

## **6 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 minimize risk to avian and bat species. These are described in the following subsections.

### *6.1.1 Project Siting and Design*

The following paragraphs describe measures previously employed or to be employed during siting, design, construction and operation that will avoid or minimize potential impacts to birds and bats upon construction and operation of the Project.

#### **Project Siting**

As previously discussed in Section 4, AWE applied rigorous screening criteria to establish a well-sited Project that minimizes potential impacts associated with access, transmission and alteration of natural habitats. The close proximity of the proposed Project to existing infrastructure minimizes the overall area of disturbance and eliminates the need for new transmission lines. Furthermore, 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.

#### **Structure Layout and Design**

Final turbine layout and facility design has taken into account the findings of the Tier 3 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.

### **Collector System Design and Interconnection Proximity**

The Project will interconnect to PSNH's 115 kV Line L163 via a three breaker ring bus substation located adjacent to the Project access road and contained within the Project's leased boundary. The interconnection substation will be a standard three phase 115 kV transmission level substation designed and constructed by PSNH. A 34.5 kV - 115 kV collector substation will be located adjacent to the interconnection substation and provide an interface between PSNH and the Project. A single 34.5 kV three phase collector line will be constructed from the collector substation to the individual turbines. This collector line will be a combination of overhead and underground facilities. All collector system facilities (substation & lines) will be designed and constructed consistent with industry standards, PSNH and ISO-NE requirements, applicable local, state and federal codes and good utility practice.

Furthermore, the Project collector lines and substation will be designed and constructed to meet or exceed the most recent recommendations of the Edison Electric Institute's Avian Power Line Interaction Committee (APLIC), as necessary and applicable.

### **Operational Lighting**

Operational lighting will be minimized to the maximum extent practicable. Project design will incorporate minimum intensity lighting on all Project structures where feasible.

No steady burning lights will be left on at the facility buildings and substation unless necessary for safety or security; in such cases, manual lighting, motion detector lighting or infrared light sensors will be used whenever possible to avoid continuous lighting. Any required facility lights will be shielded downward to minimize skyward illumination, and will not use high intensity, steady burning, bright lights such as sodium vapor or spotlights. Motion detector or manual lights will be used above tower doors and at the operations and maintenance building for nighttime maintenance visits.

AWE will implement a protocol to confirm that manual lighting controls on buildings and Project facilities are always off at night unless required for specific ongoing tasks or in the event of an emergency response.

#### **Turbine and Met Tower Lighting**

Turbine lighting will be minimized to the maximum extent practicable. Lighting 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.

The minimum amount of pilot warning and obstruction avoidance lighting specified by the FAA will be used. Based on FAA determinations for the Project, six (out of 10 total) turbines will be lit, and all lights within the facility will illuminate synchronously. FAA lights are anticipated to be flashing red strobes (L-864) that operate only at night. The lowest intensity lighting as allowed by the FAA will be used.

To the extent possible, USFWS recommended lighting schemes will be used on the nacelles to the extent they are consistent with FAA requirements, including reduced intensity lighting and lights with short flash durations that emit no light during the "off phase".

AWE will implement a protocol to confirm that manual turbine lighting controls are always off at night unless required for specific ongoing tasks or emergency response.

#### **6.1.2 Project Construction and Maintenance**

The following construction phase measures will be executed during Project construction. These measures will result in avoidance of construction activities in the vicinity of sensitive habitats during critical periods in avian and bat life cycles, and minimization of impacts to wildlife habitat and resources.

### **Tree Clearing**

Tree clearing activities will be timed, to the extent possible, to minimize impacts to bats and birds. The preferred times for tree clearing will be during frozen ground conditions (November 1 – March 31) or times when the ground is dry (July 1 through September 15). This timing will help to avoid mortality of roosting bats, most nesting birds, and their respective young.

It is AWE's preference and intent to perform tree clearing during winter if at all possible; the actual timing, however, will ultimately be dictated by the date of permit application approvals and other commercial agreements that depend on those approvals. In the event that winter clearing cannot occur, any potential mitigative measures (or need thereof) will be discussed with NHFGD and USFWS at that time.

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.

### **Minimization of Soil Disturbance and Promotion of Natural Revegetation**

Clearing and construction activities will apply practices which reduce soil disturbance and allow for the reestablishment of natural vegetation. Where possible, vegetation will be cleared without grubbing or removal of stumps or tree roots. All construction equipment will be restricted to designated travel areas to reduce impacts. Construction clearings, storage yards, staging areas, or temporary roads that are not needed for long-term operation of the Project will be allowed to revegetate after commissioning of the Project. If turbines require substantial maintenance during operations, the Project will employ the same measures as used during construction to limit clearing of vegetation and disturbance of soil.

