VHB PIONEER

Environmental | Transportation | Land Development Services

February 26, 2010

Ref: 57346.01 and 57346.02

Mr. Charles Pughe
Green Mountain Power
163 Acorn Drive
Colchester, Vermont 05446

Re: Kingdom Community Wind Project (KCW)
Lowell, Westfield, and Jay, (Orleans County), Vermont
Section 248 Natural Resources Assessment Report

Dear Charlie:

Per your request, please find enclosed four bound copies and a CD-ROM of the above-referenced report as prepared by VHB Pioneer (VHBP) and dated February 26, 2010. At the request of Green Mountain Power (GMP), VHBP conducted wetland and stream delineations for both the Wind Farm and Transmission components of the KCW Project, as well as rare vegetation and natural community surveys on the Wind Farm Component. The report outlines the methodologies employed during field work, and the findings from these investigations.

This report therefore also includes an assessment of the following Act 250 Criteria as are incorporated into Section 248 review: Outstanding Resource Waters (10 V.S.A. §1424a(d)), Air Pollution (§6086(a)(1)), Headwaters (§6086(a)(1)(A)), Wastewater Disposal (§6086(a)(1)(B)), Floodways (§6086(a)(1)(D)), Streams (§6086(a)(1)(E)), Shorelines (§6086(a)(1)(F)), Wetlands (§6086(a)(1)(G)), Water Supply (§6086(a)(2)(3)), Soil Erosion (§6086(a)(4)), Rare or Irreplaceable Natural Areas (§6086(a)(8)), and Endangered (plants) Species (§6086(a)(8)(A)).

If you have any questions or comments, please do not hesitate to contact either of us.

Very truly yours,
VANASSE HANGEN BRUSTLIN, INC.

Adam R. Crary, PWS, PWD
Senior Wetland Scientist

Jeffrey A. Nelson, CPESC, CPSWQ
Director, Environmental Services

ARC/pwe
Enclosure

cc: Peter H. Zamore Esq. – Sheehey Furlong & Behm, P.C. (bound, unbound, and CD-ROM)
Martha Staskus – VERA (bound copy and CD-ROM)
Ian Jewkes – Krebs and Lansing, Inc. (bound copy)

7056 US Route 7
Post Office Box 120
North Ferrisburgh, VT 05473
802.425.7788 • FAX 802.425.7799
www.vhb.com

Section 248 Natural Resources Assessment Report

GREEN MOUNTAIN POWER

KINGDOM COMMUNITY WIND PROJECT

Lowell, Westfield, and Jay, Vermont

Prepared for **Green Mountain Power**
163 Acorn Lane
Colchester, Vermont

Prepared by **VHB Pioneer**
7056 U.S. Route 7
PO Box 120
North Ferrisburgh, VT 05473

February 26, 2010

VHB PIONEER

Table of Contents

1.0 Introduction 1
2.0 Project Description 4
3.0 Site Description 6
3.1 Wind Farm 6
3.2 Transmission Component 7
4.0 Wetlands 8
4.1 Delineation Methodology 8
4.2 Delineated Wetlands 10
KCW Wind Farm Component 11
Transmission Component 14
5.0 Streams, Drainages, and Ditches 16
5.1 Delineation Methodology 16
5.2 Identified and Typical Streams 17
Wind Farm 17
Transmission Component 19
6.0 Outstanding Resource Waters 21
7.0 Air Pollution 21
7.1 Vehicle Emissions 22
7.2 Dust and Asbestos Particulates 22
8.0 Floodways 25
9.0 Headwaters 26
10.0 Shorelines 27
11.0 Water Supply 27
12.0 Wastewater Disposal 28
13.0 Soil Erosion 28
14.0 Endangered Species (Plants) and Rare or Irreplaceable Natural Areas 29
Threatened or Endangered Plant Survey 30
Rare or Irreplaceable Natural Areas 32
15.0 References 35

Tables

Table 1: Wetland Functions and Values
Table 2: Stream Type Definitions

Figures

Figure 1: Site Location Map

List of Appendices

Appendix 1: Natural Resource Summary Tables – Wind Farm
- Summary of Delineated Wetlands – KCW Wind Farm Site
- Summary of Delineated Streams – KCW Wind Farm Site
- RTE and Uncommon Plant Findings – KCW Wind Farm Site
- Summary of Delineated Montane Spruce-Fir Forest Stands – KCW Wind Farm Site
- Montane Spruce-Fir Forest Stand – Prism Plots

Appendix 2: Natural Resource Summary Tables – Transmission
- Summary of Delineated Wetlands – Transmission Component
- Summary of Delineated Streams – Transmission Component

Appendix 3: Representative Site Photographs – Wind Farm
- Wetlands – Photographs of Representative Features
- Streams – Photographs of Representative Features
- Montane Spruce-Fir Forest – Photographs of Representative Features

Appendix 4: Representative Site Photographs – Transmission
- Wetlands – Photographs of Representative Features
- Streams – Photographs of Representative Features

Appendix 5: Natural Resource Maps – Wind Farm
- Sheet Index
- Sheets (1 through 9)
- Bedrock Geology Map

Appendix 6: Natural Resource Maps – Transmission Component
- Index Map

- Maps (1 through 8)

Appendix 7: Water Supply Information

- Water Supply Map
- Bedrock Well Yield Analysis (table)
- Area Bedrock Well Logs: Yield Statistics (graph)
- Gravel Well Yield Analysis (table)
- Area Well Logs: Depth vs. Yield (graph)

Appendix 8: FEMA Flood Insurance Rate and/or Flood Hazard Boundary Maps

- Town of Lowell, Vermont Map Index (Community 500254 B, FIRM Map 01-17)
- Town of Lowell, Vermont (Community 500254 B), Panel 12
- Town of Lowell, Vermont (Community 500254 B), Panel 8
- Town of Lowell, Vermont (Community 500254 B), Panel 4
- Town of Westfield, Vermont Map Index (Community 500257 A, Flood Hazard Boundary Map H 01-12)
- Town of Westfield, Vermont, Panel 12
- Town of Westfield, Vermont, Panel 09
- Town of Westfield, Vermont, Panel 06
- Town of Westfield, Vermont, Panel 03
- Town of Jay, Vermont (Community – Panel 500253 0020 B)

Appendix 9: Soil Information

- Soils Map – Wind Farm
- Summary of NRCS Soils – KCW Wind Farm Project
- Soils Map – Transmission Component
- Summary of NRCS Soils – Transmission Component

1.0 Introduction

At the request of Green Mountain Power (GMP), VHB Pioneer (VHBP) has conducted extensive natural resources assessments during 2009 at the proposed Kingdom Community Wind project ("KCW" or "Project") site. This work has been done in preparation for the Section 248 filing with the Vermont Public Service Board (PSB) for a Certificate of Public Good (CPG) for the construction of a wind turbine farm. The Project is composed of two components generally differentiated herein this report as the "Wind Farm" and the "Transmission" components. The Wind Farm project component (consisting of the wind turbine, overhead collection infrastructure, substation, access road, and related improvements) is located in Lowell, Vermont where it is situated to the east of VT Route 100. The Transmission Component is located largely within existing overhead transmission utility rights-of-way (ROW) that extend from where the Wind Farm project component meets VT Route 100 in Lowell, Vermont in a northerly direction through the Lowell, Westfield, and Jay, Vermont townships (Figure 1). The Transmission Component consists of the transmission line upgrade from the collector system northward, approximately 16.2 miles, up to the planned Jay Tap substation.

