THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2012-___

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

PREFILED DIRECT TESTIMONY OF JACK KENWORTHY

ON BEHALF OF

ANTRIM WIND ENERGY, LLC

January 31, 2012

Qualifications of Jack Kenworthy

Q. Please state your name and business address.

A. My name is John (Jack) B. Kenworthy and business address is 155 Fleet Street, Portsmouth, New Hampshire 03801.

Q. Who is your current employer and what position do you hold?

A. I am employed by Eolian Renewable Energy, LLC as its Chief Executive Officer.

Q. Please describe your responsibilities at Eolian, including those that relate to the Antrim Wind Energy, LLC Project that is the subject of this docket.

A. As CEO of Eolian, I have oversight and management responsibilities for every aspect of the company. My primary roles include strategic development, capital raising, investor relations, major contract negotiations and project development support. I am generally responsible for managing the growth and health of our business on the corporate side, but also am very involved in each project Eolian is developing. I have

been heavily engaged in the Antrim project from the very beginning. I negotiated all of the land leases we have for the Project, attended dozens of meetings in Antrim related to various topics from meteorological towers to ordinance development, PILOT agreements and general Project information. I negotiated conservation easements with Harris Center and four land owners, and contribute to the management of Antrim Wind's consultants and contractors, as well as budget development and approval. As the result of all of these activities, I am very familiar with the Antrim Wind Project.

Q. What are your background and qualifications?

A. I have been an executive in the renewable energy industry for 8 years, with project development experience in wind, solar and biofuel technologies. My résumé is attached to this testimony and is labeled Attachment JBK-1.

Q. Have you previously testified before this Committee and/or any other state permitting agencies?

A. Yes. I testified before this Committee in Docket No. 2011-02, a docket in which the Town of Antrim Selectmen, over 100 registered Antrim voters and Antrim Wind Energy, LLC petitioned the Committee to assert jurisdiction over the Project that is the subject of the instant docket.

Purpose of Testimony

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide the Site Evaluation Committee ("SEC" or "the Committee") with background information about the Applicant, Antrim Wind Energy, LLC ("Antrim Wind" or "AWE") and the proposed Antrim Wind Project, and

with information on the following topics that are contained in AWE's Application for a Certificate of Site and Facility ("the Application"): alternatives to the Project that were considered; the views of municipal and regional planning commissions and the Antrim Board of Selectmen; the Project's consistency with the objectives of RSA 162-H and other public policies; the Project's impacts on public health and safety (with the exception of the issues of noise and shadow flicker which are covered respectively by witnesses Robert O'Neal and John Guariglia); and a description of the Project's conservation efforts. In addition, my testimony is intended to support and sponsor information in the Application to the extent not specifically addressed or supported by other witnesses.

Applicant Information

Q. Please provide information about the Applicant and the companies with which it is affiliated.

A. The Applicant, AWE, is a Delaware limited liability company formed to develop, build, own and operate the Antrim Wind Project. AWE has two members - Eolian Antrim, LLC, and Westerly Antrim, LLC – which in turn are owned respectively by Eolian Renewable Energy, LLC ("Eolian") and Westerly Wind, LLC ("Westerly"). Eolian and Westerly are the Project's "sponsors," i.e. the entities ultimately responsible for the development, financing, construction and operation of the Project.

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. It, along with consultants and contractors engaged by Eolian, is currently focused on renewable energy development. The Eolian team is actively developing projects in Maine, New Hampshire, and Vermont with a total of four projects, having a total aggregate capacity of 152 megawatts ("MW"). Eolian's approach is to develop appropriately-sized projects in the best locations, balancing the need for preservation and the need for clean energy development. In January 2011, Eolian entered into a Joint Development Agreement with Westerly, and Eolian Antrim, LLC and Westerly Antrim, LLC entered into a corresponding Limited Liability Company Agreement to advance the Antrim Wind Project through development, financing, construction and operation.

Westerly Wind, LLC is a Delaware limited liability company based in Braintree, Massachusetts. It was formed in 2010 to provide development capital, management expertise and commercial assistance to independent wind power developers. Westerly is a portfolio company of US Renewables Group ("USRG"), which is an energy investment firm founded in 2003. USRG focuses exclusively on investing in renewable power, biofuels and clean technology infrastructure and has invested approximately $750 million of capital in clean energy companies and projects. More detailed information about the Applicant, the companies with which it is affiliated, and persons associated with the Applicant is found in sections B and H.5 of the Application. In addition, the joint prefiled testimony of Joseph Cofelice and Martin Pasqualini provides further details concerning AWE's capabilities to finance, construct and operate the Antrim Wind Project in continuing compliance with the terms and conditions of any certificate that may be

issued by this Committee. Also, the joint prefiled testimony of Sean McCabe and Ellen Crivella addresses AWE's technical and managerial capabilities.

Site Information

Q. Please describe the location and basic characteristics of the proposed Project site.

A. The Project is located in the sparsely settled rural conservation zoning district in northwest portion of the Town of Antrim. Specifically, the Project is proposed to be located on and adjacent to 354 Keene Road (NH Route 9) and includes approximately 1,850 acres of private lands currently leased by AWE from five landowners. 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 2.5 miles. After construction is completed, the leased area will be reduced to include only the as-built windpower facilities (comprising approximately 57 acres) and buffer areas, for a total leased area of approximately 70 acres.

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 circuit. 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 in Figure C.1. of the Application.

In general, the Project site is undeveloped and forested. However, the area has been subject to industrial timber harvesting in the past several decades; hundreds of acres within the Project area have been logged recently. Because of this historical logging activity, all of which was unrelated to the Project, the area includes patches of successional forest in various stages of regeneration. A natural community survey indicated that no significant natural communities exist within the Project area, and field surveys for rare plants revealed no rare plants or species of concern.

Currently, the site is used informally for hiking and hunting. There are no maintained motorized trail systems on the parcels leased by AWE. Only one formal recreational area (a hiking trail) is within one mile of the Project.

More information about the location and characteristics of the Project site and surrounding area is contained in Sections C.1 through C.5 of the Application. In addition, Section I.5 of the Application provides information about the natural and other resources at the Project site, and Section J.1 provides information about local land use.

Facility Information

Q. Please provide information about the basic design and configuration of the proposed Project.

A. The Project consists of 10 turbines each having an expected nameplate generating capacity of 3 MW. The final nameplate capacity of the Facility will depend on final

turbine selection; as of the time of the filing of this Application, AWE has not finalized its turbine selection. The studies performed to support the Application have assumed that the Project would use the Acciona AW-116 3 MW turbine (AW-116/3000). This turbine is the largest machine that is currently under consideration for the Project and deemed to be the most intrusive machine commercially available in the 3-MW class. This turbine is a horizontal axis upwind rotor 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. The total turbine height from foundation to blade tip is 492 feet. Additional details concerning the configuration of the AW-116/3000 turbine are found in Appendix 5.

The entire Project's configuration within the leased premises 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 4 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 3.47 miles (18,318 feet) long and will be built in two sections. The first section will connect Route 9 to wind turbine generator (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 2.77 miles (14,608 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 a maintenance building. 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 (*see* Appendices 7A and 7B of the Application) and will be contained within the permitted footprint and elevations contained in the Application. The maintenance building is expected to be approximately 3,000 square feet in size. 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 approximately 100 meters (328 feet) in height and will replace the existing temporary meteorological tower on the site. The proposed Project layout is illustrated on Figure E.3 of the Application.

Q. Please explain how the power produced by the Project will be delivered to the electricity grid.

A. The Project plans to deliver electricity to the grid by interconnecting to the existing PSNH L-163 115kV electric transmission line in close proximity to the Project. This interconnection will be accomplished via a new substation to be built on property that is currently leased by Antrim Wind Energy, LLC. The substation yard will be divided into two areas; one for collection and one for interconnection. No new electric transmission lines, other than Project electrical collector system lines, are currently anticipated to be required.

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 wind turbine generator ("WTG") -10 to just east of the WTG-2 & 3 spur road. From there, the collection line will transition to overhead lines that will run 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 is shown on the civil design drawings, which are provided in Appendix 7A of the Application.

Q. Please describe the Project's anticipated capacity to produce electricity.

A. Antrim Wind Energy has been collecting on-site wind data with a 60 meter meteorological tower since 2009. Additional wind resource measurement is being accomplished through the application of remote sensing technology. Specifically, the Project is utilizing a Light Detection and Ranging ("LiDAR") device to sample portions

of the turbine array that are not as proximal to the meteorological tower. Through a combination of repeatedly correlating the LiDAR data with the meteorological mast and deploying it as a roving device, the LiDAR is contributing to a robust measurement campaign designed to maximize the accuracy and minimize the uncertainty of long-term energy production estimates.

Based on the sophisticated on-site wind resource measurement campaign, correlation with long-term reference stations, and the application of state of the art analysis methods, AWE is confident that the site offers a competitive wind resource. In the interest of achieving maximum efficiency for the facility, as well as an interest in modeling the largest turbine under consideration, the Project has chosen to evaluate the Acciona AW-116/3000, a 3 MW turbine, for the purposes of the Application. The AW-116 offers impressive power curve performance, array efficiency, and reliability. While a binding turbine supply agreement has not yet been executed, AWE maintains excellent relationships with several turbine manufacturers and believes there are several turbine models in the 3 MW size class that would perform well at the Project.

Accounting for all losses, Antrim Wind estimates that the Project will have an average annual net capacity factor of 37.5% – 40.5%. Based on this projected capacity factor, the Project is expected to produce between approximately 98,300 and 106,645 megawatt hours of electricity per year. This is the equivalent of the amount of electricity needed to serve between 13,000 and 14,000 New Hampshire homes annually. 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.

Consideration of Available Alternatives

Q. Did Antrim Wind consider any other available alternatives to the proposed site for this Project? If so, please describe those alternatives and explain why they were not selected.

A. The criteria used by Antrim Wind to select the site for this Project and the alternatives considered are described in section H.2 of the Application. In addition to the site of the instant Project, AWE considered possible alternative locations in the Towns of Stoddard and Marlow, New Hampshire. These alternatives were ruled out for several reasons. In the case of Marlow, it was ultimately determined that there were significant wetland resources in the area that would be difficult to avoid and there was also a lack of suitable transmission infrastructure in the area. In the case of Stoddard, it was found that the presence of substantial conservation lands made access and siting too difficult. Antrim was ultimately determined to be the most appropriate site to investigate further. This conclusion has been supported by various studies that have been performed since that determination was initially made.

Within the parcels of land that have been leased by AWE for the Project, a number of alternative layouts or designs were considered. The Project's current design is preferred to all of the other alternatives that were considered because it provides for the most efficient and economic use of resources with fewer environmental impacts.

Consideration of the Views of Municipal and Regional Planning Commissions and Municipal Governing Bodies

Q. Please describe steps that AWE has taken to consider the views of municipal and regional planning commissions to insure that the Project is consistent with the orderly development of the region.

A. The Project has been the subject of public conversations with the Town for nearly three years, during which time every effort has been made by AWE to advance the Project in an open and transparent manner. AWE has attended and presented (and responded to inquiries) at several different public, noticed meetings in Antrim, including before the Zoning Board of Adjustment, Planning Board and Board of Selectmen. The Project has also coordinated with Antrim Selectmen, the Town Administrator, and communicated with the Antrim Conservation Commission, the Antrim Historical Society, and the Police and Fire Departments. On November 1, 2011, AWE held a three hour informational "open house" at the Antrim Town Hall. This session was attended by approximately 50 members of the public. At the open house, representatives of the Project, including technical consultants who performed visual, noise and other studies, were available to answer questions from the public.

Outside of the Town of Antrim, the Project has met with the following officials and organizations: New Hampshire Audubon, The Harris Center for Conservation Education, The Nature Conservancy, The Society for the Protection of New Hampshire Forests, Conservation New Hampshire, the New Hampshire Department of Transportation and the New Hampshire Division of Fire Safety.

In addition to its personal interactions with the Antrim Planning Board and Board of Selectmen to solicit their views on the Project, AWE has considered the views of the Town of Antrim as expressed in its Master Plan. 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. Relevant excerpts from the Master Plan are contained in Appendix 15 to the Application.

The Antrim Master Plan's expressions of support for the need for renewable energy such as that generated by the Project were confirmed in a public vote in Antrim on November 8, 2011. At that time, voters in Antrim defeated two ballot articles relating to large-scale wind energy projects in the Town. The first article, which asked voters to adopt a large-scale wind ordinance that would severely restrict the development of wind projects, failed by a vote of 501 to 309. The second article, which would have prohibited wind turbines and meteorological towers in the Town's Rural Conservation District (the District in which the Project is located), failed by a vote of 584 to 225.

In addition to the above-described actions, AWE has considered the views of the Antrim Board of Selectmen by entering into negotiations for a payment in lieu of taxes ("PILOT") agreement, and has offered the Town an agreement on other matters that is substantially similar to agreements reached between two other New Hampshire towns (Lempster and Groton) and wind projects located within those communities. A copy of

the draft agreement offered by AWE to the Town of Antrim is contained in Appendix 17 and is described below.

The Project has considered the Southwest Regional Planning Commission's goals which, among other things, state that the "current lack of local, renewable energy alternatives" to conventional energy sources presents a substantial risk to future growth in the region. *See* Appendix 16. Taking these views into consideration, as well as those of the Antrim governing and planning bodies, and the voters in the Town of Antrim, I conclude that the Project is consistent with these views as they relate to the orderly development of the region.

Project's Consistency With the Objectives of RSA 162-H and Other Public Policies
Project's Impacts on Public Health and Safety

Q. What is your understanding of the objectives of RSA 162-H?

A. My understanding of the objectives of RSA 162-H is informed by the language in the purpose section of the statute found at RSA 162-H:1. There, the Legislature recognized "that the selection of sites for energy facilities…will have a significant impact upon the welfare of the population, the location and growth of industry, the overall economic growth of the state, the environment of the state, and the use of natural resources." Based upon that recognition, the Legislature found that:

> [I]t is in the public interest to maintain a balance between the environment and the need for new energy facilities in New Hampshire; that undue delay in the construction of needed facilities be avoided and that full and timely consideration of the environmental consequences be provided; that all entities planning to construct facilities in the state be required to provide full and complete disclosure to the public of such plans; and that the state ensure that the construction and operation of energy facilities is treated as a significant aspect of land-use planning in which all environmental, economic, and technical issues

are resolved in an integrated fashion, all to assure that the state has an adequate and reliable supply of energy in conformance with sound environmental principles.

Q. Do you believe that the objectives of RSA 162-H would be best served by the issuance of a certificate of site and facility for this Project?

A. Yes. Allowing this Project to go forward will further the objectives of RSA 162-H by enabling a new renewable energy facility with low environmental, health and safety impacts, and significant economic development benefits, to meet the growing demand for electricity in the region. On average, the power generated from the Project will be sufficient to provide electricity to approximately 13,000 to 14,000 New Hampshire homes annually. The Project will maintain an appropriate balance between the environment and the need for new renewable energy facilities. It can also be constructed relatively quickly, without undue delay, and will help to diversify the state's energy supply and to ensure that it is adequate, reliable and conforms to sound environmental principles. Through the SEC process, there is a complete and full disclosure to the public of the Project's impacts and benefits. Thus, all of the objectives of RSA 162-H will be met if the Project is certificated.

Q. Is the Project consistent with public policies relating to renewable energy and climate change?

A. Yes. The Project is consistent with and promotes several public policy goals such as those reflected in RSA 362-F, New Hampshire's renewable portfolio standard ("RPS") law, which requires that 25% of the electricity sold by retail suppliers in New Hampshire come from renewable sources by 2025. The Project is consistent with the purpose of the

RPS statute articulated in RSA 362-F:1: it provides fuel diversity to the state and the region's generation supply through the use of a local renewable resource that is completely emission-free and which can displace and lower regional dependence on fossil fuels, thereby stabilizing volatile energy costs; the Project will aid the local and state economy as indicated in the prefiled testimony of Dr. Ross Gittell; and, as indicated in the prefiled testimony of Dr. Colin High, the Project will help to reduce the amount of greenhouse gases, nitrogen oxides and particulate matter emissions generated in the state, thereby improving air quality, public health, and mitigating against the risks of climate change.

Because the Project will produce electricity without producing greenhouse gases, it is consistent with the state's Regional Greenhouse Gas Initiative ("RGGI") set forth in RSA 125-O:19 *et seq.* which is aimed at reducing greenhouse gas emissions resulting from energy use in New Hampshire. The Legislature has determined that global climate change is a significant environmental problem that can be addressed through reducing greenhouse gases such as carbon dioxide which is produced by electric power plants that combust fossil fuels. By generating electricity without using fossil fuels, the Project will assist in addressing the issue of climate change.

Lastly, the Project is consistent with state planning and zoning laws that require support of renewable energy projects through planning regulations and zoning ordinances that encourage the installation and use of renewable forms of energy such as wind projects. *See* RSAs 672:1, III-a and 674:17, I. (j).

Public Health and Safety Issues

Q. What steps will be taken to ensure that the Project will not have an unreasonable adverse impact on public health and safety?

A. AWE is committed to constructing and operating the Project with the utmost concern for public health and safety. As indicated above, the issues of noise and shadow flicker will be addressed by witnesses Robert O'Neal and John Guariglia, respectively. Below I will discuss specific examples of public health and safety issues that the Project may potentially pose, as well as how the Project intends to address each. At the outset, it should be noted that the Project is located in a remote and undeveloped area, away from inhabited structures. The nearest residence is one-half mile away from the Project, and the turbines and other facilities will be located at distances from abutting property lines so as to avoid any of the problems associated with the issues identified below. In addition, to prevent public access to the Project, the only access road into the facility will be gated and locked. To address the use of the Project area by persons granted permission for such use by landowners or otherwise, the Project will post signs within 500 feet of the Project's WTGs along informal roads and trails to warn of the potential risks identified below.

Ice Shedding

When ice builds up on the turbine blades, the turbines will sense the blade imbalances created by the ice build-up and will shut down automatically until the icing subsides. Because the Project will be located entirely on private land, where public access can be controlled, the potential risk to the public due to ice shedding is minimal.

In addition, as indicated above, 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. For the two turbines closest to property lines, AWE has a setback waiver from the abutter for one. For the other property, which is a wood lot and not a residential property, AWE will maintain a setback from the property line of 1.1 times the blade tip height. AWE has proposed additional setback requirements in it proposed agreement with the Town of Antrim. These setbacks include a distance of three times the turbine height between a turbine and a non-participating landowner residence, and a distance of 1.5 times the turbine height between a turbine and the right-of-way line of the nearest public road. These measures will provide protection against any risks associated with ice throw.

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 represent minimal danger to public health and safety. Industry improvements in design, manufacturing, and installation have greatly reduced such occurrences. Each AWE turbine will be designed in accordance with international engineering standards, and are equipped with safety features designed to minimize the chance of tower collapse or blade throw. Again, as noted above, the remote location of the Project site on private land, as well as the setbacks described above, further reduce the already remote threat that these types of events pose to the public. Further, no AW-116 or its predecessor model- the AW-1500 -

installed on a steel tower has ever experienced blade throw or tower collapse. This represents over 2,400 WTGs installed since 2004.

Lightning Strikes

Should a lightning strike occur, each turbine is equipped with lightning protection equipment which conducts the lightning from the blade to the tower via a grounding system. This prevents damage to the blade, the tower, and the electrical components. As a result lightning strikes do not present any danger to the health and safety of the public.

Fire

Fires associated with wind turbines are extremely rare. There are very flew flammable components. The use of lubricating and other oils and the presence of electrical components, however, do present a potential for fire. The Acciona AW-116/3000 WTG has a fire detection system that is connected to the main control unit and to the supervisory control and data acquisition ("SCADA") system. If any smoke is detected in the wind turbine, the SCADA system will automatically shut the turbine down and send an alarm to the control room. Each Acciona AW-116/3000 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. 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 will continue to work cooperatively with that Office to address any concerns that might arise.

Aviation Safety

The Federal Aviation Administration ("FAA") has issued a Determination of No Hazard to Air Navigation for all 10 turbine locations at the Project site. 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. In accordance with these requirements, all towers will be painted white for daytime visibility. Six of the turbines will have a single medium-intensity flashing red light, attached on top of the nacelles of the turbines.

Hazardous Waste

Each wind turbine generator will require various lubricating oils which are necessary for proper operation and maintenance. The approximate quantities of these materials, as required for operation of the Acciona AW-116/3000 wind turbine generator, are listed in Table E.6.b of the Application. These specifications may change slightly depending on final turbine selection, however, the specifications listed for the AW-116/3000 turbine are similar to those for other turbines within the 3 MW class.

With the exception of some of the greases used for lubrication, the oils and lubricants will be contained within the Acciona wind turbine generator. The AW-116/3000 is designed such that if a leak were to occur within the nacelle, liquids will flow into a contained drainage system, which ultimately delivers all spilled materials into a 50 gallon drum located in the base of the tower. 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.

In order to manage hazardous substances in accordance with federal regulations, AWE will prepare a SPCC plan prior to the commencement of commercial operation. The 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 and will comply with federal inspection, reporting, training and record keeping requirements. A Construction SPCC Plan for the Antrim Wind Energy Project is provided in Appendix 4 of AWE's Application. A separate Operations SPCC plan will be developed prior to the start of commercial operation.

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.

Q. Are there any other steps that AWE proposes to address potential public health and safety issues?

A. Yes. AWE has offered to enter into an agreement with the Town of Antrim that addresses many public health and safety issues. The proposed agreement is substantially similar to agreements between the Town of Lempster and Lempster Wind, LLC, and the Town of Groton and Groton Wind, LLC. Both of those agreements were approved by the Committee and included as conditions to the certificates of site and facility granted to the above-named wind projects. A brief description of the proposed agreement between AWE and the Town of Antrim is provided below, and a copy of the draft agreement is included with Application as Appendix 17.

Proposed Agreement with Town of Antrim

AWE proposes to enter into an agreement with the Town of Antrim that would address the following issues: warning signs; Town access to Project site; liability insurance coverage; indemnification; visual appearance of the wind turbines; turbine breaking systems and electrical components; Project site security; public information, communications and complaints; incident and other periodic reports to the Town; emergency response; road usage, maintenance, repair and reimbursement for special police details relating to construction period traffic; other construction-related issues such as scheduling, debris disposal, blasting, and vehicle usage; operating period

requirements; noise restrictions; setback requirements; decommissioning responsibilities; and environmental compliance commitments.

Q. How will staff at the Project site respond to an emergency?

A. The precise manner in which Project-related staff will respond to an emergency will be spelled out in the emergency response plan that the Project expects to develop in consultation with the Town of Antrim. The Project will cooperate with the Town's emergency services providers to develop and coordinate the implementation of an emergency response plan for the Project. Such a plan will require that the Project provide and maintain protocols for direct notification of emergency response personnel designated by the Town, as well as provisions for access to the Project Site, wind turbines and other facilities within 30 minutes of an alarm or other request for emergency response, and provisions notifying the Town of contact information for personnel available at every hour of the day.

Q. In your opinion, will the Project have an unreasonable adverse effect on public health and safety?

A. No. Based upon the information contained in Section I.6 of the Application, as well as the information set forth in my testimony above, I believe that the Project will not have an unreasonable adverse effect upon public health and safety.

Conservation Efforts

Q. Please describe the Project's efforts to ensure that areas within and surrounding the Project are protected from additional development in the future.

A. AWE reached an agreement with four owners of private lands in and around the Project site for the permanent conservation of 685 acres of forestland. Such conservation will occur if AWE secures all necessary approvals and the Project proceeds to construction and commercial operation. Approximately 625 acres will be permanently conserved and protected from subdivision and other commercial uses. The remaining 60 acres, which encompass the footprint of the wind farm, will be permanently conserved upon decommissioning of the Project. Three of the parcels that are the subject of the conservation agreement are contiguous with other conservation land in the area, some of which is owned by the Harris Center for Conservation Education and other conservation organizations.

The conservation outcome of this Project, e.g., permanently conserving 685 acres of valuable forest land, are an integral component of AWE's Project, further supports AWE's position that issuing a Certificate for the Project would be in balance with the need for the preservation of New Hampshire's environment and the need for new energy resources. Furthermore, it also demonstrates AWE's adherence to the views of the local and regional planning authorities in support of the orderly development of the region by conserving open space in the Rural Conservation District in Antrim.

Q. Does this conclude your testimony?

A. Yes.

John Bausman Kenworthy (Jack)

155 Fleet Street
Portsmouth, NH 03801
603-570-4842 (w) 484-467-5315 (m)
jkenworthy@eolian-energy.com

GENERAL QUALIFICATIONS:

Renewable energy executive with extensive management time spent in start-up environments, emerging markets and over 8 years in the renewable energy sector. Expert in the financial, legal, technical and narrative elements involved in complex clean energy project deployment. Superior communications skills and ability to build and manage excellent teams and form lasting business relationships built on a foundation of trust and follow-through.

PROFESSIONAL EXPERIENCE:

Eolian Renewable Energy, LLC: Portsmouth, NH: *Co-Founder, CEO*
(January 2009-Present)
Renewable energy development and operations company focused on building distributed utility scale wind facilities in the New England region.

Kenworthy Partners, LLC: Portsmouth, NH: *Founder, Managing Partner*
(July 2008-2010)
Kenworthy Partners served as consultants to industry, educational institutions and municipalities on strategies to maximize competitiveness by providing thought leadership in integrated sustainable systems and technical competence in energy systems design, financing, policy and performance.

Cape Systems, Limited: Eleuthera, Bahamas: *Co-Founder, President and CEO*
(July 2005 – June 2008)
Cape Systems is a full service renewable energy and biofuels engineering firm and project developer located in The Bahamas. Cape Systems is the nexus for renewable energy development and green development in The Bahamas and is responsible for many national "firsts" in clean energy systems, biofuels, carbon projects and public/private partnerships. Cape Systems recently launched a 20-year plan to make Eleuthera entirely independent of petroleum using onsite renewables – profitably.
Responsible for:

- strategic development
- contract development
- partnership development
- staff management
- financial management
- government relations
- operations oversight

Bahamas Biodiesel, Limited: Nassau, Bahamas; *Co-Founder, Chairman*
(May 2007-June 2008)
Bahamas Biodiesel is the first commercial scale biodiesel company in The Bahamas and the first in the region to be designed to operate on 100% waste cooking oils. Cape Systems was the founding partner of the company.

Cape Eleuthera Institute: Eleuthera, Bahamas: *Co-Founder and Director of Systems*, *Facility Manager* (January 2002 – June 2006)
Cape Eleuthera Institute is a center of excellence in marine resource preservation and sustainable technologies in The Caribbean. The Cape Eleuthera Institute builds relationships, provides resources, conducts research, and develops sustainable industries in South Eleuthera, The Bahamas, and the Caribbean.

Cape Eleuthera Island School: Eleuthera, Bahamas: *Teacher*, *Facilities Manager, Research Advisor* (January 2001-January 2004)

PROFESSIONAL ACCOMPLISHMENTS:

- Negotiated first successful public/private renewable energy partnership in The Bahamas using hybrid wind/solar technologies connected to utility grid in pilot partnership with utility.
- Brought first carbon finance deal to Bahamas for commercial scale biodiesel plant
- Launched "Freedom 2030" initiative to eliminate Eleuthera's dependence on oil in 20 years. Involved managing relations with partners at RMI, NREL, Bahamas Electricity Corporation, Ministry of Works, Office of the Prime Minister, technology vendors, international development banks, private capital and consumers.
- Advisor to Renewable Energy Working Group at Bahamas Electricity Corporation.

EDUCATION:
University of Vermont, B.A. (Environmental Science and Law, Summa Cum Laude)

Academic Awards:

- George T. Kidder Medal for Leadership, Scholarship and Service, University of Vermont (May 2000)
- College Honors in Arts and Sciences, University of Vermont (May 2000)
- Program Honors, Environmental Studies at the University of Vermont (May 2000)
- Member of the John Dewey Honors Program at The University of Vermont
- Member of the Phi Eta Sigma Honors Society through The University of Vermont
- Member of the Vermont chapter of the Golden Key National Honors Society
- Crow Award for Excellence in Systems Thinking - Columbia University, Spring 1998

REFERENCES:
Available upon request

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2012- ___

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

PREFILED DIRECT TESTIMONY OF

JOSEPH COFELICE AND MARTIN J. PASQUALINI

ON BEHALF OF

ANTRIM WIND, LLC

January 31, 2012

Qualifications of Joseph Cofelice:

Q. Please state your name and business address.

A. My name is Joseph Cofelice. My business address is 25 Braintree Hill Park, Suite 200, Braintree, MA 02184.

Q. Who is your current employer and what position do you hold?

A. I am the founder and Chief Executive Officer of Westerly Wind, LLC, a portfolio company of US Renewables Group ("USRG") which focuses exclusively on investing in renewable power, biofuels and clean technology infrastructure, and which has capital investments of approximately $750 million in clean energy companies and projects. Westerly Wind, LLC and Eolian Renewable Energy, LLC are the "sponsors" of the

Antrim Wind Project, i.e. they are the entities ultimately responsible for the development, financing, construction and operation of the Project.

Q. What are your background, experience and qualifications?

A. My professional background includes 30 years in the energy industry. I was previously employed as the CEO of American National Power ("ANP"). During my 15 year tenure at ANP, I was at various times directly responsible for all aspects of the business, including project development, project financing, and marketing and trading. I was later employed as the President of Catamount Energy. During my tenure at Catamount, the company successfully developed and financed approximately 585 MW of wind generation utilizing industry standard tax equity and lending structures totaling over $1 billion in the aggregate. I hold a degree in Business Administration from Northeastern University. My curriculum vitae is attached to this testimony and is labeled Attachment JEC-1.

Qualifications of Martin J. Pasqualini:

Q. Please state your name and business address.

A. My name is Martin J. Pasqualini. My business address is One Boston Place, Suite 3825, Boston, MA 02108.

Q. Who is your current employer and what position do you hold?

A. I am a founding partner and Managing Director of CP Global Partners, LLC, a financial advisory and merchant banking firm, and the majority owner of CP Energy Group, LLC ("CP Energy"), a subsidiary which specializes in providing advisory

services in connection with the development, financing, disposition and acquisition of electric generation facilities. CP Energy has been retained as a financial consultant to the Antrim Wind Project. CP Global and its affiliates are recognized experts in the renewable finance sector. Since 2006, CP Global and its affiliates have represented the sponsor or participating financing institutions in connection with the financing of 46 separate wind projects in 16 states totaling over $9 billion in asset value, and more than 5 gigawatts ("GW") of capacity.

