment of the 345-kV overhead transmission line along a new 1.1-mile, 125-foot-wide easement to bypass the use of the 0.8-mile portion of the existing 125-foot-wide 115-kV (Line 1975) ROW that presently crosses the Royal Oak Subdivision in Durham / Middlefield, along the Oxbow Junction to Beseck section of the proposed route. If the 345-kV line were moved to the new ROW, the existing 115-kV lines could remain on the existing ROW. *Companies' Ex. 175*, Response to CSC-03, Q-CSC-070; 1/19/05 Tr. at 115-118 (Bartosewicz); *Companies' Ex. 1* (Application, Vol. 9, Segment Maps 6 and 7, Aerial Photographs – 400 Scale); 6/2/04 Tr. at 225–228 (Bartosewicz).