The natural resources assessment conducted in support of project planning design and Section 248 filing to the PSB, included a wetland and stream survey, a rare, threatened and endangered (RTE) plant survey, a Rare or Irreplaceable Natural Area (RINA) evaluation, an assessment of wildlife habitat, and a review of soils and bedrock geology. This study also included an evaluation of existing conditions relevant to other Act 250 Criteria as incorporated into Section 248 review. Multiple Resource Management, Inc. (MRM), of Leicester, Vermont, conducted the wildlife habitat criterion assessments ((§ 6086(a)(8)), the results of which are reported by MRM under separate cover. This report, therefore, presents the results of onsite surveys, and/or existing condition evaluations, relating to the following criteria:

- Wetlands (§ 6086(a)(1)(G));
- Streams (§ 6086(a)(1)(E));
- Outstanding Resource Waters (10 V.S.A. § 1424a(d));
- Air Pollution (§ 6086(a)(1));
- Floodways (§ 6086(a)(1)(D));
- Headwaters (§ 6086(a)(1)(A));
- Shorelines (§ 6086(a)(1)(F));
- Water Supply (§ 6086(a)(2)(3));
- Wastewater Disposal (§ 6086(a)(1)(B));
- Soil Erosion (§ 6086(a)(4));
- Rare or Irreplaceable Natural Areas ("RINA") (§ 6086(a)(8));
- Endangered Species (Plants) (§ 6086 (a)(8)(A)).

On May 29, 2009, VHBP presented a work plan to the Agency of Natural Resources (ANR) at a meeting held with the ANR in Waterbury, Vermont. This work plan described the methodologies and protocols for field investigations, which were agreed to by the ANR. The discussion below presents the methods of these field studies and results as they pertain to the Section 248 criteria for a CPG from the PSB

to construct and operate the proposed Project. This report is intended to serve as a comprehensive natural resource document in support of the PSB process and is intended to also be utilized as a technical resource for applicable use in subsequent natural resource permit applications, as may be necessary.

2.0 Project Description

Starting in Fall 2008, on-site studies have been underway to evaluate existing site conditions and environmental considerations including natural communities, visual, sound, migratory bird and bat, breeding bird, large mammals, cultural, historic and archaeological impacts, and other site specific analysis required to enable Green Mountain Power (GMP) to prepare a PSB Section 248 petition for a CPG to construct the proposed Wind Farm and Transmission Component. Additional work included engineering and design studies to site the wind turbines, and to design the access road, electric collector system, step-up substation, maintenance building, and the infrastructure upgrades necessary to transmit the power from Lowell Mountain to the proposed VELCO connection point at the Jay Tap located off VT Route 105 in Jay, Vermont.

Preliminary plans include 2.25+/- miles of gravel access road from VT Route 100 in Lowell through private land to the Lowell Mountain ridgeline. This road will typically be 24 feet wide, although it may be wider in places to allow turning radiuses for specialized transportation equipment necessary to move the turbine components to the site. The 3.2 mile ridgeline on which the wind turbines will be installed, ranges in elevation from 2190 to 2640 feet A.S.L. and is part of over 2000+/- acres of private lands in which the Project will be sited. Along the ridgeline, a crane path road will be required to allow crane movement between wind turbine sites. Two staging areas, a 7-acre field at the intersection of the project access road and VT Route 100, and a 3-acre clearing located at the proposed location of the step-up substation and maintenance building is expected.

The number, type, and size of the wind turbines have not yet been determined, but it is expected that the project will consist of 20 to 21, 2.5 to 3.0 megawatt wind turbines.

The electric collection system will consist of an underground line along the ridgeline between the wind turbines, and overhead on single wood poles from the ridgeline to a step-up substation ("KCW Substation") located at the maintenance building area, about halfway up Lowell Mountain. A 100-foot wide clearing will be maintained along the collector line to protect from wind throw tree damage. The substation will transform the collector system voltage up to 46kV. Between the step-up KCW Substation and VT Route 100, the electric collector system will be transmitted in overhead utility. From the intersection of the access road and VT Route 100, the collector system will run 2.5 miles north along VT Route 100 to the Lowell #5/Irasburg #21 Substation northeast of the intersection of VT Route 58 and VT Route 100. The collector line will be run in a combination of existing Vermont Electric Cooperative (VEC), and where necessary, new right-of-way. The VEC Lowell #5 substation will be re-built within the existing foot print of the combined Lowell #5 and Irasburg #21 substations, converting from a 34.5kV to a 46kV distribution substation.

The 10.3 mile transmission line between the VEC Lowell #5 substation and the VEC Jay #17 substation located southeast of the intersection of Route 242 and Cross Road will be upgraded. The upgrade may involve several new sections of right-of-way to bring the line roadside where desirable, and address infringements from existing structures. The Jay #17 Substation will be upgraded in a manner similar to the Lowell #5 substation. The transmission line will continue north 1.6 miles from the Jay #17 Substation along the existing distribution right-of-way east of Cross Road to the existing 46kV transmission line at the intersection of State Route 105 and Cross Road. From this intersection point 1.7 miles to the west, the 46kV line will be reconductored to a new 46kV switching station (Jay Tap Switching Station) being

constructed by VEC as a separate project from the KCW project. Vermont Electric Company (VELCO) plans to construct a new 115 kV step-up VELCO substation constructed adjacent to the VEC Jay Tap switching station, to permit access to the VELCO 115 kV bulk transmission system.

3.0 Site Description

3.1 Wind Farm

This Wind Farm site includes terrain consisting of open rolling hills and mountainous terrain in the Town of Lowell, in Orleans County, Vermont. The Wind Farm site is located within the Lowell Mountain Range and drains to three major watersheds: the Missisquoi River Basin, Lake Memphremagog, and the Lamoille River Basinall located within the Northern Green Mountain biophysical region as described by Thompson and Sorenson (2000). The Northern Green Mountain biophysical region is characterized by colder temperatures, acidic metamorphic bedrock, and Northern Hardwood Forest and Montane Spruce-Fir Forest (Thompson and Sorenson 2000). The Wind Farm site is dominated by Northern Hardwood forests characterized by soils that are developed from glacial till with shallow depths to bedrock. Northern Hardwood Forests are dominated by broad leaf deciduous trees including sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), and yellow birch (*Betula alleghaniensis*). Species composition observed throughout the area investigated is consistent with Northern Hardwood forest and Rich Northern Hardwood Forest plant communities as described by Thompson and Sorenson (2000).

The land surrounding the Wind Farm site is located in an area of mixed, but largely rural use. Lowell is a small town with mixed land use, largely characterized by

residential, small business/commercial, forestry, and agricultural use, including several small farms dispersed along VT Route 100.

Within the Wind Farm component of the Project, two types of investigation areas were established. The direct investigation area consists of approximately 550 acres and encompasses the limits of all potential earth disturbance or land clearing as a result of project activities. Within the direct investigation area, applicable comprehensive site data was collected, including detailed wetland and waters delineations, surveys for rare species, and natural community assessments. The limits of the direct investigation area within this project component are depicted on the natural resource mapping included in Appendix 5.

Reconnaissance-level studies were also conducted within the project property parcels. Typically, a one-quarter mile offset from the direct investigation areas was used to define these study limits, except where non-project parcel boundaries prevented access for investigation, or the direct study limits were expanded during project planning to consider design alternatives. Comprising approximately 1,630 acres, this indirect investigation area was established to provide additional site resource information to be used for project planning, design, and permitting. Specifically, preliminary information on the presence/absence of wetland and waters was gathered. Features shown in the indirect study area (reconnaissance features) were recorded using productivity based GPS settings with accuracy ratings of +/- 5 meters. Reconnaissance features are intended to capture the general location and geometry of most features, and do not represent the level of accuracy associated with delineated features located in the direct study area. The limits of the indirect investigation area within this Project component are depicted on the natural resource mapping included in Appendix 5.

