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November 18, 2022

By E-Mail and First-Class Mail

Ms. Holly Anderson, Clerk
Vermont Public Utility Commission
112 State Street, Drawer 20
Montpelier, VT 05620-2701

Re: Docket No. 7250 – Deerfield Wind Project
Status Update

Dear Ms. Anderson,

The following letter is provided on behalf of Deerfield Wind, LLC ("Deerfield Wind") in response to the Public Utility Commission's ("PUC" or the "Commission") November 2, 2022 request for a status update on three compliance items in Deerfield Wind's Amended Certificate of Public Good ("CPG").

The first item relates to the ongoing bear study conducted by the Agency of Natural Resources ("ANR" or the "Agency"). As the PUC's status request noted, Condition 11 of the Amended CPG required Deerfield to mitigate the Project's impact on bears and Condition 12 required a multi-year study of the Project's potential impact on bears. Deerfield Wind reached an agreement with ANR and Vermont Natural Resources Council ("VNRC") on the scope of the bear study in 2010, and the Commission subsequently approved the 2010 Bear Study Stipulation on April 7, 2011 ("2010 Bear Stipulation"). The stipulating parties then agreed in 2016 to further expand the scope of the study from three to four years, and Deerfield Wind agreed to provide additional funding for the study ("2016 Mitigation Stipulation"). The 2016 Mitigation Stipulation also specified Deerfield Wind's financial commitments to fund land conservation required under Condition 11. The Commission concluded the conditions of the 2016 Mitigation Stipulation satisfied the requirements of Condition 11.

Paragraph 3(c) of the 2016 Mitigation Stipulation requires a copy of the bear study to be filed within 30 days of its completion, and the PUC asked for an update on the status of this work. Deerfield Wind has been in contact with ANR and understands the Agency is still in the process of analyzing data collected during the study. ANR has indicated it plans to provide the Commission a status report on the study, and consistent with paragraph 3(c) of the 2016 Mitigation Stipulation, a copy of the final report will be filed with the Commission within 30 days of its completion.

The Commission also requested a status update on two items related to the post-construction bird and bat monitoring required under Condition 16 of the Amended CPG. Specifically, the PUC requested an update on whether the monitoring has been completed, and if so, whether the results indicate further adaptive management is required. The project is already implementing approved adaptive management procedures relative to bats, under which turbine operations are curtailed in specific seasonal, weather, and wind speed conditions to minimize impacts on bats, consistent with the conditions the U.S. Forest Service's ("USFS") Record of Decision and the Project's Vermont State Takings Permit.

As specified in the Project's approved Post-Construction Monitoring Plan ("PCMP"), bird and bat surveys are required in years 1, 3, and 5 following the Project's commencement of operations, which occurred in 2017. The first two years of post-construction monitoring were conducted in 2018 and 2020 respectively, and reports on these surveys were provided to ANR and the USFS on February 28, 2019 (for 2018 monitoring), and February 28, 2021 (for 2020 monitoring).[1] The final year of survey work was just completed in October of 2022, data analysis is underway, and a final report is expected to be provided on or around February 28, 2023.

Although still preliminary, the results from the first two years of monitoring indicate that the Project has not had an undue adverse impact on birds or bats in the Project area. Under Condition 16, undue adverse impacts are defined as whether project mortality rates "exceed the most current established threshold ranges for mortality at wind projects on northern forested ridges."[2] As indicated in the attached reports, both bird and bat mortality rates at the facility are at the low end of the range of other standardized post-construction studies for wind facilities in the northeast, including other northern forest ridgeline projects located in Vermont. As a result, current data does not indicate an impact that would necessitate adaptive management.

Following completion of the third year of monitoring, Deerfield will consult with ANR and the USFS (pursuant to the federal Record of Decision for the Project) to engage in a cooperative team-based process to review the PCMP data and determine whether adaptive management measures are necessary. Consistent with Condition 16, if such measures are determined to be necessary, a proposal for adaptive management will be submitted to the PUC for review and approval.

Deerfield Wind thanks the Commission in advance for its consideration of the above information. Please let us know if you have any questions or require further information.

Sincerely,

Geoffrey H. Hand, Esq.
DUNKIEL SAUNDERS ELLIOTT RAUBVOGEL & HAND, PLLC

Encl.
cc: Service list (via first-class mail)

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[1] Copies of the 2018 and 2020 reports are attached to this letter. See Attachments 1 & 2. Deerfield Wind has reviewed its files and determined that these reports were not provided to the PUC at the time they were sent to USFS and ANR in 2019 and 2021, as the PCMP contemplated. Deerfield Wind apologizes for this oversight. The third and final report will be provided to all three agencies, concurrently.

