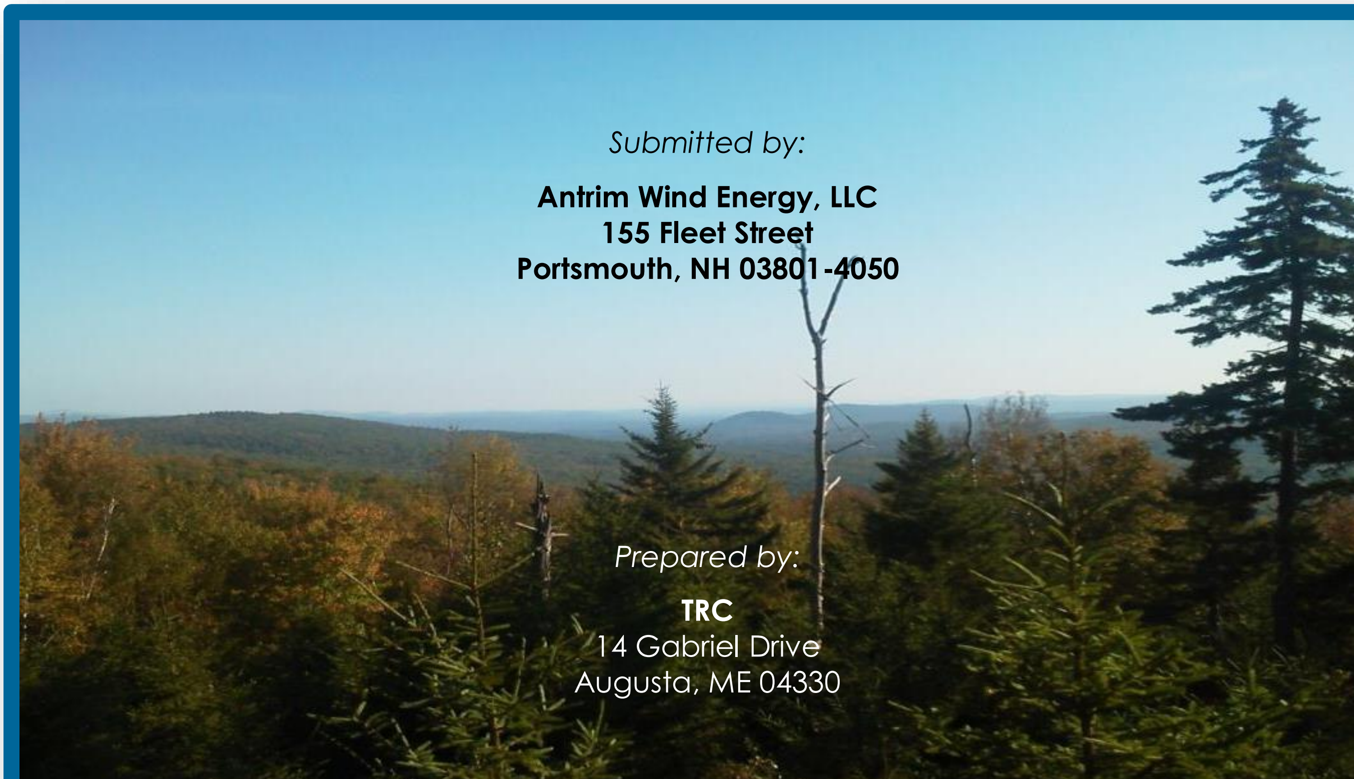
NEW HAMPSHIRE SITE EVALUATION COMMITTEE

APPLICATION OF ANTRIM WIND ENERGY, LLC FOR A CERTIFICATE OF SITE AND FACILITY

DOCKET NO. 2015-02



Submitted by:

Antrim Wind Energy, LLC
155 Fleet Street
Portsmouth, NH 03801-4050

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SEPTEMBER 10, 2015

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EXECUTIVE SUMMARY

Antrim Wind Energy LLC ("AWE") submits this Application to the New Hampshire Site Evaluation Committee ("SEC") for a Certificate of Site and Facility ("Certificate") to construct and operate the Antrim Wind Project ("Project") in Antrim, New Hampshire. The Antrim Wind Project is a planned 28.8 MW electrical generation facility consisting of nine Siemens SWT-3.2-113 direct drive wind turbines and associated civil and electrical infrastructure.

This Application is the culmination of more than six years of development work on the Antrim Project. As further explained in the detailed application materials that follow, the Antrim Project is widely supported in the Town of Antrim among its residents and elected officials and is consistent with and advances a number of important local and regional public policy goals, such as those contained in New Hampshire's renewable portfolio standard ("RPS") law, the Regional Greenhouse Gas Initiative ("RGGI"), the Antrim Master Plan and Antrim Open Space Plan. In addition to providing significant clean energy and fuel diversity benefits to the state, which can stabilize volatile energy costs resulting from overdependence on fossil fuels, the Antrim Project features a unique and extensive conservation benefit package that will permanently conserve over 908 acres of valuable forestland and wildlife habitat on or near the Project site – a process that involved extensive collaboration with local landowners, and many conservation organizations – resulting in significant perpetual benefits that advance many local and regional conservation goals and are consistent with the generation of clean wind energy. As a result of these conservation commitments the Project will permanently conserve over 16.5 times more land than will be initially cleared for construction and over 78 times more land than will be occupied by long term facilities – including more than 313 acres of the highest ranked habitat in the State under New Hampshire's Wildlife Action Plan and over 156 acres of the highest ranked habitat in the region. In addition to the "on-site" conservation lands, AWE has entered into a Land Conservation Funding Agreement with the New England Forestry Foundation ("NEFF"), whereby AWE will fund $100,000.00 to NEFF to acquire additional conservation lands in the region for the enhancement and maintenance of the region's aesthetic character, wildlife habitat, working landscape, and public use and enjoyment

AWE has executed and maintains several direct agreements with the Town of Antrim, including: (i) a PILOT Agreement, updated in November 2014, which provides significant, stable revenue to the Town for the first 20 years of the Project's life, paying the highest per MW payment of any PILOT agreement for a wind project in New Hampshire; (ii) an Agreement with the Town governing many requirements during preconstruction, construction, operations and decommissioning of the Project; (iii) a letter Agreement in which AWE commits funds to enhance recreational facilities at the Gregg Lake Beach area; and (iv) a letter agreement with the Antrim Trustees of Trust Funds where AWE has committed $5,000 per year for the life of the Project to the Antrim Scholarship Committee. This amount represents approximately 25% of the Scholarship Committee's total 2014 scholarship awards. AWE has also entered into an Agreement with the

Appalachian Mountain Club, satisfying all of their concerns related to the potential aesthetic impacts of the Project, which includes a commitment to employ innovative radar activated FAA light controls once the FAA issues the new guidance approving the use of these systems – a first for any wind project in New Hampshire.

Because the Antrim Wind Project is located directly adjacent to NH Route 9, new road construction for the Antrim Wind Project is very limited, only 3.55 miles, which is fewer new road miles per MW of installed wind capacity of any wind project in the State. Additionally, because the Project is sited directly adjacent to a high voltage transmission line, no new transmission lines will be necessary to deliver the Project's renewable power to the electric grid – eliminating any impacts associated with the construction of new transmission lines.

The Antrim Project features an innovative and biologically appropriate bird and bat conservation strategy ("BBCS") that includes voluntary curtailment to reduce and study potential impacts to bats, and tiered consultation and adaptive management to address unforeseen risks during the Project's operating life. The BBCS was developed by expert biologists on AWE's team in consultation with the US Fish and Wildlife Service ("USFWS") and New Hampshire Fish and Game ("NHFG"). There are no resident rare, threatened or endangered animal species on the site and after two site visits to the Project the New Hampshire Natural Heritage Bureau concluded that "it is unlikely that the proposed wind facility will impact rare plants species or exemplary natural communities."

AWE sought a Certificate of Site and Facility for a previous wind energy project before the SEC in Docket 2012-01. That previous project proposal consisted of 10 taller turbines. The SEC issued an Order Denying a Certificate of Site and Facility for that project due to concerns related to aesthetic impacts. This application reflects significant revisions to the Antrim Project to specifically address the concerns that were identified in that Docket with respect to aesthetics. AWE has made targeted changes to the Project design to reduce aesthetic impacts, and has increased mitigation to offset any remaining aesthetic impacts. AWE has also conducted a far more comprehensive visual analysis to characterize the Project in the landscape and to assist the Committee in its review of this important component.

Significantly, although the Certificate was ultimately denied in Docket 2012-01, the SEC made numerous findings in support of issuing a Certificate of Site and Facility, including that such project would not have an unreasonable adverse impact on the orderly development of the region, or historic sites, and that with certain conditions imposed, would not have an unreasonable adverse impact on public health and safety, the natural environment or air and water quality. The current Project proposed in this Application is in many respects very similar to the 2012-01 application. All of the impacts associated with the former project are now reduced: sound levels are lower, flicker levels are lower, ground clearing and grading amounts are reduced significantly and no new sensitive ecological resources will be impacted. The only small exception is a very small new wetland that was created by a recent logging operation that will be impacted (986 ft2). The locations of all wind turbine generators ("WTGs") have not changed since the prior application, and WTG #10 has been removed together with all of the civil and electrical infrastructure associated with it, so impacts on the ground have also been reduced.

In the SEC's Order Denying a Certificate in 2012-01 the Committee found that the Applicant possessed adequate technical and managerial capability to construct and operate the project. There was no finding on the applicant's financial capability. The Committee's finding related to technical and managerial capability was based upon the AWE management team's experience together with the turbine supplier in that Docket, Acciona Windpower. Since that time, AWE has changed the turbine, partly to be able to accommodate the other changes in the Project discussed in this Application. AWE's new turbine manufacturer, Siemens Energy Inc., is a larger, more experienced global company with vast experience in the manufacture, installation, commissioning and operation of wind turbines globally and in the United States, including New England. AWE has entered into a binding MOU with Siemens to supply turbines for the Project and to provide services to those turbines. AWE has also selected Reed & Reed Inc. of Woolwich, Maine to construct the Project.

AWE has also come under new ownership since the 2012-01 application was filed. While the original developer of the Project, Eolian Renewable Energy, LLC of Portsmouth, New Hampshire is still an owner of the Project, a majority interest in Antrim Wind Energy LLC is now owned by Walden Green Energy LLC out of New York, which is in turn majority owned by RWE Principal Investments, the principal investment arm of RWE, one of Europe's five largest electric and gas utilities. As detailed in this Application, AWE now possesses the ability to commit all of the required equity capital to the Project and its ownership team maintains the same high degree of demonstrated experience in project financings.

Issuance of a Certificate of Site and Facility relative to the Project will unquestionably serve the public interest. The New Hampshire legislature has recognized that it is in the public interest to stimulate investment in low emission renewable generation technologies in New Hampshire (RSA 362-F:1). Consistent with the state's renewable energy goals as stated in RSA 362-F, the legislature has also recognized that appropriately sited and conditioned wind energy systems have the potential to assist the state in accomplishing these goals (RSA 162-H:10-a, I.) As explained more fully in this Application, the Project is optimally sited and incorporates conditions already set forth by the SEC and NHDES in Docket 2012-01 to ensure that the Project will not have any unreasonable adverse effect. Furthermore, the Project will provide real and quantifiable benefits to the public on both a local and regional level. As noted above, the Project advances critical legislative and public policy objectives to promote renewable energy technologies and reduce greenhouse gas emissions. Wind energy produces no pollutants or greenhouse gases, and it is well documented that wind generation offsets carbon-based generation and directly reduces climate-altering carbon dioxide emissions. The Project will produce enough clean energy to meet the annual energy consumption needs of approximately 12,300 average New Hampshire homes, and by diversifying the energy mix in New Hampshire and the region it can contribute to reducing the volatility of energy costs. The Project will also promote local and regional conservation goals as it will permanently conserve over 900 acres of forest and wildlife habitat. The public will also experience economic benefits as a result of the Project, which will create both short-term and long-term jobs in the region and provide a significant long-term benefit to the Town of Antrim through a payment in lieu of taxes ("PILOT") agreement pursuant to which AWE will pay $11,250 per MW of installed capacity per year, which is more than $8.3 million over the life of the agreement.

In summary – this Application represents the best components of the 2012-01 project while containing significant improvements in areas where concerns were identified. This Project is an excellent opportunity for New Hampshire to gain many significant energy, economic and conservation benefits through the construction of a well-sited and widely supported new wind facility.

A. SIGNATURE OF APPLICANT

Certification by Executive Officer of Antrim Wind Energy, LLC

In accordance with RSA 162-H:8, I, John B. Kenworthy, an Executive Officer of Antrim Wind Energy, LLC, do hereby swear and affirm that the information contained in this Application is true and accurate to the best of my knowledge and belief.

I also certify that, as an Applicant to the New Hampshire Site Evaluation Committee, Antrim Wind Energy, LLC, agrees to provide such information as the Committee shall require to carry out the purposes of RSA 162-H.

Antrim Wind Energy, LLC

Name: John B. Kenworthy

Title: Executive Officer

Date: 9/8/2015

State of New Hampshire

County of Rockingham

On this day 8th of September 2015, personally appeared before me the above-name John B Kenworthy Executive Officer of Antrim Wind Energy LLC and swore and affirmed that the information contained in this Application is true and accurate to the best of his knowledge and belief.

Katrina Ricker

Notary Public/Justice of the Peace

My Commission expires: 3/13/2020

KATRINA RICKER
MY COMMISSION EXPIRES MARCH 13, 2020
NOTARY PUBLIC
NEW HAMPSHIRE

B. APPLICANT INFORMATION

B.1. The name of the applicant

Antrim Wind Energy, LLC

B.2. The applicant's mailing address, telephone and fax numbers, and e-mail address

Antrim Wind Energy, LLC
155 Fleet Street
Portsmouth, NH 03801-4050
Telephone: 603-570-4842
Fax: 603-386-6743
Email: generate@eolian-energy.com

B.3. The name and address of the applicant's parent company, association or corporation if the applicant is a subsidiary

Antrim Wind Energy, LLC ("AWE") is a Delaware limited liability company formed in 2009 as a special purpose entity to develop, build, own and operate the Antrim Wind Energy Project (the "Project" or "Facility"). AWE has two members – Eolian Antrim, LLC and Walden Green Energy Northeast Wind, LLC. Both of these members are registered Delaware limited liability companies and are owned by Eolian Renewable Energy, LLC ("Eolian") and Walden Green Energy, LLC ("Walden"), respectively. AWE operates from the offices of Eolian Renewable Energy, LLC at 155 Fleet Street, Portsmouth, NH 03801. The names and addresses of its parent companies are listed below.

Eolian Antrim, LLC and
Eolian Renewable Energy, LLC
155 Fleet Street
Portsmouth, NH 03801-4050
Telephone: 603-570-4842
Fax: 603-386-6743
Email: jkenworthy@eolian-energy.com
Website: www.eolian-energy.com

Walden Green Energy Northeast Wind LLC
and Walden Green Energy LLC
40 Worth Street, 10th Floor
New York, NY 10013
Telephone: 646-527-7288
Email:
henry.weitzner@waldengreenenergy.com

B.4. If the applicant is a corporation

B.4.a. The state of incorporation

See application Section B. 3.

B.4.b. The corporation's principal place of business

See application Section B.3.

B.4.c. The names and addresses of its directors, officers and stockholders;

The following is a list of owners, officers, and managers of: Antrim Wind Energy, LLC; Eolian Antrim, LLC; and Walden Green Energy Northeast Wind, LLC.

Antrim Wind Energy, LLC: Delaware limited liability company

Members
- Walden Green Energy Northeast Wind, LLC
- Eolian Antrim, LLC

Officers
- Henry D. Weitzner, Executive Officer
- Sarah Valdovinos, Executive Officer
- George Manahilov, Executive Officer
- John B. Kenworthy, Executive Officer
- John M. Soininen, Executive Officer

Eolian Antrim, LLC: Delaware limited liability company

Member
- Eolian Renewable Energy, LLC

Officers
- John B. Kenworthy, President and CEO
- John M. Soininen, Vice President
- James A. Kenworthy, Vice President

Managers
- John B. Kenworthy
- John M. Soininen
- James A. Kenworthy

Walden Green Energy Northeast Wind, LLC: Delaware limited liability company

Member
Walden Green Energy, LLC

Managers
Henry D. Weitzner
Sarah Valdovinos
George Manahilov

B.5. If the applicant is an association, the names and addresses of the residences of the members of the association

Antrim Wind Energy, LLC is not an association.

B.6. Whether the applicant is the owner or lessee of the site or facility or has some legal or business relationship to it

Antrim Wind Energy, LLC has a leasehold interest in five properties in the Town of Antrim that will be used to accommodate the wind power facilities associated with the Project. These properties are owned by five distinct private landowners, and comprise the entire proposed operational Project area in Antrim. The leases have a maximum term of 50 years. AWE has also purchased an option to acquire up to 10 acres in fee from one of the lessors where the interconnection switchyard will be located.

In addition, one additional parcel of land off Route 9, west of the proposed entrance to the Project, has been leased from another landowner for use during construction as a temporary staging or laydown yard and for the location of contractor offices, materials and equipment handling and storage.

All lease rights have been recorded at the Hillsborough County Registry of Deeds.

B.7. Statement of assets and liabilities of the applicant

A statement of the assets and liabilities of the Applicant is provided in Appendix 1 of this Application. As more fully described in Section H.5 of this Application, AWE is not relying on its balance sheet to demonstrate its financial capability to construct and operate this Project.

C. SITE INFORMATION

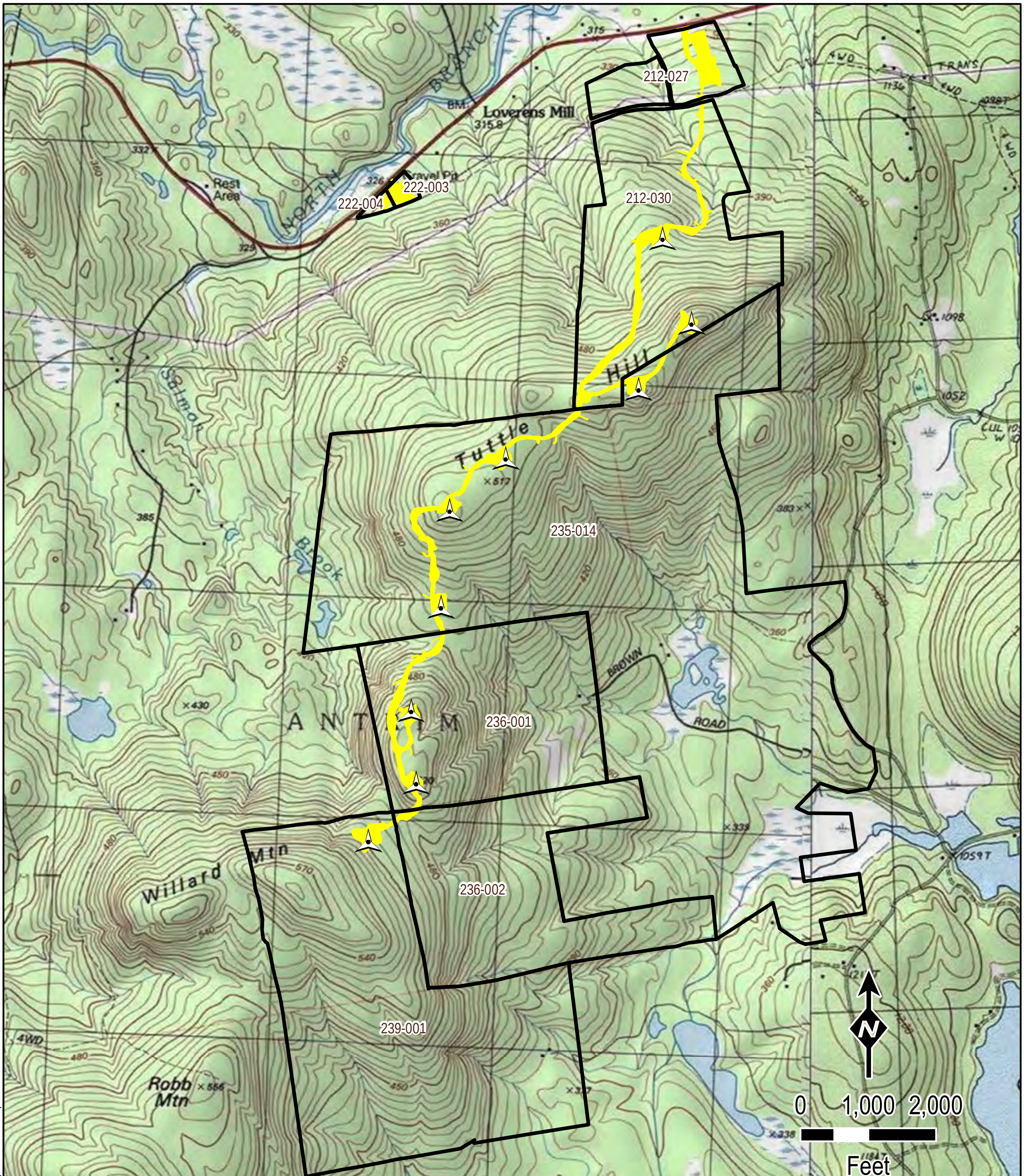
C.1. Location and address of the site of the proposed facility

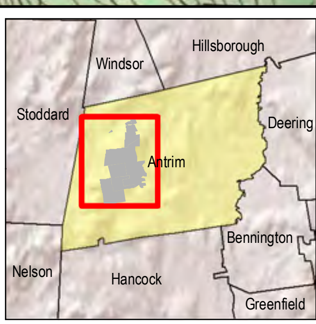
The entirety of the Project is located in the sparsely settled rural conservation zoning district in the northwest portion of the Town of Antrim. Specifically, the proposed location of the Project is on and adjacent to 354 Keene Road (NH Route 9) and includes approximately 1,870 acres of private lands currently leased by AWE from six landowners. The lease area will be reduced to include only the as-built windpower facilities and buffers after construction is completed. These lands occupy the area from Route 9, southward to the east summit of Tuttle Hill, and to the north flank of Willard Mountain to the west. The Project will be constructed primarily on the ridgeline that starts approximately 0.75 miles south of NH Route 9 and runs south-southwest, for approximately 2 miles.

Between the ridgeline (where the proposed turbine string will be located) and Route 9, to the north, is a Public Service of New Hampshire (PSNH) transmission corridor containing both a 115 kV electric transmission line and a 34.5 kV electric distribution line. AWE proposes to interconnect the Project to the grid by building a substation to interconnect to the 115 kV line known as L163. This transmission right of way (and point of interconnection) is approximately halfway between Route 9 and the northern-most turbine, and runs through property currently leased by AWE. Proposed access to the Project site is from Route 9 up the north slope of Tuttle Hill ridge.

A map of the Project location is provided as Figure C.1

For purposes of assisting in construction of the Project, an additional temporary staging or laydown yard located west of the proposed entrance to the Project will be used during construction. The location of the additional laydown yard is shown in Figure C.1.





Legend

- Proposed WTG
- Project Footprint
- Project Parcels

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

354 KEENE ROAD, ANTRIM, NH

Figure C.1

Project Location Map

Produced by: TRC | 1/29/2015

V:\PROJECTS\AUGUSTA\Eolian\ANTRIM\Figure C1 Project Location Map.mxd

C.2. Site acreage, shown on an attached property map and located by scale on a U.S. Geological Survey or GIS map

The Project is located in the sparsely settled rural conservation zoning district in Antrim on approximately 1,870 acres of private lands leased by AWE from six landowners. These areas are depicted on Figure C.1, as referenced in Section C.1, above.

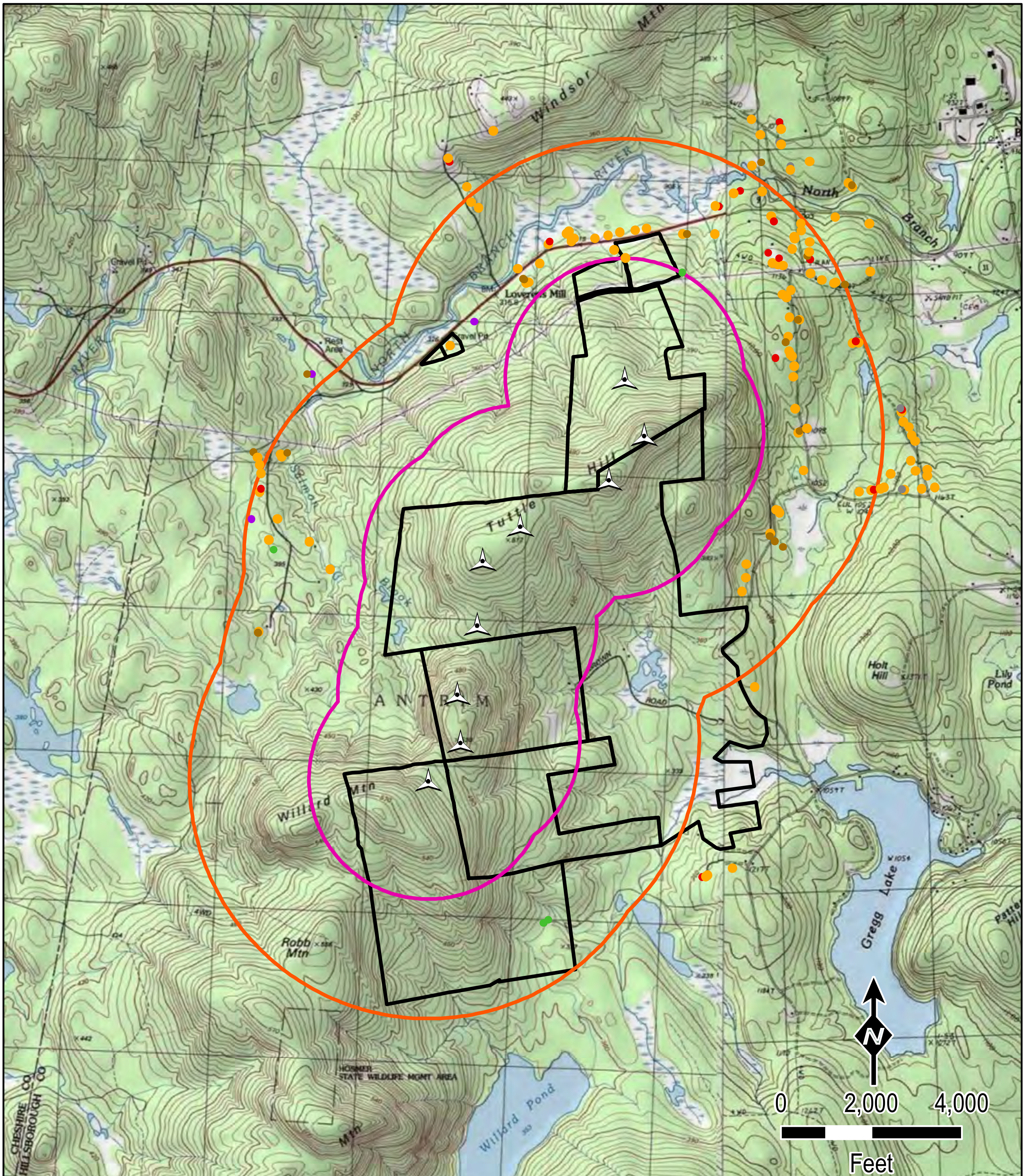
As is typical with wind projects, the Project will occupy only a very small fraction of this land post-construction. The area of initial clearing required for construction of the Project will be approximately 57.1 acres and the area that will directly accommodate any Project facilities (e.g. roads, turbine pads, substations and other facilities) will be approximately 11.3 acres. This represents only 3% of the total amount of the leased land described above.

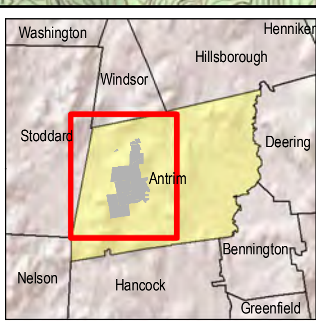
C.3. The location of residences, industrial buildings, and other structures and improvements within or adjacent to the site

Development adjacent to the proposed Project site consists primarily of rural residential dwellings (and their associated outbuildings) and seasonal camps. In general, this development is clustered along Route 9, to the north; Reed Carr Road, to the northeast; the north end of Craig Road, to the east; Brimstone Corner Road, to the southeast; and Salmon Brook Road, to the northwest.

The nearest year-round residence is located approximately ½ mile due north of the northernmost proposed turbine (Turbine #1) on Tuttle Hill. The owner of this residence is among the parties that have entered into lease agreements with AWE. The closest structure owned by a party who does not have a lease agreement with AWE is a seasonal hunting camp located approximately ½ mile to the northeast of the northernmost proposed turbine on Tuttle Hill.

All other structures are located greater than ½ mile from proposed turbine locations. The locations of structures relative to the proposed Project site are illustrated on Figure C.3.





Proposed WTG Location

Half Mile Buffer of Proposed WTG Locations

Mile Buffer of Proposed WTG Locations

Project Parcels

Structure Type

- Barn
- Shed
- Camp
- Garage
- Misc
- House/Trailer

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure C.3

Location of Structures

Produced by: TRC 1/29/2015

V:\PROJECTS\AUGUSTA\Eolian\ANTRIM\Figure C3 Location of Structures 8x11.mxd

C.4. Identification of wetlands and surface waters of the state

Wetlands, surface waters and vernal pools throughout the Project area have been delineated by a New Hampshire certified wetland scientist. The National Wetlands Inventory mapping identified 0.6 acres of wetlands within the 462-acre wetland survey area. Field delineations within the same area revealed approximately 7.1 acres of wetland within the study area. The complete results of these efforts are summarized in Section I of this Application. Full study reports for wetland and vernal pool studies are provided in Appendix 11C and 11D, respectively, of this Application.

The associated wetland impact for the Project area including access, turbines, substation, and proposed laydown areas totals 9,121 sq. ft. or 0.21 acre of wetland. *See* Appendix 2A, Exh. 5-1, Table 4-1 for specific wetland impact data. Additional wetland data is also provided in the same appendix.

Furthermore, surface waters of the site are described in detail in the application forms, design plans, and maps provided in conjunction with the Joint USACE/NHDES Standard Dredge & Fill Permit Application, NHDES Site Specific Terrain Alteration Application, and NHDES Section 401 Water Quality Certification Request, discussed in Section D of this Application. These documents are included in Appendix 2, as referenced in Section D.3 of this Application.

C.5. Identification of natural and other resources at or within or adjacent to the site

C.5.a. General setting

Most of the Town of Antrim is undeveloped, and a large proportion of the town's landscape is heavily wooded. Much of Antrim's forested areas are located in the Rural and Rural Conservation Zoning Districts of town; these two districts constitute over 70% of Antrim's total area. These woodlands are viewed by the town as a renewable resource and are logged on a regular basis. (Town of Antrim 2011). In addition to abundant woodland, there are also numerous conservation areas, hiking trails and water features.

Historically, the area of the proposed Project was cleared for sheep farming; numerous stone walls still remain as a result of this historic activity. After the decline of sheep farming, the site was allowed to regenerate into a forested condition. Subsequently, timber harvesting has occurred in many areas on Tuttle Hill and Willard Mountain. Currently, the land in and around the area of proposed development consists of undeveloped forestland in various stages of maturity, ranging from recent clearcuts and early successional stands as a result of timber harvesting, to mature forested areas.

In order to describe the current landscape of the proposed Project area in detail, a natural community survey was performed in 2011. This effort served to classify the landscape of the proposed Project into discrete natural communities, and to identify any significant, unique or rare natural communities. The results of this effort are summarized in

Section I.5, and the full Natural Communities Report is provided in Appendix 11A of this Application.

Staff of the New Hampshire Natural Heritage Bureau (NHNHB) visited the Project site on December 13, 2011 and July 13, 2012. The Natural Community Assessment is provided in Appendix 11A of the Application. On August 2, 2012, the NHNHB determined that "it is unlikely that the proposed wind facility will impact rare plants species or exemplary natural communities." The August 2, 2012 letter from NHNHB is provided as Appendix 11A-1. AWE consulted with NHNHB again in 2015 and received a letter on June 26, 2015 from NHNHB confirming that no rare plants or exemplary natural communities are likely to be found within the Project area. That letter is provided as Appendix 11A-2.

In October 2014, a field biologist visited the Project site on behalf of the Applicant to determine if any significant changes had occurred on the landscape and found that the conditions on the site remain unchanged from the 2011 and 2012 study periods.

C.5.b. Wildlife Resources

The Town of Antrim's extensive undeveloped lands and diverse natural resources, which are characteristic of much of this region in New Hampshire, provide ample haven for a wide diversity of wildlife. The abundant natural resources in and around the proposed Project area provide ample habitat opportunities for many of New Hampshire's indigenous wildlife species. Wildlife studies that have been performed specific to the proposed Project are described in Section I.5.c of this Application. A wildlife impact assessment has been conducted, as described in Section I.5.c.(h) of this Application, and the assessment is provided in Appendix 12G.

C.5.c. Water Resources

The Town of Antrim has numerous water resources. The area of the proposed Project is located near three of the town's notable water bodies; these include the North Branch River, Gregg Lake, and Willard Pond.

The North Branch River runs along the north side of Route 9, in the valley to the north of the proposed Project area. The North Branch is a major tributary of the Contoocook River; it flows northerly from Highland Lake in Stoddard to its confluence with the Contoocook River in Hillsborough. The North Branch River was placed in the New Hampshire Rivers Management and Protection Program in June 1991.

Gregg Lake is located in the valley to the southeast of Tuttle Hill. The lake is approximately 195 acres in size and supports a moderate warm water fishery. The lake is controlled by a dam located on the northeast finger of the lake off of Gregg Lake Road. A public access and recreational area is located on the north end of the lake. Recreational uses include fishing, swimming, picnicking, water skiing, boating, sailing, and bird watching.

Willard Pond is located in the valley to the southeast of Willard Mountain. The pond is an artificial impoundment approximately 96 acres in size and is located inside the dePierrefeu-Willard Pond Wildlife Sanctuary (see Section C.5.d). The pond has an excellent cold water fishery, which makes it popular for fly fishing. Electric and non-motorized boating and bird watching are also primary recreational activities associated with the pond.

Wetland and Vernal Pool resources specific to the proposed Project are further described in Section I.5.b of this Application.

C.5.d. Conservation Lands

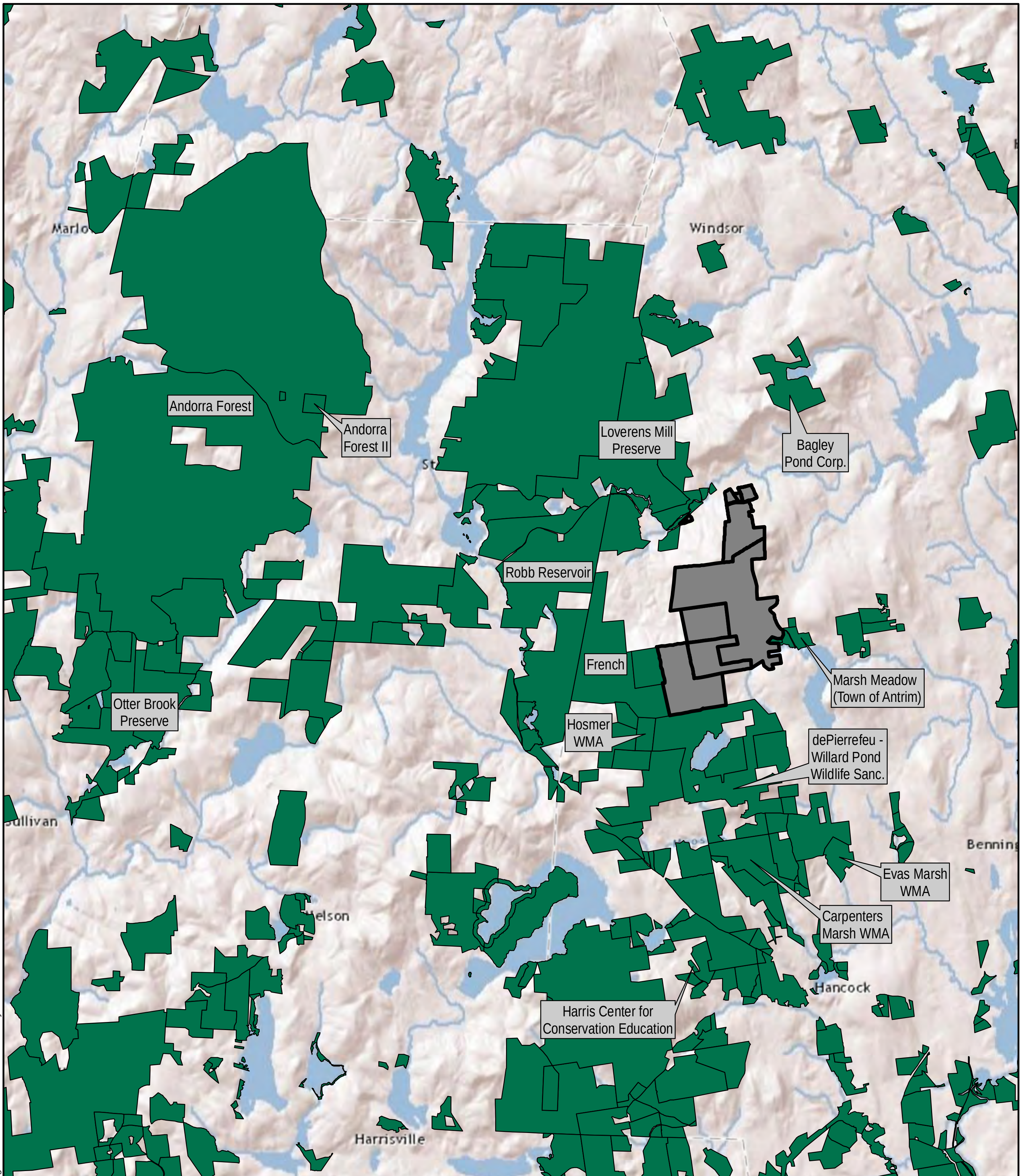
Several conservation areas exist in the vicinity of the proposed Project. These include the dePierrefeu-Willard Pond Wildlife Sanctuary, the Loverns Mill Cedar Swamp Preserve, and the Meadow Marsh Preserve.

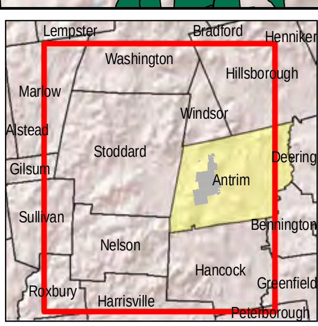
The New Hampshire Audubon's dePierrefeu-Willard Pond Wildlife Sanctuary is located immediately to the south of Willard Mountain. This property, at approximately 1,659 acres, is the New Hampshire Audubon's largest property. Additional easements held by New Hampshire Audubon, and adjacent protected lands bring the entire protected area surrounding the preserve to approximately 2,785 acres. Associated with this preserve are numerous hiking trails and road access to Willard Pond. Willard Pond is approximately 96 acres in size and is surrounded by Bald Mountain and Goodhue Hill. There are four trails in the sanctuary's system, two of which go to the summits of Bald Mountain and Goodhue Hill. The conservation lands that will be purchased by AWE once the facility is placed in operation directly abut the New Hampshire Audubon property and will add 908 acres of new contiguous conservation land. This will increase the amount of contiguous conserved land by roughly 33% above what is currently owned or conserved by the New Hampshire Audubon Society.

The Meadow Marsh Preserve is a short trail (approximately 0.5 miles) that accesses wetland areas to the north of Gregg Lake. The preserve is located on property that is maintained by the Town of Antrim.

The Loverns Mill Cedar Swamp Preserve is located on the north side of Route 9, to the north of the proposed Project area. This 613-acre conservation project is cooperatively maintained by the Nature Conservancy and the Society for the Protection of New Hampshire Forests. The preserve contains several trails and features a boreal cedar swamp that is approximately 50 acres in size. Nature conservation partners have connected the preserve to a larger conservation project, which is to include the 5,000-acre Peirce Reservation (in Stoddard and Windsor) and the 1,693-acre Otter Brook Preserve (located in the towns of Sullivan and Nelson).

Mapping depicting these and other conservation lands is provided as Figure C.5.





Legend

Project Parcels

Conservation Lands

1

Miles

N

Conserved Lands layer courtesy of NH GRANIT and Town of Antrim

EOLIAN RENEWABLE ENERGY

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure C.5

Conservation Areas

Produced by: TRC

7/24/2015

\\appesri1\GIS\PROJECTS\AUGUSTA\Eolian\ANTRIM\Figure D.5 Conservation Areas in Vicinity.mxd

C.6. Information related to whether the proposed site and facility will unduly interfere with the orderly development of the region having given due consideration to the views of municipal and regional planning commissions and municipal governing boards.

Antrim Wind Energy's preliminary site evaluation assessed numerous factors that are critical to the appropriate siting of a wind project, including: economic viability, environmental safety, and compatibility within the community. In general, the most viable wind sites include: adequate projected wind speeds at anticipated turbine hub height; proximity to adequate transportation infrastructure to allow wind farm component and construction equipment delivery; proximity to transmission or distribution infrastructure capable of handling the new generation; adequate setbacks from residences or other inhabited structures to ensure public safety; the absence of sensitive ecological resources that may be disturbed such as critical wildlife habitats, major wetlands, and other sensitive areas within the proposed Project area; and previous environmental impact and activities on site. The proposed site in Antrim meets all of these criteria.

Importantly, the proposed Project site is located approximately ½ mile from an existing PSNH transmission corridor where the Project proposes to interconnect to the grid. This eliminates the need for new transmission line construction, thereby entirely avoiding the numerous potential impacts associated with such development. The site is also located approximately ¾ mile from Route 9, a substantial state highway that can handle transportation of turbine components and construction equipment. The proximity of this existing highway minimizes the need for extensive access development, thereby reducing impacts associated with access.

The proposed site is located on private property that has been historically managed as timberlands; development of the site will not preclude this historic use which can continue largely unencumbered. For this reason, the proposed Project is deemed compatible with existing uses.

The Antrim Master Plan, updated in 2010, speaks extensively and supportively of the need for renewable energy development. See Appendix 15. The Master Plan contains a 15-page section addressing climate change, energy efficiency and renewable energy and calls for the Planning Board and Planning Department to encourage renewable energy uses. The Project is clearly consistent with these goals. In addition, the Project will support many of the Southwest Regional Planning Commission's stated goals. The Commission identifies "current lack of local, renewable energy alternatives" to conventional energy sources a substantial risk to future growth in the region. See Appendix 16, p. 79. Significantly, New Hampshire state planning and zoning laws require that planning regulations and zoning ordinances encourage the installation and use of renewable forms of energy such as wind projects. *See* RSA 672:1, III-a and RSA 674:17, I. (j).

The Project is located in an area that is largely undeveloped and has been recognized for habitat and ecological values in the Wildlife Action Plan. However, development of a wind park would be consistent with the surroundings, as there are no significant environmental impacts. At the same time, the Project would provide additional tax base for the Town of Antrim without imposing the need for additional town services, which could alleviate the need to attract high-impact development. As indicated in Appendix 12G, the Project would result in a relatively small and narrow footprint area of 11.3 acres within a much larger landscape. Most of the Project impact will be temporary and forest management activities could continue in the area. Thus, the Project would not prevent further development of other areas within the town or region, would not prevent other economic activities such as logging activities, to the extent permitted, and would not prevent orderly development of the region. That the municipal governing board, the Town of Antrim Board of Selectmen, have supported the Project, provides further indication that the Project would facilitate, rather than interfere with orderly development in the area.

AWE has also provided information to show that the habitat values provided by the Project site would not be significantly affected, allowing for continued use of the area for recreational and wildlife-related activities. Appendix 12G provides an assessment of wildlife impacts. The unfragmented habitat block associated with the Project area is approximately 12,994 acres (source: NH GRANIT, Wildlife Action Plan, Unfrag block layer, 2010). The area that will be initially disturbed during Project construction will be approximately 57.1 acres and after construction of facilities is complete, approximately 45.8 acres will be restored. Ultimately, the final Project, including the maintained roads, electrical infrastructure and turbine pad footprint, will total 11.3 acres. The Project will create some degree of disruption, but the area is a forested landscape that is already frequently disturbed and bisected by forest management activities. The narrow Project footprint does not create a significant habitat fragmentation, especially given the scale of the habitat block. Disturbance caused by road use from vehicles will be restricted to operations personnel and will be low in volume. Road footprints are narrow enough that there will still be opportunity for wildlife to traverse the area unimpeded. Finally, several large parcels of land, which are contiguous with other conserved lands in the area and include 100% of the Project ridgeline, will be conserved as part of the Project, providing for protection of 908 acres of contiguous habitat in the immediate Project area that will be conserved in perpetuity. This habitat conservation effort further ensures that a significant portion of this habitat block will remain intact and that existing values will be preserved. *See* Appendix 12G.

The Project would also provide wind lease revenues to the private landowners, resulting in direct and indirect economic impacts locally. This income mitigates the need for the landowners to develop the land for other permitted purposes such as residential subdivisions, which in turn require more municipal services.

The proposed Facility is expected to provide clean, domestically produced electricity in an amount equivalent to the annual consumption of approximately 12,300 average New Hampshire homes, while also providing jobs, tax benefits, and conservation benefits to the Town and the region. The proposed Project will not burden the Town with costs typically associated with other forms of development, such as new or larger schools, busing, police and public safety, snow removal or other similar municipal costs. In addition to the direct benefits of the annual tax payments, property lease revenues, clean energy benefits and land preservation opportunities, Antrim Wind Energy will seek to use as much qualified local labor as possible throughout the permitting, development, construction and long-term operation of the facility. This will include opportunities for site clearing, construction, surveying, maintenance and other related jobs. Further, based upon a 20-year payment in lieu of taxes ("PILOT") agreement, the Antrim Wind Energy Project would become the largest taxpayer in the Town of Antrim. Please see Section J and Appendix 14 for a further discussion of the economic impacts to the Town of Antrim and to the region.

Further, the Project will not interfere with tourism in the region. The study *The Impact of Wind Farms on Tourism in New Hampshire* (Dec. 2013) examined and compared economic trends in the region before and after the construction of the Lempster Wind Power Project to determine if there was any evidence of the Lempster Wind Power Project impacting tourism activity in NH. The study reviewed publicly available data of spending on accommodations, food services, recreational activities, traffic volumes, and changes in employment.

Key Findings of the study were:

1. The introduction of the Lempster Wind project appears to have had little or no impact on meals and rooms sales in the region where the project is located.
2. Since Lempster Wind began operating, growth in tourism-related employment in the project region has been as large, or larger, than it has been in a majority of regions in the state.
3. State park revenues have grown more at the state parks closest to the Lempster Wind region than have aggregate state park revenues, with the largest increase at the park closest to Lempster Wind.
4. Weekend traffic volume (an indication of visitor activity) in the Lempster Wind region suggests that the presence of the wind farm has not discouraged visits to the region.

The Antrim Wind Power Project is located in close proximity (approximately 20 miles) to the Lempster Wind Power Project. Towns in the vicinity of the two wind power projects are split between two tourism regions as defined by the State of New Hampshire Department of Travel and Tourism: the Dartmouth Lake Sunapee Region, and Monadnock Region. The Dartmouth Lake Sunapee tourism region features tourism-related activities including: dining, outdoor recreation, water-based recreation, state parks and regional events. The Monadnock Region features similar tourism-related activities including: dining, outdoor recreation, water-based recreation, state parks, and regional events. Based on review of *The Impact of Wind Farms on Tourism in New Hampshire* (Dec. 2013), there is no evidence to indicate that a relationship exists between wind power projects and tourism, therefore there is not expected to be any tourism impact on the region from the Antrim Wind Power Project.

In summary, the proposed Project will not unduly interfere with the orderly development of the region. The installation of a renewable energy facility in a sparsely settled area of Town on large tracts of private property is in concert with the orderly development of the region, especially considering the site's close proximity to an existing transmission corridor and a state highway. The Antrim Wind Energy Project will also bring about economic development and significant new permanent conservation opportunities and is supported by the host community.

Finally, the proposed Project will provide clean energy, which is consistent with the stated goals of NH statutes, the Antrim Master Plan, and Antrim residents' desires as presented in the Antrim Master Plan (2010) and represented by their elected Board of Selectmen.

D. OTHER REQUIRED APPLICATIONS AND PERMITS

D.1. Identification of all other federal and state government agencies having jurisdiction, under state or federal law, to regulate any aspect of the construction or operation of the proposed facility

- New Hampshire Department of Environmental Services, Water Division, Wetlands Bureau (authority under state and federal law over wetlands impacts)
- New Hampshire Department of Environmental Services, Water Division, Alteration of Terrain (AoT) Program (authority under state and federal law over alteration of terrain and pollutant discharge)
- New Hampshire Department of Environmental Services, Water Division, Water Management Bureau (authority under federal law related to U.S. Army Corps of Engineers (USACE) individual wetlands permit – water quality certification)
- New Hampshire Department of Transportation (NHDOT) (authority under state law over highway safety/transportation of oversized loads and driveway permits)
- New Hampshire Department of Safety (NHDOS) (blasting permit)
- New Hampshire Division of Historic Resources (NHDHR) (authority under federal and state law to consult with USACE regarding historic properties potentially affected by the Project
- U.S. Army Corps of Engineers (USACE) (authority under federal law to assess wetlands and other environmental impacts)
- Federal Aviation Administration (FAA) (regulation of turbine lighting in connection with determination of "no hazard" to air navigation)
- New Hampshire Department of Environmental Services, Water Division, Subsurface Systems Bureau Individual Sewage Disposal System (ISDS) Application
- New Hampshire Department of Safety, Division of Fire Safety, Office of the State Fire Marshall (authority to enforce applicable fire codes)

D.2. Documentation that demonstrates compliance with the application requirements of such agencies;

Information satisfying the application requirements of the agencies listed above in D.1 has been included within the agency application forms. Copies of these forms are included in the Appendices to this Application, as referenced in Section D.3, below. An application for a "Special Permit to Move a Load in Excess of Legal Limit" will be submitted to the NHDOT by the trucking contractor(s) who will be responsible for transporting turbine equipment and other oversized loads. The trucking contractor chosen for delivering turbine components to the site will be part of Siemens' scope under the final terms of a turbine supply agreement. The trucking contractor chosen for delivering heavy construction equipment will be part of Reed & Reed's scope under the final terms of a final construction contract. The application for a blasting permit will be filed by Reed & Reed's blasting contractor once the final blasting plan is completed prior to construction. AWE will comply with all rules and permit requirements relative to blasting that may be necessary in the construction and decommissioning of the Project.

D.3. A copy of the completed application form for each such agency

Copies of completed application forms, as required, are provided in Appendix 2 of this Application. Specific permit applications and their locations are included as follows:

- **Appendix 2A**: Joint USACE/NH DES Standard Dredge and Fill Permit Application
- **Appendix 2B**: NH DES Alteration of Terrain Application
- **Appendix 2C**: NH DES Section 401 Water Quality Certification Request
- **Appendix 2D-1**: NH DOT Application for Driveway Permit – Main Entrance
- **Appendix 2D-2:** NH DOT Application for Driveway Permit – Temp laydown
- **Appendix 2E**: FAA Determination of No Hazard
- **Appendix 2F**: NH DES ISDS Application

D.4. Identification of any requests for waivers from the information requirements of any state agency or department whether represented on the committee or not.

AWE is requesting a waiver of Rule Env-Wq 1504.08(b)(2)(b) High Intensity Soil Mapping and/or Site Specific Soil Mapping of the Alteration of Terrain Permit Application. The waiver request is located in Appendix 3 of this Application.

E. ENERGY FACILITY INFORMATION

The proposed Antrim Wind Energy Project meets the definition of a renewable energy facility under RSA 162-H:2, XII, not an energy facility as defined in RSA 162-H:2,VII. The Applicant notes that the statutory definition of "Energy Facility" includes a "renewable energy facility" (*see* RSA 162-H:2, VII. [f]); however, the definition of "energy facility" contained in N.H. Admin. Rule Site 102.09 is based on an outdated statutory definition which does not apply to Antrim Wind Energy, LLC. Although the Antrim Wind Energy Project does not meet the definition of "energy facility" contained in the Committee's rules, the Applicant is nonetheless completing this section of the Application in an effort to assist the Committee with its review of the Application.

E.1. The type of facility being proposed

Antrim Wind Energy, LLC proposes to construct and operate a wind energy facility.

E.2. A description of the process to extract, produce, manufacture, transport or refine the source of energy

The source of energy to be used by this facility is wind. As such, the source of energy to be used by the proposed Project requires no extraction, manufacturing, combustion, transportation or refinement.

E.3. The facility's size and configuration

The facility's size, in terms of generating capacity of the Project, is proposed to be 28.8 MW. The Project will consist of 9 turbines each with a nameplate generating capacity of 3.2 MW. AWE is seeking certification of the Siemens SWT-3.2-113 direct drive turbine. This turbine is a horizontal axis machine configured much like any other typical wind turbine in that its major components include a tower, a nacelle, and a rotor with three blades. A 3.2 MW generator is housed in the nacelle, which is mounted on a sliding ring that allows it to rotate into the wind to maximize energy production. The nacelle is installed on a tubular steel tower. The towers for turbines 1-8 will each be 92.5 meters tall and the tower for turbine 9 will be 79.5 meters tall. Each turbine has a rotor diameter of 113 meters. The total turbine height from foundation to blade tip for turbines 1-8 is 488.8 feet and for turbine 9 is 446.2 feet. Additional details concerning the configuration of the Siemens SWT-3.2-113 turbine are found in Appendix 5.

The proposed Project will consist of approximately 11.3 acres of new facilities, including turbine pads, gravel roadways, electrical substations and support buildings, located within approximately 1,870 acres of private lands consisting of six parcels that are leased by AWE from private landowners. The initial clearing limits to accommodate the construction of the Project will be approximately 57.1 acres. The leased parcels are shown on Figure C.1.

Temporary staging (laydown) areas will be required during construction for contractor offices and materials and equipment handling and storage. One laydown yard will be located in an upland area between Route 9 and the Project substation and will be approximately 2 acres in size. The other laydown area will be located off Route 9, west of the proposed Project entrance, and will occupy approximately 2.9 acres of previously disturbed area which was a gravel borrow pit and log landing. The use of this site will require the filling of approximately 955 square feet or 0.02 acre of scrub-shrub wetland that is within the former gravel borrow pit area.

The Project will also include a permanent meteorological ("MET") tower. The MET tower will be a 100-meter tall free-standing lattice steel tower located on the ridge between wind turbine generator ("WTG") #2 and WTG #3 close to where the access road reaches the ridge line. The MET tower will feature meteorological sensors to measure wind speed and direction in order to ensure safe and reliable operation of the wind facility.

The Project also includes a radar activated lighting system such as the Harrier Radar System manufactured by DeTect, Inc. (the "Radar System"). This system is used to control the obstruction lights required by the Federal Aviation Administration ("FAA") and consists of a radar mounted on the Project permanent MET tower. The Radar System will also require a concrete equipment pad approximately 16' X 6' located at the base of the meteorological tower. The radar system operates by detecting nearby aircraft and activating the FAA obstruction lights if an aircraft is in close proximity to the wind turbines; otherwise the system keeps the obstruction lights turned off. While AWE is seeking certification of the Radar System facilities, it may not be able to install or operate them until the FAA issues a revised advisory circular detailing the requirements for such systems. Additional details on the Radar System are included in Appendix 5-A.

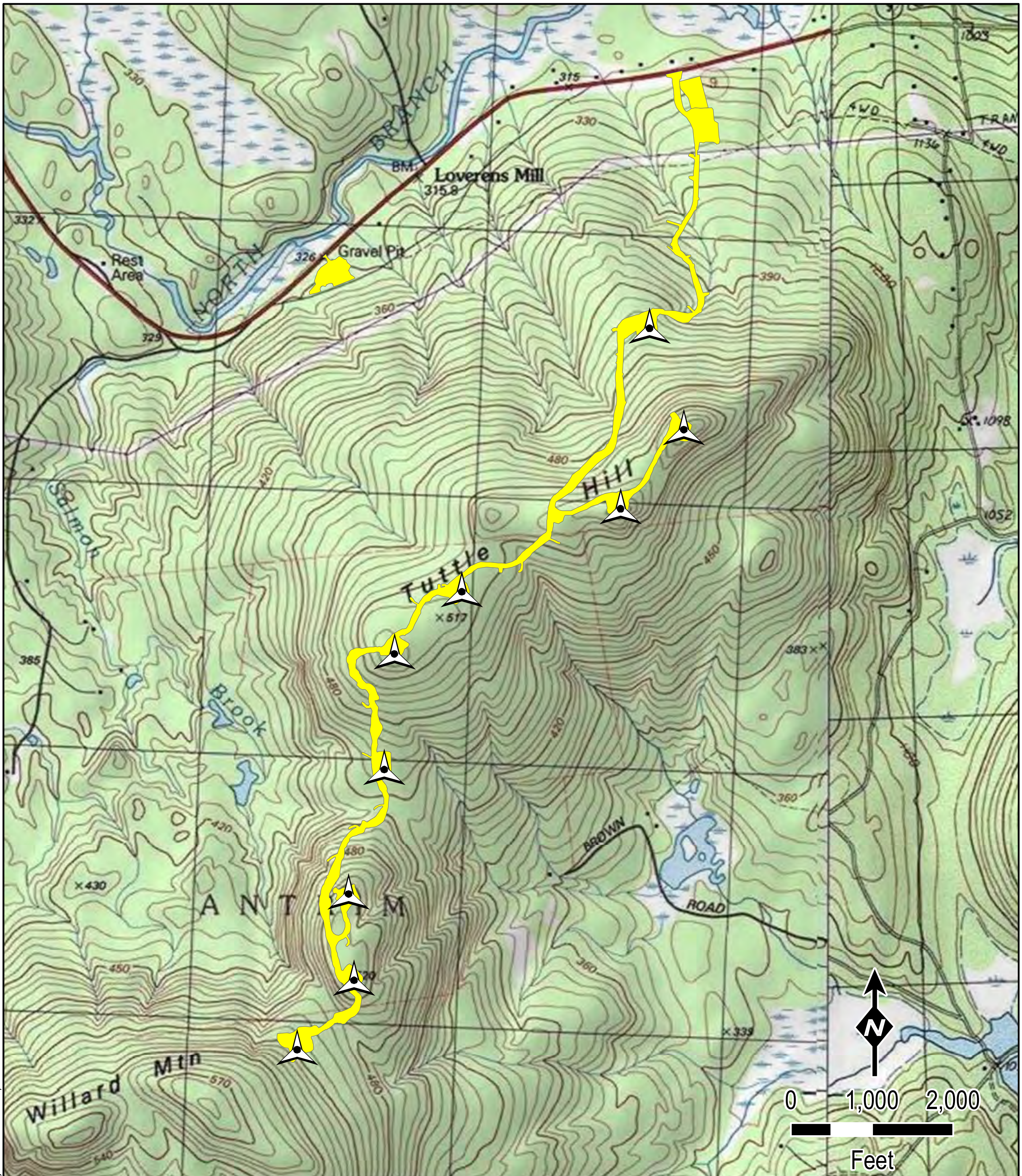
Post-construction, the leased Project area will be reduced to include only the footprint of the disturbed area of the Project's facilities and any required setbacks and undisturbed buffers. The total area is anticipated to include 11.3 acres of actual development impact (e.g. access roads, turbine pads, substation and other facilities).

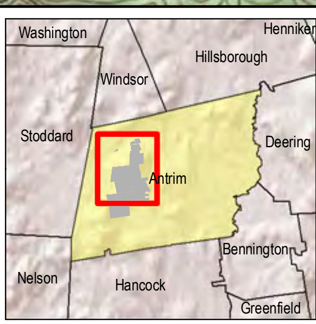
The Project's configuration is generally narrow and linear, as is typical of wind turbine strings on ridges in the Northeast. The area of development will consist of a series of turbines located primarily along the ridges and upper slopes of Tuttle Hill and Willard Mountain. These turbines will be linked by a private, gated gravel surface access road.

Approximately 3.55 miles of new gravel surface road will be built for access, construction and maintenance of the wind turbines. The main access road will be approximately 3.0 miles (15,857 feet) long and will be built in two sections. The first section will connect Rte. 9 to WTG #1; this section will be approximately 0.7 miles (3,710 feet) long and 16 feet wide. The second section includes the remainder of the road, from WTG #1 to the ridge and then along the ridgeline. This section will be approximately 2.3 miles (12,147 feet) long and will be 34 feet wide during the construction phase. Once the Project is complete, the shoulder areas of this section of road will be restored and reseeded (using approved New Hampshire native seed mixes) to a final width of 16 feet. There will also be two spur roads installed to access individual turbines; one will be approximately 0.4 miles (2,127 feet) long and the other will be approximately 0.14 miles (765 feet) long. Like the main access road, these spur roads will be 34 feet wide during the construction phase, then restored and reseeded upon Project completion to a final width of 16 feet.

The Project will also require the construction of a joint collector system and interconnection substation as well as an operations and maintenance ("O&M) building. The electrical collection system will consist of electrical cables for collecting power generated by the facility as well as fiber optic cables for two-way communications between the turbines and the O&M building. The collector system and fiber cables will be buried along the roadside along the ridgeline and will transition to pole mounted above ground installations where the access road meets the ridgeline. The collector and interconnection substations will be located immediately to the north of the PSNH L163 line that passes through property leased by Antrim Wind. The final design of the interconnection substation will be performed by PSNH but will be located within the footprint shown on civil design plans (provided in Appendix 7A of this Application) and will be contained within the permitted footprint and elevations contained in this Application. The maintenance building is expected to be approximately 3,000 square feet in size.

The proposed Project layout is illustrated on Figure E.3.





Legend

Proposed WTG Location

Proposed Disturbance Area

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure E.3

Layout of Development

Produced by: TRC | 1/29/2015

V:\PROJECTS\AUGUSTA\Eolian\ANTRIM\Figure E3 Project Location - Develpment 8x11.mxd

E.4. The ability to increase the capacity of the facility in the future

At this time, Antrim Wind Energy, LLC does not anticipate increasing the capacity of the facility in the future.

E.5. Raw materials used

E.5.a. An inventory, including amounts and specifications

Wind energy projects do not require a significant amount of raw materials. Wind energy projects are primarily infrastructure projects consisting of road construction and the installation of pre-manufactured equipment (turbines, transformers and switchgear) including the associated electrical systems needed to deliver the generated electricity to the grid. The vast majority of raw materials used in the Antrim Wind Energy Project will be those used in the construction of foundations and the electrical collection system. A detailed inventory of raw material quantities and specifications will not be finalized until a Balance of Plant construction contract is finalized. This will occur after a Certificate is issued. While final quantities of materials have not been finalized, this application contains all of the information required for the issuance of an Alteration of Terrain permit and all cut and fill performed for the Project will be consistent with the conditions of all permits issued.

Each Siemens turbine will consist of a nacelle, rotor hub, blades and a tower. Within the nacelle are the generator and the primary electrical components of the turbine, together with a cooling unit, control panel, yaw gears and hydraulic power unit. The nacelle is installed on a tubular steel tower and is enclosed by an insulated, glass fiber reinforced polymer skin covering a nodular cast iron frame that holds all of the turbine's internal components. The blades are cast in one piece and made of fiberglass-reinforced epoxy. The blades are mounted on pitch bearings to enable individual blade feathering and are bolted to a nodular cast iron hub. The tower is made of structural steel bolted to a concrete and steel foundation. The electrical collector system consists of copper and/or aluminum wiring, transformers, switchgear, protection and control devices, above ground poles and below ground conduits. The road system will be constructed of rock and gravel with concrete or plastic (typically HDPE) culverts and drainage structures. The civil design for the roads within the Project area is intended to create a balanced site meaning that fill material is not intended to be imported and excess material should not need to be exported. In some situations certain types of fill may need to be imported in limited quantities if insufficient amounts cannot be obtained from the site. Minimal amounts of bituminous pavement will be used on the access roadway from Route 9 to the interconnection substation.

The primary "raw" (or minimally manufactured) materials expected to be required for the Antrim Wind Energy Project include utility poles, PVC conduit, electrical cable, fiber optic cable, concrete, and steel rebar. Construction materials specific to the Operations & Maintenance ("O&M") building and substation will also be necessary. All of these materials are common and will be readily available from local or regional suppliers.

E.5.b. A plan for procurement, describing sources and availability

Antrim Wind Energy, LLC has selected Reed & Reed, Inc. out of Woolwich, Maine as its Balance of Plant ("BOP") contractor. AWE has entered into a Preconstruction Services Agreement ("PSA") with Reed and Reed, which will be replaced by a BOP construction contract with respect to the Project. Reed & Reed has been involved as a contractor on nearly every utility scale wind energy project in New England and is the sole construction provider for First Wind, now SunEdison. Antrim Wind Energy will directly procure turbines for the facility from Siemens Energy, Inc. and Reed & Reed will be responsible for procuring the remainder of the materials and equipment necessary for the construction of the facility through a competitive supply process among qualified vendors.

Antrim Wind Energy has entered into a binding Memorandum of Understanding with Siemens for the exclusive right to supply the Antrim Project with Siemens wind turbines through a Turbine Supply Agreement ("TSA") as well as a Service and Maintenance Agreement ("SMA"). AWE will therefore be procuring the wind turbines for the Project, including towers, nacelles, blades, hubs and spare parts from Siemens.

Siemen's currently manufactures the components for the SWT-3.2-113 wind turbine in several locations globally. In the U.S. these include manufacturing facilities for nacelles and hubs in Hutchinson, KS and in Fort Madison, IA for the blades. Siemens also has several European manufacturing locations. The final selection of which manufacturing facility will be most economic for delivery to the Project site will be determined when the final TSA is executed taking into account then current exchange rates, fuel costs and other factors.

As discussed above, Reed & Reed's scope will include supply of all necessary materials not included in Siemens' supply scope. The BOP contract will include a "local qualified contractor" clause to encourage the use of local labor. There is no guarantee of what percentage of the required labor and materials can be supplied locally. However, it is expected that many materials such as concrete, rebar, electrical materials and utility poles will be sourced locally. Given the extensive experience of our contracted vendors AWE does not view material supply as a concern relative to construction of the Antrim Wind Energy Project.

E.5.c. A description of the means of transporting

Presently it is expected that the blades and nacelles will be transported from Denmark by ship to the Port of Searsport, Maine and then by truck to the Project site. The tower sections are currently expected to be sourced from a Siemens' supplier in Quebec and transported to the site by truck, as further described in Section F.5.e.

E.6. Production information

E.6.a. An inventory of products and waste streams

During construction, some waste materials are expected to be generated. Typically these are limited to packaging materials, lumber used for forms, and general trash generated by workers. AWE's contractor Reed & Reed will contract with a waste disposal service during construction to ensure proper handling and removal of waste materials.

During operation, the Project will not generate any air or water waste streams.

E.6.b. The quantities and specifications of hazardous materials

Each wind turbine generator will require various substances that are necessary for proper operation and maintenance. The approximate quantities of these materials, as required for operation of the Siemens SWT-3.2-113 wind turbine generator, are listed in Table E.6.b.

