Cumulative Effects Analysis for the Cassadaga Wind Project

Prepared for:
EverPower Wind Holdings, Inc.
1251 Waterfront Place, 3rd Floor
Pittsburgh, PA 15222

Prepared by:
Stantec Consulting Services Inc.
30 Park Drive
Topsham, ME 04086

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1.0 INTRODUCTION

This analysis focuses on cumulative effects associated with collision mortality of birds and bats from the proposed Cassadaga Wind Project (the Facility) in light of current, proposed, and projected wind energy development within the state of New York. We selected this spatial scope because we have population estimates for all the New York native bird species and one bat species. We assumed a 25-year operational life of the Facility for the temporal scope for this analysis. Our analysis assumed the project would comprise up to 58 turbines and up to126 MW installed capacity.

For decades, researchers have studied and estimated bird mortality from several sources, such as collision with man-made structures, legal hunting, and domestic cat depredation. That wind turbines would result in collision mortality for birds is not surprising. Turbines spinning or stationary can pose a collision risk for birds. For bats, wind energy development has emerged as a new and substantial source of bat mortality in the past decade. While some level of bat mortality likely went unnoticed at wind projects previously, the rapid expansion of wind development and the increased awareness of bat mortality at wind turbines have revealed the potential for substantial cumulative impacts to bats from the wind industry. This mortality is particularly disconcerting in the wake of white-nose syndrome (WNS) and its fatal effects on cave-dwelling bats. In addition to mortality at wind energy projects, the cumulative effects analysis also considers impacts associated with other mortality sources for birds and WNS for bats.

2.0 WIND ENERGY DEVELOPMENT

According to data compiled by the American Wind Energy Association, there are 1,014 turbines with 1,749 MW of installed capacity currently in New York (AWEA 2016). Growth in the wind sector has been rapid over the previous few years, and the U.S. Energy Information Administration's energy forecasts recently indicated a nationwide growth rate of 2.2% annually for installed wind energy capacity between 2012 and 2040 (USEIA 2015). Assuming the Facility comes on line in 2017, we applied this growth rate to the installed capacity in the state for the 25-year life of the Facility. This results in a total capacity of 3,147 MW and 1,825 turbines in New York by year 2042 (average turbine capacity = 1.7 MW).

We recognize that wind development, realistically, is likely to fluctuate due to several factors, such as policies, regulations, and availability of incentives. We derived an estimate of wind development in New York using only one method among several that could be implemented. Nonetheless, our method represents a straightforward means of estimating reasonably foreseeable wind energy development in New York.

3.0 AVIAN RESOURCES

We predict the Facility will kill, disturb, and displace birds due to Project presence and operations. We recognize that birds are likely to sustain these same effects at all wind projects. However, our cumulative effects analysis for birds primarily focuses on mortality attributable to the Facility in the context of other existing and future wind facilities in New York. This analysis briefly considers other anthropogenic sources of bird mortality and includes past and present actions and reasonably foreseeable future sources of impacts to birds during the estimated 25-year operation of the Facility.

3.1 MORTALITY AT THE PROPOSED FACILITY AND OTHER WIND ENERGY FACILITIES

As explained in Section 1001.22 (f), average bird mortality is 4.0 bird per turbine per year for wind energy projects across New York and 5.1 birds per turbine per year for projects within 50 miles of the Facility.

We applied the state-wide average avian mortality rate of 4.0 birds per turbine per year to the current installed capacity of wind projects in New York, 1,014 turbines. Using the mean rate, wind energy facilities in New York currently kill roughly 4,000 birds each year. Based on mortality rates reported for 7 post-construction studies at 4 wind energy projects within 50 miles of the Facility (see Section 1001.22(f), we estimate the Facility's rate of mortality will be 5.1 birds per turbine per year (2.3 birds per MW per year) resulting in 296 bird deaths per year of which roughly 70% will be passerines. This is 7.3% of the total bird mortality from installed wind projects in New York. Over its estimated 25-year operational life, the Facility is estimated to kill approximately 7,400 birds. Using our assumptions presented above and after the Facility operates for 25 years, wind energy projects in New York will kill roughly 142,000 birds. The Project's contribution will be roughly 5.2% of the total bird mortality estimated to occur from installed wind projects in New York through year 2042. Table 1 shows a summary of the current and future cumulative effects of the Facility and wind energy in New York.