Q. What are your background, experience and qualifications?

A. My professional background includes over 20 years in the energy finance industry. I was previously employed as a Managing Director in the tax products group at BTM Capital Corporation, a wholly-owned subsidiary of Mitsubishi UFJ Financial Group, one of the largest financial institutions in the world. Previous to my employment at BTM Capital, I was a partner in the project and structured finance group at Bingham Dana LLP (now Bingham McCutchen LLP) an international law firm headquartered in Boston, Massachusetts. A primary focus of my practice was the financing of electric generation facilities. While at Bingham, I worked on the financing of energy projects throughout the continental United States as well as Puerto Rico, Jamaica, Costa Rica, Scotland and the Dominican Republic. I hold a BA from Boston College and a juris doctorate from Boston College Law School. My curriculum vitae is attached to this testimony and is labeled Attachment MJP-1.

Purpose of Testimony

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to address the financial capabilities of Antrim Wind Energy, LLC ("Antrim Wind," "AWE," or "the Applicant") to assure construction and operation of the Antrim Wind Project in continuing compliance with the terms and conditions of any certificate of site and facility that may be issued by the New Hampshire Site Evaluation Committee ("the SEC" or "the Committee") as the result of this proceeding.

Financial Capability to Construct and Operate the Project

Q. Are you familiar with the Project that is the subject of the above-captioned docket?

A. Yes. As CEO of one of the Project's sponsors, Westerly Wind, LLC, Mr. Cofelice is aware of the Project by virtue of his management positions with Westerly Wind, LLC, Westerly Antrim, LLC and AWE. As a financial consultant to the AWE Project, Mr. Pasqualini is familiar with the Project based upon his correspondence with representatives of AWE.

Q. Please describe the relationship between Westerly Wind, LLC, Eolian Renewable Energy, LLC and Antrim Wind Energy, LLC.

A. Antrim Wind Energy, LLC is a Delaware limited liability company organized for the development, construction, ownership and operation of the Antrim Wind Project. AWE has two members, Eolian Antrim, LLC and Westerly Antrim, LLC. Eolian Antrim,

LLC is owned by Eolian Renewable Energy, LLC ("Eolian"), and Westerly Antrim, LLC is owned by Westerly Wind, LLC ("Westerly"). Eolian and Westerly are the Project's sponsors, meaning that they are the entities ultimately responsible for the development, financing, construction and operation of the Project.

Eolian, is a Delaware limited liability company headquartered in Portsmouth, New Hampshire. It 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. Westerly Wind, LLC is a Delaware limited liability company based in Braintree, Massachusetts. It was formed in 2009 to provide development capital, management expertise and commercial assistance to independent wind power developers. Westerly is a portfolio company of US Renewables Group ("USRG"), which is an energy investment firm founded in 2003. USRG focuses exclusively on investing in renewable power, biofuels and clean technology infrastructure and has invested approximately $750 million of capital in clean energy companies and projects. In January 2011, Eolian and Westerly entered into a Joint Development Agreement and Eolian Antrim, LLC and Westerly Antrim, LLC entered into a corresponding Limited Liability Company Agreement to advance the Antrim Wind Project through development, financing, construction and operation.

Q. Please describe the financial capability of Antrim Wind Energy, LLC to construct and operate the proposed Project in compliance with the terms and conditions of any certificate that may be issued as the result of this proceeding.

A. Antrim Wind Energy, LLC, through its sponsors, Eolian Renewable Energy, LLC and Westerly Wind, LLC, has the capability to finance, build, own, and operate wind farms, including the one that is subject of the Application in this proceeding. Westerly's management team members' predecessor companies include American National Power, Catamount Energy Corporation, Duke Energy Corporation, US Renewables Group and John Hancock Financial Services. This management team has considerable experience in the energy sector, and has been directly involved in the development, financing, construction and operation of over 4,000 MW of independent power assets, including over 700 MW of wind power projects, representing over $3 billion of aggregate project financings.

Antrim Wind's financing plan for the Project reflects customary practices found not only within the wind industry, but throughout the broader independent power generation sector. The wind industry benefits from well-established financing structures for both construction and term financing. These structures have been developed and enhanced over the last ten years by industry participants.

The Applicant expects to employ a "project finance" approach to sourcing capital for the construction and operating phases of the Project. While the specific structure utilized will depend on the availability and type of tax incentives applicable to the wind

industry at the time of construction, the Applicant plans to utilize industry standard non-recourse project finance, which will include monetization of the tax attributes generated by the Project. By definition, non-recourse project finance is the long-term financing of infrastructure and other highly capital intensive projects where the capital provider's interest is secured by the future cash flows of a project rather than the balance sheet of a project's sponsors. This form of financing is "non-recourse," in that the capital provider only has claim to the assets and cash flow of the project, rather than the assets or credit of the project sponsors. Non-recourse project financing of independent power projects has been a common practice in the United States independent power sector since the early 1980's.

The SEC has recognized that the financing of capital intensive projects such as the Antrim Wind Project are complex endeavors which frequently involve third-party capital sources and "are rarely financed from the existing balance sheet assets of the developer."[1] The SEC has also noted that non-recourse financing is a normal means of financing and wind project.[2]

The all-in cost of constructing the Project is estimated to be $55-65 million. AWE expects to obtain the capital to construct the Project through a combination of construction loans, and Sponsor or third-party provided equity. Construction funding is replaced or "taken out" by permanent project capital upon the Project meeting certain conditions precedent including, but not limited to, commercial operation. The permanent

[1] *See* Application of Granite Reliable Power, LLC, Docket No. 2008-04, Decision Granting Certificate of Site and Facility with Conditions (July 15, 2009) at 31.
[2] *Id.*

project capital will include Sponsor or third-party equity and capital provided by an institutional tax equity investor. AWE expects to enter into construction and permanent funding agreements simultaneously; therefore the Applicant will have both committed construction and operating capital in place before construction of the Project commences.

A liquid and robust capital market exists for well-conceived, construction-ready wind projects. Potential providers of construction and long-term project financing include: large independent power producers and energy companies (strategic capital), infrastructure investment funds, tax equity investors, and project lenders. There are currently at least 12 active tax equity investors and at least 22 active lenders providing capital to wind energy facility developers. The Project's ability to raise capital from these capital providers will depend on many factors, including: 1) completion of all necessary development tasks, including environmental studies; 2) receipt of a non-appealable Site Evaluation Committee certificate; 3) execution of a financeable power purchase or financial hedge agreement for the off-take of power ("Off-Take Agreement"); 4) execution of other key commercial agreements including a financeable turbine supply agreement, a balance of plant construction contract, and an operating and maintenance agreement; and 5) completion of all necessary interconnection studies and the finalization of transmission/interconnection cost estimates. Drawing on the Sponsors' management experience and expertise, AWE possesses the capabilities needed to complete development and to negotiate all agreements necessary to obtain permanent financing of the Project.

AWE expects that its progress in advancing key commercial agreements will accelerate upon receipt of a certificate from the SEC. While execution of all the key commercial agreements will be necessary to effect a project financing, the most critical component of the financing package will be securing an Off-Take Agreement. Upon the receipt of an SEC certificate, AWE believes the probability of arranging a financeable Off-Take Agreement will be materially higher due to: 1) a lower risk profile; 2) the receipt of all material permits for construction and operation; 3) the Project's very competitive wind resource; and 4) an anticipated reasonable cost of interconnection relative to similar wind projects in New England. With the receipt of both an SEC certificate and the execution of an Off-Take Agreement, AWE believes the Project will proceed rapidly to a construction financing and actual construction.

Q. In your opinion, does Antrim Wind Energy, LLC have the requisite financial capability to assure construction, ownership and operation this Project in continuing compliance with the terms and conditions of a certificate of site and facility that may be issued by the Committee?

A. Yes. As indicated above, Westerly's management team has successfully financed, constructed and operated wind energy facilities totaling 700 MW in the United States. As a sponsor of the AWE Project, Westerly Wind, through its management team's successful participation in the wind energy market in the United States, provides the necessary assurance that AWE possesses the capability to raise the capital necessary

to construct, own and operate this Project in conformance with the terms and conditions of any certificate that may be issued by the Committee.

Q. Does this conclude your pre-filed testimony?

A. Yes.

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JOSEPH E. COFELICE
WESTERLY WIND LLC
25 BRAINTREE HILL PARK, SUITE 200
BRAINTREE, MA 02184
781 930-3190
joe@westerlywind.com

EXPERIENCE:

Westerly Wind LLC, February 2010 – Present

Co- Founder & CEO
Responsible for general management of the business. Westerly Wind provides development capital and commercial expertise to advance the development of wind energy projects. Westerly is currently providing development capital and expertise to approximately 800 MW of wind projects. Westerly Wind is a portfolio company of US Renewables Group, one of the largest private equity firms focused exclusively on investing in renewable power, biofuels and clean technology infrastructure.

US Renewables Group, April 2009- February 2010

Consultant
Developed wind energy strategy and business plan for US Renewables Group.

Catamount Energy Corporation, May 2002 – September 2008

President
Successfully managed the development, construction, and financing for approximately 580 MW of wind energy projects. Business was sold to Duke Energy in September 2008.

American National Power (formerly Transco Energy Ventures Co), February 1987 – May 2002

President & CEO, January 2001 – May 2002
Chief Executive of International Power Plc's (formerly National Power Plc) US business. General management responsibility for this approximately 4,000 MW Independent Power Company. Completed $1.2 billion of project financings.

Chief Operating Officer
Responsible for project development (green-field development), plant operations, plant construction, plant procurement, and marketing & trading. Successfully developed, constructed and operated over 3,700 MW of gas fired generating capacity.

Senior Vice President & Chief Marketing Officer
Responsible for establishing and managing the commercial operations group, including marketing and trading for approximately 4,000 MW of merchant generation in ERCOT and NEPOOL.

Senior Vice President
Responsible for new business development. Negotiated acquisition of 160 MW gas fired generating plant in Milford, MA.

Managing Director, Transpower Ltd
Responsible for start-up and general management of this Dublin, Ireland based joint venture IPP Development Company between Transco Energy Ventures Company and the ESB, Ireland's national utility. Primary focus on Eastern/Central Europe.

JOSEPH E. COFELICE
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Vice-President, ESBI Energy
Responsible for the start-up of the Fuel Consulting Business of this Houston based power generation consulting Joint Venture Company between Transco Energy Ventures Company and the ESB, Ireland's national utility.

Director, Business Development, Transco Power Company
Negotiated several project financiable long-term power contracts and project fuel supply agreements. Lead developer for Transco on 356 MW Hopewell project.

Enron Oil & Gas Co. (Currently EOG Resources), 1985 – 1987
Responsible for the marketing of natural gas and crude oil production from several offshore and onshore properties on both a spot and long-term contract basis.

Shell Oil Company, 1981 – 1985
Held several gas & oil accounting and positions.

EDUCATION:

Bachelor of Science, Business Administration – Concentration Finance
Northeastern University, 1981
Graduated with Highest Honors

Completed Success Paradox Program – Center for Advanced Emotional Intelligence
Completed National Power Global Leadership Development Program – London Business School

MARTIN J. PASQUALINI

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Boston, MA 02108
Phone (617) 570-2303
mpasqualini@cpglb.com

EXPERIENCE

CP Global Partners, LLC / CP Energy Group, LLC
Co-founder / Managing Director — May 2003 – Present

- Responsible for both originating transaction opportunities in the energy sector as well as leading deal teams responsible for the execution of such transactions on behalf of clients
- Led financings on over two dozen renewable energy electric generation facilities in 16 states and Puerto Rico
- Advised sponsors or tax equity investors in connection with the financing of wind-powered electricity generation projects representing over 5000 MW of installed electrical capacity with a capital cost in excess of $9 billion

BTM Capital Corporation
Managing Director — October 2000 – May 2003

- Responsible for originating and structuring transactions in the tax products group of BTM Capital, a wholly owned subsidiary of Mitsubishi UFJ Financial Group

Bingham McCutchen
Partner — September 1990 – October 2000

- Successfully managed numerous project financings of electric generation facilities as well as a wide variety of leased based financings involving fixed wing aircraft, rolling stock and electric generation facilities
- Advised clients on energy projects throughout the continental United States as well Puerto Rico, Jamaica, Costa Rica, Scotland and the Dominican Republic

EDUCATION

Boston College Law School
JD, Law
1987 – 2000
Graduated cum laude

Boston College
BA, Political Science
1983 – 1987
Graduated summa cum laude, elected to Phi Beta Kappa

PROFESSIONAL MEMBERSHIPS OR BOARD APPOINTMENTS

Associate member of Boston College Law School's Board of Trustees and Member of its Business Law Advisory Council
Member of the Board of Trustees for PowerOptions, the largest electric power and natural gas buying group in the Commonwealth of Massachusetts.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2012-___

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

PREFILED DIRECT TESTIMONY OF

SEAN MCCABE AND ELLEN CRIVELLA

ON BEHALF OF

ANTRIM WIND, LLC

January 31, 2012

Qualifications of Sean McCabe

Q. Please state your name and business address.

A. My name is Sean McCabe and my business address is 25 Braintree Hill Park, Suite 200, Braintree, MA 02184.

Q. Who is your current employer and what position do you hold?

A. I am Vice President of Development at Westerly Wind, LLC

Q. Please describe Westerly Wind, LLC.

A. Westerly Wind was formed in 2009 to provide development capital, management expertise and commercial assistance to independent wind power developers. Westerly currently has joint development agreements in place representing over 800 MW of potential installed capacity. Westerly is a portfolio company of US Renewables Group ("USRG"), an energy investment firm founded in 2003 focused exclusively on investing

in renewable power, biofuels and clean technology infrastructure. It has invested approximately $750 million in clean energy companies and projects.

Q. Please describe your responsibilities at Westerly Wind, LLC.

A. I am responsible for identifying and securing partnership opportunities for Westerly, as well as providing day-to-day development oversight and support to Westerly's portfolio projects.

Q. What are your background, experience and qualifications?

A. I have worked in the energy industry since 2004. Prior to joining Westerly, I was Managing Director of Wind Development for Duke Energy Corporation. Prior to that, I was Vice President of Finance and Development at Catamount Energy Corporation. I hold a Masters of Business Administration from the University of Michigan and a Bachelor of Arts Degree from the College of the Holy Cross. My curriculum vitae is attached to this testimony and is labeled SM-1.

Q. Have you previously testified before this Committee and/or any other state permitting agencies?

A. I have not previously testified before this Committee, but I have testified before the Wyoming Industrial Siting Division, the permitting body in the State of Wyoming with estimated construction costs of greater than $185 million.

Qualifications of Ellen Crivella

Q. Please state your name and business address.

A. My name is Ellen Crivella. My business address is 333 SW Fifth Avenue, Suite 400, Portland, OR 97204.

Q. Who is your current employer and what position do you hold?

A. I am a Project Manager in the Environmental and Permitting Services Group at GL Harrad Hassan.

Q. Please describe GL Garrad Hassan.

A. GL Garrad Hassan is the world's largest renewable energy consultancy. It offers independent technical and engineering services, products, and training courses to the onshore and offshore wind, wave, tidal and solar sectors. Although the GL Garrad Hassan name is new, the company has a rich heritage. It was borne of the integration of specialist companies that, united under a single brand, form the renewable energy consulting division of the GL Group. GL Garrad Hassan is a consulting company and has no equity stake in any device or project. This rule of operation is central to its philosophy, something that sets it apart from many other players and underscores its independence.

Q. Please describe your responsibilities at GL Garrad Hassan.

A. I am responsible for the management of comprehensive local, state and federal permit applications and the technical studies which support those applications. I provide project development, feasibility support and due diligence reviews to project sponsors, and manage construction and operational regulatory compliance programs for wind and solar developers.

Q. What are your background, experience and qualifications?

A. Prior to joining GL Garrad Hassan, I was an Associate Scientist in the Industrial Systems Business Group of CH2M Hill, where I provided consulting services on various

renewable energy projects. Prior to that I was a Research Associate at Vermont Law School's Institute for Energy and the Environment, and was a John Glenn Fellow at the United States Environmental Project Agency – Division of Wetlands. I hold a Masters Degree in Environmental Law from Vermont Law School, and a Masters Degree in Environmental Science and a Bachelor of Science Degree from The Ohio State University. A complete description of my background, experience and qualifications is contained in my curriculum vitae which is attached to this testimony and is labeled Attachment EJC-1.

Purpose of Testimony

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to address the technical and managerial capabilities of Antrim Wind Energy, LLC ("Antrim Wind," "AWE," or "the Applicant") to assure the construction and operation of the proposed wind energy project ("the Project") that is the subject of this proceeding in continuing compliance with the terms and conditions of a certificate of site and facility that may be issued by the New Hampshire Site Evaluation Committee ("the Committee" or "SEC").

Q. Are you familiar with the Project that is the subject of this proceeding?

A. Yes, we are. Mr. McCabe is familiar with the Project by virtue of his management positions with Westerly Wind, LLC, Westerly Antrim, LLC and AWE, as well as his role in providing day-to-day development support and oversight to the Project. As a consultant to the Project, Ms. Crivella is familiar with the Project based upon correspondence with representatives of AWE.

Technical and Managerial Capabilities

Q. Please describe Antrim Wind's technical and managerial capabilities to assure that the Antrim Wind Project is constructed and operated in continuing compliance with the terms and conditions of any certificate that may be issued by the SEC.

A. AWE is a Delaware limited liability company that was formed to own and operate the Project. AWE has two members who together own and control 100% of the membership interests in the company: Westerly Antrim, LLC and Eolian Antrim, LLC. Westerly Antrim, LLC and Eolian Antrim, LLC each control 50% of AWE. Both of these members are Delaware limited liability companies and are owned by Westerly Wind, LLC ("Westerly") and Eolian Renewable Energy, LLC ("Eolian") respectively.

AWE will be responsible for the general management of the construction and operation of the Project. It will rely on and benefit from the managerial experience of its sponsors' management teams which are comprised of individuals who have considerable experience in developing, constructing and operating wind projects. Eolian management team members include its founder and Chief Executive Officer ("CEO") Jack Kenworthy, who previously founded Cape Systems, Ltd., a leader in renewable energy project development in the Bahamas. The Eolian team also includes the company's co-founder, John Soininen, a trained civil engineer with 15 years of complex, high-value real estate development experience which includes the development of Projects valued at over $100 million in the aggregate. The Eolian team is actively developing projects in Maine, New

Hampshire and Vermont consisting of four projects with a total aggregate capacity of 152 megawatts ("MW").

To advance the Project through development, financing, construction and operation, Eolian has entered into a Joint Development Agreement with Westerly, a Delaware limited liability company based in Braintree, Massachusetts. Westerly provides development capital, management expertise and commercial assistance to independent wind power developers.

Westerly's management team includes its founder and CEO, Joseph Cofelice, who was previously the CEO of American National Power and the President of Catamount Energy. During Mr. Cofelice's tenure as President of Catamount, that company successfully developed and financed approximately 585 MW of wind power generation assets utilizing industry standard tax equity and lending structures totaling over $1 billion of aggregate project financings. Westerly's management team has been directly involved in the development, financing, construction and operation of over 4,000 MW of independent power assets, including over 700 MW of wind power projects. Members of Westerly's management team have previously worked for: American National Power, Catamount Energy Corporation, Duke Energy Corporation, US Renewables Group and John Hancock Financial Services.

AWE will be responsible for the general management of the Project, including the execution and administration of the commercial agreements that will assure that the Project is constructed and operated in conformance with accepted industry practices and any certificate of site of facility that may be issued by the SEC. AWE expects to award

"balance of plant" ("BOP") contract to a third-party construction contractor experienced in wind farm construction. Similarly, AWE's current operating plan is to contract with the wind turbine manufacturer during the warranty period (typically 2-5 years) to insure that the wind farm is operated and maintained in a manner consistent with the provisions of the equipment warranty. Thereafter, AWE will either extend the warranty, or contract with a third-party operations and maintenance ("O&M") service provider to operate the Project. The post-warranty period operating plan may change depending on the O&M capabilities of a potential long-term equity provider.

Although AWE plans to contract with third parties to construct the Project and to operate and maintain the Project (a common practice in the U.S. wind industry), AWE will retain on-site management responsibilities that will include overseeing the O&M service provider and performing all local, regulatory and administrative functions. AWE expects to staff the Project with at least five on-site personnel, including an AWE site administrator and at least three full-time O&M technicians. These staffing levels are based upon actual O & M proposals that AWE has received from turbine manufacturers.

Q. How will the Antrim Wind Project be operated and maintained?

A. The terms of an O&M contract awarded by AWE will reflect standard industry practices to ensure that the Project is operated safely and efficiently, and that the turbines are maintained in accordance with the manufacturer's specifications. It is anticipated that the O &M service provider's responsibilities will include:

1. <u>Scheduled Maintenance:</u> The O&M provider will perform scheduled maintenance on the wind turbines in accordance with the manufacturer's

suggested service intervals (typically every 6 months), including the procurement of all required materials, equipment, labor, supplies, consumables, supervision and record-keeping.

2. Operations and Safety: On-site personnel will be present during normal working hours, typically 7 a.m. to 5 p.m., Monday through Friday. When staff is not present, an "on-call" supervisor will be assigned to respond to any unforeseen events or emergencies requiring immediate attention. In addition, the O&M provider will monitor the performance of the facility on a 24/7 basis through the supervisory control and data acquisition ("SCADA") system. The O&M provider will also initiate any required wind turbine maintenance and/or resets, comply with all safety requirements, and maintain a spare parts inventory to perform required services in a prompt manner.

3. Management Reporting: The O&M provider will compile operating data and management reports, and conduct regular meetings with AWE, sponsors and investors.

As indicated above, AWE will maintain overall management responsibility for the Project and provide on-site management to ensure compliance with all regulatory and legal requirements. In addition, AWE personnel will supervise the O&M provider, and represent AWE in all matters related to site administration and balance of plant matters not covered by the third party O&M agreement. On-site management responsibilities will also include: 1) managing day-to-day relationships with the Town of Antrim; 2) ensuring that the turbine supplier and third party O&M provider are properly complying with the

warranty provisions of the turbine supply agreement; 3) managing landowner relations; and 4) supervising other Project service providers.

Q. In your opinion, does AWE possess the technical and managerial capabilities to construct and operate the proposed Project in continuing compliance the terms and conditions of a certificate of site and facility that may be issued by the Committee?

A. Yes. Based on our knowledge of and experience in the wind power industry, AWE's sponsors' capabilities, and the plans that AWE has developed for the construction, operation and maintenance of the Project, it is our opinion that AWE has the technical and managerial capabilities to assure that the Project is constructed and operated in continuing compliance with the terms and conditions of a certificate of site and facility that may be issued by the Committee.

Q. Does this conclude your testimony?

A. Yes.

839384_1

SEAN MCCABE

326 Peart Street, Suite 2 • Boulder, CO 80302-4964
sean@westerlywind.com • 802.345.7282

EXPERIENCE

2011-Present — **WESTERLY WIND, LLC** — **Boulder, CO**
Vice President of Development
- Identify and source targeted investments in U.S. wind power development assets.
- Manage development partner relationships and provide day-to-day oversight to advance the development of portfolio wind projects.
- Perform project/partner due diligence, structure joint development arrangements and assist in the negotiation and execution of definitive documents.

2008-2010 — **DUKE ENERGY CORPORATION** — **Boulder, CO**
Managing Director - Wind Development
- Developed Top of the World Windpower Project, a 200 MW wind farm with a 20-yr PPA with PacifiCorp, from site origination through permitting/construction financing.
- Managed $2 million development budget to advance six projects in Duke's pipeline by quantifying project attributes and mitigating risks.
- Directed internal and third party resources from project conception to construction.

2004-2008 — **CATAMOUNT ENERGY CORPORATION** — **Rutland, VT**
Vice President - Finance and Development
- Formulated greenfield strategy to identify and secure attractive wind energy development sites in key U.S. markets.
- Executed on development strategy: educated stakeholders on wind energy benefits and impacts; negotiated and secured land leases; led local, state and federal permitting efforts; and managed development studies and interconnection requests.
- Played key role in CVPS' sale of Catamount to Diamond Castle: built valuation model; supported management road show; and addressed corporate and portfolio project due diligence topics.

2001 — **ADAMS, HARKNESS & HILL** — **Boston, MA**
Equity Research Associate
- Analyzed demographic and consumer trends and created pro forma financial models to recommend equity investments in specialty consumer/lifestyle companies.

1999-2000 — **STREAMLINE.COM, INC.** — **Westwood, MA**
Operations-Technology Liaison
- Led cross-functional effort for Operations team to implement an enterprise software system at e-commerce delivery company serving 10,000 households in four markets.

1998-1999 — **NATIVITY PREPARATORY SCHOOL** — **Roxbury, MA**
Volunteer Teacher
- Motivated 30 boys at private Jesuit middle school serving Boston's inner-city neighborhoods; coached soccer and lacrosse teams.

1996-1998 — **GOLDMAN SACHS GROUP** — **New York, NY**
Financial Analyst
- Created financial analyses for the Budget Committee and led budget training for 200 division executives.

EDUCATION

UNIVERSITY OF MICHIGAN — **Ann Arbor, MI**
Stephen M. Ross School of Business
Master of Business Administration, April 2004
- Emphasis in General Management and Finance

COLLEGE OF THE HOLY CROSS **Worcester, MA**
Bachelor of Arts Honors in Economics, cum laude, May 1996
- College Honors Thesis: "Patriot League - Academic Boon, Athletic Bane"

ADDITIONAL
- Hold the Chartered Financial Analyst (CFA) designation

GL Garrad Hassan

ELLEN J. CRIVELLA

1. Family Name	CRIVELLA
2. First Name(s)	ELLEN J
3. Date when Joined Company	2010
4. Citizenship	American

5. Language Skills: (Mark skills as EX for Excellent, VG for Very Good, G for Good, F for Fair and B for Basic)

Language	Reading	Writing	Speaking
English (Native)	EX	EX	EX

6. Present Position Project Manager, Environment and Permitting Services

Company	Date from-to	Roles and Responsibilities
GL Garrad Hassan North America **Project Manager, Environmental and Permitting Services**	2010 to present	• Ms. Crivella's primary responsibility includes managing comprehensive energy permit applications, including NEPA, SEPA, CEQA, state, and local level permits. • Ms. Crivella is also responsible for business development in the United States as well as providing support for independent engineering due diligence reviews, evaluating siting documentation, significant issues, field studies, recommended mitigation measures, and land use or planning concerns. • Ms. Crivella also assists with the creation of environmental compliance management systems, tracking all wildlife reporting and monitoring requirements as we as federal, OR EFSC, and county permit conditions for operational compliance for an international wind developer. This includes providing templates and document standards for project specific avian bat protection plans (PSABPP) as well as completing compliance matrices. • Ms. Crivella has experience facilitating agency correspondence and meetings, public stakeholder engagement meetings, public comment responses, and communicating with tribes (Confederated Tribes of the Umatilla Indian Reservation). • Ms. Crivella has expertise in operational compliance of wind plants, including the preparation of spill plans, post-construction monitoring plans, erosion and sediment control inspections, and other operational management plans. • Ms. Crivella has significant understanding of the draft Eagle Conservation Plan Guidance put forth by USFWS and has been working with Region 3 USFWS in negotiating the preparation of one of the nation's first eagle conservation plans and eagle take permits.
CH2M Hill **Associate Scientist, Industrial Systems Business Group**	2007 - 2010	• Provided permitting expertise and support for Oregon and Washington Energy Facility Siting Council (EFSC) site certificate applications, notice of intent

Staff Scientist, Industrial Systems Business Group		(NOI) documents, Washington State Environmental Policy Act (SEPA) EIS and EA permits, and local jurisdictional permits for wind, solar, biomass, and transmission line developments in the northwest. • Served as assistant project manager for the proposed 75 MW solar PV Teanaway Solar Reserve project in Kittitas County, WA. Oversaw the scientific studies, coordinate with the public relations firm, attended agency and county meetings, and produced the state siting application, an Expanded SEPA Checklist, and supplemental submittals and amendments. • Coordinated with state and federal agencies on resource issues associated with wind and solar developments in the northwest (OR, WA, and CA), such as wildlife habitat and avian impacts, geotechnical and soil concerns, and other general siting constraints. • Managed all Spill Prevention Control and Countermeasure (SPCC) Plans for Iberdrola Renewables' U.S. wind developments. Wrote and provided field evaluations for SPCC Plans in Oregon and Washington and provided senior review and technical expertise for SPCC Plans in all other states. • Served as project manager for NPDES regulatory compliance for the largest wind farm in the US, Caithness's Shepherds Flat wind development. This included the preparation of the OR 1200-C Stormwater Construction permit, monthly site inspections and subsequent reports, and attending construction managers meetings. • Participated in agency, stakeholder, and tribe meetings, site visits, and conference calls. • Negotiated terms and contracts with subconsultants for archeological and wildlife studies. • Monitored construction activities at multiple wind developments in the northwest to ensure constraints were identified and sensitive resources were avoided. These resources included sensitive species, cultural and historic resources, and sensitive habitats. • Participated as field crew for cultural resource studies for OR EFSC projects.
Institute for Energy and the Environment **Research Associate**	2006-2007	• Ms. Crivella was responsible for producing documents, presentations, and memos about renewable energy competitiveness, health effects of fossil fuel emissions, small scale wind availability, and US energy law and policy. • Created scholarly documents for publication about obstacles to the wind energy industry.
United States Environmental Protection Agency – Division of Wetlands **John Glenn Fellow**	2003	• Created wetland policy matrix that assessed wetland laws and permitting applications in response to the *U.S. v. Solid Waste Authority of Northern Cook County (SWANCC)* decision, which repealed the migratory bird rule.
7. Education		
Institution	**Date**	**Academic Qualifications**
Vermont Law School, South Royalton, VT	2007	M.S. Environmental Law
The Ohio State University, Columbus, OH	2006	M.S. Environmental Science

The Ohio State University, Columbus, OH	2003	B.S. Natural Resources
8. Membership in Professional Societies		• Solar Oregon, Board Member and Secretary • Oregon Association of Environmental Professionals (OAEP), Board Member and Secretary • Women of Wind Energy (WoWE), National Mentoring Program Committee Member and Portland Chapter Steering Committee Member • Renewable Northwest Project, Member • American Wind Energy Association (AWEA), Siting Committee Member • Association for Women in Science, Gender Equity and Awards Task Force Member • Soil Science Society of America, Industry Awards Committee Chair • Project Management Institute, Member • Phi Kappa Phi, Honor Society
9. Publications and Presentations		• Diamond, K. and **E. Crivella.** *Wind Turbine Wakes, Wake Effect Impacts, and Wind Leases: Using Solar Access Laws as the Model for Capitalizing on Wind Rights During the Evolution of Wind Policy Standards*. Duke Environmental Law & Policy Forum. *In Press* Spring 2012, Volume 21, Number 2. • **Crivella, E.** *Permitting and New Initiatives: A Primer on Creating Offshore Wind's New Frontier*. Proceedings of the American Bar Association 40th Annual Conference on Environmental Law. March 2011. • **Crivella, E.** *Offshore Wind Project Development and Permitting: A Primer.* American Bar Association 40th Annual Conference on Environmental Law. Salt Lake City, UT. March 17-20, 2011. • **Crivella, E**. and K. Diamond. *Capitalizing on Wind Rights During the Evolution of Wind Policy Standards*. American Wind Energy Association WINDPOWER 2010, Dallas, TX. May 23-26, 2010. • **Crivella, E.**, A. Orrell, S. Tegen, M. Devine, K. Comstock, K. Briggs, and H. Hughes. *Mentoring Women in the Wind Energy Industry: Perspectives, Challenges, and Pathways Forward.* American Wind Energy Association WINDPOWER 2010, Dallas, TX. May 23-26, 2010. • M. Dworkin, S. Vale, and **E. Crivella**. *Coal-Fired Power Plants: Imprudent Investments?* Science. 30 March 2007. 315: 1791-1792. • M. Dworkin, N. Firestine, L. Furrey, C. Aslin, **E. Crivella**, and J. Sautter. *The Farmer's Handbook for Energy Self- Reliance: A Guide to Using Energy Efficiency, Biomass, and Renewable Energy on the Farm*. 2007. Available at: www.agenergysolutions.org. • **E. Crivella.** *Encyclopedia of Global Warming and Climate Change*. Sage Publishers. Publication Date: 2008. Author of 7 articles. • **E. Crivella.** *Environment*, sixth edition. Wiley Publishers. Publication date: 2008. Reviewer and contributor to 5 chapters. • **E. Crivella**. *An Analysis of Wind Energy Technology and Native American Culture.* AAAS Annual Meeting, San Francisco, CA. February 13-17, 2007. • **E. Crivella**. *An Analysis of Different Tastants on*

	Drosophila melonagaster. Denman Research Forum. Columbus, OH. May 2003.

