

**Post-construction Monitoring Study for the
Great Pathfinder Wind Project
Boone and Hamilton Counties, Iowa**

April 1 – May 15 and August 1 – October 15, 2025



**Prepared for:
Great Pathfinder Wind, LLC**

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Confidential Business Information

EXECUTIVE SUMMARY

Great Pathfinder Wind, LLC is operating the Great Pathfinder Wind Project (Project) in Boone and Hamilton counties, Iowa. Commercial operation of the Project began in February 2023. The Project consists of 66 General Electric 140 3.4-megawatt (MW) turbines with a total generating capacity of approximately 225 MW. This report details the third year of post-construction monitoring (PCM), conducted in 2025, consistent with Section 6.4 of the Project's Habitat Conservation Plan (HCP) and Incidental Take Permit (ITP; ESPE0627303) for Indiana and northern long-eared bats (Covered Species).

PCM was completed in accordance with the Year 3 Post-construction Monitoring Study Plan for the Project, which was provided to the US Fish and Wildlife Service on March 24, 2025. The overall goal of this PCM study was to monitor for fatalities of the Covered Species and to evaluate compliance with the incidental take authorization granted under the Project's ITP. Based on data collected at the Project in years 1 and 2 and consistent with the monitoring commitments in Section 6.4.2 of the HCP, the Year 3 study was designed to achieve a detection probability (g) value of at least 0.2, and to provide the necessary data to determine if adaptive management was triggered.

Standardized searches were completed for bat carcasses on three plot types: road and pad plots searched to 100 m (328 ft) from the turbine, and cleared and uncleared 80-m (262-ft) radius circular plots. Technicians searched road and pad plots once per week at all 66 turbines during spring (April 1 – May 15) and at 44 turbines during the fall (August 1 – October 15). Detection-dog teams searched circular plots twice per week at the remaining 22 turbines in the fall, including 12 that were cleared of vegetation and 10 that were uncleared. Searcher efficiency and carcass persistence trials were conducted during each study season and across the three plot types in the fall to correct for detection bias and removal bias.

No Covered Species were found at the Project during the 2025 study period. A total of 540 bats were found during the study, and 449 bats were included in analysis to calculate area adjustment factors for Evidence of Absence (EoA). The most commonly found bat species were eastern red bat (51.3%), followed by silver-haired bat (18.3%), big brown bat (14.8%), and hoary bat (13.5%).

The overall g value for Year 3 was 0.25 (95% credible interval [CrI]: 0.23–0.27) and the average cumulative g value for the three-year study period was 0.22 (95% CrI: 0.21–0.23). Based on the EoA framework, the estimated annual take rate for each Covered Species was 0.35 (95% CrI: 0–3.84), which does not exceed the authorized take rate of three bats per year or the median annual take rate of greater than one bat per year. Therefore, no adaptive management actions were triggered.

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INTRODUCTION

Great Pathfinder Wind, LLC (Great Pathfinder) is operating the Great Pathfinder Wind Project (Project) in Boone and Hamilton counties, Iowa. The Project became fully operational in February 2023 and consists of 66 General Electric 140 3.4-megawatt (MW) turbines, with a total generating capacity of approximately 225 MW. Turbine towers are approximately 322 feet (ft; 98 meters [m]) in height and the rotor diameter is 460 ft (140 m) with a maximum height from tower base to highest blade tip of 551 ft (168 m).

On April 10, 2023, Great Pathfinder obtained an Incidental Take Permit (ITP; ESPer0627303) for the federally listed endangered Indiana bat (*Myotis sodalis*) and northern long-eared bat (*M. septentrionalis*; hereafter, Covered Species) from the US Fish and Wildlife Service (USFWS). Post-construction monitoring (PCM) was required by the ITP to determine if the level of take of the Covered Species complies with the authorized take, and to evaluate if adaptive management measures are triggered.

Western EcoSystems Technology, Inc. (WEST) completed a third year of PCM with a study designed to achieve an overall probability of detection, or g , of 0.2, consistent with the HCP. The objective was to estimate take of the Covered Species as outlined in the Project's HCP and ITP and determine if adaptive management thresholds were triggered. This report presents the results of the third year of PCM conducted at the Project during the study period April 1 – May 15 and August 1 – October 15, 2025.

PROJECT AREA

The Project is located in Boone and Hamilton counties, Iowa, approximately two miles (3.2 kilometers) southeast of Stratford, Iowa (Figure 1). The Project's Permit Area, defined as the geographic area where incidental take coverage is permitted, covers 19,690 acres (ac; 7,968 hectares [ha]) in northern Boone and southern Hamilton counties. According to the National Land Cover Database (2024), the primary land cover type within the Permit Area is cultivated crops, (88.6%), followed by developed land (5.0%), and hay/pasture (5.0%). All other land cover types individually account for less than 1.0% of the Permit Area (Table 1).

