ARKWRIGHT SUMMIT WIND FARM
NORTHERN LONG-EARED BAT
TAKE AVOIDANCE MEASURES
CHAUTAUQUA COUNTY, NEW YORK

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INTRODUCTION

EDP Renewables North America (EDPR) intends to develop a Habitat Conservation Plan (HCP) for operation of the Arkwright Summit Wind Farm (Project) in Chautauqua County, New York. The HCP will be developed to support an Incidental Take Permit (ITP) application for potential take of the threatened northern long-eared bat (*Myotis septentrionalis*).

In order to ensure that Project development continues during HCP development process, EDPR has developed the following interim measures that will be implemented to avoid potential take of northern long-eared bat during construction and operation of the Project. These measures will be implemented until the ITP is issued, at which time the conservation measures in the HCP will be implemented and the interim measures will be discontinued. At this time, and based on the Project schedule, it is anticipated that these measures will be in place during 2016 and 2017 (the construction period) and 2018 (the first year of Project operations) while the HCP is being developed.

PROJECT DESCRIPTION

The Project is located approximately two miles (three kilometers [km]) east of Fredonia, New York and approximately five miles (eight km) south and east of Lake Erie. The proposed Project would consist of 36 wind turbines, a 5.5 mile long generation lead line to connect the Project to the transmission grid as well as associated infrastructure (i.e., operations and maintenance [O&M] facility, access roads, underground collector lines, and a substation), with a total capacity of approximately 78.4 megawatts (MW). As proposed, 32 turbines would have a nameplate rating of 2.2 MW and 4 turbines would have a nameplate rating of 2.0 MW, with tower heights of 95 meters (m; 312 feet [ft]), blade lengths of 56.0 m (184 ft), and a maximum vertical height when a blade is in the vertical position of 150 m (492 ft). Project construction and commissioning is anticipated to occur beginning September 2016, with completion by the end of 2017.

The Project is located on relatively broad hilltops with an elevation range of 750 to 1,900 feet (ft; 229 to 579 meters [m]), generally increasing from north to south. Primary roads near the Project area include Route 39 to the north and Route 83 towards the south. An existing 115-kilovolt (kV) transmission line runs along the western boundary and an existing 230-kV transmission line runs along the northern boundary. The Project Area is approximately 64% forested upland (deciduous, evergreen, and mixed forests), and 26% is composed of agricultural land (hay, pasture, crops, shrub/scrub) (NLCD 2011). The primary cover types are mixed throughout the Project area, with some concentrations of evergreen forests and hay/pasture (Figure 1).The Project is located within the Great Lakes and Ohio River Valley ecoregions.