We recognize the rates used to calculate mortality for the Facility and facilities state-wide are likely to fluctuate somewhere around the means (5.1 and 4.0 birds per turbine per year, respectively) from year to year, and in some years rates may be closer to the minimum or maximum rates.

Table 1. Cumulative bird mortality estimates at the Cassadaga Wind Project and current and projected installed wind energy capacity in New York.

Cassadaga				State-wide Projects							
		Annual mortality	25-year cumulative mortality			Annual mortality in 2015	Facility % contribution to annual	Annual mortality in 2042	25-year cumulative mortality	Facility % contribution to state
Mortality rate (birds/turbine/year)[1]		58 turbines	58 turbines	Mortality rate (birds/turbine/year)[2]		1,014 turbines[3]	58 turbines	1,825 turbines[4]	1,014-1,825 turbines	58 turbines
Minimum	2.36	137	3,425	Minimum	0.75	761	18.0	1,369	~27,000	12.8
Maximum	15.50	899	22,475	Maximum	15.50	15,717	5.7	28,284	~551,000	4.1
Mean	5.10	296	7,395	Mean	4.00	4,056	7.3	7,299	~142,000	5.2

[1] Rate based on the average of observed fatality rates from wind energy facilities within 50 miles of the proposed Facility.
[2] Current installed capacity (AWEA 2016).
[3] Rate based on the average of observed fatality rates from wind energy facilities across New York.
[4] Based on a projected annual growth of 2.2% a year (USEIA 2015).

Of the bird mortality estimated to occur at the Facility, roughly 70% will be composed of birds from the passerine group. It should be noted that no one has documented that a wind energy facility has caused significant population-level impact to any one species of bird. This is largely because nocturnal migrant passerines most at risk of collision are regionally abundant (NRC 2007, Johnson et al. 2002, Arnold and Zinc 2011). Nonetheless, below we attempt to provide context for consequences of bird mortality at the Facility and other facilities in New York using 5 example species.

Chautauqua County is within Partners in Flight Physiographic Area 24, the Allegheny Plateau, an area dominated by extensive forested uplands. The area transitions from oak-hickory forests in the south to beech-maple forests in the north. This forested landscape is interspersed with agriculture primarily at lower elevations. Carcass searches during monitoring at 3 wind energy facilities within 50 miles of the Facility Site found American woodcock, wood thrush, and black-throated blue warbler, all considered to be Partners in Flight priority species for the Alleghany Plateau region. We also include red-eyed vireo and golden-crowned kinglet, two species that are common in New York and also frequently killed at New York wind energy facilities. Based on data from New York wind projects from years 2006 through 2012, post-construction monitoring found 12 black-throated blue warblers, 10 American woodcocks, 4 wood thrushes, 76 red-eyed vireos, and 71 golden-crowned kinglets out of the total 666 birds.

Table 2 provides estimates of cumulative bird mortality from years 2017 through 2042 for 3 priority species relative to current population estimates in New York. We used the average mortality rate for New York projects (4.0 birds per turbine per year) as well as the projected number of turbines (1,825) operating in New York in 2042. In the year 2042, we estimate wind projects in our cumulative effects analysis area will kill roughly 7,300 birds. Using the higher fatality rate of 15.5 birds per turbine per year, we find that wind projects in New York in 2042 will kill roughly 28,000 birds. Even under the worst-case scenario, wind projects are likely to kill <1% of the population of these three priority species.

It is important to note that the most current bird population estimates reflect data that are 9 or more years old. It is possible that one or more of these species has declined or increased in recent years. This may be particularly true for the American woodcock, which has been showing declines since the 1970s, but their decline has been primarily due to habitat loss, degradation, and fragmentation (Kelley et al. 2008). In addition, we cannot predict population sizes in 2042.