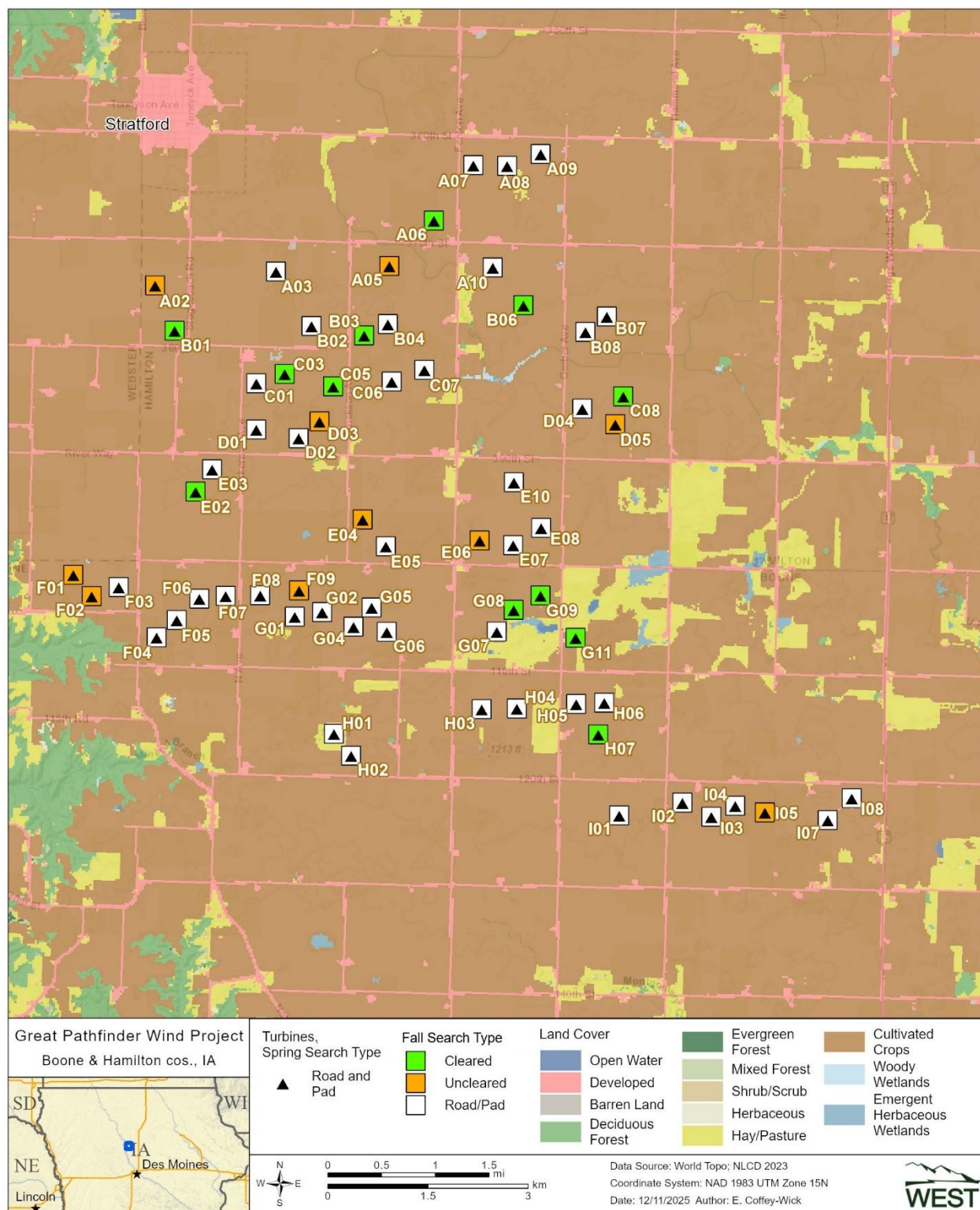


Figure 1. Land cover types and turbine locations, by season and plot type, within and around the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa.

Table 1. Land cover types, acreages, and percent (%) composition within the Great Pathfinder Wind Project Permit Area, Boone and Hamilton counties, Iowa.

Land Cover Class	Acres	% Composition
Cultivated Crops	17,451	88.6
Developed ¹	994	5.0
Hay/Pasture	983	5.0
Deciduous Forest	134	0.7
Emergent Herbaceous Wetlands	85	0.4
Open Water	15	0.1
Woody Wetlands	14	0.1
Barren Land	13	0.1
Herbaceous	1	<0.1
Mixed Forest	<1	<0.1
Total²	19,690	100

¹. Developed land cover types may include open space, low intensity, medium intensity, and high intensity.

². Sums may not equal total values shown due to rounding.

Source: National Land Cover Database 2024.

METHODS

This PCM study consisted of three primary survey components: 1) standardized carcass searches (carcass searches) of turbines, 2) searcher efficiency trials to estimate the probability a carcass was found by searchers, and 3) carcass persistence trials to estimate the average length of time a carcass remained in the search area for possible detection. In addition, a search area adjustment was estimated to account for carcasses that fell outside of search areas.

WEST developed a study design for Year 3 of the PCM study based on data collected in years 1 and 2 (Heist et al. 2024, 2025). The Study Plan was submitted to the USFWS on March 24, 2025.

Standardized Carcass Searches

Standardized carcass searches were completed in the spring and fall, with more frequent searches occurring in the fall when potential risk is expected to be higher (Appendix A). Searches were conducted within three search areas (plots): road and pad, cleared circular, and uncleared circular plots. Clearing searches were conducted at all turbines prior to the start of the fall season to remove carcasses that occurred prior to that study period.

Search Methods

Human technicians (technicians) conducted searches of road and pad plots, and detection-dog teams conducted searches of the cleared and uncleared circular plots. All personnel were trained to follow the Project's Study Plan, including proper handling and reporting of carcasses. Carcass searches were conducted during the day, beginning as early as first light.

Technician Searches

During road and pad searches, the technician started at 100 m (328 ft) from the turbine and walked the access road at a rate of approximately 45–60 m (150–200 ft) per minute toward the turbine on one side of the road, around the back of the turbine, then traversed the gravel crane

pad multiple times and walked back to the starting point on the other side of the road. The technician searched out to 1.0 m (3.3 ft) from each side of the road and pad plot to ensure full visual coverage of each plot.

Detection-dog Team Searches

Detection-dog teams, which consisted of a trained detection dog and their handler, searched cleared and uncleared 80-m (262-ft) radius circular plots. Prior to each search, dog handlers determined the start point and the number of transects needed to cover the plot after considering wind speed and direction, as well as crop row direction and density (when applicable). Dog handlers oriented the detection dog to start searches perpendicular to the wind to maximize scent detection. Both windspeed and crop density can affect dispersal of the target odor (i.e., bat carcasses) across the plot. To maximize detection rates during an olfactory search, transect width varied with vegetation density, ranging from 5–10 m (33 ft) apart in densely vegetated areas to 10–15 m (49 ft) in shorter vegetation.

Number of Turbines Sampled, Search Frequency, and Plot Size

Road and Pad Plots

Technicians conducted carcass searches on road and pad plots at all 66 turbines once per week from April 1 – May 15, 2025 (spring), and at 44 turbines once per week from August 1 – October 15, 2025 (fall; Table 2). Road and pad plots included the graveled area of the turbine pad and access road(s) out to 100 m from the turbine base.

Cleared and Uncleared Circular Plots

Twenty-two circular plots were searched by detection-dog teams during fall. Circular plots included 12 plots cleared of vegetation (cleared plots) and 10 plots where soybean (*Glycine max*) crops were grown during the study period (uncleared plots; Table 2). Uncleared plots had access channels (two perpendicular 1.5-m [5.0-ft] wide strips mowed across the plot allowing the detection-dog team to traverse the plot more easily) that were maintained during the fall.

Table 2. Search effort, by season and plot type, at Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, April 1 – May 15 and August 1 – October 15, 2025.

Season	Plot Type	Search Interval (days)	Number of Turbines	Searcher Type
spring (April 1 – May 15)	100-m road and pad	7.0	66	technician
fall (August 1 – October 15)	100-m road and pad	7.0	44	technician
	80-m cleared circular plot	3.5	12	detection-dog team
	80-m uncleared circular plot	3.5	10	detection-dog team

m = meter.

Data Collection

For each scheduled search, the searcher (either technician or dog handler) recorded the date, start and end times, searcher name, turbine number, type of search, aided search type (“none” for technicians or “dog” for detection-dog teams), and if any fatalities were found. When a fatality was found, a flag was placed near it and the search continued. After searching the entire area,

the searcher returned to record information for each fatality on a fatality data sheet, including the date and time, species, sex and age (when possible), searcher name, turbine number, measured distance from turbine, azimuth from turbine, Global Positioning System (GPS) location of carcass, land cover surrounding carcass, condition of carcass (i.e., intact, scavenged, dismembered, injured), and estimated time of death (e.g., less than one day, two days). All fatalities had their location plotted on a map of the search area. Carcasses found in non-search areas (e.g., outside of a plot boundary) or outside of the study period, were recorded as incidental discoveries and documented following the same protocol for those found during standard searches.

Although the Covered Species were the focal interest of the study, all bird and bat carcasses that were detected were recorded. The condition of each bird or bat carcass was recorded using the following categories:

- Intact—a carcass that is complete, not badly decomposed, and shows no sign of being fed upon by a predator or scavenger
- Scavenged—an entire carcass that shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, portion of a carcass), or a carcass that has been heavily infested by insects
- Dismembered—a carcass found in multiple pieces distributed more than 3.3 ft apart from one another due to scavenging or other reasons
- Injured—a bat or bird found alive

Digital photographs were taken of each fatality, including any visible injuries, and surrounding habitat. No bird carcasses were collected; these carcasses were left in place but marked to avoid duplicate counting. Bat carcasses were collected under the Project's ITP (ESPER0627303), WEST's Federal Native Endangered and Threatened Species Recovery Permit (ES234121), and WEST's Iowa Wildlife Salvage Permit (SC895). Searchers placed all bat carcasses in a re-sealable plastic bag labeled with the unique carcass identification number, turbine number, and date, for storage in a freezer on site. Leather and latex gloves were used to handle all bat carcasses to eliminate possible transmission of rabies or other zoonotic diseases.