[2] Amended CPG at Condition 16.

Attachment 1

Stantec

Post-Construction Monitoring Report Year 1, Deerfield Wind Project

Bennington County, Vermont

February 28, 2019

Prepared for:

Deerfield Wind, LLC

A subsidiary of
Avangrid Renewables, LLC. 1125 NW
Couch Street Portland, OR 97209

Prepared by:

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

Report Citation

Stantec Consulting Services Inc. (Stantec). 2019. Post-Construction Monitoring Report Year 1, Deerfield Wind Project. Stantec Consulting Services Inc., Topsham, Maine, USA. 37 pages + appendices.

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Executive Summary

The Deerfield Wind Project (Project) is a 15-turbine 30-megawatt (MW) facility located in Searsburg and Readsboro, Bennington County, Vermont. The Project is owned by Deerfield Wind, LLC (Deerfield Wind), a subsidiary of Avangrid Renewables (Avangrid). The Project consists of 8 Gamesa G97 turbines with 97-meter (m) rotor diameters, and 7 Gamesa G87 turbines with 87-m rotor diameters. The Project became operational in late 2017. As part of the permit conditions, a Post-Construction Monitoring Plan (PCMP) dated September 2017 was developed in consultation with and approved by the Vermont Agency of Natural Resources (VANR) and Green Mountain National Forest. As specified in the Project's permits, post-construction bird and bat fatality surveys will be conducted during years 1, 3, and 5 following the operational start of the Project. In compliance with these plans, Stantec Consulting Services Inc. (Stantec) conducted post-construction fatality monitoring studies at the Project during Year 1 of operation in 2018. In addition, in compliance with the Threatened and Endangered Species Taking Permit issued to the Project by VANR in 2018, the United States Forest Service Record of Decision (ROD) dated January 2012, and the PCMP, the Project implemented operational control measures from June 1 to September 30, 2018.

Stantec conducted fatality searches from April 23, 2018 to October 15, 2018. Weather and site maintenance activities permitting, all 15 turbines were searched at least once every 3 days.

During the 2018 surveys, 993 (99%) of 1,005 scheduled turbine searches were completed. Twelve searches could not be conducted due to turbine maintenance. Thirty-six carcasses were found: 26 birds and 10 bats. Twelve bird species were found, including 11 passerines (*Passeriformes*) and 1 woodpecker (*Sphyrapicus sp.*). Four bat species were found, including three tree-roosting species and one cave-dwelling species; there were no Myotis bat species found.

There were no federally or state-listed endangered or threatened bat or bird species found (VFWD 2015a). Two bird species of Vermont Greatest Conservation Need were found: blackpoll warbler (*Setophaga striata*; n =1), and black-throated blue warbler (*Setophaga caerulescen;* n = 1). All four bat species found are of Vermont Greatest Conservation Need: hoary bat (*Lasiurus cinereus*; n = 4), big brown bat (*Eptesicus fuscus*; n = 3), silver-haired bat (*Lasionycteris noctivagans*; n = 2), and eastern red bat (*Lasiurus borealis*; n = 1) (VFWD 2015b).

Fatality data, searcher efficiency trial data, and carcass persistence data were used to estimate bat and bird fatality rates (with and without a correction factor for area searched) using the Huso fatality estimator. Searcher efficiency for bats and birds was 60% and 58%, respectively, and carcass persistence for bats and birds was 8.41 days and 10.03 days, respectively, which is generally consistent with searcher efficiency and carcass persistence rates reported for other projects in New England (range = 42% - 91%). Based on the Huso Estimator, estimates of bat and bird fatality were 1.47 bats and 8.01 birds per turbine per period (with area corrections). Estimates of bat and bird fatality by rated power were 0.77 bats and 4.03 birds per MW per period (with area corrections).

The estimate of bat fatality at the Project is on the very low end of the range of other post-construction studies in the region (0.00 to 63.90 bats/turbine/period). The estimate of bird fatality at the Project is within the range of other regional post-construction studies (0.29 to 27.40 birds/turbine/period). The bat

fatality estimate at Deerfield is lower than those at other Vermont sites such as Georgia Mountain Community Wind (Georgia), Kingdom Community Wind (Kingdom), and Sheffield Wind Facility (Sheffield), which ranged from 1.94 to 14.65 bats/turbine/period. The bird fatality estimate at Deerfield is within the range of those at Georgia, Kingdom, and Sheffield, which ranged from 2.13 to 13.17 birds/turbine/period.

