2018 Post-Construction Bat Mortality Monitoring Report Wildcat Wind Farm

Madison and Tipton Counties, Indiana

Project #193704633

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CERTIFICATION

Under penalty of law, I certify that, to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of this report, the information submitted is true, accurate and complete in all material respects.

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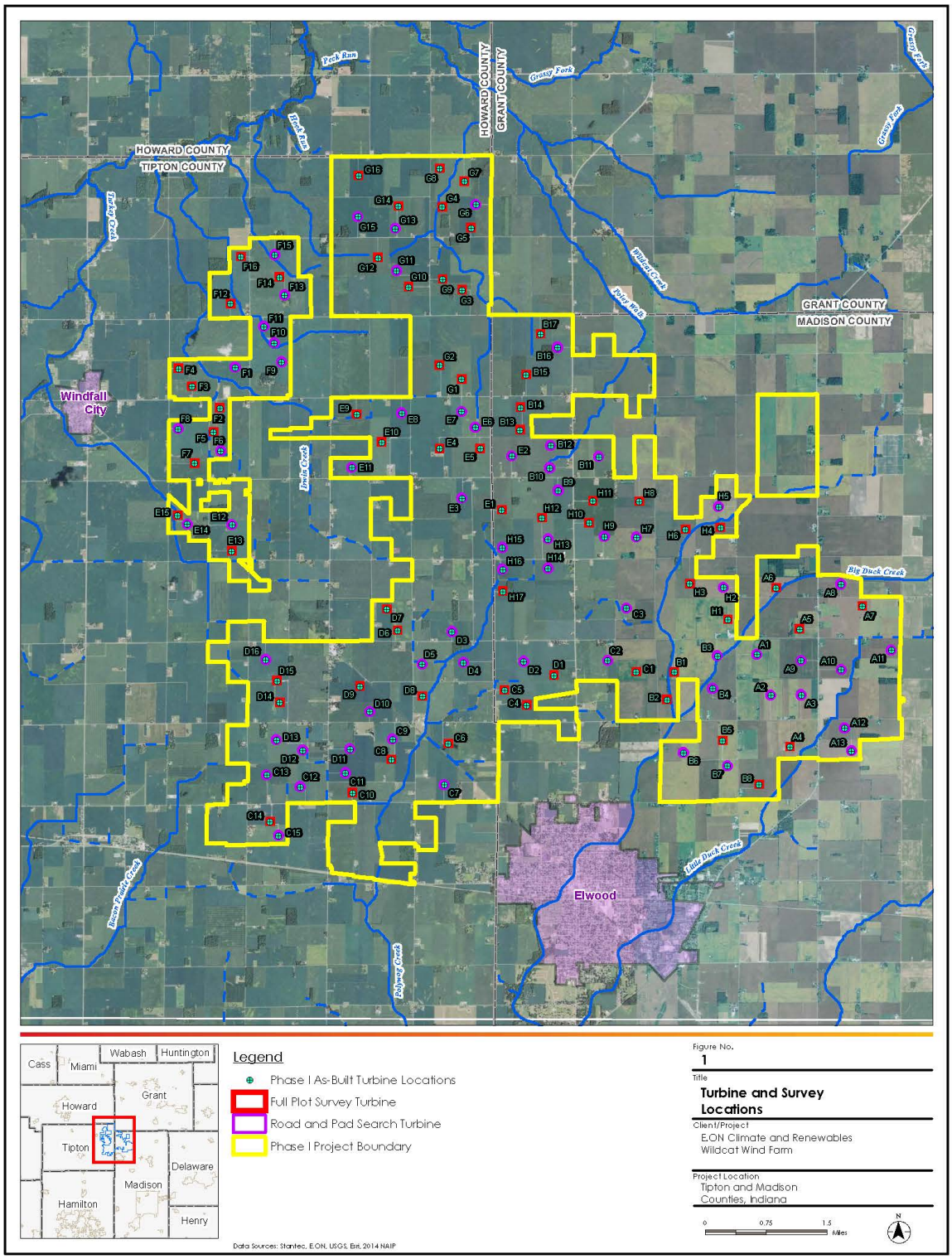
1.0 Introduction

1.1 PROJECT DESCRIPTION AND HISTORY

The Wildcat Wind Farm (Project or Wildcat), developed by Wildcat Wind Farm I, LLC (WWF), is located in Madison and Tipton counties, north of the town of Elwood, Indiana. The Project consists of 125 GE 1.6-megawatt (MW) wind turbine generators and associated access roads and collector line system for a total capacity of 200 MW (Figure 1). The Project is located on lands leased from private landowners who continue their pre-wind farm use of the land. Land use in the area is predominantly agricultural.

Wildcat is located within the range of both the federally endangered Indiana bat (*Myotis sodalis*) and federally threatened northern long-eared bat (*Myotis septentrionalis*). On 19 August 2016, the Project obtained an Incidental Take Permit (ITP) from the United States Fish and Wildlife Service (USFWS), allowing operations under the terms of the Project's Habitat Conservation Plan (HCP), which covers the Indiana bat and northern long-eared bat (covered species), requires curtailing of turbines to 5.0 meters/second (m/s) during the fall migration period (1 August–15 October), and outlines the requirements for post-construction monitoring to ensure permit compliance. The ITP authorizes the take of 162 Indiana bats and 81 northern long-eared bats over the 27 years of project operations, or an average of 6 Indiana bats and 3 northern long-eared bats per year. This is the sixth year of monitoring at the Project, and the results of previous monitoring are outlined in Section 4.2.

Figure 1. Project Location and Survey Locations



1.2 PURPOSE AND OBJECTIVES OF THE STUDY

Spring and fall monitoring were conducted as part of the baseline monitoring process under the HCP post-construction monitoring plan to:

1. Provide a means of monitoring and ensuring the Project's compliance with the take limits authorized in the ITP
2. Assess the effectiveness of the HCP in meeting the biological objective of minimizing direct morality of Indiana and northern long-eared bats

2.0 Methods

Both the spring and fall studies included the following components:

1. Standardized carcass surveys to systematically search plots at all turbines for bat casualties attributable to the turbines
2. Searcher efficiency trials to estimate the percentage of bat casualties that were found by the searcher(s)
3. Carcass removal trials to estimate the persistence time of carcasses on-site before scavengers removed them

2.1 MORTALITY STUDY

Carcass surveys were conducted in spring (2 April-17 May) and fall (1 August -16 October) during the 2018 year of project operation. The Project was operating under the following conditions:

1. Spring (1 April–15 May): 3.5 m/s cut-in speed (manufacturer's cut-in speed)
2. Fall (1 August–15 October): 5.0 m/s cut-in speed

2.1.1 Sample Size

Post-construction monitoring was conducted at 100% of the turbines. This study design provides full coverage of the facility and will serve as a control to which subsequent monitoring results can be compared.

2.1.2 Survey Plot Size

During the spring and fall seasons, surveys consisted of searching roads and pads out to 262 feet (ft; 80 meters [m]) at 50% of the turbines (n=63) and cleared plots (262-ft x 262-ft [80-m x 80-m] centered around each turbine) using a full-coverage transect method at the remaining 50% (n=62). This hybrid approach targets the areas shown to support the highest searcher efficiency while greatly reducing the financial and logistical constraints associated with clearing and searching large study plots, enabling much broader coverage of the facility.

Previous post-construction studies have indicated that the majority of bat carcasses typically fall within 100 ft (30 m) of the turbine or within 50% of the maximum height of the turbine (Kerns and Kerlinger 2004, Arnett at el. 2005, Young et al. 2009, Jain et al. 2007, Piorkowski and O'Connell 2010, USFWS 2012). The plot size used for this study exceeds one-half the maximum turbine rotor height of the project turbines (246 ft [75 m]). The subset of full-coverage plots in the fall provided a reference for estimating the number of fatalities which may have fallen outside of the search area at the road and pad search turbines. This mixed sampling method is consistent with other post-construction monitoring studies being conducted (e.g., Good et al. 2011) and will enable comparison of study results.