Carcasses that were found in non-search areas (e.g., outside of a plot boundary), found outside of the study period, or determined to have occurred prior to the study period were recorded as incidental discoveries and documented following the same protocol as those found during standard searches, but were not included in analysis. Carcasses found within plots either during scheduled searches or between scheduled searches were included in the analysis.

Carcass Identification and Agency Notification

Field identification of bird carcasses was reviewed, via photographs, by biologists with extensive field experience in identification of Midwestern birds and feathers. Federally permitted bat biologists (ES81968B-2, ESPER0039249, and ES03495B-3) provided identification confirmation of all bat carcasses and verified all potential *Myotis* carcasses via photographs. Tissue samples were collected from all potential *Myotis* or unidentifiable bat carcasses and submitted to a

USFWS-approved laboratory in two separate batches on August 26 and October 20, 2025. After DNA¹ samples were taken, carcasses were retained in a freezer onsite.

Bias Trials

Searcher Efficiency Trials

The objective of searcher efficiency trials was to estimate the probability that a carcass was found by a technician or detection dog. Searcher efficiency trials were conducted in the same areas where carcass searches occurred. Searchers did not know when searcher efficiency trials were being conducted or the location of the trial carcasses. Trial carcasses consisted of bats found during previous carcass searches. Bats were used for all plot types and species used in bias trials were eastern red bats (*Lasiurus borealis*), big brown bats (*Eptesicus fuscus*), hoary bats (*Lasiurus cinereus*) and silver-haired bats (*Lasionycteris noctivagans*).

Searcher efficiency trials were conducted for each season (spring and fall) and each plot type (road and pad, cleared, and uncleared) to account for differences in search conditions. Trials were conducted on multiple dates in each season to account for potential changes in plot conditions on searcher efficiency over time. Twenty trials were conducted per plot type per season. A trial administrator oversaw the placement and recording of the availability of each of these trial carcasses. Each trial carcass was discreetly marked with a tabbed black zip-tie with a unique number around the upper forelimb for identification as a trial carcass.

For detection-dog teams, trial carcasses were placed the night before or in the early morning of the search to allow time for a scent cone to develop prior to scheduled searches and to reduce the possibility of leaving a scent trail. The trial administrator walked in a meandering path to the placement location and dropped the trial carcasses from waist-height or higher allowing them to land in a random posture. Searchers had one chance to locate the trial carcass after carcass placement. The number and location of trial carcasses placed were recorded, and whether each trial carcass was found or missed. Immediately following the search, any carcasses that were missed were checked to confirm availability. Only carcasses confirmed as available were used to calculate searcher efficiency rates

Carcass Persistence Trials

The objective of carcass persistence trials was to estimate the length of time (in days) a carcass would persist or be available for detection in the field. Carcasses could be removed by scavengers or rendered undetectable by activities such as farming. Carcass persistence trials used different bat carcasses than those used for searcher efficiency trials. Twenty trial carcasses were placed per plot type per season. These carcasses were placed throughout the seasons to incorporate the effects of varying weather and scavenger densities on carcass persistence. No more than three trial carcasses were placed at a time in any one search area to avoid potential “over-seeding” and attracting scavengers.

¹ Deoxyribonucleic acid

Technicians monitored the trial carcasses over a 30-day period according to the following schedule. Carcasses were checked daily for the first four days, then on days 7, 10, 14, 20 and 30. Trial carcasses were monitored until they were completely removed, or the trial period ended, whichever occurred first. At the end of the 30-day period, any remaining carcasses were removed. Detection-dog teams were used to determine when carcasses were removed from the circular plots (cleared and uncleared), whereas technicians determined the status of carcasses placed on road and pad plots.

Search Plot Mapping

Technicians delineated the boundaries of all circular plot search areas using a Juniper Geode sub-meter GPS unit. Delineations from road and pad plots delineated in Year 1 were used as the road and pad search areas for Year 3. Any unsearchable areas within a plot boundary were also mapped. Plot boundaries were used to verify if carcasses were found inside the plot and to inform an area adjustment based on the spatial distribution of carcasses.

Quality Assurance and Quality Control

Quality assurance and quality control measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following searches, technicians were responsible for inspecting data forms for completeness, accuracy, and legibility. Potentially erroneous data were identified using a series of database queries. Irregular codes or data suspected as questionable were discussed with the technician and/or Project Manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes and measures were implemented. A Microsoft SQL database was developed to store, organize, and retrieve search data. All data forms and electronic data files were retained for reference.

Statistical Analysis

The Evidence of Absence (EoA; Dalthorp et al. 2017) modeling framework was used to estimate detection probability (g) and the annual take rate (λ). Data used in the EoA model included spatial distribution of all bat carcasses found during the study, and the results of searcher efficiency and carcass persistence trials.

Searcher Efficiency Estimation

Searcher efficiency was estimated separately for technicians and detection-dog teams to account for different modes of detection (i.e., technicians use sight whereas dogs use scent). The EoA model uses raw searcher efficiency data (e.g., number of found and available trial carcasses) to inform overall probability of detection. However, to determine if searcher efficiency data should be pooled, or separated by strata such as season or plot type, searcher efficiency was modeled using logistic regression. Season was included as a potential covariate for the technician model, and plot type was included as a potential covariate for the detection-dog team model. For both the technician and detection-dog team models, selection was completed using an information theoretic approach known as AICc, or corrected Akaike Information Criterion (Burnham and Anderson 2002). The best-supported model was selected as the most parsimonious model

(fewest parameters) within two AICc units of the model with the lowest AICc value. Searcher efficiency values were input into the EoA model software according to the model selection results.

The change in searcher efficiency between successive searches was defined by a parameter called the detection reduction factor (k) that can range from zero to one. When k is zero, it implies a carcass that was missed on the first search would never be found on subsequent searches. A k of one implies searcher efficiency remained constant no matter how many times a carcass was missed. Huso et al. (2017) estimated a value of $k = 0.67$ for bats, and this value was used to calculate estimates for the Covered Species using the EoA model.

Carcass Persistence Rate Estimation

Data collected during carcass persistence trials were used to estimate the amount of time, in days, that carcasses remained available to be located by the technician or detection-dog team. The average probability a carcass persisted through the search interval (i.e., the time between scheduled searches) was estimated using an interval-censored survival regression with four potential distributions: exponential, loglogistic, lognormal, and Weibull (Kalbfleisch and Prentice 2002, Dalthorp et al. 2018). As with searcher efficiency, carcass persistence models were estimated separately by search team (i.e., technicians versus detection-dog teams) to account for different modes of detection. Season was included as a potential covariate for the technician model, and plot type was included as a potential covariate for the detection-dog model. The best-supported model was selected as the most parsimonious model within two AICc units of the model with the lowest AICc value. The parameter estimates of the selected model (shape (α) and scale (β), including the 95% confidence interval of scale) were used as inputs in the EoA Single Class module.

