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Memo

To:	Seth Wilmore	From:	Trevor Peterson
	EverPower Wind Holdings, Inc.		Stantec Consulting Services Inc.
File:	195600883	Date:	March 21, 2016

Reference: Analysis of Potential Habitat Fragmentation Impacts to Songbirds and Bats Associated with the Cassadaga Wind Project, New York

INTRODUCTION

Forest habitat fragmentation occurs when large blocks of contiguous forest are divided or broken into smaller patches as a result of clearing or canopy removal. Fragmentation can occur at a variety of scales and patterns, each influenced by the habitat needs of individual species. The potential effects of habitat fragmentation depend in part on the original extent of intact forested habitat, how much habitat will be impacted during and after construction, and the behavioral sensitivity of potentially affected species or species groups. The relative impacts of forest habitat removal/conversion also depend on the configuration of impacted areas and types of anticipated activity (e.g., traffic volume, noise levels, visual disturbances) to occur in the affected areas. This memo assesses the potential for construction of the proposed Cassadaga Wind Project (Project) to result in habitat-related impacts to breeding songbird and bat populations, and has been prepared as a supplement to the Project's Article 10 permit application.

POTENTIAL EFFECTS OF FRAGMENTATION ON SONGBIRDS

The potential effects of habitat fragmentation on bird communities depend, in addition to the prior land use and extent of habitat present at a site, on the mixture of resident and migratory species present prior to impact, and how seasonally sensitive those species are to fragmentation. The categorization of bird species as "forest-interior specialists", "interior-edge generalists", "edge species," or "field-edge species," as outlined by Whitcomb et al. (1981) and modified by Freemark and Collins (1992) can be useful in conceptual understanding of potential impacts of habitat fragmentation (Villard 1998). Forest-interior habitat located deep within woodlands is sheltered from influences of forest edges and open habitats. Bird species that utilize forest interior habitat ('forest-interior species') prefer these sheltered conditions due to availability of certain types of food, less nest disruption, and fewer predators. Conversely, forest edge habitat is typically sunnier, warmer, drier, windier, prone to more disturbance, and supports a higher density of predators than interior habitat. Bird species that utilize forest edge ('edge species') are often generalists in terms of habitat needs, are well-adapted to these conditions, and can find their nesting and foraging requirements at forest edges (LandOwner Resource Centre 2000). Importantly, however, presence in a particular habitat does not necessary indicate unaffected reproductive success. Also, while such categorizations are useful in evaluating theoretical impacts of habitat fragmentation, bird species do not always conform to distinct categorizations as preferring "edge" or "interior" habitats.

The Project area consists of 35,365 acres of which 22,930 acres (65%) are forested. Existing land uses in and around the Project area include agricultural fields, a variety of roads, low density residential development, and infrastructure associated with natural gas extraction. Existing forested habitat at the Project is fairly fragmented in the western portion of the Project, and less fragmented in the eastern portion, where up to 58 turbines and associated infrastructure are proposed in relatively non-fragmented forested areas (Figure 1). Clearing for all components (service roads, collector lines,

turbine pads, and laydown areas) associated with the Project is expected to remove 319 forested acres (1.4% of forested habitat). New York Department of Environmental Conservation (NYSDEC) suggested, in a January 2016 phone meeting with Project developers, that effects of clearing on forest birds should be assumed to extend into the adjacent forest for 300 feet in all directions from cleared areas. Including this 300-foot buffer, 1,664 acres of forest (7.3% of forested area) may be impacted by clearing associated with the Project.

All pre-construction surveys were conducted in accordance with a work plan that was developed in consultation with the NYSDEC and the U.S. Fish and Wildlife Service (Service). Pre-construction breeding bird survey results and point counts conducted during fall migration provide an opportunity to assess potential impacts associated with habitat fragmentation as a result of development and operation of the Project. Stantec documented both forest-interior and edge species during spring breeding and fall migration surveys at the Project. During spring breeding bird surveys, most of the forest-interior individuals were observed in forested (hardwood forest and mixed forest) habitat (n=139, 70%; Table 1). Interior-species were also observed in non-forested habitats, and non-interior species were observed in forested habitats, indicating variation in utilization among different habitats in the Project during spring breeding season. Since no forested habitat was surveyed during fall migration surveys, and since songbirds are more difficult to identify during fall due to drab plumage and minimal singing, observations of forest-interior species during fall were infrequent. One hooded warbler, a predominantly interior species, was observed in over-grown field habitat during fall migration surveys (Stantec 2015). Breeding bird point-count surveys were not designed to quantify reproductive success rates and so that information is unavailable.