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Deerfield Wind Project (Project) is a 15-turbine 30-megawatt (MW) facility located in Searsburg and Readsboro, Bennington County, Vermont (Figure 1-1). The Project was authorized by the Green Mountain National Forest (GMNF) in 2012 and the Vermont Public Service Board (VPSB) in 2009. The January 2012 Record of Decision (USDA 2012; GMNF 2012) approved a Special Use Permit for construction of the Project in the GMNF. The Project is operated by Deerfield Wind, LLC (Deerfield Wind), a subsidiary of Avangrid Renewables, LLC (Avangrid). The Project consists of 8 Gamesa G97 turbines with 97-meter (m) rotor diameters, and 7 Gamesa G87 turbines with 87-m rotor diameters. The Project became operational in late 2017.

The maximum rotor-swept height of the turbines is 126.5 m (415 feet [ft]), with a rotor diameter of 97 m (318 ft) and a hub height of 78 m (256 ft). Seven of the 15 turbines are lit with a single L-864 aviation red-colored synchronized flashing light mounted on top of the nacelle, which is activated by a radar-activated Federal Aviation Administration (FAA) lighting Aircraft Detection Lighting System (ADLS). Other light sources at the Project are located at the substation which was designed with downward facing lights, sloped covers, and motion-detector activation. The use of the ADLS and motion-control substation lighting significant decreases the amount of lighting at night at the Project.

The Project is split between two ridges: eight turbines are located on the west ridge (Gamesa G97 turbines), and seven turbines are located on the east ridge (Gamesa G87 turbines). The east ridge is shared with the existing 12-turbine 6-MW Searsburg Wind Energy Facility. Elevations of turbines range from 837 to 882 m (2,746 to 2,894 ft) on the west ridge, and from 887 to 945 m (2,910 – 3,100 ft) on the east ridge. The west ridge is predominantly hardwood forest with American beech (*Fagus grandifolia*), red maple (*Acer rubrum*), and sugar maple (*Acer saccharum*), and the east ridge is predominantly coniferous forest dominated by spruce (*Picea* sp.). Each ridge contains one access road, with turbines located less than 50 m (164 ft) to over 100 m (328 ft) from the road. Driveways to individual turbines consist of crushed rock. Turbine pads were seeded with grass early in the season.

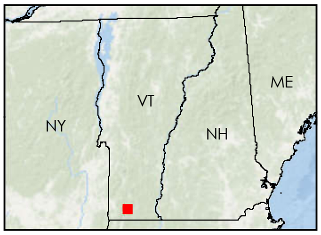
1.2 POST-CONSTRUCTION WILDLIFE MONITORING BACKGROUND AND OBJECTIVES

The Deerfield Wind Project Post- Construction Monitoring Plan: Birds and Bats (PCMP; Stantec 2017) was developed in consultation with and approved by the Vermont Agency of Natural Resources (VANR) and GMNF. The PCMP incorporates recommendations provided by the GMNF in *Recommendations for the Bird and Bat Post-Construction Monitoring Plan Deerfield Wind Project Green Mountain National Fores*t, dated August 9, 2013 (GMNF 2013), and additional review and comments provided by the GMNF and VANR between 2013 and 2017. The PCMP also incorporates recommendations from the most current VANR Fish and Wildlife Department Bat-Wind Guidelines (VANR 2016).

The objectives of post-construction monitoring were to:

- Estimate annual fatality of birds and bats at the Project;
- Investigate if there are project design characteristics (e.g., Federal Aviation Administration [FAA] lighting, east versus west ridge, size of rotor diameter), habitat or landscape features, weather conditions, or other factors that may increase risk of collision of birds and/or bats;
- Evaluate the effectiveness of operational control measures by comparing fatality at the Project to other projects in the region and investigating if and when bat fatalities were documented during the curtailment period; and
- If necessary, evaluate the effectiveness of adaptive management strategies, and modify adaptive management strategies if found to be ineffective at reducing fatalities.

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat\01468_1-1_Location.mxd Revised: 2019-01-14 By: gcarpentier



Legend
- Turbine Location
- Edge of Gravel/Collector

0 0.5 Miles
1:31,680 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 18N
2. Orthoimagery: NAIP 2016

Stantec

Project Location 195601468
Searsburg, Vermont
Prepared by GC on 2019-01-03
Reviewed by LJ on 2019-01-04

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
1-1

Title
Project Location Map

2.0 METHODS

2.1 FATALITY SEARCHES

Surveys occurred between April 15, 2018 – October 15, 2018, to cover the following wildlife activity periods:

- Spring and fall migration when nocturnal migrant passerines are found to be most at risk of collision, as well as the summer breeding period. Monitoring covered breeding and migration periods of bird species of conservation concern in the region, including Bicknell's thrush (*Catharus bicknelli*);
- Spring and fall migration periods of migratory raptors, as well as the summer breeding period of local raptors; and
- Spring dispersal, summer breeding, and late-summer and fall swarming period for bats.