Search Area Adjustment

The search area adjustment was calculated to determine the distribution of bat carcasses and the proportion of bat carcasses occurring within the search areas. The search area adjustment accounted for unsearched areas beneath turbines and was calculated as a probability that ranged from zero to one. The area adjustment was estimated as the product of the searched area around each turbine and a carcass-density distribution. A truncated weighted maximum likelihood (TWL) modeling approach (Khokan et al. 2013) was used to estimate the carcass-density distribution using site-specific fatality locations. The TWL approach uses weight-based probability of detection and the proportion of area searched in each 1.0-m annulus around the turbine. Distributions considered were normal, gamma, Gompertz, and Weibull (parameterized according to R Development Core Team [2016] and Yee [2010]). Although the spring and fall seasons have the potential to have different carcass density distributions due to differences in turbine operation, there was insufficient sample size in the spring to examine these effects. Therefore, the only models considered were those that pooled data from both turbine operation regimes and seasons. The best-supported model was selected using AICc. The proportion of area searched was calculated in a geographic information system as the amount of area searched divided by the total area searched at each 1.0-m annulus around the turbine.

Carcasses Excluded from Area Adjustment

Fatalities were excluded from the area adjustment calculation in the EoA model when a carcass was discovered outside of the spatial and temporal scope of the study design. For example, carcasses found outside a designated plot were not included in the analysis because the area adjustment calculation accounts for these carcasses by adjusting for unsearched areas. Carcasses occurring prior to the start of searches (e.g., a carcass found in a plot in the summer that was not searched until the fall) were also excluded because the carcass occurred outside of the study period. Note that carcasses found in a plot incidentally were included in the analysis if that plot had a scheduled search during the next round of searches. If a fatality of a Covered Species had been found outside of the spatial or temporal scope of the study design, it would be excluded from the area adjustment estimate but would be included in the EoA fatality estimate according to Dalthorp et al. (2020).

Covered Species Take and Arrival Proportions

The EoA model was used to estimate the annual take rate (λ) for a Covered Species and the probability of detection (g). Estimates were calculated using the EoA model (Dalthorp et al. 2017), using the Single Class, Multiple Class, and Multiple Years modules of EoA.

Detection Probability and Density Weighted Proportion

The probability of detection (g) was estimated using bias corrections for searcher efficiency, carcass persistence, and area searched, as well as the assumed seasonality of risk (arrival proportion) for the Covered Species, which was 11% in spring and 89% in fall per the Project's Study Plan. The EoA Single Class module was used to estimate the distribution of detection probability in each search stratum, and area adjustment was included in the Single Class module for each stratum. This resulted in alpha and beta parameters that defined the beta distribution of detection probability in each stratum. The EoA Multiple Class Module was then used to combine detection probability distributions across strata within a season, with weights for each class defined by the sampling fraction for each plot type. Weights ("DWP" in the software) represent the relative fatality risk within each search stratum or season and are used for combining detection probabilities. The Multiple Class Module was used again to combine the strata across seasons using arrival proportions to define the weights for each class to get a single annual beta distribution.

The Multiple Years Module was used to combine detection probabilities across years. The Multiple Years Module requires the input ρ , which weights the years appropriately based on relative turbine operations, to combine Beta distribution parameters. The relative turbine operation weight was defined as the proportion of operational turbine nights relative to total turbine nights within a given stratum, where a turbine night can be defined as a single night at a single turbine. Given that turbines undergo routine maintenance, relative turbine operations were considered normal unless the proportion of operational turbine nights was less than 0.90 during the study period. Cross-season relative turbine operations and the arrival proportions were multiplied and then re-scaled to sum to one across seasons. For the 2025 study period, the proportion of operational turbine nights was greater than 0.9, so ρ was set to one.

Adaptive Management Trigger

Table 6.5 in the HCP outlines several conditions for adaptive management at the Project. Two conditions were based on bats in hand (i.e., either two or more Indiana bat or northern-long eared bat carcasses found in Years 1–2, or a single Indiana bat or northern long-eared bat carcass found in either the spring or the summer of any year). The remaining conditions for adaptive management were based on EoA estimates. The estimates from the EoA analysis were used to test the adaptive management trigger that would be met if the median (50th credible bound) annual take rates (λ) were between one and three bats per year or greater than three bats per year, per the HCP. Outcomes for meeting individual adaptive management triggers were followed in accordance with the actions outlined in Table 6.5 of the Project's HCP. The adaptive management triggers were reviewed individually for each of the Covered Species. Three years of data were used in this analysis, 2023–2025.

RESULTS

Standardized Carcass Searches

In the spring, 462 searches were completed, and 963 searches were completed in the fall (Table 3). Four searches were missed due to ground conditions at cleared plots, turbine maintenance, weather constraints, or safety hazards. A total of 540 bat carcasses (Table 4) and 70 bird carcasses were found during searches and incidentally. No Covered Species were found during the study. In addition, no federally or state-listed species were found during the study.

Table 3. Number of searches per plot type at the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, April 1 – May 15 and August 1 – October 15, 2025.

Season	Plot Type	Search Interval (days)	Number of Searches
spring (April 1 – May 15)	100-m road and pad	7.0	462
fall (August 1 – October 15)	100-m road and pad	7.0	481
	80-m cleared plot	3.5	276
	80-m uncleared plot	3.5	206

m = meter.

Species Composition

Eight bats were found during the spring and 468 bats were found during the fall. The most commonly found bat species were eastern red bat (51.3% of carcasses), silver-haired bat (18.3%), big brown bat (14.8%), and hoary bat (13.5%). Four evening bats (*Nycticeius humeralis*; 0.7%), two tricolored bats (*Perimyotis subflavus*, 0.4%), and one little brown bat (*M. lucifugus*; 0.2%), were also found. Four carcasses that were sent for DNA analysis could not be identified to species because the laboratory failed to isolate mammal DNA from the samples due to decomposition. These carcasses consisted of patches of desiccated skin and fur or bone fragments resembling bat remnants found by detection dogs. Samples of each carcass were retained in case additional analysis is needed.

A total of 449 bats were used in analysis to estimate the spatial distribution of bat carcasses within the search plots to produce area adjustment factors for the EoA model (Table 4). Ninety-one bats were excluded from the area adjustment calculation. Eighty-two bats were either found during clearing searches prior to the fall season (64 bats) or were determined to have occurred outside the study period based on estimated time of death (18 bats). Nine bats were excluded because they were found outside of search areas.

Table 4. Number and percent (%) of carcasses, by species, included and excluded from the area adjustment analysis at the Great Pathfinder Wind Project, Boone and Hamilton County, Iowa, from April 1 – May 15 and August 1 – October 15, 2025.

Species	Included in Area Adjustment		Outside Search Area ¹		Outside Study Period ¹		Total	
	Total	%	Total	%	Total	%	Total	%
eastern red bat	217	48.3	8	88.9	52	63.4	277	51.3
silver-haired bat	85	18.9	0	0	14	17.1	99	18.3
big brown bat	69	15.4	1	11.1	10	12.2	80	14.8
hoary bat	69	15.4	0	0	4	4.9	73	13.5
unidentified bat	4	0.9	0	0	0	0	4	0.7
evening bat	2	0.4	0	0	2	2.4	4	0.7
tricolored bat	2	0.4	0	0	0	0	2	0.4
little brown bat	1	0.2	0	0	0	0	1	0.2
Overall Bats	449	100	9	100	82	100	540	100

¹ Carcasses not included in the area adjustment calculation.