2.1.3 Survey Schedule

The search interval for spring surveys at all turbines was once weekly. An individual turbine was searched on the same day each week when conditions allowed. Within a day, the turbine search schedule and order were randomized, so that each turbine's search plot was sampled at different periods throughout the day. A weekly search interval for fatality monitoring was deemed adequate by Kunz et al. (2007), and other studies have demonstrated that a weekly search interval provides effective mortality monitoring and adequately estimates impacts from wind energy facilities (Gruver et al. 2009, Young et al. 2009), such that the added effort associated with more frequent intervals is not warranted. In addition, previous spring surveys over the past four years at the site have demonstrated a minimum carcass persistence of at least seven days on roads and pads.

For the fall surveys, all turbines were searched twice weekly, with approximately three to four days between surveys when conditions allowed. This change was implemented based on the 2014 and 2015 fall monitoring results, which indicated a carcass persistence of less than seven days on roads and pads during fall surveys. In 2016, the mean carcass persistence for fall monitoring resulted in 9.3 days for full plots and 7.3 days for roads and pads, but given the two previous years' results, a twice weekly search interval was maintained for 2018.

Prior to the fall monitoring period, all search plots (roads and pads, full plots) were cleared of carcasses the last week of July ("fall sweep"), and all bats found that week were coded as incidental finds, as they were not found during either the spring or fall monitoring periods.

2.1.4 Carcass Surveys

Carcass surveys were conducted by searchers experienced and/or trained in fatality search methods, including proper handling and reporting of carcasses. Searchers were familiar with and able to accurately identify bat species likely to be found in the project area. Photos of any unknown bat discovered were sent to a permitted bat biologist for positive identification, and carcasses were kept on-site. During surveys, searchers walked at a rate of approximately 2 miles per hour (mph; 45 to 60 m per minute) while searching 10 ft (3 m) on either side of each transect.

For each carcass found, the following data were recorded (a sample data form is included in Appendix A):

- Date and time
- Initial species identification
- Sex, age, and reproductive condition (when possible)
- Global positioning system (GPS) location
- Distance and bearing to turbine
- Substrate/ground cover conditions
- Condition (intact, scavenged, decomposed)
- Any notes on presumed cause of death

A digital photograph of each carcass found was taken before the carcass was handled and removed. Representative digital photographs are included in Appendix B. All carcasses were labeled with a unique number, bagged, and stored in a freezer (with a copy of the original data sheet) at the Project Operations and Maintenance Building. Bat carcasses were collected and retained under Indiana Department of Natural Resources Special Purpose Salvage Permit No. 18-032.

Bat carcasses found in non-search areas and any bird carcasses found were coded as incidental finds and documented in a similar fashion to those found in standardized surveys when possible. This included carcasses found during non-search times and carcasses found during the fall sweep the week prior to the fall monitoring period when all survey plots were searched for any carcasses that had occurred between the spring and fall monitoring periods. Maintenance personnel were informed of the standardized surveys and were trained in collision event reporting protocol in the case of an incidental find. Bird carcasses were photographed and documented, but they were not collected and were left as found. Incidental bat carcasses were collected and stored in the freezer with the carcasses found during standardized surveys. Incidental finds were not included in the mortality estimates.

2.1.5 Species Identification

Preliminary bird and bat species identifications were made in the field by qualified staff. When carcass condition allowed, sex, age, and reproductive condition of the carcass were recorded. For bat carcasses, forearm length was recorded to facilitate species identification. Any unknown bat, or potential Indiana or northern long-eared bat, was identified by a permitted bat biologist. In addition to the carcass, photographs and data collected for each carcass were used to verify the species identification.

2.2 SEARCHER EFFICIENCY TRIALS

Searcher efficiency trials were used to estimate the probability of bat carcass detection by the searchers. A total of four searcher efficiency trials were conducted: one during the spring and three during the fall monitoring period (one for each searcher who conducted surveys). Searchers did not know when during the monitoring periods the trials were being conducted, at which

turbines trial carcasses were placed, or the location or number of trial carcasses placed in any given search plot. Commercially-available brown mouse carcasses were used as trial carcasses to represent bats. During the spring 2018 monitoring period, 20 bat carcasses collected during the 2017 monitoring period were used for searcher efficiency and carcass removal trials, along with 20 mouse carcasses.

All searcher efficiency trial carcasses were randomly placed by the field lead within the search plots. These were placed in the morning prior to the planned carcass surveys for that day. The number of trial carcasses found by searchers during the mortality surveys in each plot was recorded and compared to the total number of trial carcasses placed in the plot and not scavenged prior to the mortality search. A sample data form is included in Appendix A.

2.3 CARCASS REMOVAL TRIALS

Carcass removal trials were conducted to estimate the average length of time carcasses remained in the search plots (i.e., were available to find) before being removed by scavengers. Carcass removal trials were conducted following the searcher efficiency trials – one during the spring and one during the fall monitoring periods. Mouse and bat carcasses used during the searcher efficiency trials were left in place, and their locations were discretely marked. Searchers monitored the trial carcasses over a period of up to 30 days. During each carcass removal trial, carcasses were checked every day for the first week, and then on days 10, 14, 20, and 30.

The condition of each carcass was recorded during each trial check. The conditions recorded were defined as follows:

- Intact – complete carcass with no body parts missing
- Scavenged – carcass with some evidence or signs of scavenging
- Fur spot – no carcass, but fur spot remaining
- Missing – no carcass or fur remaining

A sample data form is included in Appendix A. Any carcasses remaining at the end of the 30-day trial period were removed from the field. For the spring 2018 monitoring data, a statistical comparison of the carcass removal rates of bat carcasses and mouse carcasses was also conducted.

2.4 STATISTICAL METHODS FOR MORTALITY ESTIMATES

In an effort to make results comparable with other post-construction mortality studies, the method used to calculate the mortality estimates largely follows the estimator proposed by Erickson et al. (2003), as modified by Young et al. (2009). The estimate of the total number of turbine-related casualties was based on three components: (1) observed number of casualties, (2) searcher efficiency, and (3) carcass removal rates. The 90% confidence intervals were calculated using bootstrapping methods (Erickson et al. 2003 and Manly 1997 as presented in Young et al. 2009).

2.4.1 Mean Observed Number of Casualties (c)

The estimated mean observed number of casualties (c) per turbine per monitoring period was calculated as:

$$c = \frac{\sum_{j=1}^{n} c_j}{n}$$

where n is the number of turbines searched, and c_j is the number of casualties found during mortality searches. Incidental carcass finds (those found outside of the surveyed areas or at times other than during mortality surveys) were not included in this calculation or in the estimated fatality rate. Mean number of observed casualties was calculated separately for each survey type (roads and pads, full plots) and each survey period.

2.4.2 Estimation of Searcher Efficiency (p)

Searcher efficiency (p) represents the average probability that a carcass was detected by surveyors. The searcher efficiency rate was calculated by dividing the number of trial carcasses observers found by the total number which remained available during the trial (non-scavenged). Searcher efficiency was calculated separately for each search type (roads and pads, full plots), searcher, and season.

2.4.3 Estimation of Carcass Removal (t)

Carcass removal rates were estimated to adjust the observed number of casualties to account for scavenger activity at the site. Mean carcass removal time (t) represents the average length of time a trial carcass remained at the site before it was removed by scavengers. Mean carcass removal time was calculated as:

$$t = \frac{\sum_{i=1}^{s} t_i}{s - s_c}$$

where s is the number of carcasses placed in the carcass removal trials and s_c is the number of carcasses remaining at day 30. This estimator is the maximum likelihood (conservative) estimator assuming the removal times follow an exponential distribution and that there is right-censoring of the data. Any trial carcasses remaining after 30 days were collected, yielding censored observations at 30 days. Carcass removal rates were calculated separately for each survey type (roads and pads, full plots) and season.