10. Project Experience

Project Title	**Operation Compliance Management System**
Date:	October 2010 – present
Company	Iberdrola Renewables
Location	Various Project Locations, USA
Position	Project Manager
Task Description	• Developed a compliance management tracking and reporting system for approximately 30 operational wind plants in various energy siting jurisdictions. • Evaluated all outstanding local and state permitting requirements for various energy facility siting jurisdictions (including OR EFSC) and provided a compliance matrix spreadsheet identifying deficiencies. • Developed template and wrote project specific avian bat protection plans (ABPP) for several wind plants, including Klondike III/A (OR), Star Point (OR), Leaning Juniper IIA/B (OR), Big Horn I/II (WA). • Created training materials and presentations for sub-contractors and construction personnel.
Project Title	**Multiple Due Diligence Environmental Permitting Reviews**
Date:	October 2010 - present
Company	Multiple
Location	Various Project Locations, USA
Position	Permitting Manager
Task Description	• Review list of required environmental permits/approvals at all government levels and evaluate permitting progress. • Review environmental studies and indicate whether the studies required to comply with county, state and federal requirements are underway or completed (flora, fauna, aquatics, heritage, acoustic impact, electromagnetic interference, visual, shadow flicker. • Review proposed mitigation/compensation plans and identify potential impacts on project siting, project operation or construction schedule. • Review environmental permit/approval conditions and identify potential impacts on project siting, project operation or construction schedule. • If no environmental studies or permit applications are available for review, provide a high-level analysis of potential environmental and siting issues that could pose a risk to the Project's successful development, based on available data, the Project's location and the applicable regulatory framework.
Project Title	**Multiple Heritage Comprehensive State and Local Permitting Support**
Date:	January 2011 - present
Company	Heritage Sustainable Energy

Location	Three project locations, Michigan, USA
Position	Project Manager
Task Description	• Manage all aspects of environmental permitting processes; including wetlands, wildlife, cultural resources, land use planning, and site plan review. • Draft mitigation and monitoring plans, include SPCC Plan, decommissioning plan, and others. • Assist with layout optimization based on applicable laws, regulations and ordinances for sound emissions, shadow flicker, and visual impacts as well as other constraints. • Prepare energy facility permitting documents for submittal to state and county agencies and respond to public comments or requests for additional information. • Work with federal and state agencies such as USFWS, Region 3 on potential species impact issues, including the potential creation of an eagle conservation plan, per the draft ECP Guidance. • Provide consulting services for administrative proceedings as well as technical assistance in evaluating new ordinances pertaining to siting (sound and shadow flicker) in relevant counties.
Project Title	**Fujeij Wind Independent Power Producer (IPP) Project RFP Assistance and**
Date:	March 2011 - present
Company	Korea Electric Power Corporation (KEPCO)
Location	Country of Jordan
Position	Permitting Manager
Task Description	• Review and evaluate preliminary environmental impact assessment (EIA) for compliance with Jordanian laws, regulations, ordinances, standards, policies, and plans, as well as the parameters of the RFP and suggest areas of improvement. • Review health and safety plan (HSE) for compliance with Jordanian regulations and best practices and suggest recommendations for improvement. • Prepare technical memos in coordination with Korean, Italian, Egyptian, and Jordanian team members and subcontractors to summarizing findings.
Project Title	**Critical Issues Analysis and Prefeasibility Study**
Date:	March 2011 - present
Company	Midland Cogeneration Ventures
Location	Michigan, USA
Position	Permitting Manager
Task Description	• Review site constraints and potential fatal flaws of siting a three-turbine array in a deep, man-made pond cooling pond associated with a natural gas fired and steam cogeneration power plant. • Evaluate local land use regulations with respect to setbacks for sound, visual and shadow flicker

	impacts and include evaluation of potential for procedural variances. • Identify wildlife and habitat concerns, specifically with regard to avian species, and provide comments and recommendations for potential mitigation strategies.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2012-____

APPLICATION OF ANTRIM WIND ENERGY

FOR A CERTIFICATE OF SITE AND FACILITY

PREFILED DIRECT TESTIMONY OF JOHN W. GUARIGLIA

ON BEHALF OF

ANTRIM WIND ENERGY, LLC

January 31, 2012

Qualifications

Q. Please state your name and business address.

A. My name is John W. Guariglia. My company's corporate headquarters is located at 443 Broadway, Saratoga Springs, New York, 12866, and my business address is 109 South Warren Street, Suite 400, Syracuse, New York 13202.

Q. By whom are you employed and what position do you hold?

A. I am an Associate Principal with Saratoga Associates, Landscape Architects, Architects, Engineers, and Planners, P.C. ("Saratoga Associates").

Q. Please describe the services provided by Saratoga Associates.

A. Saratoga Associates provides landscape architectural, architectural, engineering, planning, design and related services, including visual impact assessments and shadow-flicker analyses.

Q. What are your responsibilities with Saratoga Associates?

A. I oversee a variety of planning, design, and visual impact assessment projects. I have overseen the completion of many visual impact assessments and shadow-flicker analyses on behalf of our clients. I have been involved with a variety of energy and energy related projects such as wind farms and transmission lines.

Q. Please describe your education, training and experience.

A. I hold a Bachelors degree in Landscape Architecture from the State University of New York College of Environmental Forestry. I have more than ten years experience in conducting visual impact assessments. Some examples of projects that I have conducted and/or coordinated assessments include: Stony Creek Wind Farm (Orangeville, N.Y.), High Sheldon Wind Farm (Sheldon, N.Y.), Moresville Energy Center (Stamford, N.Y.), Beech Ridge Wind Farm (Greenbrier, WV), Wethersfield 230 kV Transmission Line (Wethersfield, N.Y.), and Upstate NY Power 230 kV Transmission Line (Hounsfield to Mexico, N.Y.). Additional projects are listed in my curriculum vitae which is labeled Attachment JWG-1 and is attached to this testimony.

Q. Have you previously testified before state permitting agencies?

A. Yes. I have provided testimony before the New York State Department of Public Service for the Empire Newsprint Recycling and Power Plant project, and the 345 kV Electrical Transmission Line project. I also provided testimony before the Public Service

Commission of West Virginia for the Beech Ridge Wind Farm project.

Q. Are you familiar with the proposed Antrim Wind Energy Power Project (the "Project")?

A. Yes. Saratoga Associates was engaged by Antrim Wind Energy, LLC to assess the potential visual impact of the Project, as well as its potential to create shadow-flicker.

Purpose of Testimony

Q. What is the purpose of your testimony in this proceeding?

A. My testimony addresses the potential visual impact of the Project and summarizes the Visual Impact Analysis ("VIA"), which Saratoga Associates prepared for the Project. The VIA was filed with the Application in this proceeding and is labeled Appendix 9A. My testimony also summarizes the Shadow-Flicker Technical Memorandum prepared by Saratoga Associates for this Project. The Shadow-Flicker Technical Memorandum was filed with the Application in this proceeding and is labeled Appendix 13B.

Visual Impact Analysis

Q. Please describe the methodology that was used for conducting an analysis of the Antrim Wind Project's visual impacts.

A. The VIA evaluates the potential visibility of the Project and objectively determines the difference between the visual characteristics of the landscape setting with and without the Project. The evaluation includes information that covers both quantitative (how much is seen and from what locations) and qualitative (how the Project may be perceived/aesthetic impact) aspects of visual assessment. This process provides a practical guide so that decision makers can understand the potential visual impact and

render a determination of visual significance. For the Antrim Project, Saratoga Associates developed the VIA using the following steps:

- Provided an overview of the existing landscape character/visual setting to establish the baseline visual condition from which visual change is evaluated;
- Conducted a visibility analysis (viewshed mapping and field investigation) to define the geographic area from which portions of the Project might be seen;
- Identified sensitive aesthetic resources that may be impacted by the Project;
- Depicted the appearance of the facility upon completion of construction (through the use of photographic simulations);
- Evaluated the aesthetic effects of the visual change (qualitative analysis) resulting from the Project construction, completion and operation; and
- Identified opportunities for effective mitigation.

Q. What is the extent of the defined study area that was evaluated in your analysis?

A. The study area for the VIA consisted of a five-mile radius around the location of each proposed turbine. The study area includes a total of approximately 100 square miles (approximately 64,276 acres). This study area was selected based on the size of the project (10 turbines located within a relatively small area), that most significant impacts will occur in close proximity to the turbines, and based on our experience in conducting visual impact analyses. It is important to recognize that the Project may be seen at distances greater than five miles, however it is assumed that natural conditions of atmospheric and linear perspective will generally mitigate potential visual impacts. In addition, at greater distances, the turbines will appear much smaller and may only

comprise a small area of the overall view.

Q. Please describe the contents of the VIA.

A. The VIA for the proposed Antrim Wind Energy Power Project addresses:

- The Landscape Character/Visual Setting of the Project area, including a summary description of local topography and vegetation, and identification of major water features, roadways, and population centers;
- Viewshed Mapping Methodology;
- Viewshed Interpretation;
- Inventory of Visually Sensitive Resources;
- Factors Affecting Visual Impact;
- Visibility Evaluation of Inventoried Resources;
- Photo Simulation Methodology;
- Representation of constructed turbines (photographic simulations);
- Character of Project Visibility;
- Strategies for mitigating/minimizing the Project's visual impacts; and
- Summary and Discussion of the Project's Potential Visual impact.

Q. Please describe the specific analytical techniques utilized in the VIA.

A. <u>Viewshed Mapping.</u>

The methodology used to map the Project's potential visibility (viewshed map) within the study area is explained in detail on pages 5 and 6 of the VIA (Application Appendix 9A). The two viewshed maps contained in the VIA identify the geographic locations within the study area where some portion of the project is theoretically visible. The first map assumes there is no

vegetation (i.e. bare earth), while the second map incorporates the study area's mature vegetation stands to represent a more accurate and reduced geographic area of Project visibility. These maps do not account for environmental conditions (e.g. fog) or activities of the viewer (e.g. driving) that may influence visibility.

The viewshed maps are based on control points established at each turbine high point (i.e. the apex of blade rotation, or 492 feet above grade). Both viewshed maps were created using ArcGIS and ArcGIS Spatial Analyst software, and publicly available digital elevation and vegetation data sets. Digital elevation model ("DEM") data was obtained through the United States Geological Survey National Elevation Data Set and vegetation data was extracted from the National Land Cover Data Set ("NLCD"). Using the GIS software, the computer scanned from each control point to all cells within the DEM, distinguishing between grid cells within the DEM that would be hidden from view and those that would be visible based solely on topography. All grid cells within the study area were color coded based on the number of proposed turbines that would be visible to a theoretical observer.

One viewshed map (Appendix 9A, Figure 1) depicts the area within which there would be no visibility of the Project due to the screening effect of intervening topography. This analysis assumes a treeless condition, and is therefore conservative in that it identifies the maximum potential geographic area within which further investigation may be appropriate. A second map (Appendix 9A, Figure 2) was prepared to illustrate the probable screening effect of existing mature vegetation. The screening effect of vegetation was incorporated by adding 40 feet[1] to the height of those DEM grid cells that are forested (according to NLCD dataset) and

[1] This is a conservative assumption, as most trees in the study area appear to be taller than 40 feet.

then repeating the viewshed calculation procedure. Forested areas were then removed from the viewshed to account for areas located within a full forest canopy. It is important to note that the NLCD dataset does not include the screening value of site specific vegetation (e.g. small hedgerows, street trees, and individual trees). Also, it does not include screening from existing structures, which in populated areas like the Village of Antrim, are likely to provide significant screening of distant views. With the above-described conditions, the viewshed map conservatively overestimates the Project's potential visibility in areas where the Project may actually be screened from view.

Inventory of Visually Sensitive Resources.

Because it is not practical to evaluate every conceivable location where the Project may be visible, it is accepted visual assessment practice to limit detailed evaluation of aesthetic impact to public locations generally considered by society, through regulatory designation or policy, to be of cultural and/or aesthetic importance. Visually sensitive resources within the study area were identified through a review of published maps and other documents, online research, and windshield survey of publicly accessible locations. Additionally, representatives of the Antrim Historical Society and the Antrim Conservation Commission provided recommendations of resources they considered to be of local significance.[2]

Factors Affecting Visual Impact

To bring order to the consideration of visual resources, they were organized into several recognizable elements including:

A. Landscape Units - Four units were identified in the study area. Landscape units are

[2] The Antrim Planning Board was offered an opportunity to participate in the process, but declined.

areas with common characteristics of landform, water resources, vegetation, land use, and land use intensity. Those units identified in the VIA include: Community Center, Forest, Water (i.e. lakes, ponds, streams, marshes, etc.), and Agricultural Landscape.

B. Viewer/User Groups - Viewer/User groups within the study area were identified to provide assistance in evaluating the sensitivity and probable reaction of potential observers to visual changes resulting from the Project. Viewers engaged in different activities are likely to perceive their surroundings differently. These groups include local residents, local workers, through travelers, and recreational users and tourists.

C. Distance Zones - Distance affects the apparent size and degree of contrast between an object and its surroundings. Distance zones identified and further described in the VIA included foreground (0-1/2 mile), middleground (1/2 mile to 3 miles), and background (3 to 5 miles).

D. Duration/Frequency/Circumstances of View - The length of time and circumstances under which a view is encountered is influential in characterizing the importance of a view. This is broken down into two groups: Stationary views (e.g. from fixed points such as a residential neighborhood), and Moving views (e.g. from a moving vehicle).

Field Observation and Photography.

On October 5, 6 and 9, 2011, Saratoga Associates drove public roads and visited many of the potentially affected visual resources to document existing visibility in the direction of the proposed wind turbines. To the extent practical, the location selected for each photograph was judged by the field observer to be the most unobstructed line-of-sight to the turbine area from the subject visual resource. The precise coordinates of each photo location were recorded in the field using a handheld global positioning system ("GPS") unit. To determine the direction of the

proposed wind turbines from each visited location, the coordinates of the proposed turbines were pre-programmed in the GPS unit as a "waypoint." The GPS waypoint direction indicator (arrow pointing along a calculated bearing) was used to determine the appropriate bearing for the camera, so that a desired turbine, or grouping of turbines, would be generally centered in the field of view of each photograph.

Visibility Evaluation of Inventoried Resources.

Seventy-two (72) resources were identified within the study area and were evaluated to determine whether visibility might exist. Table 2 of Appendix 9A (pages 14 through 16) provides a summary of potential visibility for each identified resource. This Table includes potential visibility and factors that may affect visibility.

Photographic Simulations.

To illustrate how the Project turbines will appear from a variety of distances and locations within the study area, photographic simulations were created from 10 locations. The locations for the photo simulations were selected by Saratoga Associates with input from the Applicant and local community members, and for the locations' relevance in addressing many of the factors affecting visual impact, i.e. viewer/user groups, landscape units, distance zones (foreground, middleground, and background), and duration/frequency of views (stationary or moving views). All of the photo simulations are presented in Application Appendix 9A.

A photo simulation of the Project was prepared from eight locations within the Town of Antrim: Meeting House Hill Cemetery; the Flint Estate; Salmon Brook Road; the Summit of Bald Mountain; Willard Pond Wildlife Sanctuary; Gregg Lake Road; Gregg Lake Town Beach; and Elm Avenue. Photo simulations were also prepared within the Town of Stoddard from two

locations: Island Pond Landing and Franklin Pierce Highway (NH State Route 9).

Photo simulations were developed by superimposing a rendering of a three-dimensional computer model of the Project into the base photograph taken from each of the ten identified locations. The three-dimensional computer model for the simulations was developed using *Autodesk Civil 3D*® and *3D Studio Max Design* ® software. Details of the photographic simulation methodology are contained in Appendix 9A, pages 17 and 18.

Q. What conclusions did you reach about the visual impact of the Project's turbines as a result of the VIA analysis?

A. Based on the Vegetated Viewshed Map (Appendix 9A, Figure 2), the vast majority of the study area (i.e. 94.7%) will be screened from the Project by intervening landform and/or vegetation. Of the 5.3% of the study area in which the Project will potentially be visible, it was determined, based on GIS, that 1 to 5 turbine highpoints would be visible from approximately 3.1% of the five-mile study area, and that 6-10 turbines would be visible from approximately 2.2% of the five-mile study area. Turbine visibility is most common from cleared agricultural lands and water bodies where extended open spaces provide vistas in the direction of the Project. Direct views of the Project will occur from portions of several local water bodies including Gregg Lake, Willard Pond, Franklin Pierce Lake, Nabanusit Lake, as well as the Meadow & Marsh Conservation Area. Visibility is also noted from New Hampshire Route 9 (Franklin Pierce Highway), Windsor Road and the Hillsborough Rail-Trail at locations where these corridors are on direct axis with one or more of the proposed turbines. Filtered views are possible in portions of the Village of Antrim through foreground vegetation and buildings. Such

views are most likely on the west side of the Village near the Antrim Elementary and Great Brook Schools.

B. Based on the viewshed analysis, the highpoint of one or more turbines as currently proposed will be visible from 50 of the 72 inventoried visual resources. However, as a result of Saratoga Associate's field observations, it is anticipated that additional screening by site vegetation and structures will further reduce the number of resources from which the Project will be visible.

C. From middleground views, a substantial portion of individual turbines may be seen above intervening landform and vegetation. Vegetation and landforms will provide screening of both near and distant turbines, and will prevent many long distance views (background views). As the simulations illustrate, there are opportunities to view a portion of the proposed turbines. However, at greater distances, the turbines will appear small and occupy a smaller portion of the overall view.

D. Typical views within the study area include mountain peaks, rolling hills and a patchwork of undeveloped woodland interspersed with open fields, waterbodies, ravines, and valleys. The proposed turbines will be the tallest visible elements within view and will be disproportionate to other elements within the regional landscape. The distribution of turbines along a mountain ridgeline will be perceived as highly dominant visual elements to those viewers in close proximity to the Project. As the distance between the viewer and Project increases, the turbines will comprise a smaller portion of the overall view and appear less significant. The moderately paced rotation of the turbine blades will most likely heighten the conspicuity of the turbines.

E. Despite the relatively small population of the Antrim area, large numbers of tourists visit the surrounding area. Tourists often visit the region to enjoy recreational and scenic resources. The sensitivity of individuals to visual quality is variable, but to many, visual quality is an important and integral part of their outdoor experience. Some observers may be sensitive to the visual quality and character created by the Project, while others may find the Project visually interesting. It is not uncommon for tourists to intentionally visit a wind farm to view the turbines and photograph them in the landscape. Additionally, some will see the turbines as a necessary part of the visual landscape to provide renewable power. To these viewers, the turbines may be less likely to impact their visual experience.

Q. In addition to the visual impacts of the proposed wind turbines, have you assessed the visual impacts of other Project components?

A. Yes. The VIA discusses potential visual impacts of night lighting, the proposed access roadway, the permanent meteorological tower, the operations & maintenance building, the electrical interconnection substation, the above ground electrical wires and poles and the temporary construction impacts. For the reasons discussed in the VIA, we believe that visual impacts associated with those components are relatively minor.

Q. Have mitigation measures been implemented to reduce the Project's visual impact?

A. Yes. The Project was designed in a manner to minimize potential visual impacts. Mitigation steps/strategies include:

- Wind turbines will be set back from residential structures by more than ½ mile to assure the maximum screening benefit provided by existing woodland vegetation, where it exists.

- The color of the blades, nacelles and towers will be a neutral off-white. The color is well-suited to minimize visual contrast with the background sky. Where specifications permit, non-specular paint will be used on all outside surfaces to minimize reflected glare.
- Wind turbines will not be used for commercial advertising.
- Vegetation clearing around the base of the turbines will be minimized to the extent possible without compromising operations or safety.
- Clearing along existing and new roads will be minimized to the extent possible without impeding transportation of equipment or materials.
- Subsurface routing of electrical interconnection lines that transmit power between turbine locations will be maximized to the extent possible.
- Ancillary facilities (substation, operations and maintenance facilities, etc.) will be located, to the extent possible, away from major transportation corridors to minimize the perceived visual impact of these portions of the Project. If these structures create visibility/aesthetic concerns, perimeter plantings may be used to further minimize the visibility of these structures.
- Substation lighting will be task oriented (e.g. for maintenance, security and emergency purposes).
- A high priority will be placed on facility maintenance for operational as well as aesthetic purposes.
- Antrim Wind will insure that an appropriate decommissioning plan is in place to ensure that when the Project permanently ceases its electricity generation operations, the

wind turbines can be dismantled and removed from the Project area.

Shadow-Flicker Analysis

Q. Please describe "Shadow-Flicker."

A. Shadow-flicker refers to the flickering effect that occurs within a structure resulting from shadows cast by rotating blades of wind turbines. When the repeating change of light intensity falls across a narrow opening, such as a window, it can cause a flickering effect within the structure (receptor) as the shadow appears to flick on and off. Shadow-flicker will only occur under the following coincident conditions:

- turbine blades are rotating during daylight hours when the sun is low in the sky (i.e. shortly after sunrise or shortly before sunset); and
- the sun is shining brightly (i.e. the weather is not foggy or overcast); and
- a receptor is within 10 rotor diameters of the turbine[3]; and
-turbine shadows enter a structure through unshaded windows that face the turbine.

Q. What is the concern relative to shadow-flicker?

A. The primary concern with shadow-flicker is the annoyance it could cause for the occupants of residential structures within 10 rotor diameters, i.e. for this Project, approximately 1,160 meters or 3,806 feet from each turbine.

[3] Beyond ten rotor diameters a person should not perceive a wind turbine to be chopping through sunlight, but rather as an object with the sun behind it. Beyond this distance, the intensity of the blade shadow is considered negligible and at such a distance there will be virtually no, or limited, distinct chopping of the sunlight.

Q. How was the Antrim Wind Energy Power Project's potential shadow-flicker evaluated?

A. The Project's shadow-flicker analysis was conducted using *WindPRO 2.7 Basis* software ("WindPro"), and associated shadow module, which is a widely accepted modeling software package developed specifically for the design and evaluation of wind power projects. Data input (variables and assumptions) used in the analysis are outlined on pages 5 and 6 of the Shadow-Flicker Technical Memorandum included with the Application as Appendix 13B. These inputs and variables include: terrain; latitude and longitude; turbine dimensions and blade speed; sun coverage; sun angle; receptor locations; receptor windows; sunshine probabilities; screening from vegetation and structures; and operational time/rotor orientation. Based on the identified inputs, variables and assumptions, WindPro was used to calculate the theoretical number of hours per year that shadow-flicker would occur at any given location in the vicinity of the proposed Project. Receptors (i.e. structure locations) within a 1,160 meter radius of each proposed turbine were first derived from aerial photographs and then field-verified by Antrim Wind Energy LLC to determine type and occupancy status. Within this area, 36 residential locations (receptors) were identified, and shadow-flicker analysis was conducted for all of them.

Q. What were the results of this evaluation?

A. Using the variables identified above, the WindPro model calculated the expected number of hours per year that the shadow of a rotor would theoretically fall at any given location within a 1,160 meter radius of each turbine. In addition, each of the 36 identified

residential receptors were evaluated to determine how many hours of potential shadow-flicker may be experienced. Of those 36 receptors: 17 do not fall within the Project's shadow zone; 11 have an expected shadow duration of 2-10 hours/year; 7 have an expected shadow duration of 10-20 hours/year; and 1 has an expected shadow duration of 20-30 hours/year. The relatively low number of potential receptors may be attributed to the fact that the Project was sited 1/2 mile from residences. It should be noted that these results should be considered conservative as the analysis did not take into account potential screening caused by vegetation or structures. Shadows should not occur or occur less frequently in areas where the turbine(s) is substantially screened by vegetation.

Q. How do these results compare to established regulations and thresholds for shadow-flicker from wind power projects?

A. Neither the Town of Antrim nor the State of New Hampshire has standards regarding frequency or duration of shadow-flicker from wind turbines at the Project site. However, many European countries have identified 30 hours of shadow-flicker per year as an allowable threshold; anything above this duration could be considered a nuisance and require mitigation. In addition, many municipalities within the United States have used the 30 hours per year as the threshold for determining whether mitigation measures may be required to reduce the amount of shadow hours on a particular receptor. As indicated above, only one receptor is expected to experience between 20 to 30 hours of shadow-flicker per year. Based on the limited numbers of receptors within the study area and the relatively low number of expected annual shadow hours, it appears that the Antrim Wind Project will operate without any significant shadow-flicker issues.

Q. In your opinion, will this Project have an unreasonable adverse effect on aesthetics?

A. No. Based upon the results of the completed analyses, the Project will not have an unreasonable adverse effect on aesthetics. In addition, it appears that the Project's potential impact from shadow-flicker will be minimal. The completion of photographic simulations from 10 representative locations within the five mile study area indicates that the Project will result in the proposed turbines being visible in various locations and settings. However, the VIA as a whole, does not indicate that the Project will result in a significant portion of the study area having visibility of the proposed turbines. As outlined in this prefiled testimony and discussed in greater detail in the VIA, the viewshed analysis indicates that the vast majority (i.e. 94.7%) of the Project's 5-mile radius study area will be screened from the Project by intervening landform and/or vegetation.

Wind turbines are large and highly visible structures. In order to operate efficiently, siting them in highly visible locations (e.g. along ridgelines where wind resources are favorable) may not be readily avoided. The level of visual impact will depend on each individual viewer, but over time the wind turbines will be more accepted as they become an integral part of the landscape, similar to other infrastructure projects (e.g. transmission lines) seen within the landscape.

Q. Does this complete your testimony?

A. Yes.

John W. Guariglia, RLA
Associate Principal

Project Role
Principal-in-Charge

Education
Bachelor of Landscape Architecture, State University of New York, College of Environmental Science & Forestry, 1994

Associate in Science, Monroe Community College, 1991

Registration /Certification
New York – License # 0017651

Speaking Engagements/Publications

"Use of GIS Technology and Landscape Visualization Software to Predict Visual Impact", American Cultural Resources Association Annual Conference, Providence, RI, September 2009

Allen, M. W., and Guariglia, J. W., "Development of Advanced Viewshed Analysis to Facilitate Project Siting Community Decision-Making" presented at America Wind Energy Association National Conference, May 2009

Allen, M. W., and Guariglia, J. W., "Cumulative Visual Analysis to Facilitate Project Permitting" presented at America Wind Energy Association National Conference, May 2010

Guariglia, J. W., and Perkins, G. W., "Nighttime Visual Impact Analysis to Facilitate Project Permitting" presented at America Wind Energy Association Offshore National Conference, October 2010

Professional Experience

Mr. Guariglia, a Registered Landscape Architect, brings over fifteen years experience in the field of Landscape Architecture. During his career he has worked on a variety of energy, site development, planning, and aesthetic projects throughout the Northeast. Specifically, over the past twelve years, Mr. Guariglia has become a recognized expert in the specialized discipline of visual impact assessments utilizing standard methodologies including, but not limited to, the New York State Department of Environmental Conservation's Program Policy "Assessing and Mitigating Visual Impacts." With Mr. Guariglia's unique experience, Saratoga Associates is able to assist project sponsors in the permitting of high profile projects.

Representative Experience

> Stony Creek Wind Farm, Invenergy LLC, Orangeville, NY
Principal-in-Charge of the visual resource assessment and shadow-flicker analysis for a 59-turbine wind farm. VRA included calibrated panorama simulations from select locations.

> Hounsfield Wind Farm, Upstate Power Corp., Hounsfield, NY
Principal-in-Charge of visual resource assessment for an 84-turbine wind farm located on Galloo Island within Lake Ontario.

> Arkwright Wind Farm, Horizon Wind Energy, Arkwright, NY
Principal-in-Charge/Project Manager of visual resource assessment and shadow-flicker analysis for a 47-turbine wind farm.

> Ripley-Westfield Wind Farm, Pattern Energy, Ripley/Westfield, NY
Principal-in-Charge of the visual resource assessment and shadow-flicker analysis for a 61-turbine wind farm. VRA included nighttime simulations and animations of both daytime and nighttime conditions.

> Ball Hill Windpark, Noble Environmental Power, Villenova/Hanover, NY
Principal-in-Charge/Project Manager of visual resource assessment and shadow analysis for a 60-turbine windpark. An analysis of the projects 115 KV transmission line and a cumulative analysis including an adjacent wind project were also completed.

> High Sheldon Wind Farm, Invenergy LLC, Sheldon, NY
Principal-in-Charge of visual resource assessment and shadow-flicker analysis for an 86-turbine wind farm.

> Block Island Offshore Wind Farm, Deepwater Wind, Block Island, RI
Principal-in-Charge of simulations and viewshed map for an 8-turbine offshore wind farm.

> Moresville Energy Center, Invenergy LLC, Stamford, NY
Principal-in-Charge/Project Manager of visual resource assessment and shadow-flicker analysis for a 33-turbine wind farm located along the Moresville Range in the scenic Catskill Mountain region.