Table E.6.b: Chemicals Located in the Wind Turbine Generator

LIST OF CHEMICALS IN THE SIEMENS TURBINE			
Location	**Substance**	**Type**	**Volume (L)**
Yaw bearing and yaw pinion	Grease	Castrol Optipit	6.00
Yaw gear	Gear oil	Optigear Synthetic X VG320	60.80
Main bearing	Grease	Kluberplex BEM 41-141	15.00
Generator lubrication	Grease	Kluberplex BEM 41-132	2.00
Hydraulic System	Hydraulic oil	Shell Tellus Arctic 32	130.00
Low speed brake hydraulic accumulator	Nitrogen	Nitrogen	6.00
Backup hydraulic accumulator	Nitrogen	Nitrogen	10.00
Generator cooling system	Water/glycerol	50% BASF Glysantin G30	180.00
Power unit cooling system	Water/glycerol	50% BASF Glysantin G30	150.00
Wind Turbine damper in nacelle	Water/glycerol	50% BASF Glysantin G30	200.00
Pitch lubrication system	Grease	Shell Rhodina BBZ	8.00
Pitch system hydraulic accumulators	Hydraulic oil	Shell Tellus Arctic 32	60.00
Pitch system hydraulic accumulators	Nitrogen	Nitrogen	120.00
TOTAL			**947.80**

With the exception of some of the greases used for lubrication, the oils and lubricants listed in Table E.6.b are contained within the Siemens wind turbine generator. Siemens wind turbines are designed to avoid environmental impacts from leakage of fluids and feature several provisions designed to prevent any leakage from occurring outside the turbine. Any leakage of any of the fluids in the nacelle will be collected in the lower part of the canopy. The capacity of the collection system in the canopy is more than 300 liters and this volume fully covers the potential collection needs of all fluids in the nacelle. In the hub, oil-absorbing material with a minimum capacity of 80 liters is used and this volume fully covers the needs for all fluid collection. If a leak occurs and is collected in any of these areas, these materials will be managed in accordance with a Spill Prevention, Control and Countermeasure ("SPCC") plan, as further described, below.

In general, other hazardous materials on the Project site will include: fluids (oils, fuel, etc.) associated with maintenance vehicles; on-site storage of portable fuel cans (for maintenance vehicles); oily rags and other waste associated with turbine lubrication and maintenance; and oils associated with substation components (e.g. transformers). Propane or heating oil may be associated with the Operations and Maintenance building, depending on final design plans for heating of this structure. Finally, the substation will include a backup generator that will require liquid fuel; specific fuel type will depend on final design, but is expected to be propane.

<u>Spill Prevention, Control and Countermeasure ("SPCC") Plan</u>

In order to manage hazardous substances in accordance with federal regulations, AWE will prepare an Operations SPCC plan prior to the commencement of commercial operation. The Operations SPCC plan will describe the procedures, methods and equipment that will be used at the facility to comply with the U.S. Environmental Protection Agency's ("USEPA") oil spill prevention, control, and countermeasures standards. Likewise, the SPCC plan will comply with federal inspection, reporting, training and record keeping requirements.

An example of the anticipated Construction SPCC Plan for the Antrim Wind Energy Project is provided in Appendix 4 of this Application.

E.6.c. Waste management plans

During construction, AWE's contractor Reed & Reed will contract with a waste disposal service to insure proper handling and removal of solid waste and construction debris. Any waste generated during construction will be transported and disposed of by licensed contractors. During construction, the facility's Construction SPCC plan (see Appendix 4) will direct waste management and ensure compliance with USEPA regulations.

During operation, the facility's Operations SPCC plan (described above) will direct waste management and ensure compliance with USEPA regulations. Any wastewater associated with restroom facilities at the proposed O&M building will be routed through a septic and leach field system approved by NHDES (see Appendix 2F).

F. RENEWABLE ENERGY FACILITY INFORMATION

F.1. Make, model and manufacturer of the unit

Antrim Wind Energy LLC will use Siemens' SWT-3.2-113 turbines for the Project. These turbines are three-bladed, horizontal axis, upwind turbines, typical of those currently in use in utility scale wind projects throughout New England.

The Siemens turbine has a nominal power rating of 3.2 MW (3,200 kW). The rotor diameter is 113m. The hub height is 92.5 meters for WTG #1 – WTG #8 and 79.5 meters for WTG #9. Details on the Siemens turbine are provided in Appendix 5.

Siemens Energy, Inc. ("Siemens") is a US subsidiary of Siemens AG, a global electronics and engineering conglomerate with 343,000 employees in 190 countries operating in the industry, energy, healthcare and infrastructure sectors. The SWT-3.2-113 is the latest member of the Siemens D3 platform, building on the successful design and operational experience of the SWT-2.3-113, SWT-3.0-101, SWT-3.0-108 and SWT-3.0-113 turbines. The D3 platform launched the first Siemens direct drive wind turbine, the SWT-3.0-113 in 2009. Subsequently the SWT-2.3-113, SWT-3.0-113 and SWT 3.0-108 were developed. These turbines are designed for sites with medium to high wind speeds and higher turbulence. The development of the SWT-3.2-113 wind turbine is based on years of experience with direct drive technology. On September 29, 2014 the Siemens SWT 3.2/113 turbine received its Type Certificate from Det Norske Veritas ("DNV") which certifies conformity to IEC 61400-22: 2010 "Wind Turbines – Part 22: Conformity Testing and Certification.

As of December 31, 2014, Siemens has installed over 15,260 turbines globally totaling more than 27,750 MW in installed capacity across all of its turbine platforms and 758 turbines in the D3 Platform, totaling 2,228 MW (see Appendix 19B for additional details).

F.2. Capacity in megawatts, as designed and as intended for operation

The total nameplate capacity of the Antrim Wind Energy Project is 28.8 MW.

F.3. Type of unit, including

The wind turbine generators will be Siemens SWT-3.2-113 units as described above and in Appendix 5.

F.3.a. Fuel utilized

No fuel will be used to operate the generation equipment at the Project, it will be powered by clean, renewable wind.

F.3.b. Method of cooling condenser discharge

The generator cooling water system is divided into two separate systems: one for cooling half the generator and the main bearing, and the other for cooling the other half of the generator and the hydraulic station. Each system contains approximately 90 liters of cooling water, which is a 50% glycol mix. There is no discharge from these systems under normal operation. If a leak occurs in any part of the system, the cooling water will be collected in the canopy containment system and can be pumped out for removal.

F.3.c. Whether the unit will serve base, intermediate or peaking loads

The Project will supply power to serve growing demand for clean renewable power in New England. Output from the facility will vary depending on the wind speeds, but the facility is capable of and will produce power during all times of day and year. The months when the facility is expected to produce the most power are December through March, with expected monthly capacity factors ranging between 40.9% (March) and 50.7% (December). These periods correspond to periods during which marginal power prices in New England are at their highest due to natural gas supply constraints as gas supply is shifted to home heating from electric generation. Thus the Project is expected to have a stabilizing effect on winter electricity prices. In addition, due to the fact that the source of energy for wind power plants is free and long term operating costs are very predictable, wind energy projects such as the Antrim Project generally contract for long term power sales at fixed or slowly escalating rates over long periods of time, giving load serving entities and the customers they serve long term predictable power prices.

F.3.d. Unit efficiency

The design and efficiency of a wind energy generation facility is dependent upon a variety of interrelated factors including terrain and landcover, wind speed and direction, and the rated capacity and power curve of a given wind turbine generator. Wind resource components such as wind speed, direction, turbulence intensity, and shear also effect the efficiency of a wind energy generation facility, and are assessed through the deployment of meteorological monitoring equipment and analyzed through the application of sophisticated modeling software. Analysis of a site’s wind resource needs to account for the entire turbine array and it is often necessary to sample the wind resource at various locations throughout the Project’s extents. Once the wind resource profile has been studied for at least one year it is possible to generate a site layout that optimizes the position of turbines in relation to the wind resource, other turbines within the array, and additional development constraints.

Antrim Wind Energy collected on-site wind data with a 60-meter meteorological tower from November 2009 through November 2013. Additional wind resource measurement was accomplished using remote sensing technology. Specifically, AWE utilized a LiDAR (Light Detection and Ranging) device to sample portions of the array that are not as proximal to the meteorological tower. The LiDAR also provides the capability to measure wind characteristics at heights representative of the full turbine rotor sweep. Through a combination of repeatedly correlating the LiDAR data with the meteorological tower and deploying it as a roving device, the LiDAR contributed to a robust measurement campaign designed to maximize accuracy and minimize uncertainty.

Based on the extensive on-site wind resource measurement campaign, correlation with long-term reference stations, and the application of state of the art analysis methods, AWE is certain that the site offers a competitive wind resource.

Turbine and wind plant energy yield are measured both in gross capacity factor and net capacity factor. A project would have a gross capacity factor of 100% if it were producing 100% of its rated capacity for all 8760 hours of each year. No energy plant has a 100% gross capacity factor. Items affecting gross capacity factor include the availability of the wind resource, planned and unplanned maintenance and the potential for operational curtailment for any reason. Factors affecting net capacity factor include blade soiling, icing, electrical losses in transformation, collection and transmission, and consumption of power for onsite operations. Accounting for all losses, Antrim Wind estimates that the Project will have an average annual net capacity factor of approximately 37.00%. Based on this projected capacity factor, the Project is expected to produce approximately 93,346 Megawatt hours (MWh) of electricity per year. The Project is anticipated to produce enough electricity for the average annual consumption of approximately 12,300 New Hampshire homes. This estimate is based on data from a 2009 report issued by the Department of Energy, Energy Information Administration, which indicates that electricity usage per year for the average New Hampshire home is 7,584 kilowatt hours (kWh).

F.3.e. Impact on system stability and reliability

Wind power projects have generally been found to maintain the reliability and stability of the power system. Notably, in 2010 the New England Wind Integration Study (NEWIS) was finalized and presented to ISO-NE. NEWIS studied the operational impacts of a variety of large-scale wind integration scenarios, which led to several major findings supporting the case that large amounts of wind power could be integrated into the New England power system. On the project level, ISO-NE bears responsibility for evaluating each individual project to ensure that grid reliability and stability will not be negatively impacted by new generation. ISO-NE, together with the interconnecting transmission owner (and potentially other affected parties) will study the interconnection and identify requirements for upgrades necessary to ensure that the new generation can safely and reliably interconnect. Only when those conditions are met is a new generation facility allowed to interconnect to the bulk power system. The potential impact of this Project on system stability and reliability has been well studied. The Project originally entered into a System Impact Study Agreement in September 2011 with ISO-New England ("ISO-NE"), and Northeast Utilities Service Company ("NUSCO"), on behalf of PSNH. That study was completed in December 2012. The results of that study found that the interconnection of the Antrim Wind Project, studied at 33 MW of generation at the time, would not have a steady state adverse impact on the reliability or operating characteristics of the power systems and would not have an adverse impact on the stability of the power system. No network upgrades were required. Copies of the 2012 study reports, redacted by ISO-NE to remove Confidential Energy Infrastructure Information ("CEII") are included with this Application in Appendix 6. The Project then negotiated a Large Generator

Interconnection Agreement ("LGIA") together with NUSCO and ISO-NE, which was finalized in 2013. Prior to executing the LGIA, Antrim Wind Energy LLC withdrew its interconnection request due to Project delays. Antrim Wind Energy LLC filed a new interconnection request with ISO-New England on February 27, 2015. Based on conversations with ISO-NE and the previous studies, Antrim Wind Energy does not expect the results of the current study to differ substantially from the final results included in the final 2012 Impact Study.

Given the detailed study that has already been performed on the Antrim Project, Antrim Wind Energy expects that the study process will proceed more efficiently and we expect the completed Impact study to be received within the next 12 months. Antrim Wind Energy will then finalize an LGIA with ISO-NE and NUSCO. The LGIA will document all the requirements the Project must follow to be allowed to interconnect with the region's electric grid. Only after completion of these requirements to the satisfaction of NUSCO, PSNH and ISO-NE will the Project be allowed to interconnect, thus ensuring the Project will not adversely impact system stability and reliability.

F.4. Any associated new substations and transmission lines

The Project proposes to interconnect to the existing PSNH L-163 115kV electric transmission line via a new substation located on property that is currently leased by Antrim Wind Energy, LLC. No new electric transmission lines, other than Project electrical collector system lines, are currently anticipated to be required. An electrical collection system consisting of both underground and above ground cables will transfer the electricity generated by the turbines to the substation.

The Project substation will deliver generated power from the wind turbines to the grid. The substation yard will be divided into two areas; one for collection and one for interconnection. The collection yard will be 100 feet by 111 feet and will contain a transformer and a 16-foot by 12-foot control house. The yard will be surrounded by a chain link fence topped with barbed wire. There will be a gate at the west side of the yard and a gate at the north side of the yard. Directly adjacent to (and sharing a fence line with) the collection yard, there will be an interconnection yard; this area will be 172 feet by 186 feet, and will contain a three-breaker ring bus. A 20-foot by 24-foot control house will be located in the northwest corner of the interconnection yard. This yard will also be surrounded by a chain link fence topped with barbed wire. There will be two gates on the west side of the interconnection yard. The yard surface of both areas will be comprised of gravel/crushed stone. Substation design drawings are provided in Appendix 7B of this Application.

F.5. Construction schedule, including start date and scheduled completion date

Construction of the Antrim Wind Project will begin after all required approvals and permits have been obtained and all commercial agreements are finalized. Construction is currently planned to start in October of 2016, but will ultimately depend on when a

Certificate of Site and Facility is obtained. Depending on winter weather and other seasonal conditions, the expected Commercial Operation Date is December 2017.

Antrim Wind Energy, LLC has selected Reed & Reed, Inc. from Woolwich, Maine as the BOP contractor for the Project. AWE has entered into a Preconstruction Services Agreement ("PSA") with Reed & Reed and pursuant to that Agreement, AWE will negotiate a final BOP construction contract after all permitting has been completed. To date, Reed and Reed has provided constructability analysis, cost estimating, Project scheduling and other construction related advisory services given their extensive experience with New England wind project construction. Reed & Reed is the most experienced Wind Power contractor in the northeast, having constructed, in whole or in part, over 17 wind energy projects in New England, totaling 416 turbines and nearly 1,000 MW of installed capacity in challenging mountainous terrain. A detailed statement of Reed and Reed's experience and qualifications is found in Appendix 19A.

A Project schedule has been established to outline key milestone dates and facilitate coordination of equipment deliveries toward completion of the Antrim Wind Project. This Project schedule will be maintained by Antrim Wind Energy, LLC in conjunction with Reed & Reed in order to reflect monthly changes in development status, scheduled deliveries of major equipment, and the availability of materials and labor resources based on weather and other factors. The Project-specific activities and the anticipated timeframe for each have been evaluated to create the Project schedule. The Project schedule for the proposed Antrim Wind Project is attached in Appendix 7D.

F.5.a. Construction process

Under the supervision of AWE's management team, Reed and Reed will be responsible for managing the construction of the Project. In accordance with Antrim Wind Energy's PSA and final Balance of Plant Contract with Reed and Reed, their scope will include all technical and construction services required to complete and turn over a fully commissioned and operational project within designated cost, schedule, quality and safety requirements.

Initial field work

The initial field work during equipment mobilization includes surveying and site flagging to establish clearing areas, buffer zones and non-disturbance areas. Flagging will be done using survey grade Global Positioning Systems (GPS) that will guide subsequent logging and excavation. This will prevent inadvertent over-clearing and minimize the extent of tree removal. A qualified logging company will clear and remove trees and vegetation where necessary to allow site work to proceed. Initial road construction will begin as soon as sufficient areas have been cleared to enable drilling and excavation equipment to maneuver around the site.

Clearing and grading

Construction staging areas will be developed in two locations: (i) in the vicinity of the operations building and substation area; and (ii) on a three acre area approximately ½ mile west of the main Project entrance. These staging areas will be created by stripping and stockpiling the topsoil, and grading and compacting the subsoil. A minimum of 8 inches of gravel will then be installed to create a level working yard. If there is a soil base, geotextile fabric may be used below the gravel. Electric and communication lines will be brought in from existing distribution poles to allow connection with construction trailers. At the end of construction, utilities, gravel, and any geotextile fabric will be removed (from staging areas that do not overlap with the proposed operations and maintenance facility) and the sites restored to their preconstruction condition.

In order to clear the construction area so that the land can be worked, vegetation is removed along the roads, collector system, and around turbine locations. For transport roadways, clearing is typically done to establish an approximately 30-foot corridor centered on the road alignment. Where the collection system is overhead and adjacent to the transport roadway, an approximately 40-foot corridor will be cleared to allow for the installation of poles and wire next to the road. For crane roads, an approximately 50-foot corridor is needed. Following the initial timber harvesting, additional clearing will be done by mechanical means, using heavy equipment to remove debris in the corridors so that the area is ready for drilling, blasting, excavation and earthwork activities. All marketable timber will be sold, and smaller diameter trees and brush will be chipped and used on site for re-vegetation and soil stabilization. Topsoils will be stockpiled and then used during re-vegetation, so that native, site soils organic matter and seeds are kept on the site.

Areas surrounding the turbine locations will be cleared of trees and graded to a near level surface to create a laydown area that will allow for construction of the foundation, crane pads and turbine erection. This work will require clearing of approximately one acre per turbine site.

Due to the shallow topsoil that typically exists in higher elevations of New England, many areas of the Project site will require blasting in order to construct roads and foundations. Blasting is done in strict conformance with a Project blasting plan, which will be provided to the Town of Antrim, and which will be reviewed and approved by the New Hampshire Department of Safety (NHDOS) for compliance with explosives storage regulations. Blasting will be conducted under the direct management of Reed & Reed by a licensed contractor who possesses experience and complete qualifications. Typical blasting plan provisions include advance notification through area newspapers and notices posted at the Town Hall. All blasting plans require a detailed site control plan to ensure that only licensed workers are in the vicinity, and to document safety and control measures tailored to the site. These measures include warning signs, warning sounds (air blasts), and physical site control, including in wooded areas, for an appropriate diameter around each blast site.

Grading and drainage

As part of the site design, the Applicant's civil engineer, TRC, has produced a grading and drainage plan with details on approved construction measures and best management practices for controlling storm water and drainage for the site. A storm water pollution prevention plan will be prepared for this Project and submitted for review and approval with the NHDES and maintained onsite. Culverts will be installed per the design plans as part of the road construction to maintain or improve the drainage of the area without increasing erosion of topsoil. Culverts, level spreaders and additional retention areas that are needed based on the Project's impacts will be maintained during operations in accordance with state requirements. Antrim Wind has consulted with NHDES, and the USACE on site-specific drainage and stormwater control measures. During construction, the Project will install and maintain temporary sediment and stormwater control devices, as required by NHDES, such as silt fences, hay bales, wood chips, swales, and/or water bars. After turbine erection is completed, the Project will re-seed and restore non roadway areas to ensure that exposed soils are not subject to erosion.

Road construction

In general, road construction starts with topsoil stripping and the grubbing of stumps and organic material. Stripped topsoil will be stockpiled along the road corridor for use in site restoration. Any grubbed stumps will be removed, chipped/ground, or buried. The ground stumps are an excellent local source of highly effective erosion control mix. Roads will be constructed by grading and compacting to the depth necessary to meet the specifications required for construction equipment. In many areas, excavation or fill will be required so that the road can meet design parameters. In fill areas with a soil base a permeable, geotechnical fabric that acts as a sediment barrier between the rock and soil, may be placed over the compacted area. Gravel is then spread to accommodate the required roadway width and further compacted to provide a permanent gravel road. Typical gravel depths vary from 8 to 12 inches. Drainage ditches, swales, culverts, and appropriate sediment and erosion control measures (e.g., silt fencing) will be installed in the locations where access roads are adjacent to, or cross wetlands or streams. Culvert designs have been coordinated with NHDES and USACE. Upkeep and maintenance will be performed, as needed, so that site access is maintained throughout the year.

A new access road will be constructed starting from Route 9 and extending to the southwest throughout the Project area. The access road has been designed in order to minimize impacts resulting from clearing as well as to avoid impacts to wetlands and watercourses to the greatest extent possible. The access road will extend from Route 9 south to the substation/staging area just north of the PSNH utility corridor; it will then proceed under the PSNH transmission lines heading south and then west to Turbine 1. The access road leading to the first turbine will be gravel and approximately 16 feet wide. Sections north of the new substation location steeper than a 10% grade may be paved if necessary to meet PSNH's requirements. The roadway beyond the substation will be gravel and, during the construction period, this crane path will be approximately 34 feet wide to accommodate movement of the heavy-lift turbine erection crane, which has a track width of approximately 32 feet. In numerous locations along the crane path the areas of disturbance will be wider than the road width to accommodate excavations and fills to achieve design grades and to allow for delivery truck turning radii. After completion of turbine erection, those portions of the roads that are wider than necessary for two-way traffic will be reduced to approximately 16 feet in width and the reclaimed shoulder areas will be restored and reseeded using approved New Hampshire native seed mixes. AWE will maintain these roads year-round, including plowing, sanding, and grading as necessary. Snow plowing will be contracted with a local vendor.

Turbine foundation construction

The start of turbine foundation construction is expected to occur after the majority of blasting is completed on the crane path and WTG work pads. Foundation construction occurs in several stages including excavation, installation of leveling slabs, rock anchor installation, outer form setting, rebar and bolt cage assembly, casting and finishing of the concrete, backfilling, tensioning of the bolts and finally site restoration. Similar to other New Hampshire wind projects like Lempster, rock anchor foundations will be utilized due to the shallow depth of bedrock along the ridgelines where the turbines will be located. Excavation and foundation construction will be conducted so as to minimize the size and duration of exposed excavated areas. Rock anchor foundations will require an excavation approximately eight (8) feet in depth and thirty-five (35) feet in diameter. Rock anchor foundations consist of a concrete and rebar cap that is secured to rock in the subgrade by 18 to 24 steel rock anchors. The site is excavated and a level work surface is poured at the bottom of the excavation so holes can be drilled to a depth of 40 to 50 feet below grade for rock anchor installation and grouting. The structural cap of the foundations is then constructed using concrete and steel. The finished concrete foundation will be approximately 24 feet in diameter. The cap consists of approximately 130 cubic yards of concrete, rebar and the bolt cage that connects the tower to the foundation. The rock anchors are grouted and tensioned, securing the cap to the rock below. Rock anchor foundations require maintenance to ensure that the rock anchor bolts are properly tensioned to the rock. Typically this is checked after installation of the turbine, at three months after completion of the Project and every two years through the life of the Project.

Rock anchor foundations use considerably less concrete than traditional spread-footing foundations and have a significantly smaller footprint. However, some spread footing foundations may be required due to site-specific geotechnical conditions. Spread footings require an excavation to a ten (10) foot depth and seventy (70) foot diameter. Following excavation, the foundation is formed and reinforcing steel and anchor bolts are installed prior to pouring concrete. The finished concrete foundation will be approximately 60 feet in diameter for a spread footing foundation.

In all instances, once the foundation concrete is sufficiently cured, the excavated area around the foundation will be backfilled and graded with the excavated on-site material. The tower is secured directly to the top of the foundation and the nominal 20-foot diameter pedestal cap that typically extends 6 to 12 inches above grade. The finished grade around the foundation pedestal and base of the tower will be surfaced with a graveled area approximately six (6) feet in width that covers the wider subsurface structure.

Crane pads

Crane pads will be installed adjacent to each turbine foundation to provide the main erection crane a stable, well-compacted, level base from which to accomplish heavy lifting. Crane pad dimensions are typically 60 feet wide and 90 feet long. A crane pad is constructed in a manner similar to the construction of access roads. Trees, vegetation, and compressible, organic soils and topsoil are removed as part of initial site preparation. Following the initial site preparation, geotechnical filter fabric is installed if necessary, followed by successive layers (8 to 12 inches) of well-compacted crushed aggregate. After the initial construction phase, the crane pads will only be used periodically during the operations phase of the facility. Nevertheless, leaving the crane pads intact will facilitate future operations and maintenance activities. Such activities could include replacement of a blade, maintenance tasks and equipment replacement, and post-construction environmental monitoring, which are facilitated by cleared areas around turbines.

Removal and disposal of construction debris

Debris will be removed from the site during construction by a local hauling company through the Project's general contractor. Typically, sites do not produce large amounts of waste during construction. Due to cut and fill methods and foundation excavation, some spoil piles may be made on site. In those instances, all spoil material will be natural to the site and provisions will be made for large organic material (such as stumps and logs) to be ground and used on site. These areas will be re-vegetated with native mix at the conclusion of Project construction.

Post construction and reclamation

At the conclusion of Project construction, the areas that have been cleared and do not contain a permanent structure will be re-vegetated with native mix. This helps to reduce erosion and promotes the site's natural condition. Restored areas will include road edges, cut and fill slopes, crane paths, temporary roads, and staging areas. This process will generally involve the following sequence of activities:

- Seeding with a native mix and mulching all WTG work pads.
- Spreading organics and seed with native mix at the edges of access road and crane paths to reduce widths to 16'.

- Spreading organics and seed with native mix on fill slopes and non-ledge cut slopes.
- Restoring all construction lay down areas.

At the conclusion of construction and restoration, silt fences and temporary sediment and erosion control measures will be removed as necessary, in accordance with all applicable permit conditions.

F.5.b. Substation, switchyard, staging area, and operation & maintenance building

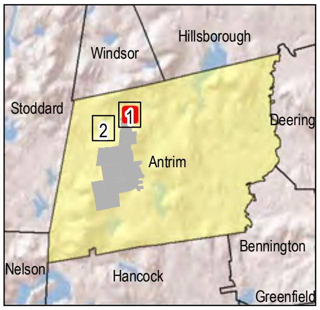
A collection switchyard and substation will be located adjacent to the PSNH transmission corridor, and will be the terminus of the Project's electrical collector system. The switchyard and substation will include transformers, switching equipment, protective relay and control equipment, transfer trip equipment, disturbance analyzer equipment, transducers, a Remote Terminal Unit, telemetry equipment and meters. In addition, a grounding bank will be installed, in accordance with utility and National Electric Code standards. Dedicated phone and data lines will be included, for data and communications between local utility facilities, and AWE's contracted SCADA monitoring service. The substation and switchyard will be enclosed within a fenced area as detailed in Appendix 7B.

As discussed above, the Project will require a temporary staging (laydown) area to serve as an on-site construction headquarters and for storing and handling materials and equipment used for the Project. Two separate sites have been selected for laydown areas. The first is located in an upland area between Route 9 and the Project substation and will be approximately 2 acres in size. Currently this site is forested, and will need to be cleared and graded. The second proposed site for a laydown yard is located off Route 9, west of the proposed Project entrance, and will occupy approximately 2.9 acres of previously disturbed area which was a gravel borrow pit and log landing. Approximately 0.02 acres or 955 square feet of previously disturbed wetland in the middle of the borrow pit will be filled.

At both locations, temporary erosion control measures will be implemented to prevent erosion and sedimentation and 25-foot setbacks from adjacent wetland areas will be employed. Topsoil will be stripped and stockpiled for use during restoration of the site; geotextile fabric will be installed and topped with a layer of well drained gravel. After construction is completed, debris, unused materials, the gravel, and the geotextile fabric will be removed and the stockpiled topsoil will be replaced. The areas will be stabilized and seeded using approved native New Hampshire seed mixes and the site will be allowed to re-vegetate with native plant species.

An O&M facility will be constructed in the Project area on the location shown in the civil design drawings (provided in Appendix 7A). This location provides for easy access to the site by operations personnel, as well as for access by utility personnel to the switchyard. The O&M facility will also provide additional construction office, material storage, and staging areas during construction. The O&M facility will be comprised of a single story building suitable for operating personnel, operations and communication equipment, parts storage and maintenance activities. A vehicle parking area will be located in close proximity to the building. There will also be an area for outdoor storage of larger materials and equipment.

The O&M building will be constructed in accordance with the design drawings contained in Appendix 7C. It will comprise approximately 3,000 square feet and will include offices and associated facilities (bathrooms, kitchen, and storage) for technicians, a garage for spare parts and supplies, and a computer server room. The O&M building is expected to have a potable water well, sewage tank and leach field, hot water heater, HVAC, plumbing, electrical, computer, fiber optic, and telephone connections, and will be alarmed for fire, heat, and intrusion, in cooperation with local fire departments.



Legend

	Proposed Disturbance Area		Wetland Boundary
	Vernal Pool		Perennial Stream
	Potential Vernal Pool		Intermittent Stream
	Wetlands		Drainage

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure F.5.b

Project Substation, O & M Building, and Temporary Staging Area

Map 1 of 2

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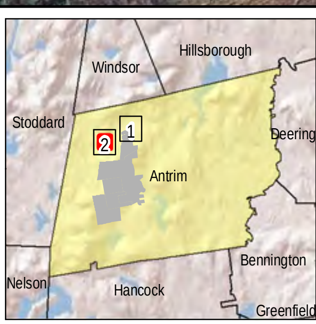

Legend

- Proposed Disturbance Area
- Vernal Pool
- Potential Vernal Pool
- Wetlands
- Wetland Boundary
- Perennial Stream
- Intermittent Stream
- Drainage

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure F.5.b

Project Substation, O & M Building, and Temporary Staging Area

Map 2 of 2

Produced by: TRC | 1/29/2015

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F.5.c. Turbine and Met Tower installation

In addition to the tower sections, nacelle, rotor, and blades, other smaller wind turbine components include: hubs, nose cones, cabling, control panels and internal facilities such as lighting, ladders, etc. All turbine components will be delivered to the Project site on specialized transport trucks, and the main components will be off-loaded at each individual turbine site. Turbine erection is performed in multiple stages including erection of the tower sections, erection of the nacelle, assembly and erection of the rotor, connection and termination of the internal cables, and inspection and testing of the electrical system prior to energizing..

Turbine assembly and erection mainly involves the use of large track mounted cranes, smaller rough terrain cranes, boom trucks, and rough terrain fork-lifts for loading and off-loading materials. The tower sections, rotor components, and nacelle for each turbine are delivered to each site by specialized trucks and unloaded by crane. A large erection crane will set the tower segments on the foundation, place the nacelle on top of the tower, and, after ground assembly, place the rotor onto the nacelle. In some turbine locations, due to space limitations, single blade erection may be required, whereby the hub is installed and then each of the three blades is individually hoisted and attached. The erection crane will move from one tower to another along the crane path.

The permanent project meteorological ("MET") tower will be a 100-meter freestanding lattice tower structure that is transported to the site by truck in sections. Concrete foundation footers will be excavated and poured for each foot of the MET tower and then the tower will be assembled using a crane. Prior to the completion of all turbine installations a temporary hub height MET tower will also be installed in the location of one of the turbines for approximately 4-8 weeks (depending on weather conditions) in order to perform a site calibration consistent with applicable IEC standards for performing a turbine power curve test. The temporary met tower will be removed from the turbine location prior to turbine installation.

F.5.d. Collection system installation

A single 34.5 kV three-phase collector line will be constructed from the collector substation to the individual turbines. The main collection line will follow the access road, with each turbine connected to the main line via an underground connection. The main collection line will consist of both underground and overhead lines. Underground lines will be installed from WTG-9 to just east of the WTG-2 & WTG-3 spur road. From there, the collection line will be installed on overhead lines running adjacent to the access road, along its east side. The overhead portions of the collection line have been designed to meet Avian Power Line Interaction Committee (APLIC) guidelines to minimize potential impacts to wildlife (APLIC and USFWS 2005). Where the access road intersects the PSNH transmission line corridor, the collection line will be installed underground to the collector substation. The electrical collection system designs are provided in Appendix 7B of this Application

Underground Collection Lines

The individual turbines will be connected to a 34.5 kilovolt (kV) collection system to form an integrated power collection system. The turbines operate in parallel. Each turbine is connected to a 690-34,500 Volt Generator Step-Up (GSU) transformer and connection cabinet.

The installation of the underground collection system, including the accompanying fiber optic communications cable and plant grounding system, will be completed in accordance with prudent construction practices and in accordance with the contract specifications, drawings, and applicable industry standards.

Trenches for electrical cables and fiber optic cables will be installed on one side of the roads. The trench is typically excavated to a depth of approximately 4 feet (minimum depth for concrete encased conduit is 38"; direct bury conduit minimum depth is 54"). A minimum of at least 6 inches of clean sand fill is used to line the trench bottom. After the cables are installed, another 6 inches of clean sand (minimum) tops the cable. The remainder of the trench is backfilled with native soil.

The installed location and depth of the cables are verified and recorded. Utility markers are placed on each side of roadway crossings and at pipeline, telephone and communication easements. For continuous trench installations greater than 1000 feet in length, a marker is placed every 1000 feet or as shown on construction detail drawings.

Overhead Collection Lines

The underground collection system transitions to an overhead collection system from just east of the WTG 2 & WTG 3 spur road down to the PSNH transmission corridor. The overhead collection lines run adjacent to the access road and have been designed to meet APLIC guidelines in order to minimize impacts to wildlife. The overhead collection lines will be supported by approximately 32 wooden poles that are 35 feet high, with medium voltage spacer cable, and an optical ground wire for grounding and fiber optic communications. The poles will be freestanding except at some turns where guying will be used.

F.5.e. Heavy/oversize trucking loads

Heavy/oversized trucking loads will follow routes approved by the NHDOT, and will be accomplished by licensed haulers experienced in wind turbine component transport. Haulers perform route surveys and propose route(s) to NHDOT, which then confirms and/or modifies the routes prior to issuing permits to the haulers. The permits identify the days of the week and hours of the day when hauling may occur. State regulations may require multiple escort vehicles, including State Police, private oversized-load escorts, and individual components may be subject to additional county and/or local police escorts as well.

For the Antrim Project, there are 9 proposed turbines. Turbines 1-8 will require 9 oversized loads per turbine in order to transport 4 tower sections, 1 nacelle, 1 hub, and 3 blades. Turbine 9 will require 8 oversized loads in order to transport 3 tower sections, I nacelle, 1 hub, and 3 blades. Therefore, it is anticipated that there will be a total of 80 oversized loads delivered to the site. The identified likely transport route is not expected to cause undue delays or disruptions along local roads. No local roads will be used. There are very few exits or turns for the Antrim transport route, namely an exit from I-89, and a single turn from Route 9. No improvements or modifications to roads are anticipated to be required as the result of this Project. However, final route approval and corresponding permit issuance will be governed by NH DOT, which may vary from current expectations. During the delivery and construction phase, Antrim Wind will retain a New Hampshire registered Professional Engineer from a local firm to assess road conditions prior to and after all component deliveries.

F.5.f. Radar Activated Lighting System installation

AWE plans to install the radar activated lighting system simultaneously with the construction of the other Project facilities, provided that the FAA has issued its revised advisory circular sixty (60) days or more prior to the commencement of construction. In the event that the advisory circular is not issued by that time, then AWE shall install the Radar System no later than twelve months after the FAA has issued the revised advisory circular detailing the requirements for such systems. In the event of a delayed FAA advisory circular, AWE may install the Radar System at the same time that other Project facilities are constructed and only activate it after the advisory circular has been issued.

In any event, the radar system will be installed at the site of the permanent Project meteorological tower. See Section H.1. for more details on the permanent meteorological tower. If the installation of the Radar System occurs after the other Project facilities are constructed and the site has been restored, then a small concrete truck will be brought to the site to pour the equipment slab, followed by a crane truck to install the radar antenna on the meteorological tower.

F.6. Decommissioning

AWE has provided a decommissioning plan in Appendix 21. This decommissioning plan and estimate is consistent with the application requirements for a Certificate of Site and Facility. It is unclear whether the Committee will require decommissioning funding assurance in a manner that includes or excludes the salvage value of the facility, which AWE expects to be significant. As described below and in greater detail in Appendix 17A (Town Agreement) and Appendix 21 (Decommissioning Plan) AWE has addressed all necessary decommissioning activities and will provide decommissioning funding assurance prior to commencement of construction that is consistent with its agreement with the Town of Antrim and any conditions contained in an SEC Certificate, whether that allows for accounting for salvage value or not.

The Siemens SWT-3.2-113 wind turbine has a certified design life of 20 years, however it is very likely the turbines will continue to run efficiently well beyond that time. If the turbines are non-operational for more than 24 months, and they are not upgraded or replaced at that time, they will be decommissioned.

Decommissioning will consist of the following activities:

1. Provide decommissioning schedule to Town of Antrim prior to initiating any decommissioning activities.
2. Acquire approvals for transport of oversized/overweight loads from Project site. Coordinate with NHDOT prior to transport to confirm routes.
3. Re-establish access road and crane path widths to accommodate transport of equipment and components.
4. Mobilize crane(s) to the site and erect crane.
5. Drain fluids from gearboxes, transformers, and hydraulic systems and put into appropriate containers before tower dismantling. Transport and dispose of fluids in accordance with all state and federal regulations.
6. Dismantle and remove the rotor, nacelle and towers and transport entire Wind Turbine Generator off site to be recycled to the greatest extent possible.
7. Use an excavator to dig a trench around the perimeter of the foundation and dig an approximately 8-foot deep hole adjacent to each foundation to accept concrete rubble. Stockpile excavated material for use in re-grading.
8. Using an excavator equipped with a hydraulic ram/impact hammer or comparable equipment, remove the top 18 to 24 inches of the foundation in compliance with all applicable state and federal environmental regulations.
9. All the metal and cable shall be cut off at the new, lower elevation of the foundation so that there is nothing left exposed above the concrete. The metal that is cut off will be separated and recycled.
10. Backfill excavation with the soil that was stockpiled and re-grade the foundation areas.
11. Remove all switchyard equipment from the site that is not owned by PSNH. Remove all fencing and concrete foundations to 18 inches below grade in the same manner as what is done for turbine foundations.
12. Remove the O&M Building from the site, including removal of foundations to 18" below grade as described above, unless the building or foundation will be reused for another purpose after the decommissioning of the wind farm.
13. Areas where subsurface components are removed will be graded to match adjacent contours.
14. Scarification and reseeding of all Project roads beyond the property boundary between Michael Ott and Antrim Limited Partnership

15. Loam and seed Project areas with an appropriate seed mix and allow to re-vegetate naturally.

In addition to the above-described actions, the Applicant and the Town of Antrim have entered into an agreement that contains provisions concerning decommissioning activities, including decommissioning funding assurance. A copy of this agreement is contained in Appendix 17. Section 14 of this agreement contains all of the agreed upon decommissioning responsibilities of AWE. Specifically the agreement requires that AWE hire a qualified third party consultant with experience in wind farm decommissioning, reasonably acceptable to the Town, to prepare a site specific decommissioning funding estimate which must be provided to the Town prior to the commencement of construction and then updated every three years thereafter. It also requires that a final decommissioning plan be provided to the Town for approval no less than three months prior to the commencement of decommissioning.

The agreement with the Town also requires:

- That decommissioning funding assurance, in the form of a decommissioning bond, letter of credit, or other financial mechanism that provides for an irrevocable guarantee to cover the costs of complying with AWE's decommissioning obligations, be in place prior to the commencement of construction, naming the Town as beneficiary.
- That any decommissioning bond, letter of credit or other financial mechanism used for providing decommissioning funding assurance must be issued or made by an entity having and maintaining a minimum credit rating of "BBB" from Standard and Poor's, or "Baa2" from Moody's, or their commercial equivalent.
- That the funds for Decommissioning Assurance shall only be used for expenses associated with the cost of decommissioning the Project.
- The amount of any such decommissioning funding assurance shall be updated every three years as the site-specific decommissioning estimate is updated.
- That the Town may access and require the expenditure of the decommissioning funds in the event that AWE does not fulfill its decommissioning obligations.

G. ELECTRICAL INTERCONNECTION LINE INFORMATION

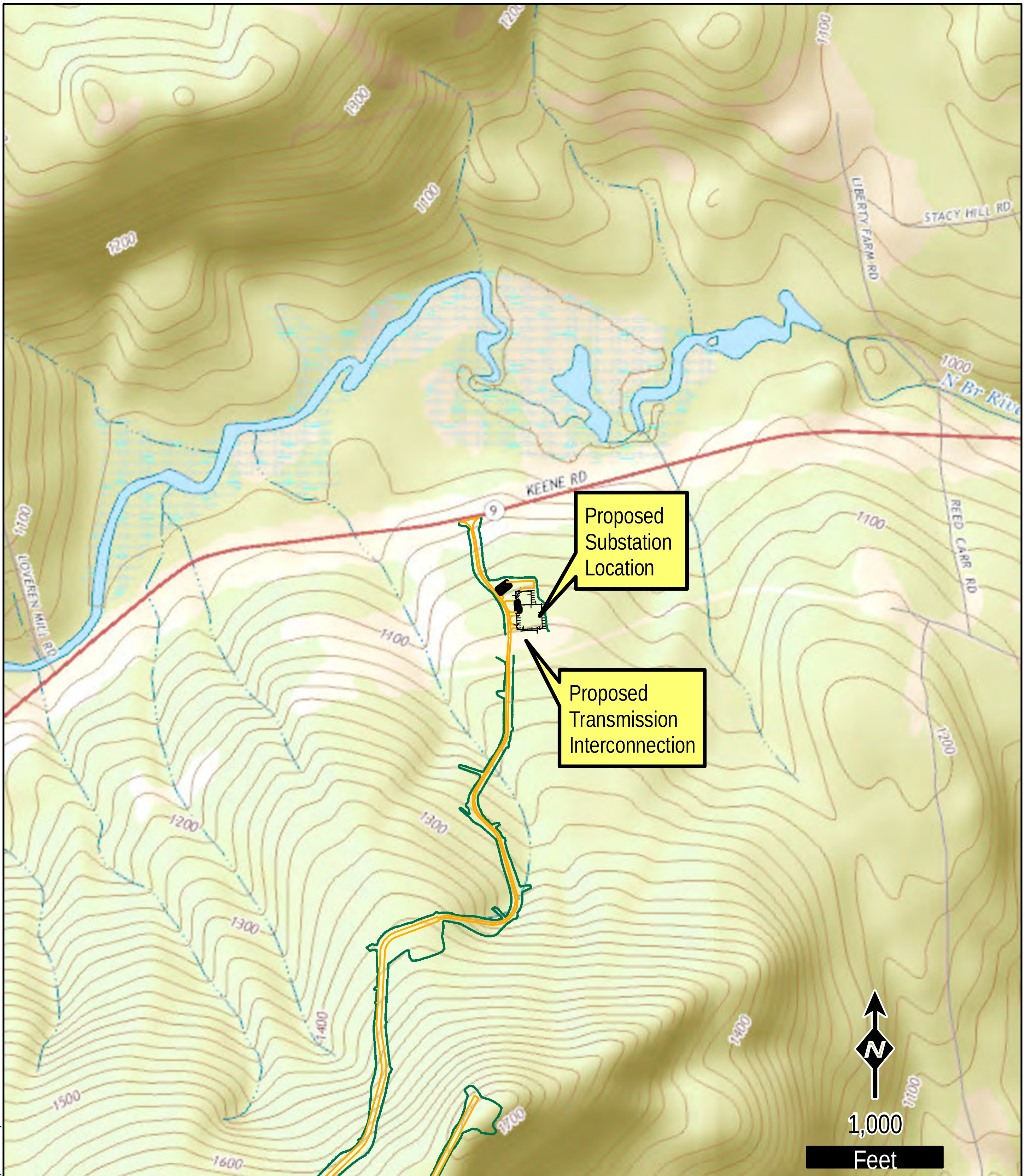
The Project proposes to interconnect to the existing PSNH L-163 115 kV electric transmission line via a new substation located on property that is currently leased by Antrim Wind Energy, LLC. No new transmission lines are currently anticipated to be required. An electrical collection system will transfer the electricity generated by the turbines to the substation, which will be located immediately adjacent to the existing transmission corridor.

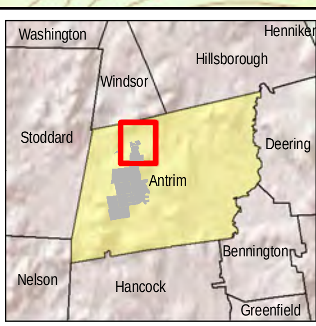
A single 34.5 kV three-phase collector line will connect the collector substation to the individual turbines. The main collection line will follow the access road, with each turbine connected to the main line via an underground connection. The main collection line will consist of both underground and overhead lines. Underground lines will be installed from WTG 9 to just east of the WTG 2 and 3 spur road. From there, the collection line will be installed overhead on poles running adjacent to the access road, along its east side. Where the access road intersects the PSNH transmission line corridor, the collection line will be installed underground to the collector substation. The electrical collection system designs are provided in Appendix 7B of this Application.

The Project substation will serve to deliver generated power from the wind turbines to the electric grid. The substation yard will be divided into two areas; one for collection and one for interconnection. The collection yard will be 100 feet by 111 feet and will contain a transformer and a 16-foot by 12-foot control house. The yard will be surrounded by chain link fence topped with barbed wire. There will be a gate at the west side of the yard and a gate at the north side of the yard. Directly adjacent to (and sharing a fence line with) the collection yard, there will be an interconnection yard; this area will be 172 feet by 186 feet, and will contain a three-breaker ring bus. A 20-foot by 24-foot control house will be located in the northwest corner of the interconnection yard. This yard will also be surrounded by a chain link fence topped with barbed wire. There will be two gates on the west side of the interconnection yard. The yard surface of both areas will be comprised of gravel/crushed stone. Substation design drawings are provided in Appendix 7B of this Application. The location of the proposed substation and transmission interconnection is illustrated on Figure G.1.

G.1. Location shown on U.S. Geological Survey Map

The location of the proposed Project is described in detail in Sections C.1 and C.2 of this application. The location of the proposed substation and transmission interconnection is illustrated on Figure G.1.





Legend

- Proposed Building
- Proposed Fence
- Proposed Access Road
- Proposed Treeline

EOLIAN RENEWABLE ENERGY

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure G.1

Location of Proposed Substation

Produced by: TRC | 7/22/2015

\\appesri1\GIS\PROJECTS\AUGUSTA\Eolian\ANTRIM\Figure H1 Project Location - SS and Transmission 8x11USGS.mxd

G.2. Corridor width for:

G.2.a. New route; or

Corridor width for a new transmission route is not applicable because the Antrim Wind Energy Project will not require new transmission development.

G.2.b. Widening along existing route

The Antrim Wind Energy Project will not require new transmission development. No widening of the existing transmission corridor is anticipated.

G.3. Length of line

The loop from the proposed substation to the existing PSNH 115kV transmission will be approximately 150 feet long; the exact length will depend on the final PSNH substation design and exact interconnection location. There will be no new transmission lines associated with the proposed Project.

G.4. Distance along new route

The Antrim Wind Energy Project will not require development of a new transmission route.

G.5. Distance along existing route

The Antrim Wind Energy Project will not require the development of a new transmission line along an existing transmission route.

G.6. Voltage (design rating)

The Project will interconnect to PSNH 115 kV Line L163 between Jackman Substation and Keene Substation via a three breaker ring bus substation located adjacent to the Project access road. The interconnection substation will be a standard three-phase 115 kV transmission level substation designed and constructed by PSNH. A 115 kV – 34.5 kV collector substation will be located adjacent to the interconnection substation and provide an interface between PSNH's facilities and the Project. The collector substation will be designed and constructed consistent with applicable industry standards, PSNH requirements, applicable local, state and federal codes and standard utility practices. A single 34.5 kV three-phase collector line will be constructed from the collector substation to the individual turbines. This collector line will be a combination of overhead and underground facilities as described elsewhere in this Application. All collector system facilities (substation and lines) will be designed and constructed consistent with applicable industry standards, PSNH requirements, applicable local, state and federal codes and standard utility practices.

G.7. Any associated new generating unit or units

The proposed facility will consist of 9 Siemens SWT-3.2-113 wind turbine generating units as described in Sections E.3, F.1 and F.3 of this Application. Details on the Siemens turbine are provided in Appendix 5.

G.8. Type of construction (described in detail)

The substation will be typical PSNH open-air exposed bus construction with gas insulated breakers and/or vacuum breakers. The aerial collector line will be three phase, four wire, 34500/19920 volt single-pole construction consistent with PSNH and utility industry standards.

G.9. Construction schedule, including start date and scheduled completion date

The construction of the electrical collection and interconnection facilities will be broken into two separate construction scopes. The interconnection substation and loop in to the L163 115 kV line will be part of Public Service of New Hampshire/Northeast Utilities' ("PSNH/NU") scope under the large generator interconnection agreement ("LGIA"). The collector substation and electrical collection system will be part of Reed and Reed's scope in the BOP construction contract.

Interconnection substation construction is planned to commence concurrently with the construction of the Project and after the receipt of all necessary regulatory approvals. Construction is planned to start in October 2016, but will ultimately depend on when a final, non-appealable Certificate of Site and Facility is obtained. The precise timing milestones for commencement and completion of construction for the interconnection substation will be detailed in the appendices to the LGIA to be executed between AWE, ISO-NE and PSNH/NUSCO, per the ISO-NE Tariff requirements.

Collector substation and collector line construction will be coordinated with the final construction schedule of the interconnection facilities and the remainder of the Project facilities. AWE's expected construction schedule is provided in Appendix 7D.

G.10. Impact on system stability and reliability

The impact of the proposed Project on system stability and reliability is discussed in Section F.3.e of this Application. A complete System Impact Study report will be provided as soon as it is completed by ISO-NE. The prior System Impact Study performed in 2011-2012 (See Appendix 6) concluded that the Project would not result in adverse impacts on power system stability, steady state voltage or reliability and AWE does not expect any significant changes in the findings of the new study. If system stability or reliability is an issue AWE will be required to pay for any necessary upgrades to ensure stability and reliability before connecting to the grid.

H. ADDITIONAL INFORMATION

H.1.Description in detail of the type and size of each major part of the proposed facility

The proposed Antrim Wind Energy Project consists of one permanent met tower, 9 wind turbines, a collection and interconnection substation, approximately 3 miles of new access road, an operations and maintenance building and two temporary staging/laydown areas. There will be no new transmission lines other than collector system lines. It is expected that the total direct impact for the access roads, turbine pads, staging areas, work pads and other construction-related disturbance will be 57.1 acres, with 45.8 acres of that to be restored and re-vegetated. The final Project footprint area, including roads, infrastructure and turbine pads, will be approximately 11.3 acres. Each element of the Project is described in more detail below.

<u>Access Road and Spur Roads</u>

Approximately 3.55 miles of new gravel surface roads will be built for access, construction and maintenance of the wind turbines. The main access road will be approximately 3.00 miles (15,857 feet) long and will be built in two sections. The first section will connect Rte. 9 to wind turbine generator (WTG) #1; this section will be approximately 0.7 miles (3,710 feet) long and will be 34 feet wide during the construction phase of the Project, and ultimately 16 feet wide after construction is completed. The second section includes the remainder of the road, from WTG #1 to the ridge and then along the ridgeline. This section will be approximately 2.3 miles (12,147 feet) long and will be 34 feet wide during the construction phase. Once the Project is complete, the shoulder areas of this section of road will be restored and reseeded (using approved New Hampshire native seed mixes) to a final width of 16 feet. There will also be two spur roads installed to access individual turbines; one will be approximately 0.4 miles (2,127 feet) long and the other will be approximately 0.14 miles (765 feet) long. Like the main access road, these spur roads will be 34 feet wide during the construction phase, then restored and reseeded upon Project completion to a final width of 16 feet.

<u>Substation</u>

The Project will include an interconnection collector substation that will deliver power generated from the wind turbines to the grid. The substation yard will be divided into two areas; one for collection and one for interconnection. The collection yard will be 100 feet by 111 feet and will contain a transformer and a 16-foot by 12-foot control house. The yard will be surrounded by a chain link fence topped with barbed wire. There will be gates at the west and at the north sides of the yard. Directly adjacent to (and sharing a fence line with) the collection yard there will be an interconnection yard which will be 172 feet by 186 feet, and will contain a three-breaker ring bus. This yard will also be surrounded by a chain link fence topped with barbed wire. A 20-foot by 24-foot control house will be located in the northwest corner of this yard. There will be two gates on the west side of this yard.

Substation lighting will consist of both general yard lighting and specific task lighting, and will be designed in accordance with the Bird and Bat Conservation Strategy ("BBCS") provided in Appendix 12F of this Application. Both general yard lighting and specific task lighting will be controlled manually and will be in use only during times of night maintenance. All lights will be shielded and downward-facing. The general yard lighting can also be set to be photo-or motion-controlled so that the yard is illuminated at night for security purposes should security concerns arise. The control house itself will have a photo-controlled light above the door. Substation drawings are provided in Appendix 7B of this Application.

Backup power for the substation will be provided by a propane-powered generator.

Public Service Company of New Hampshire requires that it own the land on which the interconnection yard is located. Antrim Wind Energy LLC has entered into an Option Agreement to purchase the land under the interconnection switchyard and will purchase the land and convey title to PSNH after completion of construction of the facility. With the cooperation of the landowner, AWE has received the necessary subdivision approval from the Town of Antrim to subdivide the land necessary for the substation for conveyance to PSNH. A copy of the recorded Notice of decision of the subdivision approval from the Town of Antrim is included as Appendix 7E.

AWE requests that the Committee approve as part of a Certificate of Site and Facility the transfer of the land and interconnection substation to Public Service of New Hampshire. A detailed map of the subdivided lot and interconnection substation facilities is provided in Appendix 7F.

Operations and Maintenance (O&M) Building

The O&M building will be single story structure of approximately 3,000 sq. ft. It will house communication equipment, parts storage, and other maintenance supplies. Exterior lighting will be designed in accordance with the Bird and Bat Conservation Strategy. Exterior lighting will be provided by shielded, manually-controlled fixtures which can also be photo-controlled.

Water for the O&M building will be supplied by a well drilled on site. Wastewater will be handled by an on-site septic system, which will be designed according to industry standards and subject to approval by the NHDES (Subsurface Systems Bureau).

A general design plan for the O&M building is provided in Appendix 7C of this Application.

Turbine Foundations, Staging Areas, and Work Pads

Turbine foundations are expected to be 24 feet in diameter for rock anchor types and made of concrete and steel. The exact dimensions of the turbine foundations will depend on final Project engineering based on preconstruction geotechnical reviews. It is expected that rock anchor foundations will be used where possible, due to the shallow depths of bedrock along the ridgeline. Final foundation and anchor design will be determined pending a geotechnical survey prior to construction. Gravel staging/assembly areas and crane pads will be installed adjacent to each turbine foundation. The staging areas will be approximately one acre. There will be a 34-foot wide crane path adjacent to the staging/assembly area that is also utilized for work space to some extent while assembling the crane. Staging/assembly areas will be reclaimed and reseeded with approved native New Hampshire seed mixes. Although primarily used during the construction phase, the crane pads will remain in place for periodic post-construction maintenance activities. WTG #1 and WTG #9 will have additional adjacent crane assembly pads of approximately 200-feet by 50-feet.

Wind Turbines

AWE plans to install 9 Siemens SWT-3.2-113 turbines, each with a generating capacity of 3.2 MW, for a total generating capacity of 28.8 MW. The turbines will be installed on concrete foundations, described above. Hub height for these turbines is 92.5 meters for WTG #1 - #8 and 79.5 meters for WTG #9. The turbine towers are made of tubular steel, on which the glass fiber reinforced polymer nacelle is mounted. The rotor diameter is 113m. More information about the Siemens turbines can be found at Appendix 5.

Electrical Collection System

A single 34.5 kV three-phase collector line will be constructed from the collector substation to the individual turbines. The main collection line will follow the access road, with each turbine connected to the main line via an underground connection. The main collection line will consist of both underground and overhead lines. Underground lines will be installed from WTG-9 to just east of the WTG-2 and 3 spur road. From there, the collection line will be installed overhead on poles running adjacent to the access road, along its east side. Where the access road intersects the PSNH transmission line corridor the collection line will be installed underground to the collector substation. The electrical collection system designs are provided in Appendix 7B of this Application.

Permanent Meteorological Tower

A permanent meteorological tower will be installed on the ridgeline between WTG#3 and WTG#4 to obtain wind data at the Project site for wind turbine performance management. This tower will be a freestanding lattice steel tower approximately 100 meters (328 feet) in height.

Radar System

The Project includes a radar activated lighting system such as the Harrier Radar System manufactured by DeTect, Inc. (the “Radar System”). This system is used to control the obstruction lights required by the Federal Aviation Administration (“FAA”) and consists of a radar mounted on the permanent meteorological tower and pad-mounted control equipment at the base of the tower. The concrete equipment pad will be approximately

16' X 6' and will be located at the base of the meteorological tower. Detailed specifications of the radar system are contained in Appendix 5A.

H.2.Identification of the applicant's preferred location and any other options for the site of each major part of the proposed facility

Siting of any wind energy project is a complex and iterative process that takes place over several years involving many interrelated criteria including technical, environmental and community considerations. AWE conducted diligence on the Antrim Project site for over 3.5 years before ultimately seeking its initial Certificate for the project from the Committee in 2012. Prior to selecting the Antrim Project site in 2009, AWE evaluated the entire state of New Hampshire through a GIS based constraint model for potentially suitable sites and specifically evaluated two different potential locations in the Antrim region. Eolian has evaluated over 90 prospective terrestrial wind power sites throughout New Hampshire, Maine, Vermont, and Massachusetts and has developed a multi-criteria evaluation model for assessment of site suitability. The model criteria evaluate a combination of interrelated geographical, infrastructural and environmental characteristics. The identification of the Antrim Wind Energy site was the result of analysis using Eolian's statewide model for wind energy suitability in New Hampshire. In applying this methodology the main site selection criteria include an adequate wind resource (based on meso wind models), environmental appropriateness, grid-interconnection, proximity to transportation routes, and distance from residences. Prior to settling on the Antrim site for the Project, alternative nearby sites in both Stoddard and Marlow were considered. Ultimately, Marlow was determined to be less desirable and potentially unsuitable due to a lack of nearby transmission resources as well as the presence of extensive wetland resources. The Stoddard location was determined to be less favorable due to siting complications arising from substantial amounts of land being under conservation easements and increased difficulty with potential access to the area from existing roadways. The Stoddard location was also less proximate to suitable interconnection options. The Antrim site, after extensive review, was determined to be the preferred location and a suitable site for the Project.

AWE's assessment of the site as suitable for a wind power project was affirmed in many respects by the Order of Decision issued by the Committee in Docket 2012-01 which found that the Project would not have an unreasonable adverse impact on public health and safety, air and water quality or the orderly development of the region, wildlife and the natural environment (subject to certain conditions that AWE has incorporated into this Application). It is also affirmed by the Town of Antrim's steadfast desire to host this Project in its current location. The concerns expressed by the Committee in issuing its denial of the Antrim Project in the 2012-01 Docket have led to significant refinements in the siting of the Project. Aesthetic impacts of the Project have been significantly reduced, while other impacts that were previously found to be reasonable have been maintained or reduced. And conservation land and mitigation have been significantly increased. Please see Appendix 10 for a more detailed description of the changes to the Project from the 2012-01 Docket and a comprehensive description of the mitigation and conservation package.

Further discussion of the suitability of the site and the history of the site selection process is found below.

Competitive Wind Resources

As a renewable source, the energy potential of the wind is unevenly distributed across the landscape. For areas such as interior New England there is a strong correlation between elevation and the strength of the wind resource, with higher elevations experiencing stronger winds when compared to lowland locations. But the adequacy of the wind resource is not simply a function of wind speeds; it is also dependent on wind speed stability and consistency, wind direction and directional variability (as well as the orientation of the relevant landform to the prevailing wind direction(s)), seasonal and daily fluctuations, wind shear, and turbulence. Some areas that initially appear to be adequate in terms of wind speed are ultimately not viable due to the other qualities of the overall wind resource.

The process for determining whether a prospective site has an adequate wind resource requires the installation of meteorological monitoring equipment for a period of at least one year and it typically longer. AWE conducted on-site monitoring of the meteorological conditions with a 60-meter meteorological tower from November 2009 through November 2013. The Project has also evaluated the wind resource with remote sensing technology. Through sophisticated analyses of the on-site wind data and scaling for long-term accuracy, the Project's meteorological consultants have confirmed that the site does have an adequate wind resource (IEC Class IIa). In addition to sufficient wind speeds, the other characteristics of the wind resource (e.g. prevailing direction in relation to the land form and turbine array, turbulence and shear characteristics) are well suited to the generation of wind energy. The wind resource at the Antrim Project site combined with the Siemens turbines is expected yield an average Net Capacity Factor ("NCF") of 37%.

Environmental appropriateness

A wind energy project should be sited to minimize the incremental impacts to sensitive environmental resources. The location of a wind project should be consistent with existing land uses and should not unreasonably impact unique wildlife habitats. A well-sited project should carefully consider the potential for effects on local and regional wildlife and vegetation as well as the potential for impact to surrounding scenic and recreational resources.

The proposed Antrim Wind Energy Project site is suitable from an environmental perspective. During its preliminary investigation, AWE confirmed that there are no conservation restrictions on the site that would limit the development of the Project. In addition, desktop GIS review of known environmental factors did not reveal the presence of any known critical habitats or endangered species. This has been confirmed by field reconnaissance conducted at the Project site. Wetland impacts are almost entirely avoided: there will be only 0.22 acres of wetlands impacted as a result of the Project. In addition, the elevation of the site, between 1042 and 1752 feet above mean sea level eliminates the potential for impacts to sensitive high elevation alpine habitats. See Sections H.3. H.4, and I.5 for a more detailed explanation of the various studies that have been conducted to demonstrate the environmental appropriateness of the site.

Compatibility with existing land uses

Wind projects should be sited in a way that is as compatible with existing land uses as much as possible. Land in the Project area has long been used as woodlots and open space, which is compatible with wind farm development. Much of the northern slope of Tuttle Hill has been heavily logged in the past decade; as recently 2012 logging operations (unrelated to the Project) have impacted hundreds of acres of the site. Once the Project is complete, landowners who have leased lands to the Project will continue to be free to manage the bulk of their properties much as they do today. It is also noteworthy that there is substantial public support for the Project from the Town of Antrim and that the Project is consistent with many of the goals of the Antrim Master Plan. Due to the Project's substantial conservation plan, whereby over 900 acres of forestland will be perpetually conserved as a result of the Project, the Project is also consistent with the Antrim Open Space plan and local and regional conservation initiatives.

Grid-interconnection

Wind energy projects need to be sited in reasonable proximity to existing electrical infrastructure. In addition, the existing infrastructure needs to be technically capable of receiving the new generation. The Antrim site offers both attributes. It is directly adjacent to existing transmission infrastructure and will not require the development of any new transmission lines. ISO-NE's 2012 System Impact Study confirmed that interconnection of up to 33 MW of new generation at this site, with no network upgrades and no new transmission, would not negatively impact power system reliability and stability.

Accessibility

Wind energy projects need to be located within close proximity to existing transportation infrastructure and in the best cases are located near transportation routes. The Antrim site is located adjacent to State Route 9, which is a major thoroughfare. Proximity to such a roadway facilitates the transport and delivery of construction equipment and turbine components without requiring extensive upgrades of existing roadways.

Adequate setbacks from residences and recreational resources

Wind turbine generators should be sited to avoid potential public health and safety risks that may arise if turbines are located too close to residences, public buildings, or public recreational areas. The closest non-participating residence to a turbine in the Project is 2,800 feet and there are no public recreational facilities such as parks or playgrounds within 3,000 feet of the Project. The Project will not create sound levels above 40 dBA at the outside of any homes in the area and will be well below industry standard shadow flicker requirements.

Distance from roads

Wind turbines should be sited so as to maintain a reasonable distance from nearby roadways. The Project is sited with more than sufficient safety setbacks from nearby public roads and rights of way. The nearest public road to any turbine location is State Route 9 to the north, which is located more than 3,000 feet north of the northernmost turbine. The two private roads to the northwest are slightly closer than Route 9 but are still located more than 2,800 feet from the nearest turbine.

Compatibility with local, regional and state long-range planning goals

The siting of wind energy facilities should strive for compatibility with previously defined planning goals at a variety of scales. Criteria for determining compatibility should focus on energy and land use priorities within both state and local frameworks.

The Antrim Master Plan, updated as recently as 2010, speaks extensively and supportively of the need for renewable energy development. The Master Plan contains a 15-page section addressing climate change, energy efficiency and renewable energy and calls for the Planning Board and planning department to encourage renewable energy uses (see Appendix 15). The Project clearly meets these objectives. In addition, the Project will support many of the Southwest Regional Planning Commission's stated goals. The Commission identifies "current lack of local, renewable energy alternatives" to conventional energy sources a substantial risk to future growth in the region (see Appendix 16). Finally, New Hampshire state planning and zoning laws require that planning regulations and zoning ordinances encourage the installation and use of renewable forms of energy such as wind projects (see RSA 672:1, III-a and RSA 674:17,I(j)). The Project also contains a substantial land conservation package as an integral component of the Project, forever preserving 908 acres in total on and around the Project site and funding $100,000 for new permanent conservation off-site. This land conservation is compatible with other aspects of the Antrim Master Plan that state the importance of the preservation of open space.

Availability of privately owned lands

The development of wind energy projects typically requires the use of privately owned lands. In addition landowners must take an active interest in the development of their property for renewable energy purposes. AWE has a leasehold interest in approximately 1,870 acres of land leased from six individual landowners.

Cultural resources

Wind energy projects should be sited to avoid negative impacts to historic resources to the greatest extent possible. All Project components are sited in such a way that does not cause any adverse direct effects on Pre-contact or historical archaeological or architectural resources.

H.2.a. Alternatives analysis

In addition to the above-mentioned factors that influenced the initial selection of the Antrim Project site, AWE also considered several different site-specific design configurations in the course of developing the Project. These alternatives took into consideration the impacts of each design that might result from the construction of roadways to access ridgelines, installation of foundations, and erection of turbines and other site infrastructure on wetlands, tree clearing, wildlife, aesthetics and overall project efficiency for construction purposes. The specific methods and measures discussed below were used to minimize impacts to the greatest extent practicable.

On-site alternatives considered

On-site alternatives included a number of different potential turbine layouts, road configurations, electrical collector system designs, wind turbine types, and various locations for the O&M building, switchyard, and permanent meteorological tower location.

Alternative 1 – Larger project size

Prior to submitting an application for a Certificate of Site and Facility in 2012 AWE had considered a larger 11-turbine project. Specifically, this alternative was based on a layout similar to the final 2012 ten turbine array but with the addition of another turbine to the south, on the mid-slope flank of Willard Mountain. This alternative was evaluated in terms of wind resource suitability, engineering constraints, and anticipated impacts. This alternative was ultimately eliminated in favor of a more compact project footprint while maintaining a greater distance to the Willard Pond wildlife sanctuary. After considering the concerns identified by interveners and the Committee in the 2012-01 Docket, AWE then further reduced the Project size by eliminating WTG #10 from the Project and significantly reducing the height of WTG #9 to specifically address aesthetic concerns.

Alternative 2 – Different access routes

Prior to filing its 2012 SEC application, AWE carefully considered several different alternatives to the final design of the access road and crane path. The most significantly different route that was considered had the access road originating further to the west, along Route 9 at its junction with the private Russell Road. Under this scenario, the ridgeline access route continued to the south to gain elevation but with an overall alignment generally to the west of the final design. This alternative was ruled out due to legal issues around property ownership and unclear chain of title on one of the proposed parcels.

AWE also considered the possibility of developing Project access from the south. This would have involved the use and improvement of local Town roads. It would have required the transport of heavy machinery closer to residential areas and Town recreational resources such as Gregg Lake. Based on these additional impacts, AWE eliminated the southern access alternative from further consideration.