2.4.4 Estimation of the Probability of Carcass Availability and Detection (π)

Searcher efficiency and carcass removal rates were combined to represent the overall probability (π) that a casualty incurred at a turbine was reflected in the mortality survey results. This probability was calculated as:

$$\pi = \frac{t \cdot p}{I} \cdot \left[\frac{\exp(I/t) - 1}{exp\,(I/t) - 1 + p} \right]$$

where I is the interval between searches. The estimation of the probability of carcass availability and detection was calculated separately for each survey type (roads and pads, full plots), searcher, and season. For the fall searches, there were three estimations of the probability of carcass availability and detection due to the use of three searchers. For this season, the numbers were averaged for each plot type using a weighted average based on the search effort of each searcher as:

$$\pi_{RP} = (0.5 * \pi_{RP1}) + (0.25 * \pi_{RP2}) + (0.25 * \pi_{RP3})$$

$$\pi_{FP} = (0.5 * \pi_{FP1}) + (0.25 * \pi_{FP2}) + (0.25 * \pi_{FP3})$$

The number was then averaged for each season using a weighted average as:

$$\pi = (0.5 * \pi_{RP}) + (0.5 * \pi_{FP})$$

2.4.5 Area Adjustment (A)

Approximation of A, the adjustment for areas which were not surveyed, was calculated following methods and data collected during post-construction monitoring studies at Fowler Ridge Wind Farm in Indiana (Good et al. 2011). For this study, A was calculated to represent the adjustment for the proportion of carcasses which likely fell outside of the area surveyed at all studied turbines.

The value for A was approximated using the following equation:

$$A = \frac{\frac{C_{RP}}{\pi_{RP} * S_{RP}} + \frac{C_{FP}}{\pi_{FP} * S_{FP}}}{\frac{C_{RP}}{\pi_{RP}} + \frac{C_{FP}}{\pi_{FP}}} * A_{FP}$$

where C_{RP} is the number of observed casualties on roads and pads, C_{FP} is the number of observed casualties on full plots, π_{RP} is the probability of carcass availability and detection on roads and pads, π_{FP} is the probability of carcass availability and detection on full plots, S_{RP} is the proportion of roads and pads surveyed across all study turbines, S_{FP} is the proportion of full plots searched across all study turbines, and A_{FP} was set at 1.305. This is equal to the correction factor calculated for the Fowler study, where it was estimated that 23.4% of fatalities fall outside of an 80-m x 80-m square plot (Good et al. 2011). For this study, S_{RP} = 0.5 and S_{FP} = 0.5, as only roads and pads will be surveyed at approximately 50% of the study turbines and full plot surveys will be conducted at the

remaining 50% of the study turbines. This number was calculated separately for the spring and fall periods.

2.4.6 Estimation of Facility-Related Mortality (m)

Mortality estimates were calculated using the estimator proposed by Erickson et al. (2003), as modified by Young et al. (2009). The estimated mean number of bat casualties/turbine/monitoring period (m) was calculated by dividing the mean observed number of bat casualties/turbine/monitoring period (c) by π, an estimate of the probability a carcass was not removed by scavengers and was detected by surveyors, and then multiplying by A, the adjustment for the area within which bats may have fallen but which was not surveyed.

$$m = \mathrm{A} * \frac{c}{\pi}$$

where A is the area adjustment, C is the number of carcasses found per turbine, and π is the probability of carcass detection and availability. This equation used the weighted average for the probability of carcass availability and detection based on approximately 50% of surveys being roads and pads and 50% of surveys being full plots, while the area adjustment and mean observed number of casualties was facility-wide.

2.5 TAKE ESTIMATION FOR COVERED SPECIES

The Evidence of Absence (EOA) software developed by Dalthorp et al. (2014, 2017) was used to estimate the probability of detection (g). This value represents the probability of detecting a carcass of either covered species that occurs at the site based on the post-construction monitoring effort performed that season. For 2018, this was applied only to the period between 1 August and 16 October, when take of the covered species was expected to occur (if at all).

The estimate of the overall probability of detection (g) is a function of several factors, including carcass persistence, searcher efficiency, area adjustment, search interval, and other factors (Dalthorp et al. 2014, 2017). These bias correction factors were calculated utilizing the methods described in Section 2.4 and input into the EOA model to calculate a probability of detection (g). The HCP set a goal of having a detection probability (g) between 0.25 and 0.30 during baseline monitoring.

Then, utilizing the EOA "Multi-Year Total" tool, the probability of detection (g) and the number of covered carcasses found (X) are input to determine, with a certain degree of confidence, that the number of fatalities of a covered species did not exceed the cumulative total authorized take and to calculate the annual take rate. These estimates (cumulative total take and average annual take rate) are then used to determine whether any of the following three adaptive management triggers outlined in the Project's HCP have been triggered:

1. Short-term trigger – is actual average annual take rate larger than expected? This trigger would be an annual take rate of 6 Indiana bats or 3 northern long-eared bats or more, and it is calculated using a significance level of a=0.01.

2. Long-term trigger – does total cumulative take exceed the long-term authorized amount? This trigger would be an estimated cumulative mortality of 162 Indiana bats or 81 northern long-eared bats or more, and it is calculated using a significance level of a=0.50.

3.0 Results

3.1 SUMMARY OF SURVEYS

A total of 804 carcass searches were conducted over 7 weeks in the spring, and 2,538 carcass surveys were conducted over 11 weeks in the fall (Table 1). Due to weather conditions and maintenance at turbines, the average time between surveys was 7.37 days during the spring monitoring period and 3.71 days during the fall monitoring period (Table 1).

Table 1. Summary of standardized surveys during the 2018 post-construction monitoring study at the Wildcat Wind Farm, Tipton and Madison counties, Indiana.

Season	Date Range	Length (Weeks)	Road and Pad Turbines	Full Plot Turbines	Total number of searches conducted	Search Interval	Bat Carcasses Found[1]
Spring	2 April–17 May	7	63	62	804	7.37	26
Fall Sweep	30-31 July	1	63	62	117	NA	20
Fall	1 Aug–16 October	11	63	62	2,538	3.71	84

[1]This includes all carcasses found during standardized searches (within plots on a scheduled search day), including live bats found within the plots.

A total of 110 individual bat carcasses were found during standardized carcass searches, 26 during the spring surveys (23.80%) and 84 during the fall surveys (76.1%).

In addition, 20 bat carcasses were found during the fall sweep the week prior to the start of fall monitoring (presumably killed between 18 May and the end of July), 1 incidental bat carcass, a silver-haired bat (*Lasionycteris noctivagans*), was found during spring monitoring, and no incidental bat carcasses were found during fall monitoring. Thus, a total of 131 bat carcasses were found during 2018 monitoring, of which 110 (84.0%) were found during standardized searches and used for calculating the adjusted mortality estimates (see Section 3.5).

3.1.1 Species Composition

A summary of all bat carcasses found incidentally and during the standardized carcass surveys during post-construction monitoring is shown in Table 2. Of the 131 bat carcasses found at the site, the silver-haired bat was the most common species detected (n=46; 35.1% of all bat carcasses found). Eastern red bat (*Lasiurus borealis*) was the next most common species (n=44; 33.6%), followed by hoary bat (*Lasiurus cinereus*; n=30; 22.9%) and big brown bat (*Eptesicus fuscus*; n=11; 8.4%). All bat carcasses were identified to the species level. Species composition did vary by season, with silver-haired bats making up 81.5% of all spring fatalities (n=22), and only 28.6% of all fall fatalities (n=24). No bat species federally listed as threatened or endangered under the Endangered Species Act of 1973 (ESA), as amended, were found. The silver-haired bat, eastern red bat, and hoary bat are all listed as special concern species in the state of Indiana, but none of these species receive any legal protection under the Nongame and Endangered Species Conservation Act.