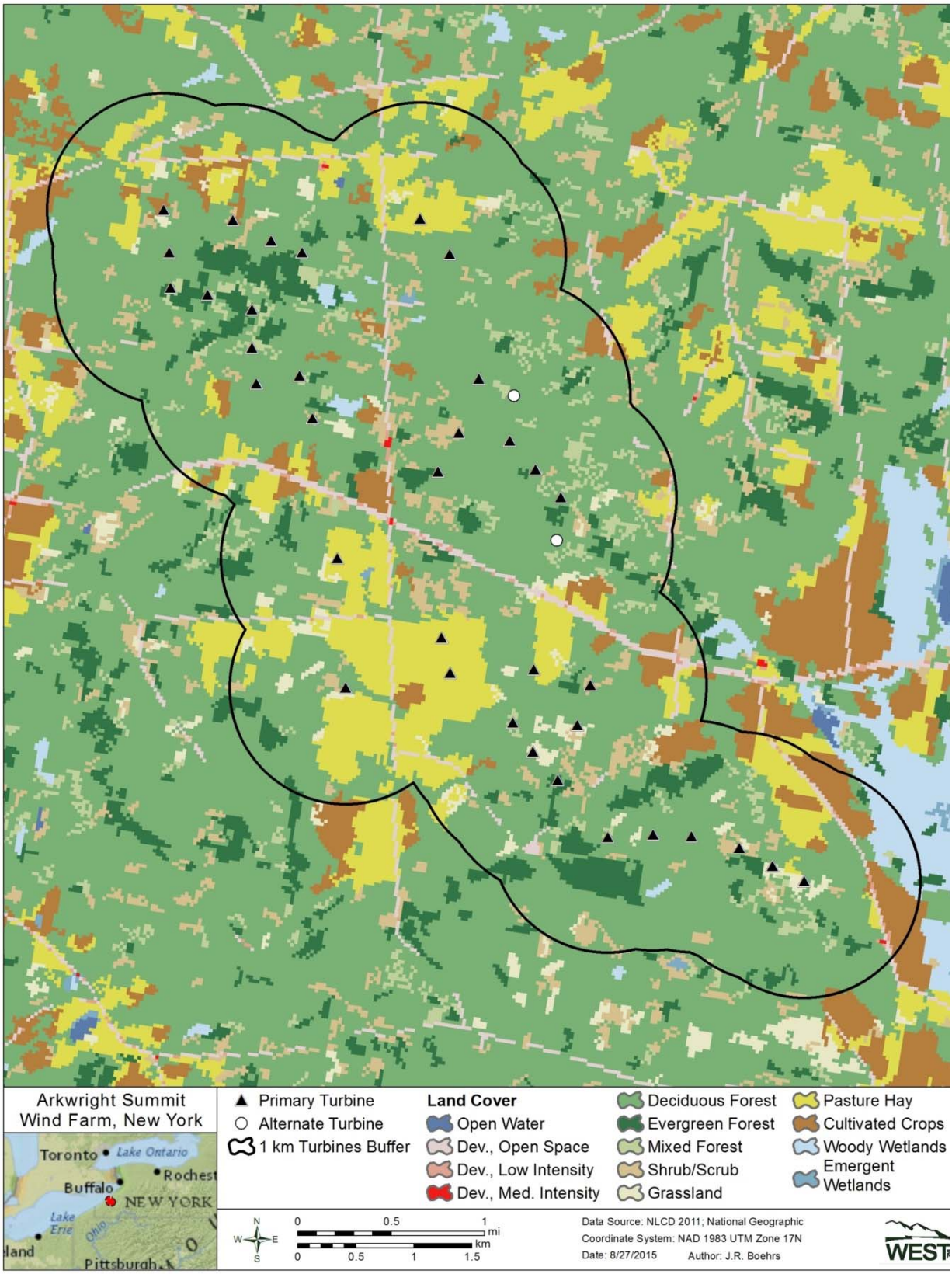

Figure 1. The Arkwright Summit Wind Farm vegetation types and landcover map.

OCCURRENCE BY SEASON

Based on the results of site-specific survey results and the best available scientific literature, occurrence by season of northern long-eared bat at the Project is expected to be as follows:

Winter Hibernation Season (November 1 to March 31)

During this period, northern long-eared bats are expected to be hibernating within caves and abandoned mines. Although northern long-eared bats have occasionally been captured outside hibernacula during the winter and have also been documented to move from one hibernaculum to another during a winter season, the physiological costs of long-distance movements make it unlikely that winter flight in northern long-eared bats involves either long distances or extended periods.

Spring Migration Season (April 1 to May 15)

The timing of spring bat emergence from hibernacula and migration to summer habitat varies depending on a number of factors such as latitude, elevation, and weather patterns but typically occurs between mid-April and the end of May in northern New York. The New York State Department of Environmental Conservation (NYSDEC) generally conducts emergence surveys in May when night time temperature exceeds 50º F (C. Herzog, NYSDEC, pers. comm.).

Northern long-eared bats occurring as possible summer residents in the central part of the Project (see below) would migrate to the area from hibernacula during the spring season. Though given the fact there were a low number of acoustic positive identifications and none captured during mist netting risk to northern long-eared bats is therefore expected to be low during spring migration at all turbines.

