

**STATE OF VERMONT
PUBLIC SERVICE BOARD**

Docket No. 6252

Petition of Vermont Electric Power Company, Inc. for a)
certificate of public good to install a Flexible AC)
Transmission System (FACTS) device and reconfigure)
certain components at its Essex substation located in)
the Town of Williston, Vermont, for the purpose of)
reinforcing the transmission system)

Hearing at
Montpelier, Vermont
September 17, 1999

Order Entered: 10/7/99

PRESENT: Peter B. Meyer, Hearing Officer

APPEARANCES: William B. Piper, Esq.
Primmer & Piper, PC
for Vermont Electric Power Company, Inc.

Geoffrey Commons, Esq.
for Vermont Department of Public Service

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for City of Burlington Electric Department

Arthur R. Hogan, Jr., Executive Director
for Chittenden County Regional Planning Commission

N. Jonathan Peress, Esq.¹
For Vermont Agency of Natural Resources

I. INTRODUCTION

This case concerns a petition filed by Vermont Electric Power Company, Inc. ("VELCO") on June 30, 1999, requesting a certificate of public good pursuant to 30 V.S.A. § 248 to install a Flexible Alternating Current Transmission System ("FACTS") device and reconfigure certain components at VELCO's Essex substation located in the Town of Williston, Vermont. VELCO's original petition in this matter was filed pursuant to

1. Notice of appearance not filed and did not attend hearing.

30 V.S.A. § 248(j). On July 7, 1999, the Public Service Board ("Board") informed VELCO that it had determined that the proposed project does not qualify for the review procedures outlined in 30 V.S.A. § 248(j), and requested that VELCO modify its petition to eliminate reference to the 248(j) process. In accordance with the Board's request, VELCO filed an amended petition on July 13, 1999, pursuant to 30 V.S.A. § 248.

Notice of the filing and public hearing was published in the Burlington Free Press on August 12 and August 19, 1999. A public hearing was held on August 31, 1999, at 7:00 p.m. at the Chittenden County Regional Planning Commission conference room, with a site visit preceding at 4:00 p.m.

Notice of the technical hearing was sent by certified mail on September 1, 1999, to all parties specified in 30 V.S.A. § 248 and all other interested parties. The technical hearing was held as scheduled on September 17, 1999, at the Public Service Board Hearing Room, Third Floor, Chittenden Bank Building, 112 State Street, Montpelier, Vermont.

No party has opposed the project.

II. FINDINGS OF FACT

Background

Based upon the substantial evidence of record and the testimony presented at the hearing, I hereby report the following findings to the Board in accordance with 30 V.S.A. § 8.

1. VELCO is a company as defined by Section 201 of Title 30, Vermont Statutes Annotated, and as such is subject to the Board's jurisdiction pursuant to Section 203 of Title 30. Petition at 1.

2. VELCO owns and operates most of the high voltage electric transmission facilities in the State of Vermont, including the transmission system that serves northwestern Vermont. Id.

3. Over the past several years, Vermont's summer peak load and summer energy consumption, particularly in the Chittenden County area of northwestern Vermont, have grown substantially. Petition at 1; Smith pf. at 4.

4. Consistent with New England Power Pool ("NEPOOL") operating practices, VELCO operates the transmission system so that loss of any one of the four 115 kV lines that supports the Chittenden County area (first contingency) can be sustained without collapse of the system. Currently, local generation, including the McNeil Generating Station ("McNeil"), gas turbines and diesel generators, are being dispatched as "must run" for reliability to cover possible contingency circumstances. Petition at 2; Smith pf. at 5.

5. Under today's substantial summer loading in the Chittenden County area, VELCO relies upon the Highgate Converter Station ("Highgate") being available most of the year, as well as McNeil operating more than 4300 hours, to maintain reliable system operation. If either of these resources is unavailable under heavy (75%-80% of peak) load situations, and in the event of the loss of a transmission line, the system's reliability cannot be guaranteed and voltage collapse could occur. Should such a scenario occur, there could be a widespread blackout in northwestern Vermont lasting up to six hours or more, with substantial economic losses ensuing. Smith pf. at 4.

6. VELCO studies show that, should the present rate of load growth be sustained over a period of five or more years, even with Highgate and McNeil in the power supply mix, the existing transmission system will be unable to provide reliable first contingency operation. Smith pf. at 7.

Project Description

7. In order to meet demand and to continue to provide safe, reliable and stable transmission service, VELCO seeks to obtain a certificate of public good ("CPG") under 30 V.S.A. § 248, authorizing it to proceed with the installation of a FACTS (Flexible AC Transmission System) device and reconfiguration of certain components of the existing Essex Substation. Petition at 2.

8. FACTS devices are a class of devices that utilize power electronics to inject reactive power into the system. These devices are capable of responding in fractions of a second. Essentially, these systems behave like capacitors that can be switched on-line in rapid response to transmission system disturbances. Their purpose is to provide voltage support under

contingency conditions, such as the sudden loss of a transmission line. Petition at 3; Smith pf. at 12.

9. VELCO analyzed two basic FACTS technologies: the SVC (Static Var Compensator) technology and the STATCOM (Static Compensator) technology. Smith pf. at 12.

10. The SVC is the generic terminology applied to a family of devices using thyristors to provide very rapid switching of shunt reactors or shunt capacitors. *Id.* at 24.

11. STATCOM technology uses a relatively small DC storage capacitor and force-commutated electronic switching to synthesize an output waveform that approximates the system sinusoidal voltage. By controlling the magnitude of the voltage, it is possible either to supply or absorb reactive power, as needed. The STATCOM utilizes a more recently developed, circa 1980's, variation on the thyristor, called the Gate Turnoff Thyristor ("GTO") or Insulated Gate Bipolar Transistors ("IGBTs"), to perform the switching. *Id.* at 25.

12. The advantages of STATCOM over the SVC include less harmonic impact as well as a smaller footprint size of system components. Smith supp. pf. at 3.

13. After an extensive bidding process and analysis, VELCO and its consultant, TESHMONT, determined to employ Mitsubishi's configuration, employing STATCOM technology. The DPS concurred with this choice. *Id.* at 2.

14. The STATCOM device will be installed at VELCO's existing Essex substation. The Essex substation is located in the Town of Williston, Vermont, just easterly of VT Route 2A, and southerly of the Winooski River. This substation is a critical installation for the power supply for northwest Vermont. It is a terminal for four 115 kV circuits that are part of the bulk power grid, one 115 kV radial supply circuit that supports a Burlington Electric Department source, two 115-34.5 kV stepdown transformers that are feeds to Green Mountain Power Corporation, and two 25 Mvar Capacitor banks that support the transmission voltage in the area. Harvey pf. at 2; VELCO exh. WFH-2 (existing substation one-line diagram); VELCO exh. WFH-3 (existing substation plan view).

15. The STATCOM device consists of standard substation components such as capacitor banks and, possibly, inductors (depending on technology), plus power electronics (thyristors)

used for switching. The components are connected and supported using standard substation practice. The electronics will be housed in a small building to provide a controlled environment. In addition to this, there will be a 115 kV transformer to step down the voltage to the level desired by the manufacturer, and a corresponding low voltage line connecting the transformer and the actual device. Smith pf. at 15-16; Harvey pf. at 6.