Stantec conducted turbine searches at all 15 turbines once every 3 days. If a scheduled search could not be conducted due to weather, turbine maintenance, or construction activities, it was visited later that day or the next day.

Search areas included a 120 m by 120 m (394 ft by 394 ft) plot (60-m [197-ft] distance from the towers); however, areas that were unsafe for surveyors (e.g., steep slopes, hazardous walking conditions), and areas with dense vegetation (e.g., forest, thick and tall brush) were not searched. Transects spaced 6 m (20 ft) in width were established within search plots, oriented north-to-south and perpendicular to the dominant wind direction (west-to-east). Transects were numbered and marked with flagging on rocks or trees for easy navigation and consistency of search area. Upon initial site visit and plot boundary mapping, Stantec determined that the searchable areas cleared of forest were variable and occasionally limited in size, therefore a search radius out to a maximum of 120 m on adjacent access roads was included where possible in order to maximize the amount of searchable area.

Surveyors were trained by a Stantec project manager and field lead experienced in conducting and managing post-construction monitoring surveys. Searches began at sunrise and continued until early-afternoon. Search order on each turbine string varied during each search day so that any one turbine would not be searched during the same time during consecutive search days. During searches, the surveyors walked slowly (at a rate of approximately 10–20 m/min) along each transect searching up to 3 m (10 ft) on both sides for bird or bat fatalities. Any fatality found along or between transects was documented. All intact bird or bat carcasses or remnants of scavenged carcasses (a cluster of feathers representing more than a molt, or a patch of skin and bone) were documented as fatalities. Carcasses found outside of standardized search times, or outside defined search areas, were considered incidental.

In addition to standard turbine plot searches, surveyors also searched driveways extending from the access road to each turbine. The driveway searches were an extension of turbine plots where turbine plot size was limited and were conducted using the same methods as the turbine plot searches. Carcasses found on turbine driveways were documented and treated the same as those found on the turbine plots.

For each carcass found, multiple distinguishing photographs were taken, and the following information was recorded on standardized datasheets:

- Turbine number;
- Carcass distance from turbine (determined with a laser range finder);
- Carcass azimuth from turbine (compass reading);
- Date;
- Surveyor;
- Time discovered;
- Ground conditions (vegetation type and height, wet, dry, etc.);
- Species identification (including age and sex when possible);
- Carcass position;
- Stage of decomposition of the carcass (fatality estimated to occur on previous night, in the last 2 to 3 days, 4 to 7 days, 7 to 14 days, or greater than 2 weeks);
- Evidence of scavenger activity; and
- Additional notes as necessary.

Each carcass was collected in an individual re-sealable plastic bag marked with a unique carcass identification number and stored in a freezer at the Project Operations and Maintenance building. Stantec's post-construction field lead or project manager (both experienced wildlife biologists) confirmed identification of carcasses collected by surveyors through photographs.

Weather information such as sky conditions and precipitation were recorded prior to each turbine search. On nights prior to scheduled searches, the surveyors recorded weather conditions including sky conditions, percent cloud cover, and moon phase from a nearby location. Operations data and weather including wind speed (m per second [m/s]) and temperature (degrees Celsius [°C]), were obtained from archived weather data from stations on turbine nacelles at the Project for the survey period.

2.2 VEGETATION MAPPING

Ground cover types within plots were characterized by visibility class as designated in **Table 2-1.** Ground Cover Visibility Class Descriptions (Based on PGC 2007, as described in Arnett et al. 2010), Deerfield Wind, 2018., and the dominant visibility class was recorded during each turbine search. Any significant changes in ground cover type were noted throughout the survey period (e.g., reclamation, mowing). The aerial extent of each cover type within search plots was mapped using a global positioning system (GPS) unit once during the season.

Table 2-1. Ground Cover Visibility Class Descriptions (Based on PGC 2007, as described in Arnett et al. 2010), Deerfield Wind, 2018.

Visibility Class	% Vegetative Cover	Vegetation Height
1 (easy)	≥ 90% bare ground	≤ 6 inches
2 (moderate)	≥ 25% bare ground	≤ 6 inches
3 (difficult)	≤ 25% bare ground	≤ 25% of cover > 12 inches
4 (very difficult)	< 5% bare ground	> 25% of cover > 12 inches

2.3 SEARCHER EFFICIENCY TRIALS

Searcher efficiency trials were conducted to quantify the percent of carcasses observed by searchers during standardized surveys. The study targeted the placement of 50 bird carcasses and 50 bat carcasses throughout the survey period. The same individual trial carcasses were re-used in multiple trials over the course of the survey period until they became too decomposed. Due to the limited number of fatalities found onsite, brown mice and 4- to 5-week-old domestic quail obtained from a feed supply lab were used as surrogates for bats and birds before additional bat and bird carcasses were obtained from VANR on August 14, 2018.