Table 1. Locations of forest-interior species observed during breeding bird surveys at Cassadaga Wind Project, Spring 2014.

Forest-interior Species	Non-forest total (59 points)	Forest total (26 points)	All points total (85 points)	% observed in forested habitat
American redstart	4	5	9	56%
black-and-white warbler	2	8	10	80%
blackburnian warbler	1	0	1	0%
black-throated blue warbler	0	2	2	100%
black-throated green warbler	0	8	8	100%
brown creeper	0	1	1	100%
hooded warbler	12	19	31	61%
ovenbird	16	36	52	69%
red-eyed vireo	16	26	42	62%
scarlet tanager	5	13	18	72%
veery	1	6	7	86%
wood thrush	3	15	18	83%
Total	**60**	**139**	**199**	**70%**

Despite being partially fragmented, the Project area supports a diversity of songbirds that is typical for similar habitats in the region, including a variety of fragmentation-sensitive interior species. Forest-

interior species such as hooded warbler, ovenbird, red-eyed vireo, scarlet tanager, and wood thrush (all observed during breeding bird surveys) are sensitive to fragmentation and may experience reproductive dysfunction associated with fragmentation (Donovan and Flather 2002). Ground or open-nesting species should be most sensitive to fragmentation, and may experience low nesting success due to nest predation and nest parasitism (Lampila et al. 2005). Species in this category include hooded warbler, black-and-white warbler, black-throated blue warbler, ovenbird, and veery (Cornell University 2015). These species were frequently observed at the Project site, with individuals utilizing both forested and forest-edge habitats. Forest-edge habitat had the greatest number of birds observed, the greatest species richness, and the greatest Shannon Diversity Index during breeding bird surveys (Stantec 2015). Large areas of forest-edge are created when continuous forest is fragmented, providing suitable habitat and supporting edge-adapted species, as observed at the Project site.

Construction and use of service roads generally present lower levels of threat to bird communities than highways and other major roads, due to smaller sizes (thus less clear-cutting), lower levels of traffic, and lower vehicle speeds (Jacobson 2005). The primary potential habitat-related impacts to songbirds that could be anticipated as a result of construction and operation of the Project may be increased predator activity along edges, which could either reduce reproductive success or remove viable habitat for certain vulnerable species (e.g., ground nesting songbirds). Certain species that are least tolerant of edges, or more susceptible to nest predation, may suffer reduced reproductive success over the long-term, based on cumulative landscape conversion in the Project area and surrounding region.

Empirical studies of the effects of constructing wind projects on breeding bird populations with similar landscapes elsewhere in New York have not documented substantial shifts in species presence or distribution before and after construction. A breeding bird study was conducted after construction of the Howard Wind Project in Steuben County, New York, to assess the potential bird avoidance and/or habituation to turbines in a fragmented landscape. Surveys did not document systematic shifts in species composition or abundance based on proximity to turbines, nor did they document behavioral avoidance of turbines. Only the passerine subtype creepers and nuthatches exhibited statistically significant patterns of avoidance across the 2-year study (West, 2014).

Given that only 1.4% of forested habitat at the Project is expected to be cleared (7.3% of habitat indirectly impacted assuming a 300-foot buffer/affected area), that access roads will have low levels of vehicle use, and that the Project area already consists of a patchwork of forested and non-forested habitats, it is unlikely that this Project poses a significant risk of habitat-related impacts to bird communities. The interior species observed in the Project area will likely continue to persist after clearing associated with the Project. Habitat-related impacts associated with wind projects are expected to be less than those associated with activities requiring greater percentages of deforestation, larger-scale construction activities, and greater human presence, such as large-scale agriculture, logging, transportation, and urban development. Species sensitive to fragmentation are currently present in partially fragmented areas of the Project, and utilize forested and non-forested habitats. Given the persistence of these species, and the fact that Project-related activities will result in minimal amounts of additional habitat fragmentation, it is likely that these species will continue to persist after small amounts of additional fragmentation.