AWE also considered a variety of access variations that were substantially similar to the final design. All of the potential alternative access alignments were ruled out in the favor of the final design, which offers the shortest acceptable route that minimizes impacts to wetlands resources as well as Project costs.

More recent updates to the Project, subsequent to the 2012-01 Docket and leading up to the filing of this Application reflect AWE's desire to maintain Project elements that the SEC found acceptable, and alter elements that were problematic.

Alternative 3 – Different turbine models

A number of wind turbine models were evaluated for efficiency, reliability, cost, transport specifications, construction requirements, spacing constraints, and overall site suitability within the site's various constraints. The consideration of alternate turbine models encompassed a range of manufacturers, rated capacities, tower heights, and rotor diameters. The Project evaluated turbine models manufactured by General Electric, Vestas, Acciona, Nordex, REpower, Alstom, Gamesa, and Siemens. AWE selected the Siemens turbines for a variety of reasons including energy yield, reliability, availability and suitability at the Antrim Project site.

Alternative 4 – Alternative plant layouts

Antrim Wind Energy has considered several alternatives to the final configuration of the plant facilities. As discussed above, several different road access options were considered. In addition, the Project evaluated over ten different turbine layouts, three different layouts for the locations of the electrical substation and maintenance building, and two different locations for the erection of the permanent meteorological tower. Of the three alternate locations considered for the siting of the substation and O&M building, the final locations were selected in the interest of minimizing wetland impacts and maximizing construction efficiency. Finally, of the two different alternatives for the location of the permanent meteorological tower, the final location was selected because it minimizes interruption of the wind resource upwind of the turbine locations, and it requires no new road construction. AWE also considered the utilization of overhead collector system lines on the ridgeline, since the site is of a low enough elevation that major icing concerns are not expected to be a problem. Ultimately, however, underground roadside collector system lines were chosen in order to minimize visual impacts as well as to reduce the potential risk to avian and bats species that use the area.

H.3.A description in detail of the impact of each major part of the proposed facility on the environment for each site proposed

Antrim Wind Energy, LLC has sited and designed the proposed Project to avoid and minimize environmental impacts to the greatest extent feasible. AWE has addressed construction and operation impacts by various means.

Numerous environmental studies have been conducted to identify important natural resources, such as wetlands, vernal pools, rare plants and significant natural communities. Numerous wildlife studies have been conducted to identify potential impacts to specific wildlife populations. Studies on noise, aesthetic and historic resource impacts have been performed. Air and water quality impacts have also been assessed. The results of these studies have been applied during the design phase to avoid and minimize impacts wherever possible. Some of these studies will help to guide operations to minimize impacts over the life of the Project. Each of these studies and assessments, as well as discussion regarding impacts and avoidance, minimization and/or mitigation measures, are described in detail in Section I.4 of this Application.

In terms of the area that will be directly impacted by the Project, AWE has designed the Facility to avoid and minimize direct impacts to the greatest extent possible. Access has been designed to minimize environmental impacts to important resources: an example of this is routing the access road to avoid wetlands or vernal pools. Similarly turbine sites will require clearing and have been located to avoid direct wetland and vernal pool impact to the extent practical. Further information and specific details relevant to access impacts on natural resources are contained in the Joint USACE/NHDES Standard Dredge and Fill Permit Application and Alteration of Terrain Permit Application, as referenced in Section D.3 of this Application and provided in Appendix 2.

H.4.A description in detail of the applicant's proposals for studying and solving environmental problems;

As noted in Section H.3, AWE has engaged in extensive studies to assess potential environmental impacts that may occur as a result of the proposed Project. Studies were performed relevant to the following:

- natural communities and rare plants;
- historical and archaeological values;
- wetlands and vernal pools;
- breeding birds;
- nocturnal avian migration;
- diurnal raptor migration;
- bat populations and use;
- bald eagle nesting;
- aesthetics;
- noise;
- shadow flicker; and
- stormwater.

The results of these studies have been applied during the design phase to avoid and minimize impacts wherever possible. Each of these studies and assessments, including discussion regarding potential impacts and avoidance/mitigation strategies, are described in Section I of this Application.

In addition to the avoidance and minimization strategies employed and/or proposed to address potential environmental concerns created by the proposed facility, the Project will also result in environmental benefits in the form of permanent land conservation and displacement of energy from non-renewable sources.

AWE has successfully negotiated several local land conservation agreements that will permanently protect approximately 908 acres of land within and adjacent to the proposed Project. This voluntary initiative will conserve valuable undeveloped lands in perpetuity. Please see Appendix 10 for a comprehensive description of the mitigation and conservation package.

Finally, it is important to take into account that the proposed Project will displace the need for power generation from other sources, thus reducing the net environmental impact of energy production as a whole. It is well documented that wind power offsets other non-renewable energy sources thus avoiding significant amounts of harmful emissions, particularly CO2 emissions, but also other emissions such as SOx and NOx. For example the Eastern Wind Integration and Transmission Study ("EWITS") updated in 2011 concluded that "Wind generation displaces carbon-based fuels, directly reducing carbon dioxide (CO2) emission. Emissions continue to decline as more wind is added to the supply picture." In addition, the New England Wind Integration Study ("NEWIS") found that wind would "primarily reduce natural gas fired generation" and that in the scenario with wind generation producing 24% of the region's electric energy the result would be "wind and natural gas generation providing approximately the same amount of electric energy to the system" and "wind generation would almost fully displace generation from oil fired thermal steam units." A report released by Environment New Hampshire in 2013 found that in 2012 wind energy displaced 84.7 million metric tons of CO2 emissions in the US and also saved enough water to meet the domestic water needs of more than a million people. The Environment New Hampshire report finds that New Hampshire's wind energy is already avoiding more than 157,267 metric tons of climate-altering carbon pollution, the equivalent of taking 32,764 cars off the road, while it also saves 70,265,000 gallons of water per year, enough to meet the needs of 2,567 people (Schneider, et al. 2013). Other energy sources, such as fossil fuels, hydropower and nuclear power, are known to create significant environmental problems. The Project will help alleviate some of these problems by producing power that:

- Does not produce pollutants or greenhouse gases;
- Does not consume fresh water to create steam to drive turbines;
- Does not produce waste that requires disposal;
- Reduces reliance on non-renewable sources such as fossil fuels; and

- Eliminates the need for transporting fuels to the generation site, thereby further reducing fossil fuel consumption and pollutant production.

Many leading environmental and health advocacy groups support the appropriate development of wind energy. The Nature Conservancy states that "The Nature Conservancy expects wind energy to play an important role in reducing carbon emissions and protecting our planet from climate change, and supports public policies that encourage investment in renewable energy sources." (http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newyork/howwework/working-with-wind.xml) The National Audubon Society states that it "strongly supports properly sited wind power as a renewable energy source that helps reduce the threat posed to birds and people by climate change" and advocates that projects are "planned, sited, and operated in ways that minimize harm to birds and other wildlife." (http://www.audubon.org/content/audubons-position-wind-power).

H.5.A description in detail of the applicant's financial, technical and managerial capability to construct and operate the proposed facility

Antrim Wind Energy, LLC, through its member-owners, has a demonstrated track record of success in the electric power industry.

AWE Ownership Structure

Antrim Wind Energy LLC ("AWE") is a Delaware limited liability company formed to develop, build, own and operate the Antrim Wind Project. AWE has two members - Walden Green Energy Northeast Wind, LLC and Eolian Antrim LLC– which in turn are owned respectively by Walden Green Energy, LLC ("Walden") and Eolian Renewable Energy, LLC ("Eolian").

Walden was formed by its 3 founding principals – Henry Weitzner, George Manahilov and Sarah Valdovinos (the "Walden Founders"). RWE AG, through its wholly owned subsidiary RWE Supply & Trading ("RWEST") is the majority outside investor in Walden. RWE AG and RWEST are collectively referred to in this application as "RWE". RWE is one of Europe's top electric and gas companies and Germany's second largest utility. RWEST is a leading European energy trading house and the interface between RWE's operating companies and global wholesale markets for energy and energy-related raw materials.

Eolian, a Delaware limited liability company headquartered in Portsmouth, New Hampshire, was formed in 2009 to manage the development, construction, and operation of utility scale wind energy facilities in New England. Eolian is the original developer of the Project. Its four principals, along with consultants and contractors engaged by Eolian, are actively developing three wind energy projects in Maine, New Hampshire, and Pennsylvania. The founder and CEO of Eolian, Jack Kenworthy, previously founded Cape Systems, Ltd., a leader in renewable energy consulting and project development in the Bahamas. Eolian's co-founder and Vice President of Development, John Soininen is trained as a civil engineer and real estate developer with over 15 years of management experience in complex high value real estate development projects totaling over $100 million.

In February 2015, Eolian and Walden entered into a Limited Liability Company Agreement to advance the Antrim Wind Project through development, financing, construction and operation. Walden is a Delaware limited liability company based in New York, NY. Walden was founded in 2011 to develop, own and operate renewable energy projects globally. Walden's three founding principals have over 45 years of collective experience in commodities trading, project financing and energy capital markets, gained over their tenure at JP Morgan, Goldman Sachs and Barclays Capital. During their respective careers the Walden team has raised billions of dollars in debt, equity, and inventory monetizations, covering numerous commodity and energy related markets. Eolian and Walden have been working together since 2013 and are partnered on other projects in the region.

<u>Applicant's Financial Capability</u>

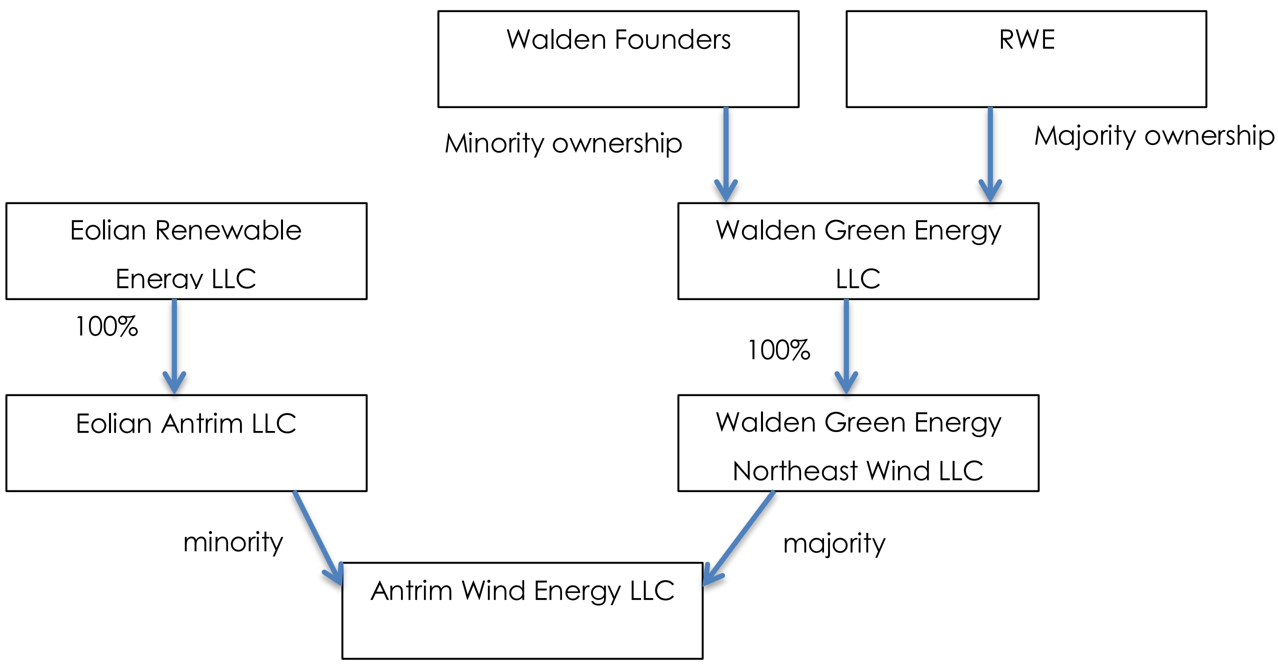
Corporate Structure

AWE, a Delaware limited liability company, was incorporated in 2009 to develop, construct, own and operate the Antrim Wind Project (the "Project"). AWE is jointly owned by: (i) Walden Green Energy Northeast Wind LLC, a Delaware limited liability company and a wholly owned subsidiary of Walden, a Delaware limited liability company, and (ii) Eolian Antrim LLC, a Delaware limited liability company and wholly owned subsidiary of Eolian, a Delaware limited liability company.

Walden is majority and controlling shareholder of AWE. Walden is jointly controlled by the Walden Founders and RWEST. RWE's Principal Investments team ("RWE PI") resides within RWEST and manages RWEST's investment in Walden.

Walden, Eolian, and RWE are referred to in this section as the Project sponsors (the "Sponsors" or "Project Sponsors")

Figure H.5.a – AWE Ownership Chart



Background of Antrim Wind Sponsors

Eolian Renewable Energy: Eolian is a Portsmouth, New Hampshire based renewable energy company founded in 2009 and is currently developing multiple renewable energy projects throughout the Eastern United States. Eolian's principals combine extensive experience in the field of renewable energy with a broad background in real estate construction management, application of GIS technology, and expertise in stakeholder outreach. Eolian began development on the Project in 2009 and has worked closely with the Town of Antrim and all major local, State and Federal agencies to design, site and permit an outstanding project for the State of New Hampshire.

Walden Green Energy: Walden is a privately held global developer, owner and operator of renewable energy projects. Walden has significant experience in the financing of energy projects, from large utility-scale projects to smaller-scale distributed generation projects. Walden has developed, financed, constructed and either currently operates, or sold upon completion, over 10 MW of renewable generation assets in Massachusetts and Vermont, and is currently developing over 200 MW of wind, solar and hydro generation assets, including the Project, in the United States, Latin America and Central Eastern Europe

The Walden management team has a combined 45 years of experience in structuring power purchase agreements ("PPAs") and hedging strategies for energy clients globally, and has successfully financed more than $5 billion of power generation and oil and gas energy infrastructure assets. The Walden Founders have worked together for many years at leading financial institutions including Barclays, Goldman Sachs and JP Morgan. Members of the Walden management team have structured, led and executed a number of prominent hedging, off-take and financing transactions for utilities, independent power generators, and energy producers, and is intimately familiar with the requirements for a successful financing of a wind project such as Antrim Wind. Some of the transactions led and executed by the Walden management team include:

- Customized Hedge Facility for oil and gas producer Chesapeake Energy (Energy Risk Magazine Deal of the Year 2010) – the facility enabled Chesapeake Energy to enter into natural gas and oil hedge contracts and provided the company more than $10 billion of mark-to-market-based hedging capacity, or approximately 400,000 contracts, representing nearly 4 years of the company`s anticipated production

- Thirty (30) year agreement with University of Massachusetts – the agreement supplied University of Massachusetts with net metering credits (equivalent to a PPA contract) from 2 solar projects in Massachusetts and was awarded in a competitive RFP process

- LNG off-take and services agreement to manage supply of natural gas for Excelerate's Northeast Gateway Deep Water port – the agreement provided Excelerate with transportation services and asset management, allowing the company to optimize pricing for natural gas buyers and marketers in the US Northeast

- Financing for Chesapeake Energy – the transaction monetized $1.15 billion of producing wells in the Barnett Shale for Chesapeake Energy via a five-year structured financing called volumetric production payment

RWE: AWE will benefit from RWE's extensive track record in developing, financing and successfully bringing wind projects into operation. Founded in 1898 in Essen, Germany, RWE has a market capitalization of $12.9 billion, assets of $104.4 billion (as of December 31, 2014), and 2014 operating revenues of $63.3 billion. RWE and its affiliates have 49,064 MW of electric generation capacity throughout Europe, and have developed, financed, constructed and operate 3,112 MW of renewable generation assets, including 2,530 MW of onshore and offshore wind assets.

RWE PI resides within RWEST and manages the investment in Walden. RWE PI invests RWE's capital by providing equity to energy companies and investing in energy assets, with its geographical focus spanning North America, Latin America, Western/Eastern Europe and Asia. RWE PI focuses on investments where RWE has deep knowledge of the underlying commodity and where it brings physical trading capabilities to manage commodity risk for the investment. In 2014 RWE invested $4.2 billion in property, plant and equipment, of which $929 million was allocated to renewable assets.

Illustrative range of relevant transactions for RWE include:

- Investment in Conergy, a global solar company - Conergy is one of the world's largest downstream solar companies, specializing in the design, finance, build and operation of high performance solar systems. RWE invested in the company as part of a larger equity funding round led by Kawa Capital Management and owns a minority stake in Conergy

- Investment in a UK solar facility "Kencot Hill Solar Farm" - RWE acquired the 37 MW ground-mounted solar PV project, which will be one of the largest in the UK and is located on a disused airfield in Oxfordshire. RWE provided essential financial capital and technical support to enable the project's commercial operation

- 100% acquisition and full biomass conversion of a 400MW coal-fired power station in the North-East of England. The project received support from the UK government in the form of Contract for Difference, and will operate until 2027 to supply around 2.3 TWh of electricity per year.

In its investments RWE PI leverages RWE's broader organizational engineering, operations and power market expertise as well as its track record of successfully managing its large power generation portfolio. RWE PI is run by Eric Shaw, brief background provided below:

- Global Head, Principal Investments, RWE Supply & Trading – July 2009 to present

- Citigroup, Head of Commodity Principal Strategies – 2007 - 2009

- Barclays Capital, Director in Commodities – 2002 – 2006

- Enron Europe, Head, Continental European Origination – 1994 - 2002

Project Financing Plan

To fund the construction of the Project the Sponsors will use a traditional project finance approach, which is currently the market standard in the United States' wind industry. Project financing will be accomplished in two phases:

1) Construction Financing Phase: This consists of a combination of a construction loan and construction equity to complete the turnkey construction process, and;

2) Permanent Financing Phase: Upon placing the Project in operation, the construction loan will convert to a "term loan".

The funding strategy outlined above and more fully described below is the most commonly used structure for funding wind projects in the United States with over 60 billion of financings completed in the past 5 years. As the majority owner and controlling shareholder of the Project, Walden, with the backing of RWE, will provide the equity to construct and operate the Project.

In explaining the funding structure the following definitions will be used:

- *Net Capacity Factor ("NCF")* -- a standard industry term that represents the ratio of the amount of actual annual generation, divided by the maximum amount of annual generation if the project were generating at 100% of its rated nameplate capacity all of the time. NCF for the Antrim Project is approximately 37%. Expected annual energy production ("AEP") of the Project is calculated by multiplying the total plant capacity, the number of hours in the year and the net capacity factor. [Plant Capacity (MW) * 8,760 (hours) * NCF (%) = Total Production (MWh): 28.8MW * 8,760hours * 37% = 93,346.56 MWh]

- *"P50 production"* -- shorthand for 50^{th} percentile, in wind finance refers to the level of AEP, usually expressed in terms of NCF, for a wind project that is forecasted to be exceeded 50% of the time. The P50 production for Antrim is approximately 93,347 MWh per annum, equivalent to a 37.0% NCF. Because P50 production is forecasted to be exceeded 50% of the time, it is a lender's base case scenario, typically used to "size" the appropriate debt quantum for a project.

- *"P99 production"* -- shorthand for 99^{th} percentile, in wind finance refers to the level of AEP, usually expressed in terms of NCF, for a wind project that is forecasted to be exceeded 99% of the time. The P99 production for Antrim is approximately 72,406 MWh per annum, equivalent to a 28.7% NCF. P99 production output is forecasted to be exceeded 99% of the time; therefore it is a lender's very conservative scenario

- *Debt Service Coverage Ratio ("DSCR")* – In corporate finance, it is the ratio of the amount of cash flow available to meet annual interest and principal payments on a loan (i.e. the available project cash flow after all project operating expenses and taxes are paid) and the actual amount of those loan payments.

- *Non-recourse project debt / loan* – in corporate finance, a non-recourse loan is a loan that is secured by a pledge of collateral, typically real property, but for which the borrower is not personally liable. If the borrower defaults, the lender can seize the collateral to seek repayment of its obligations, but the lender's recovery is limited to the collateral. In a wind project, collateral will include all project assets, including the turbines, equipment and buildings, leases, PPAs, and service agreements.

Construction Financing:

As noted above, construction financing will consist of a construction loan and construction equity. Details of the sources of each component of the financing are below:

Construction Equity: Walden, through the backing of RWE, will provide 100% of the construction equity necessary to construct the Project. Subject to the issuance of a Certificate, the completion of all necessary commercial agreements for the Project, and securing the construction loan financing for the Project, RWE will provide the construction equity funding to Walden, which in turn will invest the equity into AWE through Walden's wholly owned subsidiary Walden Green Energy Northeast Wind LLC.

Construction Loan: As a prerequisite for providing a final funding commitment for a non-recourse construction loan to a wind project, lending banks typically require that several "conditions precedent" are met. Below is a list and discussion of the specific commercial requirements AWE will be required to provide its lender(s) in order to close on a construction loan:

a. Final permits for placing the project in operation have been granted. In the case of the Antrim Project, a Certificate of Site and Facility will be required by lenders.

b. Long-term offtake contract - a long-term PPA or a financial hedge with a creditworthy counterparty to guarantee long-term cash flow from electricity sales. Lenders will require that AWE has a negotiated long-term PPA, typically with an investment grade rated counterparty (S&P rating above BBB-/Moody's rating above Baa3). The Project has numerous opportunities for securing a long-term offtake contract: i) over the past year several New England utilities, including National Grid, Northeast Utilities and Unitil, have awarded renewable energy long-term contracts through competitive RFP processes to wind projects in Maine and New Hampshire to be constructed over 2-3 years, where winning bid prices were approximately $80/MWh[1]. Based on the recent RFP results and bilateral discussions with interested counterparties in the New England market, AWE is confident that the Project is very competitive and will secure an adequate long-term PPA contract to support a successful

[1] (Source: North American Wind Power magazine http://www.nawindpower.com/e107_plugins/content/content.php?content.12664

project financing. ii) AWE has received a letter of interest from Altenex (see Appendix 18A), a leading energy management firm that Fortune 500 companies used to source clean energy for their power portfolios with clients such as GM, Dow and Microsoft. Working with Altenex represents one well-defined opportunity to secure long-term off take for the project from a credit-worthy counterparty. iii) Walden's management team has extensive experience originating, marketing and negotiating financial hedges in various commodity markets. The Project is well suited to support a long-term financial hedge for both energy and RECs and Walden is currently pursuing those opportunities.

c. Acceptable Turbine Supply Agreement ("TSA"). AWE has entered into a Binding MOU for a TSA with Siemens. The TSA will be executed after a Certificate has been issued and prior to closing on construction financing.

d. Acceptable Balance of Plant ("BOP") Contract. AWE has selected Reed and Reed as its BOP contractor and has entered into a Preconstruction Services Agreement ("PSA") with them. The PSA will be replaced by a BOP contract after a final Certificate is issued and prior to closing on construction financing.

e. Acceptable O&M agreements for ongoing maintenance of the Project. AWE has negotiated a Binding MOU for a SMA with Siemens to provide service and maintenance for the turbines. The SMA will be executed after issuance of a Certificate and prior to closing on construction financing.

Project lenders seek to comply with market standard underwriting criteria when determining the optimal amount of debt for a wind project. Such criteria are based on four key financial parameters:

a. Maximum debt tenor. Typically a project finance lender limits its debt tenor to approximately 16-18 years. Since the Project loan is "non-recourse" to the owners of the project, this requires that the cash flow generated solely by the Project is sufficient to repay the principal and interest on the loan within the final debt term.

b. Minimum amount of equity as a percentage of total project cost. The Project will cost approximately $63-65 million to construct. Based on project lenders' current market standard requirements the Project Sponsors will be required to invest a minimum of 20% of common equity in the Project. However, this amount is not determined on an absolute basis, but is evaluated as part of the key financial tests listed above. For example, if the Project debt amount is initially set at 80% of Project costs, but after performing the test of maximum debt tenor for repayment, (described above), and the DSCR tests, (described below), it is determined that the debt quantum is too high, then the Project Sponsors may be required to invest more than the minimum 20% equity threshold.

c. DSCR P50 test. In wind finance project lenders seek an annual financial test to be met, whereby the project can meet a DSCR P50 ratio of 1.45x. This means that the cash flow generated by the project, net of project operating expenses, is equal to 1.45 times the sum of principal and interest payments under the non-recourse loan during each year of the loan term.

d. DSCR P99 test. In wind finance project lenders seek an annual financial test to be met, whereby the project can meet a DSCR P99 ratio of 1.0x. This means that the cash flow generated by the project, net of project operating expenses, is equal to 1.0 times the sum of principal and interest payments under the non-recourse loan during each year of the loan term. This is a conservative lenders case and means that 99 years out of 100, the project will be able to pay all operating costs and service the loan.

AWE's financing plan for the Project has been formulated to comply with the above described market standards. Based on a reasonable assumption of obtaining a long-term PPA at current market rates, a construction cost of approximately $63-65 million, and the above financial ratios required by lenders, the Project's construction will be funded with a $38-45 million construction loan converting to a term loan upon COD, and $20-25 million of equity. The variance in the ranges for debt and equity amounts are driven by a conservation assumption on the range of final PPA prices and PPA contract tenors AWE has seen in the market.

Binding commitments for construction debt financing are typically not obtained until after permitting is completed and all final permit conditions and costs are factored into final loan documentation. However, due to the strength of the Project, the strong experience of the Project's Sponsors and the backing of RWE, AWE has obtained Letters of Intent ("LOIs") from two separate commercial banks with considerable experience in lending to utility scale wind projects that are interested in providing the debt financing package for the Project. The LOIs are included with this Application in Appendix 18B and 18C.

Walden is making the conservative assumption that there will be no Production Tax Credit ("PTC") available at the time of starting the Project's construction. In the event that the PTC is renewed and available to the Project, AWE will adjust the structure to include a tax equity provider into the Project. If utilized, the tax equity provider will act in a similar manner as project debt, which has been a very standard funding structure for U.S. wind projects that can utilize the PTC.

To provide the Committee with additional assurance that AWE has the financial capability to construct and operate the Project, AWE will agree to a condition that it provide evidence to the Committee that the debt and equity financing required for the construction of the Project is in place prior to commencement of construction.

Permanent Financing:

Upon the completion of the construction for the Project and AWE's acceptance of the turnkey facility from Reed & Reed and Siemens, the construction loan will convert into a term loan. Prior to the conversion, both the construction debt and equity will have been deployed in full to bring the Project to commercial operation, hence no additional funding will be required for the operation of the Project. The relevant financial tests that govern the repayment of the term loan post COD will be the DSCR tests described earlier: (i) DSCR test of the Project's ability to maintain sufficient contracted cash flow net of all project expenses to service principal and interest on the term loan at a multiple of 1.45x in the P50 wind production case, and (ii) DSCR test of the Project's ability to maintain sufficient contracted cash flow net of all project expenses to service principal and interest on the term loan at a multiple of 1.0x in the P99 wind production case.

As noted above, AWE has received documented interest from several large commercial banks experienced in providing construction financing to wind projects in the US and will seek the most competitive terms. AWE's agreement to provide evidence that financing is in place prior to commencement of construction specifically addresses this requirement for the issuance of a Certificate. The strong economics of the Project, the backing of RWE in providing the equity to construct the Project, and the clear framework of service and maintenance agreements put in place, all ensure that once construction financing is closed, the Project will generate sufficiently strong cash flow to ensure its continued operation in compliance with all conditions contained in the Certificate and industry best practices.

Applicant's Technical and Managerial Capability

AWE will be responsible for the overall management of the Project, including the execution and administration of all commercial agreements necessary to ensure that the Project is constructed and operated in conformance with accepted industry practices and the Certificate of Site and Facility. As the owner of the controlling interest in AWE, Walden will be ultimately responsible for the management of all contractors engaged to construct and operate this facility. AWE is committed to constructing and operating the Project to achieve the highest standards for safety, reliability and performance. To ensure such standards for safety, reliability and performance, as well as compliance with all regulatory requirements applicable to the Project, AWE has engaged DNV-GL as its Owner's Engineer. DNV-GL has been recognized as the world's leading technical authority on Windpower generation for three decades and will advise AWE in its capacity as Owner's Engineer on finalization of all BOP construction, turbine supply and service and maintenance agreements. See Appendix 19C for a more complete description of DNV-GL's relevant experience. In additional to utilizing DNV-GL's substantial resources to ensure a smooth transition from start of construction through long term operations, AWE will also rely on several well-established and highly experienced firms to perform the construction and operation of the facility. AWE has selected vendors for the Project that are the most qualified firms available, including Reed & Reed Inc., and Siemens Energy, Inc., described more fully below.

AWE has selected Reed and Reed as its BOP contractor and has entered into a Preconstruction Services Agreement ("PSA") with them. Additional information on Reed and Reed's qualifications is detailed in Sections E.5.b and H.5 as well as Appendix 19A. The PSA will be replaced by a BOP contract and the PSA stipulates that "Any BOP Contract that is negotiated between the Parties will be a fully-wrapped lump sum agreement (based on fully transparent cost plus pricing) under which Contractor will provide all post permit electrical design (Civil Design by Owner), related procurement, technical and construction services required to complete and, working in a coordinated manner with Siemens, turn over a fully commissioned and operational project within designated cost, schedule, quality and safety requirements, including (a) purchase of all materials and placement of construction contracts; (b) completion of a detailed scope of work; and (c) the provision and management of all construction labor and construction equipment." AWE will rely on its contractual arrangement with Reed & Reed to construct, commission and deliver to AWE the fully operational Project. Reed & Reed's extensive qualifications in this regard, which includes experience installing Siemens turbines, are further detailed in Appendix 19A.

In addition to the PSA signed by AWE and Reed & Reed, AWE has selected Siemens Energy, Inc. as its turbine supplier and service and maintenance provider and has entered into a binding memorandum of understanding ("MOU") with Siemens. Additional information on Siemens is detailed in Sections E.5.b and H.1 as well as Appendix 19B. The Siemens MOU provides Siemens with the exclusive right to negotiate a Turbine Supply Agreement ("TSA") and Service and Maintenance Agreement ("SMA") with respect to the Project. The TSA will govern Siemens' responsibilities to manufacture and deliver the turbine components to the Project site where they will be installed by Reed & Reed with technical assistance from Siemens as necessary. Siemens will also be responsible for turbine commissioning. The TSA will also contain warranty and performance guarantee provisions covering the Siemens Turbines. The SMA with Siemens will cover all planned and unplanned service requirements on the Turbines during the term of the contract. AWE and Siemens will negotiate the final TSA and SMA, including the term of the SMA, after permitting for the Project is completed. AWE expects to enter into an SMA with Siemens for a period of between two and five years. This term may be extended upon the expiration of the initial SMA term, or AWE may then contract with a qualified third party service provider such as UpWind Solutions or EDF Renewable Services to take over this scope. The scope of services under the SMA will be finalized in the negotiations, but will include, at a minimum:

- A dedicated Siemens maintenance team. This team will consist of 2-3 individuals (2 will always be on-site during normal hours and a third will be present for any activities requiring three technicians on site for safety reasons)
- Performance of scheduled maintenance of the WTGs (unscheduled maintenance will be provided as part of the Siemens warranty under the TSA)
- Parts/consumables supply and inventory management
- Provision, maintenance and calibration of tools required for WTG maintenance
- Provision and maintenance of all safety equipment required for WTG servicing

- 24 x 7 Remote monitoring of the Supervisory Control and Data Acquisition ("SCADA") system and alerting AWE of any issues
- Retrieval and backup of SCADA data
- Monitoring and analysis of the Turbine Condition Monitoring ("TCM") data to predict and mitigate potential malfunctions
- Implementation of relevant changes to TCM and SCADA software as necessary
- Initiating appropriate response to the events, warnings and alerts monitored
- Maintaining turbine specific logs detailing all Siemens work, repairs and visits
- Submitting monthly reports
- Notifications to AWE of all unusual events and malfunctions
- Report any incident involving Siemens personnel
- Monitoring and reporting on WTG availability in relation to the TSA guarantee

Additional terms of the SMA will reflect Siemens standard industry practices to ensure that the facility is operated safely, in a manner consistent with the terms of the interconnection and Off-Take Agreements, and that turbines are maintained in accordance with the manufacturer's specifications.

Together with DNV-GL, AWE will ensure that all necessary Balance of Plant O&M ("BOP O&M") and Asset Management services are in place for the Project. These services include all operations and maintenance required on the site that is not covered by the Siemens SMA, including:

- managing scheduled maintenance of the above and below ground electrical collector system through licensed electrical contractors
- managing maintenance of the Project substation, including switchgear, main transformer, breakers, switches and relays
- performing inspections and maintenance of pad mount transformers
- emergency response management in coordination with Siemens and local emergency response services
- parts supply and inventory management
- fiber/ethernet network maintenance
- daily turbine monitoring and fault analysis
- road maintenance (including snow removal) and repair
- general building maintenance and repair
- vegetation removal, waste disposal and general site upkeep
- maintaining site security and ensuring safety
- managing public access to the site
- conducting visual inspections of the MET tower and radar equipment and coordinating any necessary repairs
- reporting to AWE on plant production, inventories, breakdowns, maintenance performed, turbine availability, and accidents
- managing and ensuring compliance with all post construction environmental monitoring and reporting requirements
- ensuring compliance with the SEC Certificate

- ensuring compliance with applicable requirements under Federal Energy Regulatory Commission ("FERC"), North American Electric Reliability Council ("NERC") and ISO-New England regulations
- ensuring compliance with the Town of Antrim Agreement
- managing day to day relations with the Town and Antrim and State of New Hampshire
- managing landowner relations
- administrative activities

Working together with DNV-GL, AWE will hire a qualified team of 2 full time staff who, along with qualified subcontractors, will perform the duties listed above. These AWE personnel will staff the Project site during all normal business hours and will be on call 24/7 to deal with any emergencies that may arise. General qualifications in the following areas will be required for these positions: site safety and regulatory compliance experience; general wind facility operations and maintenance experience; construction monitoring experience; turbine technical knowledge; reliability and performance experience; balance of plant maintenance experience including roads and related items; electrical system experience; experience managing technical subcontractors; and ability to coordinate with a range of parties including landowners, local and regional regulatory entities. There is ample availability of qualified workers that AWE will be able to draw upon to fill these two positions and AWE plans to fill both site staff positions prior to commencement of construction activities. DNV-GL will assist AWE in developing complete job descriptions for these positions, soliciting applications from qualified personnel, reviewing applications and conducting interviews, making final hiring decisions and integrating new hires into the Project team.

In total, AWE expects an on-site staff of 4-5 personnel, including 2 AWE staff and 2-3 Siemens technicians. Additional personnel may be on site when necessary to perform specialized services such as electrical workers to perform substation or collector system maintenance, local contractors providing routine building maintenance, road plowing/repair or vegetation clearing jobs.

Both Siemens and AWE site personnel, through their contractual arrangements with AWE, will possess the authority to take any actions that are required to ensure Project operations are carried out in a manner consistent with all regulatory requirements, industry best practices and to ensure the safety, reliability and performance of the facility at all times.

As the Project Owner, AWE will maintain oversight of all contractors on the site to ensure all contractual obligations are being met in a manner satisfactory to AWE and its lenders and that the Project is operated and maintained in compliance with all applicable regulatory requirements and conditions contained in a Certificate.

H.6.A statement of assets and liabilities of the applicant; and

A statement of the Applicant's assets and liabilities is provided in Appendix 1 of this Application. As more fully described in Section H.5 of this Application, AWE is not relying on its balance sheet to demonstrate its financial capability to construct and operate this Project.

H.7.Documentation that written notification of the proposed Project, including appropriate copies of the application, has been given to the governing body of each community in which the facility is proposed to be located.

The Town of Antrim Board of Selectmen will be provided with a copy of this application at the time it is filed with the Site Evaluation Committee. The Applicant will file a copy of the return receipt or other documentation of receipt by the Town with the SEC and has reserved Appendix 8 for this purpose.

I. POTENTIAL HEALTH AND ENVIRONMENTAL EFFECTS AND MITIGATION PLANS

I.1. Aesthetics

Antrim Wind Renewable Energy engaged LandWorks to perform a Visual Assessment ("VA") for the Project. A copy of the completed VA can be found at Appendix 9A.

For the purpose of this VA the geographic scope, or study area, has been delineated as a typical 10-mile radius from each of the wind turbines, which contains 353.2 square miles and 20 towns. From a visual perspective, the vegetated landscape provides an almost continuously wooded environment and backdrop, as there are few cleared or agricultural areas in this region, and an almost continuous drape of homogenous textural character. The predominant topographic landscape within the study area is generally 400'-2500' in elevation with similar rounded hills and summits interspersed with river valleys, streams, wetlands and several lakes. Overall, this area has a denser network of state and federal routes compared to areas further north in New Hampshire, and also a greater overall development density--more settled towns and developed areas within it. Due to the rolling and sometimes rocky terrain, development typically follows the river valleys, highway corridors and lakeshores. Antrim and the surrounding area is not a "big sky" landscape, such as portions of the Mount Washington Valley or the Champlain Valley in Vermont, where long distant and panoramic views of prominent features are visible from wide-open roadsides and numerous vantage points. Rather, it is a "small sky" environment where the roadscapes are dominated by mature forests, the topography closes in and limits views, and rolling hillsides and mountains are indistinguishable from one another.

The multi-step methodology presented in the VA is an amalgamation of a number of established processes, as well as LandWorks' decades of professional experience in this industry, and provides an objective, comprehensive analysis. It is a thorough approach that helps to determine: 1) scenic resources within the 10-mile study area, 2) the sensitivity of a scenic resource, 3) the visual change the project may have to that sensitive resource, 4) the effect the visibility may have on the reasonable person, and 5) an overall conclusion on whether the project has an unreasonable adverse effect on aesthetics given the visual change.

Only national, state, and local recreational and scenic resources that are readily accessible to the public are reviewed in this analysis. Scenic resources were identified on a town-by-town basis through a consistent and systematic process including but not limited to review of available GIS data, published maps and guidebooks, online research, and town and regional plans. The 10-mile study area is located at the edge of the Monadnock tourism region, and is not a primary hub for key destinations or visitor activity. The scenic resources in the study area are primarily known or visited by local residents, and do not appear to be a consistent draw for visitors from afar. The comprehensive inventory of scenic resources found no National Parks, no National Natural Landmarks, no National Wild and Scenic Rivers, no National Scenic Trails or other highly revered scenic resources within the 10-mile study area, and no other resource of

National designation has visibility of the Project. Of the 290 identified scenic resources, only 30 (10% of all resources) have the potential for visibility, and only 10 of those are considered sensitive (3% of all resources). None of these 10 resources are of State scenic significance (i.e. designated primarily for their scenic value, such as a State Scenic Byway or a State Park). Moreover, within the entire 353.2 square mile study area, only 8.8 square miles or 2.5% of the area has potential visibility of the Project.[2] Primary Project visibility from scenic resources is limited to several local ponds and lakes and a few local and regional summits. Of the 55 public lakes and ponds identified within the 10-mile study area (there are several more without delineated access areas), only 7 have potential visibility of the Project, and only 1 is considered sensitive. The better-known and more frequently visited lakes such as Highland Lake, Halfmoon Pond, Deering Reservoir, Silver Lake or Dublin Pond have no visibility of the Project. Additionally, the average viewing distance of all 290 resources with potential visibility will be 5 or more miles, and 6 or more miles for the 10 sensitive resources. The National Forest's Handbook on Scenery Management, which is based on years of research and work in the National Forest, sets forth the use of distance zones for scenic classification and analysis, and indicates that with increased distance the "concern" level for visual effect or impacts to overall scenic integrity lessens. The handbook has identified the background zone as areas greater than 4 miles distant and that elements in this zone have less effect on the viewer.[3]

The **visual sensitivity** of the 30 identified scenic resources with potential visibility is determined by evaluating each resources 1) *cultural designation* - how a resource has been valued by the public through official designation, and 2) *scenic quality* - the character and features of a resource that make it scenic. For *cultural designation*, each resource is given a rating of low, moderate or high based on the local, regional, statewide or national cultural significance of a particular resource, often indicated by formal designation, ownership or inclusion in a current or recent community (or official) planning document that recognizes its cultural, natural resource, recreational, or scenic value. A *scenic quality* rating of low, moderate or high is also given to each resource by using the Bureau of Land Management (BLM) Scenic Inventory and Evaluation Chart, which considers seven criteria - landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. The two ratings (cultural designation and scenic quality) are then combined to obtain an overall sensitivity rating. Those resources with an overall rating of 'Moderate-High' or 'High' continue to the next step in the screening process. Of the 30 scenic resources identified as having potential visibility, 10 have a rating of 'Moderate-High' and therefore move forward to the next step of the assessment process.

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[2] Based on viewshed mapping from the hub and accounting for topography and 40 foot vegetation

[3] Landscape Aesthetics: A Handbook for Scenery Management. Rep. USDA Forest Service - Agriculture Handbook Number 701, 1995. Print. (pg. 4-5, 4-11)

The next step determines the **visual effect** the Project may have on the 10 sensitive scenic resources. Visual effect is determined by giving each sensitive resource a rating of low, moderate or high for each of the following categories:

1. *Number of turbines visible* – how many turbine hubs are visible from a given resource
2. *Percent of visibility* – what percent of the resource has visibility of turbine hubs
3. *Proximity or distance* – how close/distant is the nearest visible hub
4. *Angle of view* – how much of the total possible field of view the project occupies
5. *Visual dominance* – what is the scale of the Project in relation to the vantage point and the project surroundings
6. *Visual clutter/landscape coherence* – how discordant/balanced the turbine array appears in the landscape

The six ratings for each resource are then combined to determine the overall visual effect the Project may have on the resource. Those resources with an overall rating of 'Moderate-High' or 'High' continue to the next step in the screening process. Of the 10 sensitive scenic resources, only 1 resource, Willard Pond, has a rating of 'Moderate-High' and therefore moves forward to the next step of the assessment process.

The next stage in the assessment process incorporates and weighs a range of possible factors to determine how a reasonable person may be affected by the visibility of the Project, including:

1. *Activity* – the primary type of activity users are engaged in at the resource
2. *Extent of use* – the amount of use the resource receives
3. *Duration of view* – the extent or exposure to the Project
4. *Remoteness* – the absence of development or primitive character or experience of the resource

The four ratings are then combined to determine the project's overall **viewer effect**. For a rating of 'Low' to 'Moderate,' the effect upon the reasonable person is not considered significant; a 'Moderate-High' to 'High' rating may result in a significant effect upon the reasonable person. The overall viewer effect rating for Willard Pond is 'Moderate.'

The final piece of the assessment provides an overall summary and professional opinion as to whether the Project, as proposed, will have an unreasonable, adverse effect on aesthetics. In addition to the results of the foregoing evaluation, LandWorks considers a number of other relevant factors, including:

- The Project Site and Characteristics - The 9-turbine Project is reasonably scaled and located at an ideal site given a number of factors: existing topography and vegetation in the area limits overall visibility of the Project, both day and night; close proximity to Route 9 and an existing transmission corridor; no nearby residential neighborhoods directly in view of the Project; availability of the natural resource present – wind; and, full support of the local leadership of Antrim.

- The Regional Landscape - The topography of the area, mature deciduous and coniferous vegetation, coupled with the alignment of roads and trails greatly diminish the visibility and overall presence in the landscape of the Project. Antrim and the surrounding area is not a "big sky" landscape and do not offer sweeping views of prominent features from wide-open vantage points. There is not an expectation for panoramic views or unique and one-of-a-kind vistas in this area as compared to other areas of New Hampshire. In LandWorks' professional opinion, it is highly unlikely a reasonable person would be shocked or surprised to see a wind energy project in this type of landscape, particularly since wind projects are already present in the region.

- Night Lighting – The effect of night lighting will be limited for several reasons: only 6 lights will potentially be visible within a relatively narrow portion of the horizon; not all lights will be visible from any one of the sensitive resources and will be further mitigated by their viewing distance, which is generally in the background view; visibility will be reduced due to limited vertical beam spread - lights will not create glare or untoward light to the naked eye; and, exposure to users is very limited – very few people hike, paddle or fish at night.

- Local Conditions - Detailed analyses and several site visits to all resources with potential visibility (30 total) confirm that most of these destinations have limited views or use, typically serve local users, and are primarily of local import. These local users are likely to be aware of the Project and may not be deterred by the Project visibility in making their recreational choices. The introduction of wind turbines in this landscape will not undermine the quality of the resources or the viewer experience. Furthermore, there is no Project visibility from most roads and the Village of Antrim, as well as other surrounding village or town centers such as Hillsborough, Deering, Windsor, Hancock or Nelson, where human activity is predominant.

- Efficacy of Mitigation – Taken together, a number of mitigation measures are proposed that represent a substantial effort to reduce the overall visual effect of the Project, including: the selection of a site that requires limited clearing and no new transmission facilities; the use of underground collector lines along the ridges; post-construction re-vegetation of all disturbed areas that do not have long term facilities located on them; reducing the number of turbines from 10 to 9, significantly reducing the visual impact to Willard Pond; reducing the height of turbine #9 and thereby eliminating it as a prominent feature when viewed from Willard Pond; the commitment to use a radar activated lighting system; the set aside of significant permanent conservation lands and habitats; and the commitment to help the Town of Antrim enhance recreational facilities at Gregg

Lake. For a complete description of all mitigation plans included in this Project, please refer to Appendix 10.

From a visual assessment perspective, this is an excellent site for a wind energy project. The visual effects are extraordinarily limited given the number of resources in the Project area, and the lack of resources of State or National scenic significance. There will be limited views of the Project on an everyday basis when one considers roads, villages, lakes, ponds and the topography and extensively wooded nature of the area. The regional vantage points that typically have views of the proposed Project are experienced within a much broader context and quite distant from the Project itself, therefore diminishing any potential objectionable visual effects as well. Finally, there will be a limited effect on local resources, including the fact that the use of Willard Pond and its environs will not be substantially diminished if this Project is constructed. In light of the comprehensive analysis described in the VA, the Project as now proposed will not have an unreasonable adverse effect on the aesthetics of the region.

To ensure that AWE has adequately addressed concerns identified in the 2012-01 Docket with respect to aesthetic impacts, in addition to the reconfiguration of the Project by removing Turbine 10, lowering Turbines 1-8 and significantly lowering Turbine 9, AWE has also substantially increased mitigation for any remaining scenic impacts. Since the Committee's decision in the 2012-01 Docket, AWE has included the following additional mitigation measures:

1. AWE has entered into a binding letter agreement with the Town of Antrim concerning aesthetic impacts to the Gregg Lake Beach area. AWE has committed to make a one-time payment of $40,000.00 to enhance the recreational and aesthetic experience at this location, which the Town has agreed is full and acceptable compensation for any perceived visual impacts to the Gregg Lake area.
2. Initially, AWE contracted to put 685 acres of land under permanent conservation through binding letters of intent with four private landowners and the Harris Center for Conservation Education ("HCCE"). In December 2012 AWE added another 123 acres on top of Willard Mountain. And finally AWE has entered into another binding letter of intent for an additional 100 acres of land on the ridgeline surrounding turbines 3, 4, 5 & 6. With this additional 100 acres the total onsite conservation package consists of 908 acres of contiguous land, including 100% of the Project ridgeline, which will be permanently conserved.
3. In addition to the "on-site" conservation lands, AWE has entered into a Land Conservation Funding Agreement with the New England Forestry Foundation ("NEFF"), whereby AWE will fund $100,000.00 to NEFF to acquire additional conservation lands in the region for the enhancement and maintenance of the region's aesthetic character, wildlife habitat, working landscape, and public use and enjoyment.

These additional mitigation measures for aesthetic impacts are on top of AWE's commitment in its 2012 Settlement Agreement with the Appalachian Mountain Club ("AMC") to utilize radar activated FAA obstruction lighting once approved by the FAA, which will virtually eliminate night time FAA lighting impacts associated with the Project, and AWE's careful design of the Project site and commitments to re-vegetate the site after construction is completed. Please see Appendix 10 for a comprehensive description of the mitigation and conservation package.

I.2. Historic sites

The Project will not adversely impact any known archaeological sites. AWE contracted a Phase I review for both pre-contact period and historic period archaeological resources. A Phase IA study was conducted by archaeologists after consultation with New Hampshire Division of Historical Resources ("NHDHR") and the U.S. Army Corps of Engineers ("USACE") (in May and July of 2011). The Phase IA study revealed no documented evidence of archaeological sites within the Project area or any environmental or cultural variables that would suggest the presence of archaeological sites within a 10 km radius of the Project area.

During November 23-26, 2011, a Phase IB archaeological walkover survey of the Project Area of Potential Effect ("APE") was performed. While some stone walls in the lower elevations on the northern side of Tuttle Hill were identified, no historic features (e.g. cellar holes) were identified in the Project APE. It was determined that no subsurface testing was needed and no additional archaeological evaluation was recommended. As a result, the Project is not predicted to have an adverse impact on historic or pre-contact archaeological sites. The Phase I survey report (which combines the Phase IA and IB surveys) was filed with the NHDHR on December 7, 2011. A copy of the Phase I survey report can be found in Appendix 9B of this Application. Based on the information provided in the Phase I survey report, NHDHR has concluded that there are no known properties of archaeological significance within the area of the Project's potential impact and no further identification or evaluative studies are recommended. A copy of this NHDHR determination can be found at Appendix 9C.

While the Project will not physically alter any existing historic buildings or structures, it does have the potential to indirectly affect them through visual impacts. In order to evaluate the potential impacts of the Project on historic resources, A.D. Marble & Company completed a series of archival and field studies to assist the Project in complying with the initiation, identification, significance evaluation, and determination of effect phases of the historic review process. All studies were conducted in strict accordance with the New Hampshire Division of Historic Resources *Guidelines for Wind Farm Development* Projects. The Area of Potential Effect (APE) was defined using three and five mile radii as well as a consideration of the Project's visibility as required by the *Guidelines*.

Background research included a file search at the NHDHR to gather information on established contexts, previously surveyed properties, and properties within the APE that have been listed in or determined eligible for listing in the National Register of Historic

Places (National Register). Additional research was conducted at the New Hampshire State Library, the New Hampshire Historical Society, Dartmouth College, Plymouth State College, and the James A. Tuttle Library in Antrim. A member of the Antrim Historical Society and members of other area historical societies were also contacted. Field research included a thorough visual assessment of all potential historically significant structures within the APE as well as photographic documentation and completion of historic inventory forms. Analysis of the Project's potential effect was conducted using the Advisory Council on Historic Preservation's determination of effect tables, the creation of photographic simulations of the Project from specific resources, and consultation with the NHDHR, USACE, and the Section 106 consulting parties.

The preparation of the Project Area Form resulted in the identification of one property within the three mile APE that was previously listed in the National Register and one resource that was previously determined eligible for National Register Listing. These are the Flint Estate and the Antrim Congregational Church, respectively. The Flint Estate was removed from further consideration because the nature of its historic significance indicated that it could not be adversely affected by the Project. In addition to these known resources, six potentially significant historic resources were identified within the APE. One resource within the five mile APE, the Lower Hillsborough Village Historic District, was previously determined eligible for listing in the National Register. A copy of the NHDHR Area Form can be found at Appendix 9D.

In total, six resources were evaluated for their significance and potential to be National Register listed. These include the Village of Antrim Center, the Dodge Family Farm, Pine Haven, the Village of Clinton, the development on the north edge of Gregg Lake, and White Birch Point. Of these, the Village of Clinton and the Gregg Lake development were determined not eligible for National Register listing. The remaining properties were determined eligible. These four properties, as well as the previously determined Lower Hillsborough Village Historic District, were evaluated for their potential to be adversely affected by the Project. Copies of the Individual and Historic Area inventory forms can be found in Appendix 9E.

No buildings or structures will be acquired, physically altered or removed by the Project. Thus, any impacts from the Project would be limited to those indirectly resulting from Project visibility. Other indirect effects, such as noise, will not affect historic properties. During the assessment of effects phase, the Project was determined to have no adverse effect on the Village of Antrim Center, the Dodge Family Farm, Pine Haven, and the Lower Hillsborough Village Historic District. Lack of Project visibility and/or the presence of previously introduced modern elements detracting from the resource's setting contributed to these determinations. For the final resource, The NHDHR determined that there would be an adverse effect to White Birch Point. USACE has disagreed with this determination and the Project has reinitiated consultation with both parties to resolve the dispute, determine whether any mitigation may be necessary, and bring its obligations under Section 106 to a close. The documents supporting the Effects determinations can be found in Appendix 9F. Correspondence with NHDHR regarding the identification, significance evaluation, and, determination of effects phases are included as Appendix 9G.

I.3. Air quality

Once constructed, the Antrim Wind Energy Project will produce no air emissions; therefore it will not have an adverse impact on local air quality. Moreover, as a source of clean, renewable energy, the Project will reduce reliance on fossil fuel generation plants, which do produce pollutants that adversely impact air quality.

Many credible scientific studies and reports have demonstrated that increasing wind energy into the electrical supply system reduces harmful emissions and results in cleaner air while helping reduce the risk of climate change.

- The Eastern Wind Integration and Transmission Study found that "Wind generation displaces carbon-based fuels, directly reducing carbon dioxide (CO2) emission. Emissions continue to decline as more wind is added to the supply picture." (NREL 2011).
- The New England Wind Integration Study found that wind would "primarily reduce natural gas fired generation" and that in the scenario with wind generation producing 24% of the region's electric energy the result would be "wind and natural gas generation providing approximately the same amount of electric energy to the system" and "wind generation would almost fully displace generation from oil fired thermal steam units." (GE Energy 2010).
- The Environment New Hampshire 2013 Report found that in 2012 wind energy displaced 84.7 million metric tons of CO2 emissions in the US and also saved enough water to meet the domestic water needs of more than a million people. The Environment New Hampshire report finds that New Hampshire's wind energy is already avoiding more than 157,267 metric tons of climate-altering carbon pollution, the equivalent of taking 32,764 cars off the road, while it also saves 70,265,000 gallons of water per year, enough to meet the needs of 2,567 people (Schneider, et al. 2013).

I.4. Water quality

The Project will not have an unreasonable adverse impact on water quality. There will be no water withdrawal or discharge associated with this Project. Potential impacts to water quality include erosion and sedimentation during the construction portion of the Project, blasting, and changes in stormwater runoff once the Project is complete. The Project is designed to meet the standards set forth in the following applications, which are appended to this application as noted: Joint USACE/NHDES Standard Dredge and Fill Permit Application (Appendix 2A), NHDES Alteration of Terrain Application (Appendix 2B), and NHDES Section 401 Water Quality Certification Request (Appendix 2C).

The Project site straddles three watersheds: North Branch River; an unnamed stream which continues to its confluence with North Branch River at Steels Pond, and then on to

Franklin Pierce Lake; and Gregg Lake. In addition, several wetlands, vernal pools, and intermittent streams were identified on site during a natural resources survey performed by TRC in 2011. The removal of WTG #10 has taken all Project facilities out of the Willard Pond watershed.

Erosion and Sedimentation Control (ESC)

Various best management practices ("BMPs"), including NHDES's BMPs for blasting will be employed prior to and during construction to limit the mobilization of total suspended solids from disturbed surfaces. BMPs will include both temporary and permanent measures such as: mulch berms, silt fence, straw bale barriers, stone check dams, slope drains, rock stabilization of channels, seeding and mulching, erosion control matting, and temporary sediment traps. All have proven efficacy in similar projects characterized by steeper terrain, shallow depth to groundwater and short growing seasons. ESC devices will be monitored frequently to ensure that they are working properly; this will occur at least once a week or after rain events delivering more than one half inch of rain. Corrective measures will be taken as soon as possible if any ESC devices are shown to be performing inadequately. The BMPs and ESC devices that will be employed during Project construction and operation are illustrated on the civil design drawings provided in Appendix 7A of this Application.

Blasting Best Management Practices

NH DES has developed a set of BMPs entitled "Rock Blasting and Water Quality Measures That Can Be Taken To Protect Water Quality and Mitigate Impacts," which state that "[a]ll activities related to blasting shall follow Best Management Practices (BMPs) to prevent contamination of groundwater including preparing, reviewing and following an approved blasting plan; proper drilling, explosive handing and loading procedures; observing the entire blasting procedures; evaluating blasting performance; and handling and storage of blasted rock." These BMPs will be incorporated into the Blasting Plan developed by the blasting contractor.

Stormwater Management

Given that the Project will result in a relatively small amount of new impervious area distributed between four expansive, largely undeveloped watersheds, it is unlikely that the development will result in a significant increase in runoff compared to the pre-development condition. According to a stormwater runoff analysis (see Alteration of Terrain Application at Appendix 2B) performed by TRC civil engineers, it is reasonable to conclude that the construction of the Project will not result in an increase in peak rates of runoff from the site.

The stormwater management system has been designed to minimize impacts to the existing natural drainage ways. Because much of the access road will be constructed on the crest of the ridge, overall drainage patterns and directions of flow will remain generally the same. A permeable road base (rock sandwich) will be provided at appropriate locations to maintain sheet flow conditions and provide hydraulic connectivity between wetlands. Where steep roadway/ditch slopes will impede the effectiveness of a permeable road base, culverts have been spaced every 100 feet in order to minimize channelization of runoff. In addition, oversized culverts will be installed in locations where animals are likely to need to cross under the roadway.

The roadway will cross two identified streams. At one stream crossing, the road is in approximately 10 feet of cut. This is necessary in order to meet the maximum slope requirement of 12% for construction and delivery vehicles. As such, impacts to the stream cannot be avoided. At the second stream crossing a 3-sided concrete box culvert has been designed to comply with NHDES stream crossing guidelines.

The Project has been laid out to minimize wetland impacts to the greatest extent practicable. Construction will result in only 0.22 acres (approximately) of unavoidable wetland impacts.

The Project will comply with design requirements for runoff quality control included in Chapters 2 and 4 of the New Hampshire Stormwater Manual ("SWM"). To address the applicable water quality treatment standards for this Project, the stormwater management system incorporates a combination of roadway buffers, ditch turnout buffers, treatment swales, and bioretention basins. A copy of the complete Stormwater Management Plan can be found in the Alteration of Terrain Application at Appendix 2B.

In the 2012-01 SEC docket the Committee Found that the Project would not have an unreasonable adverse impact on air and water quality if the conditions recommended by NH DES were imposed. AWE does not object to those conditions and the site impacts have only been reduced since that finding was made, thus the Project should not now have an unreasonable adverse impact on air or water quality.

I.5. Natural environment

For the purpose of this discussion, information pertinent to natural environment shall be described in the following categories: plants and trees; wetlands and vernal pools; and wildlife. Each of these categories, including potential impacts and mitigative measures, is discussed in the following subsections.

I.5.a. Plants and Trees

(a) Natural Communities

In June 2011, a Natural Community survey was performed for the Antrim Wind Energy Project. This effort included a desktop review of existing data for the Project area, consultation with the New Hampshire Natural Heritage Bureau ("NHNHB"), and assessment of aerial photography and field surveys. The classification of the site's natural communities was done in accordance with the "Natural Communities of New Hampshire, Second Edition" (Sperduto & Nichols, 2011). The study area for the natural community assessment was the same as that which was assessed for wetlands, rare plants and other natural resources; this area is depicted on the Natural Community Map depicted in Figure I.5.a. The full natural community assessment report is provided in Appendix 11A of this Application.

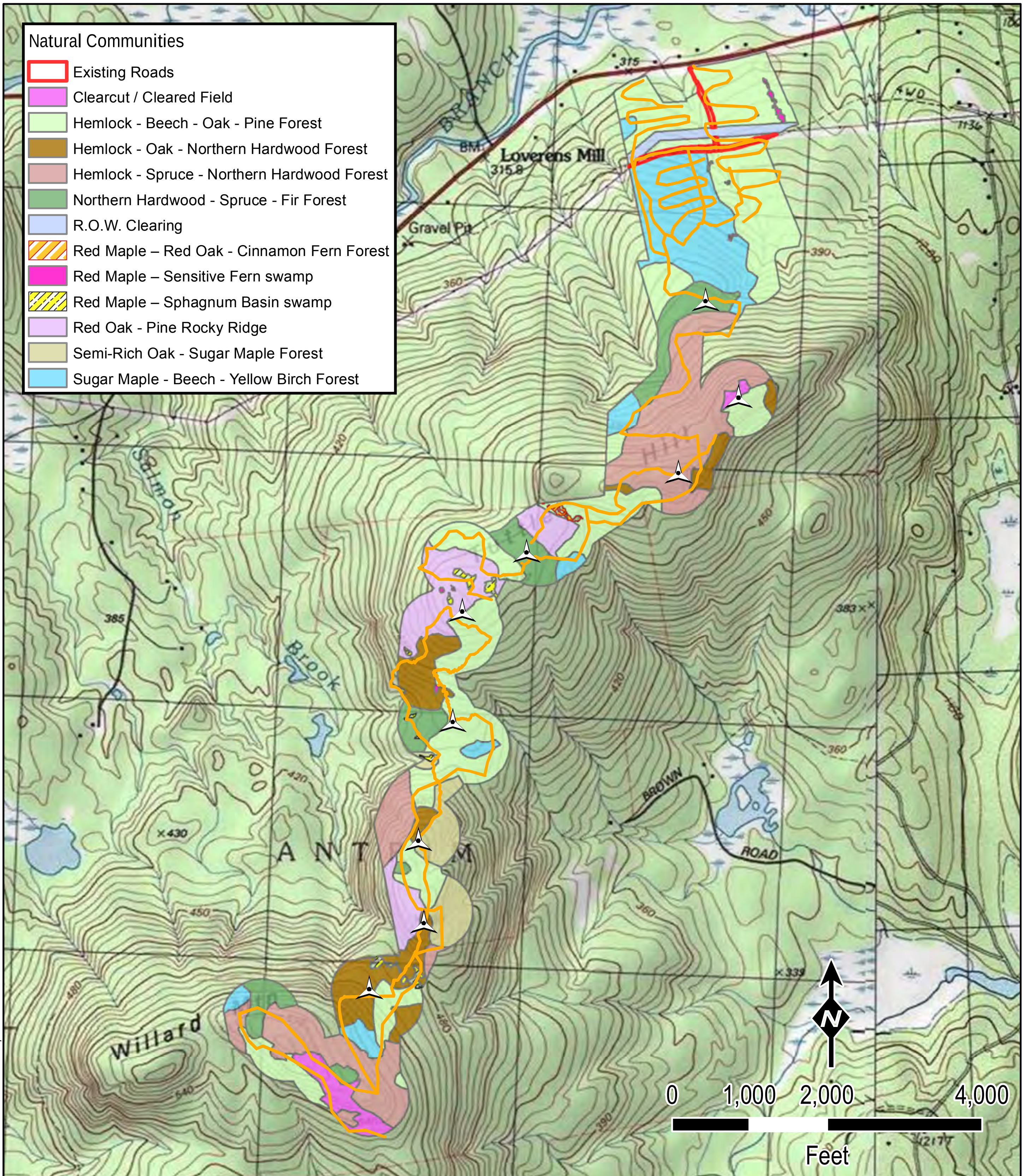
In general, the Project site is undeveloped and forested. The area has been subject to industrial timber harvesting in the past several decades. For this reason, the area includes patches of successional forest in various stages of regeneration. For the purpose of classifying community types, early successional forest areas were classified as the community type into which they will develop. The area also includes some acreage that has been recently clear cut; these areas were classified as such.

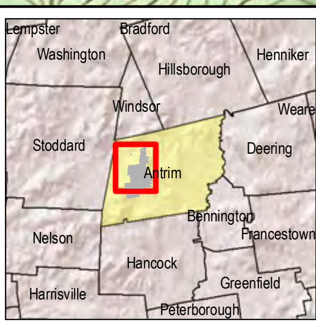
No significant natural communities were identified as a result of this survey.

Table I.5.a summarizes the natural communities that have been identified within the natural resource study area. These natural communities are illustrated on Figure I.5.a, Natural Community Map. Each of these community types is described in detail in the full study report provided in Appendix 11A.

Staff of the New Hampshire Natural Heritage Bureau ("NHNHB") visited the Project site on December 13, 2011, and July 13, 2012. Based on observations during the site visits and an additional database review in 2015, NHNHB has determined that the Project is not likely to impact exemplary natural communities. *See* Appendices 11A-1 & 11A-2 and Appendix 2A, Exhibit 2-1.

In October 2014, a field biologist visited the Project site on behalf of the Applicant to determine if any significant changes had occurred on the landscape and found that the conditions on the site remain unchanged from the 2011 and 2012 study periods.





Legend

Proposed WTG Location

Rare Plants Survey Area

Hillsboro and Stoddard 7.5-Minute USGS Topographic Quadrangles

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure I.5.a

Revised Natural Communites Map

Produced by: TRC | 1/29/2015

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Table I.5.a.: Natural Communities Identified in the Natural Resource Study Area

Natural Communities	Approximate Acres	Approximate % cover of assessment area
Hemlock - Beech - Oak - Pine Forest	155.3	33.61%
Hemlock - Oak - Northern Hardwood Forest	24.9	5.39%
Hemlock - Spruce - Northern Hardwood Forest	93.7	20.28%
Northern Hardwood - Spruce - Fir Forest	34.54	7.48%
Red Oak - Pine Rocky Ridge	33.7	7.29%
Red Maple – Cinnamon Fern Swamp	0.6	0.13%
Red Maple – Sensitive Fern Swamp	1	0.22%
Red Maple – Sphagnum Basin Swamp	3.2	0.69%
Rich Red Oak Rocky Woods	1	0.22%
Semi-Rich Oak - Sugar Maple Forest	35.8	7.75%
Sugar Maple - Beech - Yellow Birch Forest	57.1	12.36%
Temperate Acidic Cliff	0.9	0.19%
Existing Roads	4.6	1.00%
Clearcut / Cleared Field	9.3	2.01%
R.O.W. Clearing	6.4	1.39%

(b) Rare Plants

Prior to field investigations for rare plants, the New Hampshire Natural Heritage Bureau ("NHNHB") was consulted in order to identify any known or potential rare plant and/or natural community occurrences for the proposed Project site. No historic records were found as a result of this consultation. As described above, a Natural Community survey was performed in 2011. No significant natural communities were identified as a result of this survey.

Field surveys for rare plants were performed in August 2011. The study area for the rare plant survey was the same as the study are that was assessed for natural communities. This area is depicted on the Natural Community Map provided in Figure I.5.a, above. The investigation covered all identified natural communities, as well as intervening habitats such as power line corridors, roadsides, clearings and cut-over areas. Special emphasis was placed on species reported from identified natural communities by the NHNHB and New Hampshire species protected under the federal Endangered Species Act.

Some natural communities that have the potential to support rare or uncommon species were observed at the Antrim Wind study area; however, the species observed during rare plant surveys were common. No rare plants or species of concern were found. The complete Rare Plant Survey Report is provided in Appendix 11B of this Application.

Staff of the New Hampshire Natural Heritage Bureau ("NHNHB") visited the Project site on December 13, 2011, and July 13, 2012. Based on observations during these site visits and a subsequent database review in 2015, NHNHB has determined that it is unlikely that the Project will impact rare plants. *See* Appendices 11A-1 & 11A-2; Appendix 2A, Exhibit 2-1.