### **Invasive Species Avoidance**

Best management practices will be used to avoid the introduction and spread of invasive species. Construction vehicles and equipment that arrive from other areas will be regularly cleaned. In an effort to preserve natural habitat to the extent

possible, areas to be revegetated will be re-seeded with native seed (to the extent possible pending seed availability) following construction. Re-seeding will be consistent with state permit requirements to avoid the introduction of invasive plant species.

**Protection of Water Quality**

Best Management Practices for construction activities will minimize degradation of water quality from storm water runoff and sediment from construction. A plan note will be incorporated into the construction contract requiring that contractors adhere to all provisions of National Pollutant Discharge Elimination System (NPDES) permits and the Storm Water Pollution and Prevention Plan (SWPPP). Federal and state measures will be adhered to for handling toxic substances to minimize danger to water and wildlife resources from spills.

**Minimization of Fire Potential**

Fire potential will be minimized: spark arrestors will be used on equipment as appropriate, and smoking will be restricted to designated areas on site.

6.1.3 Avian and Bat Enhancement Options

As previously discussed, 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 important wildlife 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. Further information with regard to this conservation area is provided in Section 8.1 of this ABPP. Additionally, the Project will result in significant benefits relevant to air and water quality; these benefits are described in detail in Section 5.3.3.

## 7 POST-CONSTRUCTION EVALUATION AND MANAGEMENT

Post construction evaluation and management efforts for the proposed Project have been (and will continue to be, per this ABPP) designed in consultation with NHFGD and USFWS, and are in accordance with the USFWS Land-Based Wind Energy Guidelines (USFWS 2012). Specifically, these efforts address questions outlined in Tier 4 of the USFWS guidelines. Post construction evaluation and management will include formal avian and bat mortality studies, a supplemental acoustic bat study, and evaluation of a curtailment mitigative strategy to reduce injury and mortality for bats. The results of these Tier 4 studies (coupled with Tier 3 study information) will provide the basis for understanding actual Project impacts to birds and bats, and will provide a foundation for future stewardship. This information will also inform future decisions regarding Tier 5 consultation and studies, if ever warranted.

Post construction evaluation and 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 by September 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 below in Section 7.1.

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.

## **7.1 Evaluation Phase Field Studies**

Evaluation Phase field studies will include: a post-construction avian and bat mortality study; an acoustic bat monitoring study; and a curtailment evaluation study. 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.

### 7.1.1 Post-Construction Avian and Bat Mortality Study

Throughout the Evaluation Phases, the Project will perform a one-year formal post-construction avian and bat mortality monitoring study. The post-construction avian and bat mortality monitoring effort will include:

- Standardized searches for birds and bats from April 15 through October 15;
- Searcher efficiency trials to estimate the percentage of carcasses found by searchers; and
- Carcass removal trials to estimate the length of time that carcasses remain in the field for possible detection.

A detailed study protocol will be developed in consultation with NHFGD and USFWS. It is expected that all 10 of the Project turbines will be searched (in order to provide control data for treated and untreated turbines per the curtailment evaluation study described below). It is also expected that each turbine pad will be surveyed approximately once every 5 days for the duration of the study period.

Of note: turbine pads will be treated with erosion control mulch and seeded with native seed mixes subsequent to construction. It is expected that resultant vegetative growth will be minimal at the time of mortality search efforts.

To augment formal standardized mortality searches, the Project will complete a full year of eagle carcass searches. In time periods outside of the formal mortality survey window, these searches will be performed once per week, by adequately trained operations and maintenance staff.

The results of the initial formal study will help inform the need for any future adaptive management initiatives (including Tier 5 consultation and studies, if warranted). Following the first year of operations, mortality (and injury) will be informally documented and reported over the life of the Project under the provisions of a Wildlife Mortality Monitoring Program (see Section 9).

### 7.1.2 Acoustic Bat Surveys

During the Evaluation Phase, the Project will conduct post-construction acoustic bat surveys between May 1 and October 15. Acoustic survey data will be used to correlate bat activity levels measured at rotor height to corresponding bat mortality levels.

Acoustic detectors will be deployed on the nacelle of a select number of study turbines distributed throughout the Project area and will be programmed to record on a nightly basis from at least 30 minutes prior to sunset until 30 minutes after sunrise.