3.2 Transmission Component

The Transmission Component of the Project is composed of a linear investigation area approximately 16.2 miles in length, generally 100 feet-wide, and is oriented in a

south to north alignment primarily within an existing VEC right-of-way (ROW) that transects portions of the towns of Lowell, Westfield, and Jay Townships in Orleans County, Vermont. In some areas, it is expanded to encompass potential re-route alignment alternatives, or to include the two existing substations (Lowell #5, Jay #17),. The Transmission Component drains to two major watersheds, the Missisquoi and the Black River basins, the corridor is again located in the Northern Green Mountain biophysical region which is characterized by low temperatures, acidic, metamorphic bedrock, and northern deciduous or coniferous forest communities (Thompson and Sorenson 2000). This ROW is mostly cleared and is characterized with herbaceous and shrub vegetation. The majority of the ROW is located within a valley surrounded by the rolling foothills of the abutting Lowell and Jay Mountains.

The majority of this Project component follows existing overhead utility ROWs and bisects a landscape of mixed uses, including rural residential, small business, and agriculture. In some instances, to improve maintenance accessibility, the upgraded transmission line will be relocated from the existing overhead ROW to follow existing roadways. Because the transmission corridor follows either the existing overhead utility or cleared/maintained roadways, field investigations were largely focused on gathering wetland and/or waters data to support project planning and design initiatives. The location of the Transmission Component is depicted in the Natural Resources Mapping included in Appendix 6.

4.0 Wetlands

4.1 Delineation Methodology

Wetland delineations in the field were made according to the *1987 U.S. Army Corps of Engineers Wetland Delineation Manual* (1987 Manual) (Environmental Laboratory

1987). Delineations for the Project were conducted under the "Routine Determinations, Subsection 2, Onsite Inspection" as outlined in the 1987 Manual. This manual, along with modifications, clarifications, and guidance, is approved for all delineations that are subject to the Vermont Wetland Rules and U.S. Army Corps of Engineers (USACE) wetland impact permitting under Section 404 of the Clean Water Act.

The 1987 Manual stipulates that under normal circumstances, a wetland consists of three characteristics: hydric soils, hydrophytic vegetation, and wetland hydrology. Within a delineated wetland, soils must meet a New England Hydric Soils Technical Committee (NEHSTC) hydric soil indicator, the dominant vegetation community must have a prevalence (greater than 50 percent) of wetland-adapted (hydrophytic) vegetation, and the area must display evidence of wetland hydrology (NEHSTC 2004). Wetland hydrology criteria include observed inundation, saturated soils, water staining of trees and/or ground-material, drainage patterns or drift lines, and oxidized rhizospheres. Ditches or constructed ponds exhibiting the three criteria are typically not included in the delineation if such features are due to excavation from upland. However, such features may be included in the delineation if these features were determined to be modified, naturally occurring streams or wetlands, or if their locations are important to understanding site hydrology conveyance.

Wetlands within the above-mentioned survey areas were located in the field using Trimble® GPS surveying instruments. All GPS data collected in the field were differentially corrected and shape-corrected to refine the accuracy of the data and later transferred into shapefile features in ArcGIS® to complete the mapping.

VHBP flagged wetlands in the field with pink survey tape or ground flags labeled "Wetland Delineation". Flagging was coded with the year and wetland number, along with the individual flag number (e.g. 2009-1 #1). Field notes were recorded on-site along with notes pertaining to wetland classification, potential impact

considerations, any unique qualities, and wetland functions and values. Wetlands were classified based on the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979), and general landscape position, hydrology, or land use characteristics. Wetland functions and values were preliminarily evaluated based on the field notes and observations generally following the 1999 U.S. Army Corps of Engineers, *Highway Methodology Workbook: Supplement*.

4.2 Delineated Wetlands

For the Wind Farm component of KCW Project, VHBP completed detailed wetland delineations of all wetlands within the direct investigation area as described above. Field work was conducted by VHBP wetland scientists in the summer and fall of 2009, the results of which are depicted on the Natural Resources Maps presented in Appendix 5. Additionally, as described in Section 3.0 above, reconnaissance-level wetland mapping was completed within the indirect study area. The results of the indirect investigation area mapping are not treated in these narrative discussions as this was a preliminary mapping exercise to yield approximate wetland presence/absence information for project design considerations in selecting preferred routes and designs. This preliminary mapping exercise served for overall knowledge and background of natural resources within the site. The results of these reconnaissance-level studies are useful for preliminary planning and to identify general resource condition in the vicinity of the planned Project (such as stormwater discharge point identification), but should not be relied upon for detailed design or regulatory review purposes.

For the Transmission Component, detailed wetland delineations were completed by VHBP wetland scientists in the fall of 2009, the results of which are depicted on the Natural Resources Maps presented in Appendix 6. All wetlands, including other water features were delineated within the transmission study corridors described in Section 3.2 according to the methodology described above.

Wetlands were identified based on VHBP's coding, total mapped area (square feet), classification under the Vermont Wetland Rules (WRB 2002), Cowardin classification, observed principal functions and values, extent of survey, and additional descriptions and notes. Wetland functions and values were noted in general accordance with USACE (1999) methodology, as summarized in Table 1 and presented in the summary of delineated wetlands located in Appendix 1 and 2.

Table 1: Wetland Functions and Values*

GW	Groundwater Recharge/Discharge	W	Wildlife Habitat
FF	Floodflow Alteration (Storage & Desynchronization)	R	Recreation (Consumptive & Non-consumptive)
F	Fish and Shellfish habitat	ES	Educational/Scientific Value
STP	Sediment/Toxicant Retention	H	Heritage/Uniqueness
NUT	Nutrient Removal/Retention/ Transformation	V	Visual Quality/Aesthetics
PE	Production Export (Nutrient)	RTE	Threatened/Endangered Species Habitat
SS	Sediment/Shoreline Stabilization		

* U.S. Army Corps of Engineers (USACE) – New England District. 1999. The Highway Methodology Workbook: Supplement: Wetland Functions and Values – A Descriptive Approach. NAEEP-360-1-30a.

KCW Wind Farm Component

Within this Project component, VHBP conducted detailed delineations of all wetland features within the direct investigation area. Seventy-one wetland areas were identified, the locations and extent of which are depicted on the Natural Resource Summary of Delineated Wetland Tables in Appendix 1 and the Natural Resource Maps presented in Appendix 5. Collectively, approximately seven acres of wetlands were identified within the direct investigation area, which represents just over 1% of the approximately 550-acre direct investigation area. Based on review of the Vermont State Wetlands Inventory maps (VSWI), all of the wetland areas within this project component should be considered Class Three wetlands under the Vermont Wetland Rules, subject to determinations by the Vermont State

Wetlands Office (WRB 2002). The tabular Summary of Delineated Wetlands, located in Appendix 2, presents individual characteristics of each feature, including unique identification, area, Cowardin classification, principal function or values, and general comments for each. Representative photographs of on-site wetland resources are included in Appendix 3.

Wetland resources can generally be characterized by landscape position, function or value provided, and/or Cowardin classification. Using the Cowardin classification method, onsite wetlands are palustrine features characterized by either emergent, scrub shrub, or forested vegetation (PEM, PSS, or PFO). The majority of the delineated features are PEM features situated within forested openings. Relative to landscape position, the following sections describe general characteristics of the wetland resources located within the Wind Farm project component.

Wetland Descriptions

There are four general landscape position or feature shapes that characterize the majority of wetland areas within the Wind Farm component of the Project. These include: high elevation montane saddles, slope discharge seeps, upper-drainage linear depressions, and riparian fringe wetlands.