Table 2. Summary of all bat carcasses found incidentally and during standardized carcass surveys during the 2018 post-construction monitoring study at the Wildcat Wind Farm, Tipton and Madison counties, Indiana.

Species	Spring (2 April–17 May)	Fall (1 Aug–16 October)	Fall Sweep (July 30-31)	Total
Silver-haired Bat	22 (81.5%)	24 (28.6%)	0 (0.0%)	46 (35.1%)
Eastern Red Bat	4 (14.8%)	33 (39.3%)	7 (35.0%)	44 (33.6%)
Hoary Bat	1 (3.7%)	18 (21.4%)	11 (55.0%)	30 (22.9%)
Big Brown Bat	0 (0.0%)	9 (10.7%)	2 (10.0%)	11 (8.4%)
Total	**27**	**84**	**20**	**131**

3.1.2 Age and Sex

A summary of the age and sex of all bat carcasses found during the standardized post-construction monitoring is shown in Table 3. Of the 110 bat carcasses found during the standardized searches, 49 were adult females (44.5%), 3 were juvenile females (2.7%), 3 were females of unknown age (2.7%), 13 were adult males (11.8%), 2 were juvenile males (1.8%), 11 were adults of unknown sex (10.0%), 1 was a juvenile of unknown sex (0.9%), and 28 were bats of unknown age and unknown sex (25.5%; Table 3).

Table 3. Sex and age of bat carcasses found during standardized surveys (fall numbers presented in the table, with spring numbers in parentheses) for the 2018 post-construction monitoring study at the Wildcat Wind Farm, Tipton and Madison counties, Indiana. Ages include adults (A), juveniles (J), and unknown (U).

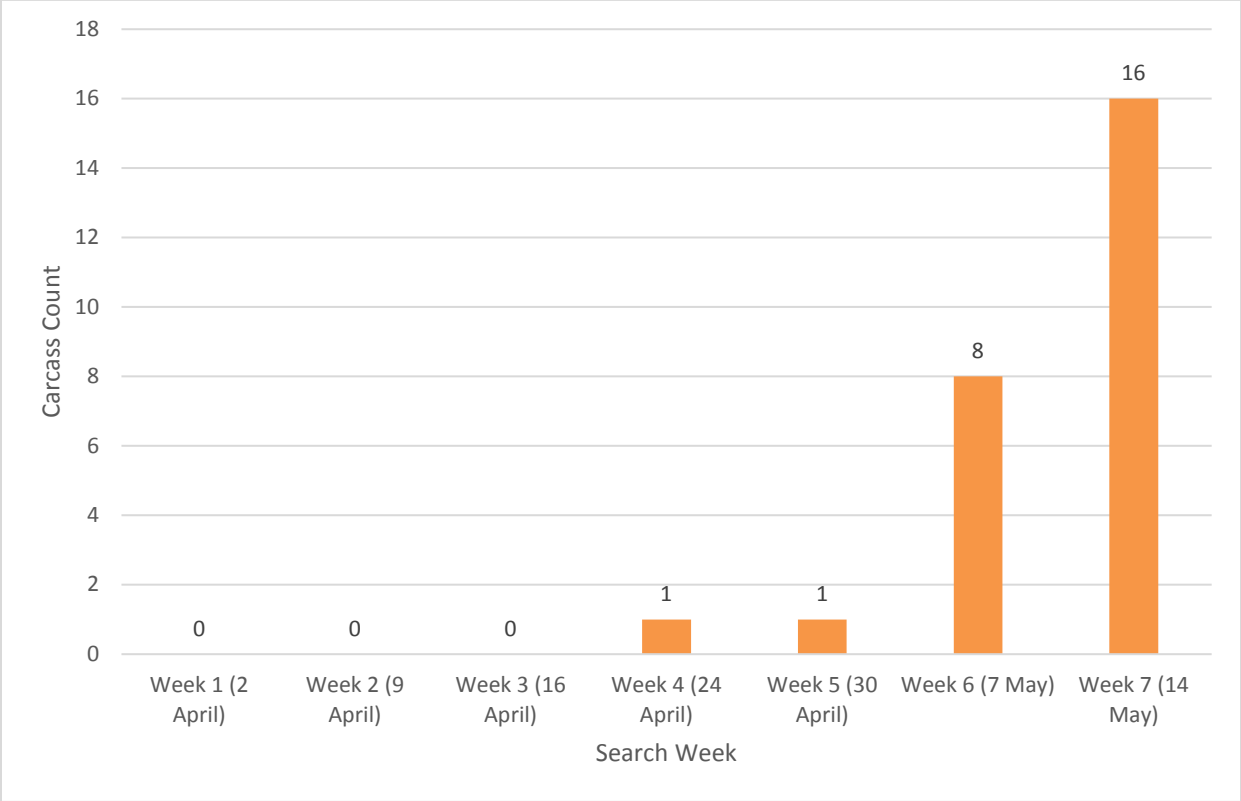
Species	Female			Male			Unknown		
	A	J	U	A	J	U	A	J	U
Silver-haired Bat	10 (15)	0 (0)	0 (0)	5 (0)	0 (0)	0 (0)	2 (6)	0 (0)	7 (0)
Eastern Red Bat	12 (4)	2 (0)	2 (0)	3 (0)	0 (0)	0 (0)	0 (0)	1 (0)	13 (0)
Hoary Bat	6 (1)	0 (0)	1 (0)	3 (0)	0 (0)	0 (0)	1 (0)	0 (0)	7 (0)
Big Brown Bat	1 (0)	1 (0)	0 (0)	2 (0)	2 (0)	0 (0)	2 (0)	0 (0)	1 (0)
Total	**29 (20)**	**3 (0)**	**3 (0)**	**13 (0)**	**2 (0)**	**0 (0)**	**5 (6)**	**1 (0)**	**28 (0)**

3.1.3 Temporal Patterns

Of the 110 bat carcasses found during standardized searches, 26 were found during the spring (23.6%) and 84 were found during the fall (76.4%).