Data will be analyzed and summarized by detector, detector night, and for the spring, summer, and fall seasons, including categorization by species and guild where appropriate. Where appropriate, bat call sequences will be individually marked and categorized by species group or "guild" based on visual comparison to reference calls.

### 7.1.3 Curtailment Evaluation Study

During pre-construction consultation, representatives from USFWS and NHFGD expressed concern over the potential for the Project to cause bat mortality, at a time when certain bat species are being affected by White Nose Syndrome (WNS: see Section 2.3). NHFGD suggested that turbine curtailment may be a viable means of avoiding and minimizing bat mortality at the proposed Project. For this reason, AWE will assess the effectiveness of a curtailment strategy to reduce impacts to bats during the evaluation phase. This study effort will help AWE, NHFGD and USFWS better understand the effectiveness of curtailment at an operating wind project in the State of New Hampshire, where documented bat mortality at wind developments has been low.

For bats, the highest risk periods include nights with low wind speeds (less than 5.0 m/s), particularly during the fall migration and swarming period. The highest numbers of fatalities among bat species at wind facilities have occurred in late summer and early

fall, coinciding with the migratory period, which occurs between mid-August and late September in the eastern U.S. (Kunz *et al.* 2007, Arnett *et al.* 2008).

The results of mortality surveys at operational wind projects to date suggest that long-distance migratory bat species are more vulnerable to collision mortality than other bat species, with three species apparently at the greatest risk: the foliage-roosting hoary bat; eastern red bat; and the cavity-roosting silver-haired bat (Kunz *et al.* 2007, Arnett *et al.* 2008). All three of these bat species have the potential to occur in the Project area.

This curtailment study will follow conditions set forth at other recently approved wind developments in the northeast, including the Bull Hill Wind Project, in Maine. Initially, the Project will test only one curtailment scenario, based on applying the following parameters to 5 of the project's 10 turbines:

- Higher Cut-In Speed: cut-in speed will be raised to 5.0 meters/second (m/s) at turbine hub height. The cut-in speed of 5.0 m/s was selected based on results from studies recently completed at the Casselman Wind Farm in Somerset County, Pennsylvania (Arnett *et al.* 2010). The remaining turbines will be allowed to operate at a normal cut-in speed (approximately 3.5 m/s) without curtailment or operational modifications in place. These turbines will represent an experimental control;
- Timing: Operational control limitations will be applicable from July 15<sup>th</sup> through September 30<sup>th</sup> during nighttime hours (roughly ½ hour after sunset until sunrise, when bats are active). This period is meant to coincide with higher documented mortality events at other operational wind projects, as well as the formal mortality surveys during the Evaluation Phase.

The operational control measures will be implemented through the Project's supervisory control and data acquisition (SCADA) system. The SCADA system provides an effective means to manage and document turbine curtailment based on real-time wind data from the site.

The curtailment study will provide AWE, NHGFD, and USFWS the data necessary to determine whether a curtailment strategy has the potential to reduce significantly any future bat fatality at the Project in a commercially reasonable manner. Based on the results of the curtailment study, the Project will be able to:

- assess the potential biological benefits, in terms of expected reduction in mortality;
- Estimate the long term cost and financial viability of implementing curtailment as a long term mitigation strategy; and
- recommend an operational control program, if warranted, which balances the Project's financial viability with positive outcomes in avoiding and reducing bat fatality at the Project.

The results and recommendations of this study will be subject to the phased consultation process described under the adaptive management strategy (see Section 9). This process will determine if curtailment should be implemented as an operational mitigative measure. This study and adaptive management consultation will guide the ultimate operational curtailment plan, if deemed necessary.

## **8 OPERATIONAL MITIGATIVE ACTIONS**

### **8.1 Conservation Benefits**

As previously mentioned, AWE is providing for the permanent conservation of 685 acres of undeveloped forest land immediately adjacent to the Project area. This represents a significant contribution to preserving important wildlife habitat in the vicinity of the Project.

The area of conservation involves four properties for which AWE, the Harris Center for Conservation Education (HCCE), and the respective landowners (collectively "the Parties") have entered into conservation easement agreements. These agreements all state that "The Parties further recognize that, if the Project proceeds, the Agreement and Easement will make a valuable contribution to the conservation interests of stakeholders in this region." The properties for which conservation Easement agreements have been obtained are depicted on a map provided in Attachment B.