Summer Maternity Season (May 16 to September 30)

On-site presence/probable absence acoustic surveys conducted in 2015 showed positive acoustics identifications for northern long-eared bats at one out of the 35 locations surveyed for the turbines and transmission. The location was located in the north-central part of the Project. No northern long-eared bats were captured during follow-up mist nest surveys at the positive acoustic location. These results indicate that northern long-eared bats may occur as summer residents though likely in low numbers. Thirty-two (89%) Project turbines are within a three-mile radius[1] (USFWS 2014) of the northern long-eared bat acoustic positive site. Northern long-eared bats may therefore occur near these turbines during the summer season, although the foraging behavior of the species (USFWS 2014), which is generally within the forests, is likely to limit exposure of the species to the rotor-swept area of the turbines. Risk to northern long-eared bats is therefore expected to be low during summer maternity season at the 32 turbines within three miles (five kilometers) of the acoustic positive sites and unlikely during the summer maternity season at the remainder of the turbines.

[1] In the absence of known roost tree locations, the USFWS considers the possible home range/foraging distance as three miles from positive capture or acoustic locations (USFWS 2014).

Fall Migration Season (August 1 to September 30)

Following the summer maternity season, there is a period when northern long-eared bats disperse away from the maternity areas and migrate back to the hibernacula. This period overlaps with the summer season as some bats may stay in summer habitat throughout much of this period. During this period there may be more "relaxed" movements between the maternity areas and the hibernacula and thus northern long-eared bats may be more dispersed on the landscape (e.g., not concentrated around maternity areas). Hibernacula are a destination for northern long-eared bats migrating from their maternity area to wintering areas; there are no documented hibernacula near the Project, although it is recognized that there are likely unknown hibernacula in western New York that could also be winter destinations for bats leaving the Project. Bat populations have been severely reduced due to WNS, indicating that few northern long-eared bats are likely to migrate across the Project. However, risk to northern long-eared bats is expected to be relatively highest during this season based on the migration behavior patterns and because most of the northern long-eared bat carcasses documented to date at wind energy facilities have occurred during this season.

Fall Swarming and Late Fall Season (October 1 to October 31)

When northern long-eared bats arrive at hibernacula in the fall, they engage in swarming (mating) activity in the habitat at the entrance and around the hibernacula. It is generally believed that northern long-eared bats generally occupy the habitat within five miles of hibernacula during the fall swarming period. Based on the distance between any hibernacula and the Project, and the reduced populations due to WNS, it is unlikely that fall swarming bats occur within the Project.

MEASURES TO AVOID POTENTIAL TAKE OF THE LISTED BAT SPECIES

Avoidance measures for the construction and operation and maintenance phases of the Project are summarized below in Table 1. These measures are discussed in more detail in the following sections.

Table 1. Summary of Avoidance Measures, by Season, for Northern Long-eared Bats at the Arkwright Summit Wind Farm.

Season	Dates	Wind Speed Blades Feathered Below		Tree Removal
		32 turbines near positive NLEB[1] acoustic ID	Remaining turbines	
Spring Migration	4/1 – 5/15	5.0 m/s	3.0 m/s	No[2]
Summer Maternity (until Fall overlap)	5/16 – 7/31	6.9 m/s	3.0 m/s	No[2]
Summer Maternity and Fall Migration	8/1 – 9/30	6.9 m/s	6.9 m/s	No[2]
Fall Swarming and Late Fall	10/1 – 10/31	3.0 m/s (no feathering)	3.0 m/s (no feathering)	Yes
Winter Hibernation	11/1 – 3/31	3.0 m/s (no feathering)	3.0 m/s (no feathering)	Yes
Adaptive Management Triggers		NLEB carcass found in Spring, increase cut-in speed to 6.9 m/s	NLEB carcass found in any season, adopt cut-in speed of 5.0 m/s; confer with USFWS about limiting # of turbines affected	

[1] NLEB = northern long-eared bat
[2] Emergency tree removal and hazard tree removal will be conducted as needed following the avoidance protocol defined in the text.