16. To improve the reliability and maintainability of the substation's circuits and equipment, and to provide a reliable point of connection to the FACTS, the existing radial bus at the Essex Substation will be reconfigured into a ring bus. When completed, the facility will accommodate the four 115 kV circuits and equipment and provide a connecting point for the FACTS, which will support the system during most load and contingency scenarios. The proposed bus configuration design is consistent with NEPOOL reliability standards, which have evolved since the original bus configuration was implemented in 1957. Smith pf. at 15-16; Harvey pf. at 3; VELCO exh. WFH-4 (revised one-line diagram with the revised configuration).

17. The existing substation consists of three 115 kV bays. Each typical 115 kV bay is 48 feet square with a tower at each corner, and with either one or two connecting trusses which add lateral rigidity, and which support switches or strain bus. The construction at the Essex Substation is referred to as lattice type. This consists of relatively light angle and channel shapes. These members are bolted together to form tower and truss assemblies that are very rigid, but do not have a massive appearance. Harvey pf. at 4; VELCO exh. WFH-5 Revised (plan view).

18. The proposed reconfiguration will add one bay to the southeast end and one bay each to the northeast and southwest sides, all within the existing substation area. Each new bay will be identical in size to the existing bays. The existing towers are 63 feet in height, as will be the new towers. Eight new circuit breakers will also be installed, replacing five existing breakers. Trusses are attached at the 45, 35, and 26 foot levels for supporting switches or strainbus. A new substation control building will also be constructed. Harvey pf. at 4; Smith pf. at 16; VELCO exh. WFH-6 Revised (elevation view).

19. VELCO has determined that it will be necessary to switch the relative positions of two of the four existing circuits, the Sandbar and East Avenue circuits, as they connect to the ring bus. This transition will, most likely, take place within the existing right-of-way. VELCO expects to complete detailed design and obtain regulatory approval, if necessary, by June, 2000, before the FACTS project is completed. Harvey supp. pf. at 2; VELCO exh. WFH-4 Revised.

20. The major items of equipment can be identified on the one-line diagram (exh. WFH-4 Revised). The eight circuit breakers in the ring will be new sulfur-hexafluoride (SF₆) breakers. Each breaker will have disconnect switches to permit de-energization for testing and maintenance, and each circuit or other component has a disconnecting switch to allow that node to be isolated from the bus and to permit the subsequent reclosing of the ring. Where necessary, there are lightning arresters, voltage transformers, grounding switches and other equipment. The circuit breakers, disconnect switches, and other current carrying components of the ringbus will be upgraded from 1200 amperes to 2000 amperes, which is required for this configuration. With all breakers in the ring closed, the power flow through the station can theoretically split, with a portion flowing around both sides of the ring. With one breaker open, all power flow will be around one side of the ring and through the breakers in that portion. Harvey pf. at 5-6; Harvey supp. pf. at 2.

21. The X62 transformer and all associated equipment -- except relay equipment -- will remain where they are and continue to be used. The existing X66 transformer and the 34.5 kV breaker associated with it will be relocated and reused with a new high side circuit switcher and some new low voltage equipment. Both existing 115 kV capacitor banks will be relocated, and all associated equipment will be reused. The five existing oil circuit breakers will be used as spare equipment, or will be used as a source of repair parts for similar units. Harvey pf. at 6-7; Harvey supp. pf. at 2-3.

22. The FACTS device will be located in an area southeast of the 115 kV equipment and will encompass, at most, an area 240 feet x 180 feet. This area will be graded to an elevation about five feet higher than the 115 kV yard. In order to accommodate a 25-foot buffer zone from the top of the bank of the Winooski River, VELCO has sited a retaining structure and

will use a 1:3 slope in the areas outside of the retaining structure. Smith pf. at 15-16; Harvey pf. at 6; Harvey supp. pf. at 5-6; VELCO exh. WFH 7B Revised; VELCO exh. WFH-7 Revised; VELCO exh. WFH-7B Revised 9/26/99; VELCO exhs. WFH-7C and WFH-18 (plan view of the area with the FACTS location, as well as the substation expansion).

23. The FACTS device will be housed in a metal building. Both it and the VELCO station control building will be metal clad, gray buildings designed to blend into the surroundings. The VELCO building will be 32' by 80'; 14' high at the eaves. The FACTS building will be 50' by 115', 12' high at the eaves. Additional testimony of W.F. Harvey p. 2; VELCO exhs. WFH-16 and WFH-17.

24. The ANR has reviewed and approved the project as depicted on WFH-7B Revised. Harvey supp. pf. at 6; VELCO exh. MAM-11.

Orderly Development of the Region

[30 V.S.A. § 248(b)(1)]

25. The proposed project will not unduly interfere with the orderly development of the region, with due consideration having been given to the recommendations of the municipal and regional planning commissions, the recommendations of municipal legislative bodies, and the land conservation measures contained in the plan of any affected municipality. This finding is supported by findings 26 through 33 below.

26. The existing substation is partially visible from nearby properties or roads. The top half of the substation structures are backgrounded by existing vegetation and are visible from the back yards of condominiums to the south. The lower portion of the substation is blocked by the intervening topography. From the north, the upper portion of the substation is visible through breaks in the intervening vegetation along the river bank. Views into the site at right angles to the direction of travel are possible from the IBM access road to the north – northeast. Views into the site for northbound travelers on Route 2A are blocked by the topography. Looking to their left, southbound travelers may see the substation structures through a break in the vegetation before dropping below the intervening tree line. Boyle pf. at 2-3.

27. The expansion will not significantly increase the visibility of the existing substation. The silhouette of the substation may increase for some of the view points because of the expanded bays to the east. However, the existing north and south bays are already in the line-of-sight from the principal area of exposure, the IBM River Road. From Route 2A, the expansion will not increase the visibility of the substation. New residential development to the south of the site has placed more people within sight of the existing structures. VELCO will add additional screening between the residences and the substation with evergreen trees. VELCO will also add additional plantings along the south, east and north sides of the site to further reduce visibility into the site. The topography that now obscures the lower part of the existing and proposed structures will be supplemented with the evergreen trees. These will be planted at the top of the slope where they are most effective. Boyle pf. at 3; VELCO exh. TJB-2.

28. The project is in context with its surroundings. It is similar in form, texture and scale with the existing facilities and other similar facilities in the immediate area. Boyle pf. at 3-4.

29. This project is consistent with the Williston Town Plan and the Chittenden Regional Plan. The Williston Plan calls for the conservation of natural resources, the protection of historic resources, and the minimization of impacts on visual resources. The proposed project utilizes an existing substation site and considers all of these issues and minimizes all such impacts. Murphy pf. at 9; findings under criterion 248(b)(5) below.

30. The Williston Comprehensive Plan, under Section II (Objectives and Policies), item number 14 (Utilities), states that "Powerlines and other utilities will be sited to minimize their visual impact." The facility complies with this community standard because the mitigation proposed clearly reduces the limited visual impact of the existing, as well as the proposed facility. The addition to the existing facility is tucked into the hillside, and is further screened by extensive planting. Boyle pf. at 4-5.

31. VELCO met with the Town of Williston Planning Commission on June 15, 1999, and July 20, 1999, to discuss this project and answer any questions the Town might have. On July 21, 1999, the Planning Commission determined that the proposed project is consistent with the

1995 Williston Comprehensive Plan. The Commission also voted to waive the 45-day notice period of 30 V.S.A. § 248 to submit its letter. VELCO exh. MAM-9; Murphy pf. at 5-6.