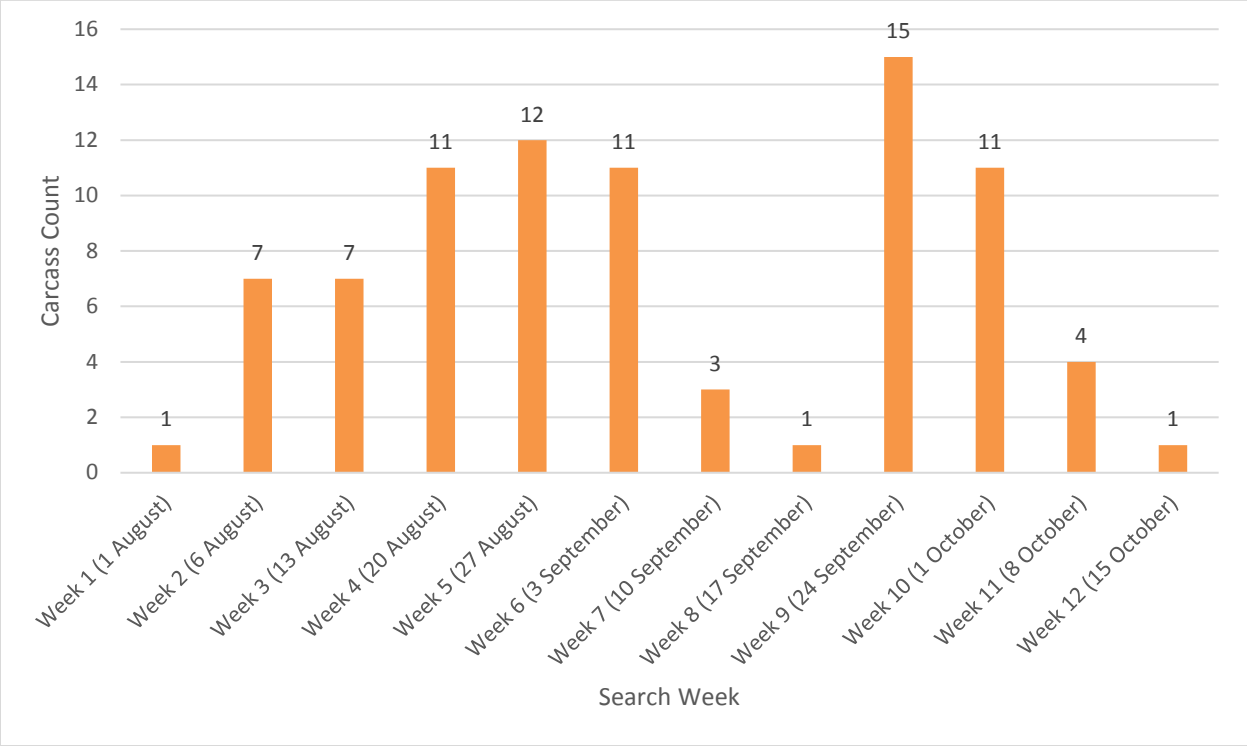
During the spring, the number of bats increased with each week (Figure 2). The greatest number of bat carcasses were found during the seventh week of searches (n=16; 61.5%), followed by the prior week of searches (n=8; 30.8%; Figure 2). A single bat was found during both week 4 and week 5, and no bats were found during weeks 1, 2, or 3.

Figure 2. Bat carcasses found by week during the spring season of standardized surveys during the 2018 post-construction monitoring study (2 April- 17 May) at the Wildcat Wind Farm, Tipton and Madison counties, Indiana.



During the fall monitoring period, bats were found during every week of searches (Figure 3). The greatest number of bats found during a single week occurred the week of 24 September (week 9; 15 bats found; 17.9%), followed by week 5 (27 August; n=12; 14.3%) and weeks 4, 6, and 10 (n=11; 13.1%). The fewest number of bats found during a single week occurred during weeks 1, 8, and 12 (1 August, 17 September, and 15 October, respectively) when only 1 bat (1.2%) was found each week.

Figure 3. Bat carcasses found by week during the fall season of standardized surveys during the 2018 post-construction monitoring study (1 Aug through 16 October) at the Wildcat Wind Farm, Tipton and Madison counties, Indiana.



3.1.4 Spatial Patterns

During the spring standardized searches, bats were found at 25 of the 125 turbines (20.0%). During the fall standardized searches, bats were found at 53 of the 125 turbines (42.4%). Of the 110 carcasses found during standardized searches, 71 (64.5%) were found at full plot turbines and 39 (35.5%) were found at road and pad search turbines.

Of the 63 turbines at which roads and pads were searched in the spring, 12 carcasses were found at 12 different turbines (19.0%), with no carcasses found at each of the remaining 51 turbines. Of the 63 turbines at which roads and pads only were searched in the fall, 27 carcasses were found at 19 different turbines (30.2%), with 3 carcasses found at one turbine (C2), 2 carcasses found at each of 6 turbines, 1 carcass found at each of 12 turbines, and no carcasses found at each of the remaining 44 turbines.

Of the 62 turbines at which full plot searches were conducted in the spring, 14 carcasses were found at 13 different turbines (21.0%), with 2 carcasses found at 1 turbine (B15), 1 carcass found at each of 12 turbines, and no carcasses found at each of the remaining 49 turbines. Of the 62 turbines at which full plot searches were conducted in the fall, 57 carcasses were found at 34 different turbines (54.8%), with 4 carcasses found at 1 turbine (B8), 3 carcasses found at 3 turbines

(A4, F5, H3), and 2 carcasses found at each of 14 turbines. Only 1 carcass was found at each of 16 turbines, and no carcasses were found at each of the remaining 28 turbines.

The number of carcasses found per turbine for the entire season varied from one to four, with the following breakdown:

- 4 carcasses – 2 turbines
- 3 carcasses – 11 turbines
- 2 carcasses – 16 turbines
- 1 carcass – 37 turbines
- 0 carcasses – 59 turbines

Carcasses were found at turbines located throughout the project area.

3.2 SEARCHER EFFICIENCY TRIALS

A total of four searcher efficiency trials were conducted: one in the spring and three in the fall. Only one trial was conducted during the spring because there was only one searcher. For the fall, one trial was conducted for each of the three searchers during the monitoring period.

A total of 40 mouse and bat carcasses (20 of each) were placed for the searcher efficiency trial during the spring monitoring period. In the fall period, 90 mouse carcasses were placed (30 for each of three searchers). Scavengers removed 9 of the trial carcasses prior to the searcher efficiency trial in the spring and 9 carcasses prior to the fall trials.

Searcher efficiency in the spring ranged from approximately 63% on the full plots to 100% on the roads and pads (Table 4). In the fall, searcher efficiency ranged from approximately 62% to 86% on full plots and from approximately 93% to 100% on roads and pads, depending on the searcher (Table 4).

Table 4. Searcher efficiency by season (Spring: 2 April to 17 May and Fall: 1 August to 16 October), search type (full 80-m x 80-m plots or roads and pads), and searcher for the 2018 post-construction monitoring study at the Wildcat Wind Farm, Tipton and Madison counties, Indiana.

	Spring Monitoring Period		**Fall Monitoring Period**					
			Roads and Pads			**Full Plots**		
	Roads and Pads	**Full Plots**	Searcher #1	Searcher #2	Searcher #3	Searcher #1	Searcher #2	Searcher #3
Number of Carcasses Placed	20	20	15	15	15	15	15	15
Number of Carcasses Scavenged Prior	5	4	1	2	0	1	3	2

	Spring Monitoring Period		Fall Monitoring Period					
			Roads and Pads			Full Plots		
	Roads and Pads	Full Plots	Searcher #1	Searcher #2	Searcher #3	Searcher #1	Searcher #2	Searcher #3
Number of Carcasses Available	15	16	14	12	15	14	12	13
Number of Carcasses Found	15	10	13	12	15	12	8	8
(p) Searcher Efficiency Mean (90% CI)	**1.0** (1.0, 1.0)	**0.6** (0.4, 0.8)	**0.9** (0.8, 1.0)	**1.0** (1.0, 1.0)	**1.0** (1.0, 1.0)	**0.9** (0.7, 1.0)	**0.7** (0.4, 0.9)	**0.6** (0.4, 0.8)

3.3 CARCASS REMOVAL TRIALS

Mouse and bat carcasses used in the searcher efficiency trials[1] were left for up to 30 days and checked each day for the first week and then on days 10, 14, 20, and 30 of the trial. Thirty mouse carcasses were used during the fall monitoring period, and 20 bat and 20 mouse carcasses were used during the spring monitoring period. Carcasses persisted for an average of 7.3 days for roads and pads and 5.3 days for full plots in the spring and an average of 9.0 days for roads and pads and 10.0 days for full plots in the fall (Table 5).

Table 5. Carcass removal by season (Spring: 2 April to 17 May and Fall: 1 August to 16 October) during the 2018 post-construction monitoring study at the Wildcat Wind Farm, Tipton and Madison counties, Indiana.