- Perrin Ranch Wind Farm, NextEra Energy, Coconino County, Arizona – Principal-in-Charge of daytime and nighttime photo renderings, viewshed analysis, and guidance to the developer on matters pertaining to potential visual impact for a 66-turbine wind farm. An animated video of the projects 3.5 mile 138 kV tie-in line was also completed.
- Wethersfield Windpark, Noble Environmental Power, Wethersfield/ Eagle, NY
  Principal-in-Charge/Project Manager of visual resource assessment and shadow-flicker analysis for an 86-turbine windpark. A cumulative analysis, including six proposed/existing windparks, and the projects 115 KV transmission line, was also completed.
- Jericho Rise Wind Farm, Horizon Wind Energy, Chateaugay/Bellmont, NY
  Principal-in-Charge of photo simulations for a 53-turbine wind farm.
- Allegany Windpark, Noble Environmental Power, Centerville/Rushford, NY
  Principal-in-Charge/Project Manager of visual resource assessment and shadow-flicker analysis for a 67-turbine windpark. A cumulative analysis, including six proposed/existing windparks, was also contained in the VRA.
- Chateaugay/Bellmont Windparks, Noble Environmental Power, Chateaugay/Bellmont, NY
  Project-in-Charge/Project Manager of visual resource assessment and shadow-flicker analysis for an 86-turbine windpark located along the northern boundary of the Adirondack Park. A cumulative analysis, including seven proposed windparks, was also completed.
- Windfarm Prattsburgh, First Wind, Prattsburgh/Italy, NY
  Project Manager/Visual Analyst of visual resource assessment and shadow-flicker analysis for a 50-turbine windfarm. A cumulative analysis of an adjacent wind project was also completed.
- Beech Ridge Wind Farm, Invenergy LLC, Greenbrier, WV
  Principal-in-Charge/Project Manager of visual resource assessment for a 124-turbine wind farm located in the mountains of West Virginia. Project is in close proximity to State, National and local resources. Provided expert testimony.
- Tuscola Bay Wind Energy Project, NextEra Energy Resources, Gilford/Merritt/Blumfield, MI
  Principal-in-Charge of the visual resource assessment for a 75-turbine wind farm.
- Blissfield Wind Energy Project, Exelon Wind, Lanawee County, MI
  Principal-in-Charge of simulations and presentation animation for a 45-turbine wind farm.
- Victory II Wind Farm, Clipper Windpower, Carroll/Crawford Counties, Iowa
  Principal-in-Charge of shadow-flicker analysis for an 80-turbine wind farm.
- Eclipse Wind Farm, Clipper Windpower, Guthrie/Audubon Counties, Iowa
  Principal-in-Charge of shadow-flicker analysis for a 20-turbine wind farm.

- Green City Growers Wind Power Project, Green City Growers, LLC, Cleveland, OH
  Principal-in-Charge of shadow-flicker analysis for community scale wind project.
- City of El Dorado Wind Power Project, City of El Dorado, El Dorado, KS
  Principal-in-Charge of shadow-flicker analysis for community scale wind project.
- Georgia Mountain Community Wind, State of Vermont, Georgia, VT
  Principal-in-Charge of photo simulations for a 5-turbine wind farm.
- Rhode Island Offshore Wind Farm, Deepwater Wind, Block Island, RI
  Principal-in-Charge of simulations for an offshore wind farm. Simulations were used in the developers' pursuit of development rights.
- New Jersey Offshore Wind Farm, Deepwater Wind, Asbury Park, NJ
  Principal-in-Charge of simulations for an offshore wind farm. Simulations were used in the developers' pursuit of development rights.
- Varian Semiconductor Wind Power, Boreal Renewable Energy Development, Gloucester, MA
  Principal-in-Charge/Project Manager of simulations and viewshed analysis for a community scale wind project overlooking the City of Gloucester. Analysis addressed concerns of Massachusetts Historical Commission.
- Massachusetts Water Resources Authority DeLauri Pump Station Wind Project, Boreal Renewable Energy Development, Boston, MA
  Principal-in-Charge of simulations for a community scale wind project in the City of Boston.
- Passadumkeag Windpark, Noble Environmental Power, Penobscot, ME
  Principal-in-Charge/Project Manager of viewshed map development for a 28-turbine windpark. The maps were created to assist the project sponsor during its fatal flaw analysis.
- Confidential Ohio Wind Farm
  Principal-in-Charge of photo simulations for a 62-turbine wind farm.
- Confidential Indiana Wind Farm
  Principal-in-Charge of photo simulations for a 63-turbine wind farm.
- Confidential Pennsylvania Offshore Wind Farm
  Principal-in-Charge of calibrated panorama simulations for an offshore wind farm.
- Confidential West Virginia Wind Farm
  Principal-in-Charge of the visual resource assessment for a 33-turbine wind farm.
- Confidential Colorado Wind Farm
  Principal-in-Charge of shadow-flicker analysis for a 100-turbine wind farm.
- Confidential Kansas Wind Farm
  Principal-in-Charge of shadow-flicker analysis for a 42-turbine wind farm.

- Confidential Arizona Wind Farm
  Principal-in-Charge of photo renderings, viewshed analysis, and guidance to the developer on matters pertaining to potential visual impact for a 81-turbine wind farm. An animated video of the project was also completed.
- Wethersfield 230 KV Transmission Line (Art. VII Application), Noble Environmental Power, Wethersfield, NY
  Principal-in-Charge/Project Manager of visual resource assessment for a 5.5 mile above ground 230 KV transmission line.
- Upstate NY Power 230 KV Transmission Line (Art. VII Application), Upstate Power Corp., Hounsfield to Mexico, NY
  Principal-in-Charge of visual resource assessment for a 51 mile above ground and sub-aquatic 230 KV transmission line.
- Centerville-Yorkshire 115 KV Transmission Line (Art. VII Application), Noble Environmental Power, Centerville to Yorkshire, NY
  Principal-in-Charge/Project Manager of visual resource assessment for a 14 mile above ground 115 KV transmission line. Also completed a cumulative analysis of the transmission line and the proposed Allegany windpark.
- Safe Harbor Offshore LNG Facility, Atlantic Sea Island Group, Long Beach, NY
  Principal-in-Charge/Project Manager of visual resource assessment for a Deepwater port application of a proposed LNG facility on a man-made island off the coast of Queens, NY.
- Confidential Offshore LNG Terminal #1, Eastern Seaboard, United States
  Principal-in-Charge of visual resource assessment for a major offshore floating LNG terminal.
- Confidential Offshore LNG Terminal #2, Eastern Seaboard, United States
  Principal-in-Charge of visual resource assessment for a major offshore floating LNG terminal.
- Brayton Point Station Cooling Tower & Unit 3 DS/FF Projects, Somerset, MA
  Principal-in-Charge of simulations illustrating facility improvements and two 500-foot tall natural draft cooling towers.
- AES Cayuga Generation Plant, AES Cayuga LLC, Lansing, NY
  Principal-in-Charge of photo simulations for a proposed landfill expansion.
- Empire Newsprint Recycling and Power Plant (Art X Application), Besicorp Development LLC, Rensselaer, NY*
  Project Manager/Visual Analyst of visual impact assessment for a 505 MW co-gen power plant (including water vapor plumes) and recycling facility. Provided expert testimony.
- 345 KV Electrical Transmission Line (Art. VII Application), Besicorp Development LLC, Rensselaer County, NY*
  Project Manager of visual resource assessment for an 8.1 mile above ground. Provided expert testimony.

** Prior to association with Saratoga Associates.*

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2012-____

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

January 31, 2012

Qualifications of Richard Will

Q. Please state your name and business address.

A. My name is Richard Will. My business address is 71 Oak Street, Ellsworth, Maine 04605.

Q. Who is your current employer and what position do you hold?

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 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. Please summarize your education, training, background and qualifications.

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. My curriculum vitae is attached to this prefiled testimony and is labeled Attachment RTW-1. It contains further information regarding my education, training, background and qualifications.

Qualifications of Russell Stevenson

Q. Please state your name and business address.

A. My name is Russell Stevenson. My business address is 375 East Elm Street, Conshohocken, Pennsylvania 19428.

Q. Who is your current employer and what position do you hold?

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 & Company.

A. A.D. Marble & Company 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 & Company?

A. As an architectural historian my job is to guide clients through the Section 106 process concerning historic resources which is described later in this testimony. My responsibilities include background research, identification level surveys, evaluation of historic resources, eligibility recommendations, assessments of effects to historic resources, and the mitigation of adverse effects.

Q. Please summarize your education, training, background and qualifications.

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, and commercial properties in New Jersey, Maryland, Delaware,

and Pennsylvania. I've also been trained and worked as a 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. My curriculum vitae is attached to this prefiled testimony and is labeled Attachment RS-1. It contains further information regarding my education, training, background and qualifications.

Purpose of Testimony

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to address the potential impacts on historic sites of the Antrim Wind Energy, LLC Project ("the Project"). More specifically, Richard Will's testimony addresses the Project's potential impacts on archaeological resources and Russell Stevenson's testimony addresses the Project's potential impacts on above-ground historic resources.

Q. Are you familiar with the Project that is the subject of this Application?

A. Yes, we are. As historic resource consultants to the Project, we have been provided with information concerning the Project's components and locations of those components.

Archeological Assessment

Q. Dr. Will, have you studied the Project's potential impacts on archeological sites?

A. Yes. TRC has initiated survey work and completed Phase 1A and Phase IB archaeological surveys.

Q. Please describe your studies.

A. 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. As part of TRC's survey, I visited the offices of the New Hampshire Division of Historical Resources ("NHDHR") twice - in May and July of 2011. At the first meeting, on May 19, 2011, I met with Ms. Edna Feigner, Review and Compliance Officer, to identify and understand NHDHR's expectations for completing an archaeological resources assessment of the Project area. The objective of the second meeting on July 20, 2011 was to collect relevant background and archival information on known Precontact 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.

[1] Precontact 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.

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 the walkover survey is that the database for archaeological sites in upland areas of New Hampshire is small. The walkover survey was conducted on November 23-26, 2011. Due to recent snowfall of about 6 inches, and the limited amount of daylight, 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 Mountain. Ms. Feigner of NHDHR confirmed to TRC on December 16, 2011 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 a report entitled "Results of Phase I Archaeological Survey of the Antrim Wind Energy Project." This TRC report is found in Application Appendix 9B. The Phase IA Survey indicated that no Historic period or Precontact 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 Precontact 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 stonewalls 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 Application Appendix 9C.

Architectural Assessment

Q. Mr. Stevenson, have you studied the Project's potential impacts on above-ground historical properties?

A. Yes.

Q. Please describe your studies.

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 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 & Company 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"). Additional research was conducted at the New Hampshire State Library and New Hampshire Historical Society. A.D. Marble & Company also contacted

Ms. Liz Robertson, a member of the Antrim Historical Society, for information on relevant resources and repositories. Other organizations with a demonstrated interest in the Project were invited to participate as consulting parties to the so-called "Section 106 process." Section 106 of the National Historic Preservation Act, as amended, requires that federally funded, licensed or assisted undertakings provide for 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 will require 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.

The 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 & Company's survey work, properties 50 years in age or older within the three-mile Project area were examined and photographed 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 NHDHR project area form ("PAF") was completed and submitted to NHDHR on January 5, 2012. The purpose of the form is to develop an historic context for the three-mile 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 & Company's studies are reflected in the PAF which is contained in Application 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 (i.e. the Antrim Congregational Church in Antrim Center). Because the Flint Estate Historic District was 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 the following resources as warranting future documentation and evaluation on the relevant inventory form:

- North Branch Cemetery – Individual Inventory Form
- Meetinghouse Hill Cemetery – Individual Inventory Form
- Farm, Reed Carr Road – Individual Inventory Form
- Pine Haven Cottages – Historic Area 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

Following concurrence from NHDHR on the recommended eligibility evaluations, future work will include the completion of the above-referenced inventory forms which will include an evaluation of the resource's eligibility for listing in the National Register. After concurrence from NHDHR regarding such eligibility, potential effects of the Project on eligible properties will be assessed using established criteria. Should the Project create the potential to detract from the ability of an historic property to convey its significance due to the introduction of the Project's features within the resource's setting, it will be necessary to consult with USACE, NHDHR and other parties to avoid, minimize, or mitigate the adverse effect.

It is important to note that no buildings or structures will be acquired or physically altered or removed by the Project, and thus impacts, if any, would be limited to those resulting from the visibility of the Project from the historic property.

Q. In your opinion will this Project have an unreasonable adverse effect on historic sites?

A. Based on the information and survey findings noted above and our current understanding of the Project, we do not believe that this Project will have an unreasonable adverse effect on 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 is unlikely to 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 structures 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. Should the proposed Project's impact on above-ground historic properties be deemed adverse by USACE in consultation with NHDHR under the Section 106 process, appropriate measures will be developed to resolve the adverse effect.

Q. Does this conclude your prefiled testimony?

A. Yes.

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RICHARD T. WILL, PHD August 2011

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 is an Adjunct Professor of Quaternary Sciences 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, Dr. Will is Operations Manager for the TRC Northeast sector of cultural resources management.

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 principle 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 (Principle Investigator: 2005-2008).** 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 (Principle 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 Principle 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 Principle 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 Principle 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 Principle 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 Principle 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 lectures 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**, Institute for Climatic Change, University of Maine
- **Chair (ex officio)**, 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**

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

1999 "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**

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**

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

2000 **State of Maine Historic Preservation Award.** Presented by the Maine Historic Preservation Commission at their summer meeting at Pemaquid, Maine, July.

Russell Stevenson
Architectural Historian/Historian

Mr. Stevenson has over five years of experience in historic preservation, including two years assessing historic resource integrity and performing conservation work. His primary responsibilities consist of conducting historic architectural surveys, historic research for archaeology and architectural projects and preparing historic contexts and survey forms for a variety of projects. Mr. Stevenson has identified, surveyed, and evaluated a wide array of residential, agricultural, and commercial properties in Pennsylvania, Delaware, Maryland and New Jersey. He is adept at the use of cultural resources databases for previously identified resources in Maryland, Pennsylvania, Delaware, New Jersey 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. 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 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.

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

S.R. 222 & Long Lane Intersection, Berks County, PA. 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.

Schuylkill River Park Pedestrian Bridge over CSX railroad tracks, Philadelphia County, Philadelphia, Pennsylvania. 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.

Lehigh Street Bridge Replacement Project, Lehigh and Northampton Counties, Pennsylvania. PennDOT. 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.

S.R. 0222, Section 22 Intersection Improvements Project, Berks County, Pennsylvania. PennDOT. 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.

SugarHouse 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 investigation.

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 and assisted with Historic Resources Reconnaissance Survey report.

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 a state-level survey form documenting two farmsteads.

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.

SEPTA Wayne Junction Station Improvement Project. Philadelphia County, PA. 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.

S.R. 6011, Section 273, Harrison Avenue Bridge Project, Scranton, Lackawanna County, Pennsylvania. 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.

S.R. 2014, Section 012, Furnace Road Bridge over Mill Creek, Lebanon County, Pennsylvania. 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.

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.

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.

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.

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.

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.

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.

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, Bucks 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.

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 background research for Phase II and III archaeological investigations for multiple sites within the project area.

Air Compressor, Building 175, Portsmouth Naval Shipyard, Historic American Engineering Record (HAER) Recordation. York County, ME. 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, ME. 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, ME. 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.

Building 303, Portsmouth Naval Shipyard, Historic American Engineering Record (HAER) Recordation. York County, ME. 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.

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.

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. Project involves a roadway realignment and improvement project. Assisted with field survey and state-level survey form preparation.

West Dover Connector Project, Dover, Kent County, Delaware. Architectural 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 a Assessment of Effect Report.

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.

Maryland

Village of Piscataway Historic District, Prince George's County, Maryland. Historian. Conducted background research for a draft National Register Nomination. Assisted with the preparation of the statement of significance.

St. Thomas Episcopal Parish Historic District, Croom, Prince George's County, Maryland. Historian. Conducted background research for a draft National Register Nomination.

Broad Creek Historic District, Broad Creek, Prince George's County, Maryland. Historian. Conducted background research for a draft National Register Nomination.

Upper Marlboro Residential Historic District, Upper Marlboro, Prince George's County, Maryland. Historian. Conducted background research for a draft National Register Nomination.

New Jersey
Replacement of Canal Street Bridge over Drake's Brook, Morris County, New Jersey. 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.

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.

Publications/Papers

2011 "Let's Go Fitchin': The Steamboat Trials of John Fitch," in *Environmental Assessment*, the newsletter for the Pennsylvania Association of Environmental Professionals.

2007 "The Effectiveness of Agricultural Zoning Ordinances in Controlling Sprawl in the Lehigh Valley, Pennsylvania." Masters Thesis, University of Delaware.

Training/Conferences

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.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2012-___

APPLICATION OF ANTRIM WIND ENERGY, LLC

FOR A CERTIFICATE OF SITE AND FACILITY

PREFILED DIRECT TESTIMONY OF COLIN HIGH, Ph. D.

ON BEHALF OF

ANTRIM WIND ENERGY, LLC

January 31, 2012

Qualifications

Q. Please state your name and business address.

A. My name is Colin High. My business address is 55 Railroad Row, White River Junction, VT 05001.

Q. By whom are you employed and what position do you hold?

A. I am a Co-Founder and Principal Consultant with Resource Systems Group, Inc. ("RSG").

Q. Please describe the services provided by RSG.

A. RSG provides technical consulting services in transportation, energy, environment, market research and information technologies. Providing such services regarding the

environmental impacts of wind energy and other renewable energy sources is one of RSG's specialties.

Q. What are your responsibilities with RSG?

A. I am the principal consultant for energy and environmental assessments and I manage the analysis of projects and client services in this professional practice area.

Q. Please describe your education, training and experience.

A. I hold a B.Sc.in Geography and Earth Sciences and Ph.D in Earth Sciences, both from the University of Bristol in England. I have more than 25 years of experience conducting avoided emissions analyses.

Before co-founding RSG, I was on the faculty of the Thayer School of Engineering and the Department of Environmental Studies at Dartmouth College. I was also on the faculty at Columbia University in New York City, where I taught environmental science, climatology and energy policy. While at Columbia University, I worked on remote sensing of the environment from space at the Goddard Institute for Space Studies. I have worked as a consultant on energy and environmental projects for numerous public and private sector organizations including the United States Department of Energy, the New Hampshire Office of Energy and Planning, and the Electric Power Research Institute.

Examples of projects for which I have conducted or coordinated energy and environmental assessments are included in my resume, which is attached and labeled Attachment CH-1

Q. Does your resume fairly and accurately represent your experience with respect to the study and evaluation of avoided emissions?

A. Yes, it does.

Q. Have you previously testified before state permitting agencies?

A. Yes. I have previously testified before several state agencies. I have testified in the following matters:

- Testimony of behalf of Highland New Wind Development LLC before the Virginia State Corporation Commission (Highland New Wind Development LLC, Case Number PUE-2005-00101 (2006)).
- Testimony on Behalf of the Conservation Law Foundation and the Independent Energy Producers of Maine before Maine's Land Use Regulation Commission (Maine Mountain Power LLC, LURC Zoning Petition ZP 702 (2006)).
- Testimony on behalf of the Conservation Law Foundation before Vermont's Public Service Board (Petition of EMDC, LLC d/b/a/ East Haven Wind Farm, Docket No. 6911 (2008)).

Q. Are you familiar with the proposed Antrim Wind Energy Power Project (the "Project")?

A. Yes. RSG was engaged by Antrim Wind Energy, LLC to assess the air emissions and water consumption impacts of the Project.

<u>Purpose of Testimony</u>

Q. What is the purpose of your testimony in this proceeding?

A. My testimony addresses the impacts that the Project will have on air quality and water

consumption. My testimony also summarizes the findings in the "Avoided Emissions from the Antrim Wind Project" report (the "Report"), which is contained in Appendix 10A of the Application in this proceeding. Included with the Report is a Letter from Richard Simon of V-Bar to myself, dated December 29, 2011, which summarizes the work that V-Bar did to estimate the Project's hourly energy production.

Avoided Emissions Analysis

Q. Please describe the purpose of the avoided emissions analysis.

A. The purpose of the avoided emissions analysis is to determine the impact that the Project will have on regional air and water emissions. The Project is located within the ISO-NE regional electric grid. Based on well-established analytical methods it is possible to determine, from publicly available data from the US Environmental Protection Agency ("EPA"), the Federal Energy Regulatory Commission ("FERC"), U.S. Energy Information Administration ("EIA") and ISO New England ("ISO-NE"), those regional, variably dispatched fossil-fueled plants where generation will be displaced at times when the Project is operating.

Q. Please explain how you determined which plants would have reduced generation while the Project was operational.

A. ISO-NE dispatches plants to provide the electricity that is needed to meet regional demands. Once installed, wind power does not have fuel costs and has very low operating costs and is therefore considered a "must run" power source. This means that when wind energy is being produced, it will displace generation at facilities with higher operating costs which can be "variably dispatched" (i.e. those that can be employed to meet demand but do not run all of the time.) These variably dispatched facilities are, in practice, fossil fuel plants, and a list of them is

provided on page 4 of the Report. Our analysis determines, on an hourly basis, which of these plants would have reduced generation when the Project is operational.

The Report uses two potential wind generation scenarios developed by V-Bar to determine which fossil-fueled plants would have reduced generation due to the Project. "Scenario A" uses data from the meteorological tower at the Project site to model actual hourly energy yield estimates for the year 2010. Because 2010 wind speeds were higher than normal, V-Bar also created "Scenario B," which provides hourly energy yield assessments based upon extrapolated long term average wind speeds, utilizing more than two years of site-specific data.

Q. Please describe the methodology that was used for conducting an analysis of the Antrim Wind Project's avoided emissions.

A. The methodology used is a time matched marginal emissions analysis on an hourly basis for 8760 hours in the year. This is consistent with the approach used by other experts to determine avoided emissions. It has been used in previous studies of avoided emissions from wind and other renewable generation in most electric grid regions in the United States, including the ISO-NE regional power market. The first step of the methodology matched projected hourly generation for the Project (in Scenario A and Scenario B) against the RSG's time-matched marginal ("TMM") model to determine which variably dispatched fossil-fueled plants would have reduced generation in each hour due to the Project's operations.

The second step in the methodology determined the avoided emissions for each of the plants where generation would be reduced. This analysis is performed using EPA data regarding carbon dioxide (CO_2), nitrogen oxides (NOx), sulfur dioxide (SO_2) and particulate matter (PM), as well as water use. The Report also includes a qualitative analysis regarding additional

pollutants (fine particulate matter, mercury, volatile organic compounds, and carbon monoxide). The RSG TMM Model has been applied extensively for estimating avoided emissions for energy efficiency and renewable energy projects in all 50 states for the U.S. Department of Energy Loan Program Office.

Q. How can the avoided air emissions be measured?

A. The Report provides two ways to consider the avoided air emissions. First, RSG calculated the average annual avoided air emissions as measured on a pound per megawatt hour basis. This measures the amount of avoided air emissions for each megawatt hour of energy produced by the Project. The average rate is based upon the emissions of the marginal units in the ISO-NE which are likely to be replaced by the Project, and does not differ between Scenario A and Scenario B. The Average Annual Avoided Emissions Rates for the Project are contained in Table 2 on page 5 of the Report.

Second, RSG calculated the total annual air emissions avoided in tons per year for each of the scenarios. Because the production of the Project influences the total tons of air emissions avoided, the results for Scenario A and Scenario B are different. The Total Annual Avoided Emissions from the Antrim Wind Farm, as measured in tons per year, are contained in Tables 4 (Scenario A) and 5 (Scenario B) on page 6 of the Report.

Q. What does the Report conclude regarding avoided air emissions?

A. The Report indicates that the Project will, for Scenario B (the more conservative Scenario), result in avoiding emissions of nearly 60,000 tons of carbon dioxide, half a ton of nitrous oxide (N_2O), nearly two tons of methane (CH_4), 26 tons of nitrogen oxides (NOx), 87 tons of sulfur dioxide (SO_2), and 35 tons of particulate matter per year. These avoided

emissions are the equivalent of taking approximately 10,631 passenger vehicles off the road, or eliminating the CO_2 emissions associated with the electricity usage of 6,761 homes for one year, or the carbon sequestered by 11,561 acres of pine forests. These avoided greenhouse gas emissions will aid in meeting state- and regional-greenhouse gas emissions goals. The NOx and SO_2 avoided emissions will decrease the costs of meeting regional acid precipitation goals. In addition, the Report concludes that there will be significant avoided emissions of fine particulate matter, mercury, volatile organic compounds, carbon monoxide, and other toxic air pollutants.

Q. What does the Report conclude regarding avoided water emissions?

A. The Report indicates that the Project will, on average, result in avoiding water use of more than seventeen million gallons of water in New England in a given year. Table 6 on page 8 of the Report contains the calculations for avoided water use for both Scenario A and Scenario B.

Q. In your opinion, will the Antrim Wind Project have an unreasonable adverse effect on either air quality or water consumption?

A. No. For the reasons indicated in the Report, it is anticipated that the Project will have positive and beneficial impacts on air quality and water consumption. There are significant air emissions that will be avoided from the electric power generated by the Antrim Wind Project. These avoided emissions will have specific environmental benefits such as reducing the occurrence of high ozone days in New England and Eastern Canada, reducing acid precipitation, and reducing regional haze and respiratory health risks. In these circumstances, the Project will have a beneficial effect upon the region's air quality. The project will also reduce emissions of carbon dioxide and other greenhouse gases which are the principal cause of global warming and

adverse climatic change. In addition, the Project is expected to avoid the consumption of water by fossil fueled electricity generators of approximately seventeen million gallons of water annually in New England. It will have a positive effect in terms of water consumption and reduce the impacts on aquifers and aquatic ecosystems associated with that water consumption.

Q. Does this complete your testimony?

A. Yes.

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Colin J. High
Co-Founder and Principal Consultant

Education

B.Sc. Geography and Earth Sciences and Ph.D., Earth Sciences, University of Bristol, England,

Experience

Dr. High has over thirty years' experience in energy and environmental research, teaching, and consulting. He is a Co-Founder of Resource Systems Group, Inc. As a Principal Consultant for energy and environmental assessments, Dr. High has supervised or worked directly on a wide range of projects in the energy environment and transportation field. He was formerly on the faculty of the Thayer School of Engineering and the Department of Environmental Studies at Dartmouth College and before that on the faculty at Columbia University in New York City, where he taught environmental science, climatology and energy policy. While at Columbia University, Dr. High worked on remote sensing of the environment from space at the NASA Goddard Institute for Space Studies. He has worked as a consultant on energy and environmental projects for numerous public and private sector organizations. He is the manager of RSG's Greenhouse Gas Management Services and he is the Lead Verifier for GHG Validation and Verification Services.

Responsibilities and RelevantProjects

Energy and Air Emissions

- *US DOE Loan Guarantee Program Office* - Established and employed a standardized and widely recognized life-cycle assessment methodology to evaluate the emissions benefits associated with renewable energy and energy efficiency projects seeking loan guarantees. To qualify for loans projects must demonstrate the ability to reduce, avoid or sequester greenhouse gases—as measured by this methodology—and use new or significantly improved technologies to qualify. More than 270 individual new or alternative technology renewable energy or energy efficiency projects were evaluated and reports were prepared for DOE decision makers. Projects included wind, solar PV, concentrated solar thermal, geothermal, ocean thermal electric, pumped hydro, compressed air storage, battery storage, frequency response flywheels electric vehicles, smart grids and bio-fuels.
- *Electric Power Research Institute (EPRI)* - Measure the accumulated life cycle greenhouse gas emissions under three alternative future energy development scenarios for the mid-Atlantic region (PJM Power Market) from 2010 to 2020. These three alternative scenarios included onshore and offshore wind farms and combined cycle natural gas turbine generators.
- *US DOE Office of Clean Coal* - Measured the accumulated life cycle greenhouse gas emissions under two alternative future energy development scenarios for the southern states (SERC region) from 2010 to 2030. These alternative development scenarios included wind, solar and bio-fuels as well as coal gasification with carbon sequestration. This used the RSG TMM model for avoided emissions from renewable energy.
- *US DOE Mid-Atlantic Regional Office* - Analyzed the implementation of energy efficiency programs in New Jersey on the PJM Interconnection Electric Power Grid. The analysis included measurement and verification of the avoided air emissions resulting from energy efficiency. This provided the basis for the New Jersey Department of Environmental Protection to credit NOx reductions to the New Jersey Board of Public Utilities' energy efficiency incentive programs.

- *Metropolitan Washington Council of Governments* - Custom designed a GHG and NOx emissions reduction model for municipal facilities reducing electric demand on a time-of-day basis. The study used RSG's Time-Matched Marginal Avoided Emission Model to determine marginal generation changes and emission rates from energy and transportation management. The results were used by the air quality agencies of the District of Columbia, Maryland, and Virginia to assess the benefits of renewable energy and energy efficiency measures and plan NOx reduction programs to comply with the 8-hour ozone standard. RSG also determined the effect of energy efficiency programs on the greenhouse gas emissions from municipal facilities.
- *Time-Matched Marginal Avoided Emission Model for the US Electric Power Market Areas*- Designed and implemented the first and most comprehensive data base of the hourly generation at all the combustion based electric power units in the US, which are large enough to have EPA mandated continuous emissions monitors. This database is used to identify the marginal units at every hour in any defined power market, state or other defined region. The analysis identifies the marginal units at each hour by a combination of factors, including the actual load following performance of the units in each power market area. From this the operating avoided emissions of energy efficiency and renewable energy projects are calculated by time matching the actual or predicted energy savings from energy efficiency projects and the generation of renewable or alternative energy projects with the emissions of marginal fossil fueled units on the grid.
- *Analysis of the Air Emissions Reductions of Energy Efficiency Programs in New Jersey* - conducted an analysis of the implementation of energy efficiency programs in New Jersey on the PJM Interconnection Electric Power Grid. The analysis included measurement and verification of the avoided air emissions resulting from energy efficiency which provided the basis for the New Jersey Department of Environmental Protection to credit NOx reductions to the New Jersey Board of Public Utilities' energy efficiency incentive programs. The analysis was supported by funding from the US DOE, Mid Atlantic Regional Office.
- *Measurement of GHG Emissions Reductions at Municipal Facilities in the Metropolitan Washington Council of Governments Region* - Provided a custom designed GHG and NOx emissions reduction model for municipal facilities reducing electric demand on a time of day basis. The study used RSG's time matched marginal avoided emission model to determine marginal generation changes and marginal emission rates from energy and transportation management. The results were used by the air quality agencies of the District of Columbia, Maryland, and Virginia to assess the benefits of renewable energy and energy efficiency measures and plan NOx reduction programs to comply with the 8 hour ozone standard.
- *Analysis of Air Emissions Reductions from Energy Efficiency Programs in SW Connecticut* - conducted an analysis of the effect of electric energy efficiency programs in commercial buildings in Southwestern Connecticut in reducing electric demand on high electric demand days. The study used RSG's time matching model to determine marginal generation changes and marginal emission rates. The results were used by Connecticut DEP to plan NOx reduction programs to comply with the 8 hour ozone standard and assess the load management benefits of energy efficiency measures. The analysis was provided to Connecticut DEP with funding from the US DOE.
- *Analysis of the Avoided Emission from the City of Chicago Green Power Purchase Program* - Conducted an analysis of the marginal avoided air emissions resulting from the purchase of green electric power by the City of Chicago. The green power purchase program included landfill gas and photovoltaic generation. This was the first dispatch based analysis of avoided emissions from publicly available emissions data. The analysis was provided to Environmental Resources Trust (now part of WinRock International) to assist them in the certification of the green power sold to the City of Chicago by Commonwealth Edison.
- *Air Impacts of the Reconstruction of the Boston Central Artery (I 93)* - conducted an analysis of the air quality impacts of part of the largest highway project in the US. This included mobile and stationary source air quality modeling of criteria and hazardous pollutants from traffic, construction equipment and trucks in the Charles River area of Boston.
- *National Emissions Study for Environmental Performance Benchmarking (EPIndex)* - gathered and generated emissions data for all the oil-, coal-, and gas-fired power plants around the nation; applied EPA emissions models to validate our existing database and to develop formulas for predicting fuel consumption and net generation. The model considered fuel composition and consumption, plant-specific stack emissions controls, and energy curves. The final product was a full environmental performance benchmarking system for every facility and electric generation company in the United States.