Features located within high elevation montane saddles occur within depressional landforms surrounded by steepened topography along the ridgeline of Lowell Mountain. These features often have irregular boundaries and are typically characterized by emergent vegetation forming openings within the forested ridgeline setting. Typical vegetation assemblages often include species such as balsam fir (*Abies balsamea*), yellow birch (*Betula alleghaniensis*), hobblebush (*Viburnum lantanoides*), jewelweed (*Impatiens capensis*), as well as various sedges (*Carex* spp.), graminoids, and pteridophytes. The principle function and value provided by wetlands in this position is groundwater discharge, as these high elevation features are often drained by high gradient, first order stream channels. Examples of such features include wetlands 2009-C13, 2009-C26, and 2009-C36.

Side-slope seepage wetlands occur throughout the investigation areas, often on steeply sloping topography. These wetlands are discreet and diffuse groundwater discharge zones where discharge velocities are constant, but not of sufficient velocity to create drainage valleys through fluvial processes. Most wetlands within this position are characterized by emergent vegetation and often include vegetation such as marsh fern (*Thelypteris palustris*), melic managrass (G*lyceria melecaria*), ostrich fern (*Matteuccia struthiopteris*) yellow birch (*Betula alleghaniensis*), and striped maple (*Acer pensylvanicum*). Examples of such features include 2009-C15, 2009-C19, 2009-C20, 2009-C32, 2009-37, 2009-C38, 2009-C36, and 2009-C49.

Wetlands located within linear, or sometimes, bowl-shaped depressions high in the local topography are common within the project site. These often form stream channel outlets where groundwater discharge is conveyed downstream. Most wetlands within this position are characterized emergent vegetation and often include vegetation such as meadow rue (*Thalictrum pubescens*), false hellebore (*Veratrum* sp.), melic managrass and jewelweed. These features function as groundwater discharge zones. An example of this type is wetland feature 2009-C32.

Wetlands located within stream riparian zones occur throughout the investigation area, but are more prevalent in the lower elevations. These features form fringe zones to several of the perennial, intermittent, and ephemeral stream drainages within the study area. These features are often saturated at the surface with a network of drainage channels. Soils are often mucky modified mineral soils with prevalent redoximorphic features. Such features are characterized by emergent or forested cover, often including vegetation such as jewelweed, sensitive fern, marsh fern, and sphagnum moss (*Sphagnum* sp.). The principal functions of this wetland type include streambank stabilization, and groundwater recharge/discharge. Examples of features include 2009-B8, 2009-C4, 2009-C10, and 2009-C41.

Wetlands preliminarily identified and mapped in 2009 by VHBP within the indirect investigation areas are also depicted on the Natural Resource Maps presented in Appendix 5. These features were preliminarily identified through general ground reconnaissance. This study was undertaken to estimate the general presence/absence and approximate extent of potential wetland resources outside the direct investigation area.

Transmission Component

VHBP delineated all wetland features within the approximately 16.2-mile KCW Transmission component of the Project. From this detailed delineation, numerous individual wetland features were demarcated, with some extending off the ROW (see the Natural Resource Maps in Appendix 6). Approximately, twenty four-acres of wetland are identified within the investigation limits, which represent nearly 9% of the approximately 268-acre transmission corridor investigation area. From VHBP's determinations, there are approximately 11.70 acres of Class Two and 12.34 acres of Class Three wetland within the investigation area, subject to final determinations by the Vermont State Wetlands Office. The tabular Summary of Delineated Wetlands – Transmission Component, located in Appendix 2, presents individual characteristics of each feature, including unique identification, area, Cowardin classification, function or values, and general comments for each. Representative photographs of onsite wetland resources are included in Appendix 4. The Natural Resource Maps in Appendix 6 depict the location, extent, and VWR classification of onsite wetland resources.

Wetland Descriptions

As this project component is situated largely within valley floors, wetland resources are located throughout the investigation area, and generally occur in nearly level or slight depressions in the landscape abutting streams, rivers, or discharge points within valley heads. Most Class Three wetlands occur within the investigation area as small depressions or within stream drainageways. Class Two wetlands are often found in similar positions, but abut large wetland swamp/marsh, or depressional

basins adjacent to the existing ROW and study corridors. Using the Cowardin classification method, onsite wetlands are palustrine features characterized by emergent or scrub shrub vegetation (PEM or PSS). Typical vegetation in the PEM wetlands included reed canary grass (*Phalaris arundinacea*), New York aster (*Symphyotrichum novi-belgii)*, giant goldenrod (*Solidago gigantea*) and melic managrass. In the PSS wetlands, typical vegetation often includes balsam fir, yellow birch, striped maple, speckled alder (*Alnus incana*) and red osier dogwood (*Cornus sericea*). In some instances, palustrine forested wetlands (PFO) occur where the study corridor is widened or includes forested fringes outside existing cleared ROWs. Where PFO wetland occurs in these situations, typical tree cover often is comprised of balsam fir, yellow birch, northern white cedar (*Thuja occidentalis*), speckled alder, red maple, and ash (*Fraxinus* spp.).

Nearly all wetland features are located with either existing utility ROW, or adjacent to existing roadway ROWs, and retain vegetative communities that reflect periodic maintenance regimes. Most of the onsite features also occur within or adjacent to agricultural land under agricultural use. Resultantly, hydrologic conditions are often altered by agricultural practices (ditching, plowing, grazing) and/or ROW maintenance activity.

Assessments of wetland function and values show that groundwater recharge/discharge (GW) is a principal function and value. Several of the wetland features provide riparian buffers for streams within the ROW, and retain sediment and shoreline stabilization functions. Sediment and toxicant retention are also principal functions for wetland features located in close proximity, or are un-buffered from roadway, driveway, or agricultural runoff. Nutrient retention is an important function of several depressional wetlands adjacent to and within active crop and pastureland. Although most wetlands occur within, or in close proximity to, human activity, evidence of wildlife use/activity was noted and is a principal

function where wetlands are not fragmented or in close proximity to regular human activity.

5.0 Streams, Drainages, and Ditches

5.1 Delineation Methodology

VHBP delineated all streams within the direct investigation area for the Wind Farm as well as the Transmission Component during the summer and fall of 2009, concomittantly with the wetland delineations as discussed above in Section 4.0. Streams, drainages, and ditches were flagged with orange survey tape. Flagging was coded with the feature identification (TB = top of bank / SC = stream center), and stream number, along with the specific flag number (e.g., TB-1 #1A). For descriptive purposes, all delineated stream flow regimes were preliminarily classified as an ephemeral drainage, intermittent stream, perennial stream, or ditch (see Table 2 for definitions of classifications used by VHB). These classifications were determined based on qualitative observations of instream hydrology indicators at the time of observation, as well as geomorphic characteristics. Generally, perennial and intermittent streams were flagged along the stream center line or at top of bank (or top of slope), according to the 2005 Vermont ANR *Riparian Buffer Guidance* (ANR 2005). Ephemeral drainages and ditches were flagged along the drainage or ditch center line. Field notes were recorded that pertain to stream type classification, bed and bank characteristics, potential impact considerations, unique qualities of the stream, and ordinary high water (OHW) width. The OHW width was determined in the field based on guidance provided in the USACE "Regulatory Guidance Letter: Subject – Ordinary High Water Identification," (USACE 2005). The OHW width for each ephemeral, perennial and intermittent stream is determined from an average of measurements of bank to bank OHW widths taken at regular intervals along the surveyed portion of the watercourse.

The location of the top of bank, and the OHW width are necessary for determining potential impacts or riparian buffer setbacks under the ANR and USACE regulatory permitting programs.

Streams and drainages under state or federal jurisdiction within the delineation areas for the KCW Wind Farm and Transmission Components were GPS-surveyed by VHBP in the field using the same methodology as noted in Section 4.1.