	Spring Monitoring Period		Fall Monitoring Period	
	Roads and Pads	Full Plots	Roads and Pads	Full Plots
Number of Carcasses Placed	20	20	15	15
Number of Carcasses Scavenged within 30 days	19	20	13	13
Mean Carcass Persistence time in days (90% CI)	**7.3** (4.5, 11.6)	**5.3** (3.4, 7.45)	**9.0** (4.4, 17)	**10.0** (5.4, 18.0)

A comparison of bat and mouse carcass removal rates during the spring monitoring period revealed no significant difference between the rates. The bat carcasses persisted for an

[1] For the fall, carcasses from Searcher #1's searcher efficiency trial were used for the carcass removal trials. Carcasses from Searcher #2 and Searcher #3's trials were removed after the searcher efficiency trials.

average of 7.4 days (90% CI: 4.6 to 11.6 days), and the mouse carcasses persisted for an average of 5.2 days (90% CI: 3.4 to 7.3 days), with significant overlap between the confidence intervals indicating no significant statistical difference.

3.4 PROBABILITY OF CARCASS AVAILABILITY AND DETECTION

In the spring, the probability of carcass availability and detection was estimated to be 63% on roads and pads and 37% on full plots (Table 6). In the fall the probability of carcass availability and detection was estimated to range from 80% to 82% on the roads and pads and from 70% to 79% on the full plots depending on the searcher efficiency of the searcher (Table 6).

Table 6. Carcass availability and detection by season (Spring: 2 April to 17 May and Fall: 1 August to 16 October), search type (full 80x80m plots or roads and pads), and searcher for the 2018 post-construction monitoring study at the Wildcat Wind Farm, Tipton and Madison counties, Indiana.

	Spring Monitoring Period		**Fall Monitoring Period**					
			Roads and Pads			**Full Plots**		
	Roads and Pads	**Full Plots**	Searcher #1	Searcher #2	Searcher #3	Searcher #1	Searcher #2	Searcher #3
(p) Searcher Efficiency Mean (90% CI)	**1.0** (1.0, 1.0)	**0.6** (0.4, 0.8)	**0.9** (0.8, 1.0)	**1.0** (1.0, 1.0)	**1.0** (1.0, 1.0)	**0.9** (0.7, 1.0)	**0.7** (0.4, 0.9)	**0.6** (0.4, 0.8)
Mean Carcass Persistence time in days (90% CI)	**7.3** (4.5, 11.6)	**5.3** (3.4, 7.4)	**9.0** (4.4, 17.0)			**10.0** (5.4, 18.0)		
(π) Probability of carcass availability and detection	**0.63** (0.49, 0.74)	**0.37** (0.23, 0.50)	**0.80** (0.64, 0.89)	**0.82** (0.68, 0.90)	**0.82** (0.68, 0.90)	**0.79** (0.66, 0.88)	**0.72** (0.53, 0.85)	**0.70** (0.50, 0.84)

The average carcass availability and detection in the spring was estimated to be 50% (90% CI: 40% to 59%) after averaging across the two search types, and the average carcass availability and detection in the fall was estimated to be 77% (90% CI: 68% to 85%) after averaging across searchers and search types.

3.5 ADJUSTED MORTALITY ESTIMATES

Mortality rate estimates were calculated based upon the carcasses found during the mortality surveys and did not include any incidental finds. Observed bat mortality estimates were

adjusted to account for searcher efficiency, carcass removal, and an area adjustment[2] using the methods described in Section 2.4. Results are summarized in the following sections by season.

3.5.1 Spring

Over the spring migratory period (2 April–17 May), the estimated bat mortality was 1.09 bats/turbine, or 137 bats over the entire facility (Table 7).

Table 7. Bat mortality estimates for the spring 2018 post-construction monitoring study at the Wildcat Wind Farm, Tipton and Madison counties, Indiana. The Project was operating at a cut-in speed of 3.5 m/s during this time period.

	Estimate
(c) Observed bats/turbine	**0.21**
(A) Area Adjustment	**2.6**
(m) Estimated bats/turbine (90% CI)	**1.09** (0.75, 1.55)
Estimated bats/MW (90% CI)	**0.68** (0.47, 0.97)
Estimated bats/facility (90% CI)	**137** (94, 194)

3.5.2 Fall

Over the entire fall migratory period (1 August–16 October), the estimated bat mortality was 2.27 bats/turbine, or 284 bats over the entire facility (Table 8).

Table 8. Bat mortality estimates for the fall 2018 post-construction monitoring study at the Wildcat Wind Farm, Tipton and Madison counties, Indiana. The Project was operating at a cut-in speed of 5.0 m/s during this period.

	Estimate
(c) Observed bats/turbine	**0.67**

[2] $A = \frac{\frac{C_{RP}}{\pi_{RP}*S_{RP}}+\frac{C_{FP}}{\pi_{FP}*S_{FP}}}{\frac{C_{RP}}{\pi_{RP}}+\frac{C_{FP}}{\pi_{FP}}} * A_{FP}$; $A = \frac{\frac{12}{0.63*0.5}+\frac{14}{0.36*0.5}}{\frac{12}{0.63}+\frac{14}{0.36}} * 1.305 = 2.6$ for the spring monitoring period

$A = \frac{\frac{27}{0.81*0.5}+\frac{57}{0.75*0.5}}{\frac{27}{0.81}+\frac{57}{0.75}} * 1.305 = 2.6$ for the fall monitoring period

	Estimate
(A) Area Adjustment	**2.6**
(m) Estimated bats/turbine (90% CI)	**2.27** (1.80, 2.84)
Estimated bats/MW (90% CI)	**1.42** (1.12, 1.77)
Estimated bats/facility (90% CI)	**284** (225, 355)

3.6 INCIDENTAL FINDS

3.6.1 Bats

One incidental bat was found during the 2018 spring and fall monitoring periods. It was observed during the spring, a silver-haired bat, outside the survey boundary (i.e., outside the boundary of the full plot), at turbine B2 on 7 May. No incidental bats were found during the fall. In addition, 20 incidental bats were discovered prior to the fall surveys during the fall sweep (searches the week prior to fall monitoring). All incidental bats are summarized in Table 2, and the sex and age of incidental bat carcasses is summarized in Table 9.

Table 9. Sex and age of incidental bat carcasses found during the 2018 post-construction monitoring study at the Wildcat Wind Farm, Tipton and Madison counties, Indiana. Ages include adults (A), juveniles (J) and unknown (U).

Species	Female			Male			Unknown		
	A	J	U	A	J	U	A	J	U
Eastern Red Bat	0	0	0	0	0	0	0	0	**7**
Hoary Bat	0	0	0	0	0	0	0	0	**11**
Silver-haired Bat	**1**	0	0	0	0	0	0	0	**0**
Big Brown Bat	0	0	0	0	0	0	0	0	**2**
Total	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**20**

3.6.2 Birds

A total of 18 bird carcasses representing 10 species were found at 17 different turbines during the 2018 post-construction studies (Table 10). Of those, four (22.2%) were found during the spring monitoring period, 13 (72.2%) were found during the fall monitoring period, and one (5.6%) was found during the fall sweep. The bird carcasses found during the survey are summarized in Table 10.

Table 10. Summary of bird carcasses found during the standardized 2018 post-construction monitoring study (2 April to 17 May and 30 July to 16 October) as well as incidentally at the Wildcat Wind Farm, Tipton and Madison counties, Indiana.