- *Analysis of the Avoided Emissions from the Operation of a Wind Farm in Western Maryland,* - the first project in the nation where emissions reductions from renewable energy generation were credited in a state and federal regulatory process. That analysis was used as a model in the U.S. Environmental Protection Agency, Guidance on State Implementation Plan (SIP) Credits for Emission Reduction Measures from Electric-sector Energy Efficiency and Renewable Energy Measures, issued in August 2004. The study was initially undertaken for Clipper Wind Power and then used by Montgomery County MD in support of NOx credits for county government wind energy purchases.
- *Avoided Emissions Analysis for Four Wind Farms in New York* – quantified the air emissions that would be displaced by the generation of wind power in New York State using time-matched marginal emissions models. Provided reports for New York State regulatory hearings.
- *Avoided Emissions Analysis for the East Haven Wind Project, Vermont* - performed analyses quantifying the air emissions that would be displaced by the development of a small wind project in East Haven, Vermont. Provided Testimony on behalf of Conservation Law Foundation before the Vermont Public Service Board.
- *Waste To Energy Emissions Analysis for New York* – Retained by the New York Attorney General to compare the air emissions from seven municipal waste-to-energy facilities to those of large coal- and gas-fired power plants.

Selected Publications

- Jacobson, D. and C. High (2010). *"U.S. Policy Action Necessary to Ensure Accurate Assessment of the Air Emissions Reduction Benefits of Increased Use of Energy Efficiency and Renewable Energy Technologies"*. George Washington Journal of Energy and Environmental Law (Vol. 1 : 1, 2010).
- Jacobson, D. and C. High (2008). *"Wind Energy and Air Emission Reduction Benefits: A Primer"*, August 31, 2007. National Renewable Energy Laboratory, Technical Report NREL/SR-500-42616; February 2008.
- Jacobson, D., P. O'Connor, C. High, and J. Brown (2006). "*Report on the Clean Energy/Air Quality Integration Initiative Pilot Project of the U.S. DOE Mid-Atlantic Regional Office for New Jersey", March 2006,* U.S. DOE Report DOE /GO-102006-2354, August 2006.
- Resource Systems Group Inc. (2007). *Avoided Emissions Report for Nitrogen Oxides from Wind Power Purchases*. Published as Appendix H of Metropolitan Washington Air Quality Committee, "*Plan to Improve Air Quality in the Washington, DC-MD-VA Region:State Implementation Plan for the 8-Hour Ozone Standard",* May 23, 2007.
- High, C. and K. Hathaway (2006). "*Avoided Emissions from the Redington Mountain Wind Farm, Redington Township, Maine".* Prepared for the Conservation Law Foundation and the Independent Energy Producers of Maine, Submitted in Testimony to the Maine Land Use Regulatory Commission Public Hearing on the Redington Mountain Wind Farm , August 3, 2006.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2012-____

APPLICATION OF ANTRIM WIND ENERGY, LLC

FOR A CERTIFICATE OF SITE AND FACILITY

PREFILED DIRECT TESTIMONY OF DANIEL T. BUTLER AND PATRICK M. MARTIN ON BEHALF OF ANTRIM WIND ENERGY, LLC

January 31, 2011

Qualifications of Daniel T. Butler

Q. Please state your name and business address.

A. My name is Daniel T. Butler. My business address is 249 Western Ave., Augusta, Maine 04330.

Q. By whom are you employed and what position do you hold?

A. I am the Manager, Civil and Transmission Engineering Department with TRC Companies, Inc. ("TRC").

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 concept to operations.

Q. What are your responsibilities with TRC?

A. I supervise, coordinate, review and stamp engineering and design work of TRC's Civil and Transmission Engineering Department.

Q. Please describe your education, training and experience.

A. I hold a Bachelor of Science degree in Civil Engineering from the University of Maine. I have more than 26 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. More information about my education, training and experience is contained in my curriculum vitae which is attached to this testimony and is labeled Attachment DTB-1.

Q. Have you previously testified before state permitting agencies?

A. Yes. I provided testimony in the State of Vermont regarding siting of the Glebe Mountain Meteorological Tower.

<u>Qualifications of Patrick M. Martin</u>

Q. Please state your name and business address.

A. My name is Patrick M. Martin. My business address is 400 Southborough Drive, South Portland, Maine 04106.

Q. By who are you employed and what position do you hold?

A. I am a Civil Engineer with TRC Companies, Inc. ("TRC").

Q. What are your responsibilities with TRC?

A. My primary responsibility is to provide civil engineering support to a variety of projects. This generally includes grading and drainage design, stormwater management design, hydrologic modeling, erosion and sediment control design, and technical report writing. I have limited supervisory and project coordination responsibilities.

Q. Please describe your education, training and experience.

A. I hold a Bachelor of Science degree in Environmental Engineering from Oregon State University. I have more than ten 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. More information about my education, training and experience is contained in my curriculum vitae which is attached to this testimony and is labeled Attachment PMM-1.

Purpose of Testimony and Overview of Project

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of our testimony is to describe the design and construction of the Antrim Wind Project. We will also discuss the Project's impacts on water quality and the proposed mitigation of those impacts, as well as some of the potential effects of the Project on public health and safety during the construction phase.

Q. Are you familiar with the proposed Antrim Wind Energy Power Project (the "Project")?

A. Yes. TRC was engaged by Antrim Wind Energy, LLC to assist in the construction design of the Project and to assess the water quality impacts and some of the public health and safety impacts during construction of the Project. In our roles as senior civil engineers for the Project we have been involved in the site planning and have conducted a field review of the site.

Q. Please describe the area that was reviewed for design and construction purposes and for water quality impacts.

A. The proposed 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 Town of Antrim has numerous water resources and the area of the Project is located near three and straddles four watersheds in the town: the North Branch River, Gregg Lake, Willard Pond 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 is a major tributary to the Contoocook River. Gregg Lake is located in the valley to the southeast of Tuttle Hill and is approximately 195 acres and supports a moderate warm water fishery. Willard Pond is about 95 acres in size and part of the dePierrefeu-Willard Pond Wildlife Sanctuary. 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. Evidence of past logging activities is clear 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 1,050 feet to 1,900 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.

Q. Please describe the design and construction of the Project.

A. Within the Project area approximately 57.9 acres will be disturbed during construction; approximately 46.4 of those acres will be restored and revegetated following construction. The Project involves the construction of 10 wind turbines, including a 1.64 acre crushed stone yard area for a Public Service Company of New Hampshire ("PSNH") substation, collector substation, and Operation & Maintenance Building and parking area, a 4.0 mile crushed stone access road (including two spur roads), 10 graveled wind turbine generator construction areas, a 34 kV collector system and associated stormwater management system. The substation yards are located adjacent to an existing PSNH transmission corridor to minimize the amount of clearing required for the new lines. These yards will be constructed to PSNH standards, with an open-graded crushed stone surface and two (2) control houses. The entire yard will be surrounded with a security fence. An access road, with two (2) spur roads, will be constructed from the project entrance at Route 9 to the wind turbine sites. The total road length will be approximately 4.0 miles. The first 900 feet of the road will be paved, per PSNH standards, and the remainder will be constructed of crushed stone. In a limited area, the road will be constructed with a width of 16 feet. The remainder of the road will have a construction width of 34 feet to accommodate the 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, and will provide room for a 6000 square foot crane pad, a 20-foot diameter concrete tower foundation, and a turbine assembly area. These locations will also be used as staging and laydown areas during construction. After construction, a significant portion of each of these areas will be revegetated, leaving the 6,000 square foot crane pad as impervious area.

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 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 site restoration. Geotextile fabric will be installed and topped with a layer of well-draining gravel. Temporary erosion control measures will be implemented to prevent erosion and sedimentation. After construction is completed, any debris, unused material, the gravel and geotextile fabric 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 34kV 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.

Water Quality Impacts

Q. Please describe how water quality issues have been taken into account.

A. The Project will require a Stormwater Management Plan and permits that include, among others, a NHDES Alteration of Terrain Permit, a NHDES Wetlands Bureau Dredge & Fill Permit, and an EPA discharge permit. We attended a stormwater pre-application meeting with NHDES staff in November of 2011 where we presented a plan of the Project that showed the Project area on a watershed level. The plan included existing features such as contours, wetlands and vernal pools, roads and structures, and soils identified by hydrologic soil group. The plan also showed the proposed roadway alignment and turbine locations.

Q. Have you studied the water quality impact this Project will have?

A. Yes. This Project does not involve any new point source discharge; there will be no water withdrawal or discharge associated with this Project. Potential impacts to water quality, including erosion and sedimentation during the construction phase and changes in stormwater runoff have been addressed; the Project has been designed to meet all state and federal standards. The stormwater management system has been designed to minimize impacts to the existing natural drainage ways. Overall drainage patterns and directions of flow will remain generally the same. The Project will result in a relatively small amount of new impervious areas distributed between four expansive, largely undeveloped watersheds. There will be a permeable road base 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. 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 impacts can not be avoided because the road is in approximately 10 feet of cut; this is necessary to meet the maximum slope requirement of 12% for construction and delivery vehicles. At the second crossing a three-sided concrete box culvert has been designed to comply with NHDES stream crossing guidelines. During the pre-application meeting with NHDES it was concluded that a curve number (CN) comparison between the pre- and post-development conditions would be an acceptable substitute for a formal stormwater runoff analysis. The CN comparison study showed that neither the composite CNs nor the times of concentration (Tc) will change as a result of this Project, in any of the four (4) watersheds; it is therefore reasonable to conclude that the construction will not result in an increase in peak rates of runoff from the site.

Q. What steps will the Applicant take to address the water quality impact of the Project ?

A. The Applicant will take a number of steps to reduce and mitigate water quality impacts associated with the Project, including complying with design requirements for runoff quality control included in Chapters 2 and 4 of the NH Stormwater Manual. 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. 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 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,

where the road is in a fill condition to minimize channelization of runoff, and in areas where the roadway crosses wetlands and maintaining hydrologic/hydraulic 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. 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. During construction, the Project will install and maintain temporary sediment and stormwater control devices, as required by DES, such as 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 turbine erection, the Project 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 can be found in Appendix 2B of the Application.

Q. In your opinion will this Project have an unreasonable adverse effect on water quality?

A. No, it will not. In our opinion the proposed water quality treatment measures will provide adequate treatment of runoff from the site, and nearby natural resources will be protected. It is therefore our opinion that the Project will not have an unreasonable adverse effect on water quality.

<u>Public Health and Safety During Construction</u>

Q. Please describe how the construction phase of the Project will be handled.

A. The Applicant will retain an experienced general contractor who will have overall responsibility for construction of the Project in accordance with the plans and technical

specifications and all applicable codes, standards and permit conditions. Initial field work will be done, 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. Road construction, which will involve the construction of approximately 4.0 miles of access road, 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 and reviewed and approved by the New Hampshire Department of Safety. Blasting plans typically include advance notification. The plans include 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, particularly during the construction phase?

A. No. In view of the above-described steps that the Applicant 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 complete your testimony?

A. Yes.

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DANIEL T. BUTLER, PE

EDUCATION

B.S., Civil Engineering, University of Maine, 1986
Civil Engineering Graduate Courses, University of Maine, 1995

PROFESSIONAL REGISTRATIONS/CERTIFICATIONS

NCEES Certificate #16505
Professional Engineer, Maine, (#6796), 1990
Professional Engineer, New Hampshire, (#8105), 1991
Professional Engineer, Florida, (#53332), 1998
Professional Engineer, New York, (#079800), 2002
Professional Engineer, Connecticut, (#23045), 2002
Professional Engineer, New Brunswick, Canada, (#L3291), 1998
Professional Engineer, New Jersey, (#24GE04574600), 2005
Professional Engineer, New Mexico, (#17752), 2006
Professional Engineer, Arizona, (#45969), 2007
Professional Engineer, Prince Edward Island, Canada, (#1141), 2007
Professional Engineer, Massachusetts, (#47517), 2008
Professional Engineer, West Virginia, (#18069), 2009
Professional Engineer, Vermont, (#46232), 2009
Professional Engineer, Rhode Island (#9164), 2009
Professional Engineer, Texas, (#106460), 2010
Professional Engineer, Pennsylvania (#PE077437), 2010

AREAS OF EXPERTISE

Mr. Daniel T. Butler, PE has management and technical experience in the following general areas:

- Engineering Management
- Civil & Structural Design
- Project Management
- EPC Project Management
- Preliminary & Conceptual Design
- Condition Assessment
- Engineering Studies
- Equipment Specifications
- Detailed Engineering Design
- Project Scheduling and Estimating
- Spill Prevention, Control & Countermeasure Plans (SPCC)
- Site Layout & Grading
- Foundation Design
- Licensing & Permitting
- Water Management Permitting

REPRESENTATIVE EXPERIENCE
Mr. Butler has approximately 27 years of broad based civil/structural engineering experience with over 10 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; storm water and erosion control management; environmental permitting; and extensive experience with engineering, procurement, and construction (EPC) contracts.

ENGINEER OF RECORD
As Manager of the Civil and Transmission Engineering Department, Mr. Butler's primary duties are those of 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.

Recent projects which Mr. Butler assisted, supervised the civil/structural design effort, and performed as the Civil Engineer of Record includes the following:

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 34.5 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. 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, Massachusetts
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. 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 3000 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.

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 & 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.

Ventus Energy, West Cape & Norway Wind Projects, PEI, 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 345 kV Rebuild, Clay, New York
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 345 kV control house and station service. The transmission reconfiguration included replacement of existing lattice steel structures of several different designs with tubular steel pole structures.

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:

- Site/Civil Design
    - site layout, grading and drainage, utilities
- Roadway Design
- Stormwater Management Design
- Hydrologic and Hydraulic Modeling
- Floodway Analysis
- Construction Plan Preparation

REPRESENTATIVE EXPERIENCE
Mr. Martin is a civil engineer with over ten years of professional consulting experience, with a background in Water Resources, Transportation, and Site-Civil engineering. His project experience includes work in both the public and private sectors, involving residential and commercial development, as well as educational, institutional, municipal, and federal level projects. Mr. Martin's 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. This range of experience provides him with a diverse, well-balanced engineering background. Mr. Martin currently serves as Civil Engineer for the Civil and Transmission Division.

Oakfield II 110 MW Wind Farm: Oakfield, Maine (Civil 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 115kV 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 management and erosion control plans.

Eliot 345kV Switchyard: Eliot, Maine (Civil Engineer)

Mr. Martin was involved in the design of a 345kV electrical switchyard, as part of a regional effort to upgrade the power grid. As the lead civil engineer, Mr. Martin provided civil support to the substation team. His responsibilities included development of the site plan, grading and drainage design, and stormwater management design. He also supported the environmental permitting effort.

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. A conceptual site plan was provided by the client, which was modified as needed. 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.

Gorham Savings Bank at Foreside Place: Falmouth Maine

This project involved the construction of a bank branch at an existing commercial development, with associated infrastructure improvements. The client also wanted to improve the grading and drainage of the existing parking lot. As the project engineer, Mr. Martin's responsibilities included field assessment of existing conditions, grading and drainage design of driveway and parking areas, development of construction drawings, utility design and coordination, stormwater management design, preparation of the stormwater report, and local permitting.

Artificial Turf Fields, University of Maine: Orono, Maine

Mr. Martin was involved in the design and construction of an NCAA field hockey/soccer multi-purpose field, a baseball field, and reconstruction of the football field. The project team worked with the college to determine project requirements and identify existing issues. Mr. Martin was also responsible for

development of construction drawings, coordination with artificial turf manufacturer, athletic field layout, grading and drainage design, utility coordination, stormwater management design and report preparation, and local and environmental permitting.

Lakeview Residence Halls, St. Joseph's College: Standish, Maine

This project involved the construction of two residence halls and associated infrastructure improvements on the main campus. Infrastructure improvements included an access road, parking lots, walkways, utilities and lighting, and stormwater management facilities. As the project engineer, Mr. Martin was responsible for working with the architect to develop a final site layout plan, development of construction drawings, access road and parking lot design, grading and drainage design, stormwater management design (including pervious pavement), preparation of the stormwater report, and local and environmental permitting.

Environmental Science Laboratory, St. Joseph's College: Standish, Maine

This project involved the construction of a single science building, with associated infrastructure improvements. As the project engineer, Mr. Martin was responsible for development of location alternatives for the access road, development of construction drawings, access road and parking area design, grading and drainage design, utility design and coordination, stormwater management design (including pervious pavement), preparation of the stormwater report, and local and environmental permitting.

True Street Subdivision: Portland, Maine

This project involved the creation of a new subdivision and public road from an existing neighborhood along a paper street. As the project engineer, Mr. Martin was responsible for development of construction drawings, roadway design, grading and drainage design, utility design and coordination, stormwater management design, preparation of the stormwater report, and local and environmental permitting. Site design was also coordinated with a separate City of Portland project involving work in Ocean Ave. so that utility connections could be made while Ocean Ave. was still open.

Hammond Lumber: Portland, Maine

This project involved the development of a commercial site with significant challenges, including substantial grade change across the site and groundwater issues. Site improvements included a retail store, a drive-through warehouse, and associated infrastructure. As the design engineer, Mr. Martin was responsible for development of construction drawings, grading and drainage design, utility coordination, stormwater management design, hydrologic and hydraulic modeling, preparation of the stormwater report, and local and environmental permitting.

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. Improvements were based on modification of existing traffic islands by resetting curb, installing stamped asphalt, and restriping. 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.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2012-____

APPLICATION OF ANTRIM WIND ENERGY, LLC

FOR A CERTIFICATE OF SITE AND FACILITY

PREFILED DIRECT TESTIMONY OF DANA VALLEAU

ON BEHALF OF ANTRIM WIND ENERGY, LLC

January 31, 2012

Qualifications

Q. Please state your name and business address.

A. My name is Dana Valleau. My business address is 14 Gabriel Drive, Augusta, Maine 04330.

Q. By whom are you employed and what position do you hold?

A. I am employed by TRC Environmental Corporation ("TRC") and I hold the position of Environmental Specialist.

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 concept to operations. In addition to engineering and historic consulting services, TRC was retained by

AWE to provide project management, perform several avian studies, identify and delineate jurisdictional wetlands and waterways, vernal pools, and wildlife habitat within the Project area to support the design, and layout, of the proposed facilities.

Q. What are your responsibilities with 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. Please describe your education, training and 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 almost 20 years in a wide variety of capacities. I was certified as wildlife biologist in June 2011 through The Wildlife Society, which is 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, which is an international organization of about 3,500 members 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 recent Central Maine Power Company Maine Power Reliability Project and also on the Kibby (Maine Land Use Regulation Commission DP 4794) and the Kibby Expansion (DP 4860) Wind Power Projects.

More information about my education, training and experience is contained in my curriculum vitae which is attached to this testimony and is labeled Attachment DV-1.

Q. Have you previously testified before state permitting agencies?

A. Yes. I have testified before the Maine Board of Environmental Protection on enforcement and licensing issues while employed by the Maine Department of Environmental Protection, and before the Land Use Regulation Commission on behalf of the applicant for the Kibby (DP 4794) and Kibby Expansion (DP 4860) Wind Power Projects.

Purpose of Testimony

Q. What is the purpose of your testimony in this proceeding?

A. My testimony supports the information contained in Antrim Wind Energy LLC's ("AWE") Application to the New Hampshire Site Evaluation Committee ("the Committee") as it pertains to the potential effects of the Project on the natural environment, particularly wetlands, vernal pools and wildlife habitat. I have summarized below the actions that have been taken to map, inventory and review the natural resources at the Project site, analyze potential effects on natural resources, and the plans for mitigating effects.

Q. Are you familiar with the proposed Antrim Wind Energy Power Project (the "Project")?

A. Yes. TRC was engaged by AWE to assess the wetlands, vernal pool and wildlife habitat effects of the Project. In my role overseeing the assessment of these effects, I have been involved in the site planning and have conducted field reviews of the site.

Wetlands and Vernal Pools

Q. Please describe the area that was reviewed for 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. The Town of Antrim has numerous water resources and the area of the Project straddles four watersheds in the town: the North Branch River, Gregg Lake, Willard Pond 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. Willard Pond is about 95 acres in size and part of the dePierrefeu-Willard Pond Wildlife Sanctuary. 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.

Q. Please describe the methodology that was used for conducting an analysis of the Antrim Wind Project's impact on wetlands and vernal pools.

A. The methodology is consistent with the approach used by other experts to determine the impact on wetlands and vernal pools. Field studies were conducted in spring, summer and fall of 2011. The field study reports for wetland and vernal pool studies are included in Appendices 11C and 11D of the Application.

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).

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 I.5.b in the Application.

Q. Please describe the wetlands identified in your surveys.

A. A total of 33 wetlands were identified 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 33 wetlands, 24 are deciduous broad-leaf forested wetlands, three (3) are conifer forested wetlands, two (2) are a mix of forested and scrub-shrub wetland types, and four (4) 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 is included in Appendix 11C of the Application.

Q. How were vernal pools identified and classified?

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 were identified?

A. A total of seven (7) features were identified within the natural resource study area during the vernal pool survey. Five (5) of these were identified as natural vernal pools, one (1) was

identified as a potential vernal pool and one (1) feature was designated as a non-jurisdictional amphibian breeding area. All six (6) natural pools observed occurred in natural isolated basins without an inlet or outlet and no populations of predatory fish. No fairy shrimp were found or documented with any of the identified features, even though they were intensively sought, 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 does the Wetlands Report conclude regarding the Project's anticipated impact on wetlands?

A. The Wetlands Report (Appendix 11C) indicates that the Project will impact nine (9) wetlands either temporarily or permanently. In total, only 0.19 acres (8,350 square feet) of permanent wetland impact (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 resulted from 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 this Project is below the NHDES threshold of 10,000 square feet, no compensatory mitigation is required. Nonetheless, during construction Best Management Practices for working in and near wetlands will be utilized. 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 in Appendix 2B and the

joint USACE/NHDES Standard Dredge and Fill permit application contained in Appendix 2A.

Q. What does the Vernal Pools Report conclude regarding the Project's anticipated impact on vernal pools?

A. The Vernal Pools Report (Appendix 11D) indicates that the Project will not directly impact any jurisdictional vernal pools or areas currently described as potential vernal pools as a result of the construction or operation of the Project.

Q. What steps has AWE taken to mitigate the impact of the Project on wetlands and vernal pools?

A. The first step in mitigating impacts is to avoid and minimize them; this has been a key component of the design for this Project. During the course of study and evaluation of the wetlands and vernal pools at the Project site, the Project's impacts on those resources have been carefully considered and have resulted in a design plan that avoids and minimizes impacts. Antrim 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. 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 Antrim Wind Project have an unreasonable adverse effect on wetlands or vernal pools?

A. No. For the reasons indicated in the Reports and described above, it is my opinion that the Project will not have an unreasonable adverse effect on wetlands or vernal pools.

Natural Communities and Rare Plants

Q. Please describe the methodology that was used for conducting an analysis of the Antrim Wind Project's anticipated impacts on natural communities and rare plants.

A. A two- part approach was used to assess the natural communities in the vicinity of the Project, including a desktop review of available data and a field survey. 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: serial photography, soils mapping, cover type, wetland and stream mapping, aspect and elevation, bedrock geology, ownership and land management, and field surveys. In June 2011, a Natural Community survey was completed by Gilman & Briggs Environmental, Inc., using a modified random point sampling protocol and data form developed in consultation with the NHNHB. This survey was performed for this Project to classify the landscape of the proposed Project into discrete natural communities, and to identify any rare, threatened or endangered plant species. The results of this survey are summarized in Section I.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 I.5.a of the Application.

Prior to field investigations, the NHNHB was consulted 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 performed in 2011. 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. Species of state concern identified by the NHNHB were sickle-pod (*Boecher canadensis*), smooth rock-cress (*B. laevigata*), Carolina cranesbill (*Geranium carolinianum*), climbing fumitory (*Adlumia fungosa*), Douglas' knotweed (*Polygonum douglasii*), smooth sandwort (*Minuartia glabra*), and green adder's mouth (*Malaxis unifolia*). None of these species were found in the area.

Q. What do the Natural Communities and Rare Plant Reports conclude regarding the Project's anticipated impacts on those resources?

A. No significant natural communities or rare plants were identified as a result of our 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. The full study of the community types at the Project area is described in detail in the study report included in Appendix 11A.

Q. In your opinion, will the Antrim Wind 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 impacts to 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 cleared for sheep farming a number of years ago and therefore contains numerous stone walls. After the decline of sheep farming, the site was allowed to regenerate 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 Report indicates that the extensive undeveloped lands and diverse natural resources provide a haven for a wide diversity of wildlife. 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." *See* Application Appendix 18.

Q. Has the Applicant taken any steps that will preserve habitat in the area?

A. AWE successfully negotiated several local land conservation agreements which will protect approximately 685 acres of land in and around the proposed Project. While this was not necessary for mitigation 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 on wildlife habitat?

A. No. For the reasons indicated above, it is anticipated that the Project will not have any unreasonable adverse effects on wildlife habitat.

Q. Does this complete your testimony?

A. Yes.

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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 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

AREAS OF EXPERTISE

Mr. Dana Valleau has experience in the following general areas:

- Project Management
- Permit Applications
- Database Management
- Agency Consultation
- Water / Soil Sampling
- Radio Telemetry
- Remote Sensing and Photo-interpretation
- Wetland Delineation
- Vernal Pool Identification and Documentation
- Fish / Wildlife Studies, including RTE Species
- Hydroelectric Licensing & Compliance
- Wind Energy Environmental Studies and Permitting

REPRESENTITIVE EXPERIENCE

Mr. Dana Valleau has 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, thorough understanding of environmental construction standards, and erosion control Best Management Practices. He is familiar with hydro-electric licensing procedures and requirements as well as wind power environmental studies and permitting.

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.

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.

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 AFFILIATIONS / REGISTRATIONS

- Registered Maine Guide since 1990, Whitewater and Master Classifications.
- CPR/First Aid Certification
- Maine DEP Erosion and Sediment Control Practices Certified (#0129)
- Maine Professional Guides Association, 1996 to present
- Certified Professional in Erosion and Sediment Control (CPESC #2334)
- Certified Volunteer Lake Monitor
- Professional Wetland Scientist (#1590)
- Certified Wildlife Biologist

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2012-___

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

PREFILED DIRECT TESTIMONY OF

DANA VALLEAU AND ADAM J. GRAVEL

ON BEHALF OF

ANTRIM WIND, LLC

January 31, 2012

Qualifications of Dana Valleau

Q. Please state your name and business address.

A. My name is Dana Valleau, and my office is located at 14 Gabriel Drive, Augusta, Maine 04330.

Q. Who is your current employer and what position do you hold?

A. I currently work for TRC Companies as an Environmental Specialist. My responsibilities include project management including 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. Please describe TRC and its experience in conducting avian and bat studies.

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 concept to operations.

TRC has conducted numerous preconstruction avian and bat studies for wind energy projects throughout the United States. TRC has consulted with state and federal biologists to develop protocols that reflect the current thinking on avian and bat issues. TRC staff are assigned based on their familiarity with avian species in a specific geographic region. They perform site work with trained and experienced biologists and prepare assessment reports for avian resources and likely impacts from proposed projects. Most recently TRC has managed radar and bat studies and performed other avian studies on two projects in Maine which were permitted by the Land Use Regulation Commission; the Kibby Wind Power Project (DP 4794) and the Kibby Expansion Project (DP 4860) (collectively the "Kibby Projects").

Q. What are your background, experience and qualifications?

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 almost 20 years in a wide variety of capacities. I was certified as wildlife biologist in June 2011 through The Wildlife Society, which is a nationally recognized certification program for professional wildlife biologists. I managed all of the Kibby Projects studies and performed breeding bird, daytime migrant, and rare raptor

nesting studies. More information about my background, experience and qualifications is contained in my curriculum vitae which is attached to this testimony and is labeled Attachment DV-1.

Q. Have you previously testified before this Committee and/or any other state permitting agencies?

A. I have not testified before this Committee, however I have testified before the Maine Board of Environmental Protection on enforcement and licensing issues while employed by the Maine Department of Environmental Protection, and before the Maine Land Use Regulation Commission on behalf of the applicant for the Kibby Projects.

Qualifications of Adam J. Gravel

Q. Please state your name and business address.

A. My name is Adam Gravel. My business address is 30 Park Drive, Topsham, Maine, 04086.

Q. Who is your current employer and what position do you hold?

A. I am employed by Stantec Consulting ("Stantec") as an Associate/Project Manager. I am responsible for coordinating and conducting wildlife use and impact assessment surveys, with a specific focus on large-scale avian and bat studies associated with wind power projects.

Q. Please describe Stantec and its experience in conducting avian and bat studies.

A. Stantec is an environmental consulting company that provides services to a variety of sectors, including the wind industry. Between 2002 and 2011, the Topsham

Maine office of Stantec[1] conducted over 390 distinct seasons of pre-construction avian and bat studies on behalf of proposed wind projects in twelve states, from Texas to Maine, including New Hampshire. These include 163 seasons of acoustic bat surveys, 124 seasons of nocturnal radar surveys, and 103 seasons of raptor surveys. The Antrim Wind Energy Project ("Project") is the sixth utility-scale project in New Hampshire for which Stantec has conducted pre-construction avian and bat studies. Pre-construction surveys typically include nocturnal radar surveys, acoustic bat monitoring, diurnal raptor surveys, breeding bird surveys, and targeted rare species surveys, depending on specific requests from state and federal resource agencies. 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 also designed and conducted agency-approved post-construction surveys at 10 Projects in Maine, New York, Pennsylvania, West Virginia, and Utah. The post-construction efforts have allowed Stantec to further refine its survey methodology to provide more comprehensive data sets to regulatory agencies and the regulated community. 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 and seeks involvement with regional and national organizations whose sole purpose is to better understand and minimize potential wind energy-associated wildlife impacts.

[1] On October 1, 2007, Stantec acquired Woodlot Alternatives, Inc. Unless otherwise noted, references to Stantec include both Woodlot and Stantec.

Stantec has directly participated in the development and review of proposed guidelines and monitoring protocols sponsored by several state and federal agencies.