The trial coordinator (Stantec's post-construction field lead) placed carcasses at search turbines prior to sunrise on the day of scheduled searches. Surveyors being tested were unaware of trial dates and locations, and the trial coordinator tried to leave no evidence of trial set-up (e.g., vehicle or foot prints in wet grass or mud). Carcasses were marked discreetly so they could be identified as trials upon inspection and were placed in search plots at arbitrary distances and azimuths from turbines and distributed among representative visibility classes. The trial coordinator recorded the following information for each carcass placed:

- Date, time of set-up, and surveyors being tested;
- Turbine number;
- Species identification;
- Carcass distance and direction from tower; and
- Vegetation type and visibility class where carcass was placed.

Trial carcasses found by the surveyors were documented, and the trial coordinator was notified. After all scheduled turbine searches were completed, the trial coordinator picked up any carcasses not found by the surveyors and determined the number of carcasses recovered during the trial or if any carcasses had been scavenged during the trial.

2.4 CARCASS PERSISTENCE TRIALS

Carcass persistence trials were conducted to determine the percent of carcasses that remained visible (i.e., not removed by scavengers or weather) between search intervals. The study targeted the placement of 50 bird carcasses and 50 bat carcasses throughout the survey period, in good disposition. Due to the limited number of carcasses found onsite, colored mice and 4- to 5-week-old domestic quail obtained from a feed supply lab were used as surrogates for bats and birds prior to obtaining additional bat and bird carcasses from VANR on August 14, 2018. VANR supplied carcasses of native species; native species are presumed to provide more realistic carcass persistence data (Devault et al. 2017).

Trial carcasses were randomly placed at multiple turbines throughout the study area and were checked daily for 14 days. On each day a trial carcass was checked, surveyors indicated whether the trial carcass was present (intact, or partially scavenged but readily detectable) or absent (completely removed, or with so few feathers or tissue that it would not be readily detectable). The following additional information was recorded on standardized datasheets for each trial carcass:

- Date, time of set-up, trial coordinator;
- Turbine number;
- Species identification;
- Carcass distance and direction from tower;
- Ground cover type and vegetation height where carcass was placed; and
- Detailed notes describing any scavenging, evidence of scavenger identification, and stage of decomposition.

2.5 OPERATIONAL CONTROL

Per ROD and State Takings Permit conditions, operational control measures were implemented for 122 nights from June 1, 2018 – September 30, 2018. The Supervisory Control and Data Acquisition (SCADA) system was programmed to incorporate curtailment treatments into nightly operation. Treatments were implemented from one half hour before sunset to sunrise during periods when ambient air temperature was greater than 10°C and wind speeds were equal to or less than 6 m/s. Curtailment was achieved by switching all the turbines into a “pause mode” in order to prevent normal turbine operations, when blades would rotate at a rate less than or equal to 1 revolution per minute (RPM). Once criteria for one of the weather conditions (e.g., temperature or wind speed) stopped being met for a total of 10 consecutive minutes, the turbines returned to normal operations.

2.6 STATISTICAL ANALYSIS

2.6.1 Temporal Distribution

We summarized the seasonal timing of bat and bird fatalities in tabular and graphical format.

2.6.2 Spatial Distribution

We summarized the range of distances that birds and bats were found from the towers, the average distances birds and bats were found from towers, and the dispersion of fatalities at turbines on east versus west ridges. We plotted the distances and azimuths of carcasses from towers on a scatterplot diagram within 10-m concentric distance increments. We also created a ridge profile figure showing the elevations and numbers of fatalities at each turbine.

2.6.3 Weather Conditions and Fatality Events

We summarized the weather conditions for nights when fatalities were believed to have occurred (i.e., for those nights following which fresh carcasses were found), including:

- Nightly mean wind speed (m/s)[1];
- Nightly mean temperature (ºC)[2];
- Moon phase[3]; and
- Sky conditions (precipitation events)[4].

We also plotted nightly wind speed, temperature, and rotor RPM in 10-min increments for turbines during each night when fatalities were believed to have occurred.

2.6.4 Operational Control and Fatality Events

We conducted the following summaries to address survey objectives specified in the PCMP:

- We determined if and when bat fatalities were documented during the curtailment period (June 1, 2018 – September 30, 2018);
- Operations data was summarized for the night prior to fresh carcass discovery from the specific turbine where a carcass was found;
- We summarized the distribution of fatalities compared to proportion of time turbines are curtailed; and
- We evaluated the effectiveness of operational control measures by comparing fatality at the Project to other projects in the region.