Table 2: Stream Type Definitions	
Perennial Stream	A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow.
Intermittent Stream	An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.
Ephemeral Drainage	An ephemeral stream has flowing water only during, and a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for the stream flow.
Ditch	A ditch, for the purposes of the delineation, is a non-jurisdictional, excavated feature constructed in the upland, and is not considered a Water of the United States. Ditches may be identified to enhance the understanding of where water is conveyed within and adjacent to a particular site.
Source: USACE 2006	

5.2 Identified and Typical Streams

Wind Farm

Stream resources identified by VHBP within the direct investigation area of the Wind Farm component are presented in the Summary of Delineated Streams table (Appendix 1). The locations and identification of each resource are depicted on the

Natural Resource Maps included in Appendix 5. The following sections provide a summary narrative of stream or drainage resources identified within the direct investigation area.

Ephemeral Channels: Drainage segments that may be classified as ephemeral in the direct investigation, or detailed delineation area of the KCW Wind Farm project component, are typically located at higher elevations and often proximal to the ridge line. Most channel flow paths are narrow scours up to 2-feet in width. Such channels often have poorly defined bank characteristics as they only have channel forming flows during, and immediately after, rain events. Such channels are located above the water table and generally flows are from surface runoff from very small sub-watersheds. Some channels, however, provide discharge outlets for upslope catchment wetlands that may be precipitation dependent and most likely formed by shallow, perched water tables. Streambed materials are composed of organic materials (leaf litter and woody debris) and bedrock. Representative photographs of ephemeral channels within the Wind Farm component of the KCW Project are included in Appendix 3.

Intermittent Streams: Stream channel segments that may be classified as intermittent within the KCW Wind Farm Project are typically located at high elevations within the project area, also near the ridgeline. OHW widths range from 1- 4 feet and averages 2.5 feet. Bedrock outcroppings and associated fractures on the ridge provide seasonal groundwater supplies for these intermittent streams. Over half of the classified intermittent streams are associated with wetlands and typically provide hydrologic connectivity between catchment wetlands. Wider and more defined intermittent streams have steep longitudinal profiles with alternating step/pool habitat features. Boulders and cobble typically characterize the bed substrate. Representative photographs of intermittent streams within the KCW Wind Farm project component are included in Appendix 3.

Perennial Streams: Perennial stream segments within the direct investigation areas are typically located in valleys oriented perpendicular to the ridgeline. Most may be considered upper-perennial flow regimes and resultantly retain narrow OHW widths ranging between 3 and 7 feet wide. Most either receive or supply hydrology to adjacent wetlands within the direct investigation area. Based on the watershed setting of these perennial streams, they may be classified using the Rosgen Level 1 fluvial geomorphic assessment as "A" stream types, and thus characteristically have high slopes, low sinuosity, low channel width-to-depth ratios and narrow floodplains (USEPA 2006). The predominant habitat features are successive steps and pools formed by and with bedrock, boulder, and cobble substrate. Representative photographs of perennial streams within the KCW Wind Farm project component are included in Appendix3.

Transmission Component

Streams identified by VHBP within the corridor investigated for the Transmission Component are presented in the tabular Summary of Delineated Streams (Appendix 2). The locations and identification of each resource are depicted on the Natural Resource Maps included in Appendix 6. The following sections provide a summary narrative of stream or drainage resources identified by VHBP within the delineation area for the Transmission Component.

Ephemeral Channels: Two channel segments within the Transmission Component delineation area were identified that may convey ephemeral flow.

Intermittent Streams: There are 16 drainage segments within the Transmission Component delineation area that may be classified as intermittent streams. Most are characterized by OHW widths of 2 to 3 feet and are connected to wetlands or are tributaries to nearby perennial streams. The intermittent streams have poorly defined banks with a heterogeneous distribution of substrate, including organic material, clay, sand, gravel, and cobble. Intermittent stream 2009-SC-C32 is a typical intermittent stream exemplifying the aforementioned channel morphology and

substrate characteristics. Existing culverts and buffer degradation/encroachment from adjacent agricultural use are factors that contribute to some channel degradation. Representative photographs of intermittent streams within the KCW Transmission component of the Project are included in Appendix 4.

Perennial Streams: Most of the stream channels located within the transmission project component may retain perennial flow regimes, likely a result of the study corridor lying within valley floors and bisecting lower catchments. There is a large variation in the characteristics of onsite perennial streams, as OWH widths range from 3 to 50 feet, and average 12 feet. The larger channels are often those mapped in the Vermont Hydrographic Dataset (VHD), and include the Missisquoi River, Taft Brook, Jay Branch, Mill Brook, and Crook Brook. These larger systems are mostly likely Rosgen "C" stream types, and are characterized by pool/run/riffle alternating habitat features with well developed bankfull features, cobble/boulder substrates, and well-developed floodplains (Rosgen 1996) (see photographs in Appendix 4). These large river/stream features are not associated with adjacent wetlands when located in this study corridor. The more diminutive (narrower) perennial channels have moderately developed stream banks with a diverse composition of streambed substrate including, organic material, clay, sand, gravel, cobble and boulders (see Appendix 4). Although most of the perennial streams are in a stable condition, several have been degraded by VT Route 100 culvert crossings and agricultural land use practices, resulting in floodplain encroachments, bank armoring, and buffer width reductions. Several perennial streams have moderate active bank erosion, such as 2009-SC-C19, which is impacted by encroaching grazing practices. Representative photographs of perennial streams within the KCW Transmission Component are included in Appendix 4.

6.0 Outstanding Resource Waters

Section 1-03(D) of the Vermont Water Quality Standards (VWQS), effective January 1, 2008, authorize the Water Resources Board (WRB) to designate Outstanding Resource Waters pursuant to 10 V.S.A. Section 1424(a) (WRB 2008). A list of these waters is maintained on the Water Resources Panel website (Vermont Water Resources Panel 2007). The following waterways have been classified by the WRB as Outstanding Resource Waters:

1. Batten Kill River, Towns of East Dorset and Arlington
2. Pike's Falls/Ball Mountain, Town of Jamaica
3. Poultney River, Towns of Poultney and Fair Haven
4. Great Falls, Ompompanoosuc River, Town of Thetford (Vermont Natural Resources Board 2003).

Based on this listing, there are no Outstanding Resource Waters in the vicinity of the proposed KCW Project (Wind Farm and Transmission project components), nor is any KCW Project activity within the vicinity of the listed waterways.

7.0 Air Pollution

The Act 250 air pollution criterion incorporated into Section 248 provides that a project must not result in undue air pollution in relation to the character of the surrounding area. The proposed construction and operation (including monitoring) phases of the proposed Project would result in emission of low levels of air pollutants. These emissions would be temporary or infrequent, and would primarily be generated through combustion of vehicle gasoline and diesel fuel. Dust generated by construction equipment movement could result in an increase in airborne dust particulates. Also, the exposure and movement of subsurface geologic strata during construction could also generate airborne particulates. In

order to identify emissions and appropriate mitigative measures against air pollution, the following sections discuss each scenario, particularly focused on the Wind Farm component of the Project, where most vehicle and construction activity will occur.

7.1 Vehicle Emissions

Potential air pollutants that may temporarily be emitted (depending on the equipment used) during the construction phase include hydrocarbons (HC), fugitive dust (PM_{10}), CO, NOx, SO_2, and CO_2. These pollutants would be released by equipment used for clearing and grubbing and earthmoving operations, by cranes erecting the wind turbines, by vehicles traveling to and from the project area and on project access roads, and by miscellaneous equipment such as generators. Many of the same types of vehicles used for the existing timbering operations would be employed during the construction phase.

During operation, there would also be minor air emissions from staff and vendor vehicles. Maintenance equipment and vehicle emissions would result in minor indirect emissions of greenhouse gases as a result of fossil fuel energy use.