Bias Trials

Searcher Efficiency Trials

A total of 109 bats were placed for searcher efficiency trials on 14 separate dates across all plot types and months of the study; 99 of these remained available for searchers to find (Appendix B1). Technicians found 89.4% of available carcasses (42 out of 47) in road and pad plots and detection-dog teams found 76.9% of available carcasses (40 out of 52) in circular plots (Appendix B1).

The selected model for searcher efficiency at road and pad plots included season as a covariate, indicating searcher efficiency rates differed between spring and fall for human searchers on road and pad plots (Appendix B2). The selected model for searcher efficiency in circular plots did not include plot type as a covariate, indicating similar searcher efficiency rates between cleared and uncleared plots for detection-dog teams (Appendix B3).

Carcass Persistence Trials

A total of 80 bat carcasses were placed to estimate carcass persistence (Appendix C1). The selected model for road and pad plots had an exponential distribution and included season as a covariate, indicating differing persistence times for spring and fall (Appendix C2). For road and pad plots, the estimated median carcass persistence was 8.94 days in spring and 1.89 days in fall (Appendix C4).

The selected model for circular plots had an exponential distribution and did not include plot type as a covariate, indicating that persistence times were similar between cleared and uncleared plots (Appendix C3), with the same median carcass persistence of 11.66 days at both cleared plots and uncleared plots (Appendix C4).

Statistical Analysis

Area Adjustment

The area adjustment calculation included 449 bats that were found during the study at road and pad plots (39 bats) and circular plots (410 bats). The best-fit model for the distribution of bats with respect to distance from turbine was a Gompertz distribution (Appendix D1) with peak carcass density about 60 m from the turbine (Appendix D3). The estimated TWL area adjustments for bats were 0.07 for road and pad plots and 0.97 for circular plots (Appendix D2).

Probability of Detection

The overall probability of detecting a bat carcass (g) during the 2025 study period was 0.25 (95% credible interval [CrI]: 0.23–0.27; Table 5). The overall detection probability for the first three years of the permit was 0.22 (95% CrI: 0.21–0.23; Table 5), which exceeded the required g of 0.2 outlined in the HCP. Inputs required to run the EoA Single Class module and stratum-specific g distribution values and inputs are presented in Appendix E.

Table 5. Data inputs for the Evidence of Absence Multiple Years Module used to combine detection probability distributions across years for the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa.

Year	Ba ¹	Bb ¹	g (95% CrI)	ρ	Carcass Count	
					INBA	NLEB
2023	374.60	3,173.60	0.11 (0.10–0.12)	1	0	0
2024	493.09	1,153.48	0.30 (0.28–0.32)	1	0	0
2025	392.56	1,183.30	0.25 (0.23–0.27)	1	0	0
Permit to date	1,227.42	4,401.66	0.22 (0.21–0.23)	–	–	–

¹ Ba and Bb are the α and β parameters of a beta distribution describing the detection probability distribution

CrI = credible interval, INBA = Indiana bat, NLEB = northern long-eared bat

Covered Species Take Estimates

No Covered Species were found during the first three years of PCM. The median annual take rate (λ) for each Covered Species estimated from the first three years of monitoring was $\lambda = 0.35$ bats per year (95% CrI: 0–3.84; Table 6). Adaptive management criteria were assessed using the median annual take rate from Years 1–3. Neither Covered Species' estimated take rate exceeded the authorized take rate of three bats per year. The estimated annual take rate must be greater than one (defined in the HCP as the "expected" take rate; Table 5.1) to trigger adaptive management. The estimated take rate for Indiana bat and northern long-eared bat was less than one; therefore, the criteria for adaptive management were not met, and no adaptive management actions are necessary at this time (Table 6).

Table 6. Estimated take rates for Incidental Take Permit Years 1–3 at the Great Pathfinder Wind Project, Boone and Hamilton County, Iowa, from 2023 to 2025.

Species	Carcass Count	Median λ (95% CrI) ²	Expected Take Rate	Authorized Take Rate
Indiana bat	0	0.35 (0–3.84)	< 1	3
northern long-eared bat	0	0.35 (0–3.84)	< 1	3

CrI = credible interval.

DISCUSSION

The Year 3 study objectives were to comply with the PCM requirements for Covered Species as outlined in the Project's HCP and ITP, estimate take of the Covered Species, and determine if adaptive management thresholds were triggered. The overall g value for the first three years of the ITP exceeded the compliance monitoring minimum detection probability of 0.2 per Section 6.4.2 of the HCP; therefore, monitoring in Year 4 will occur as outlined in the HCP. The ITP compliance monitoring completed during 2023–2025 provided evidence that the rate of take of Covered Species is below the estimated and permitted rate of take, and therefore in compliance with the permit. Adaptive management steps were not triggered due to the median annual take of Indiana bats and northern long-eared bats being less than one bat per year after Year 3.

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Appendix A. Overview of Study Design and Search Methods

Appendix A. Overview of study design and search methods for post-construction monitoring for the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, April 1 – May 15, and August 1 – October 15, 2025

Design Component	Sampling Unit
Plot type	cleared and uncleared circular plots; ¹ road and pad searches
Number of plots (percent of all turbines)	66 (100%)
Size/shape	80-meter (m) radius circle centered on turbine; 100-m road and pad searches
Search interval	road and pads once weekly in spring and fall; circular plots twice weekly in fall
Search period	April 1 – May 15 and August 1 – October 15, 2025
Spring dates	April 1 – May 15, 2025
Fall dates	August 1 – October 15, 2025
Spring plots	66 road and pad plots
Fall plots	44 road and pad plots, 12 cleared circular plots, 10 uncleared circular plots
Searcher efficiency seasons	spring and fall
Searcher efficiency carcass sizes	bat
Carcass persistence trials seasons	spring and fall
Carcass persistence trials carcass sizes	bat
Turbine Specifications	
Turbine model	General Electric-140 3.4-megawatt (66 turbines)
Hub height	322 feet (ft)
Rotor diameter	460 ft
Blade serrations (yes/no)	yes

¹ Detection-dog teams aided searches of circular plots

Appendix B. Searcher Efficiency Results and Models

Appendix B1. Searcher efficiency results for bats at all search areas at the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025, as a function of season.

Season	Search Area Type	# Placed	# Available	# Found	% Found	Searcher
spring	weekly 100-meter (m) road and pad	24	21	21	100	technician
	weekly 100-m road and pad	32	26	21	80.8	technician
fall	twice per week 80-m cleared circular plot	26	26	22	84.6	detection-dog team
	twice per week 80-m uncleared circular plot	27	26	18	69.2	detection-dog team

Appendix B2. Searcher efficiency models for bats on 100-meter road and pad plots searched by technicians at the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025 (n = 47).

Covariates	k Value	AICc	Delta AICc
season	k fixed at 0.67	30.74	0*
no covariates	k fixed at 0.67	33.94	3.20

* Selected model.

AICc = corrected Akaike Information Criterion; Delta AICc = change in AICc.