Q. What are your background, experience and qualifications?

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. Since 2006, I have been promoted to Associate and manage the wildlife biologists from Stantec's Topsham Maine office. In January 2010, I became a certified wildlife biologist through The Wildlife Society, a nationally recognized certification program for professional wildlife biologists.

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 several nocturnal radar and acoustic bat surveys, diurnal raptor migration and breeding bird surveys, rare plant and natural community surveys, and winter tracking surveys for state-listed species. 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. More information about my background, experience and qualifications is contained in my curriculum vitae which is attached to this testimony and is labeled AJG-1.

Q. Have you previously testified before this Committee and/or any other state permitting agencies?

A. Yes. I provided testimony in the New Hampshire Site Evaluation Committee ("SEC") hearings in the adjudicative hearings for 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) during hearings for the Bull Hill Wind Project (DP 4886) and the Bowers Wind Project (DP 4889) in Hancock, Penobscot, and Washington Counties, Maine. I also provided testimony before the Vermont Public Service Board during hearings for the Kingdom Community Wind Project (Docket # 7628) in Lowell, Vermont and the Georgia Mountain Community Wind Project (Docket # 7508) in Milton, Vermont.

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 this 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 12 D); and
- Bat Mist Netting Survey (Appendix 12E)

Our testimony includes a brief description of the methodology, 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 the Project's Avian and Bat Protection Plan (Application Appendix 12F) which includes proposed post-construction mitigative actions and an adaptive management strategy.

Q. Are you familiar with the Project that is the subject of this Application?

A. Yes, we are familiar with the Project and site. TRC and Stantec, acting as Project wildlife consultants, conducted a number of avian and bat surveys within the Project area. The avian and bat surveys were conducted as part of state and federal permitting processes and included investigations of the Project area ridgelines, the areas proposed for wind turbines, as well as the surrounding area. We have spent a significant amount of time at the Project site selecting survey locations, and setting up field surveys and equipment, as well as conducting some of those surveys. Over the course of these surveys, we have visited nearly all areas along the ridgelines where the turbines are

proposed to be sited, as well as other areas within and adjacent to the boundaries of the Project site.

Avian and Bat Studies

Q. Please explain how the Project determined which wildlife studies to conduct, and how the survey methods/protocols for the on-site avian and bat studies were developed.

A. The State of New Hampshire does not currently have any administrative rules addressing pre-construction wildlife surveys for proposed wind projects. Therefore, in the early spring of 2011, AWE initiated consultation with various state and federal agencies to identify the appropriate scope of studies needed to assess the Project's potential risks to avian, bat and other wildlife species. Those agencies included the United States Fish and Wildlife Services ("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"). As the result of these consultations, the above-listed pre-construction surveys were identified as necessary to assess the Project's potential impacts on avian and bat species. No other specific wildlife surveys were recommended by any of the consulting agencies.

All pre-construction studies were designed based on the best available information related to bird and bat impacts at wind energy projects and to be consistent with the methods and protocols typically recommended by state and federal regulatory

agencies for proposed wind power projects. They were also designed to be consistent with pre-construction surveys conducted in the past at other similar projects in New Hampshire and other New England states. The specific protocol for each study was designed in consultation with USFWS and NHFGD. Draft protocols for surveys of breeding birds, diurnal raptor migration, nocturnal radar, rare raptor nesting and acoustic bat monitoring were provided to each of the consulting agencies in March, 2011. AWE met with consulting agencies on April 6, 2011 to discuss the draft study protocols. Based on that consultation, protocols were revised as appropriate, and the revised draft protocols were provided to the consulting agencies on May 23, 2011. As the result of the April 6th consultation, it was determined that bat mist netting surveys should be performed. A protocol for bat mist netting was subsequently developed and executed in consultation with NHFGD. By letter dated October 13, 2011 (Appendix 18), USFWS responded to the May 23rd draft protocols by indicating that acoustic surveys coupled with bat mist netting surveys (both of which were conducted at the project) "would be valuable at assessing risk of the proposed project and provide the basis for measures to minimize or mitigate for these potential impacts".

Breeding Birds

Q. Please describe the breeding bird surveys conducted in the Project area.

A. Breeding bird surveys were conducted during June, 2011. The goal of the surveys was to document the pre-construction presence, diversity and relative abundance of breeding bird species in the Project area. The surveys used "point count methods" similar to those used for the Vermont Institute of Natural Science's Mountain Birdwatch

Program and Bird Studies Canada's High Elevation Landbird Program. Point counts were conducted along the ridges of Tuttle Hill and Willard Mountain at 12 locations that are representative of habitat types within and adjacent to the Project site. Six of the points were located in close proximity to areas that will be disturbed by the Project's development; the other six were located outside of areas of direct disturbance. Each point count location was visited twice during the study period, and all surveys were conducted at dawn (between 4:30 a.m. and 8:30 a.m.) In addition to formal bird surveys, habitat parameters associated with bird count locations were also quantified using methods accepted by the national Breeding Bird Survey (USGS), among others, for estimating bird populations.

A total of 131 individual birds, representing 25 different species were documented during the formal breeding bird surveys. Fourteen additional species were observed incidentally during other field work which occurred during the summer breeding season. A complete list and relative abundance of the 39 bird species recorded in the Project vicinity during the breeding season is provided in Table I.5.c(a) of the Application.

Q. What conclusions have you drawn based on the field surveys of breeding birds?

A. The assemblage and relative abundance of the birds observed at the Project site during the breeding bird survey period are typical of the region and of the habitat found within the study area. Significantly, no rare birds or birds of conservation concern were observed during formal breeding season surveys. Incidental observations (one auditory and one visual) of the common nighthawk, a state listed endangered species, were made

in the vicinity of Willard Mountain and Tuttle Hill (in areas outside of the area proposed for Project development) in June 2011. These observations were discussed during consultation with USFWS, NHNHB, NHDES and NHFGD on June 21, 2011, however none of these agencies expressed concerns regarding the observations.

Raptors

Diurnal Raptor Surveys

Q. Please describe the diurnal raptor surveys conducted at the Project site.

A. Diurnal migrating raptor surveys were performed during the spring and fall seasons of 2011. The purpose of these migration surveys was to document the numbers, species and flight patterns of migrating raptors within and immediately adjacent to the Project area in order to evaluate the potential for collisions at proposed turbine sites.

The protocol for diurnal raptor migration surveys followed standards set by the Hawk Migration Association of North America and HawkWatch International. The study methods were also consistent with similar studies conducted at other certificated wind energy projects in New Hampshire. Spring surveys for migrating raptors were conducted from mid March through late May of 2011. Fall surveys occurred between mid September and late November 2011. These study periods were chosen in an effort to capture the passage of species such as bald eagles and golden eagles whose migration period is extended beyond the temporal parameters for other raptor species.

Surveys were performed on multiple survey dates during each season. The spring 2011 diurnal raptor migration survey consisted of 65 total hours of observation across 9 dates between March 25 and May 15th. The fall surveys occurred between September 1

and November 20, 2011 and consisted of 147.5 total observation hours. Sampling was performed based upon favorable weather for migration. For example, in spring, fair weather days with southerly or southwesterly winds were favored. In fall, surveys were conducted on fair weather days with strong north to northwest winds, particularly following the passage of a cold front. Data on each survey day were collected for eight consecutive hours between 9 A.M. and 5 P.M. This timeframe encompasses the peak hours of thermal development and associated raptor movement. Detailed raptor observation data were collected continuously during each survey onto specialized data sheets; the flight path of each raptor observed was also recorded on a topographical map of the survey area. Weather conditions (including wind speed and direction) were also recorded at the commencement of and periodically throughout the daily observation periods.

Q. Please summarize the results of the diurnal raptor migration surveys.

A. During the spring surveys, a total of 441 individual raptors representing eleven species were identified within the immediate vicinity of the AWE Project. The vast majority of the individuals observed were turkey vultures; the next most abundant species observed were broad winged hawks and red-tailed hawks. A total of 978 individual raptors representing ten species were identified during the fall surveys. A total of 471 of these individuals were recorded on one date, September 18th. For purposes of comparison, on the same date (September 18, 2011), Carter Hill Observatory in Concord, New Hampshire recorded observations of 7,212 broad-winged hawks, and Pack Monadnock Observatory in Peterborough, New Hampshire recorded

observations of 5,208. Large, temporally-concentrated fall movement of broad-winged hawks is typical in New England. Red-tailed hawks and turkey vultures were the next most frequently observed species during the fall surveys. A list of all species observed during the spring and surveys and their relative abundance is contained in Table I.5.c(b) of the Application.

The overall passage rate during the spring 2011 surveys was 6.78 raptors per hour of effort. The overall passage rate in the fall was 6.63 raptors per hour of effort. Compared to data from the five most comparable hawk watch sites (in terms of proximity and geographic similarity) for which data was available for the same sampling period, we determined that: the spring average passage rate of 6. 78 raptors/hour of effort is comparable to the spring average passage rate of 5.78 raptors/hour of effort among the five regional hawk watch sites; the spring maximum passage rate of 14.25 raptors/hour of effort is well below the regional maximum of 49.08 raptors/hour of effort; the fall average of 6.63 raptors/hour of effort at the Antrim site is well below the regional average of 21.83; and the fall maximum passage rate of 61.75 raptors/hour of effort is significantly lower than regional maximum passage rate of 730 raptors/hour of effort. Full regional passage rate comparisons are contained in Appendix 12B of the Application.

Flight heights were estimated for the individuals that used the areas proposed for the wind turbines (i.e. ridgelines and upper slopes of Tuttle and Willard Mountains) to determine the numbers of raptors that could potentially fly within height range of the turbines. Flight heights were grouped into three categories: 0-50 feet above ground; 50-

500 feet above ground; and 500+ feet above ground. Of the 441 total raptors observed in spring 2011, 216 of them (49%) flew over the area of potential development. Of those, 162 (or 37% of all observations) were determined to have flown within the above ground range of 50-500 feet. The majority (108) of the 162 raptors that flew within this range were turkey vultures. Of the 978 total raptors observed in fall 2011, 460 of them (47%) were observed to fly over the Project area. Of those, 296 (30% of all raptors recorded in the fall) were judged to have flown within the above ground range of 50-500 feet. Of the 296 raptors that flew within this range, 168 were broad-winged hawks; 104 of these hawks passed in "kettles" (large aggregations) on the same date: September 18, 2011.

During the spring and fall raptor migration surveys, the following threatened or endangered raptor species were observed: bald eagle (state threatened); golden eagle (federal and state endangered); peregrine falcon (state threatened); and northern harrier (state endangered). A total of 14 bald eagles were recorded (3 in spring and 11 in fall); 7 of these never flew within the proposed Project area. Of those bald eagles that did fly within the proposed Project area, 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 proposed Project area. The remaining 2 golden eagles were judged to have passed within the 50-500 foot above ground range within the proposed Project area. The single peregrine falcon that was observed in the spring of 2011 did not pass within the proposed Project area. Northern Harriers were documented on 5 occasions in the spring of 2011; 3 of these never flew within the proposed Project area,

while 2 (a male and female together) were judged to have passed within the 50-500 foot above-ground range.

In addition to the threatened and endangered species listed above, three state listed species of special concern were also observed. These are American kestrel, northern goshawk, and osprey. One American kestrel was observed in the spring: it did not fly within the proposed Project area. One northern goshawk was also observed in the spring: it did not fly within the proposed Project area. Ten total osprey were observed (5 in the spring and 5 in the fall). None of the 5 osprey recorded in the spring flew within the proposed Project area. In the fall, one osprey did not fly within the proposed Project area, one flew in the 0-50-foot above ground range, and 3 were judged to have passed within the 50-500 foot above-ground range.

Overall, the observed species assemblage, relative abundance, and passage parameters were as expected for southern New Hampshire. More information about the diurnal raptor migration surveys is contained in Application Appendix 12B.

Rare Raptor Nesting Survey

Q. Please describe the rare raptor nesting survey conducted at the Project site.

A. An assessment of rare raptor nesting within a 10-mile radius of the proposed Antrim Wind Energy Project was conducted in 2011, consistent with USFWS recommendations. The purpose of rare raptor nest surveys associated with the proposed Project was to determine the current status of bald eagle, golden eagle, and peregrine falcon breeding activity in the Project area and surrounding vicinity. Specific study objectives were to:

- confirm presence or absence of bald eagle, golden eagle and peregrine falcon nesting activity at any known nest sites (current or historical) or suitable habitat within roughly a 10-mile radius of the proposed Project;
- monitor the proposed Project vicinity for bald eagle, golden eagle, or peregrine falcon activity that may indicate nesting at previously undocumented sites through incidental observations during other field surveys; and
- map (if found) bald eagle, golden eagle, or peregrine nest site locations within or adjacent to the proposed Project vicinity.

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 decided that rare raptor nest survey for this area should focus on bald eagle nesting. The reasons for focusing on bald eagle nesting were: 1) it was agreed during consultation that peregrine falcon nesting habitat is not found in close proximity to the project; 2) it was also agreed that golden eagle nesting habitat is not found in close proximity to the Project site (such habitat is found in the distant White Mountains and northern portions of the state); and 3) bald eagle habitat is available in the vicinity of the Project and the bald eagle population in New Hampshire is expanding both in numbers and range.

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 slowly as possible. The survey was performed during favorable weather conditions, which consisted of calm to light winds and clear conditions with unlimited visibility.

Q. Please summarize the results of the rare raptor nesting survey.

A. 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. This nest is located approximately 3.2 miles from the southwest end of the proposed Project (corresponding to the proposed location of turbine #10). At least two chicks (in gray down) were also confirmed on the nest during the flight.

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.) The female at the Nubanusit nesting territory was banded as a fledgling (in Massachusetts) in 1992 and has been confirmed present at Nubanusit Lake since 1999; in October of 2011, this female was found mortally injured at 19 ½ years of age. However, it is expected that a new female will occupy the matriarchal vacancy at Nubanusit Lake.

The Nubanusit Lake bald eagle territory is one of 22 occupied territories identified in New Hampshire as of 2010. The number of occupied bald eagle territories has been increasing in New Hampshire: the 22 occupied territories in 2010 represent a "record-high" as of that year, and a one-year increase of 10% compared to the previous high of 20 occupied territories documented in 2009. (New Hampshire Audubon 2010).

Nocturnal Migration

Q. Please describe the nocturnal migration surveys conducted at the Project site.

A. Nocturnal radar surveys for avian migration were conducted 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 level of migration activity, and migrants' flight direction and flight altitude.

A Furuno 12 kilowatt (kW) X-band marine radar was operated from one location (near the meteorological tower on the northeastern end of Tuttle Hill) within the Project area from sunset to sunrise each survey night for the duration of each survey period as outlined below, weather permitting. Marine radars cannot detect targets in heavy or consistent rain, so sampling occurred on nights with generally clear weather which is favorable for migration. However, to adequately characterize the migration season, nights with suboptimal weather for migration (i.e., headwinds, fog, and passing showers) were also sampled. 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 visual 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.

Q. Please summarize the results of the nocturnal migration survey.

A. ***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 within the range of those recorded at other radar studies conducted at other proposed wind projects in the Northeast during the spring migration season. Passage rates at the Antrim Project during spring were at the low end of the range of results of other publicly available radar surveys (range of results = 147 t/km/hr at the Stetson Wind Project in Maine to 1020 t/km/hr at the New Creek Wind Project in West Virginia). Average flight heights were near the middle of the range of results of other publicly available radar surveys (range of results = 210 meters at the Stetson Wind Project in Maine to 552 meters at the Sheffield Wind Project in Vermont). For complete references to the studies specified above as well as other publicly available radar survey results, see Appendix A, Table 5 of Appendix 12C or Appendix 12F of the Application.

Fall Results

The overall passage rate for the entire fall survey period was 138 ± 9 targets per kilometer per hour (t/km/hr). 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 overall season mean passage rate is at the low end of the range of results of other radar studies conducted in the east at proposed wind projects (range of results = 91 t/km/hr at Sheffield Wind Project in Vermont to 811 t/km/hr at the New Creek Wind Project in West Virginia).

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. 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 (range of results = 287 meters at the Kibby Expansion Project (Sisk Mountain) in Maine to 583 meters at the Liberty Gap Wind Project in West Virginia). Nevertheless, the recorded flight height of 203 ± 1 m is still above the proposed turbine height (150 m) for the Project. The nightly average flight height was below the proposed turbine height only on one night (August 24) and at the proposed turbine height on only one night (October 1). However, passage rates on these nights were very low: 38 t/km/hr on August 24 and 4 t/km/hr on October 1.

For complete references to the studies specified above as well as other publicly available radar survey results, see Appendix A, Table 5 of Appendix 12C or Appendix 12F of the Project's Application.

In summary, spring and fall radar surveys in the Project area documented passage rates and migration patterns similar to those recently documented at other proposed wind project locations in New Hampshire including the Groton Wind Project in Grafton County, New Hampshire (average passage rate of 234 t/km/hr in spring 2008 [Stantec Consulting Services Inc. 2008a] and average passage rate of 470 t/km/hr in fall 2008 [Stantec Consulting Services Inc. 2008b]) and the Granite Reliable Wind Project in Coos County, New Hampshire (average passage rate of 342 in spring 2007 [Stantec Consulting Services Inc. 2007a] and average passage rate of 366 in fall 2007 [Stantec Consulting Services Inc. 2007b]) , as well as at other locations in the East. Higher pre-construction passage rates were noted at the Lempster Wind Project which is approximately 12.5 miles from Antrim. Pre-construction nocturnal radar migration surveys at Lempster documented a passage rate of 542 t/km/hr in spring and 602 t/km/hr in fall.

Average flight height also was similar to those recently documented at other locations in New Hampshire (321 m in spring 2008 and 342 m in fall 2008 at Tenney Mountain [Stantec 2008a and b] and 332 m in spring 2007 and 343 m in fall 2007 at a project in Errol, NH [Stantec 2007a and b]). Average flight heights at Lempster were 358 meters in spring and 387 meters in fall. However, average flight height at Antrim was at the low end of the range of flight heights documented at other projects located on forested ridges in the Eastern United States.

More information about the nocturnal migration surveys is contained in Appendix 12C. For specific references to the above mentioned studies, refer to Appendix A, Table 5 of Appendix 12C.

Bat Monitoring

Acoustic Bat Surveys

Q. Please describe the acoustic bat surveys conducted as part of the on-site surveys.

A**.** Passive acoustic bat surveys for the proposed Antrim Wind Energy Project were performed in 2011. The purpose of this passive acoustic bat echolocation monitoring survey was to sample and document bat activity patterns and species composition within the Project area during spring, summer and fall seasons, when bats are known to be active. A total of six bat detectors were deployed in the Project area by April 15, 2011. Two detectors were deployed in the guy wires of an existing meteorological tower at the east end of the Tuttle range. The remaining four detectors were deployed throughout the Project area, suspended from trees along forested corridors and adjacent to wetlands where bats would likely travel or forage. The detectors were removed in late October, 2011.

Anabat II detectors (Titley Electronics Pty Ltd.) were used for data collection 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. Detectors were programmed to begin monitoring at one half hour before sunset each night and end

monitoring at one half hour after sunrise each morning. All data collected was visually inspected to screen out bat calls, and each call file was qualitatively identified to guild and to species, when possible. This method of guild identification represents a conservative approach to bat call identification. Once all call files were identified and categorized in appropriate guilds, nightly tallies of detected calls were compiled to provide an index of bat activity. Detailed weather data as recorded by the meteorological tower on Tuttle Hill was obtained. These data were applied to describe bat activity levels in relation to site-specific weather variables that have been documented to affect rates of bat mortality at operational wind projects in the Northeast.

Q. Please summarize the results of the acoustic bat surveys.

A. ***Spring Results***

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, with May activity increasing relative to April's.

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 the 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. More information about the acoustic bat surveys is contained in Appendix 12E.

Bat Mist Netting Survey

Q. Please describe the bat mist netting survey conducted at the Project site.

A. A bat mist netting survey was conducted in the summer of 2011, subsequent to a consultation with the NHDFG and the USFWS on June 21, 2011. The purpose of the consultation was to agree upon protocol for the mist net survey. The primary objective of this summer survey was to document the potential presence of the eight bat species known to occur in the region. Since there currently is no prescribed protocol for each bat species known to occur in New Hampshire, the federal Indiana Bat Survey Protocol was followed. The bat mist net survey was conducted at four survey sites, as agreed upon during consultation with the agencies. 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 proposed Project area; and one site was located

near the existing meteorological tower on Tuttle Hill, at the northeast end of the proposed Project area. 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.

Q. Please summarize the results of the bat mist netting survey.

A. Complete results of the bat mist netting survey are contained in Appendix 12E. 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 downslope 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 not known definitely, the capture of only a single individual may be evidence of diminished populations of bats as a result of white-nose syndrome (WNS).

White-nose syndrome (WNS) is an emerging disease that has spread throughout the New England states in the past five years and has resulted in the unprecedented decline 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.

Q. Please describe your conclusions regarding the Project's anticipated impacts on birds and bats.

A. Potential impacts to birds and bats during operation of the proposed Project include indirect impacts such as habitat loss through displacement or increased energy demands through turbine avoidance during migration, and direct, turbine-associated mortality through either collision or barotrauma. Indirect impacts, particularly habitat

impacts, have largely been addressed in the siting and design phases of the Project, i.e., no known sensitive ecological resources (such as critical wildlife habitats, major wetlands or other sensitive areas) will be disturbed. Energy expenditures as a result of turbine avoidance are expected to be negligible, given the small area and overall footprint of the Project (10 turbines arranged on approximately 60 acres of development). Thus, we conclude that any potential impacts to birds and bats will result from direct collision with the wind turbines or barotrauma.

Potential Impacts to Avian Species

In the past, wind energy 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 documented 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. In response to this trend, AWE has developed an Avian and Bat Protection Plan ("ABPP") to enable AWE to work continuously with USFWS and NHFGD in order to adapt to actual results and unknown circumstances, so that unexpected events and changes over time may be addressed.

In general, avian mortality documented during post-construction studies at ten wind facilities in New England and New York is low, with a total of 528 avian fatalities (not corrected for searcher or removal biases) documented among all ten facilities. (Costa 2011). The majority of these fatalities were passerines (n=389).

The range of fatality estimates for known wind farms studies in Maine and New Hampshire was reported at 0.44 to 5.95 birds per turbine per study period. (Costa 2011).

Large, episodic avian mortality events have been documented at certain wind projects as well as at tall communication towers, lighted buildings, and other structures. (Shire et al. 2000, Gehring et al. 2009, Avery 1979). In general, the majority of avian collision at existing wind projects tends to occur during spring and fall migration, and appears to involve nocturnally migrating songbirds. As such, impacts to nocturnal migrants tend to occur exclusively at night. Nocturnal avian mortality events have been correlated with inclement weather events and certain artificial lighting scenarios. Project lighting plans, as described in AWE's ABPP, have been designed to minimize lighting-associated mortality events.

While most avian mortality at wind farms tends to be associated with nocturnally migrating songbirds, collisions are also known to occur during the breeding season. Risk of collision for breeding birds is expected to occur primarily during evening or morning courtship behavior, daytime foraging and territory establishment, and during initial flying by juvenile birds. Pre-construction avian studies for the Project generally found avian assemblage and use to be comparable to that of similar (in terms of topography and habitat) areas in the New England region. Based on observations at operational wind projects in the region, bird collisions at the Antrim Wind Energy Project are expected to

occur at a low frequency. In addition, it is our opinion that impacts are not expected to occur at a degree which would adversely affect populations.

Of note, an active bald eagle's nest was documented in 2011, approximately 3.2 miles to the southwest of Willard Mountain. While it is not known whether individuals from this territory pass near the Project area during foraging or other activities, a recent study shows that bald eagles exhibit a high rate of avoidance of operational wind turbines (Sharp et al. 2011). In fact, no bald eagle mortalities have been documented at wind farms in New England to date. Therefore,it is expected that any bald eagles in the Project's vicinity are likely to successfully avoid contact with turbines.

Potential Impacts to Bats

Of the eight species of bats expected to occur in the state of New Hampshire, one (the eastern small-footed bat) is state-listed as endangered, and five (eastern red bat, silver-haired bat, hoary bat, northern long-eared bat, and tri-colored bat) are state species of special concern. Furthermore, 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 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 decline of all six bat species that hibernate in caves or mines in the northeast. *Myotis* species have been most affected by this disease. The total bat fatality recorded during post-construction

studies at ten wind farms in New England and New York was 1114 (not corrected for searcher or removal biases). The majority of these fatalities appear to have been recorded in New York, where the number of bat fatalities ranged from 0.7 to 40.4 bats per turbine per study period; in Maine and New Hampshire, the number of bat fatalities recorded ranged from 0.17 to 5.51 bats per turbine per study period. (Costa 2011).

Long distance migratory bat species are thought to be the most vulnerable to collision mortality at wind projects in general based on results of mortality surveys at operational projects. (Costa 2011). Long-distance migratory bats that are expected to occur within range of the Project include the eastern red bat, silver-haired bat and hoary bat. Although the majority of documented bat fatalities at existing wind projects is related to long-distance migratory species, some mortality among resident bat species is also associated with the spring and fall migration periods, and during the summer pup rearing period. Bat fatalities at wind farms are also known to be affected by other factors, such as weather variables. It has been shown that most bat fatalities tend to occur during low wind speeds over relatively short periods of time. (Arnett et al. 2008).

Operational measures which curtail turbine cut-in at low wind speeds between dusk and dawn have been shown to reduce bat mortality at some wind farms. Baerwald, et al. (2009) found that curtailment of turbines at low wind speeds reduced bat fatalities by between 57% and 60%. Studies performed at the Casselman Wind Project in Pennsylvania found that curtailment reduced bat

fatalities at individual turbines at rates from 44% to 93%. (Arnett et al. 2010). Arnett et al. (2010) concluded that curtailing operations offers an effective mitigation strategy for reducing bat fatalities at wind energy facilities. For this reason, AWE's ABPP proposes a study to assess an operational curtailment strategy to minimize bat fatality at the Project, should actual fatalities materialize and mitigation is deemed appropriate.

Based on the accumulated knowledge of bat mortality at wind farms in New England, mortality at the Project is expected to be low. In light of the WNS epidemic, however, the level of biologically significant mortality may change and therefore will be addressed during the adaptive management process as implemented by the ABPP.

Avian and Bat Protection Plan

Q. Please describe the Avian and Bat Protection Plan ("ABPP") proposed for the Project.

A. The complete ABPP is contained in Appendix 12F. It describes actions the Project has taken and will take to avoid, minimize and mitigate impacts to avian and bat species. The ABPP also includes an adaptive management strategy.

Development and Construction Phase Avoidance and Minimization

Several avoidance and minimization measures have been or will be executed during Project siting, design, construction and maintenance in order to avoid or minimize risk to avian and bat species. The Project will be constructed on previously impacted lands (as recently as 2010 by industrial timber harvesting), thereby greatly reducing the overall

impact of Project construction and development on natural habitats. Final turbine layout and facility design has taken into account the findings of biological assessments and has avoided identified sensitive areas (such as wetlands and vernal pools) to the extent feasible. The final design also effectively balances financial considerations with minimization of impacts to avian and bat species.

Operational lighting will be minimized to the maximum extent practicable. Project design will incorporate minimum intensity lighting on all Project structures where feasible. Turbine lighting will be minimized to the maximum extent practicable and will be limited to that required by the Federal Aviation Administration ("FAA") or as required to meet other safety concerns. Permanent meteorological tower(s) will also utilize the minimum lighting as required by the FAA.

Tree clearing activities will be timed, to the extent possible, to minimize impacts to bats and birds. Tree clearing is generally anticipated to be conducted between November 1, and March 31; this timing will avoid mortality of roosting bats, most nesting birds, and their respective young in the event that maternity roost or nesting trees are felled. Furthermore, prior to any tree removal, the limits of proposed clearing will be clearly demarcated with flagging tape, orange construction fencing, or similar. This will prevent inadvertent over-clearing and minimize the extent of tree removal.

Avian and Bat Enhancement Options

AWE is providing for the permanent conservation of 685 acres of undeveloped forest land immediately adjacent to the Project area. This significant conservation amenity represents a contribution to preserving wildlife and habitat in the area, and will

help sustain local wildlife populations. It also represents a direct benefit to local bird and bat species which rely on undeveloped forested areas for foraging, nesting and roosting. Furthermore, the Project represents a new source of clean, renewable energy that will displace output from fossil fuel generation plants, which produce environmental pollutants that negatively affect regional air and water quality. A study conducted by Resource Systems Group, Inc. determined that there are significant avoided air emissions that may be expected to result from the operation of the proposed Project. Among these displaced emissions are over 59,000 tons of carbon dioxide, and an additional 150 tons of sulfur dioxide, nitrogen oxides, particulate matter and other toxins on average each year. The Project is also expected to save approximately 17,500,000 gallons of fresh water each year due to the displacement of fossil fuel energy facilities that consume water. These enhancements to air and water quality, together with the conservation amenity, will constitute a significant net benefit to the environment and the species which depend on it, including birds and bats.

Post-Construction Evaluation and Management

Management of risk to avian and bat species will begin with a post-construction Evaluation Phase. The Evaluation Phase will coincide with the first year of operations, beginning on the Project's Commercial Operations Date ("COD"). The COD is expected to occur in the fall of 2014. Objectives during the Evaluation Phase will include:

- documenting baseline mortality rates and patterns for birds and bats;
- evaluating potential mitigation options including the effectiveness of turbine curtailment at low wind speeds to reduce mortality; and

- assessing the cost of implementing such a curtailment program.

Management objectives to be assessed during the Evaluation Phase will be analyzed separately across the following management groups:

- long-distance migratory bats,
- other bat species,
- nocturnally migrating birds,
- breeding birds,
- bald and golden eagles, and
- diurnally migrating raptors.

For each management group, the overall management objective is to avoid, minimize and/or reduce mortality rates in a scientifically sound and commercially reasonable manner. The Evaluation Phase will require rigorous post-construction field evaluations, including a post-construction mortality survey, a post-construction acoustic bat monitoring survey, and a curtailment evaluation study. These studies are described in Section 7 of Appendix 12F. Taken together, these studies will correlate bat activity with mortality rates at specific turbines and assess the effectiveness of reduced cut-in speeds (curtailment) at reducing bat mortality. These studies will also serve to establish baseline mortality rates for all avian and bat species at the Project and assist AWE, USFWS and NHFGD in establishing thresholds of mortality that will trigger the adaptive management process.

At the conclusion of the Evaluation Phase, AWE will work with consulting agencies (USFWS and NHFGD) to develop more specific management objectives for

each identified species group, if warranted. Management determinations will take into account: baseline mortality rates in comparison to those documented at other wind projects; potential ecological impacts of baseline mortality rates, including cumulative impacts; and the degree to which management actions are feasible and effective in reducing mortality. Management of risk to avian and bat species over the life of the Antrim Wind Energy Project will be guided by an adaptive management strategy. This strategy is described in detail in Section 9 of Appendix 12F.