(c) Impacts and mitigation for natural communities and rare plants

The proposed Project will not result in any impacts to significant natural communities, rare plants or communities which are likely to support rare plants. For this reason, there are no avoidance or mitigation plans specific to these resources.

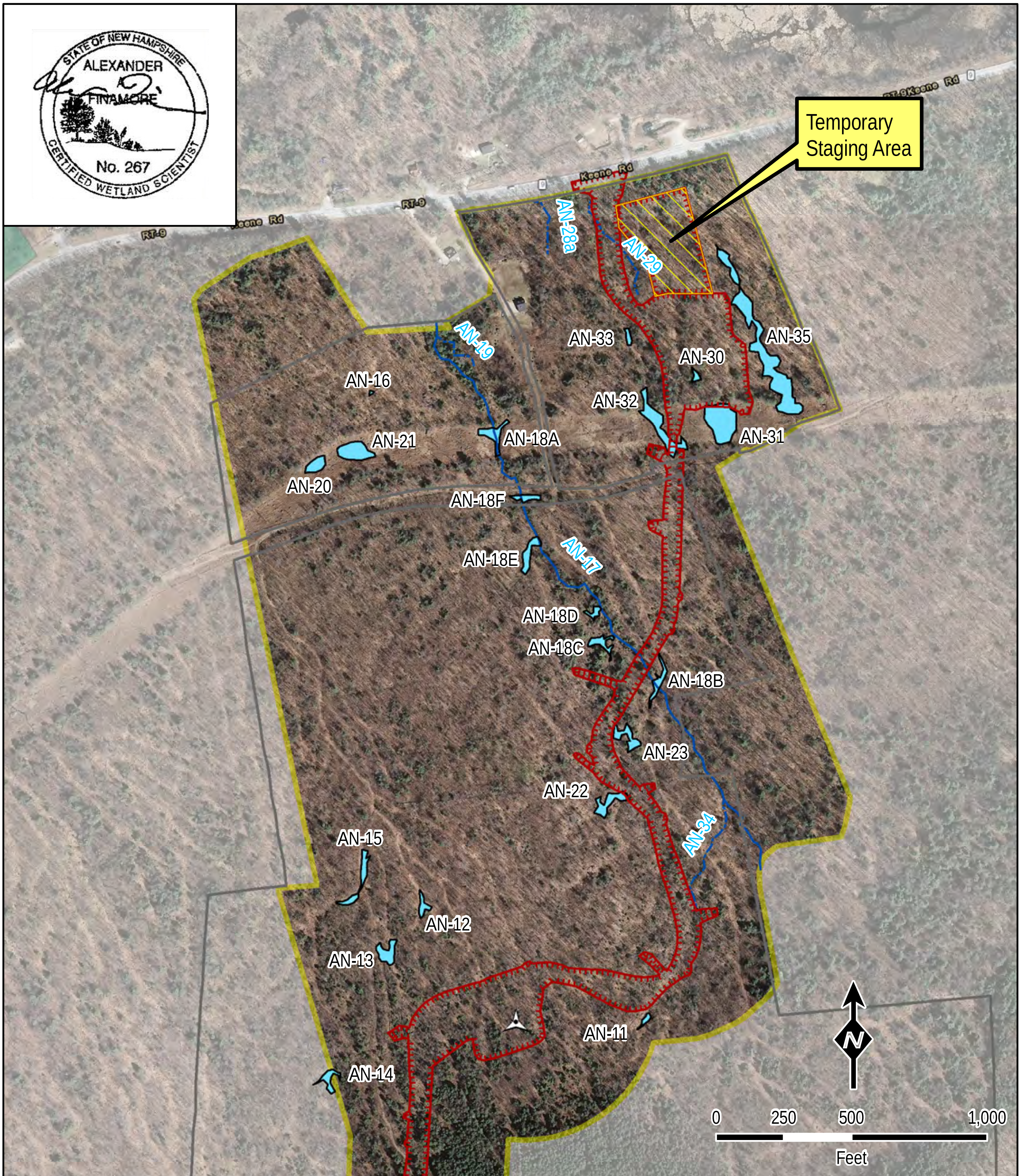
AWE successfully negotiated several local land conservation agreements that will protect approximately 908 acres of land adjacent to the proposed Project. This initiative, while not necessary for mitigation of any potential impacts to natural communities or rare plants (for the reasons noted above), will nonetheless conserve valuable undeveloped lands in perpetuity. These lands are similar in character and natural communities to those that will be developed by the proposed Project.

Again, it should also be noted that the proposed Project is a clean and renewable energy facility that will displace need for energy from other sources which produce adverse air emissions (see Section I.3). This elimination of tons of adverse air emissions from our atmosphere as a result of Project operation provides a net environmental benefit to natural communities.

I.5.b. Wetlands and Vernal Pools

Wetland and vernal pool surveys were completed within the natural resource survey area during spring, summer and fall of 2011. In October 2014, a field biologist visited the Project site on behalf of the Applicant to determine if any significant changes had occurred on the landscape and found that the conditions on the site remain unchanged from the 2011 and 2012 study periods.

The survey area as well as all wetland and vernal pool features identified are depicted in Figure I.5.b. Discussions regarding identified wetland and vernal pool features follow, respectively.



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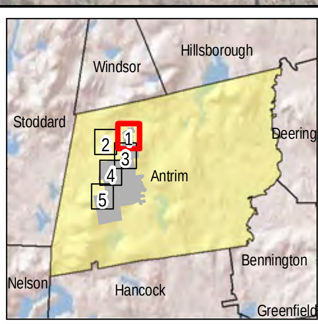

Legend

- Proposed WTG Location
- Proposed Disturbance Area
- Vernal Pool
- Project Parcels
- Existing Conserved Lands
- Resource Survey Area
- Wetlands
- Wetland Boundary
- Perennial Stream
- Intermittent Stream
- Drainage
- Stream Label
- Wetland Label

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure I.5.b

Natural Resource Survey Map

Map 1 of 5

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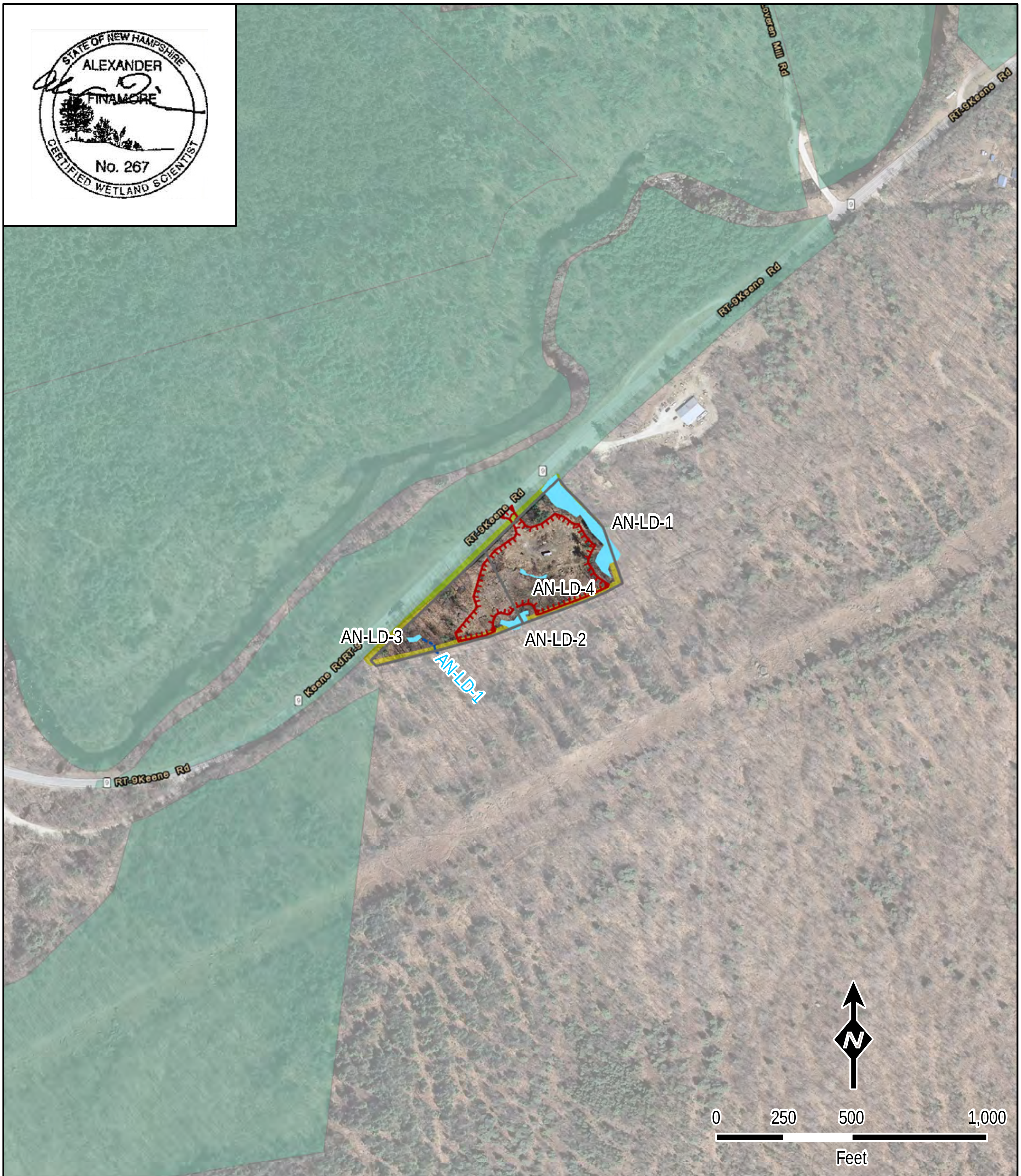

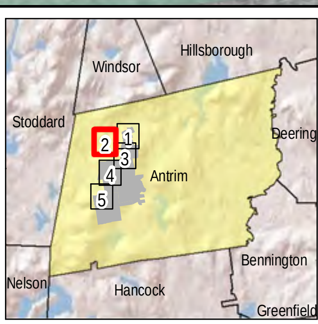

Legend

- Proposed WTG Location
- Proposed Disturbance Area
- Vernal Pool
- Project Parcels
- Existing Conserved Lands
- Resource Survey Area
- Wetlands
- Wetland Boundary
- Perennial Stream
- Intermittent Stream
- Drainage

Stream Label

Wetland Label

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure I.5.b

Natural Resource Survey Map

Map 2 of 5

Produced by: TRC | 7/6/2015

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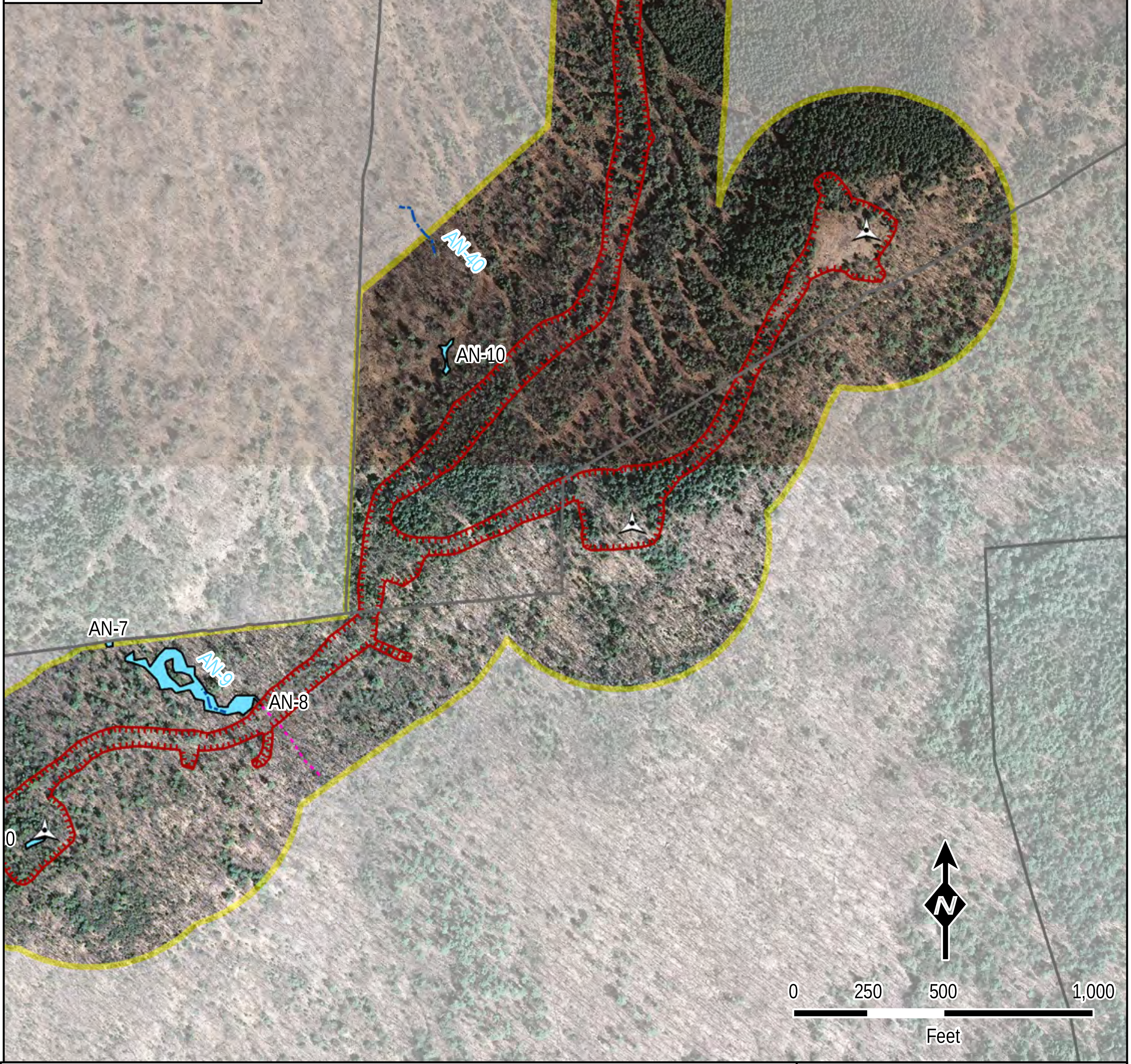

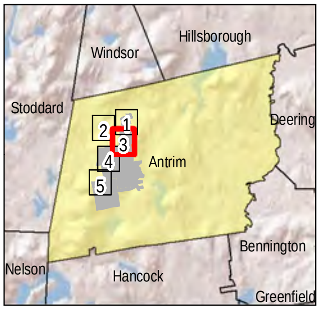

Legend

Proposed WTG Location
Proposed Disturbance Area
Vernal Pool
Project Parcels
Existing Conserved Lands
Resource Survey Area
Wetlands
Wetland Boundary
Perennial Stream
Intermittent Stream
Drainage
Stream Label
Wetland Label

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT
ANTRIM, NH

Figure I.5.b
Natural Resource Survey Map
Map 3 of 5

Produced by: TRC | 7/6/2015

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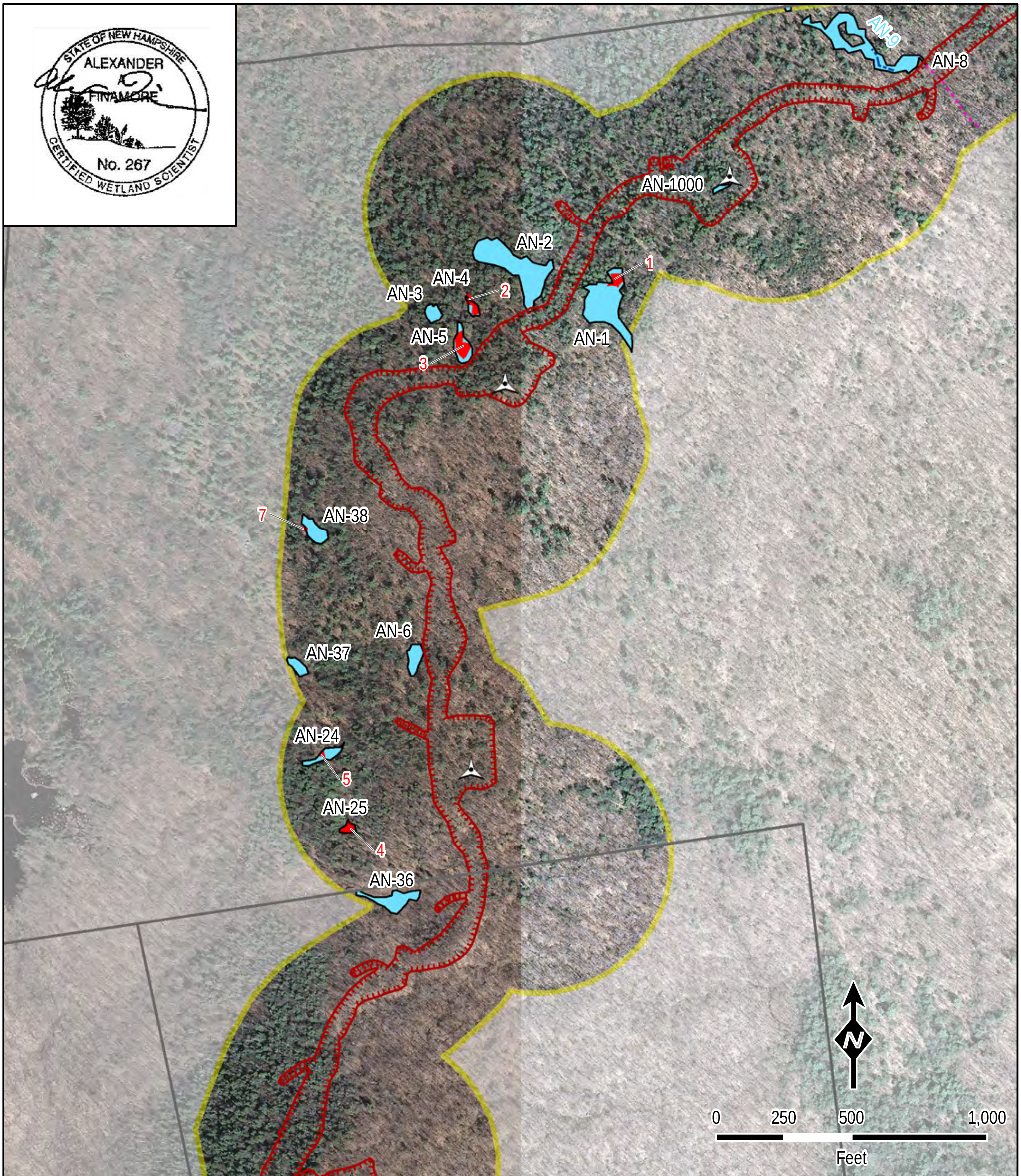

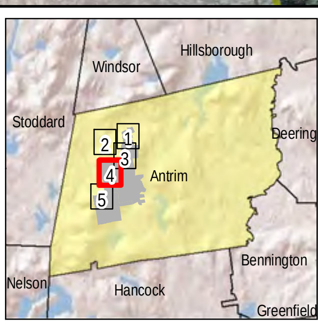

Legend

- Proposed WTG Location
- Proposed Disturbance Area
- Vernal Pool
- Project Parcels
- Existing Conserved Lands
- Resource Survey Area
- Wetlands
- Wetland Boundary
- Perennial Stream
- Intermittent Stream
- Drainage
- Stream Label
- Wetland Label

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure I.5.b

Natural Resource Survey Map

Map 4 of 5

Produced by: TRC | 7/6/2015

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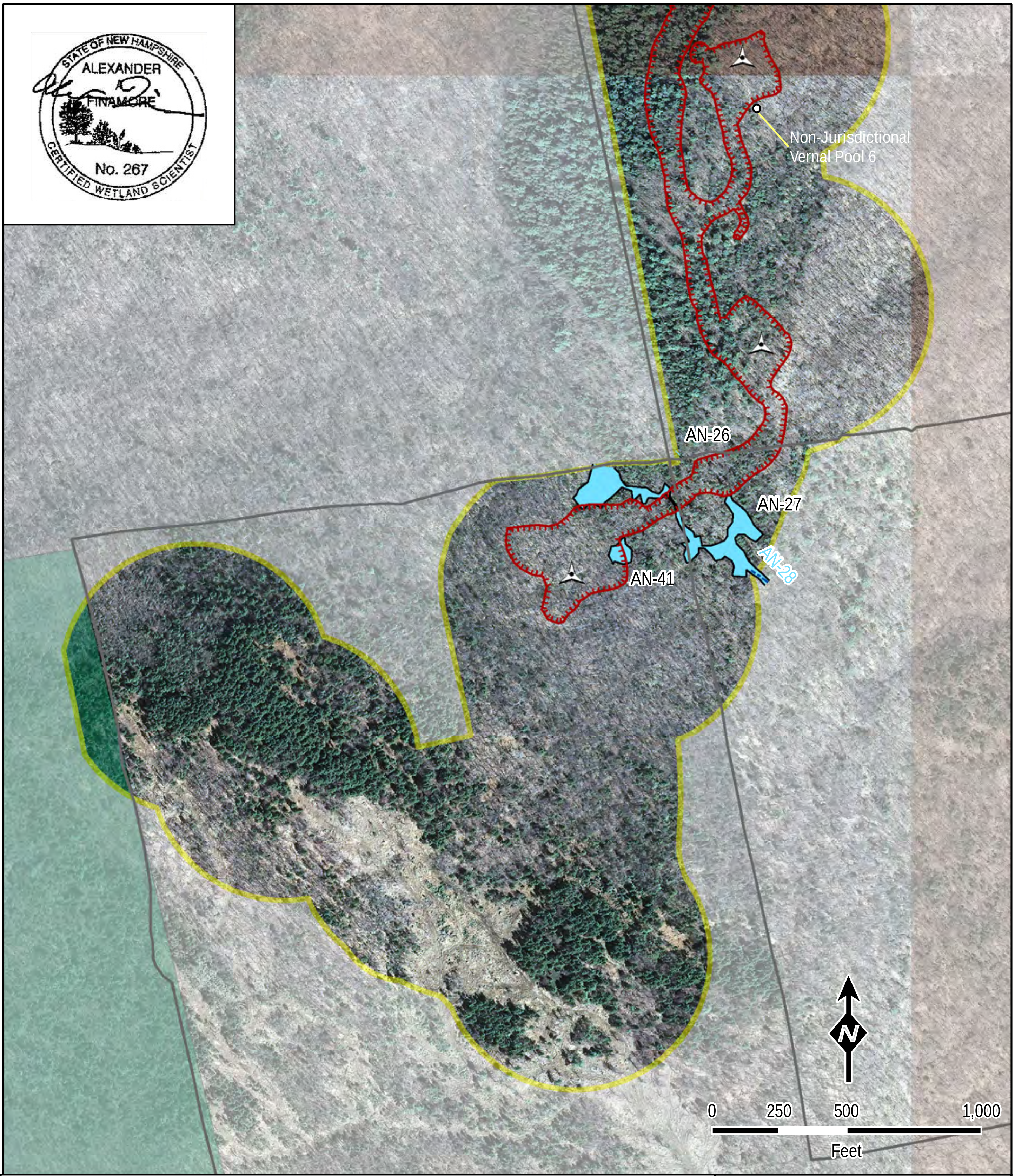
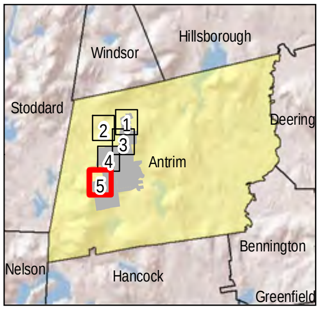




Legend

Proposed WTG Location	Wetlands
Proposed Disturbance Area	Wetland Boundary
Vernal Pool	Perennial Stream
Project Parcels	Intermittent Stream
Existing Conserved Lands	Drainage
Resource Survey Area	Stream Label
	Wetland Label

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure I.5.b

Natural Resource Survey Map

Map 5 of 5

Produced by: TRC | 7/6/2015

\\appesri1\GIS\PROJECTS\AUGUSTA\Eolian\ANTRIM\Figure I_5_b Natural Resource Survey Map.mxd

a) Wetlands

Wetland surveys were conducted for the proposed Antrim Wind Energy Project in late summer and fall of 2011 and summer of 2012. The site was re-visited in the fall of 2014 to confirm the previous wetland delineation results. This effort identified wetlands within the natural resources study area as depicted on the Natural Resource Survey Map, illustrated on Figure I.5.b, above.

A total of 34 wetlands and 8 streams were identified as a result of this effort. These features are listed in Table I.5.b(a). Detailed narrative descriptions of each feature listed are provided in the full wetland report, which is provided in Appendix 11C of this Application. Each feature listed is illustrated on Figure I.5.b, above.

Wetlands within the surveyed area consist primarily of small, forested wetlands that occur along skidder trails, in confined pockets in the regional bedrock, in saddle areas along the ridgeline, and in areas with poorly drained soils that support wetland vegetation. Streams within the Project area include unnamed perennial and intermittent streams which drain either to the north toward Route 9, or to the southeast into Gregg Lake. Because the proposed Project area is along a ridgeline and is moderately well drained, very few perennial streams occur. Observations in the field suggest that rainfall and snow-melt quickly run off the ridge to lower elevations, without collecting volumes that fill natural depressions or create natural ponds.

Table I.5.b(a): Wetlands and Streams Within the Natural Resource Survey Area

Summary of Wetlands and Watercouses within the Natural resource Survey Area			
Wetland / *Stream* ID	**Cowardin Classification**	**General Description**	**Associated Features**
AN1	PFO1	Isolated forested wetland. Contains VP1.	Vernal Pool VP1
AN2	PFO4	Isolated forested wetland.	
AN3	PFO1	Isolated forested wetland.	
AN4	PFO1	Isolated forested wetland. Contains VP2.	Vernal Pool VP2
AN5	PFO1	Isolated forested wetland. Contains VP3.	Vernal Pool VP3
AN6	PFO1	Isolated forested wetland.	
AN7	PFO1	Isolated forested wetland.	
AN8	PFO4	Forested wetland draining southeast, associated with intermittent stream AN9.	Stream AN9
AN9	*(intermittant stream)*	Intermittant stream associated with wetland AN8.	Wetland AN8
AN10	PFO1	Isolated forested wetland within skidder trail.	
AN11	PFO1	Isolated forested wetland with ephemeral inlet and outlet.	
AN12	PFO1	Isolated forested wetland within skidder trail.	
AN13	PFO1	Isolated forested wetland along ATV trail.	
AN14	PFO1	Isolated forested wetland within skidder trail.	
AN15	PFO1	Isolated forested wetland within skidder trail.	
AN16	PFO1	Very small isolated wetland along old skidder trail.	
AN17	*(perennial stream)*	Perennial stream associated with wetlands AN18a, b, c, d, e & f.	Wetland AN18
AN18	PFO1/4 & PSS1	6 forested wetland areas (AN18 a, b, c, d, e & f) draining north, associated with perennial stream AN17.	Stream AN17
AN19	*(intermittant stream)*	Intermittant stream which flows into perennial stream AN17	Stream AN17
AN20	PSS1	Isolated scrub-shrub wetland within transmission ROW.	
AN21	PSS1	Isolated scrub-shrub wetland within transmission ROW.	
AN22	PFO1	Isolated forested wetland within skidder trail.	
AN23	PFO1	Isolated forested wetland within skidder trail.	
AN24	PFO1	Isolated forested wetland. Associated with VP5. ATV trail within wetland.	Vernal Pool VP5
AN25	PFO4	Isolated forested wetland. Associated with VP4.	Vernal Pool VP4
AN26	PFO1	Forested wetland draining to the northwest.	
AN27	PFO1	Forested wetland draining to the southeast. Associated with intermittent stream AN28.	Stream AN28
AN28	*(intermittant stream)*	Intermittant stream associated with wetland AN27.	Wetland AN27
AN28a	*(intermittant stream)*	Intermittant stream associated with wetland AN27.	Wetland AN27
AN29	*(intermittant stream)*	Intermittant stream.	
AN30	PFO1	Isolated forested wetland with ephemeral inlet and outlet.	
AN31	PSS1	Isolated scrub-shrub wetland within transmission ROW.	
AN32	PSS1	Isolated scrub-shrub wetland within transmission ROW.	
AN33	PFO1	Isolated forested wetland within skidder trail.	
AN34	*(intermittant stream)*	Intermittant stream which flows into perennial stream AN17.	Stream AN17
AN35	PFO1/PSS1	Isolated forested an scrub-shrub wetland located in transmission ROW and to the north of the transmission ROW.	
AN36	PFO1	Isolated forested wetland with peat soils.	
AN37	PFO1	Isolated forested wetland adjacent to ATV trail.	
AN38	PFO1	Isolated forested wetland with potential vernal pool.	
AN40	*(intermittant stream)*	Intermittant stream.	
AN41	PFO1	Isolated forested wetland.	
AN1000	PFO1	Isolated forested wetland	

(b) Vernal Pools

Vernal pool surveys were conducted for the proposed Antrim Wind Energy Project in May of 2011. This was a field effort that consisted of visual meander surveys throughout the entire natural resources study area as depicted on the Natural Resource Survey Map, illustrated on Figure I.5.b, above. Additional surveys for vernal pools, as described below, were completed in September 2011. A potential vernal pool was identified in September 2011 during survey of area not surveyed during spring 2011. This feature is not within the area of proposed development. In October 2014, a field biologist visited the Project site on behalf of the Applicant to determine if any significant changes had occurred on the landscape and found that the conditions on the site remain unchanged from the 2011 and 2012 study periods.

All features identified were classified into three categories, as described below.

(1) Natural vernal pools: natural vernal pools are those that meet the criteria provided in state rules.

(2) Potential vernal pools: potential pools are those that were identified outside of the indicator species breeding season. These pools have the physical characteristics as described in the state and federal definitions, but require a visit in breeding season to confirm the presence of indicator species use.

(3) Non-jurisdictional features: these features include all other areas where amphibian breeding was documented but did not meet the state and federal definition of a vernal pool.

A total of 7 features were identified within the natural resource study area during the vernal pool survey. Of these, 5 were identified as natural vernal pools, 1 was identified as a potential vernal pool, and 1 feature was designated as a non-jurisdictional amphibian breeding area. Although intensively sought, no fairy shrimp were found or documented within any of the identified features. Furthermore, no rare or state-listed threatened or endangered species known to use vernal pools for at least one critical life stage were documented in any of the identified features.

A summary of each feature identified is provided in Table I.5.b(b), below. Descriptions of these features follow. The features listed in the table below are illustrated on the Natural Resource Survey Maps provided in Figure I.5.b, above. A full Vernal Pool Survey Report, including field data forms and site photographs is provided in Appendix 11D of this Application.

Table I.5.b(b): Vernal Pools Identified in the Natural Resource Survey Area

Pool ID	Category	Natural Setting (y/n)	Indicator Species Observed	Holds Water For At Least Two Months (y/n)	Associated Wetland
VP1	Natural	Y	Spotted Salamander – 8 egg masses Wood Frog – 5 egg masses Green Frog - Vocalization	Y	AN1
VP2	Natural	Y	Spotted Salamander – 16 egg masses Wood Frog – 1 egg mass	Y	AN4
VP3	Natural	Y	Spotted Salamander – 9 egg masses Wood Frog – 5 egg masses	Y	AN5
VP4	Natural	Y	Spotted Salamander – 55 egg masses Wood Frog – 4 egg masses	Y	AN25
VP5	Natural	Y	Spotted Salamander – 10 egg masses	Y	AN24
VP6	Non-Jurisdictional	N	Spotted Salamander – 9 egg masses	N	Upland
VP7	Natural	Y	Spotted Salamander – 5 egg masses	Y	AN38

Natural Vernal Pools: the Features identified as VP1 through VP5 have been classified as natural vernal pools in accordance with criteria listed in state rules. These six pools are within isolated palustrine forested wetlands along the Tuttle Hill ridgeline and are located in depressions within bedrock. Each of these pools occurs in natural isolated basins with no inlets or outlets. None of these pools support populations of predatory fish.

Potential Vernal Pools: Due to changes in Project scope that evolved during the siting phase of the Project, additional surveys for vernal pools were completed in September of 2011. One additional feature (VP7) was identified as a result of these additional surveys. VP7 is located within an isolated forested wetland (Wetland AN38), roughly midway between the previously identified features VP3 and VP5.

At the time of survey (September 27, 2011), wetland AN38 was observed to have an area of standing water approximately 1 foot deep which contained an abundance of shrubby vegetation. The area appeared to be conducive to supporting egg attachment sites for pool breeding amphibians. An ephemeral outlet drains the wetland to the northwest through a gap in the regional bedrock. This outlet does not meet the criteria for a stream or wetland, and does not have the necessary characteristics to support predatory fish populations. Since the pool was observed on September 27th, which is outside of the indicator species' peak breeding season, a second visit would be necessary to determine the presence of vernal pool species and confirm its status as a "natural vernal pool". A second visit was conducted in May 2015 and the pool was confirmed to have use by indicator species.

<u>Non-Jurisdictional Features:</u> The feature identified as VP6 has been classified as a non-jurisdictional pool. This feature is man-made; it is located within a depression in an old woods road. While the pool was wetted during initial surveys in May, it was observed to be completely dry on June 6, 2011. No hydrophytic vegetation was observed in the vicinity of the pool depression. Based on these parameters, the feature identified as VP6 is considered a non-jurisdictional feature.

(c) Impacts and Mitigation for Wetlands and Vernal Pools

No jurisdictional vernal pools, or areas currently described as potential vernal pools will be impacted as a result of Project construction or operation. Eight identified wetlands will be impacted either temporarily or permanently; the acreage of impacts for each of these wetlands is listed below.

Table I.5.b(c): Wetland Impacts

WETLAND IMPACTS			
Wetland ID	**Type**	**Acres**	**Square feet**
AN-2	PFO	0.005	228
AN-8	PFO	0.001	34
AN-22	PSS	0.004	170
AN-27	PFO	0.028	1,218
AN-30	PFO	0.02	869
AN-31	PSS	0.016	708
AN-32	PSS	0.032	1,392
AN-41	PFO	0.06	2,584
AN1000	PFO	0.022	963
AN-LD-4	PSS	0.02	955
TOTAL		***0.21***	***9,121***

In total, 0.21 acres (9,121 square feet) of permanent wetland impact are expected to be incurred as a result of construction and operation of the proposed Project. This small amount of impact is the result of careful Project planning and design, which aimed to avoid and minimize impacts to these important resources. The direct wetland impacts are those which were deemed unavoidable during the Project planning process. The specific details of each of the above listed areas of impact are described in the NHDES Site Specific Alteration of Terrain permit application, which is provided in Appendix 2B of this Application.

NHDES rules state that compensatory mitigation is required for minor impact projects with permanent jurisdictional impacts of 10,000 square feet or greater (Env-Wt 303.03). Because the proposed Project will result in less than 10,000 square feet of permanent wetland impacts, no compensatory mitigation is required.

During construction, Best Management Practices for working in and near wetlands will be applied. During construction and operation, appropriate stormwater runoff and erosion control measures will also be applied. Best Management Practices, stormwater runoff prevention and erosion control practices to be employed are described in detail in the NHDES Site Specific Alteration of Terrain permit application (see Appendix 2B), and the joint USACE/NHDES Standard Dredge and Fill permit application (see Appendix 2A).

I.5.c. Wildlife

In the spring of 2011, AWE consulted with state and federal agencies to identify the scope of wildlife studies to be performed relevant to the proposed Project. Consulting agencies included United States Fish and Wildlife Service ("USFWS"), New Hampshire Fish and Game Department ("NHFGD"), New Hampshire Natural Heritage Bureau ("NHNHB"), New Hampshire Department of Environmental Services ("NHDES"), the United States Army Corps of Engineers ("USACE"), and the United States Environmental Protection Agency ("USEPA").

As a result of consultation with the aforementioned agencies, the following pre-construction studies were identified as necessary to assess the potential impacts of the proposed Project on wildlife:

- Breeding bird surveys;
- Diurnal raptor migration surveys;
- Radar surveys for nocturnal avian migration;
- Rare raptor nesting surveys;
- Acoustic bat monitoring; and
- Bat mist nesting surveys

All pre-construction study protocols were designed to be consistent with those recommended by state and federal regulatory agencies for proposed wind power projects; they were also designed to be consistent with surveys conducted in the past at other similar projects in New England and New Hampshire. Draft protocols for breeding bird surveys, diurnal raptor migration surveys, nocturnal radar surveys, rare raptor nest surveys, and acoustic bat surveys were provided to each of the consulting agencies in March, 2011. AWE met with consulting agencies on April 6, 2011 to discuss these draft study protocols. Protocols were revised, as appropriate, based on consultation, and were provided to the consulting agencies on May 23, 2011. The USFWS was the only party that responded to this submittal, by letter, on October 13, 2011. See Appendix 12A. The April 6 meeting also precipitated a request to perform bat mist netting surveys, a protocol for which was subsequently developed and executed in consultation with NHFGD.

It should be noted that, during consultation, a desktop GIS review of known environmental factors was performed. No known critical habitats or endangered species occurrences were identified as a result of this effort.

The findings of each of the pre-construction wildlife studies performed relevant to the proposed Antrim Wind Energy Project are summarized, below. A discussion on potential Project impacts to birds and bats, as well avoidance and mitigation strategies relevant to these impacts, follows. Full survey reports for each of the wildlife studies are provided in Appendix 12 of this application.

Additional consultation with agencies was performed during 2014 and 2015 to determine whether supplemental or additional surveys were necessary for the revised Project. As a result of this consultation, review and minor revisions to the Avian and Bat Protection Plan ("ABPP") (now Bird and Bat Conservation Strategy ("BBCS")) have been made to ensure continued consistency with USFWS guidance. The BBCS also incorporates recommendations from NHFG that resulted from the previous project review. The complete BBCS is provided in Appendix 12F to this Application. No further preconstruction studies were recommended by New Hampshire Fish and Game or US Fish and Wildlife Service. AWE met with USFWS on May 27, 2015, to discuss the Project and the BBCS and the status of existing survey data for northern long-eared bat surveys. A subsequent email from USFWS on June 1, 2015 stated that bat survey data performed at the AWE Project is valid for at least ten years unless changes in northern long-eared bat populations warrant adjustments of that timeframe.

(a) Breeding Bird Surveys

A breeding bird survey for the Antrim Wind Energy Project was performed in June and July of 2011. The goal of this survey was to document the pre-construction presence, diversity and relative abundance of breeding bird species in the proposed area of development. Breeding bird surveys used point count methods based on those used for the Vermont Institute of Natural Science's Mountain Birdwatch program (VINS 2005) and Bird Studies Canada's High Elevation Landbird Program (HELP) (Whittam & Ball 2002, and 2003).

Point counts were conducted at 12 locations along the ridge of Tuttle Hill and Willard Mountain. Point count locations were representative of habitat types within and adjacent to the area proposed for Project development. Six of the points were located in close proximity to areas that will be disturbed by the proposed Project development; the other six were located outside of the area that will be directly disturbed. Each point count location was visited twice during the study period, which occurred between June 1 and July 15, 2011. All surveys were conducted at dawn (between 4:30 AM and 8:30 AM).

In addition to formal bird surveys, habitat parameters associated with point count locations were also quantified. This was done using methods that were developed specifically for making habitat measurements associated with estimating bird populations (James and Shugart 1970); these methods are still used by the national Breeding Bird Survey (USGS 2009), as well as other current studies. The results of this effort are detailed in the full study report, which is provided in Appendix 12A of this Application.

A total of 131 individual birds, representing 25 different species, were documented during the formal breeding bird surveys. An additional 14 species were observed incidentally during other field work which occurred during the summer breeding season. These observations constitute a total of 39 bird species recorded in the Project vicinity during the breeding season of 2011. A list of breeding bird species identified formally during breeding bird surveys, and informally as incidental observations, is provided in Table I.5.c(a), below.

The most frequently observed bird species, in terms of relative abundance, were ovenbird and blackburnian warbler; 17 individuals of each species were observed, constituting a 12.98% relative abundance for each. The next most abundant species were red-eyed vireo (n=14) and myrtle warbler (n=12), at 10.69% and 9.16% relative abundance, respectively. The relative abundance of each species documented is presented in Table I.5.c(a), below.

The assemblage and relative abundance of birds observed is typical of the region, and of the habitats found within the study area. No rare birds or birds of conservation concern were observed during formal breeding bird surveys. Incidental observations of the common nighthawk, a state listed endangered species, were made in the vicinity of Willard Mountain and Tuttle Hill in June of 2011. One of these observations was auditory and consisted of aerial vocalizations in the area of Willard Mountain. The other observation was visual, and consisted of several nighthawks foraging over the valley to the north of Tuttle Hill; these birds were outside of the area proposed for Project development. These observations were discussed during consultation with USFWS, NHNHB, NHDES, and NHFGD on June 21; no concerns with regard to these observations were expressed.

Table I.5.c(a): Breeding Bird Species Identified Within the Antrim Wind Energy Project Vicinity

Breeding Bird Species Observed within the Antrim Wind Energy Project Vicinity					
Common Name	**Latin Name**	**Residence***	**Number Observed**	**Relative Abundance**	**Frequency of Occurence**
Species Observed During Formal Breeding Bird Surveys					
American Goldfinch	*Carduelis tristis*	L/US	1	0.76%	0.08%
Black and White Warbler	*Mniotilta varia*	NT	5	3.82%	0.41%
Blackburnian Warbler	*Dendroica fusca*	NT	17	12.98%	0.67%
Black-capped Chickadee	*Poecile atricapillus*	L	2	1.53%	0.08%
Black-throated Blue Warbler	*Dendroica caerulescens*	US/NT	10	7.63%	0.67%
Blue Jay	*Cyanocitta cristata*	US/L	4	3.05%	0.33%
Cedar Waxwing	*Bombycilla cedrorum*	L/US	2	1.53%	0.08%
Chesnut-sided Warbler	*Dendroica pensylvanica*	NT	2	1.53%	0.08%
Common Yellowthroat	*Geothlypis trichas*	NT	2	1.53%	0.08%
Eastern Wood Pewee	*Empidonax*	NT	4	3.05%	0.33%
Golden-crowned Kinglet	*Regulus calendula*	L/US	2	1.53%	0.17%
Hairy Woodpecker	*Picoides villosus*	L	6	4.58%	0.50%
Hermit Thrush	*Catharus guttatus*	US	9	6.87%	0.58%
Magnolia Warbler	*Dendroica magnolia*	NT	3	2.29%	0.17%
Morning Dove	*Zenaida macroura*	US/L	1	0.76%	0.08%
Myrtle Warbler	*Dendroica coronata*	US/NT	12	9.16%	0.58%
Ovenbird	*Seiurus aurocapillus*	US/NT	17	12.98%	0.67%
Purple Finch	*Carpodacus purpureus*	L/US	1	0.76%	0.08%
Red-breasted Nuthatch	*Sitta canadensis*	L/US	2	1.53%	0.17%
Red-eyed Vireo	*Vireo olivaceus*	NT	14	10.69%	0.67%
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	NT	3	2.29%	0.25%
Scarlet Tanager	*Piranga olivacea*	NT	3	2.29%	0.25%
Slate-colored Junco	*Junco hyemalis*	L/US	5	3.82%	0.33%
Winter Wren	*Troglodytes troglodytes*	US	2	1.53%	0.17%
Veery	*Catharus fuscescens*	NT	2	1.53%	0.08%
Total Species Observed During Formal Surveys		***25***			
Total Individuals Observed During Formal Surveys			***131***		
Species Recorded as Incidental Observations during Summer 2011					
American Redstart	*Detophaga ruticilla*	NT			
Barred Owl	*Strix varia*	US/L			
Blue-headed Vireo	*Vireo solitarius*	US/NT			
Broad-winged Hawk	*Buteo platypterus*	NT			
Brown Creeper	*Certhia americana*	na			
Common Nighthawk	*Chordeiles minor*	NT			
Cooper's Hawk	*Accipiter cooperii*	US/L			
Least Flycatcher	*Empidonax minimus*	NT			
Pileated Woodpecker	*Picadae*	L			
Red-tailed Hawk	*Buteo jamaicensis*	US/L			
Ruffed Grouse	*Bonasa umbellus*	L			
TurkeyVulture	Cathartes aura	US			
Wild Turkey	*Meleagris gallopavo*	L			
Yellow-bellied Sapsucker	*Sphyrapicus varius*	US			
Total Species Observed Incidentally		***14***			
Total Breeding Bird Species Recorded in 2011		***39***			

* L – Local year round resident; US – Migrates within US; NT – Neotropical migrant

(b) Diurnal Raptor Migration

Surveys for diurnal migrating raptors were performed during the spring and fall seasons of 2011. The purpose of these surveys was to document the numbers, species, and flight patterns of migrating raptors in the immediate Project vicinity. The protocol for diurnal raptor migration surveys at the proposed Antrim Wind Energy Project followed standards set forth by the Hawk Migration Association of North America (HMANA 2011), and by HawkWatch International (HawkWatch International 2011, Hoffman and Smith 2003). The full study report is provided in Appendix 12B of this Application.

Spring surveys for migrating raptors were performed in late March through late May, 2011. Fall surveys were performed between mid-September and late November, 2011. Early survey dates (in March), and late survey dates (in November) were intended to capture the passage of species, such as golden eagles (*Aquila chrysaetos*), whose migration period is temporally extended.

Surveys were performed on multiple survey dates during each season. On each survey date, data was generally collected for eight consecutive hours between 9 AM to 5 PM. This timeframe encompasses the peak hours of thermal development and associated raptor movement. Sampling was performed based upon favorable weather for migration.

The spring 2011 diurnal raptor migration survey for the proposed Antrim Wind Energy Project consisted of 65 total hours of observation across 9 dates between March 25 and May 15. The fall survey consisted of 147.5 total hours of observation across 21 dates between September 1 and November 20.

In spring, a total of 441 individual raptors[4], representing eleven species were identified within the immediate vicinity of the proposed Antrim Wind Energy Project. The vast majority of individuals observed were turkey vultures, which comprised 54% (n=237) of all observations. The next most abundant species observed were broad winged hawks and red-tailed hawks at 18% (n-77) and 14% (n=60) relative abundance, respectively. All species observed and their relative abundance are listed in Table I.5.c(b).

In fall, a total of 978 individual raptors, representing 10 species were identified. The vast majority of these were broad-winged hawks, which comprised approximately 70% (n=689) of all observations. A total of 471 of these individuals were recorded on one date: September 18. The majority of these broad-wings passed in a few large aggregations ("kettles"). For comparison: on the same date (September 18), Carter Hill Observatory (in Concord, NH) recorded a total of 7,212 broad-winged hawks and Pack Monadnock Observatory (in Peterborough, NH) recorded 5,208. Large, temporally concentrated fall movement of broad-winged hawks is typical in New England. Red-

[4] For the purpose of this study, the term "raptors" refers to all members of Order Falconiformes; this order currently includes the family Cathartidae (New World vultures).

tailed hawks and turkey vultures were the next most frequently observed species at approximately 8% and 6% relative abundance, respectively. All species observed and their relative abundance are listed in Table I.5.c(b).

Table I.5.c(b): Species List and Relative Abundance of Diurnally Migrating Raptors, Spring and Fall 2011.

Common Name	Binomial Nomenclature	Total Individuals Observed		Percent Relative Abundance	
		Spring	Fall	Spring	Fall
Accipiter spp. (small)	(n/a)	2	23	0.45%	2.35%
American Kestrel	*Falco sparverius*	1	0	0.23%	0.00%
Bald eagle	*Haliaeetus leucocephelus*	3	11	0.68%	1.12%
Broad-winged hawk	*Buteo platypterus*	77	689	17.46%	70.45%
Buteo spp.	(n/a)	30	22	6.80%	2.25%
Cooper's hawk	*Accipiter cooperii*	3	15	0.68%	1.53%
Falcon spp.	(n/a)	1	1	0.23%	0.10%
Golden eagle	*Aquila chrysaetos*	0	3	0.00%	0.31%
Merlin	*Falco columbarius*	0	3	0.00%	0.31%
Northern Goshawk	*Accipiter gentilis*	1	0	0.23%	0.00%
Northern Harrier	*Circus cyaneus*	5	0	1.13%	0.00%
Osprey	*Pandion haliaetus*	5	5	1.13%	0.51%
Peregrine Falcon	*Falco peregrinus*	1	0	0.23%	0.00%
Raptor spp.	(n/a)	13	48	2.95%	4.91%
Red-shouldered hawk	*Buteo lineatus*	0	1	0.00%	0.10%
Red-tailed hawk	*Buteo jamaicensis*	60	75	13.61%	7.67%
Sharp-shinned hawk	*Accipiter striatus*	2	19	0.45%	1.94%
Turkey vulture	*Cathartes aura*	237	63	53.74%	6.44%
TOTAL		441	978		

The overall passage rate in spring 2011 was 6.78 birds per hour of effort (441 birds/65 hours) with a range of 1.88 to 14.25. The overall passage rate in fall was 6.63 birds per hour of effort (978 birds/147.5 hours) with a range of 0 to 61.75. These passage rates were compared to data from the five most comparable (in terms of proximity and geographic similarity) hawk watch sites for which data was available across the same sampling period. The spring average at Antrim (6.78 birds per hour of effort) is comparable to the spring average of 5.78 birds per hour of effort among five regional hawk watch sites. The spring maximum of 14.25 birds per hour of effort is well below the regional maximum of 49.08. The fall average of 6.63 birds per hour of effort is well below the regional average of 21.83; likewise, the fall max of 61.75 birds per hour of effort is significantly lower than the regional max of 730 birds per hour of effort. Full regional comparisons are provided in the diurnal raptor migration study report provided in Appendix 12B of this Application.

Flight height (above ground level) was estimated for individuals that used the ridge area and upper slopes of Tuttle and Willard Mountains, as these are the areas where potential development has been considered or proposed over the course of Project planning. The remaining birds were recorded as “outside” of the area of potential development. Flight height estimates were grouped into 3 categories: 0-50 feet above the ground, 50-500 feet above the ground, and 500+ feet above the ground. Estimation of raptor elevation can be influenced by perspective, distance, topography, observer and etc.; for this reason, flight height categories were designed conservatively. In order to produce the most conservative possible estimate of risk, these categories were also judged conservatively in the field, erring toward the 50-500-foot category.

Of 441 total raptors observed in spring 2011, 216 (49%) passed within the area of potential development. Of the birds that did fly within the area of potential development (n=216), 162 of them (or 37% of all birds observed) were judged to have flown within the 50-500-foot above ground range. Of the 162 birds that flew within this range, 108 of them were turkey vultures.

Of 978 total raptors observed in fall 2011, 460 of them (47%) were observed to pass within the area of potential development. Of the birds that did fly within the area of potential development (n=460), 296 of them (30% of all raptors recorded) were judged to have flown within the 50-500-foot above ground range. Of the 296 birds that flew within this range, 168 of them were broad-winged hawks; 104 of these passed in kettles on the single date of September 18.

Three listed Rare, Threatened, or Endangered raptor species were observed during spring and fall migration surveys for the proposed Antrim Wind Energy Project: bald eagle, golden eagle, and peregrine falcon. A total of 14 bald eagles were recorded (3 in spring and 11 in fall); 7 of these never flew within the area of proposed development. Of those bald eagles that did fly within the area of proposed development (n=7), 6 were judged to have passed within the 50-500 foot above-ground range. A total of 3 golden eagles were observed in the fall of 2011; one of these never flew within the area of proposed development. The remaining 2 golden eagles were judged to have passed within the 50-500 foot above-ground range within the area of proposed development. The single peregrine falcon that was observed in the spring of 2011 did not pass within the area of proposed development.

Overall, the observed species assemblage, relative abundance, and passage parameters were as expected for southern New Hampshire.

(c) Nocturnal Avian Migration

Nocturnal radar surveys for avian migration were performed for the proposed Antrim Wind Energy Project in spring and fall 2011. These studies served to assess and characterize nocturnal avian migration patterns in the proposed Project area. The objective of the study was to document the overall passage rates for nocturnal avian migration in the vicinity of the Project area, including the number of migrants, their flight direction, and their flight altitude. The full study report on nocturnal avian migration is provided in Appendix 12C of this Application.

Radar was operated from one location, near the meteorological tower on the northeastern end of Tuttle Hill. Spring radar surveys were conducted from sunset to sunrise on 30 nights between April 18 and May 26, 2011 resulting in 284 total hours surveyed. Fall radar surveys were conducted during 30 nights between August 17 and October 8, 2011 resulting in 327 total hours surveyed.

Video samples were analyzed using specialized digital analysis software. Data analysis included the removal of insects based on flight speed and the calculation of migration passage (traffic) rates over the radar location. Passage rates (expressed in targets/kilometer/hour) were summarized hourly for each night as well as the overall mean and median nightly passage rates for the entire season. The mean flight direction of recorded targets was calculated for each night of data collected. These were also summarized by night and for the entire season. Mean flight height of targets and percentage of targets below maximum turbine height was determined using the vertical data and summarized by hour, night, and season.

Spring Results

The overall mean passage rate for the entire spring survey period was 223 ± 23 targets per kilometer per hour (t/km/hr), and nightly passage rates varied from 6 ± 3 t/km/hr on May 17 to 1215 ± 299 t/km/hr on May 20.

Individual hourly passage rates varied between nights and throughout the season, and ranged from 0 t/km/hr during various hours of various nights, to 2279 t/km/hr during the 7th hour of May 20. For the entire season, mean passage rates increased rapidly between hours one and two after sunset, then gradually increased to the 6th hour after sunset before steadily declining until sunrise.

Mean flight direction through the Project area in the spring was generally northeast (44° ± 49°), but varied between nights.

The seasonal mean flight height of targets was 305 ± 1 meters (m; 1000 ft [’]) above the radar site, and nightly flight heights ranged from 135 ± 31 m to 486 ± 85 m. Flight heights, when analyzed for the anticipated 150 m (492’) height of the proposed turbines; indicate that the percentage of targets flying below turbine height ranged from 7 to 63 percent with a seasonal average of 30 percent.

These results are the lowest recorded spring passage rates recorded at a wind project site in New Hampshire and are at the low end of the range of results from among other spring radar studies conducted at proposed wind projects on forested ridges in the east.

Fall Results

The overall passage rate for the entire fall survey period was 138 ± 9 targets per kilometer per hour (t/km/hr) and is the lowest recorded fall passage rate for a wind project site in New Hampshire and is at the low end of the range of results of other fall radar studies conducted at proposed wind projects on forested ridges in the east. Fall nightly passage rates varied from 4 ± 2 t/km/hr on October 1 to 538 ± 71 t/km/h on August 26. Individual hourly passage rates varied between nights and throughout the season, and ranged from 0 t/km/hr during various hours of various nights to 839 t/km/hr during the 2nd hour of August 26. For the entire season, mean passage rates increased rapidly between the 1st and 3rd hours after sunset, then gradually declined until sunrise.

Mean flight direction through the Project area in the fall was generally southwest (217° ± 56°), but varied between nights.

The fall seasonal mean flight height of targets was 203 ± 1 m (666') above the radar site. The average nightly flight height ranged from 147 ± 23 m on August 24 to 266 ± 45 m on September 9. The percent of targets observed flying below 150 m was 40 percent for the season and varied nightly from 25 percent (169 targets) on September 9 to 56 percent (74 targets) on August 18 (Figure 2-9). For the entire fall season, the mean hourly flight heights were lowest during 1st and 10th hour after sunset.

The fall average flight height (203 ± 1 m) is among the lowest average flight heights recorded among other radar studies conducted in the eastern United States (287 m to 583 m). The recorded flight height of 203 ± 1 m is, however, above the proposed turbine height (150 m) for the Project. The nightly average flight height was below the proposed turbine height on one night (August 24) and at the proposed turbine height on one night (October 1). Passage rates on these nights were low: 38 t/km/hr on August 24 and 4 t/km/hr on October 1.

In summary, fall radar surveys in the Project area documented passage rates and migration patterns similar to those recently documented at other locations in New Hampshire and the eastern United States. Average flight height, however, was at the low end of the range of flight heights documented at other regional locations.

(d) Rare Raptor Nesting Survey

An assessment of rare raptor nesting in the vicinity of the proposed Antrim Wind Energy Project was conducted in 2011. The purpose of the rare raptor nest survey was to determine the current status of bald eagle, golden eagle, and peregrine falcon breeding activity in the Project area and surrounding vicinity. The full rare raptor nest survey report is provided in Appendix 12D of this Application.

A desktop research exercise, including data inquiries, was conducted to ascertain the location of any historic nest locations or potential nesting habitats for the species being assessed. Through this exercise, and associated consultation with the agencies, it was determined that rare raptor nest survey for this area should focus on bald eagle nesting. Pursuant to this consultation, an aerial survey was conducted on May 6, 2011 in an effort to identify and document bald eagle nesting activity within a 10-mile radius of the proposed Antrim Wind Energy Project.

During the aerial survey, two biologists (both experienced in conducting aerial avian and wildlife surveys) visually inspected the shoreline and islands of 34 lakes and ponds that were identified as having potential bald eagle breeding habitat (i.e. ponds greater than 35 acres in size) and which were located (at least partially) within a 10-mile radius of the proposed Project area. The survey was performed from a helicopter which flew as low and as slow as possible. The survey was performed during favorable weather conditions, which consisted of calm to light winds and clear conditions with unlimited visibility.

During the survey, bald eagle nesting was confirmed at Nubanusit Lake. One adult bald eagle was observed sitting on a nest located on the north shore, on the far west end of the north arm of Nubanusit Lake. At least two chicks (in gray down) were also confirmed on the nest during the flight. This nest is located approximately 3.4 miles from proposed turbine #9, which is the closest proposed turbine associated with the Project.

Nubanusit Lake is a known historic bald eagle nesting territory which has been occupied for 15 years (1997-2011). Nesting was documented in 13 of these years. This 15-year-long occupation constitutes the second most persistent bald eagle territory documented within the State of New Hampshire since 1988 (a territory at Lake Umbagog has been occupied during 22 years of monitoring (New Hampshire Audubon 2010). The female at this territory was banded as a fledgling (in Massachusetts) in 1992 and was confirmed present at Nubanusit Lake since 1999; in October of 2011, this female was found mortally injured at 19 ½ years of age (New Hampshire Audubon 2011). It is expected that a new female will occupy the matriarchal vacancy at Nubanusit Lake.

The Nubanusit Lake bald eagle territory is one of 41 occupied territories identified in New Hampshire as of 2014. The number of occupied bald eagle territories has been increasing in New Hampshire: the 41 occupied territories in 2014 represent a "record-high". Bald eagle territories have been increasing significantly recently, from 10 occupied territories in 2005, 22 occupied territories in 2010, to the currently high number of 41 (http://wildnh.com/Newsroom/2014/Q4/eagle.html).

(e) Acoustic Bat Monitoring

A passive acoustic bat monitoring survey was performed in the area of the proposed Antrim Wind Energy Project in 2011. The purpose of this survey was to sample and document bat activity patterns and species composition within the proposed Project area during spring, summer and fall seasons, when bats are known to be active. The full study report on acoustic bat monitoring is provided in Appendix 12C of this Application.

Anabat II detectors (Titley Electronics Pty Ltd.) were used based upon their widespread use for this type of survey, their ability to be deployed for long periods of time, and their ability to detect a broad frequency range, which allows detection of all species of bats known to occur in New Hampshire.

A total of six detectors were deployed in the proposed Project area by April 7, 2011. Two detectors were deployed on the guy wires of an existing meteorological tower located at the east end of the Tuttle range. The remaining four detectors were deployed throughout the proposed Project area. These detectors were suspended from trees along forested corridors and adjacent to wetlands where bats are likely travel or forage. Detectors were programmed to begin monitoring at one half hour before sunset each night, and to end monitoring at one half hour after sunrise each morning. The detectors were downloaded periodically during the study timeframe, and were removed in late October, 2011.

All data collected was inspected to screen out bat calls, and each call file was identified to guild and to species, when possible. This method of guild identification represents a conservative approach to bat call identification.

Detailed weather data as recorded by the meteorological tower on Tuttle Hill was also obtained. These data were applied to describe bat activity levels in relation to site-specific weather variables, as such variables have been documented to affect rates of bat mortality at operational projects in the Northeast.

<u>Spring Results</u>

Spring acoustic bat surveys were conducted between April 7 and June 1, 2011. The six detectors recorded a total of 1,483 bat call sequences yielding an overall detection rate of 4.9 bat call sequences per detector-night.

Rate of detection varied among individual detectors (ranging from 5 sequences at the high detector on the met tower, to 760 sequences at a lower elevation, forested site). Detection rates also varied by night, ranging from 0.1 sequences per detector-night, to 14.1 sequences per detector-night. These types of variation are typical of this type of survey.

Bats within the *Myotis* genus comprised the greatest overall percentage of detected call sequences (32 %) recorded in the spring; however, most of these sequences were recorded at a single detector over only a few nights. The big brown bat/silver-haired bat guild was the second most commonly identified guild, comprising 31 percent of the total call sequences recorded. Most call sequences within this guild were identified as big brown bats or big brown/silver-haired bats, and only a small fraction were classified as silver-haired bats. Hoary bats comprised 12 percent of bat call sequences recorded; this species was recorded at all six detectors. The eastern red bat/tri-colored bat guild was the least commonly detected guild, comprising only 1 percent of the recorded call sequences. Twenty-four percent of call sequences were classified as "unknown" due to their relatively short length or quality.

Overall, spring 2011 acoustic bat surveys documented variable activity levels within the Project area, although results suggest that activity increased in May relative to April.

Summer/Fall Results

Summer/fall acoustic bat surveys were conducted between June 1 and October 23, 2011. The six detectors recorded a total of 35,450 bat call sequences yielding an overall detection rate of 52.4 bat call sequences per detector-night.

Among sampling locations, detection rates ranged from 2.6 to 126.2 bat call sequences per detector-night. Typical of this type of survey, activity levels varied considerably among nights within the survey period and among detectors. Bats within the big brown bat/silver-haired bat (BBSH) guild comprised the greatest overall percentage of detected call sequences (48%, n=17,006). The majority of BBSH calls were recorded at the low detector positioned on the met tower. The eastern red bat/tri-colored bat guild comprised 15 percent of the recorded call sequences. The *Myotis* guild comprised 12 percent and the hoary bat guild comprised 5 percent of the recorded call sequences. Twenty of call sequences were classified as "unknown" due to their relatively short length or quality.

Of note, hoary bats were detected at five of the six detectors during the summer/fall study period, and species belonging to the *Myotis* guild and the eastern red bat/tri-colored bat guild were recorded by all six detectors.

Overall, summer/fall 2011 acoustic bat surveys documented variable activity levels within the Project area, although results suggest that activity was highest in July and August.

(f) Bat Mist Netting Survey

A bat mist netting survey was conducted for the proposed Project in the summer of 2011. The full bat mist netting survey report is provided in Appendix 12E of this Application.

Consultation with the New Hampshire Fish and Game Department ("NHFGD") and the U.S. Fish and Wildlife Service ("USFWS") on June 21, 2011 resulted in an agreed upon protocol for a mist net survey at the proposed Project. The primary objective of this summer survey was to document the potential presence of the eight bat species known to occur in the region.

The summer 2011 mist net survey was conducted at four survey sites, as agreed upon during consultation. Two of these sites were located at the south end of the proposed area of Project development, on or near Willard Mountain; one site was located in a wetland near the center of the area of proposed development; and one site was located near the existing meteorological tower on Tuttle Hill, at the northeast end of the area of proposed development. There were no suitable mist net sites on the immediate summits of Tuttle Hill or Willard Mountain, so sites were placed slightly off the peaks where better canopy closure provided more suitable mist net set locations.

The location of mist net sites was based on habitat features that may be selected by foraging little brown and northern long-eared bats, as well as eastern small-footed bats. Good-quality bat capture sites were sought; such sites are located in potential travel corridors such as forest roads, trails, streams, or other linear corridors that serve to funnel traveling bats into mist nets.

Mist net surveys were conducted on eight survey nights, which commenced on July 12, 2011 and were completed on July 28, 2011. During each sampling event, two mist net sets were erected over trails, roads, or across forest gaps. Each mist net set contained three vertically-stacked nets.

One bat was captured during 41 total survey hours among the four survey sites. This juvenile, male, big brown bat (*Eptesicus fuscus*), weighing 17.25 grams, was captured on July 27, 2011 at the northeastern survey site (located down slope from the meteorological tower on Tuttle Hill). This bat was banded with NHFG band # 43152. No other bats were captured during the bat mist netting survey.

Low capture rates were not unexpected for this survey location. Mist net surveys can be biased toward those species that fly beneath the forest canopy such as North American *Myotis* species; as such, the relative abundance of expected captures is expected to trend toward *Myotis* species. In New England, high concentrations of *Myotis* species are generally expected at low elevations, where temperatures tend to be warmer and more stable than at higher elevations; however, *Myotis* bats are still expected to be present and active in lower concentrations at higher elevations such as ridge tops. For these reasons, it was expected that this study would result in the capture of at least some *Myotis* bats. The capture of only one bat (which was not a *Myotis* species) was not the expected outcome of this effort. While it is not known, it is possible that the capture of only a single individual is indicative of diminished populations of bats as a result of white-nose syndrome ("WNS").

WNS is an emerging disease that has spread throughout the New England states in the past five years and has resulted in the unprecedented devastation of all 6 bat species that hibernate in caves or mines in the northeast. *Myotis* species have been most affected by this disease. New Hampshire may soon list the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*) as state endangered or threatened, due to rapid and dramatic population decline caused by WNS. Northern long-eared bat were listed as threatened under the federal Endangered Species Act on April 2, 2015.

(g) Impacts and Mitigation for Avian and Bat Species

Potential impacts to birds and bats during operation of the facility include direct mortality through either collision or barotrauma, and indirect impacts such as habitat loss through displacement or increased energy demands due to turbine avoidance during migration. In order to address each type of potential impact, AWE developed an Avian and Bat Protection Plan ("ABPP") for the Antrim Wind Energy Project during the development of the original project proposal. In the intervening time between then and the current proposal, the USFWS has changed the terminology used to describe the plan to a "Bird and Bat Conservation Strategy" ("BBCS"). The USFWS has also issued updated guidance regarding eagle conservation. In consultation with USFWS the plan has been updated to be consistent with the most recent guidance.

The BBCS describes, in detail, the tiered approach that was used to assess potential risk to avian and bat species associated with the proposed Antrim Wind Energy Project. It also describes how the results of wildlife studies have been and will be applied during Project design, construction and operation in order to avoid and minimize impacts to avian and bat species. Furthermore, post-construction study, monitoring and reporting commitments are defined. Finally, an adaptive management plan is proposed for addressing potential changes and unexpected events over the life of the Project.

The complete BBCS is provided in Appendix 12F to this Application.

It should be noted that in the past, developers have conducted extensive pre-construction risk assessments to calculate expected mortality at their proposed facilities. Recent studies have shown, however, that there is little correlation between pre-construction risk assessments and actual mortality of avian species at wind farms (Ferrer et al. 2011, de Lucas et al. 2008, Sharp et al. 2011). As such, it is difficult to predict expected mortality rates at a proposed facility. The BBCS is designed to continuously work with USFWS and NHFGD in order to adapt to unknown circumstances, so that unexpected events and changes over time may be addressed.