POTENTIAL EFFECTS OF FRAGMENTATION ON BATS

Potential effects of habitat fragmentation on bats are not well understood. Potential mechanisms of impact may vary among species but could include increased parasitism and/or predation, narrowed niche breadth, or shifts in home ranges (Segers and Broders 2014). Forest structure plays an important role in determining the suitability of foraging habitat, with different species selecting foraging habitat according to their prey preferences and flight morphology. Large bats such as migratory hoary bats (*Lasiurus cinereus*), eastern red bats (*Lasiurus borealis*), and silver-haired bats (*Lasionycteris noctivagans*) tend to be less maneuverable and prey on larger insects (Aldridge and Rautenbach 1987; Fenton 1990). As a result, these species tend to forage in open habitats or above the forest canopy. Small, highly maneuverable bats such as northern long-eared bats (*Myotis septentrionalis*) and eastern small-footed bats (*Myotis leibii*) typically forage closer to the ground, often beneath the forest canopy. Many bat species forage along forest edges, riparian corridors, and other gaps in the forest. Accordingly, a matrix of forest types and structural elements including gaps, edges, and corridors likely increase the overall diversity of bats in an area, provided a sufficient amount of roost opportunities and access to water (Krusic et al. 1996).

The clearing of linear corridors (e.g., access roads) and patches (e.g., turbine clearings) in an otherwise forested landscape will increase the amount of edge habitat present and reduce the amount of forest interior habitat. Accordingly, bat species that forage along forest edges and within open areas are likely to benefit from these activities whereas available habitat will be reduced for species preferring to forage within forest interior. Indeed, bat species appear to respond differently to forest thinning or clearing, probably due to a combination of prey availability, foraging behavior, or influence of forest structure on factors such as wind speed (Patriquin and Barclay 2003; Segers and Broders 2014). Forest interior specialists, such as northern long-eared bats, have shown a positive association with forest patch size, although effects differed among males and females (Henderson et al. 2008). However, forest fragmentation typically does not negatively impact bat diversity or abundance in a forested landscape unless remnant forest patches are very small or widely isolated (e.g., Lesinski et al. 2007; Medelin et al. 2010).

As described above, a small percent of forested habitats within the Project area will be cleared, and remaining forest habitat should provide ample roosting opportunity for bats. While loss of individual roost trees could certainly occur as a result of forest clearing, most bat species that reproduce in New York are not thought to be limited by day roost availability. Specifically, roost habitat is not considered a limiting factor for the federally threatened northern long-eared bat, which could occur in the Project area (USFWS 2016). Further, impacts to wetland resources, which provide preferred foraging habitat for many bat species in the region, will be avoided. Accordingly, construction of the Project is not expected to negatively impact the suitability of foraging or roosting habitat for bats. The distribution of species across the Project area may shift somewhat as a result of creating additional edge habitat and cleared corridors, although sufficient intact forest patches will remain for species that forage within the forest interior habitats as well as those that prefer open habitats and edges.