32. This project falls within the jurisdiction of the Chittenden Regional Planning Commission. Its Plan calls for VELCO to "ensure that an adequate supply of reasonably priced energy, from all sources, is available to meet the Region's future need" [p.14] and to "minimize environmental degradation associated with energy supply and use" (p.18-19). The Regional Planning Commission approved the project by letter dated June 28, 1999. Murphy pf. at 6; VELCO exh. MAM-2.

33. As shown by the contents of VELCO's § 248 application, this project complies with these goals. Specifically, this project has been undertaken in a manner that will have little or no effect upon the environment, as described below, and it is being undertaken in order to assure that an adequate supply of electricity at reasonable prices is available to the citizens of Vermont. VELCO met with the Chittenden Regional Planning Commission on May 28, 1999, to discuss this project and answer any questions. The Commission, by letter to VELCO, has stated its support for this project. VELCO exh. MAM-2.

Need for Present and Future Demand for Services

[30 V.S.A. § 248(b)(2)]

34. The proposed project is required to meet the need for present and future demand for service which could not otherwise be provided in a more cost-effective manner through energy conservation programs and measures and energy efficiency and load management measures. This finding is supported by findings 4-6 above, and 35-52 below.

35. Consistent with NEPOOL operating practices, VELCO operates the transmission system so that loss of any one of the four 115 kV lines that supports the Chittenden County area (first contingency) can be sustained without collapse of the system. Smith pf. at 5.

36. In 1998, Vermont experienced a new summer peak load. Voltage problems were noted in and around Chittenden County during that peak load period. During the summer of 1998, both GMP and VELCO operations groups became concerned after seeing low voltage occurrences in the Burlington area, particularly at the VELCO Queen City bus. However,

VELCO System Planning, using the then-existing winter base case, was unable to reproduce those results. Panel pf. at 4.

37. As a result, VELCO undertook extensive analyses to identify and determine solutions for these problems. VELCO performed four separate sets of studies. The first set of studies was used to modify VELCO's Operating Guidelines to reflect current load conditions. The second body of studies was a probabilistic analysis run to evaluate reinforcement options. The third and fourth sets of work were design analyses that established the size and type of the Essex FACTS device and selected necessary substation enhancements at Essex. Panel pf. at 23.

38. For the first set of studies, VELCO analyzed the past five years of hourly load information available from the SCADA (Supervisory Control And Data Acquisition) system, focusing on actual load distribution differences between summer and winter, load distribution differences among areas (Chittenden County vs. remainder of the state), and historical load growth trends in both peak and energy. Analysis of this SCADA data revealed that the typical load distribution in the summer months varied significantly from the winter months' load distribution. During the winter months, the ski areas are major load centers. In summer, the metropolitan areas, especially the Chittenden County area, are the major load centers, and there is little load remaining around the ski areas. In fact, Chittenden County currently reaches its annual peak during summer, even while the load of the rest of the state remains winter peaking. This redistribution of the load was sufficiently large that VELCO decided to start using two separate load representations (i.e., two base cases) for all future planning studies: the summer power period base case (May – October) and the winter power period base case (November – April). Panel pf. at 5; VELCO exh. LET-2.

39. Additionally, the analyses revealed that the peak load and energy usages in the power periods were growing at different rates. Over the past six years, 1993 – 1998, the summer loads (peaks) for the State have grown by over 2% annually while winter loads (peaks) increased annually by less than 1%. Panel pf. at 5; VELCO exh. LET-3.

40. A major influence in this different growth rate is Chittenden County, which has a six-year annual historical summer growth rate almost double the state's growth rate as a whole.

Even the winter growth rate in Chittenden County (around 2.75%) is well above the state norm. Panel pf. at 6; VELCO exh. LET-4.

41. Energy usage is growing as well. Historically, over the same years, the state's summer energy usage has grown annually at 2%, compared to the winter energy growth rate of 0.5%. Here again, Chittenden County is driving this difference with an annual summer energy growth rate of 4% and an annual winter energy growth rate of 2.2%. Panel pf. at 6; VELCO exh. LET-5; VELCO exh. LET-6.

42. A third piece of the equation is that not only are the peaks and energy levels growing, and growing at different rates between summer and winter, but the number of hours that the Vermont load is at higher levels is increasing in both power periods. Panel pf. at 6; VELCO exhs. LET-7 and LET-8.

43. This affects the number of hours that in-state generation, such as McNeil and the Essex area gas turbines, are required to run and increases the state's reliance on the availability of power flowing in at Highgate. Panel pf. at 6; VELCO exhs. DLL-8 and DLL-9.

44. Following this extensive analysis, VELCO modified its Operating Guidelines using an up-to-date model for both summer and winter peak load conditions in Vermont. Panel pf. at 24; VELCO exh. DLL-2 (VELCO Winter Guidelines); VELCO exh. DLL-3 (VELCO Summer Guidelines).

45. Examination of the Operating Guidelines shows that the VELCO system cannot be run reliably with some reasonably foreseeable combinations of system conditions. For example, for summer peak loads greater than 750 MW, the Operating Guidelines require the running of the McNeil power plant to ensure VELCO reliability. Should the Highgate Converter not be available at this load level, the Operating Guidelines show that the VELCO system is vulnerable. The Operating Guidelines clearly demonstrate how dependent system reliability is on power supply sources outside of the VELCO system. Panel pf. at 24.

46. Once VELCO identified this reliability exposure it conducted probability analyses on transmission reinforcement options. In its evaluation and decision to adopt the FACTS

project, VELCO also studied the following alternatives and determined the FACTS project to be the recommended approach:

- adding higher voltage transmission to the area;
- expanding the hours of operation of out-of-merit "must run"² local generation;
- adding generation in the area; and
- implementation of a load-shedding scheme using protective relay devices.

Smith pf. at 9-10; Panel pf. at 25, 29.

47. The analysis indicated that the FACTS project will perform as well as the 345 kV line, it will reduce VELCO's reliance on internal generation sources, and it will provide greater system flexibility. Panel pf. at 30.

48. Construction of the high voltage transmission option would take three to five years, or longer. Such a delay would be inconsistent with good utility practices, as the problematic exposure exists now. Smith pf. at 10.

49. VELCO also considered constructing a portion of this transmission expansion to solve this problem -- the portion of the 345 kV line from West Rutland to Williston. This is a substantially more costly alternative than the FACTS device, roughly estimated around \$45 million, and the permitting and construction time required for its implementation would be substantially lengthier than with the FACTS project proposed. Again, it would be inconsistent with good utility practices to delay a solution to the problem faced by VELCO any longer than necessary. *Id.* at 10-11.

50. Increasing operation of "must run" local generation was also evaluated but rejected as an alternative. Additional generation in the area -- a total of 100 MW, in blocks of 50 MW gas turbines -- would be required to assure reliable transmission system operation. Theoretically, such new generation would provide adequate backup to McNeil and/or Highgate should they suffer extended outages. There are, however, no known plans for such generation additions to the area, nor are there any specific plans to bring additional natural gas supply to the Burlington area to fuel such generators. Smith pf. at 11.

2. The term "must run" is used by electric utilities to describe generation ordered to operate for a variety of reasons, independent of its cost. The term "out-of-merit" can also be used.

51. The proposed project is necessary because the FACTS device will provide the necessary transmission system support should one of the major power supply resources cited above (Highgate or McNeil) be unavailable for extended periods of time; it is also the best alternative available at this time. Smith pf. at 5.