7.2 Dust and Asbestos Particulates

Dust resulting from construction activities will need to be managed in accordance with comprehensive erosion prevention and sediment control plans (which will be reviewed and approved by the VT DEC as part of construction-phase stormwater discharge permitting, and will include required activities for minimizing dust generation during the construction phase of the project).

The underlying bedrock geology has been investigated and found that the bedrock present at the KCW Wind Farm consists of schist and phyllite belonging to the Stowe Formation (Doll et al. 1961), which is not known to contain asbestos. Refer to the Bedrock Geology Map in Appendix 5 for the locations of bedrock formations in the vicinity of the Wind Farm component of the Project.

The Stowe Formation bedrock at the Wind Farm project site is composed of metamorphic rocks that were formed from extreme pressure and stress that was caused by folding and faulting that occurred during the uplift of the Green Mountains. These metamorphic rocks are thought to date back 500 million years to the late Cambrian or early Ordovician periods (Konig and Dennis 1964). The Stowe Formation is composed of three distinctive rock types or members, two of which are located within the KCW project area. Detailed descriptions of the rock types and mineralogy of these two members of the Stowe Formation are provided below.

OCsc – Stowe Formation (Schist and Phyllite)

The major rock types of the schist and phyllite member (OCsc) of the Stowe Formation at the Wind Farm project site are carbonaceous schist and phyllite (Konig and Dennis 1964). A schist or schistose rock has a medium to coarse grained texture and a flaky structure with a wavy foliation. Schist can have a silvery white or gray shaded coloration with yellow to brown tones and show a dull luster due to weathering over time (Chesterman 1978). Phyllite has a crystalline texture in which small crystals are visible to the naked eye. Phyllite has a wavy or crinkly foliation. The coloration of phyllite can be medium to dark gray to black, but also include green, red, purple, brown, or yellow and the luster can be described a silky sheen (Chesterman 1978). More specifically, the schist and phyllite rocks that make up the OCsc member of the Stowe Formation are characterized as fine grained and well foliated. The rocks are carbonaceous, which describes the carbon rich matter enclosed within them, and can also be observed to have a black coloration. The Stowe Formation schist and phyllite (OCsc) rock types are made up predominantly

of quartz, chlorite, and sericite minerals. Albite can also be present in smaller amounts (Konig and Dennis 1964).

OCs – Stowe Formation (Schist)

The major rock type of the schist member (OCs) of the Stowe Formation at the Wind Farm project site is schist (Konig and Dennis 1964). A general description of a schist or schistose rock is found above in the description of the schist and phyllite member (OCsc) of the Stowe Formation. Schist rocks that make up the OCs member of the Stowe Formation are characterized by a silvery-green coloration with numerous segregations of white colored quartz. The rock types of the OCs member are made up predominantly of sericite, quartz, and chlorite minerals. Porphyroblastic albite can also be present in lesser amounts. Magnetite, ilmenite, tourmaline, zircon, carbonate, and epidote can also be found, but are less common (Konig and Dennis 1964).

Bedrock formations at the Wind Farm project site do not include ultramafic (asbestos-containing) rocks such as those located at the VAG Mine Site, which also includes bedrock of the Hazens Notch Formation Ottauquechee Formation, and Pinney Hollow Formation (Doll, et al. 1961). The Ultramafic Rocks (udp) make up a large area of the VAG Mine Site and are composed of plutonic igneous rocks that were formed by the slow cooling and crystallization of magma at depth underground, as well as by inclusions of metamorphosed rock. The Ultramafic Rocks rock type (udp) is thought to date back 450 million years to the upper Ordovician period (Doll et al. 1961). The Hazens Notch Formation (Chb) also makes up a large area of the VAG Mine Site and is composed of metamorphic rocks that are thought to date to the Cambrian period (500 million years ago). The Ottauquechee Formation (Co) and Pinney Hollow Formation (Cpc) make up a much smaller area of the VAG Mine Site. Both of these formations are composed of metamorphic rocks that are thought to date back 500 million years to the Cambrian period.

The bedrock geology within the Transmission Component of the project was not investigated as activities will be limited to selective clearing and utility infrastructure placement within existing ROWs, and therefore should not involve release of airborne particulates generated from disturbance of underlying bedrock.

8.0 Floodways

Section 248 requires consideration of Act 250 criterion § 6086(a)(1)(D), which requires the applicant to demonstrate that the development within a floodway will not restrict or divert the flow of flood waters, and endanger the health, safety and welfare of the public or riparian owners during flooding, and that development within a floodway fringe will not significantly increase the peak discharge of the river or stream within or downstream of the area of development. The term "floodway" is defined in Section 6001(6) to mean "the channel of a watercourse which is expected to flood on an average of at least once every 100 years and the adjacent land areas which are required to carry and discharge the flood of the watercourse . . ." Floodway fringe is defined in Section 6001(17) as "an area which is outside a floodway and is flooded with an average frequency of once or more in each 100 years."

VHB reviewed the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for Lowell (effective 12/4/85), Westfield (maps revised 12/24/76, effective 4/1/98), and Jay (effective 8/23/00), Vermont to identify any lands that meet criteria (§ 6086(a)(1)(D)), which addresses floodways. Specifically, areas mapped by FEMA as Zone A (or Zone A derivatives) are considered those areas subject to floodway consideration under this criterion. The FEMA-FIRM maps included in Appendix 8 present the applicable index maps and map panels for the Project region.

From this review, there are no FEMA-mapped floodways within any region of the Wind Farm Component. The Project's Transmission Component crosses near several FEMA-mapped Zone A floodways. In Lowell, Vermont, these include Zone A floodways associated with the East Branch of the Missisquoi River, Ace Brook, Truland Branch Brook, an unnamed tributary to the East Branch of the Missisquoi River, and Leclair Brook. In Westfield, Vermont, these include the East Branch of the Missisquoi River, an unnamed tributary to the East Branch of the Missisquoi River, Taft Brook, and an unnamed tributary to Taft Brook. In Jay, Vermont, the corridor crosses Zone A floodways associated with Jay Branch and Crook Brook.

9.0 Headwaters

The relevant criteria with respect to 10 V.S.A. §6086(a)(1)(A), which are incorporated in the Section 248 review, are as follows:

(i) headwaters or watersheds characterized by steep slopes and shallow soils;
(ii) drainage areas of 20 square miles or less;
(iii) above 1,500 feet in elevation;
(iv) watersheds of public water supplies designated by the Vermont Department of Health; or
(v) areas supplying significant amounts of recharge waters to aquifers.

The KCW Wind Farm and Transmission Component meet one or more of the criteria above and therefore meets the definition of a headwaters area.

10.0 Shorelines

Shorelines are defined under Act 250, as incorporated into Section 248 criterion §6086(a)(1)(F), as the land adjacent to the waters of lakes, ponds, reservoirs, and rivers. Shorelines are further defined to include the land between the mean high water mark and the low water mark of such waters (Argentine 1998).

As defined, there are no such waterbodies within the Wind Farm Component that would be considered shorelines under this criterion. The Transmission Component does span areas that may be considered shoreline, specifically, land adjacent to the East Branch of the Missisquoi River, LeClaire Brook, Mississquoi River, Taft Branch, Mill Brook, Coburn Brook, Jay Branch and Crook Brook.

11.0 Water Supply

The Water Supply criteria incorporated in the Section 248 review provide that a project must have sufficient water available and not place unreasonable burden on existing water supplies. Based on the well completion reports on file with the Vermont DEC for the 38 drilled bedrock wells within one mile of the project (see Appendix 7 for tabulated well data), the average well yield is 11 gpm and the average well depth is 261 feet, indicating that there is a 98.9 percent (r^2=0.97) probability of drilling a bedrock well that yields at least 0.08 gpm. The nearest existing bedrock well to the considered project well location is Well Completion Report (WCR) #9, which is approximately 3,600 feet away to the southwest (see map in Appendix 7 for well locations). WCR #9 is a 450 foot deep bedrock well with a yield of 5 gpm. Drilled bedrock wells in Vermont with low demands of less than 1 gpm, do not affect the supply of other wells beyond the immediate vicinity, typically 100 to 200 feet from the well.