In addition, AWE has successfully negotiated several local land conservation agreements which will protect approximately 908 acres of land within and adjacent to the proposed Project. This initiative will conserve valuable undeveloped lands in perpetuity. These lands include foraging and nesting or roosting (for tree roosting bat species) habitat for the typical avian and bat species that are expected to occur in the vicinity of the proposed Project.

It should also be noted that the proposed Project is a clean and renewable energy facility that will displace need for energy from other sources which produce toxic waste (see Section I.3). This elimination of tons of toxic waste from our atmosphere as a result of Project operation provides a net environmental benefit to wildlife populations, including birds and bats.

(h) General Wildlife Impact Assessment

AWE has conducted an assessment of general impacts to wildlife, which appears in Appendix 12G. Direct impacts to wildlife from construction and operation of the Project are not expected to be a significant concern. Mortality monitoring at other projects in similar settings suggest that wildlife mortality is low. See Attachment A to Appendix 12G. In addition, the BBCS, Appendix 12F-1, incorporates monitoring and continued consultation with appropriate agencies to provide additional protection to avian and bat species on the site. With regard to impacts from habitat alteration, the assessment concludes that the narrow footprint of 11.3 acre development represents a small incision into a large block of habitat and that the habitat conservation effort coming from the

Project will ensure that a significant portion of the habitat block will remain intact. Thus, construction or operation of the Project is not expected to significantly alter any wildlife populations in the region. See Appendix 12G and Attachment A.

In the 2012-01 SEC docket concerning the Antrim Wind Project, the Committee found that the Project would not have an unreasonable adverse effect on the natural environment if certain conditions recommended by NHF&G were imposed and the plan set forth in the ABPP/BBCS was followed. AWE does not object to those requirements and has incorporated the NHF&G recommendations into the BBCS and this Application. Furthermore, the habitat impacts of the Project have been reduced, while the conservation benefits have increased since that finding was made.

I.6. Public health and safety

AWE is committed to building and operating the Project with the utmost concern for public health and safety. Below is a discussion of how AWE has addressed various areas of public health and safety.

I.6.a. Sound

AWE will not produce noise that will unreasonably adversely affect nearby residents or the general public.

A comprehensive sound level assessment was conducted for AWE by Epsilon and Associates, Inc. Baseline sound levels were measured to characterize the existing background sound levels within the area. Turbine-only sound levels were then modeled throughout the entire wind farm and off-site, so as to determine future sound levels. In making these forecasts, modeling was based on the Siemens SWT-3.2-113 turbine. Sound levels due to wind turbine operation are expected to be less than 40 dBA at all residences, the nearest one being a half-mile away. While there are no federal, state, or existing local noise standards which would apply to the Project, it is instructive to note that the Project's projected sound levels will be well below the standards outlined by the SEC in its decisions on comparable wind turbine projects (Lempster Wind, Granite Reliable Power Windpark and Groton Wind) as well as community noise guidelines published by the World Health Organization and the U.S. Environmental Protection Agency. The Project sounds levels will also be below the proposed levels in the SEC's final Order in Docket 2012-01 as well as the SEC's draft rules.

The Project also includes a collector substation with a transformer. When transformer noise was considered in the sound level assessments, the cumulative sound levels at all residences remained below the 40 dBA level described above. Please see Appendix 13A for a copy of the Sound Level Assessment Report.

I.6.b. Ice Shedding

The potential risk to the public due to ice shedding is minimal. Siemens' Wind Turbines include safety measures should an icing event occur. The mechanical meteorological instruments (wind vane and anemometer) are typically affected by icing prior to ice deposits reaching a thickness on a blade(s) that could potentially lead to safety hazards. If the wind vane or anemometer is affected by ice, the wind turbine controller system will automatically shut down the turbine and an error message will be logged. Likewise, if the SCADA system registers a variance in power output on the basis of the anemometer wind speed measurement and the power output actually measured, or, if the Turbine Condition Monitoring ("TCM") system detects an increase in vibration levels due to ice build- up, regardless of whether there was icing present on the meteorological instruments, the turbine controller system will automatically either reduce rotor speed and power or shut down the turbine until the icing subsides. The access road, which is the primary means of access to the Project area, will be secured with a locked gate. Clearly visible warning signs concerning safety risks related to winter or storm conditions shall be placed on access roads to the Wind Farm no less than 750 feet from each Wind Turbine tower base and on informal roads and trails in the vicinity of the Project at no less than 500 feet from each Wind Turbine tower base. In addition, the Project is located in a remote and undeveloped area (as previously discussed, the nearest residence is one half-mile away), with significant setbacks from adjacent property lines. In its Agreement with the Town of Antrim (Appendix 17), AWE has committed to maintaining a setback of a minimum of three times the turbine height from any non-participating landowner's existing occupied building and at least 1.5 times the turbine height from the nearest public road right-of-way. For the two turbines closest to property lines, AWE has a setback waiver from the abutter for one, and the other maintains a setback of 1.1 times the blade tip height, which is consistent with industry practice employed to protect abutting properties from ice throw risk. Of note, the latter property is a woodlot, and is not a residential property.

I.6.c. Tower Collapse/Blade Throw

Tower collapse and blade throw incidents are extremely rare, are primarily associated with the early years of modern wind power production, and currently represent minimal danger to public health and safety. Industry improvements in design, manufacturing, and installation have greatly reduced such occurrences. Each Siemens SWT-3.2-113 wind turbine is designed in accordance with international engineering standards, and is equipped with safety features designed to minimize the chance of tower collapse or blade throw. The Siemens SWT-3.2-113 turbines have state-of-the-art braking systems, pitch controls, sensors and speed controls that operate to reduce the risk of overspeed which can lead to blade and or tower failure. Additionally, the turbines' TCM system monitors sensors that are located throughout the turbine, and should vibration levels deviate from normal operations, the turbine will cease operation. In addition, Siemens uses a proprietary IntegralBlade® manufacturing process, where blades are built in one piece using a closed process which provides superior strength and resilience. Siemens' blades have no glued joints that can act as weak points, significantly reducing the risk of water ingress, cracking or damage due to lightning. In the extremely unlikely event that tower collapse or blade failure occurs, operations will immediately cease, the emergency response plan protocols will be followed, including notification of local emergency response services, and an investigation will be initiated to determine the cause of the failure.

I.6.d. Shadow Flicker

Rotating turbine blades which create intermittent shadows that fall inside a structure can create a flicker effect known as "shadow flicker." This phenomenon only occurs under certain circumstances: the turbine blades must be rotating; it must be daylight; the sun must be low in the sky so as to cast shadows; the structure must have a narrow opening or unshaded window that faces the turbine; the structure must be within ten rotor diameters of the turbine; and there must also be someone present to experience the shadow flicker effect. Without all of these variables happening simultaneously, the shadow flicker has no impact. Therefore, not only is shadow flicker not an everyday event, it only occurs if several very specific conditions are present.

AWE engaged Epsilon Associates, Inc. to perform a Shadow Flicker study for the Project. The study report on shadow flicker is provided in Appendix 13B of this Application. The study used widely-accepted modeling software in its evaluation, taking into account terrain, latitude and longitude, turbine dimensions, blade rotation speed, expected rotor operational time, expected rotor orientation, sun coverage, sun angle, sunshine probabilities, and the locations of potentially affected structures (it was assumed that each structure had windows all the way around). The study conservatively assumed that the area lacks vegetation and intervening structures. Because of this some structures which are shown to have the potential to experience shadow flicker may in fact be screened by vegetation.

As the study shows, a total of 19 locations are expected to experience some level of shadow flicker. Of that number 18 are expected to have between 1 and 10 hours of expected shadow flicker per year and 1 location is expected to have 10 hours and 10 minutes of shadow flicker per year.

Although there are no shadow flicker regulations with specific limits directly applicable to this Project, this issue has been addressed in other jurisdictions. According to the Danish Wind Industry Association (DWIA), a German court has ruled that 30 hours of actual shadow flicker per year was acceptable at a neighbor's property. In addition, a 30 hour per year limit has been adopted by multiple jurisdictions in the United States. For example, in Connecticut, Section 16-50j-95, part (c) of the Regulations of Connecticut State Agencies limits the annual duration of shadow flicker to 30 hours at any off-site occupied structure. In 2008, the New Hampshire Office of Energy and Planning released a model ordinance for small wind energy systems, which included a shadow flicker limit of 30 hours per year for abutting occupied buildings. This Project is well below widely accepted limits of 30 hours per year and thus will not cause any unreasonable adverse effects.

I.6.e. Lightning Strikes

The lightning protection system in the Siemens SWT-3.2-113 is designed to protect each of the turbines from the effects of direct and nearby lightning strikes, and has shown excellent performance all over the world. The Siemens turbines are designed and tested for lightning protection level ("LPL") 1 of 200 kA. Each blade features a lightning receptor system that is integrated into the nacelle bedplate and, in turn, is connected to the tower through a series of brushes and cabling. All main components are efficiently grounded and metal oxide arrestors in the controller are designed to provide transient protection from the effects of nearby strikes. Both the nacelle and the tower also act as a faraday cage, thus preventing a fire caused by lightning. Should a lightning strike occur, these systems conduct the lightning from the blade to the tower to the ground via a grounding system. For lightning strikes at or below 200 kA, this is designed to prevent damage to the blade, the tower, and the electrical components. As a result lightning strikes should not present any danger to the health and safety of the public. As an additional safety measure, in the case of a lightning strike to a turbine, an error code will be logged so that operations and maintenance staff on site can inspect the turbine for possible damage, and should any damage occur that causes vibration levels to deviate from normal operating levels, the turbine controller system will automatically reduce rotor speed and power or shut down the turbine.

I.6.f. Fire

Fires associated with wind turbines are extremely rare. There are very few flammable components. The use of lubricating and other oils and the presence of electrical components, however, do present a potential for fire. The Siemens SWT-3.2-113 turbine has multiple engineering and technological features to minimize the risk of fire. Each WTG has a fire detection system that is connected to the main control unit and to the SCADA. Smoke detectors are placed in all important electrical panels and connected to individual digital inputs on the wind turbine control system. Specific locations of smoke detectors include: (i) Generator: the generator is equipped with a smoke detector in the cooling circuit; (ii) Nacelle: the nacelle is equipped with smoke and heat detectors; (iii) Tower Top: the underside of the casted bedframe includes a smoke detector; (iv) Power Unit: internal smoke detectors are located in all electrical panels; (v) Transformer Unit: smoke detectors are located inside the transformer room. In addition, the turbine transformers are not located inside the Siemens turbines. The control system monitors the smoke detectors and activates all alarm systems if a fire is detected, including sending a signal to the SCADA system indicating the location of the event. The smoke detector units are failsafe. Removal of a smoke detector from its base also opens the circuit. When an alarm is registered in case of smoke (or failure of a smoke detector circuit), the turbine is stopped and the cooling fans in all cubicles are switched off in order to reduce the admission of air to a possible fire. All motors and the main circuit breaker are also switched off. An alarm from the smoke detector in the transformer room also causes a trip of the MV switchgear to switch off the transformer.

If any smoke is detected in the WTG, the SCADA system will automatically shut the turbine down, as described above, and send an alarm to the control room. In addition to the onsite Siemens operations staff, who are trained to respond to any fire or other emergencies, the SCADA system is monitored 24/7/365 by Siemens. Each Siemens WTG is also equipped with manually operated fire extinguishers. Additionally, all maintenance vehicles will be equipped with fire extinguishers and all maintenance personnel will be trained to respond appropriately to smoke and fire events.

The design elements and fire prevention and detection systems described above result in an extremely low risk of a turbine fire. As an additional safety precaution, AWE will install active fire suppression systems in the nacelle in each turbine. AWE and Siemens will work closely with Fire Trace, a third party supplier of such active fire suppression systems, to integrate those additional protections into each turbine and the Siemens services manual to ensure the risk of actual fire is further minimized and worker safety is not compromised. The Firetrace system is specifically designed for use in wind turbine applications and has been installed in other wind facilities in New Hampshire – specifically at Groton Wind. The Firetrace system will operate independently from and in parallel with the Siemens systems. This is accomplished by installing a fire suppression agent connected to nozzles that are strategically located in areas inside the turbine that may be at risk of fire. Firetrace then uses detection tubing that is run through those areas and if a fire occurs, the heat from the fire causes the tubing to rupture, which activates the release of the fire suppression agent. A trigger of the Firetrace system will also cause the turbines to shut down and will send an alarm to the control room.

The O&M building will be designed and constructed to comply with all applicable local and state fire codes.

AWE is committed to providing appropriate training to local emergency responders. AWE has met with the State Fire Marshal's Office to discuss fire safety issues associated with the Project and has incorporated the Fire Marshall's suggestions into its fire safety plan. AWE will continue to work cooperatively with that Office to address any concerns that might arise. In its Agreement with the Town of Antrim (Appendix 17A), AWE has agreed to cooperate with local emergency responders to develop and coordinate implementation of an emergency response plan for the Project. AWE has also agreed to cooperate with the Town to determine the need for the purchase of any equipment required to provide adequate emergency response to the site. In addition, should an emergency response event related to the Project result in an extraordinary expense by the Town, the agreement between AWE and the Town requires AWE to reimburse the Town for those expenses.

I.6.g. Aviation Safety

The Federal Aviation Administration has issued a Determination of No Hazard to Air Navigation for all 9 turbines located in the Project. A copy of the Determination can be found at Appendix 2E. AWE will comply with all FAA requirements for marking and/or lighting of tall structures.

However, if the FAA issues a revised Advisory Circular setting forth accepted standards for radar activated lighting systems, AWE will install and operate such a system at the Project pursuant to the terms of AWE's Agreement with AMC. *See* Appendix 10A.

I.6.h. Hazardous Materials

Please see Section E.6.b. for a discussion of hazardous materials.

I.6.i. Stray Voltage

Stray voltage is a small voltage (less than 10V as defined by the U.S. Department of Agriculture) that is generally caused by common neutral to earth grounding. Stray voltage will not be an issue at the Antrim Project because neutral currents will be extremely minimal if not zero, and the turbines will be significantly bonded to the grounding system. All related metal structures, equipment, wires and cabling will be isolated and/or guarded to prevent public contact.

I.6.j. Limiting Access

Access to the Project site will be limited to authorized personnel. As noted earlier, the entire Project will be located on private land with no formal public access. The access road, accessible from only one public location, will be gated and locked. As noted above in I.6.b, and as outlined in the Agreement between AWE and the Town of Antrim (Appendix 17), warning signs will be placed on access roads to the Wind Farm no less than 750 feet from each Wind Turbine tower base and on informal roads and trails in the vicinity of the Project at no less than 500 feet from each Wind Turbine tower base. Wind turbine exteriors shall not be climbable up to fifteen feet above the ground, and all access doors to wind turbines and electrical equipment will be locked, fenced, or both, as appropriate. Warning signs concerning voltage will be placed on all of the Project's aboveground electrical collection facilities as well as at the collection and interconnection substations.

I.6.k. Emergency Response

AWE has entered into an Agreement with the Town of Antrim that addresses requirements for AWE to develop an Emergency Response Plan ("ERP") upon request of the Town. AWE has met with the State Fire Marshall and the Antrim Fire Department and has agreed to develop the ERP in cooperation with both parties. The plan will be completed prior to commencement of construction, will be designed to comply with all applicable laws and regulations, including NFPA 1-2009, will conform to requirements of the Agreement with the Town of Antrim and shall include the following elements:

- Clearly identified duties and responsibilities under the plan for owners, plant managers and staff and technicians

- Procedures for notifications in the event of emergencies, including methods of notification and identification of all individuals required to be contacted and the methods of contact.
- Details for all emergency response equipment required to be kept on-site
- Protocols for routine inspections of all emergency response equipment
- Protocols for routine drills to test emergency response procedures contained in the ERP
- Appropriate documentation, including maps, of the location of all emergency response equipment, emergency exits, assembly areas, evacuation routes, known hazardous areas, propane or fuel tanks, fire alarm pull stations and fire alarm control panel locations, plant drawings showing turbine locations (including 911 locations), substation and access points for emergency response personnel
- Clearly posted emergency contact lists to include, site personnel, Law Enforcement, Fire, Medical, EPA, OSHA, Poison Control, National Control Center and other contacts as appropriate
- Procedures for reviewing and updating the ERP annually as necessary
- Emergency Response Procedures
- Plant Evacuation Procedures
- Fire Response Procedures
- Oil/Chemical Spill Procedures
- Safety protocols for hazardous weather conditions, including snow, extreme heat/cold
- Training and Record Keeping Requirements

A copy of Siemens' standard on-shore emergency response document, which will be adapted to the Project site as necessary is included in Appendix 20.

In the 2012-01 SEC Docket concerning Antrim Wind, the SEC found that the Project would not have an unreasonable adverse effect on public safety. While the turbine manufacturer has changed since that time, Siemens is a leading global turbine supplier with a proven turbine and operational track record. The change in turbine manufacturer has also resulted in a decrease in the expected sound and shadow flicker impacts.

J. EFFECTS OF THE FACILITY ON THE ORDERLY DEVELOPMENT OF THE REGION AND ESTIMATE OF THE IMPACTS OF CONSTRUCTION AND OPERATION OF THE FACILITY ON:

J.1. Local land use

Apart from the immediate Project area, local land uses will be able to continue in much the same manner as they have for several decades. Much of the land surrounding the Project area is open space, significant portions of which have been placed in various forms of conservation status. Other local land uses include timber harvesting, passive recreation, and widely scattered residential areas. The Project is compatible with these local land uses.

AWE has leased approximately 1,870 acres of private land from six landowners for the development of the Project. Including anticipated setbacks and undisturbed buffer areas, the Project will occupy approximately 11.3 acres of permanent development in the form of roads, turbine foundations, and other facilities. The rest of the land will remain as open space, with approximately 908 acres of land placed into permanent conservation within 180 days of the commercial operations date of the Project. Development pressure on the remaining land outside of the conserved areas will be reduced as a result of the Project, as there will be significantly less motivation for landowners to consider developing or subdividing their land due to the lease revenues from the Project. In addition, local landowners who have leased their lands to AWE will retain rights to their land, which will allow them to use it much as they currently do. The Project, therefore, represents a reasonable degree of development that also largely preserves the status of an area that has long been associated with open space, commercial timber production, and passive recreation.

<u>Commercial timber production</u>

Timber harvesting has been occurring in this area for many decades. In fact, as noted earlier, hundreds of acres within the Project area (but unrelated to the Project) have been logged as recently as last year. Local landscape features reflect these management practices, with haul roads and different forest cover types and ages evident. Landowners who have leased their land to AWE will retain the right to harvest timber on their properties much as they do today. As a result, the Project will not impede this historic use of local lands.

<u>Outdoor recreation</u>

The Project will have almost no effect on the public's ability to use the general area for outdoor recreation. As can be seen in Figure J.1, the only formal recreation (a hiking trail) area is within one mile of the Project. Informal local recreation such as hiking and hunting is anticipated to continue unrestricted in the Project area, except in the immediate vicinity of the Project facilities. The Project area will not be fenced, with the exception of the substation yard and operations and maintenance building; these structures are located close to the PSNH corridor and Rte. 9 and are not in an area that is likely to be used for recreational activities. In addition, the new conservation land area will be, for the most part, open to public access and will preserve or enhance recreational activities should the Project be built.

Non-motorized trails

The Project does not directly impact any non-motorized trails, as there are no maintained public-access trails on any of the parcels leased by AWE. Non-motorized trails that do exist within the broader area will continue to be used as they are today. Please see Section I.1.a for a discussion of potential visual impacts to these recreation resources.

Wildlife and bird watching

As noted earlier, the Project is located entirely on private land, with no formal public access points and no maintained public trail systems. Wildlife and bird watching activities are generally limited to lands adjacent to the Project area. These lands include the Hosmer Wildlife Management Area (managed by the State of New Hampshire) and the dePierrefeu-Willard Pond Wildlife Sanctuary (owned and managed by New Hampshire Audubon). Please see Section I.1.a for a discussion of potential visual impacts to these areas. Please also see Section I.5.b for a discussion of potential impacts of the development of the Project on wildlife and birds.

Motorized trails

There are no maintained motorized trail systems on any of the parcels leased by AWE. As a result the Project will not impact the public's ability to use the existing motorized trail systems within the general area.

Hunting and Fishing

Local landowners who have leased land to AWE will continue to determine whether to allow hunting on their lands. As noted above, apart from the immediate Project area the lands leased by AWE will remain as de facto open space, thereby continuing to provide land available for hunting should individual landowners wish to allow it. Therefore the Project is not expected to have an impact on hunting activities. In addition, the Project does not directly impact any fisheries, such as streams, ponds, or lakes, so there will be no impact on fishing opportunities.

Boating

The Project will not directly impact boating opportunities. Gregg Lake and Willard Pond, both of which are more than one mile away from the nearest turbine, are the nearest bodies of water with public boating access. Please see Section I.1.a for a discussion of potential visual impacts to these recreation resources. AWE's Gregg Lake letter agreement with the Town of Antrim assures funding that will be used to enhance the facilities in this area.

Swimming

The Town of Antrim maintains a public swimming beach on Gregg Lake. The Project will not directly impact the public's ability to access or use the beach. Please see Section 1.1.a for a discussion of potential visual impacts to this recreation resource. AWE's Gregg Lake letter agreement with the Town of Antrim assures funding that will be used to enhance the facilities in this area.

J.2. Local economy

J.2.(a) Economic Effects

Wind power development offers significant economic benefits from the associated manufacturing, permitting, construction, and on-going operation activities. The economic benefits of wind projects for communities include the creation of local jobs, increased tax revenues, and generation of lease income for landowners.

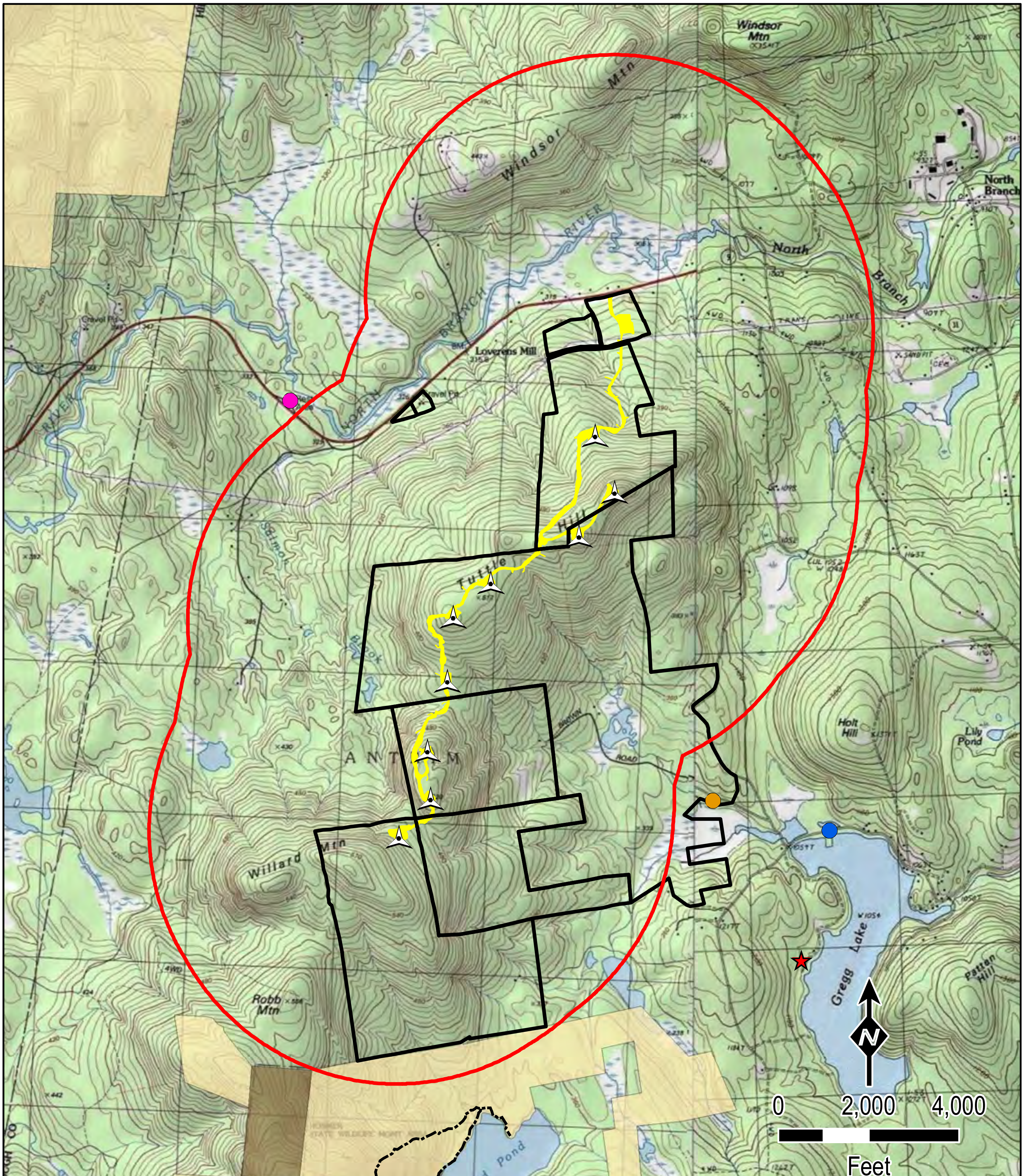
The Project's development activities have already begun to bring investment into the local area economy. To date, AWE has spent over $4.5 million on development activities, with over 45% being spent in New Hampshire on services including professional services, and lease payments.

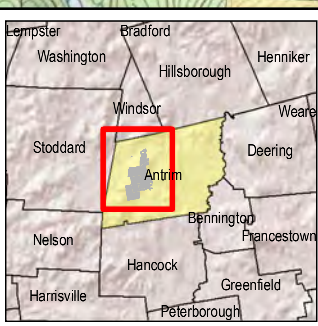
In 2011 AWE contracted with Professor Ross Gittell and Matt Magnusson from the University of New Hampshire's Whittemore School of Business and Economics to study the potential economic impacts of the Project. In 2014, Mr. Magnusson, now at Seacoast Economics, performed an updated study on the Project's economic impacts. As the economic study (Appendix 14A) demonstrates, the positive economic benefits for Hillsborough County and the surrounding area of southern New Hampshire from the Project are expected to be significant.

Mr. Magnusson's 2014 study update also evaluated the potential impacts of the Project on tourism in the region. As discussed in Section C.6 of the Application and Appendix 14A, there is no evidence to suggest that there will be any negative impact on tourism due to the construction of the Project. In fact, the results of the study *The Impact of Wind Farms on Tourism in New Hampshire* (Dec. 2013), show that growth in state park revenue has increased more at state parks closest to the Lempster Wind Project than the aggregate state park revenue growth and there did not appear to be any impact on meals or rooms sales in the region or weekend traffic in the region since the introduction of the Lempster Wind project.

J.2.(b) Property Values

Studies show that the Project will not have an adverse impact on residential property values. There is a growing body of research assessing the relationship between wind energy projects and residential property values. This research has not found a statistically significant decline in property values as a result of wind power projects.





V:\PROJECTS\AUGUSTA\Eolian\ANTRIM\Figure J1 Recreation 8x11.mxd

Legend

- Proposed WTG Location
- 1 Mile Buffer From Project Area
- Project Parcels
- Proposed Disturbance Area

Recreational Land Use

- Natural Area
- Hunting Area

Recreational Spots

- Campground
- Natural Area
- Picnic Area
- Water Sports Area
- Audobon Society Hiking Trails

Recreation Information courtesy of NH GRANIT and the Audobon Society of New Hampshire

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

ANTRIM, NH

Figure J.1

Formal Recreation Areas

Produced by: TRC | 1/29/2015

In 2011 AWE contracted with Professors Gittell and Magnusson to investigate the impact of the Lempster Wind 24 MW (12 turbine) wind energy project located in the Town of Lempster, Sullivan County, New Hampshire. This is the first significant commercial wind energy installation in New Hampshire and became operational in the fourth quarter of 2008. As such, the Lempster Wind project serves as a relevant case study to assess the relationship between wind energy development and property values in New Hampshire. In 2014, Mr. Magnusson updated the study. In the updated study, Mr. Magnusson was able to include literature reviews of several new national and regional studies evaluating the relationship between wind farms and local property values, as well as to include some additional studies performed for New Hampshire, which looked again at Lempster and also the Groton Wind Project. The statistical analysis was also re-conducted using the primary study data.

The results of the updated 2014 Lempster property value study support the 2012 study's findings in concluding that there is no evidence to suggest a statistically significant impact on local real estate values caused by wind farms in general, or by the Lempster Project in particular. In turn, based on this data, it is highly likely the Antrim Project, if constructed, would have no adverse impacts on local residential property values. The updated study is included with this Application as Appendix 14B.

J.3. Local employment

The construction phase of the Project is the time period when there will be the greatest economic activity and benefits for Hillsborough County and the surrounding area, contributing $11.6 million to the local economy. During this phase, the Project is expected to create or support a total of 84 full-time equivalent (FTE) local jobs. This employment figure includes jobs directly filled by local labor and consists of construction employment and indirect and induced employment from Project wages and local Project expenditures (the so-called multiplier effect).

Once the Project is complete it is expected to contribute $2.2 million annually to the local economy through the creation of an estimated 4 FTE jobs for workers employed by AWE and an additional 8 FTE jobs in the local area. The Project is expected to bring $53.4 million in increased economic activity to New Hampshire over the next 20 years.

The development of the Project, then, is expected to have a significant immediate and long-term net positive impact on the local economy through the creation of jobs, increased tax revenues, and lease payments to local landowners. Additional details on the jobs benefits are included in the Economic Impact assessment in Appendix 14A.

K. PRE-FILED TESTIMONY AND EXHIBITS SUPPORTING THE APPLICATION

STATE OF NEW HAMPSHIRE

BEFORE THE SITE EVALUATION COMMITTEE

Docket No. SEC 2015-02

<u>APPLICATION OF ANTRIM WIND ENERGY, LLC</u>
<u>FOR A CERTIFICATE OF SITE AND FACILITY</u>

PREFILED DIRECT TESTIMONY OF ROBERT D. O'NEAL
ON BEHALF OF ANTRIM WIND ENERGY, LLC

September 10, 2015

Q. Please state your name, title and business address.

A: My name is Robert O'Neal. I am a Principal at Epsilon Associates, Inc. ("Epsilon"). My business address is 3 Clock Tower Place, Suite 250, Maynard, MA 01754.

Q. Briefly summarize your educational background and work experience.

A: I received a Bachelor of Arts degree in Engineering Science from Dartmouth College in 1983. I earned a Masters in Atmospheric Science from Colorado State University in 1987. I have over twenty-five years of experience in the areas of community noise impacts, meteorological data collection and analyses, and air quality modeling. My noise impact evaluation experience includes the design and implementation of sound level measurement programs, modeling of future impacts, conceptual mitigation analyses, and compliance testing. I am a member of the Institute of Noise Control Engineers ("INCE"), the Acoustical Society of America, the American Meteorological Society, and the Air &Waste Management Association.

I am Board Certified by INCE in Noise Control Engineering and I am a Certified Consulting Meteorologist (CCM) by the American Meteorological Society. Both of these certifications are national programs.

From 1987 until 1997, I was employed by Tech Environmental, Inc. where I was a Project Manager responsible for noise impact assessments and air quality modeling studies. In 1997, I joined Earth Tech, Inc. as a Program Director. In that capacity, I was responsible for community noise studies for electric generating stations, as well as meteorological analyses, and air quality modeling. In 2000, I joined Epsilon Associates, Inc. as a Senior Consultant. In 2004, I was made a Principal of the firm. My practice at Epsilon continues to focus on community noise impact assessments and meteorological analyses for power generation facilities in the Northeast, Mid-Atlantic region, the Midwest, and the Southwestern United States. Since 2004, my noise impact assessment work has focused on wind energy generation facilities.

Additional detail regarding my education, background and experience is contained in my curriculum vitae which is attached hereto as Attachment RDO-1.

Q. Have you ever testified before the New Hampshire Site Evaluation Committee ("SEC")?

A. Yes. I gave testimony on the issue of sound levels before the SEC in Docket 2010-01, which pertained to Groton Wind, LLC's application for a certificate of site and facility. I also provided testimony to the SEC regarding the same subject matter in connection with Antrim Wind Energy, LLC's ("AWE") application for a certificate of site and facility in Docket 2012-01.

Q. What is your role in relation to the Antrim Wind Project and AWE's application for a certificate of site and facility (the "Application")?

A. I have been retained by AWE to evaluate and assess sound levels and "shadow flicker" effects associated with the operation of wind turbines and a collector substation associated with the Antrim Wind Project (the "Project").

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to present and discuss the results of the comprehensive sound level assessment conducted by Epsilon in connection with the Antrim Wind Project. Epsilon's Sound Level Assessment Report is attached as Appendix 13A to AWE's Application. I will also address the Shadow Flicker Analysis performed by Epsilon relative to the Project.

Q. Are you familiar with the site of the wind energy facility proposed in AWE's Application?

A. Yes. I have reviewed the site plans and discussed the project with representatives of AWE. I have also personally visited the Project site and the area surrounding it to assess potentially sensitive receptors to sound emissions from the Project.

I. <u>Sound Level Assessment Report</u>

Q. What assessments did Epsilon conduct in connection with sound levels associated with the proposed Project?

A. Epsilon conducted a comprehensive sound level assessment to evaluate the potential effect of sound associated with the operation of the proposed wind energy facility at the Project site. First, existing sound levels were measured at five locations intended to be representative of nearby residences in various directions from the proposed wind farm. The five measurement locations are described in detail in the Sound Level Assessment Report attached as Appendix 13A to the Application. These measurements were taken to establish background sound levels as a function of wind speed prior to operation of the proposed wind farm. By documenting existing sound levels in the community, we can place the predicted sound levels from the Project into context. Figure 5-1 of the Sound Level Impact Assessment report shows the proposed wind turbine locations overlaid upon an aerial photograph of the surrounding area, as well as the actual measurement locations, and all structures within a two kilometer radius (~1.25 miles) in any direction of each wind turbine.

Epsilon also measured existing wind speeds during the same time that it measured ambient sound levels as described above, as wind speed can have a strong influence on ambient sound levels. As the wind speed near the ground increases, the sound levels increase due to either the wind itself, and/or rustling of vegetation or other objects. Epsilon deployed a modular weather station with tripod and data logger to continuously measure the wind speed and wind direction. The wind sensors were mounted at a height of 2 meters above ground level and data were logged every 10 minutes.

Q. Does the sound measurement program conducted in 2011 remain valid?

A. Yes. Conditions in the measured area have not since been altered in any manner that could materially affect these background sound measurements. Therefore, the sound level measurement program conducted in 2011 still provides a reliable representation of community sound levels.

Q. Did Epsilon model sound levels for the wind turbines that AWE proposes to construct?

A. Yes. Epsilon modeled the predicted sound levels associated with the operation of nine (9) Siemens SWT-3.2-113 wind turbines at the Project site. Epsilon modeled sound levels for 155 potentially sound-sensitive structures within a 2-kilometer radius of each wind turbine using a height of 1.5 meters AGL to mimic the ears of a typical standing observer. Epsilon also modeled sound levels throughout a large grid of over 200,000 receptor points covering an area approximately 8 km by 10 km.

Q. Did Epsilon also perform an assessment of the predicted sound levels associated with the substation?

A. Yes. In addition to the wind turbines, the project will include a collector substation, and Epsilon has evaluated the predicted sound levels associated with the transformer required to interconnect the 34.5 kV line bringing power from the Project with the regional power grid. The proposed transformer, which is rated at 24/32/40 megavolt-ampere (MVA), has various cooling mechanisms that modestly effect its sound levels. Epsilon modeled the predicted sound levels for the transformer using sound level data for typical transformers of comparable size and assumed the maximum MVA rating, loudest cooling sound, and no barrier walls around the transformer for a conservative result.

Q. Please briefly describe the modeling scenarios used to conduct Epsilon's analysis.

A. The anticipated noise impacts associated with the Project were predicted using the Cadna/A noise calculation software. This software uses the ISO 9613-2 international standard for sound propagation. The benefit of this software is that it provides for a refined set of computations that account for topography, ground attenuation, multiple building reflections, drop-off with distance, and atmospheric absorption. The inputs and parameters employed in the model are described in detail in the Sound Level Assessment Report attached as Appendix 13A to the Application.

As indicated above, sound levels anticipated from the operation of all nine wind turbines were modeled at 155 of the closest community receptors and throughout a large grid of over 200,000 receptor points within an area of approximately 8 km by 10 km. The five monitoring locations were also covered by the modeling points. Sound levels were computed assuming that the receptors are always located directly downwind from all turbines simultaneously, an approach that provides conservative results and is required by the ISO 9613-2 calculation methodology. This conservative set of modeling assumptions has been verified multiple times through post-construction sound level measurement programs at operating wind farms. For example, post-construction sound level measurements for Groton Wind, a NH ridgeline site, found that the predicted sound levels were conservative (higher) than measured sound levels under worst-case operating conditions for sound. The modeled locations and results of the sound level modeling are depicted on a sound level contour map depicted in Figure 7-1 of the Sound Level Impact Assessment Report. For ease of reference, Figure 7-1 is submitted with this prefiled testimony and is labeled Attachment RDO – 2. The colored contour lines in Figure 7-1 show the sound levels for worst-case wind turbine operational sound levels. These are "Project-only" sound levels, and do not include contribution from existing sounds in the community ("background").

Q. Are there regulations or standards that would apply to the Project?

A. There are no state or local noise regulations that apply to the Project. However, AWE entered into an agreement with the Town of Antrim dated March 8, 2012 that imposes certain Residential Noise Restrictions upon the Project. Section 1.1 of the Agreement states that "sound from the Wind Farm during Operations at the exterior facades of homes shall not exceed 50dBA or 5 dBA above ambient, whichever is greater, during daytime and 45 dBA or 5dBA above ambient, whichever is greater, at night." Furthermore, the SEC considers sound levels when assessing an application for a certificate of site and facility for a wind energy facility such as the Project, and has imposed certain conditions in orders pertaining to previously proposed projects. For example, the SEC included several noise-related conditions in its orders approving the Lempster and Groton wind energy projects.[1] Notably, the SEC required that sound from the Lempster project not exceed the greater of 45 dBA or 5 dBA above the ambient sound level immediately outside the residences of non-participating homeowners, and required that sound levels generated by the Groton project not exceed 55 dBA (day time) or 45 dBA (night time) or 5 dBA above ambient, whichever is greater, at the outside façades of homes. The SEC has also issued draft rules in outlining application requirements and criteria for energy facilities. Section 301.08(f)(2)a of these regulations contains wind energy facility sound standards stating:

> A-weighted equivalent sound levels produced by the applicant's energy facility during operations shall not exceed the greater of 45 dBA or 5 dBA above ambient levels between the hours of 8:00 a.m. and 8:00 p.m. each day, and the greater of 40 dBA or 5 dBA above ambient levels at all other times during each day, as measured at the exterior wall of any existing permanently occupied building on a non-participating landowner's property, or at the non-participating landowner's property line if it is less than 300 feet from an existing occupied building, and these sound levels shall not be exceeded for more than 3 minutes within any 60 minute period.

Draft Revised 100-300 Rules, Site 301.08(f)(2)a (Dec. 16, 2014).

In Docket 2012-01, the previous Antrim Wind Energy docket, the SEC assessed predicted sound levels and would have imposed conditions pursuant to which sound levels could not exceed 45 dBA or 5 dBA above ambient, whichever is greater, in the day time or 40 dBA or 5 dBA above ambient, whichever is greater, at night (or 5 dBA above ambient sound levels at any time).[2] As described more fully below, the SEC based its condition requiring that night time sound not exceed 40 dBA on an *annual average* metric included in the World Health

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[1] Docket 2006-01, Application of Lempster Wind, LLC, Decision Issuing Certificate of Site and Facility with Conditions at 47-49 (June 28, 2007); Docket 2010-01, Application of Groton Wind, LLC, Decision Issuing Certificate of Site and Facility with Conditions at 80-89 (May 6, 2011).

[2] Docket 2012-01, Application of Antrim Wind Energy, LLC, Decision and Order Denying Application for Certificate of Site and Facility at 68-69 (April 25, 2013).

Organization's (WHO) 2009 report "Night Noise Guidelines for Europe," rather than the shorter-term guideline value of 55 dBA (day time – based on 16 hours) and 45 dBA (night time – based on 8 hours) included in the "Guideline for Community Noise" published by the WHO in 1999. The WHO's 1999 guideline value is therefore the more appropriate sound level limit to apply to the daily operation of a wind energy project, and is consistent with conditions imposed by the SEC in prior dockets.

Q. What other criteria are typically considered when evaluating sound levels?

A. The science of sound analysis around wind farms has developed significantly since the early wind projects of the 1990s, and there is no one sound standard to follow. It is helpful to look at guidelines put forth by a number of organizations that have proposed sound limits based on rigorous study and science. Comparing these guidelines to the limits set in past SEC dockets and the limits currently under consideration by the SEC will help establish the scientific framework for imposing proper sound limits.

A useful guideline for putting sound levels in perspective is the "Guideline for Community Noise" (World Health Organization, Geneva, 1999). This document states that daytime and evening outdoor living area sound levels at a residence should not exceed an L_{eq} of 55 dBA to prevent serious annoyance and an L_{eq} of 50 dBA to prevent moderate annoyance from a steady, continuous noise. At night, sound levels at the outside facades of the living spaces should not exceed an L_{eq} of 45 dBA, so that people may sleep with bedroom windows open. The time base for these WHO sound levels is 16 hours for daytime and 8 hours for nighttime. In other words, they are not 10-minute averages but over a longer period of time.

Since the 1999 World Health Organization (WHO) "Guideline for Community Noise" report was issued, WHO released another report in 2009 entitled "Night Noise Guidelines for Europe." The 2009 WHO report recommends a Night noise guideline (NNG) of 40 dBA. This is a health-based limit to protect the public from the adverse health effects of night noise (Executive Summary pp. XVII-XVIII). However, the 40 dBA guideline is an "$L_{night, outside}$" descriptor, which is NOT the same as a short-term measurement. $L_{night, outside}$ is defined as the A-weighted long-term average sound level determined over all the night periods of a year; in which the night is eight hours (23:00 to 07:00 local time). Thus, the $L_{night, outside}$ is an annual average, and is not an appropriate descriptor to use for evaluating a permit's compliance criteria.

Since $L_{night, outside}$ considers 365 nights of operation, there will be some nights the wind turbines do not operate at all and many others where they will operate at a level below maximum sound level. Therefore, the $L_{night, outside}$ sound level will ALWAYS be lower than the worst-case (highest) short-term sound level measured on a given night. In other words, the $L_{night, outside}$ guideline of 40 dBA, is not a 10-minute or 1-hour sound level, but is an annual level. Therefore the most recent guideline from the WHO in 2009 is less stringent than the level proposed in the draft SEC rules (short-term nighttime level of 40 dBA), and is still highly protective of public health. The Project will easily meet both guidelines.

Another useful guideline for comparing sound levels is the "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety" (U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Washington, DC, 550/9-74-004, March 1974). This document, often referred to as the "Levels" document, identifies an L_{dn} of 55 dBA outdoors in residential areas as the maximum level below which no effects on public health and welfare occur due to interference with speech or other activities. This level includes a 10 dBA "penalty" for sound levels at night (10 p.m. to 7 a.m.). This level will permit normal speech communication, and would also protect against sleep interference inside a home with the windows open. A constant sound level of 48.6 dBA 24 hours per day would be equal to an L_{dn} of 55 dBA.

Q. Please summarize the results of Epsilon's sound level studies relative to the criteria described above.

A. The predicted worst-case sound levels from the Antrim Wind Energy Project will be below 40 dBA at all occupied buildings. A review of Table 7-5 shows that the highest sound level will be under 40 dBA at receptor #24 (39.8 dBA), and this structure is a hunting cabin that is not generally occupied. The next highest sound level of 39.5 dBA is at receptor #21 which is a participating residence (Michael Ott). All other residences will be below 39 dBA under worst-case operating conditions. Therefore, the Antrim Wind Energy Project will easily meet the criteria applied to the Lempster and Groton wind projects. It will also comply with the parameters set forth by the SEC in Docket 2012-01, though the 40 dBA night time criterion imposed by the SEC in that docket was based on an annual average metric that is not applicable to the day-to-day operation of a wind project.

Q. Based upon your assessment, will sound levels associated with the Antrim Wind Project have any unreasonable adverse effects?

A. No. Sound levels due to wind turbine operation are expected to be 40 dBA or less at all participating and non-participating residences. These sound levels will meet previously approved noise conditions from the SEC, as well as the World Health Organization's 1999 and 2009 guidelines (though the 2009 guidelines should not be applied on a daily basis), and the US EPA guideline of 48.6 dBA (24-hour) which is equal to an L_{dn} of 55 dBA. The Project will also comply with the limit set in the draft rules currently being considered by the NH SEC.

II. Shadow Flicker Analysis

Q. What analysis did Epsilon perform regarding shadow flicker associated with the Project?

A. Epsilon conducted a shadow flicker analysis to predict the expected annual duration of shadow flicker caused by the operation of the nine (9) proposed wind turbines at modeled locations in the area of the Project. A copy of Epsilon's Shadow Flicker Analysis is attached to AWE's Application at Appendix 13B.

Q. Did anyone assist you in performing the analysis and developing the conclusions drawn in the shadow flicker analysis report?

A. Yes. Richard M. Lampeter, a Senior Consultant at Epsilon who has significant experience in shadow flicker modeling, assisted in conducting and preparing the Shadow Flicker Analysis and developing the results and conclusion set forth below.

Q. What is "shadow flicker"?

A. With respect to wind turbines, shadow flicker can be defined as an intermittent change in the intensity of light in a given area resulting from the operation of a wind turbine due to its interaction with the sun. Indoors, an observer experiences repeated changes in the brightness of the room as shadows cast from the wind turbine blades briefly pass by windows as the rotor gyrates. In order for this to occur, the wind turbine must be operating and the sun must be shining. A stationary wind turbine only generates a stationary shadow similar to any other structure.

Q. Are there any regulations limiting or otherwise controlling shadow flicker resulting from the operation of wind turbines that would apply to the Project?

A. There are no federal, state, or local regulations regarding shadow flicker that will apply to the Project. Although there are no shadow flicker regulations with specific limits directly applicable to this Project, this issue has been addressed in other jurisdictions. According to the Danish Wind Industry Association (DWIA), a German court has ruled that 30 hours of actual shadow flicker per year was acceptable at a neighbor's property.[3] In addition, a 30 hour per year limit has been adopted by multiple jurisdictions in the United States. For example, in Connecticut, Section 16-50j-95, part (c) of the Regulations of Connecticut State Agencies limits the annual duration of shadow flicker to 30 hours at any off-site occupied structure.[4] In 2008, the New Hampshire Office of Energy and Planning released a model ordinance for small wind

[3] Danish Wind Industry Association, 2003. http://xn--drmstrre-64ad.dk/wp-content/wind/miller/windpower%20web/en/tour/env/shadow/index.htm. Accessed in December 2014.

[4] State of Connecticut, 2014. http://www.sots.ct.gov/sots/lib/sots/regulations/recentlyadopted/ecopy_reg_6158.pdf. Accessed in December 2014.

energy systems which included a shadow flicker limit of 30 hours per year for abutting occupied buildings.5 For a recent project in New Hampshire, a shadow flicker limit was not a component of the Certificate of Site and Facility with Conditions which was issued to Groton Wind, LLC.[6] In the absence of regulations, the predicted duration of shadow flicker is often put into context by comparing expected shadow flicker impacts at residences to a guideline value of 30 hours per year. Therefore, 30 hours per year of shadow flicker was used as the evaluation level for occupied buildings in this analysis.

Q. Please briefly describe Epsilon's methodology for evaluating shadow flicker associated with the Project.

A. Shadow flicker was modeled using a software package, WindPRO version 2.9.285. WindPRO is a software suite developed by EMD International A/S and is used for assessing potential environmental impacts from wind turbines. Worst-case shadow flicker in the area surrounding the wind turbines was calculated based on data inputs including: location of the wind turbines, location of discrete modeling points, wind turbine dimensions, calculation limits, and terrain data. Worst-case is defined as the sun is always shining during daylight hours (i.e., never a cloud all year) and the winds are always strong enough during daylight hours that the wind turbine is always operating. Both of these assumptions are overly conservative. Based on user input geographic information, the model was able to incorporate the appropriate sun angle and maximum daily sunlight for this latitude into the calculations.

[5] New Hampshire Office of Energy and Planning. http://www.nh.gov/oep/resource-library/energy/wind-systems.htm. Accessed in December 2014.

[6] State of New Hampshire Site Evaluation Committee. Docket No. 2010-01. May 6, 2011.

The WindPRO shadow flicker module can be further refined by incorporating sunshine probabilities and wind turbine operational estimates by wind direction over the course of a year. The values for this further refinement, also known as the "expected" shadow flicker, were included in this analysis. The Siemens SWT-3.2-113 wind turbine has a cut-in wind speed of 3 m/s, and a cut-out wind speed of 25 m/s. Based on the extrapolated data from the AWE on-site meteorological tower the wind turbines would operate for 8,240 hours out of 8,760 hours per year (94%). This corresponds to the period when hub height winds would be between 3 m/s and 25 m/s.

Q. What were the results of the modeling performed by Epsilon?

A. The predicted shadow flicker duration ranged from 0 hours, 0 minutes per year to 10 hours, 10 minutes per year. The majority of the modeling locations (136) were predicted to experience no shadow flicker. A total of 18 locations were predicted to experience some shadow flicker but less than 10 hours per year. The modeling results showed that one (1) location would be expected to have 10 – 20 hours of shadow flicker per year while no locations would be expected to have over 30 hours of shadow flicker per year. The modeled locations and results of the shadow flicker modeling are depicted on a contour map as Figure 4-2 of the Shadow Flicker Analysis Report. For ease of reference, Figure 4-2 is submitted with this prefiled testimony and is labeled Attachment RDO – 3.

Q. Having conducted the Shadow Flicker Analysis, what are Epsilon's conclusions with respect to the Project?

A. A shadow flicker analysis was conducted to calculate the duration and location of shadow flicker in the vicinity of the Antrim Wind Energy Project. Shadow flicker resulting from the operation of the nine (9) wind turbines was calculated at 155 discrete modeling points and isolines were generated from a grid encompassing the area surrounding the wind turbines. The expected annual duration of shadow flicker at sensitive receptors ranges from 0 hours, 0 minutes per year to 10 hours, 10 minutes per year, and therefore, will not result in a significant impact. This analysis is conservative in that modeling locations were treated as "greenhouses" and obstacles such as structures and vegetation were not included.

Q. Based upon your analysis, will "shadow flicker" caused by the operation of the Antrim Wind Project have any unreasonable adverse effects?

A. No. All of the residential locations surrounding the Antrim Wind Energy project are predicted to experience no more than 10 hours, 10 minutes per year of shadow flicker. Actual values will likely be even lower. This level is well below the most often cited guideline value limiting shadow flicker to 30 hours per year.

Q. Does this conclude your pre-filed testimony?

A. Yes.

ROBERT D. O'NEAL, CCM, INCE BD. CERT.

PRINCIPAL

EDUCATION

M.S., Atmospheric Science, Colorado State University, 1987
B.A., Engineering Science, Dartmouth College, 1983

REGISTRATIONS

Certified Consulting Meteorologist, #578
Institute of Noise Control Engineering, Board Certified

PROFESSIONAL SUMMARY

A Principal of the firm, Mr. O'Neal is Board Certified in Noise Control Engineering and a Certified Consulting Meteorologist with over 25 years of experience in the areas of community noise impact assessments, meteorological data collection and analyses, and air quality modeling. Mr. O'Neal's noise impact evaluation experience includes design and implementation of sound level measurement programs, modeling of future impacts, conceptual mitigation analyses, and compliance testing. Rob has performed noise measurement and modeling assessments for wind energy and fossil-fuel power generation facilities in the Northeast, the Mid-Atlantic region, the Midwest, and the Southwestern U.S. Other industries served include hard rock quarries, aggregate handling, asphalt and concrete plants, C&D processing facilities, landfills, real estate development, and mobile sources. He has also provided expert witness testimony on noise impact studies and air pollution modeling in front of local boards, courts of law, and adjudicatory hearings.

PROFESSIONAL EXPERIENCE

Wind Energy Projects

- *Iberdrola Renewables – Groton Wind, Groton, NH.* Developed an extensive sound level measurement and modeling program for a proposed 48 MW wind farm near Plymouth, NH. Concurrent sound level data and meteorological data were collected and analyzed. The results were presented as expert witness testimony at community open houses and during the Site Evaluation Committee public hearings.

- *Massachusetts Clean Energy Center – Research Study on Wind Turbine Acoustics*. The study includes measuring sound emissions from a variety of operating wind turbines in the Commonwealth of Massachusetts. Fieldwork includes measuring both the level and quality of sound emissions from operating wind turbines under various wind regimes and topography. To better understand how wind speed and wind direction vary over the turbine height, meteorological data are collected using on-site meteorological towers and LiDAR systems. Acoustical data are measured at various distances from the wind turbines and include broadband, one-third octave band, low frequency and infrasound, and interior/exterior sound levels.

- *Eolian Renewable Energy -- Antrim Wind, Antrim, NH.* Developed an extensive sound level measurement and modeling program for a proposed 30 MW wind farm in Antrim, NH. Concurrent sound level data and meteorological data were collected and analyzed. The results were presented as expert witness testimony at community open houses and during the NH Site Evaluation Committee public hearings.

- *FPL Energy – Horse Hollow Wind Energy Center, Taylor County, TX.* Developed and executed an extensive sound level measurement program for a 735 MW wind farm in Taylor County, TX. Concurrent sound level data, meteorological data, and wind turbine power output data were collected and analyzed. The results were used in legal proceedings as part of expert witness testimony in the case.

- *Pioneer Green Energy – Great Bay Wind, Somerset County, MD.* Developed an extensive sound level measurement and modeling program for a proposed 99 MW wind farm on the eastern shore of Maryland. Concurrent sound level data and meteorological data were collected and analyzed. The results were used in the state-level permit applications.

- *FPL Energy – Wolf Ridge Wind Farm, Cooke County, TX.* Developed and executed an extensive sound level measurement and modeling program for a proposed wind farm in Cooke County, TX. Concurrent sound level data and meteorological data were collected and analyzed. The results were used in legal proceedings as part of expert witness testimony in the case.

- *John Deere Renewables –Michigan Thumb I Wind Farm, Huron County, MI.* Developed and executed a long-term sound level measurement program for an existing 69 MW wind farm in Michigan to determine compliance with the local noise ordinance. Concurrent sound level data and meteorological data were collected and analyzed.

- *NextEra Energy Resources (formerly FPL Energy) – Low Frequency & Infrasound Study, TX.* Developed and executed a sound level measurement program as part of a scientific study to determine low frequency and infrasound levels from two types of wind turbines. Both interior and exterior data were compared to independent impact criteria for audibility, vibration, rattle, and annoyance. The study results were published in the peer-reviewed Noise Control Engineering Journal.

- *NextEra Energy Resources (formerly FPL Energy) – Ashtabula Wind Farm, Barnes County, ND.* Developed and executed a sound level measurement program for an existing wind farm in North Dakota in response to noise complaints. Concurrent sound level data and meteorological data were collected and analyzed.

- *Gamesa Energy – Barton Chapel Wind Farm, Jack County, TX.* Developed an extensive sound level measurement and modeling program for a proposed 120 MW wind farm in Jack County, TX. Concurrent sound level data and meteorological data were collected and analyzed. The results were used in legal proceedings as part of expert witness testimony in the case.

- *TCI Renewables – Crown City Wind Farm, Cortland County, NY.* Developed an extensive sound level measurement and modeling program for a proposed 80 MW wind farm in central

NY. Concurrent sound level data and meteorological data were collected and analyzed. The results were used in the state-level permit applications.

- *Babcock & Brown – Allegheny Ridge Wind Farm, Portage, PA*. Developed and executed a sound level measurement program for an 80 MW wind farm in Cambria and Blair Counties, PA. Concurrent sound level data, meteorological data, and wind turbine power output data were collected and analyzed. The results were used to demonstrate compliance with the noise standard of the Development Agreement with the local Township.

- *FPL Energy – Waymart Wind Farm L.P., Waymart, PA*. Managed the post-construction community noise study for a 65 MW wind turbine facility utilizing 43 GE 1.5 MW turbines. A compliance demonstration with the local noise ordinance was done utilizing the pre-construction ambient sound level data and the on-site meteorological data.

- *State of New Hampshire, Office of the Attorney General -- Lempster Mountain Wind Power Project, Lempster, NH*. Performed an independent review of a proposed 24 MW wind turbine farm. The applicant's noise impact analysis was evaluated and comments provided to the State of NH.

- *Varian Semiconductor Equipment Associates, Inc. – Wind Farm, Gloucester, MA*. Two 2.5 MW wind turbines are proposed at a facility which manufacturers the machinery used in computer chip making. Managed the sound level impact study including existing condition measurements and future modeling using the WindPro model. The results were presented at a series of city council public hearings resulting in approval of the project.

Independent Power Projects

- *Braintree Electric Light Department – Thomas A. Watson Generating Station, Braintree, MA*. Conducted long-term continuous ambient sound level measurement program for a proposed 105 MW natural gas and oil-fired simple-cycle electric power generation facility. Acoustical modeling, including several rounds of mitigation, was performed to demonstrate compliance with the State noise policy.

- *Montgomery Energy Billerica Power Partners -- Billerica Energy Center, Billerica, MA*. Worked on noise aspects for a proposed 350 MW natural gas and oil-fired simple-cycle electric power generation facility. Acoustical modeling, including several rounds of mitigation, was performed to demonstrate compliance with the State noise policy. Expert testimony on noise issues was presented to the Energy Facilities Siting Board.

- *Advanced Power Services – Brockton Power, Brockton, MA*. Conducted a 168-hour continuous ambient sound level measurement program at multiple sites for a proposed 350 MW natural gas-fired combined-cycle electric power generation facility. Acoustical modeling, including mitigation, was performed to demonstrate compliance with the State noise policy. Expert testimony on noise issues was presented to the Energy Facilities Siting Board.

- *Besicorp-Empire Development Company – Rensselaer, NY*. Prepared interrogatory responses, and testimony for the Noise section of the Article X application for this proposed 505 MW combined-cycle gas-fired electric power generation facility, recycled newsprint manufacturing plant, and waste water treatment plant. Additional testimony was provided for Technical Conference hearings before a NYS DEC Administrative Law Judge.

- *Cornell University, Ithaca, NY.* Prepared a sound level impact assessment report for the NY SEQRA process and Article VII natural gas pipeline application for this proposed 30 MW combined heat and power generation facility.

- *Milford Power Co., LLC – Milford, CT.* Conducted post-construction ambient sound level measurements for a 544 MW combined-cycle gas-fired electric generating facility. The project utilizes two Alstom GT-24 combustion turbines, one steam turbine, and an 8-cell wet mechanical cooling tower. High-pressure steam blows and transformer noise were also measured during construction and assessed for community impacts.

- *FPL Energy – Jamaica Bay Peaking Facility, Far Rockaway, NY.* Managed the noise impact study as part of an Environmental Assessment for a 50 MW natural gas-fired peaking plant utilizing two P&W combustion turbines. A compliance demonstration with the local noise ordinance was done utilizing the ambient background data and acoustical modeling. Follow-up noise monitoring was done to evaluate vendor performance specifications.

- *FPL Energy – Bayswater Peaking Facility, Far Rockaway, NY.* Managed the noise impact study as part of an Environmental Assessment for a 55 MW natural gas-fired peaking plant utilizing two P&W combustion turbines. A compliance demonstration with the local noise ordinance was done utilizing the ambient background data and acoustical modeling.

- *Sithe Energies – Heritage Station, Oswego, NY.* Conducted ambient sound level measurements and performed sound level modeling at the 1000 MW Independence Station power plant in support of permitting a proposed 800 MW combined-cycle electric generation facility adjacent to the existing station in Oswego. The proposed project will utilize General Electric's new "H" System combustion turbine technology, and a 16-cell wet mechanical cooling tower. A compliance demonstration with the local noise ordinance was done utilizing the ambient background data and acoustical modeling. Mr. O'Neal prepared the Noise section of the Article X Application in conjunction with the New York State Public Service Law as well as expert testimony on noise for the Article X public hearings.

- *Duke Energy Power Services, LLC -- OH, IN, IL, MO.* Conducted ambient sound level measurement programs and performed acoustical modeling for six proposed simple-cycle electric power generation facilities in the Midwest for Duke Energy. These 640 MW peaking stations were permitted for 8 GE 7EA combustion gas turbines. The results of the noise impact assessment were used to secure site plan approval from the local community.

- *Calpine Corporation – Ontelaunee Energy Center, Ontelaunee, PA.* Conducted 24-hour ambient sound level measurements at multiple sites for a proposed 543 MW natural gas-fired combined-cycle electric power generation facility utilizing two Westinghouse 501F combustion turbines. A compliance demonstration with the local noise ordinance was done utilizing the ambient background data and acoustical modeling. Post-construction sound level measurements were done on the turbines to confirm they met the vendor guaranteed noise limits.

Linear Siting and Transmission Projects

- *NSTAR 345 kV Transmission Reliability Project, Stoughton, Canton, Milton, Boston, MA*: Responsible for noise impact assessment for this proposed 18 mile multi-circuit underground 345 kV project. Construction noise impacts along the route and operational noise from substations in Hyde Park and South Boston were analyzed. Expert testimony before the EFSB was provided.

- *Weaver's Cove Energy, Fall River, MA*. Managed the implementation of an extensive existing condition sound level measurement program. Long-term continuous and short-term measurements were taken at multiple locations around a proposed liquefied natural gas (LNG) import terminal. Expected future sound level impacts from operation of the LNG import terminal were calculated. In addition, community sound level impacts from an associated 2.5 million yd^3 dredging project in the adjacent channel were evaluated. The FERC Resource Report 9 section on noise impacts was prepared.

Industrial/Commercial Projects

- *General Electric Company, Hudson River PCBs Superfund Site, Hudson River, NY*. Prepared the Noise Impact Assessment for dredging, processing, and construction activities associated with Phase 1 of the Final Design Report. Source-specific sound level measurements of key sources were also made. Sound level monitoring was done during Phase 1 dredging and processing of the sediment to determine compliance with the Quality of Life Performance Standards.

- *Former Coal Tar Gasification Facility, Island End River, Everett, MA*. Managed an extensive sound level measurement program prior to and during a dredging operation. An existing condition measurement program over multiple seasons was conducted for one-week intensive periods. A measurement program during a 10-day pilot study was carried out to determine key sources of dredge noise within the community. Sound level monitoring was also conducted throughout the remediation work program itself. This work was coordinated with the land-based and water-based parties on the remediation team.

- *Environmental Soil Management, Inc., Loudon, NH*. An extensive sound level measurement program was conducted for a thermal soil treatment plant in response to community noise complaints. Simultaneous overnight measurements were made at multiple locations with and without the plant operating to identify the possible sources of area noise. Digital audio tape recordings were collected and presented at the local zoning board meeting to demonstrate the low noise levels. Follow-up measurements were made to satisfy decibel limits imposed by the board in order to allow 24-hour per day operations.

- *Gordon Food Service, Brighton, MI*. Noise impacts from loading dock activity, truck traffic, yard dogs, and rooftop mechanical equipment were analyzed as part of the local approval process for a 170,000 square foot regional distribution center in Michigan. Detailed existing condition sound level measurements were made and future operational impacts modeled.

- *Eastman Gelatine Corp., Peabody, MA*. A detailed sound level measurement program was performed to identify sources of community noise concerns around an existing manufacturing facility. Long-term continuous broadband and short-term narrow band sound level measurements were collected around the site. The narrow-band measurements allowed the annoying sources of noise to be identified and a mitigation program to be established.

- *The Home Depot, Sutton, MA*. Ambient sound level measurements, noise modeling, and air quality modeling were conducted to evaluate the potential noise impacts from the operation of a new 24-hour per day 200-dock regional distribution center. The primary sources included the delivery trucks and yard dogs. Expert testimony on air quality and noise impacts were presented in Massachusetts Land Court.

- *The Stop & Shop Supermarket Company, Freetown, MA*. Noise impacts from loading dock activity, truck traffic, and rooftop mechanical equipment were analyzed as part of the local approval process for a 1,500,000 square foot regional distribution center in Freetown. The results of the study were presented to the neighborhood in a series of meetings.

Rock Quarries

- *A. Colarusso & Son., Inc., Hudson, NY*. A sound level impact analysis was performed for a proposed rock quarry expansion at a site in Columbia County in support of the NYS DEC Mined Land Reclamation Permit and SEQRA process. Ambient background sound level measurements were collected around the site. Project-specific impacts of the excavation and haul equipment were measured at an existing excavation site and were used to calculate future sound level impacts.

- *Aggregate Industries, Peabody, MA*. A Noise Management Plan was developed as part of the Special Permit requirements at this site. A method of correlating noise complaints with meteorological conditions were set-up. In addition, a series of Best Management Practices for noise reduction were implemented. An extensive community sound level monitoring program was developed and implemented. Mitigation measures to reduce noise from the quarry were designed and presented to city officials and the neighborhood.

- *Sour Mountain Realty, Inc., Fishkill, NY*. A sound level impact analysis was performed at the site of a proposed hard rock quarry in support of a NYS DEC Mined Land Reclamation Permit application in Dutchess County. Ambient background sound level measurements were collected around the site. Project-specific impacts of the excavation and processing equipment were measured at existing rock quarries and used to calculate future sound level impacts. Expert testimony on noise impacts was provided before a NYS Administrative Law Judge.

- *Paquette Pit, Center Harbor, NH*. A sound level impact analysis on rock-crushing and processing equipment, and electrical generators was conducted for a proposed quarry. The results were submitted to the Planning Board.

- *A.A. Wills Materials, Inc., Freetown, MA.* Ambient sound level measurements were conducted at residential locations around an existing 105-acre hard rock quarry along Route 140. Four days of continuous measurements were made with and without the quarry operating to determine the impact of the operations on ambient sound levels in the neighborhood.

Sand & Gravel Operations

- *Okemo Mountain Resort, Ludlow, VT.* A sound level impact analysis was performed for a proposed sand and gravel excavation site in Ludlow. Ambient background sound level measurements were collected around the site. Project-specific impacts of the excavation and haul equipment were used to model future sound levels from operation of gravel extraction. Expert testimony on noise impacts was presented before the Act 250 District Environmental Commission and the local review board.

- *Dalrymple Gravel & Contracting Co., Inc., Erwin, NY.* A sound level impact analysis was performed for a proposed sand and gravel excavation site ("Scudder Mine") at a site in Steuben County in support of the NYS DEC Mined Land Reclamation Permit and SEQRA process. Ambient background sound level measurements were collected around the site. Project-specific impacts of the excavation and haul equipment were measured at an existing excavation site and were used to calculate future sound level impacts. Expert testimony on noise impacts was presented before a NYS Administrative Law Judge.

- *Palumbo Block Co., Inc., Ancram, NY.* A sound level impact analysis was performed for a proposed sand and gravel excavation site ("Neer Mine") in Columbia County in support of the NYS DEC Mined Land Reclamation Permit process. Ambient background sound level measurements were collected around the site. Project-specific impacts of the excavation and haul equipment were measured at existing excavation sites and used to calculate future sound level impacts. Expert testimony on noise impacts was presented before a NYS Administrative Law Judge.