Appendix B3. Searcher efficiency models for bats on 80-meter circular plots searched by detection-dog teams at the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from August 1 – October 15, 2025 (n = 52).

Covariates	k Value	AICc	Delta AICc
no covariates	k fixed at 0.67	58.26	0*
plot search type	k fixed at 0.67	58.67	0.41

* Selected model.

AICc = corrected Akaike Information Criterion; Delta AICc = change in AICc.

Appendix C. Carcass Persistence Modeling Results and Trial Data

Appendix C1. Bat carcasses placed for carcass persistence trials, by date, season, species, and turbine, at the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025.

Date Placed	Season	Species	Turbine	Before Removal*	After Removal**
04/07/2025	spring	eastern red bat	A05	04/14/2025	04/16/2025
04/07/2025	spring	eastern red bat	B02	04/20/2025	04/27/2025
04/07/2025	spring	eastern red bat	B03	04/16/2025	04/27/2025
04/07/2025	spring	eastern red bat	B04	04/16/2025	04/20/2025
04/07/2025	spring	eastern red bat	C03	04/14/2025	04/16/2025
04/07/2025	spring	eastern red bat	H03	04/16/2025	04/20/2025
04/07/2025	spring	eastern red bat	H04	04/20/2025	04/27/2025
04/07/2025	spring	eastern red bat	H05	04/07/2025	04/08/2025
04/07/2025	spring	eastern red bat	H06	04/07/2025	04/07/2025
04/07/2025	spring	eastern red bat	H07	04/16/2025	04/20/2025
04/14/2025	spring	eastern red bat	C05	04/16/2025	04/17/2025
04/14/2025	spring	eastern red bat	C06	04/16/2025	04/17/2025
04/14/2025	spring	eastern red bat	C07	05/13/2025	05/13/2025
04/14/2025	spring	eastern red bat	E06	04/14/2025	04/15/2025
04/14/2025	spring	eastern red bat	E07	05/13/2025	05/13/2025
04/14/2025	spring	eastern red bat	G07	04/14/2025	04/15/2025
04/14/2025	spring	eastern red bat	G08	04/16/2025	04/17/2025
04/14/2025	spring	eastern red bat	G09	05/13/2025	05/13/2025
04/14/2025	spring	eastern red bat	G11	04/16/2025	04/17/2025
04/14/2025	spring	eastern red bat	I01	04/23/2025	04/27/2025
08/11/2025	fall	big brown bat	A02	08/13/2025	08/15/2025
08/11/2025	fall	silver-haired bat	A03	08/12/2025	08/13/2025
08/11/2025	fall	eastern red bat	A05	08/17/2025	08/20/2025
08/11/2025	fall	big brown bat	A05	08/13/2025	08/15/2025
08/11/2025	fall	big brown bat	A06	08/20/2025	08/24/2025
08/11/2025	fall	silver-haired bat	B01	08/13/2025	08/15/2025
08/11/2025	fall	eastern red bat	B03	08/14/2025	08/17/2025
08/11/2025	fall	silver-haired bat	B06	08/24/2025	08/31/2025
08/11/2025	fall	eastern red bat	C01	08/12/2025	08/13/2025
08/11/2025	fall	silver-haired bat	C05	08/15/2025	08/18/2025
08/11/2025	fall	hoary bat	D01	08/11/2025	08/11/2025
08/11/2025	fall	silver-haired bat	D02	08/14/2025	08/17/2025
08/11/2025	fall	big brown bat	D03	09/10/2025	09/10/2025
08/11/2025	fall	eastern red bat	D05	09/10/2025	09/10/2025
08/11/2025	fall	silver-haired bat	E05	08/20/2025	08/24/2025
08/18/2025	fall	eastern red bat	E02	08/20/2025	08/21/2025
08/18/2025	fall	silver-haired bat	E04	08/20/2025	08/21/2025
08/18/2025	fall	silver-haired bat	F01	08/24/2025	08/27/2025
08/18/2025	fall	big brown bat	F02	08/27/2025	08/31/2025
08/18/2025	fall	eastern red bat	G08	08/21/2025	08/24/2025
08/18/2025	fall	eastern red bat	G11	08/18/2025	08/18/2025
08/18/2025	fall	silver-haired bat	H03	08/21/2025	08/21/2025
08/18/2025	fall	silver-haired bat	H04	08/19/2025	08/21/2025
08/18/2025	fall	silver-haired bat	H05	08/21/2025	08/21/2025
08/18/2025	fall	silver-haired bat	H06	08/19/2025	08/21/2025
08/18/2025	fall	big brown bat	H07	09/17/2025	09/17/2025
08/18/2025	fall	eastern red bat	I05	08/27/2025	09/01/2025
09/01/2025	fall	big brown bat	A05	09/10/2025	09/14/2025
09/01/2025	fall	big brown bat	A07	09/02/2025	09/02/2025
09/01/2025	fall	silver-haired bat	A08	09/04/2025	09/07/2025
09/01/2025	fall	silver-haired bat	A09	09/02/2025	09/02/2025

Appendix C1. Bat carcasses placed for carcass persistence trials, by date, season, species, and turbine, at the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025.

Date Placed	Season	Species	Turbine	Before Removal*	After Removal**
09/01/2025	fall	silver-haired bat	A10	09/02/2025	09/02/2025
09/01/2025	fall	hoary bat	B03	10/01/2025	10/01/2025
09/01/2025	fall	eastern red bat	B06	10/01/2025	10/01/2025
09/01/2025	fall	eastern red bat	C03	09/03/2025	09/04/2025
09/01/2025	fall	hoary bat	C05	09/03/2025	09/04/2025
09/01/2025	fall	eastern red bat	C08	09/21/2025	10/01/2025
09/01/2025	fall	eastern red bat	C08	10/01/2025	10/01/2025
09/01/2025	fall	eastern red bat	D03	09/10/2025	09/14/2025
09/01/2025	fall	eastern red bat	D03	09/21/2025	10/01/2025
09/01/2025	fall	eastern red bat	D04	09/04/2025	09/07/2025
09/01/2025	fall	silver-haired bat	D05	10/01/2025	10/01/2025
09/15/2025	fall	eastern red bat	B08	09/15/2025	09/17/2025
09/15/2025	fall	hoary bat	C03	09/24/2025	09/29/2025
09/15/2025	fall	eastern red bat	E02	09/16/2025	09/17/2025
09/15/2025	fall	eastern red bat	E04	09/22/2025	09/25/2025
09/15/2025	fall	eastern red bat	E06	09/18/2025	09/22/2025
09/15/2025	fall	hoary bat	E06	09/18/2025	09/22/2025
09/15/2025	fall	hoary bat	F01	09/29/2025	10/06/2025
09/15/2025	fall	eastern red bat	F06	09/17/2025	09/18/2025
09/15/2025	fall	eastern red bat	F09	10/06/2025	10/14/2025
09/15/2025	fall	hoary bat	F09	10/06/2025	10/14/2025
09/15/2025	fall	eastern red bat	G06	09/15/2025	09/15/2025
09/15/2025	fall	eastern red bat	G08	09/15/2025	09/15/2025
09/15/2025	fall	eastern red bat	G09	09/25/2025	09/29/2025
09/15/2025	fall	silver-haired bat	H02	09/15/2025	09/16/2025
09/15/2025	fall	eastern red bat	H07	10/14/2025	10/14/2025
09/15/2025	fall	silver-haired bat	I01	09/15/2025	09/16/2025
09/15/2025	fall	silver-haired bat	I04	09/15/2025	09/16/2025
09/15/2025	fall	eastern red bat	I05	09/15/2025	09/15/2025

* Last date checked before removal.