Table 2. Estimates of annual cumulative turbine mortality compared to population estimates for five species of birds that have been detected during post-construction monitoring at wind energy facilities in New York.

Species	New York population	Proportion of total fatalities[1]	Annual mortality in 2042 based on mean rate, 4.0 b/t/y	Percent of population affected	Annual mortality in 2042 based on maximum rate, 15.5 b/t/y	Percent of population affected	Breeding Bird Survey trend in New York, 1966-2013[4]
Black-throated blue warbler	140,000[2]	0.018	131	0.094	509	0.364	Slight decline
American woodcock	232,000[2]	0.015	109	0.047	424	0.183	Declining
Wood thrush	620,000[3]	0.006	44	0.007	170	0.027	Declining
Red-eyed vireo	3,800,000[2]	0.114	832	0.022	3,224	0.085	Increasing
Golden-crowned kinglet	300,000[2]	0.106	734	0.258	2,998	0.999	Slight increase

[1] Based on a list of species and their numbers killed at New York wind energy facilities from 2006 through 2012 as reported in post-construction monitoring reports. Proportions by species were calculated relative to the total number, i.e., 666 birds. of birds killed.

[2] Taken from Partners in Flight landbird data base (PIF Science Committee 2013). These data are based on an average of Breeding Bird survey data from 1998-2007 (Blancher et al. 2013).

[3] Woodcock population estimates based on 2000-2004 surveys that counted singing males only. Our population estimate assumes 1:1 ratio of males to females. However, there is strong evidence that sex ratios may be skewed towards more females than males among adults (Roberts 1989), but a more precise ratio is not available.

[4] North American Breeding Bird Survey 1966 - 2013 Analysis (Sauer et al. 2014).

Our annual mortality estimates were applied to single population values at one place in time, and the calculation does not include other variables often used in population dynamics such as recruitment and other sources of mortality. Despite these limitations, the results do indicate a relatively low risk for significant population declines caused by wind power. Even if our predicted mortality rate was as high as 15.5 birds per turbine per year (the highest mortality rate observed at wind power projects in New York), wind projects in 2042 would kill <1% of the most current estimated population sizes of any of the five species in New York, all of which are abundant in the state.

In summary, we do not expect that wind projects in New York will cause population-level effects to avian resources, even those species of conservation concern.

Our cumulative fatality estimates for New York are based on one approach to understanding cumulative effects to birds. However, this approach is conservative and uses the best available information to analyze the effect of wind energy development as a source of avian mortality.

3.2 ANTHROPOGENIC SOURCES OF AVIAN MORTALITY OTHER THAN WIND ENERGY FACILITIES

Table 3 provides estimates of anthropogenic sources of bird mortality for the U.S. in general. The national level is not our cumulative effects analysis area, but similar data scaled to the state of New York or any other region are not readily available.

Table 3. Estimated annual avian mortality from anthropogenic causes in the U.S.

Mortality source	Estimated annual mortality	% of overall mortality
Depredation by domestic cats	1.4–3.7 billion	71-75
Collisions with buildings (including windows)	97-1,200 million	5-23
Collisions with power lines	130-174 million	3-7
Legal harvest	120 million	6
Automobiles	50-100 million	2-3
Pesticides	67-72 million	4
Communication towers	4-50 million	<1
Oil pits	1.5-2 million	<1
Wind turbines	20,000-440,000	<1
Total mortality	1.9-5.2 billion	

Sources: USFWS (2002), Erickson et al. (2005), Thogmartin et al. (2006), Dauphiné and Cooper (2009), Manville (2009), Loss et al. (2013).

3.3 SUMMARY OF CUMULATIVE EFFECTS TO AVIAN RESOURCES

Bird mortality at wind energy facilities contributes to overall mortality. Compared to other anthropogenic sources of avian mortality (Table 3), the effect of avian mortality at wind energy facilities is minor.