The KCW Wind Farm Component is not located within a wellhead protection area for any public water supply well. The Transmission Component will not involve blasting and will not require a long term source of water, and therefore was not included in the review of existing water supplies.

12.0 Wastewater Disposal

The Act 250 Waste Disposal criterion incorporated into Section 248 review provides that a project must meet applicable health and environmental conservation department regulations regarding the disposal of waste, and must not involve the injection of waste materials into ground water or wells. Once the project is operational, sanitary wastewater will be generated from a planned Operations and Maintenance (O&M) building that will require on-site treatment within the Wind Farm component. The O&M building is planned to be sited approximately around the 1,600-foot (a.s.l.) elevation contour on the western flank of Lowell Mountain, and wastewater will be disposed via a leachfield disposal system. The surface soil in this region is mapped by the Natural Resources Conservation Service (NRCS) as the Dixfield sandy loam series (Aquic Haplorthods) (VCGI 2008). This soil series is considered marginally suitable for drainfield use, and site specific studies are often required, in large part due to the depth to the seasonal groundwater table and slopes commonly greater than 20% (NRCS 2008). To ensure adequate renovation of sanitary wastewater, the treatment and disposal system will be designed, permitted, and constructed to meet the applicable criteria of the 2007 *Vermont Wastewater System and Potable Water Supply Rules*.

13.0 Soil Erosion

The Act 250 Soil Erosion criterion, as incorporated into Section 248 review, requires that projects (1) prevent soil erosion; and (2) prevent a reduction in the land's

capacity to hold water. The NRCS has classified each soil series in terms of its potential erodibility. As depicted on the Soil Maps and Tables in Appendix 9, there are several soil series within the both the Wind Farm and Transmission Component areas that have erodibility K-factors which the NRCS considers to be of "medium" or "high" erodibility ranking (VCGI 2008). In accordance with DEC construction phase stormwater discharge permitting requirements, the project will prepare an Erosion Prevention and Sediment Control (EPSC) Plan which will include the appropriate measures to mitigate against soil erosion effects.

14.0 Endangered Species (Plants) and Rare or Irreplaceable Natural Areas

The Act 250 criteria for Endangered Species and Rare or Irreplaceable Natural Areas (RINA) incorporated into Section 248 review provides that a project will not destroy or significantly imperil any Endangered Species and will not have an undue adverse effect on RINAs. Endangered Species include those that are defined as "threatened" or "endangered" on the Vermont state endangered species list and the state threatened species list[1], and that are protected under the Vermont Endangered Species Rule[2]. Those species protected under the federal 1973 Endangered Species Act are included. RINAs are loosely defined under Act 250 Criterion 8[3], but in general may be designated based on a combination of the rarity of the natural community and quality rank as determined by the Vermont Non-game and Natural Heritage Program (NNHP).

To identify the presence of threatened or endangered plant species within the KCW Wind Farm Component, VHBP conducted a review of RTE and RINA GIS data for Element Occurrences (EOs) as maintained by the NNHP. An EO is the known *Occurrence* (current or historical presence in a given area of land or water) of an

[1] 10 V.S.A. App. § 10
[2] 10 V.S.A. Chapt. 123
[3] 10 V.S.A. Section 6086 (a)(8)

Element (species or natural community type) of conservation concern. An EO can be defined as the occurrence of a rare species population or exemplary natural community at a specific location (NNHP 2006), and therefore can also be used to preliminarily identify known RINA resources. From this database review, no EOs were identified within or adjacent to the Wind Farm project site. Additionally, there are two federal-listed plant species currently known by the U.S. Rish and Wildlife Service (USFWS) to occur in Vermont, neither of which is known from Orleans County, Vermont, or other Vermont county, in the surrounding vicinity (USFWS 2009). Although no EOs or federal-listed species are known, field studies were completed by VHBP during the summer of 2009 to verify the presence/absence of any federal or state-listed threatened or endangered plant species, or RINA, within the KCW Wind Farm component of the Project, which are described below.

In January 2010, VHBP also conducted a review of the NNHP database for known EO's within or immediately adjacent to the Transmission Component study corridor. From this review, the NNHP has identified three EOs that occur within, adjacent, or in immediate proximity, to the study corridor. Mapped near the Lowell/Westfield town line (to the east of the Missisquoi River and the west of Farman Hill), all three EOs occur within the same locale (see the Natural Resources Maps in Appendix 6 for a location approximation). Following review of correspondence received from NNHP on February 3, 2010, these EO's consist of two rare plants, a state threatened (G3S2) and an unlisted (G4S2) species, and an associated natural community (G2?S1) (NNHP 2010).

Threatened or Endangered Plant Survey

In July and August 2009, VHBP conducted a survey for rare plants listed as either threatened or endangered under the Vermont Endangered Species Act. The surveys consisted of field inventories of flora within the direct investigation area of the Wind Farm Component, with particular attention given to habitats of higher or unique ecological value (habitats that retain increased rare flora habitat potential).

Based on the results of the 2009 survey, one population of the state-threatened male fern (*Dryopteris filix-mas*) was found high on a mountain saddle near the VHBP-delineated wetland 2009-C32. Male fern retains a conservation ranking of G5S2, indicating that the species is considered globally common but rare in Vermont (NNHP 2009). Common over much of its range, this pteridophyte is a circumboreal species that occurs in habitats created by thickets, moist woods, and streambanks (Gleason and Cronquist 1991). Three individuals were found in a concentrated location, which was recorded using sub-meter accurate GPS equipment. The locations of the onsite male fern is depicted on the Natural Resources Map presented in Appendix 5. Other vascular plant species found that are considered rare in Vermont, include northern mountain ash [*Sorbus decora* (G4G5S3)], boreal bedstraw [*Galium kamtschaticum* (G5S2S3)], and three-leaved rattlesnake root [*Nabalus trifoliolatus* (G5S2?)], none of which hold protective listed status in Vermont (NNHP 2009). The summary spreadsheet of RTE plant findings is included in Appendix 1.

The Transmission Component was not able to be surveyed for threatened or endangered vascular flora in 2009. From review of the NNHP database described above, there are known EOs of rare and listed plants within immediate proximity to the investigation area in one locale near the Westfield/Lowell town line. In the Spring 2010, surveys will be conducted to verify the presence and determine the extent of the known occurrences. Additionally, although no other EOs have been identified by NNHP within the remainder of the study corridor, searches of appropriate habitat for potential occurrences will be completed in the Spring 2010. The investigation area occurs within existing overhead utility or roadway ROWs which are periodically disturbed for overhead line, roadway ROW, or woody vegetation maintenance. Since any rare plant populations potentially occurring within the study area would typically be adapted to such regular disturbance (that may not be unlike disturbance associated with the planned project), follow-up searches will target habitats favored by Vermont threatened or endangered flora

known from the region, and focus on areas where permanent alterations may be considered (i.e., forest clearing).

Rare or Irreplaceable Natural Areas

During the threatened and endangered plant survey conducted in July and August 2009, VHBP observed three basic forest community types, as defined in *Wetland, Wildland, Woodland, A Guide to the Natural Communities of Vermont*, at the KCW Wind Farm project site: Northern Hardwood Forest (NHF), Montane Yellow Birch-Red Spruce Forest (MYBRSF), and Montane Spruce-Fir Forest (MSFF) (Thompson and Sorenson, 2000). The MYBRSF and MSFF are considered S3 by the NNHP, meaning that high quality examples of these communities are uncommon in the state, but not rare. The NHF is a S5 ranked community, meaning the NNHP considers high quality examples of this type to be common and widespread in the state. As discussed above, RINAs may be designated based on a combination of the natural community rarity and quality as determined by NNHP.