Construction:

Tree removal on site will only occur during the period October 1 to March 31, except in the case of emergency tree removal which will be carried out according to the provisions described below. During this period, October 1 to March 31, northern long-eared bats are expected to be engaged in swarming behavior at the hibernacula, roosting and foraging in habitat near the hibernacula, or hibernating over the winter months and therefore not roosting in trees in the Project Area. Tree removal during this period would avoid taking northern long-eared bats because they would not be present in the Project Area.

If any emergency tree removal[2] is necessary it will be conducted as needed. If removal of high-risk[3] hazard trees is necessary from April 1to September 30 during construction, operations, or maintenance, of the Project, EDPR will notify the USFWS in advance and, if appropriate, have a qualified biologist conduct an emergence survey at the tree(s) requiring removal. If no bats are observed during the emergence survey, the high-risk hazard tree(s) will be promptly removed.

[2] Emergency tree removal would be for trees that pose an imminent risk to human life or property damage.
[3] Trees that are likely to require removal prior to the next late fall/winter season would be considered high-risk.

This will reduce the risk of removing an undiscovered roost tree. If bats are observed, then EDPR will conduct further consultation with the USFWS to determine the appropriate course of action.

Operation and Maintenance:

Tree removal necessary for regular maintenance on site will only occur during the period October 1 to March 31 (Winter Hibernation Season), except in the case of emergency tree removal which will be carried out according to the provisions described for construction, above.

During the operation and maintenance phase of the Project, EDPR will adjust turbine operational protocols in a manner designed to avoid take of northern long-eared bats during periods when the bats are at risk (Table 1). The seasonal turbine operational adjustment protocol to be implemented will be as follows:

- April 1 to May 15 (Spring Migration Season): Feather turbine blades when wind speeds are 5.0 m/s or lower between sunset and sunrise at the 32 turbines within 3 miles of the northern long-eared bat acoustic positive sites. Feather the remaining four turbines at 3.0 m/s or lower.
- May 16 to July 31 (Summer Maternity Season-until overlapped by Fall Migration Season): Feather turbine blades when wind speeds are 6.9 m/s or lower between sunset and sunrise at the 32 turbines within 3 miles of the northern long-eared bat acoustic positive sites. Feather the remaining four turbines at 3.0 m/s or lower.
- August 1 to September 30 (Summer Maternity Season and Fall Migration Season): Feather turbine blades when wind speeds are 6.9 m/s or lower between sunset and sunrise at all turbines

Based on extrapolation of the results of curtailment studies conducted to-date, feathering turbines under the manufacturer's rated cut-in speed (3.0 m/s) is expected to achieve at least a 30% reduction in all bat mortality. Studies have shown curtailing the turbines under 5.0 m/s have shown reductions of 33% and 82% (with an average of 59%). It is currently unclear if operational adjustments will be equally effective at reducing mortality among different species or species groups. Collectively, hoary bats, eastern red bats, and silver-haired bats comprise the vast majority of all bat fatalities documented at wind facilities (e.g., 78% of estimated fatalities 2000-2011, Arnett and Baerwald 2013); consequently, these three species have provided the bulk of the all bat fatality data analyzed in the curtailment studies to-date. It is likely that, based on their morphology and flight behavior, smaller species of bats such as *Myotis* are less active at higher wind speeds compared to larger species of bats that typically forage in more open habitats, and especially in the rotor-swept area of turbines. If this hypothesis is true and *Myotis* species are more active on low wind speed nights and less active as wind speed increases (which is considered plausible given their small size and typical behavior of not foraging in large open areas, where wind speeds are typically greater), then feathering turbine blades to reduce blade movement at low wind speeds would be most effective at reducing *Myotis* mortality.