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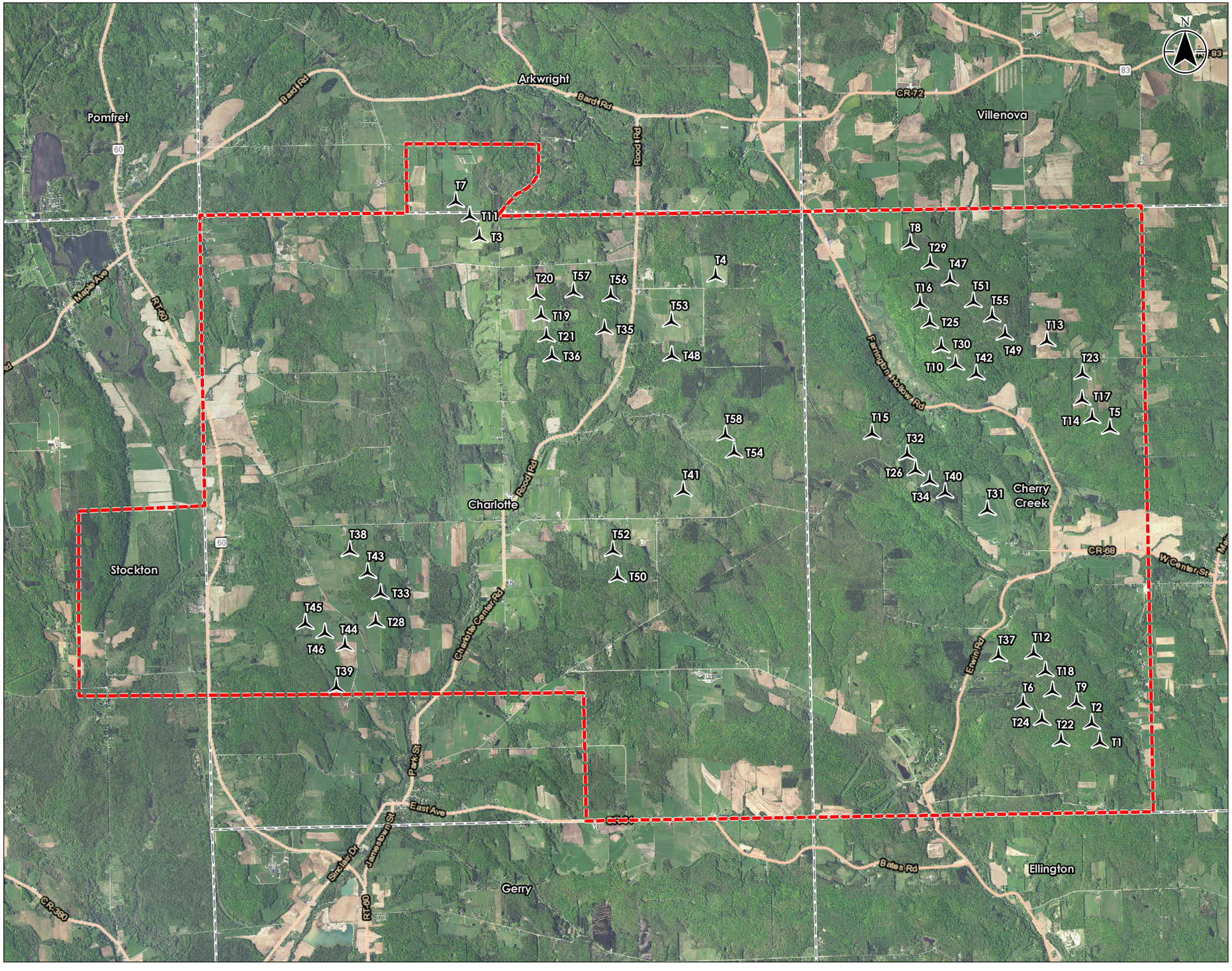
Attachment: Figure 1 – Proposed Turbine Location



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Legend

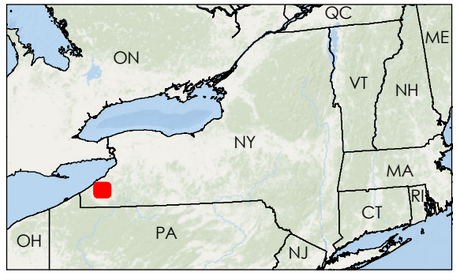
- Proposed Turbine Layout (EP_WTG_L23R20160115)
- Proposed Project Area 2015-04-03
- Town Boundary

0 1 2 Mile

1 inch = 1 mile (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. 2015 National Agriculture Imagery Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency.



Project Location
Chautauqua County, New York

195600883
Prepared by DLJ on 2016-03-07
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Independent Review by TSP on 2016-03-07

Client/Project
EverPower Wind Holdings, Inc.
Cassadaga Wind Power

Figure No.
1

Title
Proposed Turbine Location

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