- *Newport Sand & Gravel, Goshen, NH.* A sound level impact analysis was performed for a proposed 68-acre sand and gravel excavation site along Route 10 in Goshen. Ambient background sound level measurements were collected around the site. Project-specific impacts of the excavation and haul equipment were measured at existing excavation sites and used to calculate future sound level impacts. The results of this work were presented to the local Zoning Board of Appeals.

- *Morse Sand & Gravel, Lakeville, MA.* A sound level impact analysis was performed for an existing concrete batch plant. Ambient background and operational sound level measurements were collected around the site. A mitigation program was designed and the effectiveness of various noise control options were tested. The results of this work were presented as expert witness testimony in Massachusetts Land Court in Boston.

- *Ambrose Brothers, Inc., Sandwich, NH.* A sound level measurement program was performed for an existing sand and gravel excavation site in Sandwich. A future sound level measurement program will be conducted upon the opening of a new phase of the operation to determine the sound level change due to equipment relocation.

Asphalt Plants

- *Massachusetts Broken Stone Company, Berlin, MA*. Performed an ambient hydrogen sulfide (H_2S) and meteorological monitoring program at an existing hot mix asphalt plant. Continuous measurements were made of H_2S, wind speed, and wind direction to determine if the facility may be a source of odor in the area.

- *Tilcon Capaldi, Inc., Watertown and Weymouth, MA*. Air quality impacts from two asphalt-batching plants were evaluated based on best management practices and dispersion modeling. Both fugitive sources from materials handling and ducted combustion sources were reviewed and mitigation measures were recommended. Expert testimony was provided on matters before the MA DEP and abutters of the plants.

- *Pike Industries, Inc., Henniker, NH*. Air quality dispersion modeling, control technology evaluation, best management practice review, and meteorological data analysis were conducted for an asphalt batch plant in order to address a local odor issue. The results of this work were presented in meetings with the NH ARD and the neighbors.

Transfer Stations/Landfills

- *Pine Tree Waste, Inc., Westbrook, ME*. Prepared a noise impact assessment for a proposed construction & demolition transfer station and processing facility. This project involved calculation of expected operational noise impacts from the processing equipment, a compliance evaluation with State and local noise regulations, and testimony before the local Planning Board.

- *Holliston Transfer Station, Holliston, MA*. Prepared a noise impact assessment for an existing C&D and MSW transfer station in Holliston, MA. This project involved ambient background noise monitoring at sensitive receptors around the site, a compliance evaluation with State and local noise regulations, and expert testimony before the Board of Health during the site assignment hearings.

- *Resource Recovery of Cape Cod, Sandwich, MA*. Prepared a noise impact and mitigation assessment for an existing 600-ton/day construction & demolition transfer station on Cape Cod. This project involved extensive ambient background noise monitoring at sensitive receptors around the site, calculation of expected operational noise impacts from the processing equipment, a compliance evaluation with State noise regulations, and mitigation calculations.

- *WSI, Oxford, MA*. Prepared a noise impact assessment for a proposed 750-ton/day C&D and MSW transfer station in Oxford, MA. This project involved ambient background noise monitoring at sensitive receptors around the site, calculation of expected operational noise impacts from the processing equipment, a compliance evaluation with State noise regulations, and expert testimony before the Board of Health during the site assignment hearings.

Transportation Projects

- *Tren Liviano EIS, San Juan, Puerto Rico.* Developed an extensive sound level measurement and modeling program for a proposed 5.3 mile light rail system in Old San Juan. The analysis was done in accordance with EQB and US FTA procedures. Meetings were held with the Permit Management Office (OGPe) and City of San Juan officials to discuss the scope of study. In addition, Epsilon attended the DEIS public hearings in San Juan to answer noise-related questions.

- *Tren Caguas EIS, San Juan, Puerto Rico.* Developed an extensive sound level and vibration measurement and modeling program for a proposed 17 mile rapid transit rail system linking Caguas to San Juan. The analysis was done in accordance with EQB and US FTA procedures.

- *Town of Westwood, MA.* Independent technical reviewer for Town of Westwood government officials for noise-related issues associated with highway traffic noise from Interstate 95/Route 128 in Westwood, MA. Reviewed FHWA TNM modeling for interchange modifications and exit ramp widening impacts on residential neighborhoods, including barrier wall design analyses. In addition, Epsilon attended public hearings in Westwood to present the findings to concerned citizens and answer noise-related questions.

EXPERT TESTIMONY EXPERIENCE

Expert witness before the Environmental Review Tribunal, Ontario, Canada on noise issues for SP Armow Wind Ontario GP Inc., Kincardine, Ontario [Case ERT 13-124 to 13-125, Kroeplin v. Director, Ministry of the Environment].

Expert witness before the Environmental Review Tribunal, Ontario, Canada on noise issues for Dufferin Wind Power, Melancthon, Ontario [Case ERT 13-070 to 13-075, Bovaird v. Director, Ministry of the Environment].

Expert witness before the Environmental Review Tribunal, Ontario, Canada on noise issues for K2 Wind Ontario, Inc., Ashfield-Colbourne-Wawanosh, Ontario [Case ERT 13-097 to 13-098, Drennan v. Director, Ministry of the Environment].

Expert witness before the NH Site Evaluation Committee on noise issues for the 30 MW Antrim Wind Project (2012); 48 MW Groton Wind project (2010).

Expert witness before the MA Energy Facilities Siting Board on noise issues for: 18-mile underground electric transmission line and substation project in the Boston Metropolitan area (2004-2005); Billerica Energy Center power plant (2007); Brockton Clean Energy (2008-2009).

Expert witness in Vermont Act 250 Land Use proceedings on noise issues for a proposed sand and gravel excavation site at Okemo Mountain (2007).

Expert witness in the 42nd District Court of Texas on noise issues for a 735 MW wind turbine farm (2006).

Expert witness before NY DEC Administrative Law Judge on noise issues for a hard rock quarry facility (1997), two sand and gravel excavation sites (2001; 2003), and a cogeneration power plant (2003).

Expert witness for site assignment hearings on noise issues from solid waste transfer stations in Lowell, MA (1998); Marshfield, MA (1999); Holliston, MA (2004); Oxford, MA (2006).

Expert witness in Massachusetts Land Court on noise issues for a proposed sand and gravel pit (1991), a proposed cross-dock distribution center (2002), and an existing concrete batch plant (2005).

Expert witness in Vermont Act 250 Land Use process for air quality impacts at ski areas (1991; 1992; 1997).

Expert witness before MA DEP Administrative Law Judge for an asphalt plant in Boston (1996).

Expert witness before municipal boards on issues of air pollution and noise impacts from local industries (many years).

Invited specialty speaker on noise impact assessments for Boston University's Masters of Urban Planning degree program (1994; 1996).

PROFESSIONAL ORGANIZATIONS

Institute of Noise Control Engineers (INCE), Board Certified Member, Board of Directors (2014-2015)
Acoustical Society of America
American Meteorological Society - Certified Consulting Meteorologist #578
Air and Waste Management Association

PUBLICATIONS

O'Neal, R.D., Hellweg, Jr., R.D. and R. M. Lampeter, 2011. Low frequency sound and infrasound from wind turbines. Noise Control Engineering Journal, **59** (2), 135-157.

O'Neal, R.D., and R.M. Lampeter, 2007: Sound Defense for a Wind Turbine Farm. North American Windpower, Zackin Publications, Volume 4, Number 4, May 2007.

O'Neal, R.D., 1991: Predicting potential sound levels: A case study in an urban area. Journal of the Air & Waste Management Association, **41**, 1355-1359.

McKee, T.B. and R.D. O'Neal, 1989: The role of valley geometry and energy budget in the formation of nocturnal valley winds. Journal of Applied Meteorology, **28**, 445-456.

CONFERENCE PRESENTATIONS

O'Neal, R.D., 2014. Wind Energy Sound Monitoring Under High Wind Shear Conditions. NOISE-CON 2014, Fort Lauderdale, FL.

O'Neal, R.D. Lampeter, R.M., Emil, C.B. and B.A. Gallant. Evaluating and controlling noise from a metal shredder system. Presented at INTER-NOISE 2012, NY, NY, August 19-22, 2012.

O'Neal, R.D., 2011. Wind Turbine sound Levels: The Michigan I, Huron County, MI Study. Presented at Great Lakes Wind Collaborative 4th Annual Meeting, Ypsilanti, MI.

O'Neal, R.D., Hellweg, Jr., R.D. and R. M. Lampeter, 2011. Low frequency sound and infrasound from wind turbines. Presented at WINDPOWER 2011, Anaheim, CA.

O'Neal, R.D., Hellweg, Jr., R.D. and R. M. Lampeter, 2010. Low frequency sound and infrasound from wind turbines – a status update. NOISE-CON 2010, Baltimore, MD.

O'Neal, R.D., 2010. Noise control evaluation for a concrete batch plant. NOISE-CON 2010, Baltimore, MD.

O'Neal, R.D., and R.M. Lampeter, 2009: Nuisance noise and the defense of a wind farm. INTER-NOISE 2009, Ottawa, Canada, August 23-26, 2009.

O'Neal, R.D., and R.M. Lampeter, 2009: Sound from Wind Turbines: A Key Factor in Siting a Wind Farm. 12th Annual Energy & Environment Conference – EUEC 2009, Phoenix, AZ, February 2, 2009.

O'Neal, R.D., 2001: The Impact of Ambient Sound Level Measurements on Power Plant Noise Control in Massachusetts: A Case Study. Proceedings of the Air & Waste Management Association 94th Annual Meeting and Exhibition, Orlando, FL, June 24-28.

Hendrick, E.M., and R.D. O'Neal, 2001: A Case Study of Class I Impacts Using CALPUFF Screen. Proceedings of the Air & Waste Management Association Guideline On Air Quality Models: A New Beginning, Newport, RI, April 2001.

O'Neal, R.D., 1994: Indoor air sampling techniques used to meet workplace and ambient air toxic detection requirements. Proceedings of the Air & Waste Management Association 87th Annual Meeting and Exhibition, Cincinnati, OH, June 19-24.

O'Neal, R.D., 1992: Estimating future noise levels from industrial noise sources. Acoustical Society of America 124th Meeting, New Orleans, LA, October 31 - November 4.

O'Neal, R.D., 1991: Temporal traffic fluctuations and their impact on modeled peak eight-hour carbon monoxide concentrations. Proceedings of the Air & Waste Management Association 84th Annual Meeting and Exhibition, Vancouver, B.C., June 16-21.

O'Neal, R.D., 1990: Noise barrier insertion loss: A case study in an urban area. Proceedings of the Air & Waste Management Association 83rd Annual Meeting and Exhibition, Pittsburgh, PA, June 24-29.

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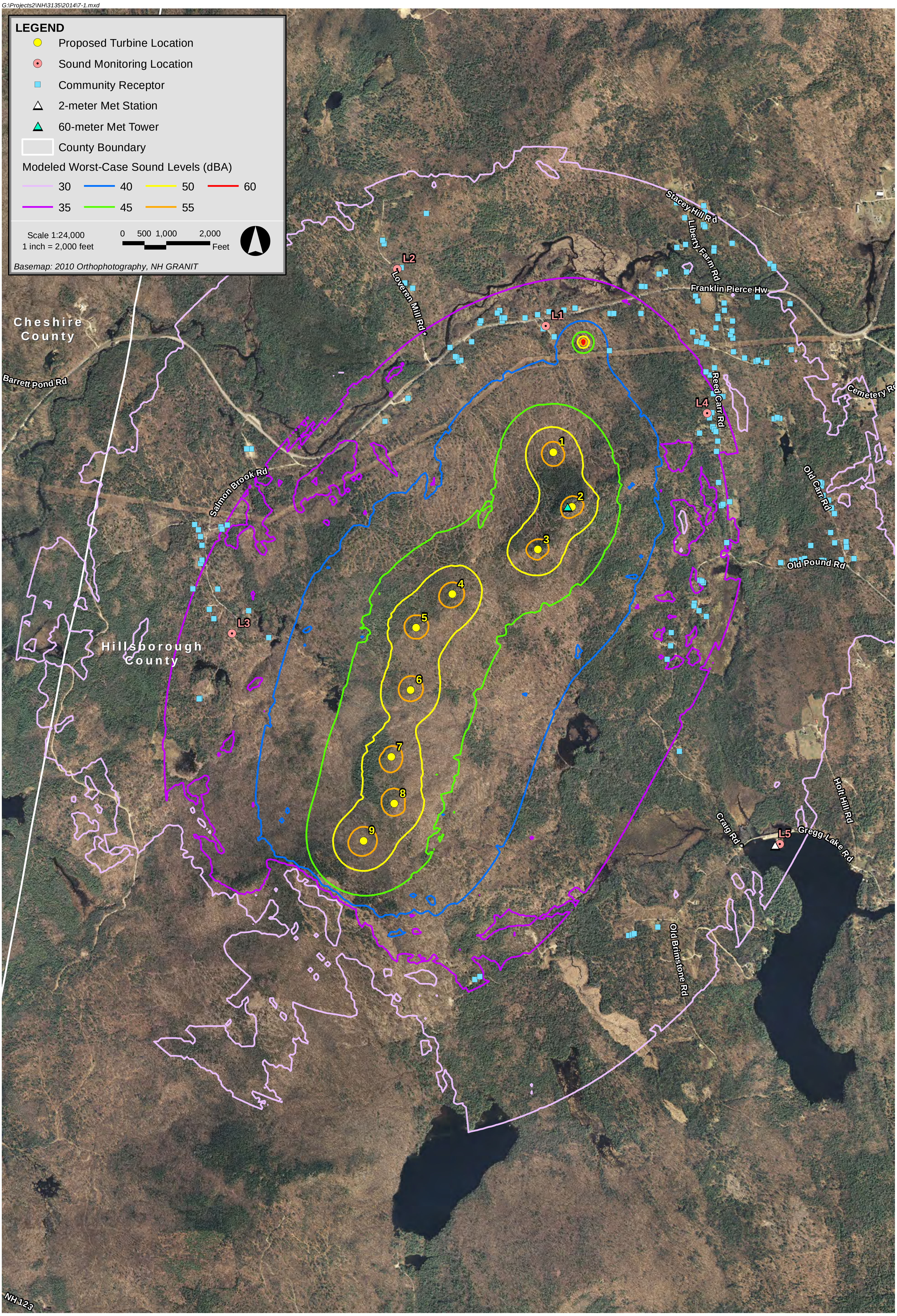

Antrim Wind Antrim, New Hampshire

Figure 7-1
Modeled Worst-Case Sound Levels (dBA)

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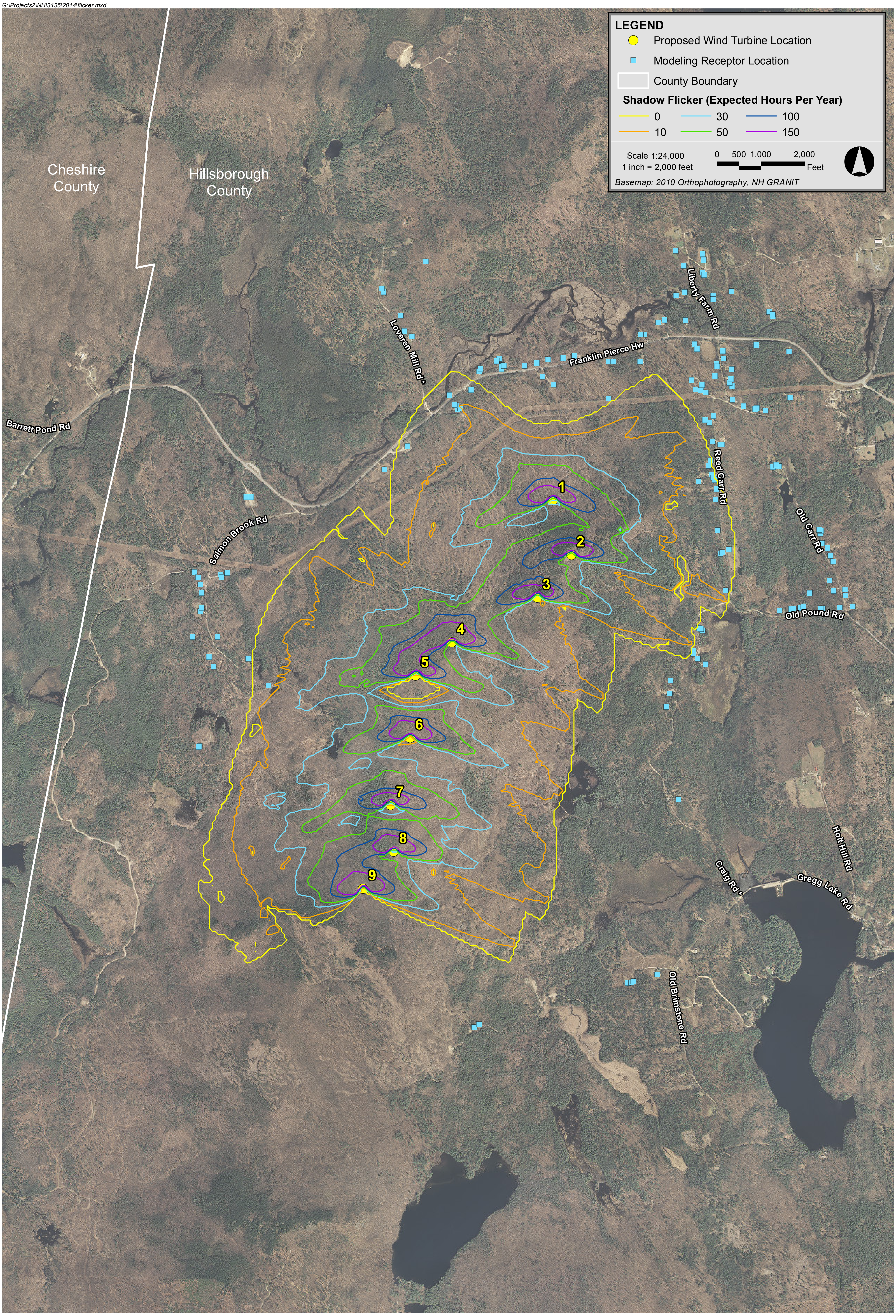

Antrim Wind Antrim, New Hampshire

Epsilon ASSOCIATES INC.

Figure 4-2

Shadow Flicker Modeling Results

STATE OF NEW HAMPSHIRE

BEFORE THE SITE EVALUATION COMMITTEE

Docket No. SEC 2015-02

<u>APPLICATION OF ANTRIM WIND ENERGY, LLC</u>
<u>FOR A CERTIFICATE OF SITE AND FACILITY</u>

PREFILED DIRECT TESTIMONY OF DANA VALLEAU AND ADAM J. GRAVEL ON BEHALF OF ANTRIM WIND ENERGY, LLC

September 10, 2015

<u>Qualifications of Dana Valleau</u>

Q. Please state your name, title and business address.

A: My name is Dana Valleau. I am employed by TRC Environmental Corporation ("TRC") as an Environmental Specialist. My business address is 14 Gabriel Drive, Augusta, Maine 04330.

Q. Please describe the services provided by TRC.

A: TRC is a national engineering, consulting and construction management firm that provides integrated services to energy, environmental and infrastructure projects. TRC serves a broad range of clients in government and industry, implementing complex projects from initial concept to operations. Antrim Wind Energy ("AWE") has retained TRC to provide project management, perform avian studies, identify and delineate jurisdictional wetlands and waterways, vernal pools, and wildlife habitat within the Project are to support the design and layout of the proposed Antrim Wind Project (the "Project").

Q. What are your responsibilities at TRC?

A: My responsibilities include project management, scoping field studies, consultation with agencies, and overseeing field studies. I also conduct field work as a wetland scientist, wildlife biologist and environmental inspector on construction sites. I also provide documentation of field study results, prepare permit applications and perform compliance reporting.

Q. Briefly summarize your educational background and work experience.

A: I have a B.S. Degree in Wildlife Management from the University of Maine and a Juris Doctorate also from the University of Maine. I have worked in the environmental science field for over 20 years in a wide variety of capacities. I was certified as wildlife biologist in June 2011 through The Wildlife Society, a nationally recognized certification program for professional wildlife biologists, and have been certified as a Professional Wetland Scientist since May 2005 by the Society of Wetland Scientists, an international organization dedicated to fostering sound wetland science, education and management. I have conducted/coordinated wetland and vernal pool surveys and assessments on electric transmission line projects such as the Central Maine Power Company Maine Power Reliability Project and also on the Kibby and the Kibby Expansion Wind Power Projects in Maine.

Additional detail regarding my education, background and experience is contained in my curriculum vitae which is attached hereto as Attachment DV-1.

Q. Have you ever testified before the New Hampshire Site Evaluation Committee ("SEC")?

A. Yes. I presented testimony on the results of bat field studies, as well as testimony regarding the potential effect of the Antrim Wind Project on the natural environment, particularly wetlands, vernal pools, and wildlife habitat, in connection with Antrim Wind Energy, LLC's ("AWE") application for a certificate of site and facility in Docket 2012-01. I also testified before the Maine Board of Environmental Protection on enforcement and licensing issues while employed by the Maine Department of Environmental Protection, as well as before the Maine Land Use Regulation Commission on behalf of the applicant in the Kibby and Kibby Expansion wind power projects.

<u>Qualifications of Adam J. Gravel</u>

Q. Please state your name, title and business address.

A: My name is Adam Gravel. I am employed by Stantec Consulting ("Stantec") as Managing Leader of Stantec's Topsham, Maine office. My business address is 30 Park Drive, Topsham, Maine 04086.

Q. Please describe the services provided by Stantec.

A: Stantec is an environmental consulting company that provides services to a variety of sectors, including the wind industry. AWE is the sixth utility-scale project in New Hampshire for which Stantec has conducted pre-construction avian and bat studies. Between 2002 and 2014, the Topsham Maine office of Stantec conducted nearly 400 distinct seasons of pre-construction avian and bat studies in connection with proposed wind projects in twelve states. These include 172 seasons of acoustic bat surveys, 130 seasons of nocturnal radar surveys, and 109 seasons of raptor surveys. Stantec also has completed or is currently conducting eagle point count surveys consistent with the United States Fish and Wildlife Services' ("USFWS") Eagle Conservation Plan Guidance for 6 utility-scale wind projects (April 2013). Based on the results of on-site field surveys, Stantec has also prepared screening-level avian and bat risk assessments for a variety of wind projects, and has designed and conducted agency-approved post construction surveys at Projects in Maine, New York, Vermont, Pennsylvania, West Virginia, and Utah. Post-construction surveys are particularly helpful to determine if any relationships exist between pre-construction and post-construction survey results and overall impacts to bird and bat species that result from wind energy projects. Stantec maintains regular contact with state and federal resource agencies, including the New Hampshire Fish and Game Department and United States Fish and Wildlife Service Region 5, and maintains continued involvement with regional and national organizations, such as the National Wind Coordinating Collaborative, National Renewable Energy Laboratory, Department of Energy, and Bureau of Ocean Energy Management, to better understand and minimize potential wind energy-associated wildlife impacts.

Q. What are your responsibilities at Stantec?

A: As the Managing Leader of Stantec's Topsham Maine office, I am responsible for our business operation which includes 65 natural resources professionals comprising of wetland scientists, ecologists, wildlife biologists, and regulatory specialists. For this project, I served as a wildlife biologist and as a Project Manager, and was responsible for coordinating and conducting the nocturnal avian migration studies and all acoustic bat and bat mist-net surveys for the Project, as well as collaborating with TRC on additional avian studies and the development of the Bird and Bat Conservation Strategy. My work experience over the course of the past 10 years with Stantec has focused on large-scale avian and bat studies associated with wind power projects.

Q. Briefly summarize your educational background and work experience.

A: In 2003, I earned a Bachelor of Science degree in Wildlife Management from the University of New Hampshire. I was hired by Woodlot Alternatives, Inc. (now Stantec) in 2004 as a Project Technician and radar ornithologist and was promoted to Project Manager in 2006. I was promoted to Associate and managed the wildlife biologists from Stantec's Topsham Maine office until recently when I was appointed the Managing Leader role of Stantec's Topsham, Maine office. In addition, I am a certified wildlife biologist through The Wildlife Society, a nationally recognized certification program for professional wildlife biologists. Additional detail regarding my education, background and experience is contained in my curriculum vitae which is attached hereto as Attachment AJG-1.

I have conducted and coordinated environmental studies as part of state and federal permitting requirements for over 110 wind energy projects from Maine to Virginia. The subjects of these studies include daytime raptor migration, nocturnal radar migration, acoustic bat detector, and breeding bird surveys designed to assess potential direct impacts from proposed wind energy projects. I have also assessed the potential indirect (non-collision related) impacts of projects on wildlife, including habitat impacts and fragmentation effects, impacts to rare species, and impacts to common, local wildlife communities.

My experience in New Hampshire includes managing and conducting numerous nocturnal radar and acoustic bat surveys, diurnal raptor migration and breeding bird surveys, rare plant and natural community surveys, winter tracking surveys for state-listed threatened and endangered species, post-construction monitoring, and a peregrine falcon radio-telemetry study. I have consulted with state and federal agencies to identify and discuss potential resources of concern at proposed projects and also have developed work plans and associated field surveys to address agency concerns about wildlife. I have conducted these studies for the three permitted wind projects in the State of New Hampshire.

Q. Have you ever testified before the New Hampshire Site Evaluation Committee ("SEC")?

A. Yes. I presented testimony on the results of avian and bat field studies in connection with Antrim Wind Energy, LLC's ("AWE") application for a certificate of site and facility in Docket 2012-01. I also provided testimony in connection with the Noble/Granite Reliable Power, LLC Project (SEC Docket No. 2008-04) and the Groton Wind, LLC Project (SEC Docket No. 2010-01). I have also testified before the Maine Land Use Regulatory Committee (LURC) in connection with the Bull Hill and Bowers Wind Projects (DP 4886 and DP 4889, respectively), as well as before the Vermont Public Service Board in connection with the Kingdom Community and Georgia Mountain Community Wind Projects (Dockets ## 7628 and 7508, respectively).

Avian and Bat Field Surveys – Adam Gravel and Dana Valleau

Purpose of Testimony

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to briefly explain and summarize the results of avian and bat field surveys conducted by TRC and Stantec on behalf of Antrim Wind Energy, LLC ("Antrim Wind" or "AWE") for the Project. Complete presentations of the methods, analysis, and results of each survey are contained in the following reports which are included as Appendices to Antrim Wind's SEC Application:

- Breeding Bird Surveys (Appendix 12A);
- Diurnal Raptor Migration Surveys (Appendix 12B);
- Nocturnal Migration Surveys and Acoustic Bat Monitoring Survey (Appendix 12C);
- Rare Raptor Nest Survey (Appendix 12D);
- Bat Mist Netting Survey (Appendix 12E); and

TRC and Stantec completed these studies in connection with AWE's Application for a Certificate of Site and Facility in Docket 2012-01. These studies remain valid to characterize the wildlife and habitat found at the site. Site characteristics have not changed significantly since these studies were performed, and it is very unlikely that wildlife use at the site has changed appreciably in the short time that has passed.

Our testimony includes brief descriptions of the methodologies, investigations and consultations related to the individual avian and bat studies referenced above, as well as a discussion of the results of those surveys. Our testimony also describes and supports AWE's Bird and Bat Conservation Strategy (BBCS) for the Project (Application Appendix 12F) which includes proposed post-construction monitoring and minimization activities and an adaptive management strategy.

Q. Are you familiar with the Project proposed by AWE in this matter?

A. Yes. TRC and Stantec conducted a number of avian and bat surveys within the Project area. Over the course of these surveys, we visited all areas along the ridgelines where the turbines and other Project facilities are proposed to be sited, as well as other areas within and adjacent to the boundaries of the Project site.

TRC and Stantec have reviewed the design of the reconfigured Project that is the subject of AWE's current Application for a Certificate of Site and Facility. Overall the current site layout is smaller in area due to the removal of one turbine. The disturbed area required for construction and operation is smaller and the proposed road lengths are shorter. Additionally, the turbines currently proposed have a smaller rotor swept area than the original proposed turbines, and also have a shorter overall height.

Q. Are you familiar with the SEC's finding in Docket 2012-01 with respect to the effect of the Project on wildlife and the natural environment?

A. Yes. After considering evidence submitted by several parties, including our testimonies and the surveys listed above, the SEC concluded that the Project as proposed in Docket 2012-01would not have an unreasonable adverse effect on wildlife, and furthermore would not have an unreasonable adverse effect the natural environment provided that certain conditions were imposed. All of these conditions have been incorporated into the BBCS.

Q. What conditions did the SEC indicate would be required with respect to the natural environment if it were to issue a certificate of site and facility?

A. The SEC stated that the following conditions would be required to ensure that the Project did not cause an unreasonable adverse effect to the natural environment:

- AWE would complete three (3) years of avian and bat post-construction studies in addition to implementation of all of the provisions of AWE's "avian and bat protection plan" (now referred to as the BBCS) as amended in Docket 2012-01, including adaptive management and phased consultation;

- During construction of the proposed facility, logging operations shall be limited to periods of time when the ground is dry or frozen;

- AWE must use New Hampshire licensed foresters who will apply best management and forestry practices such as those contained in the publication Good Forestry in the Granite State for all of its logging and forestry operations;

- AWE's plan to curtail invasive species shall be extended to the post-construction period, as well as the construction period; and

- The BBCS shall adopt and include conditions contained in the October 26, 2012 letter from NHFGD in Docket 2012-01.

Q. Has AWE incorporated these conditions into its Application for Certificate of Site and Facility and BBCS for the Antrim Wind Project?

A. Yes. AWE has revised the BBCS to incorporate conditions proposed by the SEC in Docket 2012-01. The permit condition recommendations made by NHFGD in Docket 2012-01 are incorporated into the BBCS, as well.

Q. In your opinion, have circumstances at the Project site changed since the SEC issued its Order in Docket 2012-01 in a way that would result in the reconfigured Project having a more significant impact to wildlife or the natural environment?

A. No. In fact, the smaller footprint of the reconfigured Project lessens any potential impacts to wildlife and natural environment. Moreover, AWE has adopted the conditions proposed by the SEC and NHFGD in Docket 2012-01 and included them in its BBCS, ensuring that the Project will not have an unreasonable adverse effect upon the natural environment.

Q. Please explain how AWE determined which wildlife studies to conduct relative to the Project, and how you developed the survey methods/protocols for the on-site avian and bat studies.

A. In accordance with the USFWS Land-Based Wind Energy Guidelines ("USFWS Guidelines"), AWE applied a tiered approach to assessing potential risk to avian and bat species associated with the proposed Antrim Wind Energy Project. A detailed description of the tiered approach utilized by AWE is set forth in the BBCS attached as Appendix 12F to the Application. Preliminary site evaluation and site characterization assessments performed to determine the Project's site suitability, which are described in the BBCS attached as Appendix 12F to the Application, are consistent with Tier 1 and Tier 2 as described within the USFWS Guidelines. In accordance with Tier 3 of the USFWS Guidelines, AWE consulted with various regulatory agencies, including the USFWS, New Hampshire Fish and Game Department ("NHFGD"), New Hampshire Natural Heritage Bureau ("NHNHB"), New Hampshire Department of Environmental Services ("NHDES"), United States Army Corps of Engineers ("USACE"), and United States Environmental Protection Agency ("USEPA"), to identify the pre-construction surveys necessary to assess the Project's potential impacts on avian and bat species. The scope, duration and results of those environmental field studies are included in the BBCS. The findings of AWE's Tier 3 studies will provide the baseline, pre-construction reference data upon which the Tier 4 post-construction monitoring, reporting and adaptive management efforts will be based. In addition, AWE, Stantec, and TRC consulted with the NHFGD and USFWS in the spring 2011 prior to conducting field surveys. This consultation resulted in the prescribed preconstruction surveys listed above.

Q. Has AWE consulted with the USFWS regarding the reconfigured Antrim Wind Project?

A. Yes. AWE contacted Sarah Nystrom at USFWS in November 2014 to discuss its plans for the reconfigured project. During the discussions that ensued, USFWS requested that AWE ensure that its BBCS reflect the most recent USFWS land based wind guidelines. On May 14, 2015, AWE submitted a letter to the New England Field Office of the USFWS requesting a review of AWE's updated and revised BBCS. AWE sought USFWS's concurrence that the updated BBCS meets the Service's land-based Wind Energy Guidelines. In its letter, AWE detailed revisions incorporated into the BBCS to conform to the USFWS's most recent guidelines, as well as address conditions proposed by the NHDES and the SEC subcommittee in

Docket 2012-01. Shortly after providing its letter, AWE met with USFWS on May 27, 2015 to further discuss the updated BBCS and status of existing data collected at the site in 2011 by Stantec for northern long-eared bats. A subsequent email from the USFWS on June 1, 2015 stated that bat survey data performed at the AWE Project is valid for 10 years unless changes in northern long-eared bat populations warrant adjustments of that timeframe.

<u>Bird and Bat Conservation Strategy</u>

Q. Please describe the Bird and Bat Conservation Strategy ("BBCS") proposed for the Project.

A. AWE submitted an initial BBCS with its application for a certificate of site and facility in Docket 2012-01, and subsequently submitted a revised BBCS on August 10, 2012 as part of its first supplement to the application. In formulating the BBCS, AWE incorporated recommendations and guidance from the following sources: USFWS Draft Land-Based Wind Energy Guidelines; USFWS Final Land-Based Wind Energy Guidelines; USFWS Avian Protection Plan Guidelines; the USFWS Eagle Conservation Plan Guidance, and the Edison Electric Institute's Avian Power Line Interaction Committee. AWE has further revised the BBCS to incorporate certain conditions proposed by the SEC in Docket 2012-01 as well as the permit condition recommendations made by NHFGD in the 2012-01 Docket. The complete BBCS is contained in Appendix 12F. The BBCS is a customized, site-specific strategy that includes an adaptive management plan that will allow for the continued monitoring, reporting, learning, consultation and adaptation, as necessary, over the life of the Project.

In order to continuously address changing circumstances in the area of avian and bat interaction at wind farms, and potentially changing circumstances at the proposed Project, AWE will implement an adaptive management strategy for managing risk to birds and bats over the life of the Project. Adaptive management allows decisions and actions to be tailored to specific problems and circumstances (e.g., a specific species, location, weather pattern, wind speed, or season) at the specific point in time at which they occur. Adaptive management will be guided by: formal post construction study results documented during three year Evaluation Phase; a continuous Wildlife Mortality Monitoring Program ("WMMP"), equipped with an Immediate Alert Procedure ("IAP") for reporting of unusual mortality events; and a phased consultation process that includes AWE, USFWS and NHFGD. The adaptive management component of the BBCS also includes the curtailment study during the first three years of operations, where four of the nine turbines will have increased cut-in speeds as described in the BBCS and bat mortality will be compared between those turbines that were curtailed and those that were not. The WMMP, the IAP and the phased consultation process are described in detail in Appendix 12F.

Q. Why is the BBCS an optimal approach to addressing the issue of avian and bat mortality?

A. Traditional post- construction monitoring programs merely document actual project impacts and include no action steps intended to reduce mortality. In contrast, AWE's BBCS is structured around an adaptive management framework and includes detailed provisions for avoiding, reducing, and mitigating potential impacts to birds and bats in a direct and timely manner from the start of operation. The BBCS also offers the best use of project and agency resources to study and address avian and bat mortality. By undertaking research into the effects of targeted curtailment on mortality, the BBCS will advance the science of avian and bat protection around wind farms. Thus, in our opinion, the BBCS attached as Appendix 12F to the

Application represents a superior approach to addressing and minimizing issues of bird and bat mortality at the Project site. .

Q. What is your opinion on the issue of whether the Project would create an unreasonable adverse effect upon and avian, bat and other wildlife species?

A. Based on our pre-construction surveys at the Project site, our evaluation of post-construction avian and bat mortality data from other wind energy projects, and AWE's BBCS, which incorporates the SEC's conditions from Docket 2012-01, it is our conclusion that the Project will not have an unreasonable adverse impact to any bird or bat populations. AWE's commitments to significant land conservation and radar activated lighting systems, as well as the fact that the project has only reduced in size, reinforces our conclusion.

Natural Environment – Dana Valleau

<u>Purpose of Testimony</u>

Q. What is the purpose of your testimony?

A. My testimony supports AWE's Application for a Certificate of Site and Facility for the Antrim Wind Project, specifically as it pertains to the potential effects of the Project on the natural environment, including wetlands, vernal pools, and wildlife habitat. My testimony summarizes the actions that AWE has taken to map, inventory, and review the natural resources at the Project site, as well as analyze potential effects of the Project on natural resources. I also discuss AWE's mitigation plans.

Q. Are you familiar with the Project proposed by AWE in this matter?

A. Yes, I am. AWE first retained TRC to assess the wetlands, vernal pool and wildlife habitat effects of the Project as it was proposed in Docket 2012-01. In my role overseeing the assessment of these effects, I conducted field reviews of the Project site and assisted in site planning, and I have reprised that role in this case.

Q. Are you also familiar with the SEC's findings in Docket 2012-01 with respect to the natural environment?

A. Yes. After considering evidence submitted by several parties, including my testimony on the issues discussed below and the Natural Communities Report attached as Appendix 11A to the Application, the SEC concluded that the Project as proposed in Docket 2012-01 would not have an unreasonable adverse effect on wildlife or the natural environment, provided that certain conditions were imposed. Those conditions are discussed in the previous section. However, the SEC did not propose any conditions with respect to the matters discussed below and, in fact, no parties disputed AWE's determination that the Project would not impact rare plant species or exemplary natural communities, a finding confirmed by the New Hampshire Natural Heritage Bureau ("NHNHB") after two separate site visits.

Q. In your opinion, have characteristics of the Project site changed since the SEC issued its Order in Docket 2012-01 in a way that would result in the reconfigured Project having a more significant impact to wildlife or the natural environment?

A. No. In fact, the smaller footprint of the reconfigured Project lessens any potential impacts to wildlife and natural environment.

<u>Wetlands and Vernal Pools</u>

Q. Please describe the area that was reviewed for potential effects on wetlands and vernal pools.

A. The proposed Project site is on the ridges of Tuttle Hill and Willard Mountain, which are oriented east-northeast to west-southwest and approximately parallel to Route 9, which is about ¾ of a mile to the north. The area is heavily wooded and undeveloped, though it has been logged on a regular basis for a number of years, including the last two years. The Town of Antrim has numerous water resources and the area of the Project straddles three watersheds in the town: the North Branch River, Gregg Lake and an unnamed stream which continues to its confluence with North Branch River at Steels Pond. The North Branch River, which was placed in the NH Rivers Management and Protection Program in June 1991, runs along the north side of Route 9, in the valley to the north of the Project area, and it is a major tributary to the Contoocook River. Gregg Lake, in the valley to the southeast of Tuttle Hill, is approximately 195 acres and supports a moderate warm water fishery. Streams in the Project area include unnamed perennial and intermittent streams which drain either to the north toward Route 9, or to the southeast into Gregg Lake. There are very few perennial streams.

Under my direction, wetlands, surface waters and vernal pools were delineated throughout the Project area. The surveyed area included approximately 462 acres. Area characteristics have not changed significantly since TRC initially performed these delineations.

Q. Please describe the methodology used by TRC to conduct an analysis of the Project's potential effect upon wetlands.

A. The methodology implemented by TRC is consistent with that used by environmental experts to determine wetlands and vernal pool effects. TRC conducted field studies in the spring, summer, and fall of 2011, and field study reports for the wetland and vernal pool studies are included in Appendices 11C and 11D to the Application. TRC revisited the site during the early fall of 2014 to confirm that the prior delineations and all the data collected during the 2011 surveys remain valid. One additional wetland was delineated during the 2014 survey and it has been incorporated into AWE's project plans.

TRC wetland delineation crews surveyed proposed corridors during August, September and November of 2011 using the United States Army Corps of Engineers ("USACE") Federal Routine Determination Method as presented in the USACE Wetlands Delineation Manual (USACOE 1987) and the Regional Supplements to Corps Delineation Manual (USACOE 2009), which emphasize a three-parameter approach to wetland boundary determination in the field. This approach involves the identification of: (1) evidence of wetland hydrology; (2) presence of hydric soils; and (3) predominance of hydrophytic vegetation as defined by the National Plant List Panel (Reed 1988). Positive indicators of all three parameters are normally present in wetlands and serve to distinguish between both upland and transitional plant communities. TRC also investigated hydrologic connectivity (drainage ditches, natural swales, intermittent and perennial streams outside the study corridor where necessary to verify "normal conditions" or "nexus" hydrologic determinations). Identified wetlands were classified according to Cowardin et al. (1979).

TRC conducted an additional wetland delineation of approximately 4 acres at the Projet site in July 2012 after AWE supplemented its Application in Docket 2012-01 to include a second temporary staging area (the "laydown yard") to be located on approximately 2.9 acres of previously disturbed area that had been used as a gravel borrow pit and log landing, as well as two temporary meteorological towers.

TRC conducted a review of the wetland delineations done in 2011 and 2012 in the early fall of 2014 to confirm prior work and evaluate potential for changes in hydrology and vegetation due to logging being performed on the site. A 2014 addendum to the original wetlands report is included in Appendix 11C to the Application. One additional wetland was delineated during this effort.

Q. Please describe the wetlands identified in your surveys.

A. TRC identified a total of 38 wetlands within the surveyed area and in relative proximity to the proposed roads, turbines, collector system, the proposed transmission right-of-way corridor, and other facility sites associated with the Project. These consisted primarily of small forested wetlands that occur along skidder trails, in confined pockets in the regional bedrock, in saddle areas along the ridgeline, and in areas with poorly drained soils that support wetland vegetation. Of the 38 wetlands identified, 27 are deciduous broad-leaf forested wetlands, three (3) are conifer forested wetlands, three (3) are a mix of forested and scrub-shrub wetland types, and five (5) are scrub-shrub wetlands. Three (3) of the delineated wetlands within the Project corridor consist of two or more wetland types, including three (3) streams with associated palustrine wetlands (two intermittent and one perennial stream). The full wetland report and the 2014 addendum is included in Appendix 11C of the Application.

When TRC conducted the additional wetlands delineation of the laydown yard in 2012, it identified four wetlands and one intermittent stream channel segment. The wetlands found on the eastern and western extents of the laydown site are broad-leaved deciduous forested wetlands draining in a northerly direction where overland stormwater flow entered 30 inch concrete culverts and traversed under Route 9 to a larger wetland complex. A third isolated broad leaved deciduous scrub-shrub wetland was found along the southern border of the site. This wetland was previously forested but trees had been removed by logging activity. The fourth wetland was found within the borrow pit and is dominated by speckled alder shrubs. This wetland appears to have been created during the excavation of the material in the borrow pit, and the use of the laydown yard site will require that 955 square feet of this wetland be filled. The intermittent stream channel was found to enter the site from the south and flowed towards Route 9. Before reaching Route 9, the channel dispersed within wetland AN-LD-3. The wetland delineation report for the second temporary staging area is included in Appendix 11C of the Application.

Q. What are TRC's conclusions regarding the Project's potential effect upon wetlands?

A. The Wetlands Report and 2014 Addendum, attached as Appendix 11C to the Application, and the laydown yard delineation report indicate that the Project will impact eleven (11) wetlands permanently. In total, only 0.22 acres (9,573 square feet) of permanent wetland impact (i.e., those which are deemed unavoidable during the Project planning process) are expected to occur as a result of the construction or operation of the Project. This small amount of impact is the result of careful planning and design to avoid and minimize impacts. Specific details of each of these areas are included in the Site Specific Alteration of Terrain permit application, which is included as Appendix 2B to the Application.

Because the level of permanent wetlands impact anticipated from the Project is below the New Hampshire Department of Environmental Services ("NHDES") threshold of 10,000 square feet, no compensatory mitigation is required. However, AWE will implement Best Management Practices for working in and near wetlands during construction. These practices include appropriate stormwater runoff and erosion control measures, which are described in more detail in the Site Specific Alteration of Terrain permit application and the joint USACE/NHDES Standard Dredge and Fill permit applications attached to the Application as Appendices 2A and 2B.

Q. Please describe the methodology used by TRC to conduct an analysis of the Project's potential effect upon vernal pools.

For purposes of the vernal pool field effort, TRC adopted the definitions described by the USACE Programmatic General Permit for the State of New Hampshire and the New Hampshire Department of Environmental Services ("NHDES") rules for identifying vernal pools and vernal pool habitat. The vernal pool surveys involved a field effort by two qualified biologists familiar with vernal pool resources in New England which consisted of visual meander surveys throughout the entire natural resources study area as depicted on the Natural Resource Survey Map, illustrated on Figure J.5.b in the Application.

Q. How did TRC identify and classify vernal pools?

A. All vernal pool features identified were classified into three categories: (1) natural vernal pools (those that meet criteria in state rules); (2) potential vernal pools, including those identified outside the indicator species breeding season and that have the physical characteristics described in state and federal definitions, but that will require a visit during breeding season to confirm the presence of indicator species; and (3) non-jurisdictional features including all other areas where amphibian breeding was documented but did not meet state and federal definitions of a vernal pool. Field observations suggest that rainfall and snowfall quickly run off the ridge to lower elevations, without collecting volumes that fill natural depressions or create natural ponds.

Q. How many vernal pools did TRC identify?

A. TRC identified a total of seven (7) features within the natural resource study area during the vernal pool survey. Six (6) of these were identified as natural vernal pools and one (1) feature was designated as a non-jurisdictional amphibian breeding area. No vernal pools were found in the area surveyed for the laydown yard. All six (6) natural pools observed occurred in natural isolated basins without an inlet or outlet and no populations of predatory fish. TRC did not find or document fairy shrimp in any of the identified features, despite seeking them intensively, and no rare or state-listed threatened or endangered species known to use vernal pools for at least one critical life stage were documented in any of the identified features. A full Vernal Pool Survey Report, including field data forms and site photographs is provided in Appendix 11D to the Application.

Q. What are TRC's conclusions regarding the Project's potential effect upon vernal pools?

A. The Vernal Pools Report prepared by TRC (Appendix 11D) indicates that the reconfigured Project will not directly impact any jurisdictional vernal pools or areas currently described as vernal pools as a result of the construction or operation of the Project.

Q. Has AWE taken steps to mitigate the effect of the Project on wetlands and vernal pools?

A. A key consideration in the design of the Project was avoiding and minimizing such effects. During the course of study and evaluation of the wetlands and vernal pools at the Project site, the Project's impacts on those resources were carefully considered and have resulted in a design plan that avoids and minimizes impacts. AWE has designed roadways to minimize environmental impacts to important resources, including routing the access road to avoid wetlands or vernal pools. Turbine sites and other Project components have been located to avoid direct wetland and vernal pool impact to the extent practical. The proposed laydown area has been defined with a 25-foot undisturbed buffer between graded areas and the remainder of the wetlands and stream resources that were identified on the Project site. As indicated above, due to the very small size of permanent wetlands impacts, no compensatory mitigation is required under NHDES rules.

Q. In your opinion, will the Project have an unreasonable adverse effect on wetlands or vernal pools?

A. No. For the reasons indicated in the above-described reports, it is my opinion that the Project will not have an unreasonable adverse effect on wetlands or vernal pools.

<u>Natural Communities and Rare Plants</u>

Q. Please describe the methodology used by TRC for conducting an analysis of the Project's potential effects on natural communities and rare plants.

A. TRC took a two- part approach to assessing the natural communities in the vicinity of the Project. First, TRC conducted a desktop review of available data for the Project area, including aerial photography, soils mapping, cover type, wetland and stream mapping, aspect and elevation, bedrock geology, ownership and land management, and a review of data available from the New Hampshire Natural Heritage Bureau ("NHNHB"). The second part of the natural community assessment included a field survey intended to classify the landscape of the proposed Project into discrete natural communities, and to identify any rare, threatened or endangered plant species. The survey was completed using a random point sampling protocol and data form developed in consultation with the NHNHB. The results of this survey are summarized in Section J.5 of the Application and the full Natural Communities Report is provided in Appendix 11A to the Application. The classification of the site's natural communities was done in accordance with the "Natural Communities of New Hampshire, Second Edition" (Sperduto & Nichols, 2011). The study area for the natural community assessment, approximately 460 acres, was the same as that assessed for wetlands, rare plants and other natural resources and as depicted in Figure J.5.a of the Application.

Prior to field investigations, TRC consulted with the NHNHB in order to identify any known or potential rare plant and/or natural community occurrences for the proposed site. No historic records were found. No significant natural communities were identified as a result of the Natural Community Survey. TRC followed up with the NHNHB in 2015 in order to identify any new occurrences of known or potential rare plant and/or natural community for the proposed site. No historic records were found that coincide with the Project site as a result of the 2015 NHNHB data check. While some natural communities that have the potential to support rare or uncommon species were observed in the study area, the species observed were generally common and no rare plants or species of concern were found.

Q. What do the Natural Communities and Rare Plant Reports conclude regarding the potential effects of the Project ?

A. TRC did not identify any significant natural communities or rare plants as a result of its surveys. None of the surveyed communities in the Project area would qualify as being "exemplary." Because of these findings, there are no avoidance or mitigation plans specific to these resources. A full study of the community types in the Project area is described in detail in the study report included in Appendix 11A.

Q. What was the NHNHB's determination with respect to the Site?

A. Staff of the New Hampshire Natural Heritage Bureau ("NHNHB") visited the Project site on December 13, 2011, and July 13, 2012. Based on observations during the site visits, NHNHB has determined that it is unlikely that the Project will impact rare plants or exemplary natural communities. Results of the NHNHB database review in 2015 had similar results as the data base review performed previously for the site, with no rare or exemplary elements identified that occur on the site.

Q. In your opinion, will the Project have an unreasonable adverse effect upon natural communities or rare plants?

A. No. Based on our surveys, the proposed Project will not result in any effect upon significant natural communities, rare plants or communities which are likely to support rare plants.

<u>Wildlife Habitat</u>

Q. Please describe the area that was reviewed for effects on wildlife habitat.

A. The Project area is undeveloped and forested, and it includes diverse natural resources that provide ample haven for a wide diversity of wildlife. The elevation of the site is between 1,042 and 1,904 feet above mean sea level and thus it eliminates the potential for impacts to sensitive high elevation alpine habitats. The area was once cleared for sheep farming and therefore contains numerous stone walls. After the decline of sheep farming, the site re-vegetated into a forested condition. It has been subject to industrial timber harvesting in the past several decades and therefore it includes patches of forest in various stages of regeneration and maturity, ranging from recent clear cuts and early successional stands, to mature forested areas. For purposes of classifying community types, early successional forest areas were classified as the community type into which they will develop. The site has a variety of cover types that are typical of the lower hills and slopes of the Monadnocks of the Hillsboro Inland Hill and Plains subsection of southwestern New Hampshire.

While abundant natural resources in and around the Project area provide ample opportunities for many of New Hampshire's indigenous wildlife species, a desktop review of known environmental factors indicated that no known critical habitat or endangered species were present at the Project site. Consultations with state and federal agencies yielded the conclusion that no wildlife habitat assessment report needed to be prepared for this Project. In a letter dated October 13, 2011, the United States Fish and Wildlife Service ("USFWS") confirmed that "no federally listed or proposed, threatened or endangered species of critical habitat under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area(s). Preparation of a Biological Assessment or further consultation with us under section 7 of the Endangered Species Act is not required."

Q. Has AWE taken any steps that will preserve habitat in the area?

A. AWE successfully negotiated several local land conservation agreements which will protect approximately 908 acres of land in and around the proposed Project. While this was not necessary for migration of any potential impacts to natural communities, rare plants or wildlife, these agreements will conserve in perpetuity valuable lands that are similar in character and natural communities to those being developed in the Project area.

Q. In your opinion, will the Antrim Wind Project have an unreasonable adverse effect in wildlife habitat?

A. No. For the reasons indicated above, we find no evidence to suggest that the Project will not have an unreasonable adverse effects on wildlife habitat.

Q. Does this conclude your pre-filed testimony?

A. Yes.

Results you can rely on

DANA B. VALLEAU, CPESC, PWS, CWB

EDUCATION
J.D., University of Maine School of Law, Portland, Maine, 1994
B.S., Wildlife Management, University of Maine, Orono, 1990

PROFESSIONAL AFFILIATIONS / REGISTRATIONS
- CPR/First Aid Certification
- Maine DEP Erosion and Sediment Control Practices Certified (#0129)
- Certified Professional in Erosion and Sediment Control (CPESC #2334)
- Certified Volunteer Lake Monitor
- Professional Wetland Scientist (#1590)
- Certified Wildlife Biologist
- Registered Maine Guide since 1990, Master Classification

AREAS OF EXPERTISE
Mr. Dana Valleau has experience in the following general areas:
- Project Management
- State and Federal Permit Applications
- Wind Energy Environmental Studies and Permitting
- FERC Pipeline Environmental Studies and Permitting
- Hydroelectric Licensing & Compliance
- Compliance Inspection
- Database Management
- Agency Consultation
- Water / Soil Sampling
- Radio Telemetry
- Remote Sensing and Photo-interpretation
- Wetland Delineation and Vernal Pool Identification and Documentation
- Fish / Wildlife Studies, including RTE Species

REPRESENTITIVE EXPERIENCE
Mr. Dana Valleau has over twenty years of experience working in the environmental field in a wide variety of capacities, including reviewing state permit applications, enforcing state land use laws, database management, water, biota, and soil sampling, radio telemetry, wetland delineation, fishway operations, fish and wildlife habitat identification including vernal pools, and fish and wildlife population studies. He has experience in local, state, and federal regulatory processes and permitting, a thorough understanding of environmental construction standards, and erosion control Best Management Practices. He is familiar with wind power environmental studies and permitting as well as FERC permitting and compliance with pipeline and hydro-electric licensing.

Texas Eastern Transmission, LP, Texas Eastern Appalachian Lease (TEAL) Project (2014 – Present

The TEAL Project is a proposed 4.5 mile natural gas pipeline loop which includes a connecting pipeline, new compressor station, additional compression at an existing compressor station, and piping modifications at other existing facilities. The purpose of the project is to facilitate transmission of natural gas from areas of production to other facilities in the upper Midwest. Mr. Valleau is the project manager for permitting and environmental studies. The project is a FERC regulated interstate pipeline.

TransCanada Energy, Ltd., Kibby Wind Power Project (2004 – present)

Coordinated and managed all field studies related to the successful permitting a 132-megawatt wind power generation facility and related facilities including substation and transmission line. Consulted with federal and state agencies and worked on permit applications for federal, state, and local permits. Provided expert testimony at public hearings related to site natural resources and avian studies. Was the project manager for construction environmental compliance and owners engineer work for TransCanada. Currently assisting TransCanada Operations with post-construction compliance and operations.

Algonquin Gas Transmission, LLC, Atlantic Bridge Project (April 2014 – Present)

The Atlantic Bridge Project is a proposed expansion to existing natural gas pipeline in the northeast, and includes lift-and-replace of existing pipeline, addition of looping pipeline, modifications to existing aboveground facilities, and new above ground facilities. Mr. Valleau is project manager. Duties include coordinating staff and subcontractors, drafting relevant FERC Resource Reports, agency consultation, preparation of applicable federal, state, and local permits.

Texas Eastern Transmission, LP, Ohio Pipeline Expansion Network (OPEN) Project (2013 – Present)

The OPEN Project is a proposed 76-mile long 36-inch diameter natural gas pipeline that extends through five counties in eastern Ohio and a greenfield compressor station for purposes of transporting processed shale gas into the Spectra Energy natural gas pipeline system. Mr. Valleau is managing the wildlife and fisheries surveys and reports. Duties include drafting relevant FERC Resource Reports, participation in agency consultation, preparation of applicable federal and state permits, and coordination of biological survey efforts.

Eolian Renewable Energy, LLC, Antrim Wind Energy Project (2010 – Present)

Coordinated and managed all field studies related to preparing a New Hampshire Site Evaluation Committee permit application including a state Alteration of Terrain and Dredge and Fill permit applications. Consulted with federal and state agencies to scope field studies and assess potential impacts. Consultation with USFWS included developing an Avian and Bat Protection Plan and addressing Bald and Golden Eagle Act issues.

Central Maine Power, Various Electric Transmission Line Construction Projects (2010 – present)
Provided environmental training and inspection services for electric transmission line construction projects.

TransCanada Energy, Ltd., Kibby Expansion Wind Power Project (2009 – 2011)
Coordinated and managed all field studies related to permitting a 45-megawatt addition to an existing wind power generation facility and related facilities including substation and collector line. Consulted with federal and state agencies and worked on permit applications for federal, state, and local permits. Provided expert testimony at public hearings related to site natural resources and avian studies.

Algonquin Gas Transmission Company, East to West HubLine Expansion Project, MA and CT (2007 – 2009)
This project consisted of expanding AGT's existing pipeline system in southeastern Massachusetts from Weymouth to Stoughton and in New London County Connecticut. Mr. Valleau's responsibilities included stream surveys.

New York Power Authority, Niagara Power Project Relicensing - Niagara Falls, New York (1999 – 2008)
Scoped and managed wildlife and RTE species field studies and a land management study that are part of FERC hydroelectric relicensing of the Niagara Project. Also drafted sections of the applicant prepared Environmental Impact Statement (EIS) and developed land management plan.

Maritimes and Northeast Pipeline, LLC, Phase II, III, IV Natural Gas Pipeline Project, Maritimes and Northeast Pipeline, Massachusetts (1999 – 2007)
ESA agency consultation for project crossing Atlantic salmon (*Salmo salar*) habitat; wetland monitoring on 98 miles of pipeline ROW; vegetation monitoring on 66 miles of ROW; fishery consultation on new pipeline construction.

Florida Power & Light, Hydroelectric Water Quality Compliance (2000 – Present)
Managed and collected water quality data on four hydro projects for FERC hydroelectric permitting and compliance. Drafted fish passage facility operation, maintenance, and effectiveness study plan for proposed fish lift.

Alabama Power Company, Recreation/Shoreline Management, Alabama (2001 – 2002)
Performed recreation site surveys and shoreline management planning for seven hydroelectric impoundments as part of FERC relicensing for the Coosa and Warrior River hydroelectric projects, Alabama.

Florida Power and Light Energy, Indian Pond Project FERC Relicensing and Compliance, (1999 – present)
Conducted radio telemetry study of salmonids below Harris Station, an 88 MW peaking facility on the Kennebec River, Maine. Study included analysis of flow-induced movements, an IFIM study, habitat use, seasonal movements, and spawning survey. Assisted in construction of study database (Access) for GIS.

Maritimes and Northeast Pipeline, LLC, Phase II Natural Gas Pipeline Project, Spread 2 (1999 – 2001)
Price Construction - Conducted erosion and sediment control and environmental compliance inspections of pipeline construction for primary construction contractor.

Central Maine Power Company, RPA Transmission Line, Section 217 (1999 – 2000)
Planned ROW construction access, conducted environmental compliance inspections, and managed construction restoration for new transmission line construction.

Other Experience

Maine Department of Environmental Protection, Enforcement Unit (1998 – 1999)
Investigated complaints, conducted on-site investigation and inspection, provided technical advice and education to the public to ensure compliance with environmental laws, rules, and standards, reviewed Maine State Natural Resource Protection Act Permit-by-Rule Notifications and drafted, negotiated, and presented notices of violation and consent agreements.

Maine Department of Environmental Protection, Enforcement Unit (1998 – 1999)
Prepared educational presentations of State rules and regulations to construction and forestry professionals and municipal officials.

Maine Department of Environmental Protection, Licensing Unit (1997 – 1998)
Reviewed and evaluated Site Location of Development Permit Applications. Negotiated, drafted permits and performed compliance inspections of Site Projects.

Maine Department of Environmental Protection, Geology Unit (1996 – 1997)
Compiled and confirmed site data of potential groundwater threats and performed QA/QC on state-wide groundwater database (ORACLE) and GIS for the Maine Department of Environmental Protection (MDEP), Augusta, Maine.

Maine Department of Environmental Protection, Biology Unit (1995)
Provided assistance to MDEP biologists and engineers by collecting water, fish, and insect samples, observing field conditions, managing data, and writing reports for waste-load allocation studies, a state-wide toxin study, and a state-wide water quality survey.

Atlantic Sea-Run Salmon Commission, Narraguagus River Project (1991 – 1993)

Assisted State Atlantic salmon (*Salmo salar*) biologists in the development and implementation of a habitat survey of the Narraguagus River drainage, using standard surveying techniques and GIS as part of ongoing Atlantic salmon restoration program. Monitored adult populations through fishway trapping. Also assessed juvenile populations by electro-fishing and collected surface and ground water samples.

Bangor Hydro Electric Company, Veazie and Milford Hydro Projects (1989)

Assisted Bangor Hydro-Electric Company biologists in locating fish with radio telemetry, tending fishway traps, data management and entry, and fishway inspection, as part of hydroelectric licensing and relicensing on the Penobscot River, Maine. Funded by Buddy Lane Fellowship.

Atlantic Sea-Run Salmon Commission, Salmon Restoration Project (1987 – 1988)

Assisted State Atlantic salmon biologists in radio telemetry, electro-fishing, tending fishway traps, stocking, hatchery work, habitat survey, habitat maintenance, fishway inspection data management and entry, and water pH and DO sampling in ongoing Atlantic salmon restoration efforts and hydro-electric licensing and relicensing on all the Atlantic salmon rivers in Maine. Funded by Buddy Lane Fellowship.

Downeast Peat LP, Denbo Heath Project, Downeast Peat LP Peat Mine and Electric Generation Facility (1988)

Conducted breeding bird and mammal use survey in and adjacent to peat bogs.

U.S. Fish and Wildlife Service, Fisher Project, Maine Coop Fish and Wildlife Unit, Orono, ME (1986)

Assisted doctorate candidate in field study of fisher (*Martes pennanti*) utilizing radio telemetry to identify home range and habitat use in central Maine.

PROFESSIONAL COURSEWORK & TRAINING

- 1998 Basic Erosion Control Practices for Contractors
- 1999 Advanced Erosion Control Practices for Contractors
- 1999 Geotechnical and Soil Bioengineering Slope Stabilization
- 2002 Advanced Hydric Soil Identification
- 2002 Delineating Hydric Soils on a Human Disturbed Site

Adam J. Gravel

Project Manager, Certified Wildlife Biologist

Mr. Gravel is the Managing Leader of Stantec's Topsham, Maine Office, comprised of natural resource and regulatory specialists. He is also a Certified Wildlife Biologist and Project Manager responsible for coordinating ecological inventories and environmental resource evaluations, including wildlife surveys, avian and bat impact evaluations, and habitat studies. Mr. Gravel has most recently been involved in organizing and conducting large-scale natural resource investigations associated with wind power and transmission projects. He has provided permitting and expert testimonial support to several New England wind projects, including three in New Hampshire and two in Vermont. His field biology experience has allowed him to conduct avian radar surveys, breeding-bird surveys, winter track surveys, bat surveys, raptor surveys, and natural community surveys in Maine, New Hampshire, Vermont, Pennsylvania, Ohio, West Virginia, Virginia, and New York. Mr. Gravel takes an innovative, solution oriented approach to survey design and implementation which has enabled Stantec to conduct ecological surveys in some of the Northeast's most remote and challenging locations.

PROFESSIONAL EXPERIENCE

- Stantec Consulting. 2014 to present. Managing Leader of Stantec's Topsham, Maine Office.
- Stantec Consulting. 2007-2014. Wildlife Biologist and Project Manager.
- Woodlot Alternatives, Inc. 2004-2007. Wildlife Biologist and Project Manager.
- New Hampshire Division of Forests and Lands. 2003. Field Research Technician.
- University of New Hampshire. 2002-2003. Research Lab Technician.
- University of New Hampshire. 2002. Field Research Assistant.

EDUCATION

BS, Wildlife Management, University of New Hampshire, Durham, New Hampshire, 2003

40-hour HAZWOPER Certified, OSHA, Topsham, Maine, 2012

REGISTRATIONS

Certified Wildlife Biologist, the Wildlife Society

Lempster Wind Project, New Hampshire

As the Project Manager, Mr. Gravel was responsible for coordinating and conducting environmental surveys and providing permitting support for this 24 MW wind project, the first in New Hampshire. Tasks included developing and negotiating work plans with agencies, performing avian and acoustic bat studies, rare species investigations, vernal pool surveys, and providing testimonial support. Mr. Gravel was also involved in the initial development of post-construction bird and bat monitoring protocols for the project.

PROJECT EXPERIENCE

Groton Wind Project, Grafton County, New Hampshire

Mr. Gravel is Project Manager for the proposed Groton Wind Project, which will consist of up to 25 2.0 MW turbines on the forested ridges of Tenney and Fletcher Mountains in the Sunapee Uplands of New Hampshire. He has coordinated numerous studies to address wildlife-related issues present in the vicinity of the project, including avian radar studies, acoustic bat surveys, and Breeding Bird Surveys (BBS) using the United States Fish and Wildlife Service BBS methods. Mr. Gravel worked with the New Hampshire Fish and Game Department to develop protocol and perform spring and fall raptor surveys, and collaborated with New Hampshire Audubon to conduct monitoring of peregrine falcons near the project area. He was involved in the drafting of an avian risk assessment that evaluated the potential impacts to birds and bats as a result of the project and provided expert witness testimony and support during the New Hampshire Site Evaluation Committee process

Adam J. Gravel

Project Manager, Certified Wildlife Biologist

Granite Reliable Wind Park, Coos County, New Hampshire

Mr. Gravel has acted as the Project Manager on this long-term project, supervising and conducting a variety of natural resource surveys to assess potential concerns raised by the proposed project. Surveys included several seasons of nocturnal radar surveys, wetland and vernal pool reconnaissance surveys, multiple seasons of acoustic bat surveys, rare plant surveys, a raptor migration survey, and a Natural Community Characterization. A winter track survey was also conducted within the project site to document occurrence of American marten (State Threatened) and Canada Lynx (Federally Threatened). Mr. Gravel gave several agency presentations to summarize the multiple seasons of environmental surveys and their implications for the project and he has provided expert witness testimony regarding the work conducted at the site.

Georgia Mountain Community Wind Project, Milton, Vermont

As Technical Lead for the 4.5 megawatt wind project, Mr. Gravel coordinated a nocturnal migration study using X-band radar. He also provided support for the Section 248 process, including participation in meetings with Vermont Agency of Natural Resources biologists and development of a work scope for nocturnal radar surveys. Mr. Gravel prepared and submitted pre-filed testimony and responses to discovery requests, and he provided expert witness testimony during subsequent evidentiary hearings before the Vermont Public Service Board. The project is currently operational.

Deerfield Wind Project, Readsboro, Vermont

Mr. Gravel served as technical lead for the proposed Deerfield Wind Project. He conducted and coordinated numerous studies to address wildlife-related issues present in the vicinity of the project, including avian radar studies, acoustic bat surveys, and Raptor Migration Surveys in accordance with agency approved methods. Mr. Gravel worked with the Vermont Agency of Natural Resources prior to initiating studies. He also supported the expert witness testimony process as part of the evidentiary hearings before the Vermont Public Service Board.

Record Hill Wind Farm, Maine

Mr. Gravel acted as Project Manager for the Record Hill wind project, which is a 22-turbine, 55 MW wind project on a forested ridge environment in the western mountains of Maine. For this project, he coordinated planning and feasibility studies, wetland delineations, wildlife impact studies, noise and visual impact assessments, and helped to coordinate all state and Federal environmental permitting.