Northern long-eared bats exhibit flight behaviors that minimize exposure to the rotor-swept area of turbines during periods of higher wind speeds. The lack of northern long-eared bat fatalities at wind energy facilities operating with blades feathered at raised cut-in speeds provides further support for the effectiveness of these measures at reducing risk to the species.

Feathering turbines below 6.9 m/s is the current protocol recommended by the USFWS to avoid take of northern long-eared bats during the fall season and other periods of high risk for listed species (e.g. Indiana bat). Therefore, take of northern long-eared bats under the seasonal turbine operational adjustment protocol outlined above is unlikely.

For ease of reference, the avoidance measures described above for the construction and operation and maintenance phases of the Project are summarized below in Table 1.

POST-CONSTRUCTION MORTALITY MONITORING PROGRAM

The objective of the post-construction mortality monitoring during the period when the avoidance measures will be in place (April 1 to September 30) is to provide data that can be used to determine the effectiveness of the above seasonal turbine operational adjustment protocol.

Field Methods and Data Collection

Observers trained in proper search techniques will conduct carcass searches at all 37 turbines once per week from April 1 to September 30. Searches will be conducted in searchable areas out to 60 m from the turbine tower (i.e., a plot of 120 m in diameter); this plot size incorporates the area within which nearly 100% of bat carcasses are expected to fall. Searches will be conducted along transects within each search plot and observers will walk at a rate of approximately 45 to 60 m per minute along each transect, scanning the ground out to 2-3 m either side of the transect for casualties[4]. Transects will be spaced at a maximum of 5-m intervals, allowing for some visual overlap of search area between transects to help maximize casualty detection.

For all casualties found, data recorded will include species, sex and age determination (when possible), turbine identification number, date and time collected, GPS location, condition (e.g., injured, intact, scavenged), and distance from turbine, as well as any comments that may indicate cause of death. For casualties where the cause of death is not apparent, the assumption that the casualty is due to wind turbine collision will be made for the analysis. All casualties located will be photographed as found and plotted on a detailed map of the Project showing the location of the wind turbines and associated facilities. Casualties found outside of standardized searches or by non-study personnel will be coded as incidental discoveries and will be documented in a similar fashion as those found during standard searches. Incidental casualties will be handled following the above protocol as closely as possible.

Old or scavenged bat carcasses will be identified to the extent possible, labeled with a unique number, and then bagged and frozen for future reference and possible species identification testing (e.g., DNA analysis). A copy of the data sheet for each casualty will be maintained, bagged with the carcass, and kept with the carcass at all times.

[4] A casualty is defined as either a dead or injured bird or bat.

Appropriate wildlife salvage permits will be obtained from the NYSDEC and USFWS. Dissemination of data (e.g., to the USFWS Special Agent and/or other agency representatives) will be as needed, or according to permit condition. All *Myotis* carcasses will be identified as soon as possible by biologists trained in the identification of *Myotis* species. In order to verify field identifications, all *Myotis* carcasses will be provided to the USFWS and/or NYSDEC for concurrence on species identification. The final disposition of individual casualties will be based on direction from the appropriate salvage permits (as per the NYSDEC and USFWS) and the legal status of individual carcasses. The USFWS and NYSDEC will be notified (by email and/or phone) within 24 hours or the next business day if any eagles or federally listed species casualties are discovered.

If any northern long-eared bat carcasses are discovered outside of the 32 turbines within 3 miles of the northern long-eared bat acoustic positive sites, all Project turbines will be operated under the same protocol as outlined for the aforementioned 32 turbines until EDPR coordinates with USFWS to determine the circumstances of the northern long-eared bat fatality and a more precise adjustment to the Project-wide operational protocol can be determined, as appropriate.