** Date checked after removal.

Appendix C2. Carcass persistence models with covariates and distributions for bats in 100-meter road and pad plots searched by technicians at the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025 (n = 40).

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
season	–	exponential	169.99	0*
season	no covariates	Weibull	172.32	2.33
season	season	lognormal	173.24	3.25
season	no covariates	lognormal	173.35	3.36
season	no covariates	loglogistic	173.51	3.52
season	season	loglogistic	173.83	3.84
season	season	Weibull	173.96	3.97
no covariates	season	lognormal	181.00	11.01
no covariates	season	loglogistic	181.42	11.43
no covariates	no covariates	loglogistic	182.33	12.34
no covariates	no covariates	lognormal	182.35	12.36
no covariates	season	Weibull	185.47	15.48
no covariates	no covariates	Weibull	186.00	16.01
no covariates	–	exponential	188.45	18.46

* Selected model.

AICc = corrected Akaike Information Criterion; Delta AICc = change in AICc.

Appendix C3. Carcass persistence models with covariates and distributions for bats on 80-meter circular plots searched by detection-dog teams at the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from August 1 – October 15, 2025 (n = 40).

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
no covariates	–	exponential	185.21	0*
no covariates	no covariates	loglogistic	185.88	0.67
no covariates	plot search type	loglogistic	185.96	0.75
no covariates	no covariates	Weibull	186.78	1.57
no covariates	plot search type	Weibull	186.95	1.74
no covariates	plot search type	lognormal	187.04	1.83
no covariates	no covariates	lognormal	187.04	1.83
plot search type	–	exponential	187.40	2.19
plot search type	no covariates	loglogistic	187.95	2.74
plot search type	plot search type	loglogistic	188.26	3.05
plot search type	no covariates	Weibull	189.10	3.89
plot search type	no covariates	lognormal	189.14	3.93
plot search type	plot search type	lognormal	189.41	4.20
plot search type	plot search type	Weibull	189.42	4.21

* Selected model.

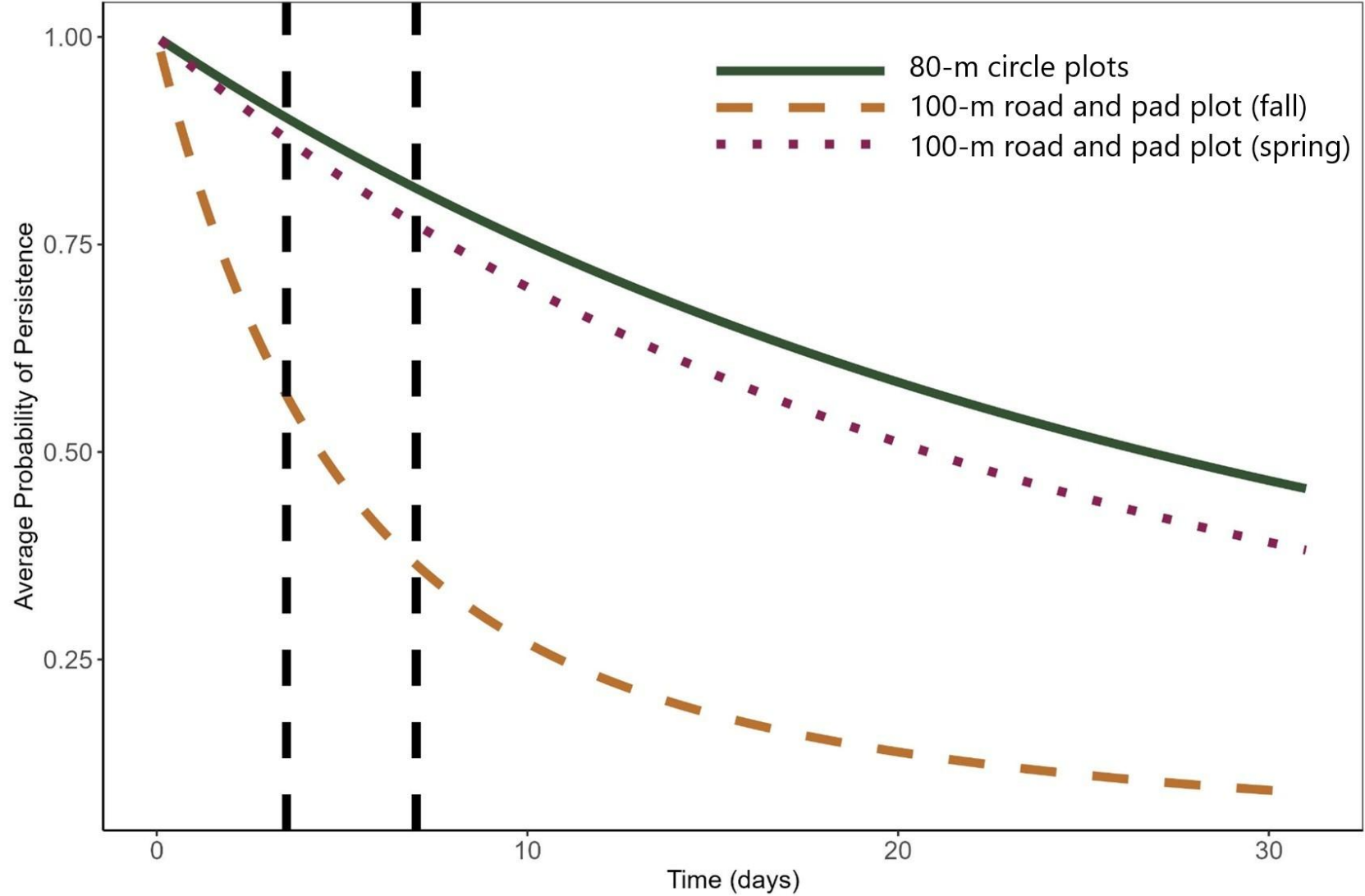
AICc = corrected Akaike Information Criterion; Delta AICc = change in AICc.

Appendix C4. Carcass persistence top models with covariates, distributions, and model parameters for the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025.

Size Class	Plot Type	Season	Distribution	Predicted Median Removal Times (days)	Parameter 1	Searcher
bat	100-m road and pad	spring	exponential*	8.94	rate_R = 0.078	technician
	100-m road and pad	fall	exponential*	1.89	rate_R = 0.366	technician
	80-m circular plot	fall	exponential*	11.66	rate_R = 0.059	detection-dog team

* Parameterization follows the base R parameterization for this distribution.

m = meter



Appendix C5. Average probability of carcass persistence as a function of time (days) for bat carcasses placed on 100-meter road and pad plots and 80-meter circular plots at the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025. Search intervals of 3.5 days and 7.0 days are represented by vertical dashed lines for reference.

Appendix D. Area Adjustment Modeling Results

Appendix D1. Search area adjustment models for bats from the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025.