Stetson Mountain Wind Farm, Washington County, Maine

Stetson is a 57 MW generation facility consisting of 38 turbines on a 6.5-mile, low-elevation ridge in Washington County, Maine. Mr. Gravel acted as Technical Lead responsible for avian and bat studies during the planning process and assisted in the design of a post-construction avian and bat monitoring program.

Sheffield Wind Project, Sheffield, Vermont

Mr. Gravel served as technical lead for the Sheffield Wind Project. He conducted and coordinated numerous studies to address wildlife-related issues present in the vicinity of the project, including avian radar studies, acoustic bat surveys, acoustic bird surveys, and raptor migration surveys in accordance with agency approved methods. Mr. Gravel worked with the Vermont Agency of Natural Resources prior to initiating studies. The information collected from these studies was used to develop a comprehensive wildlife impact evaluation. He also supported the expert witness testimony process as part of the evidentiary hearings before the Vermont Public Service Board. The project is now operational.

Kingdom Community Wind Project, Lowell, Vermont

As Technical Lead for the Kingdom Community Wind Project, Mr. Gravel coordinated a nocturnal migration study using X-band radar, an acoustic bat study, breeding bird surveys, and raptor migration studies. He also provided support for the Section 248 process, including participation in meetings with Vermont Agency of Natural Resources biologists and development of a work scope avian and bat surveys. Mr. Gravel prepared and submitted pre-filed testimony and responses to discovery requests, and he provided expert witness testimony during subsequent evidentiary hearings before the Vermont Public Service Board. The project is now operational.

Adam J. Gravel

Project Manager, Certified Wildlife Biologist

PUBLICATIONS

Pelletier, S.K., G.C. Kendrick, T.S. Peterson, and A.J. Gravel. Atlantic Offshore Bird & Bat Pilot Study: 2009 Results. *Poster Presentation at AWEA Offshore Energy Conference, Atlantic City, New Jersey*, 2010.

Pelletier, S., G. Kendrick, G. Giumarro, T. Peterson, and A. Gravel. Gulf of Maine Offshore Bat and Bird Project. *Poster Presentation at AWEA Offshore Energy Conference; Boston, Massachusetts*, 2009.

Giumarro, G. and A. Gravel. Assessing The Risk Of Avian And Bat Mortality At Commercial Wind Farms. *Presentation at the Windpower 2009 Conference and Exhibition, Chicago, Illinois*, 2009.

Pelletier, S.K., A.J. Gravel, and T.S. Peterson. Nocturnal avian flight heights relative to risk of collision with wind turbines. *Poster presentation at the NWCC Wind Wildlife Research Meeting VII in Milwaukee, Wisconsin*, 2008.

Pelletier, S.K., C.W. Meinke, T.S. Peterson, and A.J. Gravel. 2008. Radar and acoustic bat surveys in pre and post-construction bird and bat mortality monitoring. *Poster presentation at the 2008 American Wind Energy Association conference in Los Angeles, California*, 2008.

Gravel, A. Windpower and Wildlife an Overview of Pre-construction Survey Methods and Results. *Presentation to State and Federal Natural Resource Agencies*, 2008.

STATE OF NEW HAMPSHIRE

BEFORE THE SITE EVALUATION COMMITTEE

Docket No. SEC 2015-02

<u>APPLICATION OF ANTRIM WIND ENERGY, LLC</u>
<u>FOR A CERTIFICATE OF SITE AND FACILITY</u>

PREFILED DIRECT TESTIMONY OF DANIEL T. BUTLER AND PATRICK M. MARTIN ON BEHALF OF ANTRIM WIND ENERGY, LLC

September 10, 2015

Qualifications of Daniel T. Butler

Q. Please state your name, title and business address.

A: My name is Daniel T. Butler. I hold the position of Manager, Civil and Transmission Engineering Department with TRC Companies, Inc. (TRC"). My business address is 249 Western Ave., Augusta, Maine 04330.

Q. Please describe the services provided by TRC.

A: TRC is a national engineering, consulting and construction management firm that provides integrated services to energy, environmental and infrastructure projects. TRC serves a broad range of clients in government and industry, implementing complex projects from initial concept to operations.

Q. What are your responsibilities at TRC?

A: I supervise, coordinate, review and stamp engineering and design work of TRC's Civil and Transmission Engineering Department.

Q. Briefly summarize your educational background and work experience.

A: I hold a Bachelor of Science degree in Civil Engineering from the University of Maine. I have almost 30 years of broad-based civil / structural engineering experience. Examples of projects on which I have worked include structural and foundation design of electrical equipment supports and civil site design for electrical and transmission substations and wind projects; stormwater quantity and quality calculations for substations, transmission lines, and wind projects; preparation of SPCC plans and designs; and land-use permit application preparation.

Additional detail regarding my education, background and experience is contained in my curriculum vitae which is attached hereto as Attachment DTB-1.

Q. Have you ever testified before the New Hampshire Site Evaluation Committee ("SEC")?

A. Yes. I presented testimony regarding the design and construction of the Antrim Wind Project, as well as its potential effect on water quality and proposed mitigation measures, in connection with Antrim Wind Energy, LLC's ("AWE") application for a certificate of site and facility in Docket 2012-01. I have also provided testimony in the State of Vermont regarding the siting of the Glebe Mountain Meteorological Tower.

<u>Qualifications of Patrick M. Martin</u>

Q. Please state your name, title and business address.

A: My name is Patrick M. Martin. I am a Civil Engineer with TRC Companies, Inc. ("TRC"). My business address is 6 Ashley Drive, Scarborough, Maine 04047.

Q. What are your responsibilities at TRC?

A: My primary responsibility is to provide civil engineering support to a variety of projects. This generally includes grading and drainage design, storm water management design, hydrologic and hydraulic modeling, erosion and sediment control design, and technical report writing. I also undertake some supervisory and project coordination responsibilities.

Q. Briefly summarize your educational background and work experience.

A: I hold a Bachelor of Science degree in Environmental Engineering from Oregon State University. I have nearly fifteen years of civil engineering experience, with a background in water resources, transportation and site-civil engineering. My project experience includes work in both the public and private sectors. My responsibilities have included roadway design, site layout, grading and drainage design, utility design and coordination, hydrologic and hydraulic modeling, preparation of construction plans and permitting.

Additional detail regarding my education, background and experience is contained in my curriculum vitae which is attached hereto as Attachment PMM-1.

Q. Have you ever testified before the New Hampshire Site Evaluation Committee ("SEC")?

A. Yes. I presented testimony regarding the design and construction of the Antrim Wind Project, as well as its potential effect on water quality and proposed mitigation measures, in connection with Antrim Wind Energy, LLC's ("AWE") application for a certificate of site and facility in Docket 2012-01.

<u>Purpose of Testimony and Overview of Project</u>

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to describe the design and construction of the reconfigured Antrim Wind Project. We will also discuss the Project's effect on water quality and the proposed mitigation of any such effects. Furthermore, we will explain why the construction of the Project will not have an unreasonable adverse effect upon public health and safety.

Q. Are you familiar with the Project proposed by AWE in this matter?

A. Yes, we are. AWE first retained TRC to assist in the construction design of the Project as it was proposed in Docket 2012-01, and TRC has again assisted in the design of the reconfigured Project proposed in this Docket. As in Docket 2012-01, TRC has also been tasked with assessing the potential effect of the proposed Project upon water quality, as well as the potential effect, if any, of the Project's construction upon public health and safety. As senior civil engineers, we have also been involved in the site planning and have conducted a field review of the Project site.

Q. Please describe the Project that TRC reviewed for design and construction purposes.

A. Though the design of the Project has been revised to address aesthetic concerns expressed in Docket 2012-01, the proposed Project site has not significantly changed. The proposed Project site runs approximately north to south along the ridge top of Tuttle Hill and Willard Mountain and spans several individually owned parcels. It will be accessed from State Route 9. The Project area touches upon three watersheds in the town: the North Branch River, Gregg Lake, and an unnamed stream which continues to its confluence with North Branch River at Steels Pond.[1] The North Branch River, which was placed in the NH Rivers Management and Protection Program in June 1991, runs along the north side of Route 9, in the valley to the north of the Project area, and is a major tributary to the Contoocook River. Gregg Lake, which is approximately 195 acres, is located in the valley to the southeast of Tuttle Hill and supports a moderate warm water fishery. Streams in the Project area include unnamed perennial and intermittent streams which drain either to the north toward Route 9, or to the southeast into Gregg Lake. There are very few perennial streams. The Project site is predominantly unimproved and heavily wooded. There is clear evidence of past logging activities in some areas. Slopes in the Project area range from approximately two (2) percent at the ridge top and saddles, to approximately 50 percent along the steeper natural slopes. Elevations range from approximately 1,042 feet to 1,752 feet above mean sea level. Soil types on or adjacent to the Project site include stony loam and complex stony loam, as well as rock outcrop and rock outcrop complex.

[1] The Project site, as initially proposed in Docket 2012-01, also touched upon the Willard Pond watershed. However, with the removal of the 10th turbine, the Project site no longer touches upon the Willard Pond watershed.

Q. Please describe the Project that TRC reviewed for design and construction purposes.

A. The Project involves the construction of nine (9) wind turbines, nine (9) graveled wind turbine generator construction areas, a 1.64 acre gravel/crushed stone yard area for a Public Services of New Hampshire (PSNH) interconnection substation, a collector station, an Operation and Maintenance building and parking area, approximately 3.55 miles of crushed stone access roads (including two spur roads), a 34.5 kV collector system, and a stormwater management system. Within the Project area, approximately 55.3 acres will be disturbed during construction; approximately 44.05 of those acres will be restored and revegetated upon completion of construction. The interconnection and collector substation yards, which will feature an open-graded crushed stone surface and two (2) control houses, are located adjacent to an existing PSNH transmission corridor to minimize the amount of clearing required for the new lines. The entire yard area will be enclosed within a security fence. The first 900 feet of the access road will be paved, if required by PSNH, and the remainder will be constructed of crushed stone or gravel. From the entrance at Route 9 to turbine #1, the road will be constructed with a width of 16 feet. The roadway beyond the turbine #1 will have a construction width of 34 feet to accommodate the turbine-erection crane. The road will have a maximum slope of 12%, with the exception of two short lengths where it reaches 13%. Upon completion of construction, the road width will be reduced to 16 feet along its entire length by revegetating a 9-foot shoulder on both sides. The side slopes will also be stabilized and revegetated. A gravel wind turbine construction area will be built at each turbine location. These areas will be approximately 0.9 acres each, and will provide room for a 6,000 square foot crane pad, a 20-foot diameter concrete tower foundation, and a turbine assembly area. These areas will also be used as staging and laydown areas during construction. After construction, all areas not required to be kept clear for maintenance purposes will be revegetated.

A temporary staging area to serve as on-site construction headquarters (i.e. the site of construction trailers, parking, receiving, and storage) will be located in a two (2) acre upland area between Route 9 and the Project substation. This area will be cleared and graded, and topsoil will be stripped and stockpiled for use during restoration. Geotextile fabric will be installed and topped with a layer of clean, well-draining gravel. An additional laydown area will be located off Route 9, west of the proposed Project entrance, and will occupy approximately 2.9 acres of previously disturbed area which was a gravel borrow pit and log landing. Temporary erosion control measures will be implemented to minimize erosion and sedimentation. After construction is completed, any debris, unused material, the gravel and geotextile will be removed, and the stockpiled topsoil will be replaced. The area will then be stabilized and seeded using approved native New Hampshire seed mixes, and allowed to revegetate with native plant species.

A 34.5 kV collector system will be constructed from the turbines to the sub-station, with certain portions being underground, under the roadway, and other portions running overhead, roughly parallel with the road, depending on the topography and other factors.

<u>Potential Effect of Project Upon Water Quality</u>

Q. Has TRC assessed the potential effect of the Project upon water quality?

A. Yes. There will be no water withdrawal or discharge associated with the Project. The Project is designed to meet all state and federal water quality standards, and all potential effects upon water quality, including erosion and sedimentation during the construction phase and changes in storm water runoff have been addressed. AWE has designed a storm water management system that minimizes potential effect to existing natural drainage ways. Overall drainage patterns and directions of flow will remain generally the same. The Project will result in only a relatively small amount of new impervious areas distributed between three expansive and largely undeveloped watersheds, and as such the Project is unlikely to result in a significant increase in runoff. There will be a permeable road base at appropriate locations to maintain sheet flow conditions and provide hydrologic / hydraulic connectivity between wetlands. Where steep roadway / ditch slopes will impede the effectiveness of the permeable road base, culverts have been spaced every 100 feet to minimize channelization of runoff. The roadway will cross two identified streams. At one stream crossing, the road is in approximately 10 feet of cut to meet the maximum slope requirement of 12% for construction and delivery vehicles. As a result, impacts to the stream cannot be avoided. At the second crossing a three-sided concrete box culvert has been designed to comply with NHDES stream crossing guidelines.

A stormwater runoff model has been prepared for each of the three (3) watersheds affected by the Project. These models demonstrate that, on a watershed scale, the project will not result in a significant increase in stormwater peak rates of runoff for the 2-year, 10-year, or 100-year design storms in any of the three watersheds.

Q. What steps will AWE take to address effects of the Project upon water quality?

A. AWE will take a number of steps to reduce and mitigate the effect of the Project on water quality, including complying with design requirements for runoff quality control included in Chapters 2 and 4 of the New Hampshire Storm Water Manual. AWE's storm water management system incorporates a combination of roadway buffers, ditch turnout buffers, treatment swales and bioretention basins. TRC has prepared a grading and drainage plan detailing approved construction measures and best management practices for controlling storm water runoff and drainage for the site. A permeable road base constructed of coarse rock that allows runoff to pass freely under the road is proposed for reasonably flat lengths of roadway where bypass is less likely and the road is in a fill condition, to minimize channelization runoff, and in areas where the roadway crosses wetlands and maintaining hydraulic / hydrologic connectivity is desirable. Culverts will be installed per the design plans to maintain or improve the drainage of the area without increasing erosion of topsoil. During construction of the Project, AWE will install and maintain temporary sediment and storm water control devices, including silt fences, mulch berms, straw bale barriers, stone check dams, slope drains, rock stabilization of channels, hay bales, wood chips, swales, erosion control matting, and temporary sediment traps and / or water bars. After erection of the turbines, AWE will reseed with native mix and restore non-roadway areas to ensure that soils are not subject to erosion. A copy of the complete Stormwater Management Plan is included in Appendix 2B to AWE's Application.

Q. What was the Site Evaluation Committee's finding with respect the effect of the Project, as proposed in Docket 2012-01, upon water quality?

A. The Committee found that any potential concerns regarding water quality were adequately addressed by three recommended permits issued by the Department of Environmental Services (the Alteration of Terrain Permit and §401 Water Quality Certification, the Wetlands Permit, and the Subsurface Systems Permit) and that compliance with the conditions of said permits would support a finding that the Facility would not have an unreasonable adverse effect on water quality.

Q. In your opinion, will the Project have an unreasonable adverse effect on water quality?

A. No. AWE's proposed water quality treatment measures adequately address runoff from the Project site and protect nearby natural resources. It is therefore our opinion that the Project will not have an unreasonable adverse effect on water quality.

Public Health and Safety During Construction

Q. Please summarize the construction phase of the Project.

A. AWE has retained an experienced general contractor, Reed & Reed**,** who will have overall responsibility for the construction of the Project in accordance with the plans and technical specifications, as well as all applicable codes, standards and permit conditions. Reed & Reed will manage initial field work, including surveying and site flagging to establish clearing areas, buffer zones and non-disturbance areas. A qualified logging company will clear and remove trees where necessary. Access road construction will begin as soon as sufficient areas have been cleared to enable drilling and excavation. A construction staging area will be cleared in the vicinity of the operations building and substation area. For transport roadways, clearing is typically done to establish an approximately 30-foot corridor centered on the road alignment. Where the collection system is overhead and adjacent to the transport roadways, an approximately 40-foot wide corridor will be cleared; for crane roads the width of the corridor will be approximately 50 feet. Any blasting that is necessary will be done by an experienced licensed contractor who will operate in strict compliance with a project blasting plan, which will be provided to the Town of Antrim and reviewed and approved by the New Hampshire Department of Safety. Blasting plans will include advance notification procedures, as well as documented safety and control measures and warning signs and sounds. At the end of construction, all areas that are not developed into the final, operational components of the Project will be restored to their preconstruction condition.

Q. In your opinion will this project have an unreasonable adverse effect on public health and safety during the construction phase?

A. No. In view of the above-described steps that AWE will take during construction, we do not believe that this Project will have an unreasonable adverse effect on public safety during the construction phase.

Q. Does this conclude your pre-filed testimony?

A. Yes.

DANIEL T. BUTLER, PE

EDUCATION
B.S., Civil Engineering, University of Maine, 1986
Civil Engineering Graduate Courses, University of Maine, 1995

PROFESSIONAL REGISTRATIONS/CERTIFICATIONS
Registered Professional Engineer, Alabama (#32832-E), 2012
Registered Professional Engineer, Arizona (#45969), 2007
Registered Professional Engineer, Connecticut (#23045), 2002
Registered Professional Engineer, Florida (#53332), 1998
Registered Professional Engineer, Georgia (#PE037171), 2012
Registered Professional Engineer, Maine (#6796), 1990
Registered Professional Engineer, Massachusetts (#47517), 2008
Registered Professional Engineer, Mississippi (#20709), 2012
Registered Professional Engineer, Nevada (21881), 2012
Registered Professional Engineer, New Brunswick, Canada (#L3291), 1998
Registered Professional Engineer, New Hampshire (#8105), 1991
Registered Professional Engineer, New Jersey (#24GE04574600), 2005
Registered Professional Engineer, New Mexico (#17752), 2006
Registered Professional Engineer, New York (#079800), 2002
Registered Professional Engineer, North Carolina (#38931), 2012
Registered Professional Engineer, Pennsylvania (#PE077437), 2010
Registered Professional Engineer, Prince Edward Island, Canada (#1141), 2007
Registered Professional Engineer, Rhode Island (#9164) 2009
Registered Professional Engineer, South Carolina (#29946), 2012
Registered Professional Engineer, Texas (#106460), 2010
Registered Professional Engineer, Vermont (#46232), 2009
Registered Professional Engineer, Virginia (Pending Board Approvals)
Registered Professional Engineer, West Virginia (#18069), 2009

AREAS OF EXPERTISE
- Engineering Management
- Civil and Structural Design
- Project Management
- EPC Project Management
- Preliminary and Conceptual Design
- Condition Assessment
- Engineering Studies
- Equipment Specifications
- Detailed Engineering Design
- Project Scheduling and Estimating
- Spill Prevention, Control and Countermeasure Plans (SPCC)
- Site Layout and Grading

- Foundation Design
- Foundation Design
- Licensing and Permitting
- Stormwater and Water Management Licensing and Permitting

REPRESENTATIVE EXPERIENCE

Mr. Butler has approximately 26 years of broad-based civil/structural engineering experience with over 10 years in the power delivery sector with specific expertise in substation site grading and development; foundation and concrete design; roadway design; sanitary sewer and water system designs; stormwater and erosion control management; environmental permitting; and extensive experience with engineering, procurement, and construction (EPC) contracts. Mr. Butler is also experienced with SPCC Plan and secondary containment design and has prepared and/or modified SPCC plans for commercial, government, and utility facilities across the country.

As Manager of the Civil and Transmission Engineering Department, Mr. Butler's primary duties are as an Engineer of Record. As an Engineer of Record, Mr. Butler is responsible for the preparation, reviewing, coordinating, signing, dating, sealing, and issuing of any engineering document prepared by himself or by others working under his direction.

PSNH, Thornton 115/34kV Greenfield Substation Project – Merrimack, NH

Lead civil engineer and engineer of record for this EPC project to design and construct a 115/34.5kV greenfield substation. This project had its challenges including highly liquefiable soils. Led the effort to design an efficient pile-support foundation system that resulted in substantial savings allowing the project to come in on budget.

First Wind, Oakfield II 106MW (46Turbines) Wind Farm – Oakfield, ME

TRC's scope of work included design of the ridge-top turbine sites; about 20 miles of crane and access roads; over 30 miles of 34.5kV collector system, including 2 miles of underground collector; a 34.5 to 115kV substation; 60 miles of 115kV transmission system; and site design for the Operation and Maintenance facility. TRC's work also included coordination with the Owner's environmental engineer to identify and minimize impact on significant natural resources.

TransCanada, Kibby Wind Project – Kibby Township, ME

The Kibby Wind Project consisted of two distinct project developments—one on Kibby Mountain and the other on nearby Sisk Mountain. For the Kibby project, TRC designed the 30 mile 115kV transmission line and served as the Owner's Engineer for the design of the substation. For the Sisk project, TRC provided all permitting and engineering design services, including the preparation of the stormwater and erosion control management plans and the design of the access and ridge top roads, 34.5kV collector system, and the 115/34.5kV substation.

When completed, the overall wind development will consist of over 50 3.0MW, v90 Vestas wind turbines spread along the two mountain ranges, making this wind project the largest in New England.

National Grid, Wakefield Junction Substation – MA
As the prime consultant/contractor on the Wakefield Junction Substation project, TRC is providing engineering, procurement, and construction services for a new 345/115kV GIS substation under the terms of an EPC contract. The project includes engineering, designing, procuring, constructing, and testing equipment to provide the owner with complete operational facilities. These facilities include an indoor 115kV twelve breaker gas insulated substation, an indoor 345kV twelve breaker gas insulated substation, and four 345/115kV autotransformers situated within concrete containments and protected via removable, pre-cast firewalls. Each containment was constructed with a steel platform system to support a layer of crushed stone designed to squelch flames. Completion of this project is a critical part of various improvements to the transmission system associated with the North Shore Area Upgrades.

Northeast Utilities, Barbour Hill Substation – South Windsor, CT
TRC provided engineering, procurement, and construction services to Connecticut Light & Power for the Barbour Hill Substation Modification Project. This project included the removal and disposal of 3,000 cubic yards of contaminated soils, the construction of a new 115kV substation, the cut-over of six 115kV overhead lines from an existing 115kV substation to the new 115kV substation, the demolition and removal of the existing 115kV substation, the construction of a new 345kV substation, and the cut-over of an existing 345kV overhead line. Use of pre-cast foundations for the smaller substation equipment cut the construction effort significantly; the 345kV structures were founded on 6’ diameter x 35’ long caisson foundations to save cost and to resist significant uplift. Containment for the 345/115kV transformers consisted of geomembrane-lined, stone-filled pits. Cast-in-place firewalls provided the necessary fire protection per applicable NFPA codes.

Central Maine Power, Maguire Road Project – Southern Maine
TRC, as a joint venture, provided engineering, licensing, procurement, and construction services to Central Maine Power. This project was designed to improve the reliability of the transmission system in Southern Maine and included the construction of a new 115kV substation, a major expansion of a 345kV substation, upgrades at multiple remote end substations, and transmission line rebuilds and re-conductors.

Bangor Hydro Electric Company, NRI Orrington 345kV Substation Expansion Project
TRC provided engineering, procurement, and construction services to BHE for an expansion at the existing 345/115kV Orrington Substation Facility as part of the Northeast Reliability Interconnect 345kV Transmission Line Project. Changes

included the relocation of the existing Orrington-Maxcy's tie-line, the addition of a series compensation of the Orrington-Maxcy's 345kV Line, termination of an additional second tie-line to New Brunswick Power, expansion of the existing control house to accommodate new and future protection and control equipment, cable trench, and conduit additions to comply with NPCC separation requirements.

Rochester Gas & Electric, Rochester Transmission Project – Rochester, NY
TRC, working in partnership with two other firms, completed final design, procurement, and construction of the Rochester Transmission Project EPC project. At the time of award this project was the largest one of its kind in the country. The scope of work included engineering, procurement, project management, civil and electrical construction, testing, and commissioning of all facilities in this project. The facilities in this project included approximately 38 miles of new or rebuilt 115kV transmission lines, two new 115kV substations, and expansion and equipment upgrades at nine existing substations, including a 345/115kV yard. The steel-pole transmission towers were founded on reinforced concrete caissons in sizes up to 10' in diameter and up to 30' deep. Containment for the new 345/115kV transformer consisted of a geomembrane-lined, stone-filled pits. Existing 115/34.5kV transformers at several of the expanded yards received retro-fitted containments that included stone-lined, geomembrane pits, or remote oil/water separators.

Ventus Energy, West Cape and Norway Wind Projects – Prince Edward Island, Canada
TRC's scope of work included the design, procurement, project management, construction oversight, and commissioning of 138/69kV interconnection facilities and 34.5kV collector systems for two wind-powered generating facilities located along the north western coastline of Prince Edward Island, Canada.

National Grid, Clay 345kV Rebuild – Clay, NY
This project consisted of reconfiguring seven existing 345kV transmission lines in conjunction with rebuilding a 40-year–old substation. The project included the addition of an eighth bay to an existing seven-bay 345kV yard to allow most of the work to be done in a de-energized bay. The substation upgrade included a new 345kV control house and station service. The transmission reconfiguration included replacement of existing lattice steel structures of several different designs with tubular steel pole structures.

Public Service of New Hampshire, Saco Valley Substation Upgrade – NH
TRC supported this project to improve the reliability of electricity in northern New England by providing design, construction oversight, and commissioning services for the Saco Valley Substation upgrade project that included the installation and protection of a 290MVA Phase Shifting Transformer (PST). To accommodate the PST, TRC modified the existing substation structures to include a 115kV bus extension, protection and control systems, and a new control house. Containment for the 600-ton PST was provided by a geomembrane-lined, stone-filled pit. An oil-

minder pump system was incorporated to automatically pump stormwater from the pit without the danger of discharging oil.

Barksdale AFB, Jet Fuel Off-Load Facility – LA
Design manager and lead civil engineer for a 5-acre JP-8 petroleum logistics facility to support jet fuel receipt requirements at Barksdale Air Force Base (AFB), Louisiana. The design provides the capability to receive 100% of the Base's daily jet fuel requirement by tank truck, operating storage for receipt/issue of JP-8, aircraft refueler fillstands, and connection into the existing petroleum logistics infrastructure. Ancillary facilities include a system pumphouse, operations facility, reinforced concrete secondary containment systems, and a 2,000 gpm oil/water separator capable of treating contained stormwater during the site's "first flush.

DFSP Tampa, Repair Petroleum, Oil, and Lubricant Facilities – Tampa, FL
Design manager and lead civil engineer for a containment lining, drainage system, and an oil/water separator repair project for the 7-acre fuel facility. The project includes the design of a 750,000-square–foot geomembrane liner system, a 2,000-foot drainage system, and twin 1,250 gpm precast concrete aboveground oil/water separators. Environmental permitting and plans included an SP3 Plan, a Florida DEP Air Emissions Permit, a Florida DEP Wastewater Discharge Permit, and an EPA NPDES Discharge Permit.

Rochester Gas & Electric, Substation SPCC Updates
Lead civil engineer on project to update or prepare new SPCC plans for eleven substations in and around Rochester, New York, in accordance with revised 40CFR112 regulations. Work effort ranged from minor text revisions to developing transformer inspection program in lieu of secondary containment.

Various FPL Facilities, SPCC Upgrades
Lead civil engineer on projects to survey all inside and outdoor, oil-containing systems, including tanks, equipment, piping, and on-site switchyards and substations for compliance to new SPCC regulations. Designed secondary containments, where needed and not already present. Work included secondary containments for outdoor aboveground oil piping, utilizing a membrane pipe-wrap system.

DFSP, Oil/Water Separator and Drainage System Design – Charleston, SC
Lead civil engineer on project to design new drainage system for a DOD fuel farm facility. The project included the design for a cast-in-place aboveground concrete 4,500 gpm oil/water separator and new drainage system to treat stored water from secondary containments. Environmental permitting and plans included a Stormwater Pollution Prevention Plan and a South Carolina DHEC Wastewater Discharge, South Carolina DHEC Air Emissions, and EPA NPDES Stormwater Discharge Permits.

Austin Energy, SPCC Upgrades – Austin, TX
Lead engineer on project to survey aboveground storage tanks to develop an integrity testing program consistent with new SPCC requirements.

Green Mountain Power, Generation Facility Inspections – VT
Lead civil engineer on project to inspect eight hydro-generation facilities throughout the State of Vermont. Responsibilities included the inspection and assessment of generation assets, transmission and distribution system structural elements, and limited SPCC compliance for bond holders.

PSNH, Rochester Substation Upgrade – NH
Lead civil engineer on the upgrade project that included site and spread footing and cast-in-place caisson foundation designs. Project also included the design of a remote transformer oil containment system and oil/water separator.

Rochester Gas & Electric, Russell Station Oil/Water Separator – NY
Served as design manager and senior civil engineer for project that provided complete design for two 1,250 gpm aboveground hopper-style oil/water separators. Separators were housed within a steel-framed building with accommodations for a future oil/water separator. Since three different oils with varying densities have the potential to be present in the cooling water, the oil/water separator design was optimized to insure maximum oil removal throughout a wide water temperature range.

PATRICK M. MARTIN P.E

EDUCATION

B.S., Environmental Engineering – Oregon State University, Corvallis, OR, 2000

PROFESSIONAL REGISTRATION/ CERTIFICATES

Professional Engineer, Maine, (#12007) 2009

AREAS OF EXPERTISE

Mr. Patrick M. Martin has technical experience in the following fields:

- Engineering Management
- Site/Civil Design (Site Civil Design, not structural)
- Preliminary & Conceptual Design
- Drafting Services
- Detailed Engineering Design
- Site Layout
- Licensing & Permitting
- Geographic Information Systems (GIS)

REPRESENTATIVE EXPERIENCE

Mr. Martin is a civil engineer with over nine years of professional experience. His experience includes engineering design in the fields of water resources, transportation, and site-civil/land development. This range of experience provides him with a well-balanced engineering background. Mr. Martin has experience with Hydraflow, HEC-HMS, HEC-RAS, and ArcView 9.2. Mr. Martin currently serves as Civil Engineer for the Civil and Transmission Division.

Oakfield II 110MW Wind Farm: Oakfield, Maine (Project Engineer)

Mr. Martin was involved in the Oakfield II project which included the development of a permit-level design for a 54 turbine, 110 MW wind farm located in the forested mountains and hills of Eastern Maine. TRC's scope of work included the civil design of the ridge-top turbine sites, about 20 miles of crane and access roads, 31 miles of 34.5 kV collector system including 2 miles of underground collector, a 34.5 to 115 kV substation, 60 miles of 115 kV transmission system, and site design for the Operation and Maintenance facility. Mr. Martin assisted with the access and ridge road design and the project stormwater and erosion control management plans.

The Resort at Goose Rocks: Kennebunkport, Maine (Project Engineer)

Mr. Martin was involved in the improvements to an existing seasonal resort including the demolition of an existing multi-unit structure and the construction of 30 cottage-style units. As the project engineer Mr. Martin was responsible for development of construction drawings, grading and drainage design, utility coordination, stormwater management design, preparation of the stormwater report, and local and environmental permitting.

USPS Processing and Distribution Center: North Reading, Massachusetts (Project Engineer)
Mr. Martin was involved in the construction of a 130,000 s.f. expansion of an existing United States Postal Service Processing and Distribution Center. The project lead was the construction management firm. The site-civil engineers coordinated the work with the client, architect, and mechanical engineer. Throughout the project they incorporated federal (USPS), state, and local design requirements. Mr. Martin was responsible for access road, loading dock, and parking lot design, grading and drainage design, utility design coordination, and preparation of construction documents. He oversaw the staff engineer working on the stormwater management design and report, and the CAD technician assisting with the construction drawings. Mr. Martin also assisted the project manager with the local and environmental permitting.

Artificial Turf Field, New England College: Henniker, New Hampshire
Mr. Martin was involved in the design of a multi-purpose NCAA athletic field for field hockey/soccer multi-purpose field, a baseball field, and reconstruction of the football field. Mr. Martin responsibilities also included development of construction drawings, coordination with artificial turf manufacturer, athletic field layout, grading and drainage design, utility coordination, and stormwater management design, report preparation and local and environmental permitting.

Bouffard Property FEMA LOMR Flood Study: Falmouth, Maine
Mr. Martin was involved the completion of a riverine flood study for the purpose of filing a Letter of Map Revision application with FEMA. To respond to the FEMA reviewer's comments, he reviewed the original HEC-HMS and HEC-RAS models, flood study and application working with the FEMA reviewer to address concerns. This involved making minor revisions to the HEC-RAS model, and revising and resubmitting the workplan and annotated FIRM.

Kennebunk Coastal Flood Study: Kennebunk, Maine
Mr. Martin was involved in a peer review of FEMA's provisional flood maps and coastal BFEs. He Used current bathymetric and topographic (LIDAR) data, he propagated FEMA's deep water wave (based on significant wave height and peak period) to each of the transect locations using the 2-D wave model STWAVE, run from the SMS 10.2 platform. This allowed him to account for any wave refraction, shoaling, and/or restricted fetch conditions, as applicable. As design engineer, Mr. Martin reviewed FEMA's data for assumptions and errors digitized the land/sea boundary for the STWAVE model. He evaluated the wave setup, wave height, and run up elevation using the Direct Integration Method, TAW, and Casco Bay Method, and the wave modeling software WHAFIS 4, RUNUP 2, and/or ACES. Mr. Martin created figures (using ArcGIS) illustrating our findings at each transect. He also wrote and compiled the final report. A similar service was also provided to the municipalities of Portland, South Portland, Cape Elizabeth, Kennebunkport, Falmouth, and Harpswell.

Exit 3, I-295 Reconstruction: South Portland, Maine (Design Engineer)
Mr. Martin was involved in the reconfiguration and reconstruction of the intersection of Broadway and Westbrook Street, including a new on-ramp at the I-295 interchange. As an engineer on the design team, he was responsible for assisting with the design of the on-ramp and intersection improvements, grading and drainage design, signage and striping layout, construction staging plan, and development of construction drawings.

Route 1/Route 88 Intersection Improvements: Falmouth, Maine (Design Engineer)
Mr. Martin was involved in the improvements to an existing intersection with an unusual traffic pattern and poorly defined lanes. As the design engineer, his responsibilities included intersection design, grading and drainage design, signage and striping layout, construction staging plan, and development of construction drawings.

Snohomish County Drainage Needs Report (DNR); Snohomish County, Washington
Mr. Martin delineated drainage sub-basins, collected drainage inventory data, developed f-tables for HSPF models, prepared HEC-RAS and SWMM hydraulic models, managed a GIS database, created numerous drainage maps in GIS, and wrote sections of the report.

Upper Thornton Creek-Ronald Bog Flood Reduction Study and Improvements; Shoreline, Washington (Design Engineer)
Mr. Martin was involved in converting approximately 1,400 feet of closed conduit and ditch conveyance to a more natural stream channel. As design engineer, he assisted with the preliminary design to daylight Thornton Creek in Corliss Avenue, just downstream of Ronald Bog. This included plans preparation and development of a HEC-RAS hydraulic model.

SPECIALIZED TRAINING
- AutoCAD/LDD 2006
- Auto-Turn
- HydroCAD
- Hydraflow
- HEC-HMS
- HEC-RAS
- ArcView 9.2
- CHAMP

STATE OF NEW HAMPSHIRE

BEFORE THE SITE EVALUATION COMMITTEE

Docket No. SEC 2015-02

APPLICATION OF ANTRIM WIND ENERGY, LLC
FOR A CERTIFICATE OF SITE AND FACILITY

PREFILED DIRECT TESTIMONY OF RICHARD WILL AND RUSSELL STEVENSON ON BEHALF OF ANTRIM WIND ENERGY, LLC

September 10, 2015

<u>Qualifications of Richard Will</u>

Q. Please state your name, title and business address.

A: My name is Richard Will. My business address is 71 Oak Street, Ellsworth, Maine 04605.

Q. Please state your name, title and business address.

A: I am employed by TRC Companies and hold the position of Manager, Northeast Cultural Division.

Q. Please describe the services provided by TRC.

A: TRC is a national engineering, consulting and construction management firm that provides integrated services to energy, environmental and infrastructure projects. TRC serves a broad range of clients in government and industry, implementing complex projects from initial concept to operations. In addition to the environmental and engineering services that TRC is providing to the Antrim 1 Wind Project, we are also providing historic consulting services to ensure compliance with state and federal regulations related to archaeological resources.

Q. What are your responsibilities at TRC?

A: Currently, I am the Operations Manager of the TRC Northeast sector of cultural resources management. I serve as the Project Director, overseeing a staff of numerous archaeologists on numerous small and large-scale cultural resources management projects throughout the Northeast, including New Hampshire, Maine, Vermont and New York. My responsibilities include serving as Principal Investigator on large and small-scale surveys for archaeological sites associated with: natural gas pipelines; electrical transmission lines; hydroelectric projects undergoing federal relicensing; state and federal licensing of wind projects; and other commercial development projects.

Q. Briefly summarize your educational background and work experience.

A: I have been involved in the archaeological resources assessment of wind power projects since 1992, beginning with studies in Maine and most recently in New York. I have been the principal investigator on the St. Laurence and West Hill wind projects in New York, and the Aroostook, Kibby, Oakfield, Stetson, Rollins, Highlands, Record Hill, Bingham and Bowers projects in Maine.

Additional detail regarding my education, background and experience is contained in my curriculum vitae which is attached hereto as Attachment RTW-1.

<u>Qualifications of Russell Stevenson</u>

Q. Please state your name, title and business address.

A: My name is Russell Stevenson. My business address is 375 East Elm Street, Conshohocken, Pennsylvania 19428.

Q. Please state your name, title and business address.

A: I am employed by A. D. Marble & Company and hold the position of Architectural Historian.

Q. Please describe the services provided by A.D. Marble.

A: A.D. Marble & Company ("A.D. Marble") is an environmental, cultural and engineering services firm. We provide environmental and cultural resource studies for clients to satisfy environmental and cultural compliance regulations.

Q. What are your responsibilities at A.D. Marble?

A: As an Architectural Historian, I guide clients through the historic resources review process set forth in Section 106 of the National Historic Preservation Act of 1966, as amended. My responsibilities include background research, reconnaissance level surveys, identification level surveys, evaluation of historic resources, eligibility recommendations, assessments of effects to historic resources, consulting party coordination, and the mitigation of adverse effects on a wide variety of small and large scale projects.

Q. Briefly summarize your educational background and work experience.

A: I have a Bachelor's degree in history from Pennsylvania State University and a Master's degree in historic preservation from the University of Delaware. As an architectural historian, I've identified, surveyed, and evaluated a wide array of residential, agricultural, industrial, and commercial resources in New Jersey, Maryland, Delaware, and Pennsylvania. I've also been trained and worked as an architectural conservator and restoration carpenter performing conservation work on a variety of historic buildings in the greater Philadelphia area. I'm familiar with the Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings and meet the Secretary of the Interior's Professional Qualification Standards for Architectural History.

Additional detail regarding my education, background and work experience is contained in my curriculum vitae which is attached hereto as Attachment RS-1.

Q. Have you ever testified before the New Hampshire Site Evaluation Committee ("SEC")?

A. Yes. I presented testimony regarding the potential effect of the Antrim Wind Project upon above-ground historic resources in connection with Antrim Wind Energy, LLC's ("AWE") application for a certificate of site and facility in Docket 2012-01.

Purpose of Testimony

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to address the potential effect of the reconfigured Antrim Wind Project (the "Project") on archaeological and historic resources. Specifically, Richard Will's testimony addresses the potential effect of the Project on archaeological resources and Russell Stevenson's testimony addresses the potential effect of the Project on above-ground historic resources.

Archaeological Assessment – Richard Will

Q. Are you familiar with the Project proposed by AWE in this matter?

A. Yes, I am. As a historic resource consultant to the Project, I have been provided with information regarding the Project's components and the locations of those components. I am aware of and have considered revisions to the original Project configuration, including the removal of one turbine. The removal of the tenth turbine does not affect delineation of the Project boundaries for the purposes of an archaeological assessment, not does it affect determination of the Project's area of potential effects ("APE").

Q. Please describe the work that TRC has performed relative to the Project.

A. TRC conducted Phase IA and Phase IB archaeological surveys relative to the Project as it was proposed in Docket 2012-01. Changes proposed for the Project do not warrant additional archaeological review and evaluation, and as such there has not been any additional archaeological fieldwork conducted within the Project's boundaries since the Phase 1A and 1B studies were completed. Due to the fact that the reconfigured Project proposed in this Docket removes one turbine and shortens another, the Phase IA and Phase IB surveys conducted in the prior Docket remain applicable to the Project.

The Phase IA archaeological survey provides an initial review of the Project to assess areas of archaeological sensitivity and potential resource management issues. This survey consisted of identifying and collecting information pertaining to the archaeological resources in the context of the proposed Project. TRC's Phase IA survey included two visits to the offices of the New Hampshire Division of Historical Resources ("NHDHR"), during which TRC identified NHDHR's expectations for completing an archaeological resources assessment of the Project area and collected collect relevant background and archival information on known Pre-contact period[1] and Historic contact period[2] archaeological resources in the Project area (i.e. within 10 km of the Project) and within the Project boundaries. A report of the Phase IA Survey results was submitted to NHDHR on October 25, 2011.

In addition to the above-described Phase IA Survey, TRC conducted a Phase IB Survey which consisted of an archaeological walkover survey of the Project's archaeological area of potential effect ("APE"), i.e. the area where construction activities may result in ground disturbances. One of the primary reasons for conducting a walkover survey is the small nature of the database for archaeological sites in upland areas of New Hampshire. TRC conducted the walkover survey on November 23-26, 2011. Due to 6 inches of snow cover in the area and the limited daylight period, a 100% walkover of the entire Project area could not be completed without staying overnight on the upper elevations. Therefore, walkover was conducted on the northern and southern portions of the Project area including the tops of Tuttle Hill and Willard

[1] Pre-contact period archaeological resources are described on pages 5-9 of TRC's Results of Phase I Archaeological Survey contained in Application Appendix 9B.
[2] Historic period archaeological resources are described on pages 9-10 of TRC's Results of Phase I Archaeological Survey contained in Application Appendix 9B.

Mountain. The NHDHR subsequently confirmed to TRC that a walkover of less than 100% of this Project's area was adequate.

Q. Please summarize the results of your studies.

A. The results of the Phase IA and IB Surveys are contained in TRC's report entitled "Results of Phase I Archaeological Survey of the Antrim Wind Energy Project," attached to the Application as Appendix 9B. The Phase IA Survey indicated that no Historic period or Pre-contact period archaeological sites within the Project boundaries or within 10 km of the Project boundaries have been previously documented. Environmental and cultural variables that have been demonstrated to be important predictors of archaeological site locations are either rare or non-existent within the Project's boundaries. During the Phase IB Survey walkover, no landforms suitable for Pre-contact period subsurface testing were observed. In addition, no Historic period features (e.g. cellar holes) were identified within the Project area with the exception of stone walls in the lower elevations on the northern side of Tuttle Hill. Therefore, no subsurface testing was conducted and no additional archaeological evaluation is recommended for the proposed archaeological APE. NHDHR has agreed with the recommendations and conclusions in the Phase I report. A letter documenting NHDHR's concurrence is contained in Appendix 9C to the Application.

Q. Did the SEC make a determination with respect to archaeological resources in Docket 2012-01?

A. Yes. After reviewing the record presented to it in Docket 2012-01, including my testimony and the surveys described above, the SEC unanimously concluded that the Project would not have an unreasonable adverse impact on historical sites.

<u>Architectural Assessment – Russell Stevenson</u>

Q. Are you familiar with the Project proposed by AWE in this matter?

A. Yes, I am. I have reviewed Project-specific information and mapping, including the GIS view shed analysis, for the Project. In addition, I've reviewed regional and local histories, literature on regional and local architecture, historic mapping, historic aerials, visited local historical societies, conducted a thorough file review at the NHDHR, and performed site-specific fieldwork and research which included reviewing tax parcel information and deeds.

Q. Have you studied the potential effect of the Project on above-ground historical properties in the area?

A. Yes.

Q. Please describe the studies conducted by A.D. Marble.

A. A. D. Marble & Company followed the methods outlined in NHDHR's *Guidelines for Windfarm Development Projects* ("Guidelines") for initiation, identification, evaluation and determination of effects of wind farm projects on above ground historic resources located within an established three-mile and five mile area. A geographic information system ("GIS")-based screening defined a three-mile radius surrounding the Project, as well as the viewshed-based area of potential effect ("APE"). A.D. Marble completed a search of NHDHR's files to gather information on established contexts, previously surveyed properties, and properties within the Project area that have been listed in or determined eligible for listing in the National Register of Historic Places ("National Register"). We also conducted additional research at the New Hampshire State Library and New Hampshire Historical Society, and contacted Ms. Liz Robertson, a member of the Antrim Historical Society, for information on relevant resources and repositories.

AWE invited organizations with a demonstrated interest in the Project including representatives from towns and counties located within the Project area, local historical societies, and the New Hampshire State Historical Society to participate as consulting parties to what is known as the "Section 106 process." Section 106 of the National Historic Preservation Act, as amended, requires that federally funded, licensed or assisted undertakings take into account the potential effects of their proposed project(s) on the protection of historic properties (i.e. a prehistoric or historic district, site, building, structure or object included in, or eligible for listing in the National Register). Because the Antrim Wind Project requires a permit from the U.S. Army Corps of Engineers ("USACE"), the Project is subject to the Section 106 process in which USACE, in consultation with NHDHR, determines whether the Project will have an adverse effect on historic sites and, if so, whether mitigation measures must be taken.

NHDHR Guidelines state that resources 50 years in age or older within the APE that have the potential to be visually impacted by the Project (i.e. affected by changes in setting) require evaluation for National Register eligibility. During the course of A.D. Marble's survey work, we examined and photographed properties 50 years in age or older within the three-mile Project area from the public rights-of-way to develop an understanding of the evolution of the landscape and to identify resources that might potentially be eligible for listing in the National Register. After completion of background research and survey work, A.D. Marble completed a NHDHR project area form ("PAF") and submitted it to NHDHR on January 5, 2012. The purpose of the form is to develop a historic context for the Project area, identify contextual themes and projected building types, and recommend further survey for resources within the Project's three-mile viewshed/APE.

Q. Please summarize the results of your studies.

A. The results of A.D. Marble's studies are reflected in the PAF attached to the Application as Appendix 9D. The PAF identified one property within the three-mile radius that was previously listed in the National Register (i.e. the Flint Estate Historic District) and one property that was previously determined eligible for listing in the National Register (the Antrim Congregational Church in Antrim Center). Because the Flint Estate Historic District is listed in the National Register for its architectural significance and not as a rural estate, it does not have the potential to be affected by changes in setting that the Project may introduce; therefore, it is not necessary to further assess the potential effects of the Project on this resource. The PAF identified certain resources as warranting future documentation and evaluation, and on July 3, 2012 I submitted the following inventories to NHDHR:

- Dodge Family Farm, Reed Carr Road – Individual Inventory Form
- Pine Haven Cottages – Individual Inventory Form
- White Birch Point – Historic Area Form
- Gregg Lake – Historic Area Form
- Village of Clinton - Historic Area Form
- Village of Antrim Center - Historic Area Form

NHDHR responded in a letter dated July 30, 2012, indicating that the Dodge Family Farm was eligible for listing in the State Register and National Register of Historic Places, but that the development along the north shore of Gregg Lake was not eligible. NHDHR requested additional information regarding Pine Haven Cottages, Antrim Center, White Birch Point, and Clinton prior to making a decision on their eligibility; after receiving the requested supplemental information, NHDHR determined that Pine Haven, Antrim Center and White Birch Point were all eligible for listing in the State Register and National Register of Historic Places, whereas Clinton Village was determined to be not eligible.

Q. Are you familiar with the SEC's determination with respect to above-ground historical resources in Docket 2012-01?

A. Yes. Though the Section 106 process was ongoing at the time that the SEC issued its decision on the Application in Docket 2012-01, the SEC noted that New Hampshire law permits it to condition a Certificate upon the results of federal or state agency studies whose study period exceeds the application period. Notwithstanding the fact that the Section 106 process was incomplete, the SEC unanimously concluded that the Project would not have an unreasonable adverse impact on historical sites.

Q. Has the Section 106 Process continued since the SEC issued its decision in Docket 2012-01?

A. Yes. After receiving the NHDHR's eligibility determinations, A.D. Marble prepared an assessment of effects package for each of the four newly identified National Register-eligible properties located within the three mile APE. In addition, NHDHR guidelines require that effects be assessed for any properties previously listed on or determined eligible for listing on the National Register within a 5-mile radius or APE. The only National Register eligible or listed property that has the potential to be affected by the project within the 5-mile APE is the Hillsborough Lower Village Historic District, which was determined eligible for the National Register in 2006. In total, five assessment of effects packages were prepared and submitted to DHR for review on February 19, 2013. Each assessment of effects package contained effects tables that applied the definition of effect of the proposed Project on each resource. If it was determined that the Project would have an effect on the historic resource, the criteria of adverse effect was then applied and summarized in a criteria of adverse effect table. In addition, each package contained site specific photo simulations prepared by AWE. The photo simulation compared a photograph taken from the resource looking to the project (in this case the turbines) to that same photograph with computer generated images of the turbines that were drawn to scale. This allowed for a comparison of view sheds from the resource both with turbines and without turbines. A photo location map was included with each package that depicted the proposed turbines, the historic resource, the photo location and photo direction on a topographic relief map. Lastly, an aerial map was also included that depicted the National Register boundary of the resource, outlines of buildings within the resource, the photo simulation point and the project visibility areas, which were based on the GIS view shed analysis conducted for the PAF.

The NHDHR made “No Adverse Effect” findings for the Antrim Center Historic District, Dodge Family Farm, Hillsborough Lower Village Historic District, and Pine Haven. However, NHDHR determined that there would be an adverse effect to White Birch Point, though it did not indicate that such adverse effect would be unreasonable.. USACE, which is the lead federal agency for the Section 106 review, has disagreed with NHDR’s determination with respect to White Birch Point and AWE is engaged in continuing consultation with both agencies to resolve the disagreement and determine any mitigation measures necessary to satisfy its obligations under Section 106.

No Unreasonable Adverse Effects

Q. In your opinion, will the Project have an unreasonable adverse effect on archaeological resources and historic sites?

A. Based on the information and survey findings described above and our review of the reconfigured Project, it is our opinion that the Project will not have an unreasonable adverse effect on archaeological resources and historic sites. Based upon our experience with other projects, and the manner in which potential impacts on historical sites have been addressed by state and federal regulators in the past, it is our opinion that the proposed Project will not have an unreasonable adverse effect on any known archaeological or above-ground historic sites. There are no areas within the Project where archaeological resources would be predicted to be located or areas that might initially be assessed to be sensitive for archaeological resources. In addition, no historic structure will be physically impacted. Moreover, should future studies determine that the Project may adversely affect archaeological resources, data recovery excavations are an accepted mitigation measure and will be undertaken in consultation with NHDHR and USACE. Notwithstanding the NHDHR's finding with respect to the White Birch Point area, we are also of the opinion that the Project will not have an unreasonable adverse effect upon above-ground historic properties. AWE is engaged in continuing consultation with USACE and NHDHR regarding this issue and appropriate measures will be undertaken pursuant to the Section 106 process to ensure the mitigation of any perceived adverse effect.

Q. Does this conclude your pre-filed testimony?

A. Yes.

Russell Stevenson
Architectural Historian/Historian

Mr. Stevenson has over nine years of experience in cultural resource management, including two years assessing historic resource integrity and performing conservation work. His primary responsibilities consist of conducting historic architectural surveys and research, evaluating architectural resources for National Register eligibility, documenting architectural resources, writing assessment of eligibility and effect reports, and preparing mitigation documents and materials. He has effectively coordinated and completed a multitude of projects as part of Section 106 of the NHPA. Mr. Stevenson has identified, surveyed, and evaluated a wide array of residential, agricultural, industrial, commercial, and engineering resources in Pennsylvania, Delaware, Maryland, New Jersey and New Hampshire. He is adept at the use of cultural resources databases for previously identified resources in Maryland, Pennsylvania, Delaware, New Jersey, New Hampshire and Virginia as he routinely prepares preliminary findings for Phase I investigations. He spent two summers as an apprentice and one year as an architectural conservator technician performing conservation work for the Fairmount Park Historic Preservation Trust. As a conservator technician, his work regularly required him to assess the integrity of both interior and exterior architectural elements of historic buildings in order to decide on and apply the appropriate treatment. Mr. Stevenson is knowledgeable of federal and state regulations and guidelines concerning the treatment of historic properties and exceeds the Secretary of the Interior's Professional Qualifications Standards for Architectural Historians. Mr. Stevenson served two years as a board member for the Allentown Preservation League; a small non-profit organization in Allentown, Pennsylvania.

Education

2001 B.A. Pennsylvania State University, State College, Pennsylvania.

2007 M.A. University of Delaware, Newark, Delaware

Professional Training

2014 Section 106 Principles and Practice
Consultant Continuing Education, held by PennDOT
and taught by SRI Foundation.

2011 Project Review (Section 106) Architectural Historian
Consultant Continuing Education, held by the New
Hampshire Division of Historical Resources.

2011 Introduction to the Section 106 Review Process presented
by the Advisory Council on Historic Preservation and held
at the Chester County Historical Society.

2008 Pennsylvania Historical and Museum Commission summer apprenticeship program. On site training at the Daniel Boone Homestead, Birdsboro, Pennsylvania.

Professional Publications

2011 "Let's Go Fitchin': The Steamboat Trials of John Fitch," in *Environmental Assessment*, the newsletter for the Pennsylvania Association of Environmental Professionals.

2009 "Annual Property Inspection Maintenance Manual for Fairmount Park Historic Preservation Trust lessees." Fairmount Park Historic Preservation Trust, Philadelphia, Pennsylvania.

2007 "The Effectiveness of Agricultural Zoning Ordinances in Controlling Sprawl in the Lehigh Valley, Pennsylvania." Masters Thesis, University of Delaware.

Professional Conferences

2014 Pennsylvania Combined Preservation Conference, Philadelphia, Pennsylvania.

2012 Pennsylvania Combined Preservation Conference, Lancaster, Pennsylvania.

Professional Experience

2009-Present – A.D. Marble & Company

Architectural Historian/Historian

In his position as an Architectural Historian/Historian, Mr. Stevenson conducts architectural surveys, historic research and fieldwork and prepares architectural survey forms, historic context reports, assessments of effect and other project documents in support of federal, state and local preservation laws. As a historian, Mr. Stevenson conducts background research and prepares historic contexts for Phase I, II and III archaeological investigations.

Multiple

National Gateway Initiative. Multiple Counties, MD, PA, WV. CSX Transportation, Inc. Historian. Project involves vertical clearance improvements associated with a double-stacking initiative along a rail corridor through portions of Ohio, Pennsylvania, Maryland, West Virginia, Washington, DC, and Virginia. Responsible for background research on tunnel and bridge sites throughout Pennsylvania, Maryland, West Virginia, Washington D.C. and Virginia for all phases of project. Assisted with documentation of Magnolia Cutoff and six historic tunnels in Maryland and West Virginia. Assisted with the preparation of historic contexts on the B&O Railroad and Pittsburgh and Lake Erie Railroad. Assisted with assessment of effect documentation and drafts of multi-state Programmatic Agreement (P1168).

Scour Remediation Project. Multiple counties, PA and NJ. Delaware River Joint Toll Bridge Commission. Historian. Project included scour remediation of 16 of the 22 bridges owned by the Delaware River Joint Toll Bridge Commission. Responsible for background research that was used to prepare a state-level survey form and historic identification report that presented a historic context and recommendations for National Register eligibility of the 18 bridges owned by the Delaware River Joint Toll Bridge Commission that span the Delaware River between Pennsylvania and New Jersey.

Pennsylvania

P3 Rapid Bridge Replacement Project, PennDOT Engineering Districts 1-0, 2-0, 3-0, 4-0, 5-0, 6-0, 8-0, 9-0, 10-0, 11-0, 12-0. Cultural Resource Professional/Architectural Historian. Received training as a PennDOT Cultural Resources Professional delegated for the P3 project which will replace 558 bridges throughout the Commonwealth in approximately three years. Responsible for guiding approximately 250 bridges through the entire Section 106 Process in two years, from scoping and identification through to effects resolution and mitigation.

Environmental Open-End Contract, PennDOT Engineering District 6-0. Architectural historian. Responsible for a variety of tasks in assisting the District 6-0 Cultural Resource Professional for historic structures. Tasks have included construction monitoring to ensure historic properties are not impacted by construction projects, final inspections for bridge projects, attending pre-construction meetings and bi-weekly project progress meetings for monitored projects, attending field views with the CRP, and coordinating consulting party meetings, letters and documentation for various projects throughout the district.

S.R. 222 & Long Lane Intersection, Berks County, Pennsylvania. PennDOT District 5-0. Architectural Historian. Responsible for historic structure evaluations related to intersection improvements at two intersections of S.R. 222 at Long Lane and Topton Road. Completed background research, fieldwork and prepared Historic Resource Survey Forms for seven properties along the S.R. 222 corridor in the project area (P1250).

Schuylkill River Park Pedestrian Bridge over CSX railroad tracks, Philadelphia County, Philadelphia, Pennsylvania. PennDOT District 6-0. Historian. Project involves the construction of a pedestrian bridge that carries the Schuylkill River Park Trail over CSX railroad tracks in Philadelphia. Responsible for background research that centered on remnants of historic wharves revealed by archaeological testing beneath the railroad tracks. Prepared a historic context and participated in consulting party meetings. Worked with a graphic designer to create placards to be installed on the finished bridge informing pedestrians of the wharves and industrial development along the Schuylkill River (P1007C).

Lehigh Street Bridge Replacement Project, Lehigh and Northampton Counties, Pennsylvania. PennDOT District 5-0. Architectural Historian. Project involves a cultural resources survey of residential, industrial, and transportation-related resources.

Responsible for assisting with fieldwork, background research, and documentation of multiple individual properties including a former nineteenth-century iron works property, a section of the Lehigh Canal, and multiple railroads (P1179).

S.R. 0222, Section 22 Intersection Improvements Project, Berks County, Pennsylvania. PennDOT District 5-0. Architectural Historian. Project involves a cultural resources survey of eighteenth, nineteenth and twentieth-century residential and agricultural properties. Conducted extensive background research into the history and context of the resources. Conducted field survey to document multiple properties, including several agricultural complexes. Assisted with the preparation of a Determination of Eligibility Report (P1147).

S.R. 2047, Section 02B, Bridge Project, Amity Township, Berks County, Pennsylvania. PennDOT Engineering District 5-0. Architectural Historian. Project involves a cultural resources survey of residential, agricultural and industrial-related resources that date to the 18th century. Responsible for coordination, fieldwork, background research and documentation of multiple properties including a 18th century grist mill (P1380A).

S.R. 3010, Section 01B, Church Street over Spring Creek Bridge Project, Lower Heidelberg Township, Berks County, Pennsylvania. PennDOT Engineering District 5-0. Architectural Historian. Project involves the replacement of the Church Street bridge, which is adjacent to a National Register-listed property. Responsible for the preparation of effects documentation and assisted with consulting party coordination (P1388A).

Sugar House Casino, Philadelphia, Pennsylvania. HSP Gaming. Historian. Project involves the construction of a new building on the Delaware River. Responsible for background research for the Phase III archaeological investigation (P-983K).

Pennsylvania Turnpike Northeast Extension (I-476), Milepost A31-A38. Montgomery County, PA. Pennsylvania Turnpike Commission. Architectural Historian. Project involves widening and full-depth reconstruction of a portion of I-476 in Franconia, Lower Salford, and Salford townships. Responsible for background research, assisted with Historic Resources Reconnaissance Survey report, assisted with field survey and completed multiple state-level survey forms for farms along the project corridor. Assisted with Determination of Eligibility Report and prepared Effects documentation (P1263).

S.R. 1028 Culmerville Bridge Project. West Deer Township, Allegheny County, Pennsylvania. PennDOT Engineering District 11-0. Architectural Historian. Responsible for the preparation of a state-level survey form for a nineteenth-century railroad bridge. Completed historic research and form preparation. (P1254)

Replacement of S.R. 0611 Bridge over Oughoughton Creek. Northampton County, PA. TRC Solutions, Inc. and PennDOT Engineering District 5-0. Architectural

Historian. Project involves a bridge replacement in a rural area. Conducted background research and assisted with the preparation of two state-level survey form documenting two farmsteads (P1194C).

Replacement of S.R. 3001 Bridge over Spring Creek. Lehigh County, Pennsylvania. TRC Solutions, Inc. and PennDOT Engineering District 5-0. Architectural Historian. Project involves a bridge replacement in a rural/suburban area. Conducted background research and assisted with the preparation of a state-level survey form documenting the Catasauqua and Fogelsville Railroad (P1194).

S.R. 0032 River Road over Delaware Canal Bridge, Bucks County, Pennsylvania. PennDOT Engineering District 6-0. Architectural Historian. Project involves investigation of a bridge replacement in a rural area near the Delaware River. Responsible for background research, fieldwork and the preparation of a memo describing the current conditions (P1333).

S.R. 0313 Dublin Pike over Morgan Creek Bridge, Bucks County, Pennsylvania. PennDOT Engineering District 6-0. Architectural Historian. Project involves investigation of a bridge replacement in a rural/suburban area. Responsible for background research, fieldwork and the preparation of a memo describing the current conditions (P1333A).

S.R. 2073 Pennsylvania Avenue over Pennsylvania Canal Bridge, Bucks County, Pennsylvania. PennDOT Engineering District 6-0. Architectural Historian. Project involves investigation of a bridge replacement in the borough of Morrisville. Responsible for background research, fieldwork and the preparation of a memo describing the current conditions (P1333B).

SEPTA Wayne Junction Station Improvement Project. Philadelphia County, Pennsylvania. Urban Engineers and Southeastern Pennsylvania Transportation Authority. Historian. Project involves rehabilitation of a National Register-eligible train station. Completed background research to aid in state-level recordation (P-976).

S.R. 6011, Section 273, Harrison Avenue Bridge Project, Scranton, Lackawanna County, Pennsylvania. **PennDOT Engineering District 4-0.** Architectural Historian. Project involves improvements to a National Register-eligible bridge. Conducted background research for the preparation of state-level survey forms and attended public meetings. Prepared mitigation requirements which involved the research, writing, and creation of an interpretive sign (P-995/P-995A).

S**.R. 2014, Section 012, Furnace Road Bridge over Mill Creek, Lebanon County, Pennsylvania. PennDOT Engineering District 8-0.** Architectural Historian. Project involves the replacement of an early pre-stressed concrete bridge in a rural area. Responsible for researching and documenting the history of pre-stressed concrete bridge technology (P1060A).

S.R. 0061 and Tuckerton Road Intersection Improvements, Berks County, Pennsylvania. PennDOT Engineering District 5-0. Architectural Historian. Project involves intersection improvements in a developed area north of Reading, Pennsylvania. Conducted background research, fieldwork and documentation on Historic Resource Survey Forms of several properties adjacent to the intersection (P1251).

S.R. 0706, Section STY, Susquehanna County, Pennsylvania. PennDOT District 4-0. Architectural Historian. Project involves spot improvements and structure replacements along S.R. 706 in a rural area. Responsible for background research, fieldwork and assisted in the preparation of Historic Resource Survey Forms for four properties in the project area. Conducted oral interviews with members of a local IOOF hall (P-819A).

S.R. 2051-001, Replacement of Bridge over Wolf Run, Lycoming County, Pennsylvania. PennDOT District 3-0. Architectural Historian. Project involves the replacement of a bridge in a rural area. Responsible for background research, fieldwork and the preparation of a Historic Resource Survey Form to document a farm property located adjacent to the bridge (P1201).

S.R. 1022-002, Replacement of Zaners Rohrsburg Road Bridge over Tributary of Green Creek. PennDOT District 3-0. Architectural Historian. Project involves the replacement of a bridge in a rural area. Responsible for background research, fieldwork and the preparation of a state-level survey form to document a farm property located adjacent to the bridge (P1201H).

S.R. 0074, Replacement of Bridge over Panther Creek, Perry County, Pennsylvania. PennDOT District 8-0. Architectural Historian. Project involves the replacement of a bridge in a rural area. Responsible for background research, fieldwork and the preparation of a state-level survey form to document a farm property located adjacent to the bridge (P1108D).

S.R. 1014, Section ERH, Replacement of Creamery Road Bridge over Tohickon Creek, Bucks County, Pennsylvania. PennDOT District 6-0. Architectural Historian. Project involves the replacement of a bridge in a rural area. Assisted with background research, fieldwork and the preparation of a state-level survey form to document a farm property located adjacent to the bridge (P1269).

S.R. 0028, Section 164, Improvement Project, Armstrong County, Pennsylvania. Historian. Project involves the replacement of two culverts and one bridge in a rural area. Conducted background research and prepared a historic context of the project area of archaeological Phase II investigations.

Topton Lutheran Home, Berks County, Pennsylvania. Architectural Historian. Assisted with the preparation of documentation and assessment of eligibility for second-oldest Lutheran elder home in Pennsylvania as part of state-level clearance for planned improvements to the property (P1073).

Federal

Washington Crossing National Cemetery, State-Level Recordation. Bucks County, Pennsylvania. U.S. Department of Veterans Affairs. Architectural Historian/Historian. Project involves development of a veterans' cemetery on agricultural land occupied by several historic dwellings and agricultural outbuildings. Assisted with the preparation of state-level recordation (equivalent to Historic American Buildings Survey) to document an early-nineteenth-century log dwelling and a nineteenth-century farmstead in accordance with a Memorandum of Agreement (MOA). The recordation included written, graphic, and photographic documentation and appended previous documentation. Ongoing tasks include preparation of an educational brochure and preparation of an advertisement for the lease and rehabilitation of buildings associated with a historic farm. Conducted extensive background research for Phase II and III archaeological investigations for multiple sites within the project area (P1061).

Philadelphia Navy Yard Seawall Repair, Philadelphia County, Philadelphia, Pennsylvania Army Corps of Engineers. Architectural Historian. Provided on-site monitoring to ensure a historic stone seawall and ferry dock was not damaged during the repair of the modern seawall. Documented the conditions of the historic seawall through photographs and notes (P1202D).

Tobyhanna Army Depot Cultural Resources Investigations, Tobyhanna, Monroe County, Pennsylvania. U.S. Army Corps of Engineers-Philadelphia District. Architectural Historian. Responsible for assisting with architectural investigations, including documentation of over 70 buildings, located at Tobyhanna Army Depot. Assisted with completing field work, photographic documentation, background and archival research, and development of historic context within which to evaluate the twentieth-century property. (P1202C)

Air Compressor, Building 175, Portsmouth Naval Shipyard, Historic American Engineering Record (HAER) Recordation. York County, Maine. Oak Point Associates. Architectural Historian. Project involved HAER recordation of a World War II-era air compressor located within a substation in a National Register-listed historic district. Responsibilities included background research.

Building 45, Portsmouth Naval Shipyard, Historic American Buildings Survey (HABS) Recordation. York County, Maine. Oak Point Associates. Architectural Historian. Project involved HABS recordation of a late-nineteenth century shipbuilding facility within a National Register-listed historic district. Responsibilities included background research.