[1] Data were downloaded from weather stations on the nacelles of turbines in the Project area.
[2] Data were downloaded from weather stations on the nacelles of turbines in the Project area.
[3] Data were downloaded from www.wunderground.com for the nearest weather station (VTW04; Searsburg, VT).
[4] Data were recorded nights prior to searches by observers at a location proximal to the Project.

2.6.5 Bat and Bird Fatality Estimates

The Huso estimator, developed in 2010 (and updated in 2012) based on Thompson (1992), is one of the leading methods for developing fatality rates in the United States (US) and is available in a US Geological Survey software application. This estimator has been developed and thoroughly tested with simulated data by leading statisticians and is geared specifically for estimating fatalities at wind turbines. The model is suitable for fatality studies because it is stochastic, meaning it can generate estimates of probability distributions of potential results by allowing for random variation in 1 or more model inputs over a period of time. As such, the Huso estimator was used to estimate fatality at the Project for 2018. Only carcasses found during standardized turbine searches were included in estimates of fatality due to bias that may be introduced into the model by carcasses found incidentally. A detailed description of the software is available in Huso 2010 and Huso et al. 2012. The software, available at http://pubs.usgs.gov/ds/729/, was run with the statistical program R (R Core 2016).

The Huso estimator assumes carcass equilibrium between search intervals, where all carcasses are either found by searchers or scavenged prior to the next search (M. Huso, US Geological Survey, personal communication). The estimator assumes a zero probability of searchers observing a carcass on a subsequent search if it was missed on the first search. However, field data indicate that some carcasses do persist on the ground for longer than a single interval and that searchers find some of these carcasses. To account for this bias in the model, Huso recommends that only those carcasses that died since the previous search (based on stage of decomposition) be input into the model. Otherwise the software could overestimate fatality rates because the proportion of older carcasses are separately accounted for in the measurement of searcher efficiency (i.e., if searcher efficiency is determined to be 50% then there is a 50% probability of a carcass being missed on the first search). Therefore, only those carcasses believed to have died since the last search at a turbine were input into the model for this analysis. However, if the age of the carcass was unknown (e.g., only feathers present or too few remains to determine age), the carcass was assumed to have died within the last search interval and included in the model.

The formula for Huso's model is available in Bernardino et al. 2013:

$$\hat{M} = \frac{1}{\pi} \frac{C}{p\left[\frac{\bar{t}(1-e^{-i/\bar{t}})}{d}\right]v}$$

- $\hat{M}$ is the estimated dead animal population size (including variance parameters);
- C is the actual (unadjusted) number of dead animals found;
- π is defined as the product of the proportion of actual fatalities contained in the searchable area of the plot, and the probability of including that plot in the sample;
- p is the average probability that the carcass is detected by the searchers;
- $\bar{t}$ is the mean carcass persistence time;
- d = min(i, $\tilde{i}$), with $\tilde{i}$ representing the length of time beyond which the probability of a carcass persisting is ≤ 1% (i.e., $\tilde{i}$ is such that P[T > $\tilde{i}$] ≤ 0.01);
- $\tilde{i}$ can be estimated as $\tilde{i}$ = -log(0.01)x$\bar{t}$ (based on an exponential distribution [e]);
- v is the effective search interval, where v = min (1, $\tilde{i}$ / i), with i representing the interval between searches (i is measured in days.

Because turbine towers were not centered within turbine clearings at the Project, and carcasses may have landed over forested areas, the empirical distribution of bird and bat carcass distances was determined to apply a density-weighted proportion (DWP) area searched value in the model (the value for *π*). Area corrections were based on methods proposed by Jain et al. 2009 (modified from Fiedler et al. 2007). The proportion of the total birds and bats found during searches was determined per 10-m concentric distance increment radiating out from tower bases. The proportion of the area that was searchable (i.e., not cut off by forest edge) within each of these distance bands was determined. The percent area searched per distance band was multiplied by the proportion of bat and bird carcasses found within each distance band to find a DWP value per distance band. The DWP value for each band was summed to find a value for each turbine for birds and for bats. Turbine-specific DWP values were input into the model to adjust the number of carcasses by the proportion of carcasses found within the proportion of the plots that was searchable. This DWP analysis provides a per-turbine adjustment for the total number of bird and bat carcasses that would have been found out to 120 m the turbine (the maximum distance searched from towers along turbine access roads or pad), had that entire area at each plot been available to be searched. It should be noted that a small sample size of carcasses found does not allow for a robust estimate of DWP.