Date	Species	Turbine
2 April	Killdeer (*Charadrius vociferous*)	B5
10 April	European Starling (*Sturnis vulgaris*)	G7
12 April	European Starling	C7
18 April	Yellow-rumped warbler (*Setophaga coronate*)	H13
30 July	Horned lark (*Eremophila alpestris*)	B13
15 August	Horned lark	H17
29 August	Horned lark	A6
30 August	American robin (*Turdus migratorius*)	C15
3 September	Horned lark	C1
10 September	Horned lark	H9
11 September	Cape May warbler (*Setophaga tigrine*)	F12
17 September	Horned lark	B8
19 September	Red-eyed vireo (*Vireo olivaceus*)	H11
19 September	Red-eyed vireo	H9
24 September	Turkey Vulture (*Cathartes aura*)	H9
24 September	Red-tailed hawk (*Buteo jamaicensis*)	B3
27 September	Turkey Vulture	D7
9 October	Red-breasted nuthatch (*Sitto canadensis*)	G16

The most commonly found bird species were the horned lark (*Eromophila alpestris;* n=6, 33.3%), European starling (*Sturnis vulgaris;* n=2, 11.1%), red-eyed vireo (*Vireo olivaceus;* n=2, 11.1%), and turkey vulture (*Cathartes aura*; n=2, 11.1%), which made up 66.6% of all bird fatalities. An individual carcass was found for the remaining six species (Table 10).

3.7 ESTIMATED TAKE OF INDIANA BATS AND NORTHERN LONG-EARED BATS

There were no Indiana bats or northern long-eared bats found during the 2018 post-construction monitoring surveys. The following inputs were used to calculate the probability of detection (g) for the 2018 fall season using the EOA software:

- Searcher efficiency: 0.86
- Coverage (a): 0.38
- Search interval[3]: 3.5
- Factor by which searcher efficiency changes with each search (k): 0.67 (EOA default)

[3]Closest value to the actual search interval (3.71 days) that EOA would accept.

- Persistence Distribution: exponential with a mean persistence of 9.5 days (95 % CI: 4.9 to 17.5)

This resulted in a probability of detection (g) of 0.293 (95% CI: 0.255 to 0.334).

The "Multi-Year Module" tool was then used, with the following inputs for the first year (from 2016 monitoring):

- Carcasses found = 0
- Probability of detection = 0.267 (B_a = 139.4113, B_b = 383.4858)

And the following inputs for the 2017 monitoring effort:

- Carcasses found = 0
- Probability of detection = 0.206 (B_a = 21.865, B_b = 84.2986)

And the following inputs for the 2018 monitoring effort:

- Carcasses found = 0
- Probability of detection = 0.293 (B_a = 151.0874, B_b = 363.702)

Which resulted in an estimated cumulative total take of 0 Indiana bats and 0 northern long-eared bats and an estimated annual take rate of 0.6564 for both species. Since neither the Indiana bat nor northern long-eared bat have been found at the Project, the estimates are the same for both species. Thus, neither the short-term nor long-term triggers for adaptive management have been met.

4.0 Summary and Conclusions

4.1 SUMMARY

- A total of 3,342 standardized carcass surveys were conducted over 18 weeks encompassing two survey periods (spring and fall) in 2018.
- A total of 110 bat carcasses were found during standardized carcass searches, with an additional 21 incidental bat carcasses and 18 bird carcasses.
- No bird or bat species listed as federally threatened or endangered under the ESA were found during this study.
- Three Indiana special concern bat species (silver-haired bat, eastern red bat, and hoary bat) were found during this study.
- No Indiana special concern bird species were found during this study.

- Bat species found during standardized surveys included silver-haired bat (45), eastern red bat (37), hoary bat (19), and big brown bat (9).

- Estimated facility-wide bat mortality in the spring (2 April to 17 May) was 137 bats (90% CI: 94 to 194), compared to an estimated bat mortality in the fall (1 August to 16 October) of 284 bats (90% CI: 225 to 355).

- No Indiana bat or northern long-eared bats were found during the 2018 study.

4.2 COMPARISON TO PREVIOUS STUDIES

A Post-Construction Mortality Minimization and Monitoring Proposal (MMMP) was developed in June 2012, revised in June 2015 (Stantec 2015), and is consistent with methods and the recommendations of the USFWS Land-Based Wind Energy Guidelines (USFWS 2012). From 2013 through June 2015, the Project operated under the terms of a Technical Assistance Letter (TAL) dated 18 June 2012, that established an operational scenario under which no take of Indiana bats was expected to occur (i.e., 6.9 m/s cut-in speed during the fall migration period [1 August–15 October]).

From July 2015 to 18 August 2016, the Project operated under the terms of a second TAL secured on 2 July 2015 that established a revised operational scenario under which no take of Indiana bats or northern long-eared bats was expected to occur. This second TAL required curtailment to 6.9 m/s during the fall migration period (1 August–15 October) and 5.0 m/s during the spring migration period (15 March–15 May). On 19 August 2016, the Project obtained an ITP from the USFWS, allowing operations under the terms of the Project's HCP, including curtailment to 3.5 m/s during the spring migration period (1 April–15 May) and curtailment to 5.0 m/s during the fall migration period (1 August–15 October). Due to this, the 2016 data were analyzed separately for the time periods before and after 19 August due to the differing operational protocols that the turbines were operating under.

Post-construction monitoring has been conducted for 6 years at the Project. While the surveys differed in level of effort (search interval, search area) and bias correction factors (searcher efficiency, carcass persistence, area adjustments), all surveys had overall fatality estimates corrected for these differences, allowing for comparison of results. In addition, the Project operated under different cut-in speed adjustments between years based on the TAL or ITP requirements.

4.2.1 Spring Migration Season

For the first three years of project operations and for the 2017 and 2018 spring seasons the turbines operated at the manufacturer's cut-in speed of 3.5 m/s. The mean bat fatality estimate ranged from 88 to 175 bats during the spring period, compared to 34 bats during the 2016 spring season, when the Project was operating at a cut-in speed of 5.0 m/s (Table 11).

Table 11. Bat mortality estimates by year for the spring migratory period (1 April–15 May) at the Wildcat Wind Farm, Tipton and Madison counties, Indiana.

	Year and Cut-in Speed					
	2013 (3.5 m/s)	**2014 (3.5 m/s)**	**2015 (3.5 m/s)**	**2016 (5.0 m/s)[1]**	**2017 (3.5 m/s)**	**2018 (3.5 m/s)**
(m) Estimated bats/turbine	0.7	1.1	1.0	0.3	1.4	1.09
Estimated bats/MW	0.4	0.7	0.6	0.2	0.88	0.68
Estimated bats/facility	88	138	119	34	175	137

[1]2016 season began on 15 March per USFWS request, so the search season was two weeks longer than prior years, though no bats were found during that time period, so it did not change the overall fatality estimate.

4.2.2 Fall Migration Season

For the first three years of project operations, the turbines operated under the terms of TALs, with a cut-in speed of 6.9 m/s. The mean bat fatality estimate ranged from 88 to 188 bats during the fall period, compared to 328.8 bats during the 2016 fall season, when the Project was operating at a cut-in speed of 5.0 m/s after 19 August (Table 12). The 2017 fall migration season was the first year that the Project operated at 5.0 m/s for the entire period, and the mean bat fatality estimate for the facility was 271 bats (Table 12). In 2018, the mean bat fatality estimate was 284 bats for the fall period, when the Project also operated at 5.0 m/s.

Table 12. Bat mortality estimates by year for the fall migratory period (1 August–15 October) at the Wildcat Wind Farm, Tipton and Madison counties, Indiana.