Three of the properties subject to conservation will contain portions of the Project development (Ott, Cotran and Whittemore: see Attachment B), while one (Micheli) is not expected to contain any development associated with the Project. Respectively, approximately 14.4, 10.2 and 0.9 acres (for a total of approximately 25.5 acres) of the Ott, Cotran and Whittemore properties will be directly impacted by Project development. As previously discussed, much of this initial impact area will be allowed to revegetate after Project construction is complete. After project decommissioning, all four properties will be conserved in an undeveloped state in perpetuity.

The area designated for conservation is undeveloped and forested. In general, the area contains a variety of forest cover types that are typical of the lower hills, slopes, and headwater areas of the Monadnock region of southwestern New Hampshire. The cover types are in various stages of succession, ranging from recently cleared forest to intact mature stands of hardwood, softwood, and mixed forest. According to a natural

community assessment performed during Project pre-construction assessments, none of the natural communities identified on the site are considered rare or unusual. These lands, however, have been identified as open space worthy of protection in both the Antrim Master Plan of 2010 and the Antrim Open Space Committee Open Space Plan adopted by the Town of Antrim in 2006. Both plans state that preservation of unfragmented forest areas in the western portion of Antrim, including the properties to be conserved, is one of the principal objectives of its residents. These lands also constitute typical habitat for many of New Hampshire's wildlife species, including birds and bats. The conservation proposal will also protect a significant area of land identified in the New Hampshire Wildlife Action Plan (NHFG 2005; NHFG 2010). Specifically, 275.6 acres of Highest Ranked Habitat in New Hampshire, 148.9 acres of Highest Ranked Habitat in Biological Region, and 256 acres of Supporting Landscape will be protected by the AWE conservation proposal.

This conservation area represents a direct benefit to local bird and bat species which rely on undeveloped forested areas for foraging, nesting and roosting, and will help to sustain local wildlife populations.

## **8.2 Environmental Benefits**

As described in detail in Section 5.3.3, 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. This displacement will result in a significant reduction in toxic air emissions and preservation of water quality. There are specific environmental benefits to these improvements (see Section 5.3.3). Collectively, the expected reductions in the production of toxic air emissions support AWE's position that the proposed Project will provide net benefit (or a positive net impact) in terms of air quality. In turn, improved air quality will positively affect the physical environment and its fauna, including birds and bats.

Direct losses of individual birds and bats as a result of Project operations are expected to be low, and are not expected to impose population level impacts; however, bird and bat populations as a whole are expected to benefit from diminished toxic air emissions. For these reasons, AWE believes that net benefits to avian and bat populations as a result of Project operation are possible.

### **8.3 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 assessed within this 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.

### 8.3.1 Curtailment Evaluation Phase

At the conclusion of the curtailment study during the Evaluation Phase, AWE will collaborate with USFWS and NHFGD to review results of monitoring, effectiveness of the management treatment, and cost and feasibility of management treatment options. The ultimate goal of the ABPP is to avoid and minimize levels of mortality for each species group such that they meet a reasonable threshold. Given the lack of existing baseline mortality data from the Project and the lack of data on the effectiveness of various curtailment strategies in a variety of landscapes, meaningful and defensible mortality thresholds cannot be established for the Project until the results of evaluation phase studies are available. Ultimately, the determination of what is "reasonable" will depend on the baseline mortality rate at the Project, and how it compares to mortality rates at similar projects. This "reasonableness" test will have to take into account the cost of potential management options in terms of Project financial viability, and balance these considerations with positive outcomes in terms of reducing bat fatalities.

The Evaluation Phase of the ABPP is intended to provide AWE, USFWS and NHFGD with a sufficient quantity and quality of data to identify specific treatment options that meet management objectives while minimizing cost of implementation. This evaluation will also insure the consideration that management actions to be implemented will be effective throughout the life of the Project without precluding the Project's financial viability.

### 8.3.2 Curtailment Implementation Phase

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.

Turbine curtailment and a considerable conservation effort are the primary management actions provided under this ABPP. However, 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. Any such proposed changes to operation and management

strategy may be incorporated by AWE in the annual report under the WMMP, and will initiate the phased consultation process.

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.

#### **8.4 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: 1) the development and construction phase measures described in Section 6; 2) the post-construction studies and consultation described in Section 7; 3) the adaptive management strategy of this ABPP, which includes a Wildlife Mortality Monitoring Program, an Immediate Alert Procedure, and a phased consultation strategy (see Section 9); and 4) 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.