For the Huso estimator to calculate estimates of fatality for birds and bats separately, a sample size of at least 10 bird and 10 bat carcasses for both the searcher efficiency and carcass persistence trials is required. The results of searcher efficiency trials were input into the model as 1 (if trial carcass was found) and 0 (if trial carcass was not found). These values are distributed as binary random variables within the model, with 'Found' indicated by the highest numeric value. A generalized linear model of the binary response is fit to the data, with a modeled response of $\log_e$ (odds of observing a carcass = $\log_e$ (p/1-p)).

The results of carcass persistence trials were input into the model based on the following trial outcomes:

- Carcass gone at first check on ‘Day 1’ of trial, left censoring = 2;
- Carcass still present (visible) on last day of trial, right censoring = 0; and
- Carcass was removed between checks, interval censoring = 3.

Carcass persistence times are modeled with a log-linear parametric accelerated failure time model and are assumed to follow a probability distribution. When persistence time is not known or is censored, the model is appropriately modified. Each time the model is run, one of the following distributions of carcass persistence must be selected by the user for the model: Exponential, Loglogistic, Lognormal, or Weibull. Huso recommends running trials of the dataset with each distribution to compare values of Akaike information criterion (AIC), the measure of the relative goodness of fit of the model, where *k* is the number of parameters in the statistical model, and *L* is the maximized value of the likelihood function for the estimated model.

$$AIC = 2k - \ln(L)$$

The preferred distribution for the model is the one with the minimum AIC value. For this analysis, carcass persistence was modeled using Weibull distribution for bats and Exponential distribution for birds.

Because detection bias, persistence bias, and proportion of carcasses within search areas are estimated, the Huso estimator uses a bootstrapped estimate of variance based on methods proposed by Erickson et al. 2004, where the fatality adjustment (π) and total fatality (M) are calculated for each bootstrapped sample. This analysis used 5,000 bootstrap resample iterations, as recommended by Huso et al. 2012. The alpha value was defined as 0.05; therefore, all confidence intervals were calculated at 95%.

3.0 RESULTS

3.1 SURVEY EFFORT AND SEARCH PLOT VISIBILITY

Stantec conducted 993 of 1,005 (99%) scheduled turbine searches. Twelve searches could not be conducted due to turbine maintenance. Three searches were postponed for one day due to turbine maintenance (n = 2) or access road construction (n = 1).

Visibility class, project attributes (FAA lighting, elevation, topography) and size of searchable areas within plots are described in **Table 3-1** The majority (80%) of search areas consisted of completely bare ground or included small portions of areas with large rocks. The average Visibility Class within all search plots was 1 (Easy); 90% bare ground characterized the majority of ground cover within most plots. Three turbines had a proportion of search area develop grass growth late in the study period. These limited areas represented Visibility Class 2. However, these areas were relatively small and had negligible impact on the overall visibility within plots. Appendix B Figures 1 through 15 show the search plot boundaries and ground cover at each search turbine.

Table 3-1. Description of Search Turbines, Deerfield Wind Project, 2018.

Turbine No.[1]	FAA Lighting	Primary Visibility Class[2]	Elevation (m)	Search Area (m^2)	Search Area Ground Cover Description
E1	Y	1	919	2,886	91% bare cover, 9% large rocks
E2	N	1	887	3,121	84% bare cover, 16% large rocks
E3	N	1	906	3,534	87% bare cover, 13% large rocks
E4	Y	1	914	3,411	92% bare cover, 8% large rocks
E5	N	1	945	4,312	95% bare cover, 5% large rocks
E6	N	1	940	10,555	100% bare cover
E7	Y	1	930	3,236	93% bare cover, 7% large rocks
W1	Y	1	839	4,950	91% bare cover, 9% grass
W2	Y	1	837	3,470	94% bare cover, 6% large rocks
W3	N	1	846	4,399	100% bare cover
W4	N	1	877	4,767	100% bare cover
W5	Y	1	850	5,926	95% bare cover, 5% large rocks
W6	N	1	845	4,109	99% bare cover, 1% large rocks
W7	N	1	879	2,749	93% bare cover, 7% large rocks
W8	Y	1	882	3,049	87% bare cover, 13% large rocks

[1]E = east ridge; W = west ridge.

[2]Ground cover visibility class descriptions based on PGC 2007, as described in Arnett et al. 2010.

3.2 BIRD AND BAT FATALITIES

There were 26 birds found, all during standard searches. Passerines (n = 24) represented 92% of birds found. There were 12 species of passerine found, as well as 5 unidentified passerines and 3 unidentified warblers. One woodpecker species, yellow-bellied sapsucker (*Sphyrapicus varius)* was found (n = 2) (**Table 3-2**; **Appendix A Table 1**).