Additional Mitigative Actions for Bats

Bat fatalities directly attributable to the Antrim Wind Energy facility are expected to be low, based on the results of pre-construction surveys and the precedents at other facilities in the state and in New England. (Costa 2011). Despite this expectation, AWE is offering to assess and implement (if Evaluation Phase studies and consultation deem such measures feasible, practical and effective) an operational curtailment protocol as a means of reducing risk to bat species. AWE offers this mitigative action approach in lieu of committing to a multiple-year mortality study. AWE believes that such a multiple-year study is inappropriate because it will either:

- Cost more than life-of-project curtailment to determine that fatality is low and that no mitigation is needed, or;
- Cost more than life-of- project curtailment to determine that fatality is biologically significant and that mitigation is necessary.

Alternatively, AWE believes that the curtailment study is a better use of limited post-construction biological funds. Not only will it have more scientific and commercial value,

but it will enable the Project to implement, if deemed necessary during the Evaluation Phase, timely operational mitigative measures which are known to reduce risk to bats, rather than simply to perform studies that will result in no-action (at best) or the same (at worst).

In light of recent population declines as a result of white-nose syndrome in bats, even low mortality of some species could possibly become biologically significant over the life of the Project. The operational mitigative strategy within the ABPP, in the form of curtailment, may help to avoid and reduce impacts to bats most susceptible to the WNS such as the *Myotis* species. This strategy may also reduce risk to the resident and migratory bats which may use the Project area. The actual implementation of an operational mitigative strategy in the form of turbine curtailment will be assessed during an Evaluation Phase, following the completion of the curtailment study. Questions about if and how long-term curtailment measures should be implemented at the Project will be made in consultation with USFWS and NHFGD via the adaptive management process described in Section 9 of Appendix 12F.

Should AWE, NHFGD and USFWS agree that an operational control measure is warranted based on the results of the Evaluation Phase, the parties will determine the most appropriate curtailment parameter for implementation. Depending on patterns and species composition of bird and bat mortality documented during the Evaluation Phase, parameters of curtailment (such as cut-in wind speed, daily and nightly timing of curtailment, seasonal timing of curtailment, and numbers of turbines to curtail), may be adjusted to best manage potential risk to particular species or species groups while

maintaining Project viability and maximizing the clean energy benefit realized by the Project. If any unforeseen, biologically significant events occur over the life of the Project, then manipulation of curtailment strategy may be considered (among other potential solutions, as appropriate) during the phased consultation process. Again, any changes in the curtailment strategy must balance Project financial viability with positive outcomes for birds and/or bats, and must be agreed upon by all parties participating in the phased consultation process.

Throughout the implementation phase, AWE will record and retain turbine operation and weather data to document the amount of time that turbines are curtailed at various seasons. This information will provide a means of tracking the cost of the management actions implemented at the Project and will provide consistent data on the degree to which "high risk" conditions for each species group are being avoided. AWE may propose to modify Project curtailment procedures should viable future technology, such as acoustic or visual deterrents or blade design innovations, be developed that will reasonably and cost effectively reduce impacts to birds and bats. Any such potential changes to Project operations will be proposed and/or initiated by AWE and will need to be vetted and agreed to by all parties participating in the phased consultation process. If this occurs, additional monitoring may be warranted to document the effectiveness of any new measures.

In the event that bat mortality at the Project is found to be very low during the implementation period, and that operational controls are not making a significant contribution to lowering mortality, AWE reserves the right to propose alteration or

suspension of the curtailment regime. Likewise, if conditions change over the life of the Project which cause operational controls to financially jeopardize continued operation, then AWE may propose financially viable alternatives to the current regime. Any such proposal would be subject to the phased consultation process.

Additional Mitigative Actions for Birds

AWE has worked cooperatively with the relevant agencies and implemented the most current available scientific knowledge, technology and survey methods into the development and definitive planning of the Project. Furthermore, AWE has committed to pursuing the most feasible risk avoidance and minimization techniques for avian species through the measures outlined in the ABPP, and has committed to the permanent conservation of 685 acres of forested that provide valuable habitat for avian species as well as other wildlife. For these reasons, AWE does not believe any further operational mitigation for avian species is warranted at this time.

Adaptive Management Strategy

The state of knowledge regarding avian and bat interactions at wind farms on the forested ridges of the northeast is still evolving. Likewise, the technology available to mitigate risks to birds and bats at wind farms is continuously developing as the science matures. Furthermore, the population status of a given species is dynamic, as exemplified by the population impacts to bats incurred by white-nose disease and the increase in bald eagle populations in the northeast in recent years. As such, the biological significance of individual losses can change over time.

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.

The adaptive management process needs to take into account impacts to Project operations. Any additional controls will need to be supported not only by science, but by economic considerations that ultimately determine the Project's viability. Project adaptation should not only be geared toward additional controls, but also should take into account positive outcomes such as the documentation of minimal impacts to wildlife. Adaptive management will be guided by: formal post construction study results documented during the year-one 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 WMMP, the IAP and the phased consultation process are described in detail in Appendix 12F. Generally, the phased consultation process will be initiated by an alert from AWE as prescribed by the IAP. Under unforeseen circumstances, however, the phased consultation process may be initiated based on the results of annual reporting under the provisions of the WMMP. The phased consultation process is also the mechanism by which evaluation phase studies and recommendations

will be assessed. This process must seek solutions which balance Project financial viability and ability to operate with positive outcomes for avian and bat species.

Q. Do you have an opinion regarding whether the ABPP with adaptive management combined with a year of post-construction fatality monitoring is preferable to other post-construction plans or surveys that have been developed for other wind projects to address the issue of avian and bat mortality?

A. Yes. We believe the ABPP presented by AWE and discussed herein is a superior plan for addressing potential avian and bat mortality in a meaningful, targeted manner. Traditional post- construction monitoring programs that we have seen implemented at other wind projects merely document actual project impacts. Such monitoring (i.e. without an adaptive management component) does not provide a mechanism to use the information gained during post-construction surveys to address fatalities. In contrast, AWE's ABPP is structured around an adaptive management framework and includes detailed provisions for avoiding, reducing, and, if warranted, mitigating for potential impacts to birds and bats based on the outcome of the year of post-construction monitoring. Thus, because the AWE ABPP would actually implement measures at the Project that have been shown in practice to be effective at addressing avian and bat mortality, we believe it is much more appropriate and valuable than the traditional approach, which merely replicates pre-construction surveys at substantial cost to the Project and with no action steps intended to reduce mortality.

To date no studies have been able to link pre-construction survey results to post-construction fatality rates. Nor is there any evidence to suggest that conducting pre-

construction type surveys again after construction will establish credible information on avian or bat populations in the area, or that such knowledge, if it were obtainable, would be useful in reducing impacts to birds and bats. Therefore, replicating pre-construction studies after a project commences operations in the hope of determining the impact of a project on the composition of bird and bat populations in the region is inappropriate for several reasons. First, because pre-construction surveys are not capable of determining regional population levels[2], post-construction surveys cannot determine impacts to those population levels. Further, bat acoustic and nocturnal radar surveys cannot differentiate between individuals, so site-specific population levels cannot be determined. Moreover, even if regional population levels could be ascertained from studying the limited geographic area of a wind project, recent studies conclude that bird mortality caused by collisions with man-made structures has no discernable effect on North American bird populations[3]. Thus, replication of pre-construction surveys after a project commences operations will serve no useful purpose. On the other hand, because the AWE ABPP includes mitigative action steps intended to reduce avian and bat mortality, we believe it

[2] For example: 1) raptor surveys provide information about raptors' use of the project area, not the overall population of raptors in the area; 2) radar surveys do not identify whether targets are birds or bats, so these surveys will not provide any information on population sizes; 3)while breeding bird surveys may address population levels on a site-specific basis, they are most likely to provide habitat shift information rather than population change information; 4) acoustic bat surveys focus on migratory activity and therefore have the same limitations as raptor surveys, i.e. they provide usage not population information; and 5) typical bat mist netting surveys are intended to determine presence or probable absence of rare species, not to establish population estimates.

[3] Arnold, T.W. and Zink, R.M., "Collision Mortality Has No Discernable Effect on Population Trends of North American Birds." (Sept. 9, 2011). The Arnold and Zink study focused on bird mortality caused by collisions with tall buildings and cell towers. The results of their study should also apply to mortality caused by wind turbine collisions given that the American Bird Conservancy estimates that the number of such collisions in the United States is orders of magnitude smaller than collisions with other man-made structures and vehicles. *See* www.abcbirds.org/abcprograms/policy/collisions/index.html.

is a scientifically superior post-construction option than the replication of pre-construction surveys which, as indicated above, have no predictive value.

The scientific community now understands that weather factors (e.g. fog, cloud cover, storm fronts) or project variables (facility lighting) have been shown to be more important in predicting bat fatalities than simply knowing the number of individuals in the area. Importantly, the AWE APBB addresses these factors to the extent possible. These factors, while potentially difficult to measure or predict, can be adapted to with protocols such as those proposed in AWE's APBB.

We believe the AWE ABPP 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 ABPP will better advance the science of avian and bat protection around wind farms. By implementing mitigation through adaptive management, the ABPP will reduce impacts to bat species in a direct and timely manner from the start of operation. In light of these realities, we greatly prefer the AWE ABPP to the traditional post-construction approaches at other wind projects.

Conclusion

Q. What is your opinion on the issue of whether the Project would create an unreasonable adverse affect 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 plan for protecting avian and bat species, it is our conclusion that the AWE Project will not have an unreasonable adverse impact to any bird or bat populations.

Q. Does this conclude your testimony?

A. Yes.

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Adam J. Gravel

Associate/Project Manager, Certified Wildlife Biologist

Mr. Gravel is an Associate/Project Manager at Stantec 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 and manages Stantec's New England-based wildlife biologists. 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. 2007-present. Associate/Project Manager.
- Woodlot Alternatives, Inc. 2004-2007. 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, 2011

REGISTRATIONS

Certified Wildlife Biologist, The Wildlife Society

PROJECT EXPERIENCE

Natural Resource Services

Nocturnal Avian Migration Study, Milton, Vermont

As Project Manager for the proposed 4.5 megawatt Georgia Mountain Community 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.

Avian Radar, Acoustic Bat, and Breeding Bird Surveys, Grafton County, New Hampshire

As Project Manager for the proposed Groton Wind Project, Mr. Gravel 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.

Wildlife Studies, Somerset County, Maine

As the Technical Lead for the Highland Wind Project wildlife studies, Mr. Gravel was responsible for coordinating wildlife studies, including nocturnal radar migration surveys, acoustic bat surveys, raptor migration surveys, and rare, threatened, and endangered species surveys. He acted as a liaison between the client and state and federal resource agencies to develop work plans and avoidance and minimization measures during the planning phase of the project. Mr. Gravel also assisted in generating permit application materials for the project.

** denotes projects completed with other firms*

Adam J. Gravel

Associate/Project Manager, Certified Wildlife Biologist

Nocturnal Avian and Bat Studies, Aroostook County, Maine

As the Technical Lead for the Mars Hill nocturnal avian and bat studies, Mr. Gravel acted as Technical Lead during the planning process and was responsible for avian and bat studies, including nocturnal radar migration surveys, acoustic bat surveys, raptor migration surveys, and morning bird stopover surveys. He also assisted in the design of a post-construction avian and bat monitoring program.

Nocturnal Migration Surveys, Galloo Island, New York

As Project Manager for the nocturnal migration surveys conducted to determine site suitability for this proposed wind energy project located on Galloo Island in Lake Ontario, Mr. Gravel negotiated and designed a marine radar survey reflective of the unique location of this island site. Solutions to transport, maintain, and cover the site were carefully determined in order to produce one of the most extensive migration surveys to date, successfully documenting avian abundance, flight patterns, and flight altitudes surrounding the site. Mr. Gravel and his project team were praised for their thoroughness and insights provided to state agencies.

Natural Resource Studies, 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.

Site Evaluation and Impact Analysis, Biddeford Pool, Maine

Mr. Gravel served as the Technical Lead overseeing an extensive desktop review of the known effects of boardwalks on wildlife, and a habitat assessment to characterize existing ecological conditions within the project area and potential impacts to bird habitat due to use of the spur by the public. Using the results of this work, Mr. Gravel provided the client with recommendations to minimize and avoid impacts to birds in the area during construction and use of the boardwalk, and provided a report to the Maine Department of Environmental Protection discussing the results of the desktop and field analyses, which led to the approval of the construction permit.

Avian and Bat Studies, Washington County, Maine

Mr. Gravel acted as Technical Lead responsible for avian and bat studies during the planning process of this 57-megawatt generation facility consisting of 38 turbines on a 6.5-mile, low elevation ridge in Washington County, Maine. He also assisted in the design of a post-construction avian and bat monitoring program.

Environmental Surveys and Permitting Support, New Hampshire

As the Project Manager, Mr. Gravel was responsible for coordinating and conducting environmental surveys and providing permitting support for the 24 megawatt Lempster wind project, the first in New Hampshire. Tasks included developing and negotiating work plans with agencies, performing avian and 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.

Wildlife Surveys and Feasibility Study, Roxbury, 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 feasibility studies, wetland delineations, wildlife impact studies, noise and visual impact assessments, and helped to coordinate all state and Federal environmental permitting which resulted in a development permit for the project.

** denotes projects completed with other firms*

Adam J. Gravel

Associate/Project Manager, Certified Wildlife Biologist

Bird and Bat Surveys and Impact Studies, Lowell, Vermont

Mr. Gravel collaborated with Green Mountain Power and the Vermont Department of Fish and Wildlife to develop study plans, manage studies, and conduct radar surveys for nocturnal migrants, diurnal raptor surveys, breeding bird surveys, acoustic surveys for bats, and habitat assessments for the state-threatened small-footed bat as part of pre-construction project planning and permitting. He assisted with the integration of project-specific survey results and regional data and known wind/wildlife impacts to develop a Risk Assessment for birds and bats. He also helped develop a post-construction mortality monitoring program widely accepted by state and federal agencies. Mr. Gravel participated in the Act 248 permitting process, developing discovery responses and provided expert witness testimony for the Vermont Public Service Board, a process that successfully resulted in a development permit for the Project.

Wind Farm Development Bird and Bat Surveys and Impact Studies, Mid-Atlantic, New England, Pennsylvania, Ohio, and New York

Mr. Gravel has managed and conducted pre-construction wildlife impact assessments at proposed wind energy projects at multiple sites in the Mid-Atlantic, New England, Pennsylvania, Ohio, West Virginia and New York. These assessments include habitat analyses, critical issues analyses, nocturnal migration surveys using marine radar, acoustic bat surveys, breeding bird surveys, raptor migration surveys, and ecological community characterizations. Mr. Gravel has effectively served as liaison between clients and regulatory agencies to ensure that studies and monitoring plans are in accordance with federal and state guidelines. Study results and determinations of risk have been provided to clients to assist with their project planning and permit applications in compliance with applicable local, state, and federal natural resource regulations. Mr. Gravel has also provided expert witness testimony for projects in Vermont and New Hampshire.

Adam J. Gravel

Associate/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.

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., 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.

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.

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 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

AREAS OF EXPERTISE

Mr. Dana Valleau has experience in the following general areas:

- Project Management
- Permit Applications
- Database Management
- Agency Consultation
- Water / Soil Sampling
- Radio Telemetry
- Remote Sensing and Photo-interpretation
- Wetland Delineation
- Vernal Pool Identification and Documentation
- Fish / Wildlife Studies, including RTE Species
- Hydroelectric Licensing & Compliance
- Wind Energy Environmental Studies and Permitting

REPRESENTITIVE EXPERIENCE

Mr. Dana Valleau has 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, thorough understanding of environmental construction standards, and erosion control Best Management Practices. He is familiar with hydro-electric licensing procedures and requirements as well as wind power environmental studies and permitting.

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.

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.

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.

<u>Other Experience</u>

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 AFFILIATIONS / REGISTRATIONS

- Registered Maine Guide since 1990, Whitewater and Master Classifications.
- CPR/First Aid Certification
- Maine DEP Erosion and Sediment Control Practices Certified (#0129)
- Maine Professional Guides Association, 1996 to present
- Certified Professional in Erosion and Sediment Control (CPESC #2334)
- Certified Volunteer Lake Monitor
- Professional Wetland Scientist (#1590)
- Certified Wildlife Biologist

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2012-___

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

PREFILED DIRECT TESTIMONY OF ROBERT D. O'NEAL

ON BEHALF OF

ANTRIM WIND, LLC

January 31, 2012

Qualifications:

Q. Please state your name, position 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, Maynard, Massachusetts.

Q. Please summarize educational background, professional experience and qualifications.

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 am a Certified Consulting Meteorologist, and have over twenty years 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.

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.

More detailed information concerning my education, background and experience is contained in my curriculum vitae which is attached to this prefiled testimony and labeled Attachment RDO-1.

Q. Have you ever testified before the New Hampshire Site Evaluation Committee?

A. Yes. I testified on the issue of sound at the New Hampshire Site Evaluation Committee's ("SEC's") adjudicative hearings on the application for a certificate of site and facility filed by Groton Wind, LLC.

Q. What is your involvement and responsibility with respect to the proposed Antrim Wind Project?

A. I am a consultant to the Antrim Wind Project and have responsibility for evaluating and assessing the sound impacts associated with the operation of Antrim Wind's proposed wind farm.

Purpose of Testimony

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to address the potential noise impacts related to the Antrim Wind Project and to convey the results of Epsilon's Sound Level Assessment Report which is contained in Appendix 13A to Antrim Wind's SEC Application.

Q. Are you familiar with the site of the proposed Antrim Wind facility?

A. Yes. I have reviewed the site plans and discussed the Project with representatives of Antrim Wind. In addition, I visited the site to determine some of the closest potentially sensitive receptors in all directions surrounding the wind farm that might be impacted by Project noise emissions. For general residential locations, we relied upon a map (shown on Figure 5-1 of Appendix 13A) produced by Epsilon. The location of each residence was identified by Antrim Wind and shared with Epsilon through GIS mapping. This map

identifies all structures within a two kilometer radius (~1.25 miles) in any direction of each wind turbine.

Q. Have you or persons under your supervision conducted any assessments or evaluations related to the potential noise from the operation of the Antrim Wind Project?

A. Yes. Epsilon conducted a comprehensive sound level assessment to evaluate the potential noise from the operation of this Project. Existing sound levels were measured at five locations intended to be representative of nearby residences in various directions from the proposed wind farm. These measurements were taken from September 16, 2011 to October 4, 2011 to establish background sound levels as a function of wind speed prior to operation of the proposed wind farm. This was done in order to document existing sound levels in the community, and to help place the predicted sound levels from the Project into context. Figure 5-1 of Appendix 13A to Antrim Wind's SEC Application 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. Each background sound level monitoring location is described below.

- Location 1 - 354 Keene Road (Route 9). This location is approximately 2,900 feet from the closest proposed wind turbine (#1) and is representative of the nearest residences to the north of the wind farm along Route 9.

- Location 2 – 47 Loveren Mill Road. This location is approximately 5,500 feet from the closest proposed find turbine (#1) and is representative of the nearest residences to the north of the wind farm along Loveren Mill Road, set far back from traffic on Route 9.

- Location 3 – Salmon Brook Road. This location is approximately 4,200 feet from the closest proposed wind turbine (#5) and is representative of the nearest residences to the west of the wind farm along Salmon Brook Road.

- Location 4 – 72 Reed Carr Road. This location is approximately 3,600 feet from the closest proposed wind turbine (#1) and is representative of the nearest residences to the east and northeast of the wind farm along Reed Carr Road and Craig Road.

- Location 5-- Gregg Lake Road. This location is approximately 8,700 feet from the closest proposed wind turbine (#8) and is representative of the residences to the southeast of the wind farm along Gregg Lake Road to the north of Gregg Lake.

In addition to the background sound measurements at the above-described locations, Epsilon modeled sound levels that are expected to be produced as the result of the operation of all ten wind turbines at 154 of the closest community receptors including residences, all of which are at least 2,600 feet (one-half mile) away from the nearest wind

turbine. Epsilon also modeled sound levels throughout a large grid of over 200,000 receptor points within an area approximately 8 km by 10 km.

Q. Please describe the noise assessment studies conducted for this Project.

A. The anticipated noise impacts associated with the Project were predicted using the Cadna/A noise calculation software (DataKustik Corporation, 2005). This software uses the ISO 9613-2 international standard for sound propagation. The benefit of this software is a more refined set of computations due to the inclusion of topography, ground attenuation, multiple building reflections, drop-off with distance, and atmospheric absorption. The turbine locations and terrain height contour elevations in the surrounding area were directly imported into Cadna/A. This allowed for the consideration of terrain shielding where appropriate. Acciona AW116/Class II/300 wind turbines were modeled using the manufacturer-provided broadband sound power level with respect to wind speed.

As indicated above, sound levels anticipated from the operation of all ten wind turbines were modeled at 154 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 described above were also covered by the modeling points. Sound levels were computed assuming that the receptors are always located directly downwind from all turbines simultaneously. This is a physical impossibility but provides conservative results and is required by the ISO 9613-2 calculation methodology. The modeled locations and results of the sound level modeling are depicted on a sound level

contour map depicted in Figure 7-1 of Appendix 13A of the Antrim Wind SEC Application. 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. Please describe the standards used to evaluate the potential sound impacts of the Antrim Wind Project.

A. Typical noise evaluation criteria or guidelines relate to how much the Project changes sound levels over existing background (relative change), or by comparison to an absolute standard. While there are no state or local noise regulations that apply to this wind Project, several noise conditions have been imposed by the New Hampshire Site Evaluation Committee in its orders on applications for certificates of site and facility filed by other wind energy facility developers, examples of which are set forth below.

<u>Lempster Wind – Noise conditions (in Town of Lempster Agreement)</u>

1. Audible sound from the project shall not exceed 55 dBA measured at 300 feet from any existing occupied building, or at the property line if the property line is less than 300 feet from an existing occupied building for non-participating landowners.

2. Sound pressure levels shall not be exceeded for more than 3 minutes in any hour of the day, for non-participating landowners.

3. If the existing ambient sound pressure level exceeds 55 dBA, the standard shall be ambient dBA plus 5 dBA.

4. Sound from the project immediately outside any residence of a non-participating homeowner shall be limited to the greater of 45 dBA or 5 dBA above the ambient sound level, for non-participating landowners.

5. These thresholds set out in an agreement between Lempster Wind and the Town of Lempster were modified by the NH SEC to a level of 45 dBA.

Groton Wind – Noise conditions

1. Sound levels generated by the Project at the outside facades of homes should not exceed 55 dBA or 5 dBA greater than ambient, whichever is greater, in daytime and 45 dBA or 5 dBA greater than ambient, whichever is greater, at night.

2. Sound levels generated by the Project shall not exceed 40 dBA or 5 dBA greater than ambient, whichever is greater as measured within current boundaries of the Baker River Campground.

3. Any landowner may waive the noise restriction set forth in the SEC Certificate by signing a waiver of their rights, or by signing an agreement that contains provisions providing for a waiver of their rights.

In addition to the foregoing standards adopted by the SEC, there are two other useful guidelines for putting sound levels into perspective. The first 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 Leq[1] of 55 dBA to prevent serious annoyance and an Leq 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 Leq of 45 dBA, so that people may sleep with bedroom windows open.

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 Ldn[2] 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 Ldn of 55 dBA.

Q. Please summarize the results of your sound studies regarding the Antrim Wind Project as they relate to the standards described above.

[1] Leq, the equivalent level, is the level of a hypothetical steady sound that would have the same energy (i.e. the same time-averaged mean square sound pressure) as the actual fluctuating sound observed.

[2] Ldn is the average equivalent sound level over a 24 hour period, with a 10 decibel penalty added for noise during the nighttime hours of 22:00 to 07:00.

A. Epsilon's findings and assessment are contained in a report entitled "Sound Level Assessment Report" dated November 17, 2011 and submitted with the Antrim Wind Application as Appendix 13A. A review of Table 7-2 of Epsilon's Sound Level Assessment Report shows that the sound level at a hunting cabin (which is the closest structure to the site and not generally occupied) will be approximately 43 dBA, and that at all residences, sound will be at or below 41 dBA under worst-case operating conditions.

Information from Table 7-3 shown below indicates the predicted sound levels attributable to full wind turbine operations, as modeled by the Cadna/A program at the five monitoring locations.

Table 7-3 Cadna/A Modeling Sound Level Results – Ambient Monitoring Locations

Location	**10 Wind Turbines (dBA)**
Location L1 – Keene Road	40
Location L2 – Loveren Mill Road	35
Location L3 – Salmon Brook Road	42
Location L4 – Reed Carr Road	39
Location L5 – Gregg Lake Road	33

Because the predicted worst-case sound levels from the Antrim Wind Project will be below 45 dBA at all occupied buildings, the Project will easily meet the acceptable noise levels applied by the SEC to the Lempster and Groton Wind Projects. It will also

meet the World Health Organization's 45 dBA night time guideline for residential locations, and the US EPA guideline of 48.6 dBA.

Q. Did you study any other sources of sound from operation of Antrim Wind besides the wind turbines themselves?

A. Yes. There will a substation constructed as part of the Project. We have analyzed sound impacts of the voltage step-up facilities that will be needed to interconnect the 34.5 kV line bringing power from the Antrim Wind Project with the regional power grid.

Q. Please describe any studies you have conducted regarding the above-referenced interconnection facilities.

A. A sound level modeling study was conducted for the substation. The primary source of sound at the substation will be the transformer. Sound level data from a typical transformer sized for this site were used to predict future operational sound levels at the nearest residents in all directions around the substation. The worst-case (loudest) mode of transformer cooling was assumed in the modeling. No barrier walls were included around the transformer to be conservative.

Q. Have you prepared a report of your above-described studies?

A. Yes. A memo dated January 17, 2012 from Epsilon Associates, Inc. to Antrim Wind Energy summarizes the results from the above-described study. This memo is included with Appendix 13A to the Antrim Wind SEC Application. Worst-case sound levels from the transformer are expected to be 33 dBA or less at any residence around the substation. When combined with the highest expected sound levels from the wind turbines, the resultant sound levels will be changed by less than 1 decibel due to the

substation. These sound levels are lower than existing sound levels in the area from traffic, and other natural or man-made sources (see Figure A-1 in the November 17, 2011 Epsilon report, Appendix 13A).

Q. In your opinion, will the Antrim Wind Project have an unreasonable adverse effect on public health and safety, specifically as the result of noise?

A. No. Because all future sound levels during operation of the Project have been predicted to be within the acceptable sound level criteria and guidelines outlined above, I believe that the Antrim Wind Project will not have an unreasonable adverse effect on public health and safety as the result of noise produced by the Project. A comprehensive study released by the American Wind Energy Association ("AWEA") and the Canadian Wind Energy Association ("CanWEA") entitled "Wind Turbine Sound and Health Effects – An Expert Panel Review" (December 2009) further supports this position. The panel conducting this review included audiologists, doctors, public health officials and acousticians. The conclusion drawn by these professionals was that "vibroacoustic disease," "wind turbine syndrome," and "visceral vibratory vestibular disturbance" are unproven hypotheses that have not been confirmed by appropriate research studies. In particular, the three fundamental conclusions of the review were:

1. There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.
2. The ground-borne vibrations from wind turbines are too weak to be detected by or to affect humans.

3. The sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and the frequencies of the sounds and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences.

Another just-released study by an independent panel of experts reached similar conclusions to those listed above. The "Wind Turbine Health Impact Study: Report of Independent Expert Panel, January 2012" was commissioned by the Massachusetts Department of Environmental Protection and the Massachusetts Department of Public Health. Among some of the findings were:

1. There is insufficient evidence that the noise from wind turbines is directly (i.e., independent from an effect on annoyance or sleep) causing health problems or disease.

2. Whether annoyance from wind turbines leads to sleep issues or stress has not been sufficiently quantified.

3. Claims that infrasound from wind turbines directly impacts the vestibular system have not been demonstrated scientifically. Available evidence shows that the infrasound levels near wind turbines cannot impact the vestibular system.

4. There is no evidence for a set of health effects, from exposure to wind turbines that could be characterized as a "Wind Turbine Syndrome."

The strongest epidemiological study suggests that there is not an association between noise from wind turbines and measures of psychological distress or mental health problems.

Q. Does this conclude your testimony?

A. Yes, it does.

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ROBERT D. O'NEAL, CCM, INCE

PRINCIPAL

EDUCATION

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

REGISTRATIONS

Certified Consulting Meteorologist, #578

PROFESSIONAL SUMMARY

A Principal of the firm, Mr. O'Neal is a Certified Consulting Meteorologist with 24 years 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. His air quality background involves applying air quality dispersion models for regulatory permitting applications, as well as for general air quality impact evaluations. He has experience with the CALMET/CALPUFF modeling system used to evaluate visibility and acid deposition impacts in Class I areas.

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.

- *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.

- *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) – 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.

- *PG&E – Mantua Creek, West Deptford, NJ*. Conducted single-station CALPUFF modeling for impacts at the nearest Class I area for a proposed 800 MW natural gas-fired combined-cycle electric power generation facility. The latest IWAQM Phase 2 guidance was followed for calculating ambient concentration, wet and dry deposition, and regional haze impacts at the Brigantine National Wildlife Refuge.

- *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.

- *BP/Amoco – Continental Divide EIS, WY and CO*. Performed meteorological and air quality dispersion modeling for a proposed natural gas field development project in Wyoming using the CALMET and CALPUFF models. Extensive emission inventories were developed within a large domain (200,000 km^2) using state air agency records and permit file reviews. Ambient pollutant concentrations, wet and dry deposition, and visibility impacts at eight Class I areas from long-range transport were evaluated as a result of the project and the cumulative inventory.

- *Iroquois Pipeline Company, NY, NY*. Third Party contractor with the Federal Energy Regulatory Commission (FERC) for preparation of an Environmental Impact Statement for the Eastchester Pipeline Project filed with FERC by Iroquois Gas Transmission System. The project consists of a proposed new 30-mile pipeline from Northport across Long Island Sound into the Bronx, New York and four compressor stations in upstate New York. Responsible for air quality and noise existing conditions and future impact evaluation along various routes.

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.

- *Wingra Engineering, Inc., TN*. Performed meteorological and air quality dispersion modeling in support of a multi-site evaluation for a proposed gray and ductile iron foundry project in Tennessee using the CALMET and CALPUFF models. Ambient pollutant concentrations, wet and dry deposition, and visibility impacts at four Class I areas from long-range transport were evaluated as a result of the project and background sources.

- *Dartmouth-Hitchcock Medical Center, Lebanon, NH*. As part of the state air quality permitting process, applied the ISC and VALLEY models to demonstrate compliance with the NAAQS for the new construction of a major New England hospital's boilers, incinerator, and diesel generators. Interactive modeling was required within the area of significant impact. Prepared original and renewal Title V Operating Permits for the hospital complex.

- *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. Expert testimony on noise impacts will be presented before a NYS Administrative Law Judge.