52. In addition to the Essex FACTS device, four different Essex bus configurations were studied for connecting the device. These ranged from a radial extension of the existing, single Essex bus to an 8-breaker ring bus with a position for each of the five transmission lines, two transformers and the new FACTS device. The studies support the following conclusions:

- The present system is highly reliant both on internal Vermont sources and an optimal mix of PV20 flow and Highgate import. A disruption in this combination of internal and external sources compromises VELCO's reliability.
- To resolve single contingencies under a reasonable set of system conditions, the Essex FACTS device should be at least 100 Mvar in size.
- To resolve stuck breaker contingencies at the Essex bus (as required by NEPOOL criteria) under reasonable system conditions, an 8-breaker ring bus for Essex is required.
- To survive local stuck breaker outages and bus faults, the Essex FACTS device should be at least 120 Mvar.

Panel pf. at 35-36; VELCO exh. DLL-6.

System Stability and Reliability

[30 V.S.A. § 248(b)(3)]

53. The proposed project is necessary to ensure system stability and reliability, and will not adversely affect system stability and reliability. This finding is supported by findings 3-6 and 34-52 above, and 54-62 below.

54. Addition of the FACTS device is necessary to insure reliable first contingency operation of the transmission system. VELCO operates the transmission system so that loss of any one of the four 115 kV lines that supports the Chittenden County area (first contingency) can be sustained without collapse of the system. Currently, local generation, including the McNeil generator, gas turbines, and diesel generators, is dispatched to help support the load to cover possible contingency circumstances. If either Highgate or McNeil is unavailable under

heavy (75 to 80% of the peak) load situations, and in the event of the loss of any of the four 115 kV lines that support Chittenden County, the existing system is not able to provide reliable first contingency operation, and thus significantly increases the likelihood of a voltage collapse occurring. Findings 5-6 above.

55. Voltage collapse is a cumulative, cascading series of phenomena, in which one triggering event degrades the system, resulting in rapidly progressive and unpredictable collapse of the network. To some degree, the situation can be aggravated by protective devices that will normally correct minor disturbances, but could create additional sources of strain during severe events. On a transmission system such as VELCO's, voltage collapse would likely require some significant initiating event, such as the loss of a major line like Plattsburgh – Sandbar or Granite – Barre. Should the outage occur at a time when system conditions were unfavorable (high loads with an inadequate amount of local sources), the system would be vulnerable. The loss of the line would increase the current on the remaining in-service transmission lines, resulting in high reactive power losses. The additional reactive power losses begin the downward spiral of voltage reduction, which then causes a drop in output of capacitors, whose very function is to support local voltage by providing reactive power. Tap changers and regulators on the sub-transmission and distribution systems operate to boost customer voltage, but these actions increase current drawn from the network, which creates additional reactive power losses. At some point, the reactive drain on the network could cause generators to trip, resulting in an even greater loss of system voltage support. Ultimately, due to the increased reactive losses on the transmission system and the decreased reactive support provided by capacitors and local generation, the voltage ultimately collapses. Should such a scenario occur, there could be a widespread blackout lasting up to six hours or more. Panel pf. at 15-16.

56. It is also clear that in order to be useful to the transmission system, the reactive power compensation needs to be on the 115 kV system, not on the sub-transmission system. VELCO studied adding capacitors on the sub-transmission system to compensate the system so that the power factor would be close to unity (VELCO would not be supplying any reactive power to its customers). Pre-contingency, with all lines in service, the sub-transmission

system can be compensated with capacitors at particular substations so that the power factors are close to unity. However, this assumes a pre-determined transmission network, i.e., McNeil on, gas turbines on, etc. As soon as this paradigm is changed, such as McNeil not available, then the compensation at the sub-transmission level is not optimized. There would be capacitors in the wrong places, too much reactive power being added in some locations and not enough in others; and, because of the compensation being added to the sub-transmission system, the capacitors on the 115 kV system would be turned off. In that event, post-contingency, they may not be available in time to help ride out the loss of a transmission line. Panel pf. at 13.

57. Transmitting reactive power from remote generation sources or capacitors is not technically or economically feasible due to excessive i^2x losses resulting in voltage drops. Thus, capacitors at the sub-transmission level can supply the customers with reactive support, but they cannot take the place of reactive support needed by the transmission system. In other words, reactive power compensation will not help the transmission system survive an event on the transmission system unless it is on the 115 kV system. Panel pf. at 13-14; VELCO exh. LET-13.

58. For short-term unavailability of McNeil, the system could be adequately supplemented with gas turbines under all but peak load conditions. Recent operating experiences, however, demonstrate that gas turbines are not always available when called upon. Smith pf. at 6; VELCO exh. GES-2.

59. The main concern is a sustained outage of McNeil due to a catastrophic mechanical failure, or possibly even the lack of sufficient fuel supply to sustain operation over extended periods. The most significant concern with respect to Highgate is a sustained outage. This could be a catastrophic event, such as a fire in the thyristor valve hall. At least three of these valve hall fire events have occurred worldwide, in Brazil, India and California. Or this contingency could result from a sustained interruption of the Hydro Quebec contract that results, for example, from a failure of the Hydro Quebec transmission system, such as occurred during the winter of 1998. Smith pf. at 6-7.

60. VELCO's obligation is to provide reliable, cost-effective transmission to the Vermont utilities. Smith pf. at 7.

61. The threat to reliability also will rise if load levels increase. Should the present rate of load growth be sustained over a period of five or more years, even with Highgate and McNeil in the power supply mix, the existing transmission system will be unable to provide reliable first contingency operation. Smith pf. at 7.

62. The addition of the FACTS device at the Essex substation will also have widespread benefits to customers in Chittenden County. Faults on the interconnected transmission, sub-transmission, and distribution systems cause dips in voltage that can impact sensitive electronic equipment (such as computers, process controllers), causing losses of productivity and other hardships. By injecting reactive power immediately after an incident, the FACTS device can mitigate the voltage dip on the VELCO system and thereby mitigate its effect on end users. Smith pf. at 30.

Economic Benefit to the State

[30 V.S.A. § 248(b)(4)]

63. The proposed project will result in an economic benefit to the State. This finding is supported by findings 64-76 below.

64. The total estimated installation cost of the project, including the FACTS device, modifications to the Essex substation and land development, ranges from \$14.3M to \$15.3M. Spring supp. pf at 2; Smith supp. pf at 2.

65. The cost of the FACTS device installation, between \$9M and \$10M, is significantly less than originally estimated by VELCO. Bids were received from five vendors, and Mitsubishi's configuration of the STATCOM, which was selected by VELCO, was lower than the next bid by \$1.5M. Smith supp. pf. at 2, 4; Smith pf. at 35.

66. Spare equipment is required to facilitate rapid restoration of the FACTS device upon failure of any of its components. The most critical piece of equipment is the transformer that steps the voltage down from 115 kV to the operating voltage of the thyristors (10 kV to 35 kV, depending on the manufacturer's design). Other spare components include capacitors,

thyristors, and other devices including control system components. The total cost of spare equipment is between \$0.9M and \$1.1M. Smith supp. pf. at 3-4.

67. The cost of the Essex ring bus reconfiguration is estimated at \$4.2M, and the land acquisition and site development is estimated around \$1.1M. Smith pf. at 35; Harvey pf. at 8; Smith supp. pf. at 4.