If any northern long-eared bat carcasses are discovered during the spring season (April 1 – May 15) at the 32 turbines within 3 miles of the northern long-eared bat acoustic positive sites, blades of all 32 turbines will be feathered when wind speeds are 6.9 m/s or lower between sunset and sunrise until EDPR coordinates with USFWS to determine the circumstances of the northern long-eared bat fatality and a more precise adjustment to the operational protocol for the aforementioned 32 turbines can be determined, as appropriate.

Field Bias Trials

The efficiency rates of observers and removal rates of carcasses (e.g., by scavengers) will be quantified to adjust the observed number of fatalities for detection bias. Bias trials will be conducted throughout the entire monitoring period each year. Frozen or fresh bird and bat carcasses (non-*Myotis* only) may be used for carcass removal trials and searcher efficiency trials, if available and allowed by permit. Commercially available non-native/non-protected species, such as house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), rock dove (*Columba livia*), or hen pheasant (*Phasianus colchicus*), and mice (*Mus musculus*) may be used to supplement carcasses found during searches. Bias trials will consist of approximately 40 large birds, 40 small birds, and 40 bats (or mice if bats are not available) each season of monitoring. Trial carcasses will be spread out as evenly as possible both spatially and temporally over the course of the monitoring period to avoid overseeding the area with carcasses (i.e., introducing a large number of carcasses over a small period of time or over a small area such that it creates a concentration of carcasses in space and time that may influence scavenger activity and therefore result in an inaccurate estimate of carcass removal at the site).

The field crew leader will gather all carcasses and redistribute those that are intact at the predetermined random points within any given turbine's searchable area prior to that day's searches. Data recorded for each trial carcass prior to placement will include date of placement, species, turbine number, and the distance to and the direction from turbine. Small, black zip ties will be placed on the wing or legs of each carcass to distinguish it from other casualties potentially

caused by the facility, or if scavengers move the trial carcass away from its original random location. For the removal trial, each trial carcass will be left in place and checked by the field crew leader or an observer not involved with carcass searches for up to 14 days, or until the carcass is removed. To the extent practical, trial carcasses will be checked on days one, two, four, six, eight, 10, 12, and 14.

Trial carcasses will also be used for estimating searcher efficiency bias. Observers conducting carcass searches will not know when, where, or how many carcasses will be placed for the trials. When a carcass is found, the observer will inspect the carcass to determine if a trial carcass had been found. If so, the observer will contact the field crew leader and the carcass will be left in place for the carcass removal trial as described above.

Fatality Estimation

The estimates of total bird and bat fatalities will be calculated based on:

- Observed number of bird and bat casualties found during standardized searches during the monitoring period;
- Carcass persistence rates, expressed as the estimated average probability a bird or bat carcass is expected to remain in search areas and be available for detection based on the carcass removal trials;
- Searcher efficiency, expressed as the proportion of planted carcasses found by searchers during searcher efficiency trials, and
- An area adjustment factor for non-searchable areas or casualties potentially falling in non-searched areas around the turbine.

Upon completion of each monitoring year, data will be examined to determine the most appropriate methods for calculating bird and bat mortality (casualty rate). It is anticipated that the most appropriate statistical methods will be the Huso estimator (2010; Huso and Dalthorp 2014); however, other estimators developed in the future may be considered, as appropriate.

The species composition method (as defined below) will be used to estimate if take of northern long-eared bats may have occurred. If the northern long-eared bat estimate calculated through the species composition method is less than 0.5 bat for the study period, then it will be determined that no take occurred. That is, we would predict less than 0.5 bat, rounded down to 0 individuals, over the study period.

The species composition method is based directly on fatality records of the covered species and assumes the fatality records from post-construction monitoring studies available for review are generally representative of the species composition of bat mortality in general and at the Project. The species composition method consists of two steps: (1) determine the all-bat fatality rate estimate for the Project and (2) determine the proportion of the all-bat fatality rate that may be attributable to northern long-eared bats The second step will be achieved by using regional data available for review (i.e., public post-construction monitoring data from other wind energy facilities in regions biologically relevant to the Project), because there will be no prior post-construction bat mortality data from the site.

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