Distribution	AICc	Delta AICc
Gompertz	28,158.20	0*
normal	28,646.57	488.37
Weibull	28,846.56	688.36
gamma	29,136.42	978.22

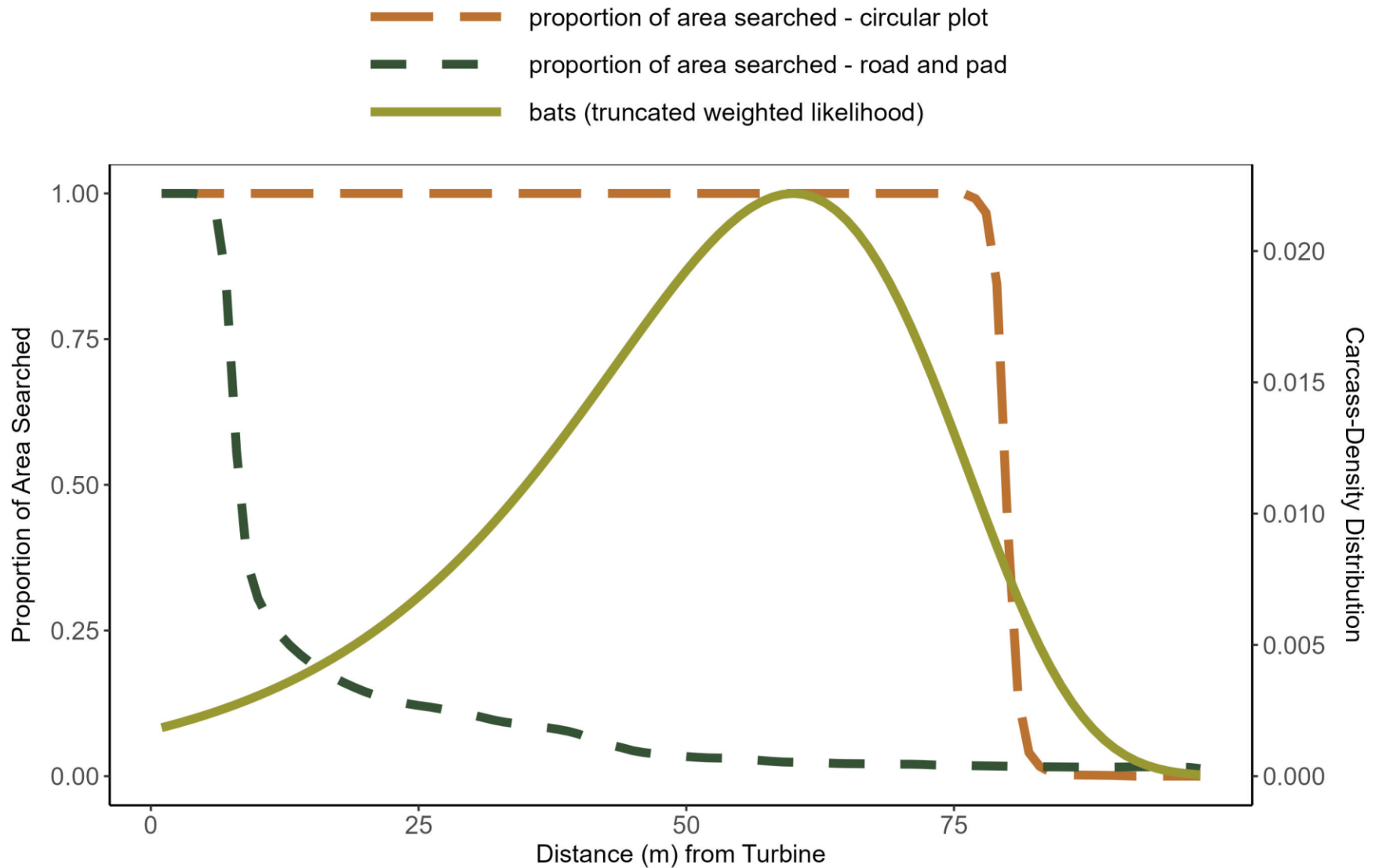
* Selected model.

AICc = corrected Akaike Information Criterion; Delta AICc = change in AICc.

Appendix D2. Truncated weighted maximum likelihood search area adjustment estimates for the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025 (bat n = 449).

Size Class	Area Adjustment	Search Area Type	Distribution	Parameter 1	Parameter 2
bat	0.07	100-m road and pad plot	Gompertz	0.0586	0.0017
	0.97	80-m circular plot	Gompertz	0.0586	0.0017

m = meter.



Appendix D3. Estimated bat carcass-density distribution, and proportion of area searched, by distance from turbine, for all search areas at Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025.

**Appendix E. Evidence of Absence Inputs for Single Class, Multiple Class, and Multiple
Years Modules**

Appendix E1. Data inputs needed for the Evidence of Absence Single Class Module for the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025.

Season	Search Area Type ³	# of Turbines	Search Interval (days)	Average Number of Searches	Spatial Coverage (a)	Searcher Efficiency ¹		Carcass Persistence ²			
						Carcasses Available	Carcasses Found	Distribution	Shape (α)	Scale (β)	β CI (95%)
spring	road and pad	66	7.0	7	0.07	21	21	exponential	—	12.90	8.00–20.78
	road and pad	44	7.0	11	0.07	26	21	exponential	—	2.73	1.75–4.26
fall	cleared plot	12	3.5	22	0.93	52	40	exponential	—	16.83	11.89–23.83
	uncleared plot	10	3.5	22	0.93	52	40	exponential	—	16.83	11.89–23.83

¹ The detection reduction factor k was assumed to equal 0.67 for all strata.

² Parameterization follows the EoA parameterization according to Dalthorp, et al. 2017.

³ Temporal coverage (v) was set to 1 across all strata. Seasonality of risk is accounted for in the Multiple Class Module.

Appendix E2. Data inputs for the Evidence of Absence Multiple Class Module used to combine detection probability distributions across strata within season for the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from August 1 – October 15, 2025.

Season	Search Area Type ¹	# of Turbines	Weight (DWP) ²	Ba ³	Bb ³	g (95% CrI) ⁴
fall	cleared plot	12	0.33	104.62	29.72	0.78 (0.71–0.84)
	uncleared plot	10	0.33	104.62	29.72	0.78 (0.71–0.84)
	road and pad	44	0.67	22.77	1,082.60	0.02 (0.01–0.03)

¹. Road and pad plots were searched by technician; cleared and uncleared plots were searched by detection-dog team

². The density-weighted proportion (DWP) is the fraction of carcasses expected within the stratum.

³. Ba and Bb are the α and β parameters of a beta distribution describing the detection probability distribution.

⁴. CrI = credible interval.

Appendix E3. Data inputs for the Evidence of Absence Multiple Class Module used to combine detection probability distributions across seasons within the study period for the Great Pathfinder Wind Project, Boone and Hamilton counties, Iowa, from April 1 – May 15 and August 1 – October 15, 2025.

Season	Weight (DWP) ¹	Ba ²	Bb ²	g (95% CrI) ³
spring	0.11	196.09	3489.12	0.05 (0.05–0.06)
fall	0.89	362.72	964.37	0.27 (0.25–0.30)

¹. The density-weighted proportion (DWP) is the fraction of carcasses expected within the stratum.

². Ba and Bb are the α and β parameters of a beta distribution describing the detection probability distribution.

³. CrI = credible interval.