68. With a total capital cost range of between \$14.3M to \$15.3M, the total annual carrying cost (i.e., capital costs, taxes, and maintenance) reflective of that range will be \$1,866,290 to \$1,984,950. Spring supp. pf. at 2; VELCO exh. GFS-2 Revised.

69. At its September 10, 1999, meeting, the NEPOOL Participants Committee unanimously approved Pool Transmission Facilities ("PTF") designation for the Essex FACTS project, which means that almost all of the facility costs (95%) will be borne pro rata by load in New England. Spring supp. pf. at 2.

70. As a PTF, the costs of the project, under the NEPOOL tariff, will be borne pro rata by the load share of NEPOOL constituents. Vermont's load share will bear 4.37% of the costs associated with this project. Associated annual carrying costs to Vermont are estimated at \$180,000, \$80,000 of which represents Vermont's 4.37% load ratio share of the PTF costs, and approximately \$100,000 of which is to cover the carrying costs of the non-PTF assets (representing improvements to the facilities tied to supplying native load) that will be installed. Spring supp. pf. at 3; VELCO exh. GSF-3 Revised.

71. The installation of the FACTS device is also expected to achieve cost savings. NEPOOL operates a market-priced, bid-based power exchange in which participants can buy and sell electricity services. Typically, the market clearing price determines which units are dispatched within NEPOOL. "Out of merit" refers to NEPOOL's dispatch of local generation units that are needed to preserve the reliability of the system, even though the bid price of the units called upon to run may be well above the market clearing price. An "out of merit" charge results when units are run "out of merit." Spring pf. at 2.

72. As explained earlier, under current operating conditions, generating units in northwestern Vermont are being run to provide VELCO with needed transmission reliability support. VELCO reliability requires the Highgate converter to be operating nearly full time

under most load conditions. For moderate to high loads, McNeil and local peaking units (usually some combination of Berlin and Burlington gas turbines) are run as well for transmission support. Howland pf. at 3; VELCO exh. REH-2.

73. These units are being called on by VELCO in order to meet VELCO's Operating Guidelines. Howland pf. at 2; VELCO exhs. DLL-2 and DLL-3 (VELCO Operating Guidelines).

74. Applying conservative assumptions, VELCO estimates that continuing to run local generation out-of-merit (i.e., to provide reliability support to the transmission system) will cost over \$2M annually in excess of the costs that would be incurred under merit-order dispatch. If Highgate were not available, the costs would be even more significant. Howland pf. at 8; VELCO exh. REH-4.

75. Therefore, a FACTS device, in addition to its system reliability benefits, is likely to pay for itself in avoided generation cost savings. *Id.*

76. Other benefits, such as improved power quality and reliability of the system, cannot be readily quantified in economic terms, but will flow through to the ratepayers as smoother operation of their equipment and reduced risk of power outages. Smith pf. at 20.

**Aesthetics, Historic Sites and Water Purity, the Natural Environment
and Public Health and Safety**

[30 V.S.A. § 248(b)(5)]

77. The proposed project will not have an undue adverse affect on aesthetics, historic sites, and water purity, the natural environment and the public health and safety. This finding is supported by the findings below based upon the criteria specified in 10 V.S.A. §§ 1424a(d) and 6086(a)(1) through (8) and (9)(K).

78. The Vermont Agency of Natural Resources ("ANR") has notified the Board that as long as VELCO maintains a naturally vegetated, undisturbed buffer of at least twenty-five feet from the bank of the Winooski River, and this buffer is marked during construction to ensure that it remains undisturbed, ANR is satisfied that the project will have no undue adverse effect on aesthetics, historic sites, air and water purity, or the natural environment and the public health and safety, particularly as regards 10 V.S.A. § 6086(a)(1) through (8) and (9)(k).
VELCO exh. MAM-11.

79. The Essex Substation is located in Williston, just east of Route 2A and south of the Winooski River. The property currently owned by VELCO is 3.75 acres. To the north and west of the existing substation is property owned by Green Mountain Power. Land to the south and east is owned by Gerald and Shirley Emmons, and VELCO owns approximately one acre south of the existing substation. Between the southwest corner of VELCO's existing fence and the Winooski River is approximately 200 feet of property owned by Green Mountain Power. VELCO also has easements for the transmission lines that come into the Essex Substation. A 150-foot wide easement enters from the northeast, crossing the river. Another 150-foot wide easement heads southeast across the Emmons' property. To the southwest, VELCO maintains a 300-foot wide easement, also from the Emmons. Nearly all the land in this vicinity is maintained for transmission rights-of-way. Murphy pf. at 3; Harvey supp. pf. at 4-5; VELCO exh. WFH-7 Revised (plan view with FACTS and substation modifications).

80. VELCO will need more land to expand the substation and to build the FACTS device. To the north, approximately 1.8 acres will be required from Green Mountain Power. This land will be used for both substation expansion and part of the FACTS device. To the southeast, approximately 2.5 more acres will be purchased from the Emmons for locating the FACTS device. VELCO has selected land that is already encumbered by transmission right-of-way for the FACTS device location. Harvey supp. pf. at 4-5.

81. Before this substation was constructed, it was abandoned pasture. No rare, threatened, or endangered species have been found at the site. Existing wildlife habitat along the banks of the Winooski River will be left undisturbed to the extent possible. No archaeological sites have been found at the site, primarily because of the 1927 flood. The site is not located in the 100-year flood plain. Murphy pf. at 4.

Outstanding Resource Waters

[10 V.S.A. § 1424a(d)]

82. No designated "outstanding resource waters" exist within the project area or the watershed in which the project is situated. Murphy pf. at 7.

Water and Air Pollution

[10 V.S.A. § 6086(a)(1)]

83. The proposed project will not result in undue water or air pollution. The finding is supported by findings 84-108 below.

Water Pollution

84. During construction, VELCO will require the contractor to install and maintain the erosion control measures that comply with the Vermont Handbook for Soil Erosion and Sediment Control on Construction Sites and comply with its site-specific erosion control plan (VELCO exh. WFH-19). Harvey pf. at 12; Murphy pf. at 13; See findings under Soil Erosion, 10 V.S.A. § 6086(a)(4), below.

85. The construction contract will also require the prompt seeding, mulching, and revegetation of areas disturbed by the construction activities. The control building will contain sanitary facilities, which will discharge into a properly designed onsite disposal facility. Harvey pf. at 12 (see findings 90-91 below).

Air Pollution

86. During construction, no brush will be burned. Maintenance traffic on the paved access road will be infrequent, and as such there will be minimal dust generation caused by vehicles. During construction, dust will be controlled by the application of water or calcium chloride, as required. After construction, the site will be landscaped and open areas revegetated so that they will not be subject to wind or water erosion. Murphy pf. at 7; Harvey pf. at 11-12.

87. The circuit breakers contain sulfur-hexafluoride (SF₆) which is a green-house gas. VELCO carefully monitors the circuit breakers for leakage prior to installation, and during their time of service. If maintenance operations require opening the breaker, VELCO removes and contains the gas with a device called a gas cart. Harvey pf. at 11-12.

Noise

88. Currently, the site holds two transformers. One of these transformers will be unchanged and the other will be relocated within the current substation fence line. Two new transformers will be needed to connect the system to the FACTS device. Noise from the FACTS device will be less than or equal to EPA's recommended guideline to protect public health and welfare of 55 dBA at the fence line. Murphy pf. at 8; tr. at 90.