The proposed Facility is not expected to cause naturally occurring populations of common or rare birds to be reduced to numbers below levels for maintaining viability at local or regional levels. Resulting bird mortality will contribute cumulatively to other causes of mortality, specifically other wind projects and other anthropogenic sources as listed above in Table 3. Less than 0.1% of all anthropogenic bird mortality is attributed to wind projects. Mortality at wind facilities in New York is not likely to result in population-level impacts to any species of bird. The Facility's BBCS includes a monitoring plan and adaptive management framework designed to monitor bird mortality and respond to significant events should they occur.

4.0 BAT RESOURCES

Based on our analysis of effects to bat resources in Section 1001.22 (f), the Project has the potential to kill bats during operations. We recognize that bats will sustain these same effects at all wind energy facilities in New York. This analysis also considers the effects of WNS, which has resulted in significant bat mortality since its discovery in 2006.

4.1 MORTALITY AT THE PROPOSED FACILITY AND OTHER WIND ENERGY FACILITIES

Table 4 provides a summary of cumulative effects to bats estimated for the Facility, other existing wind facilities in New York, and future installed capacity of wind energy in New York. Rates of mortality of bats vary substantially among projects and depend on a number of factors, such as operational decisions, turbine type, and landscape characteristics. For the purposes of assessing cumulative impacts to bats at the Facility, we used the average mortality rate of 9.7 bats per turbine per year (4.5 bats per MW per year), which is based on publicly available information from four wind energy facilities within 50 miles of the Facility. Therefore, the Facility is estimated to kill 563 bats annually and 14,065 bats over a 25-year term (Table 4).

Table 4. Cumulative bat mortality estimates at the Cassadaga Wind Project and current and projected installed wind energy capacity in New York. Data are from studies of facilities that did not employ feathering or other operational adjustments to minimized bat mortality.

Cassadaga				Statewide Projects						
		Annual mortality	25-year cumulative mortality			Annual mortality in 2015	Project % contribution to annual	Annual mortality in 2042	25-year cumulative mortality	Project % contribution to state
Mortality rate (bats/turbine/year)		58 turbines	58 turbines	Mortality rate (bats/turbine/year)		1,014 turbines[1]	58 turbines	1,825 turbines[2]	1,014-1,825 turbines	58 turbines
Minimum	3.50	203	5,075	Minimum	0.64	649	31.3	1,168	~23,000	22.3
Maximum	24.45[3]	1,418	35,452	Maximum	40.4[3]	40,966	3.5	73,730	~1,400,000	2.5
Mean	9.70	563	14,065	Mean	11.70	11,864	4.7	21,352	~416,000	3.4

[1] Current installed capacity (AWEA 2016).

[2] Based on a projected annual growth of 2.2% a year (USEIA 2015).

[3] Observed at Wethersfield in 2010.

[4] Observed at Cohocton/Dutch Hill in 2009.

To estimate cumulative effects to bats at wind energy facilities in New York during the assumed 25-year operational life of the Facility, we used the average mortality rate of 11.7 bats per turbine per year derived from wind energy projects across New York for which we have post-construction data. Bat fatality rates from these projects were based on operations that implemented no feathering or curtailment, and roughly 77% of the fatalities were migratory tree-roosting bats (eastern red bat, hoary bat, and silver-haired bat). (Generally speaking, this percentage has been observed at wind energy facilities throughout the eastern and Midwestern U.S.) We assumed the fatality rate of 11.7 bats per turbine per year is applicable for all facilities in New York and will remain constant during the 25 years of Facility operation.

Applying this rate to the 1,014 turbines currently installed in New York yields a mortality estimate of roughly 12,000 bats (Table 4). Applying this rate to the projected installed capacity of 1,825 turbines in year 2042 indicates an annual mortality of approximately 21,000 bats in New York and a cumulative total of roughly 416,000 bats taken during this 25 year period, of which more than 320,000 will be migratory tree-roosting bats. Applying the highest rate observed at wind energy facilities in New York (24.45 bats per turbine per year), fatalities would more than double (Table 4). However, we do not anticipate that bat mortality rates would typically be this high at all facilities statewide and would be expected to occur only in certain years at any wind energy facility in New York. We have assumed that the rate of 11.7 bats per turbine per year is the appropriate rate, and the statewide fatality rate for bats could become less as the implementation of operational adjustments is becoming more common and may significantly reduce the average statewide fatality rate.