	Year and Cut-in Speed						
	2013 (6.9 m/s)	**2014** (6.9 m/s)	**2015** (6.9 m/s)	**2016**		**2017** (5.0 m/s)	**2018** (5.0 m/s)
				(6.9 m/s until 19 August)	(5.0 m/s after 19 August)		
(m) Estimated bats/turbine	0.7	1.0	1.5	0.43	2.2	2.17	2.27
Estimated bats/MW	0.4	0.6	0.9	0.27	1.38	1.36	1.42
Estimated bats/facility	88	125	188	53.8	275	271	284

4.3 CONCLUSIONS

No Indiana bat or northern long-eared bat fatalities were detected during 2018, and neither the long-term trigger nor the short-term trigger were reached for either species when analyzed using EOA. Thus, no adaptive management actions will be implemented. The bias-correction parameters from the fall 2018 monitoring period (e.g., searcher efficiency, carcass persistence, area adjustment, etc.) will be used in the design of protocols for implementation monitoring, in accordance with the ITP and HCP, to be conducted in the fall of 2019.

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APPENDIX A

Sample Data Sheets

CARCASS SEARCH DATA SHEET

WILDCAT WIND FARM 193704633

DATE: _____ **BIOLOGIST:** _____

LABEL CARCASSES AND PHOTO WITH DATE-TURBINE -CARCASS NUMBER (e.g., 2009Apr01-T04-C07, to describe carcass #7 found at turbine 4 on April 1, 2009).

TURBINE NO.[1]	PLOT TYPE [2]	CARCASS NO. [3]	FROM TURBINE		ON ROAD/PAD?	GPS COORDINATES	SPECIES [4]	FOREARM LENGTH OF BAT (mm)	AGE[5]	SEX[6]	CAUSE OF DEATH [7]	CONDITION[8]	CHECK IF COMMENTS (write on back)[9]
			DISTANCE (m)	AZIMUTH (DEGREES)								/	
												/	
												/	
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Turbine No.[1]	Plot Type [2]	Carcass No. [3]	From Turbine		On Road/Pad?	GPS Coordinates	Species [4]	Forearm length of bat (mm)	Age[5]	Sex[6]	Cause of Death [7]	Condition[8]	Check if Comments (write on back)[9]
			Distance (m)	Azimuth (degrees)								/	
												/	
												/	
												/	
												/	
												/	
												/	
												/	

[1] Turbine – Enter Number of Turbine. Also search the turbine pad and access road in addition to the Study Plot.

[2] Plot Type – R=Roads and Pads, F=Full Plot

[3] Carcass No. – Number carcasses in the order they are found.

[4] Species – If Unknown, specify unknown bat or unknown bird.

[5] Age – If identifiable: Adult = A; Juvenile = J; Unknown = U

[6] Sex – If identifiable: Female = F; male = M, Unknown = U

[7] Cause of Death – Collision with turbine = T; Predation = P; Unknown = U (add explanation in comments if necessary).

[8] Condition – enter F=Fresh or D=decomposed AND Whole =W; Most of body with some missing = M; Pieces = P (e.g., wing only); Feather spot = F (example: F/W)

[9] Comments – Including: Reproductive Condition, if identifiable: Pregnant = P; Lactating = L; Post-Lactating = PL; Non-reproductive = NR; Testes descended = T; Unknown = U; B= breeding (birds).
Band Color/No. – If banded, record color of band (or metal), and number.
Other Comments. INCLUDE CARCASS NUMBER NEXT TO ALL COMMENTS.

PHOTOS: Where possible, photograph for bats: back, breast, muzzle, tragus, ruler behind ear, ruler next to forearm, foot, toehairs, calcar (if exposed).
for birds: back, breast, head, feet, underside of winds (for raptors).

Additional comments (record carcass number next to associated comment; include any identifiers and bands, if present):

_____

_____

_____

CARCASS SEARCH SUMMARY SHEET

WILDCAT WIND FARM 193704633

DATE: ___________________ BIOLOGIST: ____

WEATHER: % CLOUD COVER___________TEMPERATURE (˚F) ________PRECIP_______________________

WIND______________________SITE DESCRIPTION/COMMENTS: __________________________________

____

TURBINE NUMBER	PLOT TYPE (Full or Roads/Pads)	SURVEY TIME (MILITARY)		CARCASSES FOUND (#BIRD, #BAT, NONE)
		START	END	

SCAVENGER REMOVAL TRIAL LOG
Wildcat Wind Farm 193704633

Trial (spring, fall)_____ **Start Date_____**

Carcasses are labeled with date-turbine- carcass number as they were originally found (e.g., 2009Apr01-T04-C07, to describe carcass #7 found at turbine 4 on April 1, 2009).

Carcass ID[1]	Placement				Species			Condition[4] When Checked, Checked By[5]								
	GPS Coordinates	Time (Military)	Turbine[2]	Placed By[3]		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 10	Day 14	Day 20	Day 30

Carcass ID[1]	Placement				Species			Condition[4] When Checked, Checked By[5]								
	GPS Coordinates	Time (Military)	Turbine[2]	Placed By[3]		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 10	Day 14	Day 20	Day 30

[1] Carcass ID – Identification number marked inside carcass.
[2] Turbine – Turbine number where carcass placed.
[3] Placed By – Initials of the person who placed the carcass.
[4] Condition – Record the condition the carcass was in when checked. Intact = I, Signs of scavenging = S, Feather/Fur Spot = F, Missing or < 10 feathers = 0
[5] Checked by – Record the initials of the person who checked on the carcass.

Comments:_____
_____
_____
_____
_____
_____

More data on back? Yes No

SEARCHER EFFICIENCY TRIAL LOG
Wildcat Wind Farm 193704633

Trial (spring, fall)_____ **Trial Date_____**

Carcasses are labeled with date-turbine- carcass number as they were originally found (e.g., 2009Apr01-T04-C07, to describe carcass #7 found at turbine 4 on April 1, 2009).

Carcass ID[1]	Placement				GPS Coordinates	From Turbine		Species	Trial Result		
	Time (Military)	Turbine[2]	Placed By[3]	On Road/Pad?		Distance (m)	Azimuth (degrees)		Found By[4]	Not Found	Scavenged Prior to Search

Carcass ID[1]	Placement				GPS Coordinates	From Turbine		Species	Trial Result		
	Time (Military)	Turbine[2]	Placed By[3]	On Road/Pad?		Distance (m)	Azimuth (degrees)		Found By[4]	Not Found	Scavenged Prior to Search

Comments (record carcass number next to associated comment, include any identifiers and bands, if present):

_____
_____
_____
_____
_____
_____

[1] Carcass ID – Use carcass ID from when it was originally found. If no ID, just number.
[2] Turbine – Turbine should be labeled with the turbine number where it was placed.
[3] Placed By – Initials of the person who placed the carcass.
[4] Found By – Record the initials of the person who found the carcass.

More data on back? Yes No

APPENDIX B

Representative Carcass Photos

Photo 1. Representative example of an Eastern Red bat (*Lasiurus borealis*) found during road and pad surveys at turbine E7 at the Wildcat Wind Farm (August 6, 2018).

Photo 2. Hoary bat (*Lasiurus cinerus*) with calipers found during full plot surveys at turbine H11 at the Wildcat Wind Farm (August 15, 2018).

Photo 3. Representative example of a big brown bat (*Eptesicus fuscus*) found during full plot surveys at turbine F7 at the Wildcat Wind Farm (September 24, 2018).

Photo 4. Representative example of a silver-haired bat (*Lasionycteris noctivagans*) found during full plot surveys at turbine C10 at the Wildcat Wind Farm (May 7, 2018).

Photo 5. European Starling (*Strunus vulgaris*) with clippers found during spring surveys at the Wildcat Wind Farm post-construction monitoring surveys. This bird was found at turbine G7 (March 10, 2018).

Photo 6. Horned Lark (Eremophila alpestris) with clippers found during fall surveys at the Wildcat Wind Farm post-construction monitoring surveys. This bird was found at turbine B8 (September 17, 2018).

Photo 7. Turkey Vulture (*Cathartes aura*) found during fall surveys at the Wildcat Wind Farm post-construction monitoring surveys. This bird was found at turbine D7 (September 27, 2018).