Headwaters

[10 V.S.A. § 6086(a)(1)(A)]

89. The proposed project does not affect any headwaters. There are no headwaters in the vicinity of the site. The project will meet all applicable Health and Environmental Conservation Department regulations regarding ground and surface water quality. Murphy pf. at 8.

Waste Disposal

[10 V.S.A. § 6086(a)(1)(B)]

90. The proposed project, as designed, will meet any applicable health and environmental conservation regulations regarding the disposal of wastes, and will not involve the injection of waste materials or any harmful toxic substances into the ground waters or wells. Findings 91-98 below.

91. A sewage system consisting of a septic tank and leach field exists in a control building at the site. This building and the sewage facilities will be replaced with a new system that will be needed for a single toilet and sink for use by operations and maintenance personnel. The facility is normally unstaffed. The system has been designed to meet all Department of Health and Department of Environmental Conservation regulations. The existing septic tank will be pumped and filled with gravel and abandoned. This abandonment will be performed in a manner that is acceptable to the Wastewater Management Division of ANR. A Water Supply and Wastewater Disposal permit has been issued by the Department of Environmental Conservation and presented to the Board. Murphy pf. at 8-9.

92. Stormwater runoff will be managed in such a manner as to minimize velocities and erosion potential and will include a retention facility. The stormwater drainage system will be designed in accordance with ANR Water Quality Standards. A Stormwater Discharge Permit is not required from the ANR Permits and Compliance Section because stormwater will not reach any surface water. *Id.* at 9; VELCO exh. MAM-13.

93. Construction debris will be disposed of at an approved landfill. Excavated material such as soil, stones and tree stumps will also be disposed of off-site. There will be no negative affect on the stability of the roadway, of existing drainage patterns or

environmentally sensitive areas due to excavation or fill. VELCO has agreed to provide details to the Board regarding the final disposal site of the excavated materials prior to disposal. Murphy pf. at 10; tr. at 78.

94. All PCBs and PCB contaminated equipment have been removed from this location. Any new equipment which contains dielectric fluids will be certified to be free of PCBs. Harvey pf. at 13.

95. The five existing circuit breakers to be retired contain a total of 8700 gallons of insulating oil. This reduction in oil on site will be offset somewhat by the addition of the step-up transformer for the FACTS installation, which will contain about 7000 gallons of insulating oil. Harvey pf. at 13.

96. The substation transformers will be mounted on concrete foundations with integral oil retention sufficient to contain the total transformer oil volume. Foundation design will follow ANSI/IEEE Standard 980, "IEEE Guide for Containment and Control of Oil Spills in Substations." This meets with VELCO's current standard practice for environmental protection and exceeds State and Federal requirements. Murphy pf. at 9.

97. The foundations that support the substation transformers consist of concrete piers on a spread footing. The size and depth of the foundation vary with the size and weight of the transformer. VELCO will excavate an area around the transformer foundation, line the excavated area with a very heavy flexible membrane, and fill the area with crushed stone. The volume of the excavated area is designed to hold all of the oil in the transformer with one foot of freeboard at the top of the containment area. The crushed stone will provide 40% voids. Provision will be made to remove rainwater from the containment area, either with a drainpipe and gate valve for gravity drainage, or a standpipe for pumping out the area if the site does not permit gravity drainage. VELCO has agreed to provide final details of transformer oil retention facilities to the Board for review and approval prior to installation. Harvey pf. at 13-14; tr. at 86.

98. In addition to the containment, all transformers have low oil alarms, which should minimize leakage amounts. VELCO maintains a Spill Prevention Control and Countermeasures plan as required by Federal Regulations. Harvey pf. at 14.

Water Conservation

[10 V.S.A. § 6086(a)(1)(C)]

99. Currently, the substation receives water from a spring on the Emmons' property based on a verbal agreement. A new well will be drilled at the site. The new well will be a more reliable source than the existing supply. Use of water at the site will be consistent with historic operation. The plumbing fixtures will use low-flow water conserving devices.

Murphy pf. at 10.

100. The FACTS installation will have a closed coolant-to-air cooling system, and will use no water after the initial charging of the system. In any event, this project will not require either municipal water or sewer services. Harvey pf. at 14.

Floodways

[10 V.S.A. § 6086(a)(1)(D)]

101. No portion of the project is within the 100-year flood boundary. (FEMA, Flood Insurance Rate Map, Town of Willison, Chittenden County, 3/2/81). Murphy pf. at 10.

Streams

[10 V.S.A. § 6086(a)(1)(E)]

102. No shorelines or rivers will be traversed or adversely impacted by this project. The Essex Substation site is adjacent to the Winooski River. VELCO will maintain a naturally vegetated, undisturbed buffer of at least twenty-five feet from the top of the bank of the Winooski River, which will be staked during construction in order to ensure that this project will not disturb the bank of the Winooski River. Activity at the site, including grading, will be at least 50 feet from the edge of the river. Murphy pf. at 11; Harvey supp. pf. at 5-6; VELCO exh. WFH-7B Revised.

103. VELCO will utilize appropriate soil stabilization techniques as necessary during construction. See findings below under Soil Erosion, 10 V.S.A. § 6086(a)(4).

Shorelines

[10 V.S.A. § 6086(a)(1)(F)]

104. No shorelines or rivers will be traversed or adversely impacted by this project. Findings 102-103 above.

Wetlands

[10 V.S.A. § 6086(a)(1)(G)]

105. On May 24, 1999, James Boyle and Kirsten Anderson of Boyle Associates assessed the site of VELCO's proposed project for wetland locations, functions, and values. Mr. Boyle is a licensed professional forester with significant experience in wetland science, and Ms. Anderson is a wetland ecologist with experience in wetland science. The assessment was conducted using the standard techniques outlined in the U.S. Army Corps of Engineers New England Division publication entitled, *The Highway Methodology Workbook Supplement: Wetland Functions and Values, a Descriptive Approach*. Murphy pf. at 11.

106. The project will not impact any Class I or Class II wetlands identified on the National Wetlands Inventory Maps. The wetland scientists, however, did discover some Class III wetland soils that may be impacted by the project. This wetland area is generally abandoned pasture, and is maintained as shrub and herbaceous vegetation, as it is beneath electric transmission lines. Soils are somewhat poorly drained loamy material underlain with clay. Soil permeability is slow, with a seasonably high water table. Of the twelve wetland functions and values outlined in the Vermont Wetland Rules, only one -- sediment retention -- was determined to be a principle function of this wetland. Murphy pf. at 11-12; VELCO exh. MAM-3.

107. The largest area of these wetland soils that could be impacted would be approximately one-third of one acre. This sediment retention function will be replaced by the stormwater retention structure that will be added as part of the project. *Id.*; VELCO exhs. MAM-4 (depicts the location of wetland soils with an overlay of the proposed layout) and WFH-7B.

108. The U.S. Army Corps of Engineers has determined that the project will have minor individual and cumulative impacts on the waters and wetlands of the U.S. and has authorized the project under State of Vermont General Permit (GP-58). VELCO exh. MAM-10.

Air Pollution

[10 V.S.A. § 6086(a)(1)]

109. The proposed project will not result in unreasonable air pollution. Findings 86-87 above.

Sufficiency of Water and Burden on Existing Water Supply

[10 V.S.A. § 6086(a)(2) and (3)]

110. The proposed well will provide sufficient water to supply the site's minimal needs, and the project will not place an undue burden on existing water supply. See findings 99-100 above.