During initial natural community and threatened and endangered plant surveys, distinct red spruce-balsam fir forest stands were noted that preliminarily met the NNHP descriptions of high quality MSFF. The MYBRSF communities that are onsite, although of S3 status, are not high quality, in part due to disturbances from past and recent logging. VHBP, through coordination with the NNHP, learned that the NNHP had previously identified, through remote sensing, potential MSFF within the study limits. NNHP subsequently provided VHBP with GIS map files of the location and extent of the mapped MSFF. Using the NNHP mapping as a guide, VHBP conducted a detailed ground-based survey and delineation, with sub–meter capable GPS, of stands that represent distinct examples of the MSFF community type, as described by Thompson and Sorenson (2000), within the direct study area at the Wind Farm site.

During site visits conducted by VHBP on September 21, September 30, and October 2, 2009, MSFF stands were mapped that contain a dense overstory composed

entirely of balsam fir and/or red spruce (*Picea rubens*), as well as thin herbaceous ground cover that is dominated by a consistent layer of mosses and lichen. Areas containing prevalent pteridophyte cover, excessive wind-throw, and/or tree species other than red spruce or balsam fir were not considered exemplary MSFF stands. Prism plots (10-factor) were taken within selected delineated MSFF stands to confirm composition, relative age, size, and height of the forest cover. Resultantly, examples of the distinct MSFF community found on site are relatively small in size, occur in isolated stands, and are surrounded by the more prevalent MYBRSF community type.

From VHBPs field delineations, ten distinct examples of the MSFF community type, covering a total area of 2.9 acres, were noted and mapped. Stands occur in isolated patches, ranging from as small as 1,130 square feet (0.03 acres) to 37,150 square feet (0.85 acres) in size and are located between 2,475 and 2,600 feet (a.s.l.) in elevation. Stand composition, evaluated via 10-factor prism plots for MSFF stands 3, 6, 7 and 10, is 75-percent balsam fir and 25-percent red spruce. Red spruce, while less abundant, are typically older, taller, and with larger diameter-at-breast-height (DBH) than balsam fir. The age of the four stands measured range from 32 to 41 years old, tree height is 21 to 33 feet, and DBH averages from 5.1 to 5.7 inches. The ten MSFF stands are distributed in non-contiguous clusters within the broader MYBRSF and NHF communities observed at the Wind Farm site. The summary spreadsheet of the MSFF stands, presented in Appendix 1, details characteristics of each and representative photographs from the MSFF delineation are included in Appendix 3. The MSFF stand locations are depicted on the Natural Resource Maps presented in Appendix 5.

The Transmission Component was not able to be surveyed for RINAs in 2009. From review of the NNHP database described above, there is a known significant natural community EO within immediate proximity to the investigation area in one locale near the Westfield/Lowell town line. In the Spring of 2010, surveys will be

conducted to verify the presence and determine the extent of the known occurrence. Additionally, although no other significant community EOs have been identified by NNHP within the remainder of the study corridors, searches for potential occurrences will be completed in the Spring 2010. This follow-up survey will target habitats retaining conditions typically favoring known significant communities from the region, and focus on areas outside of existing ROWs or otherwise disturbed land where permanent alterations to existing natural community conditions may be considered (i.e., forested clearing or excavation/fill).

15.0 References

Argentine, C.C. 1999. Vermont Act 250 Handbook. Putney Press, Brattleboro, VT.

Chesterman, C.W. 1978. *The Audubon Society Field Guide to North American Rocks and Minerals.* Alfred A. Knopf, Inc. New York, NY.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitat of the United States. U.S. Fish and Wildlife Service. FWS/OBD-79/31. 103pp.

Doll, C.G., W.M. Cady, J.B. Thompson, Jr., and M.P. Billings, 1961. *Centennial Geologic Map of Vermont.* Scale 1:250,000. Vermont Geologic Survey.

Environmental Laboratory, 1987. Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1, U.S. Army Engineer Waterways Experiments Station.

Gleason, H.A., A.C. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. The New York Botanical Garden Press. Bronx, NY, 10458.

Konig, R.H. and J.G. Dennis. 1964. *The Geology of the Hardwick Area, Vermont.* Vermont Geologic Survey. Vermont Development Department. Montpelier, VT.

New England Hydric Soils Technical Committee (NEHSTC). 2004. 3rd ed., Field Indicators for Identifying Hydric Soils in New England. New England Interstate Water Pollution Control Commission, Lowell, MA.

Rosgen, D.L. and H.L. Silvey. 1996. "Applied River Morphology". Wildland Hydrology Books, Fort Collins, Co.

Thompson, E. H. and E. R. Sorenson. 2000. Wetland, Woodland, Wildland: A Guide to The Natural Communities of Vermont. The Nature Conservancy and the VT Dept. of Fish and Wildlife, Hanover, NH. p. 24.

U.S. Army Corps of Engineers (USACE) – New England District. 1999. The Highway Methodology Workbook: Supplement: Wetland Functions and Values – A Descriptive Approach. NAEEP-360-1-30a.

U.S. Army Corps of Engineers (USACE). 2005. "Regulatory Guidance Letter. Subject: Ordinary High Water Mark Identification." No. 05-05. Accessed online at: http://www.usace.army.mil/cw/cecwo/reg/rglsindx.htm.

U.S. Army Corps of Engineers (USACE) – Denver Regulatory Office. 2006. "Nationwide Permit Definitions."Accessed online at: https://www.nwo.usace.army.mil/html/od-tl/nwp_def.html#14. Accessed and archived: 10/10/2006.

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). 2008. Vermont Soil Fact Sheet, Orleans County, Vermont.

U.S. Environmental Protection Agency (US EPA). 2006. Fundamentals of the Rosgen Stream Classification System. Accessed online at: http://www.epa.gov/watertrain/stream_class/.

U.S. Fish and Wildlife Service (USFWS). 2009. Endangered Species: *New England Listed Species*. Accessed online at: http://www.fws.gov/newengland/EndangeredSpec-NEListedSpecies.htm.

Vermont Agency of Natural Resources (ANR). 2005. Riparian Buffer Guidance: December 9, 2005. Accessed online at: http://www.anr.state.vt.us/site/html/buff/anrbuffer2005.htm. Accessed and archived: 10/10/2006.

Vermont Department of Fish and Wildlife Nongame and Natural Heritage Program (NNHP). 2009. Rare and Uncommon Native Vascular Plants of Vermont. Accessed online at: http://www.vtfishandwildlife.com/library/Reports_and_Documents/NonGame_and_Natural_Heritage/Rare_Threatened_and_Endangered_Species%20%20---%20lists/Rare_and_Uncommon_Vascular_Plant_%20of_Vermont.pdf .

Vermont Department of Fish and Wildlife Nongame and Natural Heritage Program (NNHP). 2010. VHBP communication with Jodi Shippee in electronic mail correspondence dated February 3, 2010.

Vermont Water Resources Board (WRB). 2002. Vermont Wetland Rules. Effective January 1, 2002.

Vermont Water Resources Board (WRB). 2008. Vermont Water Quality Standards. January 1, 2008. Montpelier, VT.

Vermont Center for Geographic Information (VCGI). 2008. Digital soil survey information derived from Natural Resource Conservation Service (NRCS) soil survey mapping (updated 2/18/2008).

Vermont Water Resources Panel. 2007. Outstanding Resource Waters. Accessed online at: http://www.nrb.state.vt.us/wrp/orw.htm. Accessed and archived: 2/2/2007.