- *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.

- *Granite State Concrete, Inc., Lyndeborough/New Boston/Mont Vernon, NH*. A sound level impact analysis was performed for a proposed 39-acre expansion of an existing sand and gravel excavation site in Lyndeborough. Ambient background sound level measurements were collected around the site. Project-specific impacts of the excavation and haul equipment were measured at the existing excavation site and used to calculate future sound level impacts. The results of this work were presented to the local Zoning Board of Appeals.

- *P.J. Keating Co., Townsend, MA*. A sound level impact analysis was performed for a proposed sand and gravel excavation site. 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 as expert witness testimony in Massachusetts Land Court in Boston.

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.

- *Pike Industries, Inc., Ossipee and Madison, NH*. Air quality dispersion modeling was conducted for two asphalt batch plants in order to revise the State air pollution permit to allow the burning of specification used oil.

Transfer Stations/Landfills

- *Confidential Client, ME*. Project manager for an ambient air quality monitoring plan submitted to ME DEP for two existing landfills as part of the landfill gas and odor management system. CALMET meteorological modeling and CALPUFF dispersion modeling were used to specify the continuous hydrogen sulfide (H_2S) monitoring locations and appropriate H_2S Action Levels.

- *Wood Recycling, Inc., Southbridge, MA*. Prepared an ambient air quality monitoring plan for the existing Southbridge Landfill as part of the landfill gas and odor management requirements. MA DEP approval was obtained for the sampling locations and equipment specifications of three fixed hydrogen sulfide (H_2S) monitoring systems and an on-site meteorological station. Dispersion modeling was used to specify the appropriate detection limits for the H_2S equipment.

- *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.

- *Valley Mill Corp., Pittsfield, MA*. Prepared a noise impact assessment for a proposed 250-ton/day C&D transfer station in Pittsfield. This project involved ambient background noise monitoring at sensitive receptors around the site, calculation of expected operational noise impacts from the processing equipment, and a compliance evaluation with State noise regulations.

- *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.

EXPERT TESTIMONY EXPERIENCE

Expert witness before the NH Site Evaluation Committee on noise issues for the 48 MW Groton Wind project.

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; Billerica Energy Center power plant; Brockton Clean Energy.

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

Expert witness before NY DEC Administrative Law Judge for a cogeneration power plant, a hard rock quarry facility, and two sand and gravel excavation sites.

Expert witness for site assignment hearings on solid waste transfer stations in Lowell, MA; Marshfield, MA; Oxford, MA, Holliston, MA.

Expert witness in Massachusetts Land Court for a proposed sand and gravel pit, an existing concrete batch plant, and a proposed cross-dock distribution center.

Expert witness in Vermont Act 250 Land Use process for ski areas.

Expert witness before MA DEP Administrative Law Judge for an asphalt plant.

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

Invited specialty speaker on noise impact assessments for Boston University's Masters of Urban Planning degree program.

PROFESSIONAL ORGANIZATIONS

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

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., 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., 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., 2001: The Impact of Ambient Sound Level Measurements on Power Plant Noise in Massachusetts: A Case Study. 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. Air & Waste Management Association Guideline On Air Quality Models: A New Beginning, Newport, RI, April 2001.

Wu, Z.X., J.S. Scire and R.D. O'Neal, 1998: Comparison of One Year of MM5 and CALMET Meteorological Fields with Observations in the Western United States. Presented at the Eighth PSU/NCAR Mesoscale Model Users' Workshop, Boulder, CO, June 1998.

O'Neal, R.D., 1994: Indoor air sampling techniques used to meet workplace and ambient air toxic detection requirements. 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: Predicting potential sound levels: A case study in an urban area. Journal of the Air & Waste Management Association, 41, 1355-1359.

O'Neal, R.D., 1991: Temporal traffic fluctuations and their impact on modeled peak eight-hour carbon monoxide concentrations. 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. Air & Waste Management Association 83rd Annual Meeting and Exhibition, Pittsburgh, PA, June 24-29.

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.

O'Neal, R.D. and T.B. McKee, 1987: Draining or pooling mountain valleys: A matter of geometry. Proceedings of the Fourth Conference on Mountain Meteorology, Seattle, WA, August 25-28.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2012-___

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

PREFILED DIRECT TESTIMONY OF ROSS GITTELL

ON BEHALF OF

ANTRIM WIND, LLC

January 31, 2012

Qualifications of Ross Gittell

Q. Please state your name and business address.

A. My name is Ross Gittell and my business address is 404 South Street, Portsmouth, NH 03801.

Q. Who is your current employer and what position do you hold?

A. I am employed by the University of New Hampshire, Whittemore School of Business and Economics and I hold the position of James R. Carter Professor.

Q. What are your background, experience and qualifications?

A. Detailed information concerning my background, experience and qualifications is contained in my curriculum vitae which is attached to this testimony and is labeled RG-1. I hold a Bachelor of Arts Degree from the University of Chicago, a Masters Degree in Business Administration from the University of California, Berkeley, and a Doctorate Degree in Public Policy from Harvard University.

Purpose of Testimony

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 Antrim Wind Energy Project ("the 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 that is the subject of this docket?

A. Yes. Antrim Wind Energy, LLC ("AWE") contracted with me to independently examine the potential impact of its proposed 30 megawatt ("MW") wind power project on the local area economy in Hillsborough County and surrounding counties in New Hampshire, and to study the potential impact of the Project upon area residential property values. During the course of this engagement, I have been provided with information about the Project and therefore am familiar with it.

Economic and Employment Impacts

Q. Please describe the methodology you employed for examining the economic and employment impacts of the Project.

A. To evaluate the local area economic impacts of the Project, my research team drew upon our previous research that focused on economic impacts of wind power in New Hampshire including research conducted on: 1) the New Hampshire Renewable Portfolio Standard legislation; 2) New Hampshire's participation in the Regional Greenhouse Gas Initiative ("RGGI"); 3) green industry employment in New Hampshire;

4) the Granite Reliable Windpark in Coos County; and 5) the Groton Wind Farm in Grafton County. The research team also considered current studies related to the economic costs and benefits of wind power projects.

One of the specific analytical tools used by the research team was the Job & Economic Development Impact ("JEDI") Wind Energy model provided by the National Renewable Energy Laboratory ("NREL"), a widely used and cited economic input-output model that is used to calculate regional economic impacts from wind power generation projects. Another analytical tool used by the research team was IMPLAN 3.0 (2010 data), a system of software and databases that is also widely used and accepted for regional input-output economic modeling. IMPLAN serves as a source of local economy employment and output multiplier inputs for the JEDI model. In addition, spreadsheet modeling was conducted. This modeling relied on project specific data, information gained from interviews with project managers and 2011 employment data available through the U.S. Bureau of Labor Statistics. The spreadsheet modeling supplemented and expanded on the outputs produced by the JEDI and IMPLAN models.

Q. Please summarize the results of your study of the Project's anticpated economic and employment impacts.

A. The complete results of our economic impacts study is found in Appendix 14A of the Antrim Wind Application. The results of our study indicate that the Project is expected to contribute $12 million to the local New Hampshire economy during the construction phase. The construction activity would help stimulate the local economy during a period of stagnant employment due to a weak overall U.S. economy. During the

construction phase, the impact on local employment would be significant, with 86 jobs and $5 million in wages in earnings. Longer term, the local employment impacts are lower, but still significant for Hillsborough County and the surrounding local area. In addition to the direct employment benefits, there are indirect and induced local jobs created as a result of the Project during the construction phase. These jobs significantly magnify the employment impact of the Project on the local area economy.

In the on-going operational (post-construction) phase of the Project, the economic and jobs impact are reduced but still significant. The Project is anticipated to contribute $2.3 million annually to Hillsborough County and the surrounding local area economy. Antrim Wind has proposed an annual Payment In Lieu of Taxes ("PILOT") to the Town of Antrim in the amount of $11, 250 per MW for the first year, escalating at 2.25% per year during the 20 year operating term. The first year's payment would be $337, 500 for a 30 MW project. This is in addition to payments prior to the commencement of the operating term and will result in total PILOT payments of $8,721,322 to the Town of Antrim during construction and the first 20 years of operations.

Total benefits produced by the Antrim Wind Project, including direct, indirect and induced to the local economy, are expected to be $55.7 million or $1.85 million per MW over a 20-year period. This is consistent with other reports that local economic benefits can be up to $1.6 million per MW over 20 years from wind power projects.

Q. As the result of your study, what conclusions have you drawn about the Antrim Wind Project's economic impacts?

A. I conclude that the Project is expected to have a positive economic impact on Hillsborough County and the surrounding local area, with the highest impact experienced during the construction phase. Given the weak state of the current economy, this Project - with its immediate and stimulating impacts - can be particularly valuable to the local area economy. The construction jobs and direct employees of Antrim Wind created by the Project will be part of the growing green economy in New Hampshire and are expected to be high quality, paying over 12% more than the local average annual wage. Long-term, ongoing benefits will be derived from: an estimated 3 full time equivalent on-site jobs; and the support of 10 jobs in the local area economy paying approximately $700,000 in wages; local purchases of goods and services by Antrim Wind (such as plow, maintenance and supply contracts); land owner lease payments; and tax/tax equivalent payments to local and state governments. In combination, these benefits will result in an annual increase of $2.4 million in local area economic activity. Additionally, annual tax payments beginning at $337,500 and escalating thereafter for 20 years would have a significant impact on revenue to the Town of Antrim. The Town would also experience positive impacts from the conservation measures put in place as part of the Project.

Property Values

Q. Please describe the study you performed for the purpose of assessing the Antrim Wind Project's anticipated impacts on area property values.

A. Our study included an in-depth review of six studies that utilized actual arms-length property transactions in their analysis, were more recent, and typically had large transaction data sets. While there is a growing body of research on the impact of wind

energy projects on residential property values - which generally indicates no statistically significant decline in property values as the result of these projects - none of the existing research has focused specifically on New England or New Hampshire projects. Thus, in addition to reviewing the existing body of research in regards to residential property values and wind power projects, we undertook a study of the only operating wind farm in New Hampshire – the Lempster Wind Project - in order to assess the impact of wind energy development on New Hampshire property values.

Our study of the Lempster Project included obtaining a total of 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 to determine if the Lempster Project had any regional impacts on property values. In addition, we examined the 88 property transactions that occurred during the post-turbine construction phase in the Town of Lempster, and the bordering towns of Goshen, Marlow, Unity and Washington. These properties were mapped using Geographic Information Software ("GIS") and, with the assistance of Antrim Wind, we developed a model showing the areas where the Lempster Wind turbines were likely to be visible. Mapped property locations were cross-referenced against the modeled turbine views to determine the properties that were expected to have a view of the turbines. All of these modeled locations were then "ground truthed" or visited by a member of the research team to ensure that they did have a view of the Project. The views in those locations were categorized as either "none," "obscure," or "visible." View impacts were then statistically tested to determine if there was a statistically significant difference between properties with no view, an obscured

view and a clear view of the turbines. More specifically, we tested to see if the obscure view and clear view groups of properties had a statistically significant presale valuation and to see if the average difference between the deed price and presale valuation were statistically different. The rationale for this is that if the view of the turbines was a significant factor in the selling price, there should be a difference in the average selling prices of each group.

In addition to compiling view data, we tested for "nuisance" by examining the correlation between the distances of the properties from the nearest turbine. The reason for doing this was that if distance was a significant factor, then some form of relationship to property values would be observable.

Q. Please summarize the results of your property values study.

A. A complete report of our study is contained in Appendix 14B of the Antrim Wind Application. Of the 88 single family home purchases sales transactions that occurred from September 2008 through November 2011, 3 of them (2.5%) were within a 1 mile radius of the nearest turbine, 33 (28%) were within a 3 mile radius of the nearest turbine, and 77 (65%) were within a 5 mile radius of the nearest turbine. Based on our review of this information, we conclude that that neither a view of nor proximity to the wind turbines negatively impacted residential property values. There is no evidence to support that an obscure or clear view of a wind turbine reduced the selling price of a property below what it should have been. Similarly, there was no correlation between a property's distance from a turbine and sales price. Our broader review of county-wide property transactions found that in the period of time after the New Hampshire Site Evaluation

Committee's approval of the Lempster Project in 2007, and also in the period of time after completion of the Lempster Project, changes in property values and transaction volume in local communities around the Lempster Wind Project were of similar nature to those observed in the overall residential market in Sullivan County.

Conclusion

Q. In your opinion, taking into consideration the issues of economic, employment and property value impacts, will the Antrim Wind Project unduly interfere with the orderly development of the region?

A. No. In my opinion, for the reasons set forth above and in our reports contained in Application Appendices 14A and 14B, I believe that the Antrim Wind Project will have a positive impact on the local economy and on employment, and will not adversely affect residential property values. Therefore, from an economic development standpoint, the Project will not unduly interfere with the orderly development of the region.

Q. Does this conclude your testimony?

A. Yes.

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Ross Gittell
James R. Carter Professor
University of New Hampshire
Whittemore School of Business and Economics
Ross.Gittell@.unh.edu

EDUCATION

Ph.D. (Public Policy), Harvard University, Dively Fellow, November 1989.

M.B.A. University of California, Berkeley, Beta Gamma Sigma, June 1981.

A.B. (Economics), University of Chicago, Phi Beta Kappa, June 1979.

RESEARCH, TEACHING & PUBLIC SERVICE

Scholarly and professional focus involves applying economic and management theory to regional and community economic development policy issues. Main areas of interest include: work force development, education and the economy, and collaborative university, public and private sector efforts.

FACULTY & RELATED POSITIONS

James R. Carter Professor, Department of Management, *Whittemore School of Business and Economics, University of New Hampshire*. 2000-.

Visiting Scholar, *Federal Reserve Bank of Boston. New England Public Policy Center,* Fall 2010.

Professor, Department of Management, *Whittemore School of Business and Economics, University of New Hampshire*. 2004-.

Associate Professor, Department of Management, *Whittemore School of Business and Economics, University of New Hampshire*. 1993-2004.

Visiting Associate Professor and Hubbard Professor, Department of Management, *Whittemore School of Business and Economics, University of New Hampshire*. 1992-93.

Assistant Professor, *Graduate School of Management and Urban Policy, New School for Social Research*, 1990-1992.

Lecturer, *Department of Economics and Kennedy School of Government, Harvard University*, 1989-1990.

ORGANIZATIONAL POSITIONS

Vice President, Board Member and Forecast Chair, *New England Economic Partnership,* 1999-present.

Board Member, *Foundation for Healthy Communities*, Concord, NH, March 2009 - present.

Council Member, *State of New Hampshire Economic Development Advisory Council,* appointed by the Governor, October 2008 - present.

Trustee & Executive Committee Member, *Exeter Health Services*, Exeter, NH, April 2008 - present.

Trustee and Executive Committee Member, *Exeter Hospital*, Exeter, NH, April 2008 - present.

Director, *Exeter Trust Company*, Portsmouth, NH, 2001-present.

Board Member and Chair of Strategic Planning Committee, *Endowment for Health*, Concord, NH, September 2006 - 2010.

Founding Board Member, *NetworkNH*, 2000-2008.

Member, *Shipyard Advisory Panel*, Appointed by the Governor. 2005.

Member, *New Hampshire Consensus Revenue Estimating Committee*. Appointed by the Governor. 1998-2005.

Member, *State of New Hampshire, Office of the Governor and New Hampshire State Treasurer*. Member of fiscal analysis and advisory team which includes the Governor's Budget Director, the State Treasurer and the State Comptroller. The team prepares analyses and makes presentations to bond rating agencies (Moodys, Standard & Poors and Fitch). 1994 – ongoing (periodic).

Board Member, *Children's Alliance of New Hampshire*, 2003-2007.

Member, Task Force for Philanthropy, *New Hampshire Charitable Foundation*, 2000-2003.

Board Member, *New England Higher Education Public Policy Collaborative*. 1999-2001.

ADMINISTRATIVE & COMMITTEE POSITIONS

Visiting Team Member, New England Association of Schools and Colleges, Bentley College, University of Maine (Orono) and University of Massachusetts (Dartmouth).

Steering Committee Member, University of New Hampshire, Strategic Planning Committee, 2009.

Co-Chair, University of New Hampshire, Strategic Planning Teach & Learning Committee , 2009.

Co-Chair and Member, Provost Search Committee, University of New Hampshire, 2009.

Chair, Undergraduate Curriculum & Assurance of Learning Committee, Whittemore School of Business & Economics, UNH, Undergraduate Curriculum Committee & Continuous Improvement Team, 2009-continuing.

Promotion and Tenure Committee, Whittemore School of Business and Economics, University of New Hampshire. 1997-1999 and 2003-2005.

Senior Fellow, Executive Committee and Advisory Board Member, Carsey Institute, University of New Hampshire, 2004-2012.

Outreach Scholar, University of New Hampshire, 2004-2005.

Advisory Board Member, University of New Hampshire Engagement, Outreach and Public Service Committee, 2002-03.

Department Chair and Member of WSBE Executive Committee, Department of Management, Whittemore School of Business and Economics, University of New Hampshire. 1999-2002.

Academic Planning Committee Member, University of New Hampshire, 2000-2002. Serving at the request of the University Provost. The committee worked closely with the Provost to make recommendations on academic programs and university administration.

Presidential Search Committee Member, University of New Hampshire, 2001-2002. Serving at the request of the Chancellor and the Chair of the USNH Board of Trustees.

Transition Committee Member, University of New Hampshire President's Office, At the request of the President, Summer 2002.

Lead Researcher, USNH, Chancellor's Office and Board of Trustees. Research to identify workforce and economic development needs in New Hampshire over the next

decade, assess USNH's capacity to address those needs and recommend priority actions, programs and policies for the USNH. 2001.

Federation Committee Member, University of New Hampshire, 1998-1999. Served at the request of the University President and Provost. The committee made recommendations on changes in professional programs at the University.

Transition Committee Member, Whittemore School of Business and Economics, University of New Hampshire. 1997-98. Selected by the faculty to serve on committee to guide school after the resignation of the Dean.

PUBLICATIONS

BOOKS

With Matt Magnusson, Michael Merenda, The Sustainable Business Casebook (New York: Flat World Knowledge, *forthcoming*).

With Kathe Newman, editors, Activist Scholar (Newbury Park, CA. Sage Publications, 2011).

With Avis Vidal, Community Organizing: Building Social Capital as a Development Strategy (Newbury Park, CA: Sage Publications,1999).

Renewing Cities (Princeton, NJ: Princeton University Press, 1992).

BOOK CHAPTERS

With Matt Magnusson, "Sustainable Business," in Exploring Business, (New York: Flat World Knowledge, 2009).

With John Holcomb and Matt Magnusson, "Business and Public Policy," in Exploring Business, (New York: Flat World Knowledge, 2009).

"Community Organizing," in Chris Ansell (editor) The Encyclopedia of Governance (Newbury Park: CA: Sage Publications, 2007)

With Allen Kaufman, "Post-Industrial New England, 1945 to the Present," in Burt Feintuch and David Watters (eds), The Encyclopedia of New England, (New Haven: Yale University Press, 2005).

With Charles Colgan, "New England Regionalism: Economic Motivations and Barriers," in Charles Colgan and Stephen Tomblin (editors), Regionalization: Challenges for New

England and Atlantic Canada in the New Continental Economy (Peterborough, Ontario: Broadview Press, 2003).

With Charles Colgan, "Regionalism in New England Political and Governmental Institutions," in Charles Colgan and Stephen Tomblin (editors), Regionalization: Challenges for New England and Atlantic Canada in the New Continental Economy (Peterborough, Ontario: Broadview Press, 2003).

With Phil Thompson, "Making Social Capital Work: Social Capital and Community Economic Development" in Susan Saegert, Phil Thompson and Mark Warren (eds.) Social Capital and Poor Communities (New York: Russell Sage Foundation Press, 2002).

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Federal Reserve Bank of Boston. New England Public Policy Center, Visiting Scholar, Fall 2010.

New Hampshire Office of Energy and Planning and U.S. Department of Energy, Green Launching Pad. Co-PI, February 2010 – April 2012, $1,500,000.

New Hampshire Department of Health and Human Services, Medicaid Enrollment Forecasts, June 2008 - Continuing , $30,000.

New Hampshire Public Utility Commission, Regional Greenhouse Gas Initiative Program Evaluation, Co-PI, 2009-2010, $100,000.

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NH Charitable Foundation and NH Dept. of Agriculture, The Economic Impact of Local Food Systems in New Hampshire, June 2009-October 2009, $19,000.

Energy Foundation, Assessment of the Economic Impact of a Regional Greenhouse Gas Initiative in New Hampshire, 2007-08, $50,500.

U.S. Department of Commerce, National Atmospheric & Oceanic Administration, Co-Principal Investigator, Northeast Center for Atmospheric Science and Policy. Modeling of the Potential Economic and Social Benefits of Atmospheric Policies in the Northeast United States (2006-2009), $300,000.

National Science Foundation, Co-Principal Investigator. US Traffic Safety –A National Crisis: Mitigating Fatality Risk with Objective Decision Making, 2005-2006, $104,500

State of New Hampshire, Department of Environmental Services, Analysis of the Potential Economic Impact of a Renewable Portfolio Standard for the state of New Hampshire, 2006-07, $27,500.

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New Hampshire Charitable Fund and NH Women's Policy Institute, Indicator Report on Economic Status of Women in New Hampshire, 2003-2005, $10,000.

U.S. Department of Commerce, National Atmospheric & Oceanic Administration, Lead Project Investigator, An Analysis of the Potential Economic and Social Benefits of Air Quality Information and Forecasts. Three-year project (2002-2004), $450,000.

US SBA and NH OEI-SBDC, Economic Cluster Analysis and Manufacturing Industry Assessment of New Hampshire and New Hampshire Counties, 2003-2004, $23,000.

UNH Parents Association Gift Committee. To support the Community Service component of the ADMN 400 Intro to Business Course, 2002-2004, $1,000.

Intown Manchester. Lead Project Investigator and coordinator of MBA and economic student research on the City of Manchester's economic conditions and economic potential. Research and findings were presented to Mayor and Business Leaders and

featured in newspaper articles and on NH Public Radio Exchange program. Spring-Summer 2003, $10,000.

Rockefeller Foundation, Economic Development Initiatives in the Inner City: An Assessment of Economic Initiatives by the Harlem Congregations for Community Improvement, 2002-03, $20,000.

Instructional Technology Faculty Development Grant. To fund Introduction to Business Course use of instructional technology to facilitate and increase student engagement and exposure to instructional technology. Given through Provost and VP for Academic Affairs Office, 2002-2003, $37,888.

Kauffman Foundation, Regional Entrepreneurship: An Outline of Work, with Jeff Sohl, 2002, $30,000.

NH Small Business Development Corporation, High Technology Industry in New Hampshire Assessment, 2002, $12,000.

Children's Alliance of New Hampshire. Lead investigator in research on how investment in children affects business development and economic competitiveness, 2001, $24,000.

University System of New Hampshire, Chancellor's Office and Board of Trustees. Lead investigator and project leader on research to identify workforce and economic development needs in New Hampshire over the next decade, assess USNH's capacity to address those needs and recommend priority actions, programs and policies for the USNH. 2001. Funding provided for course release and student researcher expenses.

The New Hampshire Forum on Higher Education. 2000-2001, $12,000.

Library & Archives of New Hampshire's Political Tradition. Project director on an analysis of economic impact of first-in-the-nation primary in New Hampshire. 1999-01, $10,000.

State of New Hampshire, Project Leader, Economic Development Plan. Work included economic analysis, survey research and focus groups with over 400 business leaders in the state. The final report made economic and business development policy recommendations to the Governor and Legislature, 1999-2000, $85,000.

New Hampshire Charitable Foundation. Analysis of philanthropy in New Hampshire and recommendations on strategies to increase charitable giving in the state. 1999-2000.

Josiah Bartlett Center for Public Policy (Concord, NH). Research project with Fred Kaen assessing state-assisted financing activities in Northern New England, 1996-1997. $5,000.

John D. and Catherine T. MacArthur Foundation, Community Economic Develompent Studies. 1991-1993, $100,000.

PRESENTATIONS *(examples*)

The Northeast Regional Center for Rural Development, What Works! 2011 Entrepreneurship and Community Development in the Northeast. Philadelphia,"Creating the Future: Nurturing the Next Generation of Entrepreneurs and Job Creators," September 2011.

Association to Advance Collegiate Schools of Business (AACSB) Sustainability Conference, Charlotte, "Lessons on Sustainability in Business from UNH's Green Launching Pad," June 2011.

Federal Reserve Bank of Boston, Economics Department, Federal Reserve Bank of Boston, "Clean Technology Industry Development and State Level Energy and Environmental Policies," December 2010.

New England Economic Outlook Conference, New England Economic Partnership, Federal Reserve Bank of Boston, "New England Economic Outlook," May 2011.

Federal Reserve Bank of Boston, New England Economic Study Group, "The Effects of State-Level Energy and Environmental Policies on Clean Tech Innovation and Employment," May 2011.

Urban Affairs Association, Annual Meetings, "Creating Shared Value for Communities: A Market Strategies Approach to Community Economic Development," New Orleans, March 2011.

Babson College Entrepreneurship Research Conference, Babson College & Kauffman Foundation, Lausanne, Switzerland, "Is there a Sweet Spot for US. Metropolitan Areas?" June 2010.

Massachusetts Institute of Technology, "Clean Technology Industry Innovation and Business Accelarators," Urban Planning Department, March 2010.
Federal Reserve Bank of Boston, Economics Department, "Clean Technology Industry Development in New England and the Role of State-level Energy and Environmental Policies," December 2010.

University System of New Hampshire Board of Trustees, University System of New Hampshire, Durham, NH, "New Hampshire Science and Technology Business Plan," July 2010.

NH Forum on the Future, New Hampshire Higher Education Assistance Foundation, the New Hampshire College & University Council and The NH High Technology Council, Manchester, NH, "New Hampshire Science and Technology Business Plan", May 2010.

Mount Washington Resort, Sixty-fifth Anniversary of Bretton Woods Monetary Conference, Invited Speaker, Bretton Woods, NH, July 25, 2009.

Federal Reserve Bank of Boston, New England Community Development Advisory Council, "The Green Economy and Community Development," Panelist, Durham, NH, July 13, 2009.

New England Economic Partnership, "New England Economic Outlook," Federal Reserve Bank of Boston, May 2009 and November 2008.

University System of New Hampshire Presidents Council, University System of New Hampshire, Concord, NH, "Economic Impact of the University System of New Hampshire," January 2009.

New England Council, "New England Economic Outlook," Boston, MA, December 2008.

Unveiling the Future of Energy Frontiers, USAEE/IAEE North American Conference, New Orleans, "Economic Impact in New Hampshire of the Regional Greenhouse Gas Initiative," December 2008.

Unveiling the Future of Energy Frontiers, USAEE/IAEE, New Orleans, "Residential Energy Efficiency Opportunities in New England: Economic and Environmental Benefits of Improved Insulation," December 2008.

American Geophysical Union Fall Meeting, "Providing Decision-Relevant Information for a State Climate Change Action Plan," San Francisco, December 2008.

International Atlantic Economic Conference, International Atlantic Economic Society (IEAS), Montreal, "Poverty Traps: Poverty Persistence and Local Fiscal Structure in U.S.," October 2008.

NH Forum on the Future, New Hampshire Higher Education Assistance Foundation, the New Hampshire College & University Council and The NH High Technology Council, Manchester, NH, "New Hampshire High Technology Outlook", October 2008.

Urban Planning Faculty Seminar, MIT Department of Urban Planning, Cambridge, MA, "The Green Economy in New England", September 24, 2008.

PROFESSIONAL AWARDS

Outstanding Associate Professor Award, University of New Hampshire, 2004.

Excellence in Public Service Award, University of New Hampshire, 2002.

Who's Who in America, 2009.

NH Educational Opportunity Association, Champion of Educational Opportunity, 2005.

International Biographical Centre, Leading Educators of the World, 2005.

Who's Who Among America's Teachers, 2003.

NH Commissioner of the Department of Resources and Economic Development, Award for Excellence in Service, December 2002.

New England Board of Higher Education, nominated for Higher Education Excellence Award. 2002 and 2003.

Media Appearances and Quotes *(examples of outlets)*
Public Radio International
NPR Morning Addition
CBS News
Bloomberg News
Fox News
Nippon Broadcasting System
Wall Street Journal
Washington Post
Chicago Tribune
USA Today
New York Times
Wall Street Journal
San Jose Mercury News
Boston Globe
Boston Herald
Providence Journal
New Hampshire Union Leader
New England Cable News
WMUR, New Hampshire
WBUR Boston
NH Public Television
New Hampshire Public Radio

ACADEMIC PROFESSIONAL SERVICES

Journal of Public Finance and Management, *Editorial Board Member*, 2005-present.

The Open Business Journal, *Editorial Advisory Board Member*, Bentham Science Publishers, 2007-present.

Journal of Education for Business, *Editorial Board Member*, 2007-present.

New England Developments, Advisory Board Member, Northeast Utilities System, Oct. 2005-2008.

New England Board of Higher Education, *Advisory Panel Member*, report and policy recommendations. Building Human Capital: A New England Strategy, Spring and Summer 2003.

New England Association of Schools and Colleges, Commission on Institutions of Higher Education, *Accreditation team member*, University of Maine, April 2009; Bentley College, April 2002.

U.S. Department of Education's National Center for Education Statistics. *Member of a national review team,* Review of national data set on college course work in business administration and allied areas. Washington, DC, January-May 2001.

Beta Gamma Sigma, *President and Vice President (Rotating)*, University of New Hampshire chapter, 2000-.

American Behavioral Scientist, *Guest Editor*, Vol. 43 No. 7, April 2000.

Economic Development Quarterly, Journal of Policy Analysis and Management, Public Finance and Management, Journal of Regional Science, Journal of Urban Affairs, Non-Profit and Voluntary Sector Quarterly, Journal of Housing Research, Brookings Institute Press, and Cornell ILR Press, *Academic Journal, Peer Reviewer/Referee*.

University of Southern Maine, *Presiding Officer*, Inaugural Beta Gamma Sigma, Honors Convocation Ceremony, April 2000.

Brookings Institute (Washington, DC). *Member*, National Community Development Policy Analysis Network, 1996 - 1998.

Harvard University, Kennedy School of Government, Innovations in American Government Program, *Program evaluator*, 1991-1995.

Harvard Institute of International Development, Project Consultant, Jakarta, Indonesia, June-August 1990.

OTHER PROFESSIONAL POSTITIONS

SRI International, Menlo Park, CA, Senior Consultant. Specialist in economic development planning, Jan. 1985 - June 1985.

Chase Econometrics, San Francisco, CA, Consultant. Consulting economist for corporate and public sector clients, March 1981 - Jan. 1985.

PROFESSIONAL AND ACADEMIC AFFILIATAIONS
Phi Beta Kappa
Beta Gama Sigma
Academy of Management
Urban Affairs Association