Soil Erosion

[10 V.S.A. § 6086(a)(4)]

111. The proposed project as designed will not result in unreasonable soil erosion or reduce the ability of the land to hold water. This finding is supported by findings 112-115 below.

112. The area in the vicinity of the access driveway and substation expansion is moderately sloping terrain (approximately 12-15%). The existing substation is surrounded on the up-slope side by a drainage ditch installed during construction of the substation. The new substation will have a similar drainage ditch on the up-slope edge of fill, and one or more subsurface drains or culverts. Murphy pf. at 13.

113. Temporary erosion control measures will be implemented during construction to minimize erosion as specified in VELCO's erosion control plan. These measures will comply with standards from the Vermont Handbook for Soil Erosion and Sediment Control on Construction Sites. Erosion control methods most likely to be employed include sediment barriers constructed of hay bales located at the bottom of disturbed slopes. Exposed soils will be seeded and covered by geotextile erosion control and turf reinforcement mat as soon as possible after disturbance. VELCO exh.WFH-19 and VELCO Figures 1 and 2.

114. Permanent erosion control measures will be installed at the appropriate stages during construction. Examples of permanent erosion control measures include re-vegetation of all disturbed ground. Channels will be constructed which will be lined with crushed stone as shown in area 3, Figure 2 on Exhibit WFH-19. Id.

115. Impervious areas, which represent approximately three percent of the total project site, will include the buildings and transformer pads. Because the percentage of impervious area is small in comparison to the existing drainage basin, no significant stormwater detention

measures will be needed. The access driveway around the existing substation will have a drainage swale to divert runoff to a stone-lined retention and outlet structure. Id.

Traffic

[10 V.S.A. § 6086(a)(5)]

116. The proposed project will not cause unreasonable congestion or unsafe conditions with respect to transportation systems. This finding is supported by findings 117-118 below.

117. Traffic congestion, if any, will be kept to a minimum since most of the construction will take place at the substation site and away from busy town streets and state highways. Construction vehicles should be able to park at the existing parking lot adjacent to the substation site. Vehicular traffic on the gated access road to the substation will be minimal and will be consistent with historic use. Access to Route 2A currently exists. An access road and parking area also currently exists. The access road will be extended to provide better access to the FACTS device. Like the current vehicle area, the future area will provide adequate access and turn-around space for emergency vehicles. The parking area will accommodate five vehicles and be sufficient for normal substation personnel. Murphy pf. at 14-15.

118. There will be very little traffic associated with the project. The project will not affect a railroad, airport, or other means of transportation. Id. at 15.

Educational Services

[10 V.S.A. § 6086(a)(6)]

119. The project will not bring additional students to the area or otherwise affect the ability of any municipality to provide educational services. Murphy pf. at 15.

Municipal Services

[10 V.S.A. § 6086(a)(7)]

120. The proposed project will not place an unreasonable burden on the ability of any involved municipalities to provide municipal services. The project will not create any additional burden on local fire departments or local law enforcement offices. The project will not generate a significant amount of solid waste. Any that is generated will be transported to a landfill approved to accept the particular type of waste. This project will not create any hardships on municipal services. It will in fact, improve the economic vitality of the town as a

result of the taxes it pays to the town, and its almost nonexistent requirement for governmental services. Murphy pf. at 15.

Aesthetics, Historic Sites or Rare and Irreplaceable Natural Areas

[10 V.S.A. § 6086(a)(8)]

121. The proposed project will not have an undue adverse effect on the scenic or natural beauty of the area, or upon aesthetics, historic sites or rare and irreplaceable natural areas. This finding is supported by findings 122-133 below.

122. The existing substation is partially visible from nearby properties or roads. The top half of the substation structures are backgrounded by existing vegetation and are visible from the backyards of condominiums to the south. The lower portion of the substation is blocked by the intervening topography. From the north the upper portion of the substation is visible through breaks in the intervening vegetation along the river bank. Views into the site at right angles to the direction of travel are possible from the IBM access road to the north – northeast. Views into the site for northbound travelers on Route 2A are blocked by the topography. Looking to their left, southbound travelers may see the substation structures through a break in the vegetation before dropping below the intervening tree line. Boyle pf. at 2-3.

123. The expansion will not significantly increase the visibility of the existing substation. The silhouette of the substation may increase for some of the view points because of the expanded bays to the east. However, the existing north and south bays are already in the line-of-sight from the principal area of exposure, the IBM River Road. From Route 2A, the expansion will not increase the visibility of the substation. New residential development to the south of the site has placed more people within sight of the existing structures. Although these views are backgrounded and not particularly noticeable now, VELCO has indicated a willingness to add additional screening between the residences and the substation with evergreen trees. VELCO will add additional plantings along the south, east and north sides of the site to further reduce visibility into the site. The topography that obscures the lower part of the existing and proposed structures now will be supplemented with the evergreen trees, which will be planted at the top of the slope. Boyle pf. at 3; VELCO exh. TJB-2.

124. Both the substation control building and the FACTS building will be pre-engineered steel buildings as specified in VELCO exh. WFH-17. They will have light gray siding with galvanized or aluminized roofing. The VELCO building will be 32 by 80 feet with 14-foot height to the eaves, while the FACTS building will be 50 by 115 feet with 12-foot high eaves. Additional Testimony of William F. Harvey at 2.

125. The retaining wall in the FACTS area will be constructed of a gray manufactured product with the appearance of quarried stone as depicted on VELCO exh. WFH-18. *Id.* at 3.

126. ANR has reviewed and approved the planting and screening as set forth on TJB-2 Revised. Letter of ANR dated September 23, 1999. VELCO exh. MAM-12.

127. The project is in harmony with its surroundings. It is similar in form, texture and scale with the existing facilities and other similar facilities in the immediate area. Boyle pf. at 3-4.

128. The Williston Comprehensive Plan, under Section II (Objectives and Policies), item number 14 (Utilities), states that "Powerlines and other utilities will be sited to minimize their visual impact." The facility complies with this statement because the mitigation proposed reduces the visual impact of the existing, as well as the proposed facility. The addition to the existing facility is tucked into the hillside, and is further screened by planting. Boyle pf. at 4-5.

129. It is unlikely that the average person who frequently sees substations throughout the state would find one in this setting offensive, if in fact he or she even notices it. The occupants of the nearest residence, which is at a distance of 600-700 feet, will see less of the facility in the future than they currently do. *Id.*

130. The placement of screening vegetation as part of this proposal will mitigate any adverse aesthetic impact of the project. *Id.*

131. VELCO will install high pressure sodium lights emitting a soft orange-yellow light, pointing generally downward. The existing lighting points upward. The new lighting is intended for safety and not of an intensity to do work at the facility. Above the height of approximately 10 feet, there will be significantly less illumination than currently at the site. Tr. 9/17/99 at 79-81.

132. Based on the above, the proposed project will generally fit within the context of, and will not adversely affect, the area where it will be located. Id.

133. The project will not have an impact on historic sites. An archaeological Phase 1-b study was conducted to determine if any sites of cultural significance may be impacted by the project. All work was conducted in accordance with the State of Vermont's Guidelines for Archaeological Studies. No Native American or European American artifacts were found. The study results were forwarded to the Vermont Division for Historic Preservation, which has "concurred" with the results. Murphy pf. at 16; VELCO exh. MAM-12.