Building 178, Portsmouth Naval Shipyard, Historic American Engineering Record (HAER) Recordation. York County, Maine. Oak Point Associates. Architectural Historian. Project involved HAER recordation of a WWII-era shipbuilding facility within a National Register-listed historic district. The building was originally constructed in

1939, but evolved to meet changing needs during World War II and the Cold War era. Responsibilities included background research (P-920F).

Building 303, Portsmouth Naval Shipyard, Historic American Engineering Record (HAER) Recordation. York County, Maine. Oak Point Associates. Architectural Historian. Project involved HAER recordation of a Cold War-era acoustic testing facility slated for demolition within a National Register-listed historic district. Responsibilities included background research.

Buildings M6, M10, and H29 MHBR Documentation. Portsmouth Naval Shipyard.York County, Maine. Architectural Historian. Project involved a 1945 Neuropsychiatric Ward that was built using a standardized plan for hospital wards during a period of rapid expansion on the shipyard associated with World War II. Responsibilities included background research.

Portsmouth Naval Shipyard, Dry Dock #2 Repair Project. York County, Maine. Architectural Historian. Project involved the documentation of a significant 1901 granite dry dock within the Portsmouth Naval Shipyard National Register Historic District. Responsibilities included background research.

Building 93, Portsmouth Naval Prison Complex MHER Documentation. Portsmouth Naval Shipyard. York County, Maine. Architectural Historian. Project involved an early-twentieth century naval prison with two World War II-era additions, and associated buildings, both extant and demolished, at the Portsmouth Naval Shipyard within the Portsmouth Naval Shipyard National Register Historic District. Responsibilities included background research (P-920G).

Building 170 MHBR Documentation. Portsmouth Naval Shipyard. York County, Maine. Architectural Historian. Project involved a World War II-era masonry storage building at the Portsmouth Naval Shipyard within the Portsmouth Naval Shipyard National Register Historic District. Responsibilities included background research.

Lumber Complex, Buildings 129, 132, and 149 MHER Documentation. Portsmouth Naval Shipyard. York County, Maine. Architectural Historian. Project involved a grouping of early-twentieth century buildings and landscape features, both extant and demolished, that form the lumber complex at the Portsmouth Naval Shipyard within the Portsmouth Naval Shipyard National Register Historic District. Responsibilities included background research (P-920E).

Storage Complex, Buildings 131, 136, 159, and 166 MHER Documentation. Portsmouth Naval Shipyard. York County, Maine. Architectural Historian. Project involved a grouping of multiple buildings, both extant and demolished, that form the early- to mid-twentieth century storage complex at the Portsmouth Naval Shipyard within the Portsmouth Naval Shipyard National Register Historic District. Responsibilities included background research.

Delaware

SR 1 Improvement Project, Little Heaven, Kent County, Delaware. Architectural Historian/Historian. Project involves a roadway realignment and improvement project. Assisted with field survey and state-level survey form preparation. Prepared historic contexts for multiple archaeological sites within the project area (P-731C).

West Dover Connector Project, Dover, Kent County, Delaware. Architectural Historian/Historian. Project involves the construction of a new roadway. Assisted with field survey and preparation of survey forms for over ten resources, including agricultural and residential properties. Assisted with the preparation of an Assessment of Effects Report. Prepared historic contexts for multiple archaeological sites within the project area (P-738A).

South Frederica Phase II Archaeological Investigation, Kent County, Delaware. Historian. Responsible for background research and the preparation of historic contexts for multiple archaeological sites within the project corridor (P1311).

Kent County Sewer Relocation Project, Kent County, Delaware. Century Engineering. Historian. Responsible for background research and the preparation of historic contexts for multiple archaeological sites within the project area (P1310).

Clarence Street Extension Project. Kent County, Delaware. Century Engineering, Inc. Architectural Historian. Project involved extension of an existing roadway within a primarily residential neighborhood of Dover, Delaware. Performed fieldwork and assisted with the preparation of CRS forms for several individual properties and two potential historic districts, including an industrial complex and a portion of a traditionally African-American residential community as well as a Determination of Eligibility Report (P-866A).

Dover Air Force Base Cargo Ramp, Kent County, Delaware. Century Engineering. Historian. Project involves the construction of a Civil Air Terminal at the Dover Air Force Base. Responsible for background research and the development of a historic context for a demolished farmstead associated with Phase I archaeological investigation (P1364).

Vaughn to Wells Substations Utility Line Replacement, Kent County, Delaware. Delmarva Power and Light Company. Architectural Historian. Project involves the replacement of existing utility poles and lines with new utility poles and lines. Responsible for background research, fieldwork and the preparation of a memo detailing the current conditions and recommendations for future work (P1379).

Wells to Harrington Substations Utility Line Replacement, Kent County, Delaware. Delmarva Power and Light Company. Architectural Historian. Project involves the replacement of existing utility poles and lines with new utility poles and lines. Responsible for background research, fieldwork and the preparation of a memo detailing the current conditions and recommendations for future work (P1379A).

Delaware National Golf Course, New Castle County, Delaware. Toll Brothers. Architectural Historian/Historian. Project involved the construction of a residential subdivision on a former golf course. Responsible for background research and the preparation of state-level survey forms for two barns located on the property. Prepared historic contexts for multiple archaeological sites within the project area (P1198).

Maryland

Oldfield Point Road Improvments, Breon Lane to Old Chestnut Road, Cecil County, Maryland. Wallace Montgomery Associates. Architectural Historian. Conducted background research, fieldwork and the preparation of two state-level survey forms. Completed Section 106 initiation and identification packages for agency coordination (P1438)

Village of Piscataway Historic District, Prince George's County, Maryland. Maryland-National Capital Park and Planning Commission, Prince George's County Department of Planning. Historian. Conducted background research for a draft National Register Nomination. Assisted with the preparation of the statement of significance (P1172A).

St. Thomas Episcopal Parish Historic District, Croom, Prince George's County, Maryland. **Maryland-National Capital Park and Planning Commission, Prince George's County Department of Planning.** Historian. Conducted background research for a draft National Register Nomination (P1172).

Broad Creek Historic District, Broad Creek, Prince George's County, Maryland. Maryland-National Capital Park and Planning Commission, Prince George's County Department of Planning. Historian. Conducted background research for a National Register Nomination (P1172B).

Upper Marlboro Residential Historic District, Upper Marlboro, Prince George's County, Maryland. Maryland-National Capital Park and Planning Commission, Prince George's County Department of Planning. Historian. Conducted background research for a draft National Register Nomination (P1172B).

Prologis Site Study, Harford County, Maryland. Maryland Transit Administration. Architectural Historian. Responsible for fieldwork, background research and assisted with the completion of Section 106 initiation and identification packages for agency coordination as part of project planning for a future transit complex. (P1075J)

Riverside Rail Purchase Project, City of Baltimore, Maryland. Maryland Transit Administration. Architectural Historian. Responsible for fieldwork, background research and assisted with the completion of Section 106 initiation and identification packages for agency coordination as part of project planning for a future transit complex. (P1075I)

Elkton Station Feasibility Study, Cecil County, Maryland. Maryland Transit Administration. Architectural Historian. Responsible for fieldwork, background research and assisted with the completion of Section 106 initiation and identification packages for agency coordination as part of project planning for a future transit complex. (P1075J)

Eastern Shore Freight Line Improvement Project, Multiple Counties, Maryland. Maryland Transit Administration. Architectural Historian. Responsible for fieldwork, background research and assisted with preparation of ten state-level survey forms for individual bridges and a railroad line throughout Maryland. (P1075G)

New Jersey

Salem Railroad Reconnaissance-Level Survey Project, Gloucester and Salem Counties, New Jersey. County of Salem, New Jersey. Architectural Historian/Project Manager. Responsible for coordinating and completing all aspects of a reconnaissance-level survey of the Salem Railroad to fulfill stipulations of a signed Memorandum of Agreement (MOA). Conducted background research, fieldwork, coordination and the preparation of a reconnaissance-level survey report (P1416).

Replacement of Canal Street Bridge over Drake's Brook, Morris County, New Jersey. FST Engineers. Architectural Historian. Project involves the replacement of a reinforced concrete bridge in a historic district. Completed all aspects of documentation including fieldwork, background research and preparation of an Application for Project Authorization under the New Jersey Register of Historic Places Act (P1203).

North Elmwood Road Site Project, Burlington County, New Jersey. Dewberry. Architectural Historian. Project involves the construction of residential housing in a former agricultural field. Responsible for background research, fieldwork and the preparation of state-level survey forms to determine the eligibility of a previously unidentified resource.

New Hampshire

Antrim Wind Energy Project, Antrim, Hillsborough County, New Hampshire. Eolian, Inc. Architectural Historian. Project involves the construction of ten wind turbines along several mountain ridges in rural New Hampshire. Assisted with an identification level survey which included a five-mile area of potential effect. Evaluated eligibility for resources which included two individual survey forms and four historic district survey forms. Testified in court for the New Hampshire Site Evaluation Committee on behalf of the client. Completed an effects report for all eligible resources (P1295).

2007-2009 – The Fairmount Park Historic Preservation Trust
Architectural Conservator Technician

Mr. Stevenson's work included assessing and performing conservation on a variety of buildings in Southeastern Pennsylvania and the City of Philadelphia. His work routinely involved complex Dutchman repairs, epoxy repairs, strap hinge replacement, painting, dowel reinforcement at deteriorated mortise-and-tenon joints, replacement and glazing of broken glass panes, cedar shingle roof repair, stabilization and repointing of stone foundations, re-creation of exterior architectural moldings by hand and other rehabilitation and carpentry activities. In 2009, he developed the "Annual Property Inspection Maintenance Manual for Fairmount Park Historic Preservation Trust Lessees."

2005-2007 – Center for Historic Architecture and Design, University of Delaware
Research Assistant
From 2005 to 2006 Mr. Stevenson assisted in the preparation and finalization of Delaware's Scenic and Historic Byways Manual to assist citizens with the nomination of historic byways. In addition, he performed extensive background research and fieldwork for the proposed Harriet Tubman Underground Railroad Byway. The goal of this scenic and historic highway is to provide the traveler with opportunities for experiencing Delaware's Underground Railroad history by guiding visitors to locations where this history happened.

From 2006-2007 Mr. Stevenson was the project lead for the Historic Agricultural Landscapes in Delaware project. This project began in 1998 when the Center for Historic Architecture and Design (CHAD) contracted with the Delaware Agricultural Lands Preservation Foundation (DALPF) to document farmsteads whose owners were applying for permanent protection through the purchase of development rights. The projects goal was to evaluate the level of historic significance of each farm complex; the results for the evaluation would be factored in with other criteria used by DALPF in ranking applications for development rights purchase. Fieldwork was conducted at each farm to document the number and type of historic buildings present. Following the fieldwork each farm was rated on five criteria developed by the CHAD staff and generally fashioned after the National Register of Historic Places Criteria for Evaluation.

2003-2005 – Allentown Preservation League, Allentown, Pennsylvania.
Board Member
Mr. Stevenson served two years as a board member for the Allentown Preservation League, a small non-profit organization. The Allentown Preservation League promotes historic preservation in Allentown, Pennsylvania and the greater Lehigh Valley. The organization operates an architectural salvage warehouse in Allentown, Pennsylvania.

RICHARD T. WILL, PH.D.

EDUCATION

Ph.D., Anthropology, University of Alberta, 1985
M.S., Quaternary Sciences, University of Maine, 1981
B.A., Anthropology, University of Arizona, 1976

PROFESSIONAL REGISTRATIONS

Register of Professional Archaeologists, 1999
List of Approved Archaeologists, Maine, 1987
List of Approved Archaeologists, New Hampshire, 2000
List of Approved Archaeologists, Vermont, 2005

AREAS OF EXPERTISE

Dr. Will has over 20 years of experience encompassing:

- Business Management
- Large and Small Scale Archaeological Surveys
- Archaeological Site Data Recovery
- Cultural Resources Management Plans
- Native American Consultation
- Lithic and Faunal Analysis
- Report Writing and Editing
- Public Education

REPRESENTATIVE EXPERIENCE

Dr. Will has been a professional archaeologist since earning his Doctorate in Anthropology in 1985. Since then, he has been employed as a social science researcher in criminology and archaeology. Dr. Will has been an Adjunct Professor in the Climate Change Institute at the University of Maine where he occasionally teaches classes and advises graduate students. In 1989, he founded a small business to serve Maine companies with their cultural resources management needs as required by state law and Section 106 of the National Historic Preservation Act. Dr. Will had been the project director on numerous small and large-scale cultural resources management projects that have involved cost-effective and timely solutions to sometimes-complex issues ranging from survey design to Native American consultation. Currently, he is Principal Scientist for the cultural resource management practice at TRC.

Business Management (CEO, 1989–2003)
Archaeological Research Consultants, Inc. was incorporated in Maine in 1989 to provide cultural resources management consulting to the business community. It additionally competed for and won grants to undertake scientific research and publication in archaeology. Its client base grew from a few local businesses to include Bangor Hydro, Bowater International, Central Maine Power, Florida Power and Light, International Paper, and Pennsylvania Power and Light to name but a few. TRC acquired Archaeological Research Consultants in 2003.

Large and Small Scale Archaeological Surveys
Dr. Will is the principal investigator on numerous projects, including linear transmission and hydropower that require cultural resources management studies.

- **Cultural Resources Management of the Federal Relicensing of the Niagara Power Project, Western NY (Principal Investigator: 2005–2014).** This multiyear project was initiated by the New York Power Authority. Dr. Will directed and completed all phases of cultural resources management investigations on this project including Native American consultation.

- **Phase IA and IB Archaeological Studies of the St. Lawrence Wind Farm Project, Western NY (Principal Investigator: 2006–2007).** Dr. Will successfully conducted consultation with the New York Office of Parks, Recreation and Historic Preservation to define and implement a scope of work to identify and assess archaeological sites within this large proposed wind farm undertaken by Acciona Energy, NA

- **Cultural Resources Management Studies of the Maine Portion of the Maritimes & Northeast Natural Gas Pipeline Project (Project Director and Principal Investigator: 1998–2000).** This project was completed for Maritimes and Northeast, LLC. It involved archaeological sampling and survey of approximately 350 miles of natural gas pipeline corridor beginning at the St Croix River (Maine Canadian boundary) and ending at the Piscataqua River (Maine-New Hampshire boundary). More than 40 personnel were involved in this multiyear project, which completed on time and within budget.

- **Cultural Resources Management Studies for the Federal Licensing of the Moosehead Lake Outlet Dams (FERC no. 2671) (Project Director and Principal Investigator: 1992–2004).** This multi-year project was initiated for Central Maine Power Company and is being completed for FPLE Maine Hydro. It began in 1992 with survey of more than 200 prehistoric archaeological sites along 350 miles of shoreline. Additional fieldwork has involved data recovery on eight sites eligible for listing in the National Register of Historic Places.

Archaeological Site Data Recovery

Dr. Will has been principal investigator on more than a dozen large-scale data recovery projects involving more than 700 square meters of excavation, analysis, and reporting. Many of these data recovery studies have been the basis of research articles in a variety of professional journals.

- **Phase III Study of the Clark I Site (Project Director and Principal Investigator: 2000)*.*** This data recovery project was completed for FPLE Maine Hydro under a contract originally awarded by Central Maine Power Company. Excavation in river alluvium in Norridgewock, Maine proceeded to more than 1.5 meters below the ground surface and yielded a sequence of human occupations spanning 6,000 years. Results of this study were published in the ***Archaeology of Eastern North America*** in 2002.

- **Phase III Study of the Chan Site (Project Director and Principal Investigator: 1996).** This project was completed for the Maine Public Service Company in Caribou, Maine. The site yielded a variety of data from a geographic area of Maine that is not well known. A report of the project was published in the ***Bulletin of the Maine Archaeological Society*** in 1997.

- **Phase III Study of the Bombazee West Site (Project Director and Principal Investigator: 2000).** This project was completed for FPLE Maine Hydro and involved excavation of a Woodland Period site to a depth of 2.0 meters along the Kennebec River in Norridgewock, Maine. A report of the project was published in the ***Bulletin of the Maine Archaeological Society*** in 2001.

Historic Properties Management Plans (HPMP)

Dr. Will has written Historic Properties Management Plans (HPMPs) as required under Section 106 of the National Historic Preservation Act (1966) for a number of clients. These plans have been reviewed and approved by State Historic Preservation Officers, the Advisory Council on Historic Preservation, the Federal Energy Regulatory Commission, and the Department of Defense.

- **Historic Properties Management Plans for the Ripogenus and Penobscot Mills Projects (1999).** The plans for these northern Maine, federally licensed dams were prepared for Bowater International and are now being implemented by Brookfield Power, the current owner of the projects. The plans involve archaeological site investigations phased in over a 7-year period and public education initiatives.

- **Historic Properties Management Plans for the Milford, Stillwater and Veazie Projects (1999).** The HPMPs for these central Maine, federally licensed dams were prepared for Penobscot Power & Light, Maine. The plans call for data recovery and interpretation of findings at several large and important prehistoric Native American sites and also include public education initiatives.

- **Historic Properties Management Plans for the Maine Army National Guard (2002).** The CRMP for the Maine Army National Guard was completed in 2002 to provide a model for managing known and anticipated cultural resources in the Guard's training facilities, which are located around the state of Maine.

Native American Consultation
Dr. Will has worked with leaders of the Penobscot Indian Nation and the Passamaquoddy Tribe since 1998 and has earned their trust as an honest and reliable negotiator. He has worked with these Native American tribes to negotiate cultural resources management plans on behalf of the U.S. Environmental Protection Agency, the Maine Army National Guard, and PPL Maine. Currently, he serves as consulting archaeologist to the Passamaquoddy Tribal Historic Preservation Officer. He has also worked on Section 106 consultation with leaders of the Seneca, Tonawanda Seneca, and Tuscarora Indian Nations in western New York.

Lithic and Faunal Analysis
Dr. Will has advanced graduate training in the identification and analysis of prehistoric Native American stone and bone artifacts as well as food bone remains recovered from archaeological sites. He has conducted studies on these materials from sites in Maine, Montana, and the High Arctic. His research has been published in ***American Antiquity***, ***Archaeology of Eastern North American***, ***Lithic Technology***, ***Northeast Anthropologist***, ***and Zooarchaeological Research News***, to name but a few.

Report Writing and Editing
Dr. Will is the author or co-author of more than 80 archaeological reports ranging in length from a few dozen pages to more than 450 pages. He has co-authored a book on dinosaurs and has also written and published on criminal justice issues, such as alternative sanctioning for non-violent offenders and AIDs in prison. Dr. Will served as Associate Editor (1986–1994) for ***Crime and Justice***, and internationally acclaimed book series published by the University of Chicago Press and currently serves as Editor for the ***Maine Archaeological Society Newsletter***.

Public Education
Dr. Will has been actively involved in public education for more than a decade. He serves as an Adjunct Professor of Quaternary Studies at the University of Maine where he advises graduate students and teaches courses in archaeology. Additionally, he teaches adult education courses, speaks in the public school system, and frequently is asked to lecture on archaeology to historic societies and civic organizations. One of his major accomplishments is the production of archaeological curriculum materials that are now in use in more than 50 Maine schools and libraries.

PROFESSIONAL AFFILIATIONS

- **Adjunct Professor (ex officio)**, Institute for Climatic Change, University of Maine
- **Member**, Maine Historic Preservation Commission
- **Editor,** Maine Archaeological Society Newsletter
- **Research Associate (ex officio)**, Robert Abbe Museum
- **Member, Board of Directors (ex officio),** Maine Humanities Council
- **Member, Board of Directors (ex officio)** Woodlawn Museum

PUBLICATIONS AND PRESENTATIONS
Dr. Will has published in several scholarly journals, has authored and coauthored numerous cultural resources management reports, and has presented at professional meetings

Journal and book articles

2015 The Little Ossipee North Site (7.7) and the Gulf of Maine Archaic Tradition. *Bulletin of the Maine Archaeological Society* 55(1):1-38.

2014 Precontact Pottery from Moosehead Lake, Maine: Some Insights on Manufacture and Use. *Bulletin of the Maine Archaeological Society* 54(1):1-45.

2013 The Limington Rips Site (7.4). *Bulletin of the Maine Archaeological Society* 53(2):31–61.

2012 Site 117.39: A Probable Middle Archaic Chipped Stone Tool Workshop and Cache Location, Rockwood, Maine. *Bulletin of the Maine Archaeological Society* 52(1):27–56.

2007 The Corrigan Site (with Edward Moore. *The Maine Archaeological Society Bulletin* (47):35–50.

2006 Intersite Comparisons of Archaic Period Stone Artifacts: The Clark I Site and the Gulf of Maine Archaic Tradition (with James Clark). In *The Archaic of the*

Far Northeast, edited by David Sanger and M. A. P. Renouf. The University of Maine Press, Orono.

2003 Bone Artifacts: Continuity in Technology and Form. In Pre-European Archaeological Sites Along the Maine Coast. *Northeast Anthropology* 64:5–16.

2002a Understanding Archaic Period Ground Stone Tool Technology through Debitage Analysis from the Clark I Site, Norridgewock, Maine. *Archaeology of Eastern North America* 30:29–38.

2002b Recent Late Paleoindian Finds in Maine (with Edward Moore). *Bulletin of the Maine Archaeological Society* 42(1):1–14.

2001a The Bombazee West Site (52.10): A Small Ceramic Period Site on the Kennebec River (with Karen Mack and Alice Kelley). *Bulletin of the Maine Archaeological Society* 41(1):1–23.

2001b A Tale of Two Flint-Knappers: Implications for Lithic Debitage Studies in Northeastern North America. Lithic Technology 25(2):101–119.

2000 Calcined Turtle Bones from the Little Ossipee North Site in Southwestern Maine (with Kristin Sobolik). Archaeology of Eastern North America 28:15–28

Radiocarbon Chronology of Northeastern Paleo-American Sites: Discriminating Natural and Human Burn Features (with Robson Bonnichsen). In Ice Age Peoples of North America: Environments, origins, and Adaptations of the First Americans, edited by R. Bonnichsen and K. Turnmire. Oregon State University Press, Corvallis.

1998 Archaeological Investigations at the Janet Cormier Site (23.25), Poland, Maine (with Edward Moore). Bulletin of the Maine Archaeological Society 38(1):23–38.

1997 Excavations and Endscrapers at the Chan Site (177.2) (with Edward Moore and James Clark). Bulletin of the Maine Archaeological Society 37(2):1–23.

1996a Stone Artifact Movement on Impounded Shorelines: A Case Study from Maine (with James Clark). American Antiquity 61(3):499–519.

1996b A Probably Middle Archaic Cemetery: The Richmond-Castle Site in Surry, Maine (with Rebecca Cole-Will). Archaeology of Eastern North America 24:149–158.

1996c An Example of Late Middle Ceramic (Woodland) Period Biface Production Technology, Moosehead Lake, Maine. Archaeology of Eastern North America 24:227–238.

1990 A Preliminary Report on the Ann Hilton Site (with Rebecca Cole-Will). The Maine Archaeological Society Bulletin 15:1–11.

1984 Muskox Procurement and Use on Banks Island by Nineteenth Century Copper Inuit. In: D.R. Klein, R.G. White and S. Keller (eds.) Proceedings of the First International Muskox Symposium. Biological Papers of the University of Alaska, Special Report, No. 4:153–161.

1982a The Use of Wildlife Data in Archaeological Faunal Analysis. Canadian Journal of Anthropology 2(2):189–194.

1982b Review of Bones: Ancient Men and Modern Myths by L.R. Binford. Zooarchaeological Research News 1(1):7–8.

1980 Cultural Modification of Bone: The Experimental Approach in Faunal Analysis (with Robson Bonnichsen). In: B.M. Gilbert, (ed.) Osteoarchaeology: North America, pp. 7–30. Laramie, Wyoming.

1979 Prehistoric Pottery from Two Maine Sites. Maine Archaeological Society Bulletin 19:31–41.

Reports

2014 Phase III Archaeological Investigations of the Channer Point Site (130.27), Moosehead Lake Outlet Dams Hydroelectric Storage Project, Somerset County, Maine (FERC No. 2671). Report on file with the Maine Historic Preservation Commission, Augusta, ME.

2013a Phase III Data Recovery for NPP5: Niagara Power Project (FERC No. 2216.). (With E. Moore, K. E. Mack, and J. Clark). Report prepared for the New York Power Authority, White Plains.

2013b Results of a Phase II Cultural Resources Investigation of the Access Road on the Eddington Bend Site, or Site 74.8 in Eddington, Penobscot County, Maine (with K. E. Mack). Report on file with the Maine Historic Preservation Commission, Augusta, ME.

2013c Historic Properties Management Plan for the Flagstaff Project (FERC No. 2612). Document prepared for Brookfield Renewables, Hallowell, Maine.

2013d Monitoring of Archaeological Sites and Resources within S.D. Warren Company's Presumpscot River Hydroelectric Projects. (with Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta, ME.

2011 Results of Phase I Archaeological Survey of the Antrim Wind Energy Project Antrim, Hillsborough County, New Hampshire. (with Karen Mack). Report on file at New Hampshire Division of Historical Resources, Concord, NH.

2010a Maine Power Reliability Program: A Central Maine Power Company Program, Phase II Precontact Archaeological Resources Report. (with James Clark, Karen Mack, and Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta, ME.

2010b Maine Power Reliability Program: A Central Maine Power Company Program, Precontact Archaeological Survey Report for MPRP Segment 15Alt, Re-Rate Segments 30A, 34B, 34C, 35B, 38B, 41, Substations & Minor Modifications. (with James Clark, Karen Mack, and Maureen Smith). Report on file with the Maine Historic Preservation Commission, Augusta, ME.

2010c Results of Phase II Precontact Archaeological Investigations of Site 74.172 in Milford, Penobscot County Maine as part of Bangor Hydro Electric Company Line 64 Rebuild Project. (with Karen Mack and James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

2010d Results of Phase I Precontact Archaeological Survey of the GenLead LLC, Transmission Line, Aroostook and Penobscot Counties, Maine. (with Karen Mack and James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

2010e Results of Phase III Precontact Archaeological Investigations of Site 74.8 in Eddington Bend, Penobscot County Maine as part of Bangor Hydro Electric Company Line 64 Rebuild Project. (with Karen Mack and James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

2010f Results of Phase I/II Archaeological Survey of the Public Service Company of New Hampshire's Eliot Substation Project, York County Maine. (with Karen Mack). Report on file with the Maine Historic Preservation Commission, Augusta.

2009a Report on 2007 Archaeological Data Recovery Big Ram Site (Site 36.32) Gulf Island/Deer Rips Hydroelectric Project (FERC #2283) Androscoggin County, Maine. (with Karen Mack and James Clark. Report on file with the Maine Historic Preservation Commission, Augusta.

2009b Results of Phase I Precontact Archaeological Survey of the Bangor Hydro Electric Company Line 64 Rebuild Project, Penobscot County, Maine. (with Karen Mack and James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

2009c Report on 2007 Archaeological Data Recovery Cape Site (Site 36.27) Gulf Island/Deer Rips Hydroelectric Project (FERC #2283) Androscoggin County, Maine. (with Karen Mack and James Clark). Report on file with Maine Historic Preservation Commission, Augusta.

2009d Phase II Determination of eligibility for precontact period archaeological resources, Salem – Manchester IM-IR-93-1(174)0, 10418C, I-93 Transportation Improvement Project, prepared for Parsons-Brinckerhoff. (with Karen Mack, James Clark, and Larry Elrich). Report on file at New Hampshire Division of Historical Resources, Concord, NH.

2008 Phase II Cultural resources Investigation: Niagara Power Project (FERC No. 2216). Report on file with the New York Power Authority, White Plains and the New York Office of Parks, Recreation, and Historic Preservation, Albany.

2006a Phase IB Cultural resources Investigation: Niagara Power Project (FERC No. 2216). Report on file with the New York Power Authority, White Plains and the New York Office of Parks, Recreation, and Historic Preservation, Albany.

2006b Phase I & II Archaeological Survey, Tinker Hill Subdivision, Ellsworth, Hancock County, Maine. (with Rebecca Cole-Will and Jacob Freedman). Report on file with the Maine Historic Preservation Commission, Augusta.

2006c Results of Phase I prehistoric Archaeological Survey of the Littlejohn Subdivision, Yarmouth, Cumberland County, Maine. (with Jacob Freedman). Report on file with the Maine Historic Preservation Commission, Augusta.

2005 VOICES OF THE PEOPLE: Perspectives on Project Effects by the Tuscarora. Report on file with the New York Power Authority, White Plains, and the Tuscarora Nation, Sanborn, New York.

2004a Results of Phase III Archaeological Data Recovery at Sites 121.52a and 121.52b Located within the Penobscot Mills Project (FERC No. 2458), Piscataquis County, Maine (with E. Moore, J. Marron, and James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

2004b Reconnaissance Archaeological Survey of the Land for Maine's Future Board Parcel Located on Tinker Island, Hancock County, Maine (with Peter Morrison and James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

2003a Phase II Investigations of the Bar Mills Project (FERC No. 2194), York County, Maine (with Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

2003b The Archaeology and Prehistory of Moosehead Lake, Maine: Phase III Data Recovery from Seven Sites (with J Clark, L. Elrich, and B. Newsom). Report on file with FPL Energy Maine Hydro, LLC, 160 Capitol Street, Augusta.

2003c Results of a Partial Phase III Archaeological Data Recovery at Five Sites within the Ripogenus Hydroelectric Project (FERC No. 2572), Piscataquis County, Maine (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

2002a Results of a Phase I Archaeological Survey of the Proposed Merrymeeting Airfield Project Bowdoinham, Maine (with Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

2002b Report on a Phase I Archaeological Survey of the Bar Mills Project (FERC No. 2194), York County, Maine (with Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

2002c Report on a Phase I and Phase II Archaeological Survey and Study of the Maine Natural Gas Mid-Coast Natural Gas Pipeline Project, Bowdoin to Brunswick, Maine (with Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

2002d Phase I Prehistoric Archaeological Survey of the Ferland Farm Project, Poland, Androscoggin County, Maine. Report on file with the Maine Historic Preservation Commission, Augusta.

2002e Phase I Archaeological Survey of the Portland International Jetport Project, South Portland, Cumberland County, Maine. Report on file with the Maine Historic Preservation Commission, Augusta.

2001a Report on a Phase I Archaeological Survey of Bangor Hydro-Electric Company’s Line 13 Reroute, Hancock, Maine (with Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

2001b Phase I Archaeological Survey of the Monmouth Water Main Interconnection, Monmouth, Maine. Report on file with the Maine Historic Preservation Commission, Augusta.

2001c Report on a Phase I Archaeological Survey of the Proposed Eliot Natural Gas Compressor Station, York County, Maine (with Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

2001d Report on a Phase I Archaeological Survey of the McGrath Pond Municipal Recreation Area, Oakland, Maine (with Bonnie Newsom). Report on file with the Maine Historic Preservation Commission, Augusta.

2001e The Esker Site (84.12): A 14C Dated Paleoindian Campsite along the Kennebec River in Caratunk, Maine (with Edward Moore and Christopher Dorion). Report on file with the Maine Historic Preservation Commission, Augusta.

2000a The Clark I Site (52.16): Results of Phase III Prehistoric Archaeological Resource Investigations in the Weston Hydroelectric Project (FERC #2325), Norridgewock, Somerset County, Maine (with James Clark, Bonnie Newsom, Karen Mack, and Christopher Dorion). Report on file with the Maine Historic Preservation Commission, Augusta.

2000b Phase I Archaeological Survey of the Proposed Calpine Electrical Transmission Project, Gorham to Westbrook, Cumberland County, Maine (with Julia Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

2000c Results of Phase I and II Archaeological Testing of the Great Works Hydroelectric Project, FERC No. 2312, Penobscot County, Maine (with Julia Clark, Karen Mack, John Mosher, and Bonnie Newsom). Report on file with the Maine Historic Preservation Commission, Augusta.

2000d Results of Phase III Archaeological Testing of the Proposed University of New England's Marine Studies Center, Biddeford, York County, Maine (with Karen Mack). Report on file with the Maine Historic Preservation Commission, Augusta.

2000e Results of Phase I and II Archaeological Testing of the Eastern Surplus Company Superfund Site, Meddybemps, Washington County, Maine (with Julia Clark, Karen Mack, John Mosher and Bonnie Newsom). Report on file with the Maine Historic Preservation Commission, Augusta.

2000f Phase III Archaeological Investigations of the Tim Pond Brook Site (84.40), Franklin County, Eustis, Maine (with John Mosher). Report on file with the Maine Historic Preservation Commission, Augusta.

1999a Phase III Archaeological Resource Mitigation of the Chartier Field Site (7.12) in the Bonny Eagle Hydroelectric Project (FERC #2529), Standish, Maine (with Edward Moore and James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1999b The Limington Rips Site (7.4): Results of Phase III Prehistoric Archaeological Resource Mitigation on the Bonny Eagle Hydroelectric Project (FERC #2529), Limington, Maine (with Edward Moore and James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1999c Phase III Archaeological Resource Mitigation of the Quartz Scraper Site (36.29), Gulf Island/Deer Rips Hydroelectric Project (FERC #2283), Turner, Androscoggin County, Maine (with James Clark and Janet Cormier). Report on file with the Maine Historic Preservation Commission, Augusta.

1999d Additional Phase I Archaeological Survey of the Proposed University of New England Marine Center, Biddeford, York County, Maine (with Karen Mack). Report on file with the Maine Historic Preservation Commission, Augusta.

1999e Phase II Archaeological Testing of the Storage Project (FERC No. 2634), Piscataquis and Somerset Counties, Maine (with James Clark and Julia Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1999f Cultural Resource Investigations, Maritimes & Northeast Pipeline, L.L.C., Phase II Pipeline Project, Maine. FERC Docket No. CP96-809-000: Prehistoric Archaeological Survey Report for January 1998 – February 1999 (with Julia Clark and Karen Mack). Report on file with the Maine Historic Preservation Commission, Augusta.

1999g Cultural Resource Investigations, Maritimes & Northeast Pipeline, L.L.C., Phase II Pipeline Project, Maine. FERC Docket No. CP96-809-000: Prehistoric and Historic Archaeological Investigations Along Proposed Laterals, 1998 (with Julia Clark, Karen Mack, Wayna Roach, and Kathleen Wheeler). Report on file with the Maine Historic Preservation Commission, Augusta.

1999h The Bombazee West Site (52.10): Results of Phase III Prehistoric Archaeological Resource Investigations in the Weston Project (FERC #2325), Norridgewock, Maine (with Karen Mack and Alice Kelley). Report on file with the Maine Historic Preservation Commission, Augusta.

1999i Phase II Archaeological Study of Mooselookmeguntic Lake, Maine, Upper and Middle Dam Storage Project (FERC UL94-1) (with Edward Moore and James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1999j A Summary of Archaeological Phase I and II Investigations Conducted at Site 96.02, Meddybemps, Maine. Report on file with the Maine Historic Preservation Commission, Augusta.

1999k Phase I Archaeological Survey of the Proposed Calpine Natural Gas Lateral, Gorham to Westbrook, Cumberland County, Maine (with Julia Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1999l Cultural Resource Investigations, Maritimes & Northeast Pipeline, L.L.C., Phase II Pipeline Project, Maine. FERC Docket No. CP96-809-000: Supplemental Report, Prehistoric Archaeological Survey (with Karen Mack and Julia Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1998a Results of Phase I Archaeological Survey of the Storage Project (FERC No. 2634) (with James Clark and Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

1998b Results of Phase II Archaeological Survey of the Flagstaff Project (FERC #2612), Somerset and Franklin Counties, Maine (with James Clark and Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

1998c Results of Phase I Survey for Prehistoric Archaeological Resources on the Proposed RPA T/L Transmission Line Project, Oxford County, Maine (with James Clark and Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

1998d Results of Phase I Archaeological Survey of the Medway Alternative to the Weldon Transmission Line Project, Penobscot County, Maine (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1998e Phase I Archaeological Survey of the Proposed Great Northern Paper Company Intermill Tie Line, Penobscot County, Maine (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1998f Results and Recommendations of a Phase 0 Archaeological Review of the Indian Pond Project (FERC #2634), Piscataquis and Somerset Counties, Maine (with James Clark and Christopher Dorion). Report on file with the Maine Historic Preservation Commission, Augusta.

1998g Results of Phase I Archaeological Survey of the Indian Pond Project (FERC No. 2142), Piscataquis and Somerset Counties, Maine (with James Clark and

Christopher Dorion). Report on file with the Maine Historic Preservation Commission, Augusta.1998h Phase I Archaeological Survey of the Sandy River Portion of the Weston Project (FERC no. 2325), Somerset County, Maine (with James Clark and Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

1998i Results of Phase I Archaeological Survey of the Proposed Casco Bay Energy Gas-Fired Facility (with Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

1998j Phase I Archaeological Survey of the Proposed West Falmouth Crossing Project, Cumberland County, Maine. Report on file with the Maine Historic Preservation Commission, Augusta.

1998k Phase II Testing of Site 8.18, West Falmouth Crossing Project, Cumberland County, Maine. Report on file with the Maine Historic Preservation Commission, Augusta.

1998l Phase I Archaeological Survey of the Gorham Energy Project in Gorham, Maine. Report on file with the Maine Historic Preservation Commission, Augusta.

1998m Reconnaissance-Level Archaeological Survey of the Craig Brook National Fish Hatchery, East Orland, Hancock County Maine (with James Clark and Kathleen Wheeler). Report on file with the U.S. Fish and Wildlife Service, Hadley, Massachusetts.

1998n Phase I Survey of the Proposed University of New England's Marine Studies Center, Biddeford, York County, Maine (with Karen Mack). Report on file with the Maine Historic Preservation Commission, Augusta.

1998o Cultural Resources Investigations, Maritimes & Northeast Pipeline, L.L.C., Phase II Pipeline Project, Maine. FERC Docket No. CP96-809-000. Volume 1: Archaeological Survey Report (with Kathleen Wheeler, Edward Moore, Ellen Marlatt, and Julia Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1997a Results of Phase I Archaeological Survey of the Proposed Line 60 Project (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1997b Interim Report on the Results of a Phase I Archaeological Survey of the Bowater/Great Northern Paper Company Storage project (FERC 2634) (with

James Clark and Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

1997c Results of Phase I Archaeological Survey of the Proposed Cherryfield Cranberry Project (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1997d Cultural Resources Investigations, Joint Pipeline Project, Massachusetts, New Hampshire, Maine (with multiple authors). Report on file with the Maine Historic Preservation Commission, Augusta.

1997e Archaeological Investigations at the Janet Cormier Site (23.25), Poland, Maine (with Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

1997f Reconnaissance-Level Archaeological Survey of the Craig Brook National Fish Hatchery East Orland, Hancock County, Maine (with James Clark and Kathleen Wheeler). Report on file with the U.S. Fish and Wildlife Service, U.S. Department of the Interior.

1997g Phase I Archaeological Survey of Mooselookmeguntic Lake, Maine, Upper and Middle Dams Storage Project (FERC UL94-1) (with James Clark and Edward Moore). Report on file with the Maine Historic Preservation Commission, Augusta.

1996a Phase I Archaeological Resource Assessment of the Flagstaff Lake Storage Project (FERC No. 2612) Somerset and Franklin Counties, Maine (with James Clark and Janet Cormier). Report on file with the Maine Historic Preservation Commission, Augusta.

1996b Phase II Archaeological testing of the Augusta Hydroelectric Project (FERC #2389) Kennebec County, Maine (with James Clark and Janet Cormier). Report on file with the Maine Historic Preservation Commission, Augusta.

1996c Phase III Archaeological data Recovery at the Little Ossipee North Site (7.7) (with James Clark, Edward Moore, and others). Report on file with the Maine Historic Preservation Commission, Augusta.

1996d Results and Recommendations of Phase 0 Archaeological Review of the Storage Project (FERC #2634), Piscataquis and Somerset Counties, Maine (with James Clark and Janet Cormier). Report on file with the Maine Historic Preservation Commission, Augusta.

1995a Rachel Carson National Wildlife Refuge Historic and Prehistoric Archaeological Resource Survey (with Emerson Baker, Janet Cormier, and James Clark). Report on file with the U.S. Fish and Wildlife Service, U.S. Department of the Interior.

1995b Phase I Archaeological Survey of the Magalloway Acres-Wilson's Mills Subdivision, Lincoln Plantation, Oxford County, Maine (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1995c Phase I Archaeological Survey of the Holmes Road Subdivision, Scarborough, Maine. Report on file with the Maine Historic Preservation Commission, Augusta.

1995d Archaeology on Clarks Island, Portsmouth Naval Shipyard: Results of a Phase I Archaeology Survey (with Kathleen Wheeler). Report on file with the Maine Historic Preservation Commission, Augusta.

1995e The Nicholas Site: A Late Paleoindian Campsite in Southern Oxford County, Maine (with Deborah Wilson and Janet Cormier). Report on file with the Maine Historic Preservation Commission, Augusta.

1995f Phase III Archaeological Mitigation of the C. Varney Site (36.30) Gulf Island/Deer Rips Hydroelectric Project (FERC #2283) Turner, Androscoggin County, Maine (with James Clark and Janet Cormier). Report on file with the Maine Historic Preservation Commission, Augusta.

1994a Phase II Archaeological Survey of Eight Prehistoric Sites Located Within the Burnham Hydropower Project (FERC No. UL91-03-ME) Area, Waldo and Somerset Counties, Maine (with Deborah Wilson and Janet Cormier). Report on file with the Maine Historic Preservation Commission, Augusta.

1994b Phase II Archaeological Survey of the Moosehead Lake Outlet Dams Project (FERC #2671) Somerset and Piscataquis Counties, Maine (with James Clark, Rebecca Cole-Will, Janet Cormier, and Sarah Staber). Report on file with the Maine Historic Preservation Commission, Augusta.

1994c Phase 0 Archaeological Review of the Damariscotta Mills Hydropower Project (FERC No. UL89-34-ME) (with James Clark, Janet Cormier, and Emerson Baker). Report on file with the Maine Historic Preservation Commission, Augusta.

1994d Results and Recommendations of Phase 0 Study of the Flagstaff Storage Project (FERC #2612), Somerset and Franklin Counties, Maine (with James Clark and Janet Cormier). Report on file with the Maine Historic Preservation Commission, Augusta.

1994e Phase I Archaeological Survey of the Bar Harbor Airport Project, Hancock County, Maine. Report on file with the Maine Historic Preservation Commission, Augusta.

1994f Review of the Hancock Timber Resource Project Area for Prehistoric Archaeological Potential. Report submitted to the Conservation Group, Brunswick, Maine.

1994g Phase I Archaeological Survey of the Proposed Gravel Pit Expansion, King Brothers Trucking/Dodlin Road Gravel Pit, Enfield, Penobscot County, Maine (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1992a Phase IIA Archaeological Survey of the Moosehead Lake Outlet Dams Project (FERC #2671), Somerset and Piscataquis Counties, Maine (with James Clark and Rebecca Cole–Will). Report on file with the Maine Historic Preservation Commission, Augusta.

1992b An Archaeological Phase 0 of the U.S. Windpower - New England Energy Station. Report on file with the Maine Historic Preservation Commission, Augusta.

1992c Phase I Archaeological Survey of the Proposed International Paper, Hoytville Sand and Gravel Extraction Site in Howland, Maine (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1992d Phase I Archaeological Survey of the Proposed Tilcon/Maine Inc. Mineral Extraction Site Medway, Maine (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1992e Phase I Archaeological Survey of the Proposed Expansion of the Windham Gravel Pit, Grondin Property, Windham, Maine (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1991c Phase I Archaeological Survey of the Augusta Hydroelectric Project (FERC #2389), Kennebec County, Maine (with James Clark and Rebecca Cole-Will). Report on file with the Maine Historic Preservation Commission, Augusta.

1991b Phase I Archaeological Survey of the Moxie Pond Storage Facility (FERC # 2613), Somerset County, Maine (with James Clark and Rebecca Cole-Will). Report on file with the Maine Historic Preservation Commission, Augusta.

1991c A Report on the Excavation and Analysis in Progress of the Ann Hilton Site (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1991d Results of Phase I Archaeological Survey of the Mars Hill Wastewater Treatment Project, Mars Hill, Aroostook County, Maine (with James Clark). Report on file with the Maine Historic Preservation Commission, Augusta.

1990 Phase I Archaeological Assessment, Ellis River Pipeline, West Andover, Maine (with James Clark). Final report submitted to the Maine Historic Preservation Commission, Augusta.

1989a Phase I Archaeological Assessment, Mooseleuk Lake, Piscataquis County, Maine (with Rebecca Cole-Will). Final report submitted to the Maine Historic Preservation Commission, Augusta.

1989b Phase I Archaeological Assessment of Meddybemps Lake Subdivision, Meddybemps, Maine (with Rebecca Cole-Will). Final report submitted to the Maine Historic Preservation Commission, Augusta.

1989c Phase I Archaeological Assessment, Walker Pond Subdivision, Brooksville, Maine (with Rebecca Cole-Will). Final report submitted to the Maine Historic Preservation Commission, Augusta.

1986 A Survey for Prehistoric Site, York, Maine (with Rebecca Cole-Will). Final report submitted to the Maine Historic Preservation Commission, Augusta.

1985 A Survey for Prehistoric Sites in the Harraseeket Estuary, Freeport, Maine. Final report submitted to the Maine Historic Preservation Commission, Augusta.

1984 Nineteenth Century Copper Inuit Subsistence Strategies on Banks Island, N.W.T. Doctoral dissertation. Department of Anthropology, University of Alberta, Edmonton, Canada.

1980 A Study of Prehistoric Bone Tools from the Turner Farm Site, North Haven, Maine. Master of Science Thesis, Institute of Quaternary Studies, University of Maine, Orono.

1979 A Report on 1987 Pryor Mountain Archaeological Research (with Robson Bonnichsen). Paper No. 2. Institute for Quaternary Studies, University of Maine, Orono.

1978 An Evaluation of Shell Middens on the Coast of Maine (with David Sanger). Report prepared for the Critical Areas Act Program, State Planning Office and Maine Historic Preservation Commission, Augusta.

Presentations

2014 Precontact Period Pottery from Moosehead Lake. Paper presented at the Maine Archaeological Society Annual Meeting, May 4 29, Bar Harbor.

2006 Effective Methods for Native American Consultation. Paper presented at the Annual Meeting of the National Association of Hydropower, Portland Oregon, August 2.

2002 Bone Artifacts and Technological Continuity in Pre-European Archaeological Sites along the Maine Coast. Paper presented at the 67th Annual Meeting of the Society for American Archaeology, Denver, March 24.

2001 Chaucoet: An Almouchiquois Village in Biddeford, Maine. Paper presented at the Maine Archaeological Society Annual Meeting, April 29, Augusta.

2000a Some New Empirical Data on the Locations of Prehistoric Archaeological Sites in Maine. Paper presented at the 65th Annual Meeting of the Society for American Archaeology, Philadelphia, April.

2000b Teaching Archaeology in the Public School System, Eighth Annual Research Symposium, University of Maine Institute for Quaternary Studies, Orono, Maine, May 9.

1998a Archaeological Resource Survey of the Proposed Maritimes & Northeast Natural Gas Transmission Pipeline, Sixth Annual Research Symposium, University of Maine Institute for Quaternary Studies, Orono, Maine, May 8.

1998b Some Recent Paleoindian Finds from Maine, 38th Annual Meeting of the New England Anthropological Association, University of Maine, March.

1997 Archaeology in the Draw Down Zone of Northern Rivers and Lakes. Fifth Annual Research Symposium, University of Maine Institute for Quaternary Studies, Orono, Maine, May 9.

1996a Landforms and Prehistory in Maine. Northeastern Friends of the Pleistocene 59th Field Conference. Machias, Maine, May 31.

1996 The Archaeological Record in the Realm of Soils and Sediments. Maine Association of Professional Soil Scientists, Waterville, Maine, March 21.

1994a The Little Ossipee North Site. Maine Archaeological Society, Bar Harbor, Maine, October 30.

1994b Soils Research Questions in Archaeology. Society for Northern New England Soil Scientists, University of Maine at Farmington, December 6.

1990 What We Know about Prehistoric Peoples. Maine Teachers Convention, Cultural Initiative of Maine, Waterville, Maine, October.

1989 The Red Paint People. Annual Meeting of the Robert Abbe Museum, Bar Harbor, Maine, October.

1986 Omingmak and the Copper Inuit. Bowdoin College, Brunswick, Maine with sponsorship of the Peary-McMillian Arctic Museum, April.

1984a Microcomputer Applications to Zooarchaeology. 17th Annual Meeting of the Canadian Archaeological Association, Victoria, British Columbia, April.

1984b Bone Technology Studies: Beyond Description (with Rebecca Cole-Will). 17th Annual Meeting of the Canadian Archaeological Association, Victoria, British Columbia, April.

1983a The Nature of Skeletal Disarticulation in Arctic Environments. 16th Annual Meeting of the Canadian Archaeological Association, Halifax, Nova Scotia, April.

1983b Utilization of Banks Island Muskox by Nineteenth Century Copper Inuit. First International Muskox Symposium, Fairbanks, Alaska, May.

1983c Omingmak: Procurement and Utilization by Nineteenth Century Copper Inuit. Boreal Circle, Boreal Institute for Northern Studies, University of Alberta, Edmonton, October.

1982a The Use of Microcomputers in Archaeological Research (with Terrance Gibson and Clifford Hickey). 47th Annual Meeting of the Society of American Archaeology, Minneapolis, Minnesota, April.

1982b Muskox Exploitation: Hunter and Gatherer Subsistence Models Re-examined. 15th Annual Meeting of the Canadian Archaeological Association, Hamilton, Ontario, April.

1982c Dental Annuli Analysis as an Aid in the Determination of Copper Inuit Subsistence Strategies (with James Savelle). 15th Annual Meeting of the Canadian Archaeological Association, Hamilton, Ontario, April.

HONORS AND AWARDS

1999 **State of Maine Historic Preservation Award.** Presented by the Maine Historic Preservation Commission at their summer meeting at Pemaquid, Maine, July.

STATE OF NEW HAMPSHIRE

BEFORE THE SITE EVALUATION COMMITTEE

Docket No. SEC 2015-02

<u>APPLICATION OF ANTRIM WIND ENERGY, LLC</u>
<u>FOR A CERTIFICATE OF SITE AND FACILITY</u>

PREFILED DIRECT TESTIMONY OF MATTHEW MAGNUSSON ON BEHALF OF ANTRIM WIND ENERGY, LLC

September 10, 2015

<u>Qualifications of Matthew Magnusson</u>

Q. Please state your name, title and business address.

A: My name is Matthew Magnusson. I am owner of Seacoast Economics. My business address is PO Box 302, Hampton Falls, NH 03844.

Q. Please describe the services provided by Seacoast Economics.

A: Seacoast Economics provides project-based economic analysis and report authorship consulting services. The firm has typically focused on analysis and evaluation of NH-based projects or policies. Seacoast Economics has provided economic analysis for several NH-based clients including the New Hampshire Port Authority, Department of Health and Human Services, the Community College System of New Hampshire, and the NH Community Development Finance Authority.

Q. Briefly summarize your educational background and work experience.

A: I am a graduate of the University of New Hampshire's Whittemore School of Business and Economics with a Masters of Business Administration. I have performed economic research on each of the three commercial wind farms currently operating in New Hampshire as well as the previously-proposed 30 MW wind farm by Antrim Wind Energy, LLC. I have also performed economic analyses on energy policy in the state of New Hampshire, including the NH Renewable Portfolio Standard, the Regional Greenhouse Gas Initiative, the NH Greenhouse Gas Emissions Reduction Fund, and the NH Better Buildings program.

Additional detail regarding my education, background and experience is contained in my curriculum vitae which is attached hereto as Attachment MM-1.

Q. Have you ever testified before the New Hampshire Site Evaluation Committee ("SEC")?

A. Yes. I presented testimony regarding the potential effect of the Antrim Wind Project on regional employment, economics, and property values in connection with Antrim Wind Energy, LLC's ("AWE") application for a certificate of site and facility in Docket 2012-01.

<u>Purpose of Testimony</u>

Q. What is the purpose of your testimony?

A. The purpose of this testimony is to provide information on the anticipated economic impacts of the proposed Project upon the region in which the Project is proposed to be located. More specifically, my testimony focuses on the impacts that the Project is anticipated to have upon the region's economy, employment, and property values.

Q. Are you familiar with the Project proposed by AWE in this matter?

A. Yes. In connection with the application that was the subject of Docket 2012-01, AWE retained Professor Ross Gittell and me, then both at the University of New Hampshire, to assess the potential effects of the Project upon the region's economy, employment, and property values. I assisted in the preparation of Professor Gittell's economic impact analysis of the Project in Docket 2012-01, and ultimately adopted the Professor's testimony when he accepted new employment during the course of the Docket. During the course of my current engagement, I have been provided with further information about the proposed Project and therefore am familiar with it.

Q. Are you also familiar with the finding of the New Hampshire Site Evaluation Committee (SEC) with respect to the economic impacts of the Project in Docket 2012-01?

A. The SEC considered the testimony and studies that Professor Gittell and I submitted in the broader context of its deliberations regarding the orderly development of the region. After considering our submissions in combination with other evidence, the SEC concluded that the Project would not unduly interfere with the orderly development of the region.

Q. In your opinion, have circumstances relative to the Project changed in a way that would affect the SEC's finding on these issues in Docket 2012-01?

A. No. For the reasons summarized below and described more fully in the updated studies attached as Appendices 14A and 14B to the Application, my findings with respect to the economic impacts of the Project and the potential effect of the Project on local and regional property values have not changed. In my opinion, the Project will have both positive short and long term impacts on the regional economy and employment, and will not affect local or regional property values or tourism.

<u>Economic and Employment Impacts</u>

Q. Please describe the methodology that you employed to assess the potential effects of the Project on regional employment and economic activity.

A. I reviewed the economic impact analysis "Economic Impact of the Proposed Antrim 30 MW Wind Power Project in Antrim, New Hampshire" ("EIS") that Professor Ross Gittell and I performed in 2012. The purpose was to review and update the EIS as necessary. I then conducted a literature review of studies that have examined economic impacts of wind power projects, including studies submitted as part of Wild Meadows Docket No. 2013-02 and other economic studies performed since the date of the EIS. I also obtained updated financial and construction information on the Project provided by Antrim Wind Energy, LLC and its construction partner Reed & Reed, Inc.

The updated EIS considers the net direct, indirect and induced economic impacts of the Project on the local area economy, defined in this case as Cheshire, Hillsborough, Merrimack, Rockingham and Sullivan counties. The update includes evaluation of the local area economic impacts during the construction phase and the on-going operations phase. Economic factors incorporated into economic modeling include employment, local capital expenditures, tax revenue, local material and supplies purchases, landowner payments and the broader economic “multiplier” impacts of the Project.

I performed the economic modeling for the initial EIS using the MIG IMPLAN and JEDI economic models, and I am familiar with the application of these models to wind power projects. Based on the literature review and the information provided to me in connection with the Project, I determined that the methodology used in the EIS remains valid and appropriate for use in an update. Both the JEDI model and the IMPLAN model are widely used and cited economic input-output models that are frequently applied to economic impact analysis of wind power projects. I updated the MIG IMPLAN model to use the latest economic data available (2013), and utilized the latest version of the JEDI Land-based Wind Model. I then performed the economic analysis using these updated models with the latest financial and construction data provided on the Project.

The updated economic impact analysis also considers the Project in the context of the broader regional electricity market as well as any potential impacts the Project might have on residential property values or tourism.

Q. Please summarize the results of the updated economic analysis.

A. The results of the economic analysis are incorporated into a written update to the EIS**,** included in Appendix 14A to the Application. The results of my updated analysis indicate that the Project is expected to bring $53.4 million in increased economic activity to Cheshire, Hillsborough, Merrimack, Rockingham and Sullivan counties in NH over the next twenty years.

The construction phase of the Project is the time period when there will be the greatest economic activity and benefits for these counties. During the construction phase, the Project is expected to contribute $11.6 million in economic activity and generate 25 full-time equivalent (FTE) construction-related jobs and support an additional 59 FTE jobs paying a total of $5.9 million in wages and earnings in the local area economy. In the on-going operating phase after construction, the economic and jobs impact of the wind power project is reduced but still positive. The project is expected to contribute $2.2 million annually to the local economy, as well as create an estimated 4 FTE new jobs for employees of Antrim Wind and support an additional 8 FTE jobs in the local area. Antrim Wind has signed an annual Payment In Lieu of Taxes (PILOT) agreement with the Town of Antrim in the amount of $11,250 per MW for the first post-construction year, escalating at 2.5% per year during the 20 year operating term. This agreement results in a total of approximately $8.4 million being paid to the Town of Antrim in PILOT payments during construction and the first 20 years of operations.

As discussed below, the Project is not expected to affect local or regional property values. Moreover, there is no evidence indicating that a relationship exists between wind power projects and tourism in the region, and as such I do not anticipate that the Project will have any effect upon local or regional tourism.

Q. Based on your analysis, what are your conclusions regarding the economic effects of the Project?

A. For the reasons discussed above and in the updated EIS, it is my opinion that the Project will have a positive economic impact on Cheshire, Hillsborough, Merrimack, Rockingham and Sullivan counties in NH, with the greatest positive impact during the construction phase of the Project but continuing thereafter for the operational life of the Project. I do not expect the Project to have any effect upon local or regional property values or tourism.

<u>Property Values</u>

Q. Please summarize the analysis that you performed regarding the Project's anticipated impacts on area property values.

A. My analysis incorporates and updates the study entitled *Impact of the Lempster Wind Power Project on Local Residential Property Values* ("Study") that Professor Gittell and I submitted in Docket 2012-01. The Study as initially prepared included an in-depth review of six studies that performed statistical analysis to examine the relationship between wind power projects and residential property values. These studies did not find a wide-spread, consistent change in property values associated with wind power projects, though none of the studies included NH wind power projects. To validate the studies' findings in New Hampshire, Professor Gittell and I reviewed 2,593 arms-length, single-family home sales transactions from January 2005 through November 2011 for all of the towns and cities located in Sullivan County. Eighty-eight of those sales transactions occurred in the towns immediately surrounding the Lempster Wind Power Project after it was constructed. Utilizing GIS mapping software and a visual inspection of each property sold, we determined the distance of the property to the nearest turbine of the Lempster Wind Power Project and whether the property had a view of the turbine.

Utilizing two statistical tests, simple linear regression and ANOVA, we concluded that there was no relationship between the proximity of a property to a wind turbine or views of wind turbines and the selling prices of properties.

In the update to the Study, I reviewed a total of twenty studies, including ones that were performed after the Study that statistically examined the relationship between wind power projects and residential real estate values using observations of property transactions. I also repeated the statistical tests on the Lempster property transaction data set and obtained identical statistical results. The purpose of replication was to ensure that the results were repeatable and still supported the original findings in the Study.

Additionally, I conducted a study of the impact of the proposed Wild Meadows Wind Farm on local residential property values ("Wild Meadows Study") in December 2013. That study reviewed 382 single family home property transactions (occurring between January 2008 and July 2013), including 132 post-construction transactions around both the Lempster Wind Power Project and the Groton Wind Farm located in Grafton County, NH. The results from the Wild Meadows Study are discussed in the updated study.

The Wild Meadows Study combined with the Study provide almost five years of real estate transactions in the communities surrounding the Lempster Wind Power Project This period of time was sufficient to observe any potential post-construction impacts on residential property values surrounding the Lempster Wind Power Project.

Q. What were the conclusions of the original property values study?

A. The Study concluded that there was no evidence that the Project has had a consistent, statistically-significant impact on property values within the Lempster region. This finding was based not only reviewing property transactions surrounding the Lempster Wind

Power Plant, but also the findings of the six other studies referenced in the Study that found no conclusive evidence of wide spread, statistically-significant changes in property values resulting from wind power projects.

Q. Have those conclusions changed as a result of your updated analysis?

A. No. A complete report of my updated study is contained in Appendix __ to the Application. The updated study confirms that single family homes surrounding the Lempster Wind Power Project have not experienced an overall change in their assessed values, nor have they been observed to sell for a value that was consistently different from their expected market value. There has been no overall change observed in the residential real estate market value surrounding the Lempster Wind Power Project that differs from the trends of the overall area real estate market. This observation holds true even when considering the types of residential properties that would be expected to be the most impacted by the presence of a wind power project, including properties that are in close proximity to a turbine and/or that have direct views of one or more turbines.

The updated study supports the original conclusion that the Lempster Wind Power Project has not had any consistent, statistically-significant impact on property values. The experiences of other New England states are consistent with this finding. Studies reviewing wind power projects in Massachusetts, Rhode Island, and Vermont have not found evidence of a consistent difference in property values associated with the presence of wind power projects. Furthermore, the findings from this update study agree with the substantial body of evidence from international, national, and regional studies that also have not found evidence of systematic, wide-spread changes in property values associated with wind power projects.

Therefore, it is my opinion that there will not be a decrease in the value of the overall residential market around the proposed Antrim Wind Energy Project, including those properties that would be in close proximity to a turbine and/or that would have direct views of one or more turbines, if the Project is developed.

Q. In your opinion, taking into consideration potential economic, employment and property value impacts, will the Project unduly interfere with the orderly development of the region?

A. No. In my opinion, for the reasons set forth above and contained within Appendices 14A and 14B to the Application, I continue to believe that the Project will have a positive impact upon the local economy and employment, and will not adversely affect property values. Therefore, the Project will not unduly interfere with the orderly development of the region.

Q. Does this conclude your pre-filed testimony?

A. Yes.

Matthew Magnusson

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Experience:

2012 - 2015 **KPItrac, LLC d.b.a Seacoast Economics, Hampton Falls, NH**
Owner
Provide data collection, analysis, presentations and report authoring on project-based energy and economic research.

- **2015 - Economic Impact of the Proposed 28.8 MW Antrim Wind Power Project in Antrim, New Hampshire**
  Sponsor: Antrim Wind Energy, LLC
- **2014 – Impact of the Lempster Wind Power Project on Local Residential Property Values Update**
  Sponsor: Antrim Wind Energy, LLC
- **2014– New Hampshire Cleantech 2014 Market Report**
  Sponsor: New Hampshire Cleantech Council
- **2014– New Hampshire Medicaid Program Enrollment Forecast SFY 2014-2016**
  Sponsor: New Hampshire Department of Health & Human Services
- **2013 - The Impact of the Wild Meadows Wind Farm on Local Residential Property Values**
  Sponsor: Iberdrola Renewables, LLC
- **2013 – An Evaluation of the NH BetterBuildings Program**
  Sponsor: NH Community Finance Development Authority
- **2012– Climate Impacts on the Winter Tourism Economy in the United States**
  Sponsor: Natural Resources Defense Council, Protect Our Winters
- **2012 – The Economic Impact of the Piscataqua River and the Ports of Portsmouth and Newington**
  Sponsor: Piscataqua River Economic Development Committee
- **2012 - Economic Impact of the Proposed Antrim 30 MW Wind Power Project in Antrim, New Hampshire**
  Sponsor: Antrim Wind Energy, LLC
- **2012 - Impact of the Lempster Wind Power Project on Local Residential Property Values**
  Sponsor: Antrim Wind Energy, LLC

2012 – Present **Community College System of New Hampshire, Portsmouth, NH**
Grant Researcher & Analyst
Responsible for establishing reporting systems, ensuring compliance with U.S. Dept. of Labor performance reporting, and evaluating grant performance across 8 different consortium campuses for $19.1 million Trade Adjustment Assistance Community College and Career Training Grant awarded to NH Community College System. Designed, programmed, and released ASP.net based reporting system that was recognized by the Dept. of Labor. Reported student outcomes from Oracle and Cognos.

ATTACHMENT MM-1

Matthew Magnusson

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Dover, NH 03820
603- 285-5735
magnusson3@gmail.com

2005–2013 **University of New Hampshire, Durham, NH**

Research Associate (Most recent official position: Project Director II)
Provide project leadership, data collection, analysis, presentations and report authorship on project-based grant-funded research.

Summary of Work

- **2013– New Hampshire Medicaid Program Enrollment Forecast**
  Sponsor: New Hampshire Department of Health & Human Services

- **2012 – Energy & Economic Impacts of the NH Greenhouse Gas Emissions Reduction Fund**
  Sponsor: New Hampshire Public Utility Commission

- **2012– "The Sustainable Business Case Book",** co-author with Professor Ross Gittell and Professor Michael Merenda textbook published by Flat World Knowledge

- **2010 – The Economic Impact of the Local Sea Food Industry in New Hampshire – Opportunity for Sustainability**
  Sponsor: University of New Hampshire Cooperative Extension

- **2010 – New Hampshire Medicaid Program Enrollment Forecast SFY 2011-2013 Update**
  Sponsor: New Hampshire Department of Health & Human Services

- **2010 – The Economic Impact of Local Food Systems in New Hampshire - Current Status and Prospects for Growth**
  Sponsor: University Office of Sustainability, NH Charitable Foundation

- **2010 – Economic Impact of the Proposed Groton Wind 50 MW Wind Power Project in Groton, New Hampshire**
  Sponsor: Groton Wind LLC

- **2009 – "Sustainability and Business"** Chapter in "Exploring Business" textbook published by Flat World Knowledge

- **2009 – Economic Impact of Granite Reliable Power Wind Power Project in Coos County, New Hampshire**
  Sponsor: Granite Reliable Power LLC

- **2009– Economic & Greenhouse Gas Impacts of the New 2009 Fuel Economy (CAFE) Standards in New England**
  Sponsor: Carbon Solutions New England

- **2009– New Hampshire's Green Economy and Industries: *Current employment and future opportunities***
  Sponsor: Rockingham Economic Development Committee (REDC), U.S. Dept. of Commerce-Economic Development Administration

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- **2009 – Economic Analysis of Policies Proposed by the NH Climate Change Policy Task Force for the Governor's NH Climate Change Action Plan**
  Sponsor: New Hampshire Charitable Foundation

- **2008 - Economic Impacts of Regional Greenhouse Gas Initiative on New Hampshire**
  Sponsor: New Hampshire Department of Environmental Services, The Energy Foundation

- **2007- Economic Impacts of a State Renewable Portfolio Standard in New Hampshire**
  *Sponso*r: New Hampshire Department of Environmental Services

- ***2006*- Economic Modeling of Low Sulfur Heating Oil in the Northeast**
  Sponsor: Northeast States for Coordinated Air Use Management (NESCAUM)

2012 **University of New Hampshire, Durham, NH**
Adjunct Lecturer
Taught senior-level undergraduate Sustainable Business Models course. Instruction included grading, and course development.

2005–2012 **University of New Hampshire, Durham, NH**
Lead Recitation Instructor
Lead classroom instruction for the Introduction to Business course. Instruction included grading, leading classroom discussion and course development.

2000–2008 **University of New Hampshire, Durham, NH**
Information Technologist III
Project manager for UNH Information Technology projects including management reporting and ERP system. Responsible for employee training of new IT related systems. Web application and database development of in-house applications for undergraduate student admissions.

Education:

2005 **Whittemore School of Business and Economics, University of New Hampshire, Durham, NH**
Masters Degree in Business Administration

1997 **University of New Hampshire, Durham, NH**
Bachelor of Science Degree in Kinesiology

Technical Skills:

- Data extraction, manipulation, integration, query development and reporting of complex data sets from government and proprietary sources

- Application and programming experience includes: IMPLAN 3.0, SQL Server, Oracle, JavaScript, HTML 5.0, C#, ASP.NET MVC, Windows Azure, Excel, PowerQuery, PowerPivot, DAX, MDX, R, Python

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