Cumulative mortality at the proposed Facility will account for roughly 3.4% of the cumulative mortality of bats in the assumed 25 years of operation. Bat mortality at the Facility is not expected to be a significant addition to the cumulative bat mortality at wind energy facilities in New York, particularly with implementation of operational adjustments. Feathering turbines up to the manufacturer's rated cut-in speed will result in reducing mortality by 30% or more (Baerwald et al. 2009, Young et al. 2011, Stantec 2013, AWEA 2015).

Looking at future wind energy development in New York, it is impossible to determine to what extent the cumulative estimate of 416,000 bat fatalities over 25 years causes population-level impacts as no baseline population estimates exist for all of these species with the exception of northern long-eared bats. This particularly applies to the migratory tree bat species, the species group most susceptible to wind turbine mortality. Operational adjustments made by individual wind energy facilities will have a substantial effect on reducing cumulative mortality of bats in New York.

4.1.1 Northern Long-eared Bats

Publicly available post-construction monitoring results in New York reported 8 northern long-eared bat fatalities at 4 wind energy facilities, 2 of which are within 50 miles of the proposed Facility. Any project within the species' range has the potential to take northern long-eared bats, particularly during the fall migratory season. We did not calculate a fatality rate for northern long-eared bats. But we briefly reviewed bat mortality by species documented in available post-construction monitoring reports and found that <1% of bats killed in New York have been northern long-eared bats.

The USFWS estimates there are 228,480 northern long-eared bats in New York (USFWS 2016). Based on the number of northern long-eared bat fatalities reported to date, we conclude that cumulative mortality at the Facility and all other wind facilities in New York is not likely to lead to population-level declines in northern long-eared bats. Additionally, the U.S. Fish and Wildlife Service (USFWS) recently estimated anticipated future impacts to northern long-eared bats from collision with wind turbines throughout its range (USFWS 2016). This analysis estimated the number of northern long-eared bat fatalities in the absence of any operational adjustments. Based on the relatively small numbers affected annually compared to the state population sizes, the USFWS did not find that the operation of wind energy facilities would result in population declines of northern long-eared bats (USFWS 2016).

4.2 WHITE-NOSE SYNDROME

WNS has emerged as the largest single source of mortality for cave-hibernating bats in recent years. As of March 2016, WNS has been confirmed in 30 states and 5 Canadian provinces and as far west as King County, Washington (east of Seattle; WDFW 2016). In 2012, the USFWS estimated total bat mortality reached 6.7 million bats since discovery of the disease in 2006 (USFWS 2012). Turner et al. (2011) documented an 88% decline in overall numbers of hibernating bats comparing pre- and post-WNS counts at 42 sites in 5 northeastern states. At these sites, northern long-eared bats decreased by 98%, little brown bats by 91%, tri-colored bats by 75%, Indiana bats by 72%, big brown bats by 41%, and eastern small-footed bats by 12% (Turner et al. 2011). To date, WNS has not been documented in migratory tree-roosting bat species.

4.3 SUMMARY OF CUMULATIVE EFFECTS TO BAT RESOURCES

We acknowledge that bat mortality at wind energy facilities contributes to overall bat mortality, and the Facility's resulting bat mortality will contribute cumulatively to other wind facility mortality. Compared to the effects of WNS, cave-dwelling bat mortality at wind energy facilities is minor. However, wind energy facilities kill more migratory tree-roosting bats than any other known documented source.

By 2042, wind facilities in New York are predicted to result in more than 400,000 bat fatalities, most of these being migratory tree-roosting bats (~77%). The effect of cumulative mortality on bat populations is highly uncertain because estimates of current population sizes are unknown. Bat mortality at the Facility is not expected to be a significant addition to the cumulative bat mortality at wind energy facilities in New York, particularly with implementation of operational adjustments.

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