Discussion

Based on the above findings, this project will not have an undue adverse effect on the aesthetics or scenic and natural beauty of the area. In reaching this conclusion, I have relied on the Environmental Board's methodology for determination of "undue" adverse effects on aesthetics and scenic and natural beauty as outlined in the so-called Quechee Lakes decision. Quechee Lakes Corporation, #3W0411-EB and 3W0439-EB, dated January 13, 1986.

As required by this decision, it is first appropriate to determine if the impact of the project will be adverse. The project would have an adverse impact on the aesthetics of the area if its design is out of context or not in harmony with the area in which it is located. If it is found that the impact would be adverse, it is then necessary to determine that such an impact would be "undue." Such a finding would be required if the project violates a clear written community standard intended to preserve the aesthetics or scenic beauty of the area, if it would offend the sensibilities of the average person, or if generally available mitigating steps will not be taken to improve the harmony of the project with its surroundings.

Given the facts of this case, it would be difficult to find that this project would have an adverse effect on the aesthetics of the area because of the limited nature of the proposal, because of the fact that it will be located primarily within an existing substation site, and because the FACTS facility will be located in an excavated area that will be largely hidden from view from surrounding areas both from the contours of the site and by the existing and proposed vegetative screening.

Even if the Board were to find this proposal aesthetically adverse, it would be difficult to find that such adverse impact is undue because there is no written community standard that would be violated, the project will not offend the sensibilities of the average person, and

VELCO will take generally available mitigating steps in the form of vegetative screening and limited site lighting shown on the Project Site Plans.

Necessary Wildlife Habitat and Endangered Species

[10 V.S.A. § 6086(a)(8)(A)]

134. The project will not have an impact on any rare and irreplaceable natural areas since there are none at the site. Murphy pf. at 17.

135. A review of wildlife habitat at the project site was conducted by a qualified expert. This inventory and review of the State Significant Habitat Maps shows there are no known rare, threatened, or endangered species, or necessary wildlife or endangered species habitat on the proposed site. Murphy pf. at 17.

136. Existing habitat is old-field type. Goldenrod and grasses dominate with early successional woody plants such as gray-stemmed dogwood, choke cherry, poplar, white pine and staghorn sumac seedlings and saplings invading the site. Three powerlines traverse the project area, one right-of-way being 300 feet wide and the other two 150 feet wide. Consequently, nearly all of the habitat on the site has been and will be subjected to typical right-of-way management practices. The footprint of the proposed substation expansion will impact less than five acres of this old-field type habitat. Id.

137. The proposed project is tucked in the corner of two barriers to terrestrial wildlife movement, the Winooski River and US Route 2A. Consequently, the site does not function as connective cover or a travel lane between habitats. The lack of overhead softwood vegetation precludes the function of critical winter shelter for deer, which is further limited by the commercial/residential setting. Significant palustrine habitat exists along the banks of the Winooski River in the forms of emergent wetland persistent habitat and forested wetland habitat which transition to upland forest on the steep slopes upstream of the project. The project has been designed to minimize the amount of this habitat that will be affected. Murphy pf. at 18.

138. The only impact to wildlife will be indirect and short-term, in the form of noise and disturbance during construction. Such impacts will be insignificant. Direct loss of habitat will result from the expansion of the substation footprint and will primarily impact habitat of passerine bird species such as the Eastern kingbird, Eastern meadowlark, and a variety of warblers, swallows and sparrows. Extensive reaches of similar habitat exist along the rights-

of-way that traverse the site and in surrounding environs. Murphy pf. at 18; VELCO exh. MAM-7.

Development Affecting Public Investments

[10 V.S.A. § 6086(a)(9)(K)]

139. The proposed facilities will not unnecessarily or unreasonably endanger the public or quasi-public investments in any governmental public utility facilities, services, or lands, or materially jeopardize or interfere with the function, efficiency, or safety of, or the public's use or enjoyment of or access to, such facilities, services, or lands. The project is not located near any public resource, and consequently will not have any negative effects upon public resources. Murphy pf. at 19.

Compliance With Electric Energy Plan

[30 V.S.A. § 248(B)(7)]

140. The DPS determined on September 16, 1999, that the proposed project is consistent with the Vermont 20-Year Electric Plan, in accordance with 30 V.S.A. § 202(f), provided the project is constructed as described by VELCO. DPS Determination filed September 16, 1999.

Outstanding Water Resources

[30 V.S.A. § 248(B)(8)]

141. No waters of the state that have been designated as Outstanding Resource Waters will be affected by the project, and the project will not have any undue adverse affect upon any waters that it is near. See finding 82 above.

Existing Transmission Facilities

[30 V.S.A. § 248(b)(10)]

142. This project will have no adverse affect on Vermont customers or utilities, and in fact will improve reliability of existing service. Findings 34-52 and 54-62 above, and 143-144 below.

143. Engineers from Green Mountain Power Corporation, Central Vermont Public Service Corporation and Burlington Electric Department, as well as from the Department of Public Service, have been participating in a group referred to as the Strategic Options Working Group since December 1996. Meetings of this Working Group in 1998 and early 1999 focused on Vermont reliability as a major issue. The FACTS project was among the alternatives developed by this group. Smith pf. at 7-8.

144. Study results and plans have been reported with regularity at meetings of the VELCO Board of Directors, which includes Vermont utility representatives. This culminated in an unanimous vote by that board, at their April 1999 meeting, to support filing the Section 248 petition for the FACTS device. Smith pf. at 8.

The parties to this docket have waived their right to review and comment on the Proposal for Decision, pursuant to 3 V.S.A. Section 811.

Date at Montpelier, Vermont this _____ day of October, 1999.

Peter B. Meyer
Hearing Officer

III. ORDER

IT IS HEREBY ORDERED, ADJUDGED AND DECREED by the Public Service Board of the State of Vermont that VELCO's proposal to install a Flexible Alternating Current Transmission System (FACTS) device and reconfigure certain components at VELCO's Essex substation located in the Town of Williston, Vermont, in accordance with the evidence and plans submitted in this proceeding, are necessary reinforcements to the transmission system to provide system reliability and will promote the general good of the State of Vermont in accordance with 30 V.S.A. § 248. A certificate of public good to that effect shall be issued.

DATED at Montpelier, Vermont, this 7th day of October, 1999.

| | | |
|-----------------------------|---|----------------|
| <u>s/Michael H. Dworkin</u> |) | |
| |) | PUBLIC SERVICE |
| |) | |
| <u>s/Suzanne D. Rude</u> |) | BOARD |
| |) | |
| |) | OF VERMONT |
| <u>s/David C. Coen</u> |) | |

OFFICE OF THE CLERK

Filed: October 7, 1999

Attest: s/Susan M. Hudson
Clerk of the Board

NOTICE TO READERS: This decision is subject to revision of technical errors. Readers are requested to notify the Clerk of the Board of any technical errors, in order that any necessary corrections may be made.

Appeal of this decision to the Supreme Court of Vermont must be filed with the Clerk of the Board within thirty days. Appeal will not stay the effect of this Order, absent further Order by this Board or appropriate action by the Supreme Court of Vermont. Motions for reconsideration or stay, if any, must be filed with the Clerk of the Board within ten days of the date of this decision and order.