Ten bats were found, including hoary bat (*Lasiurus cinereus*; n = 4, 40%), big brown bat (*Eptesicus fuscus*; n = 3, 30%), silver-haired bat (*Lasionycteris noctivagans*; n = 2, 20%), and eastern red bat (*Lasiurus borealis*; n = 1, 10%). No Myotis species were found (**Table 3-2**; **Appendix A Table 2**). Three of the bat species found (silver-haired bat, hoary bat, and eastern red bat) are tree-roosting bats, and one species (big brown bat) commonly roosts in caves or rock structures. All bats were found during standard searches.

Table 3-2. Total Number and Species Composition of Bird and Bat Carcasses Discovered at Deerfield Wind Project, 2018.

Species		Number of Carcasses	Percent of Carcasses
Birds			
unidentified passerine	*Passerformes (fam, gen, sp)*	5	19%
unidentified warbler	*Parulidae (gen, sp)*	3	12%
blackburnian warbler	*Setophaga fusca*	2	8%
black-throated green warbler	*Setophaga virens*	2	8%
magnolia warbler	*Setophaga magnolia*	2	8%
yellow-bellied sapsucker	*Sphyrapicus varius*	2	8%
yellow-rumped warbler	*Setophaga coronata*	2	8%
blackpoll warbler	*Setophaga striata*	1	4%
black-throated blue warbler	*Setophaga caerulescens*	1	4%
Cape May warbler	*Setophaga tigrina*	1	4%
purple finch	*Haemorhous purpureus*	1	4%
ruby-crowned kinglet	*Regulus calendula*	1	4%
song sparrow	*Melospiza melodia*	1	4%
Tennessee warbler	*Oreothlypis peregrina*	1	4%
white-throated sparrow	*Zonotrichia albicollis*	1	4%
Total Birds		**26**	**100%**
Bats			
hoary bat	*Lasiurus cinereus*	4	40%
big brown bat	*Eptesicus fuscus*	3	30%
silver-haired bat	*Lasionycteris noctivagans*	2	20%
eastern red bat	*Lasiurus borealis*	1	10%
Total Bats		**10**	**100%**

On December 21, 2018, operations staff at Deerfield discovered a ruffed grouse carcass at turbine E7, located less than 10 m east from the turbine. This occurred outside of the fatality monitoring period, and Deerfield Wind reported the finding to VANR as per the State Takings Permit.

Based on carcass condition, most birds found (n = 15, 58%) and most bats found (n = 7, 70%) were estimated to have died between 24-48 hours prior to discovery (**Table 3-3**).

Table 3-3. Summary of Estimated Time of Death for Bird and Bat Carcasses Found at Deerfield Wind Project, 2018.

Species Type	Estimated Time of Death	Number of Carcasses	Percent of Carcasses
Birds	24–48 hours	15	57.7%
	2–3 days	8	30.8%
	4–7 days	1	3.8%
	7–14 days	1	3.8%
	2+ weeks	1	3.8%
Bats	24–48 hours	7	70.0%
	4–7 days	1	10.0%
	7–14 days	2	20.0%

There were no federally or state-listed endangered or threatened bat or bird species found (VFWD 2015a). Two bird species of Vermont Greatest Conservation Need were found: blackpoll warbler (n = 1), and black-throated blue warbler (*Setophaga caerulescen;* n = 1). Blackpoll warbler is a species of high priority in Vermont, and black-throated blue warbler is a species of medium priority (VFWD 2015b). All four bat species found are of Vermont Greatest Conservation Need. Hoary bat, silver-haired bat, and eastern red bat are species of high priority in Vermont, and big brown bat is a species of medium priority (VFWD 2015b).

3.3 SEASONAL TIMING OF FATALITIES

The majority of birds were found during the month of October (n = 11, 42%), followed by May (n = 6, 23%). All birds were found during the spring and fall migration seasons, and none were found during summer (**Table 3-4; Figure 3-1**; **Appendix A Table 1**).

Table 3-4. Seasonal Timing of Bird Fatalities, Deerfield Wind Project, 2018.

Month	No. Birds	% Total
April	2	8%
May	6	23%
June	2	8%
July	0	0%
August	0	0%
September	5	19%
October	11	42%
Total	**26**	

Bats were found throughout the summer and early fall; the first was found in mid-June. The majority of bats were found in August (n = 4, 40%), followed by July (n = 3, 30%) (**Table 3-5; Figure 3-1**; **Appendix A Table 2**).

Table 3-5. Seasonal Timing of Bat Fatalities, Deerfield Wind Project, 2018.

Month	No. Bats	% Total
April	0	0%
May	0	0%
June	1	10%
July	3	30%
August	4	40%
September	2	20%
October	0	0%
Total	**10**	

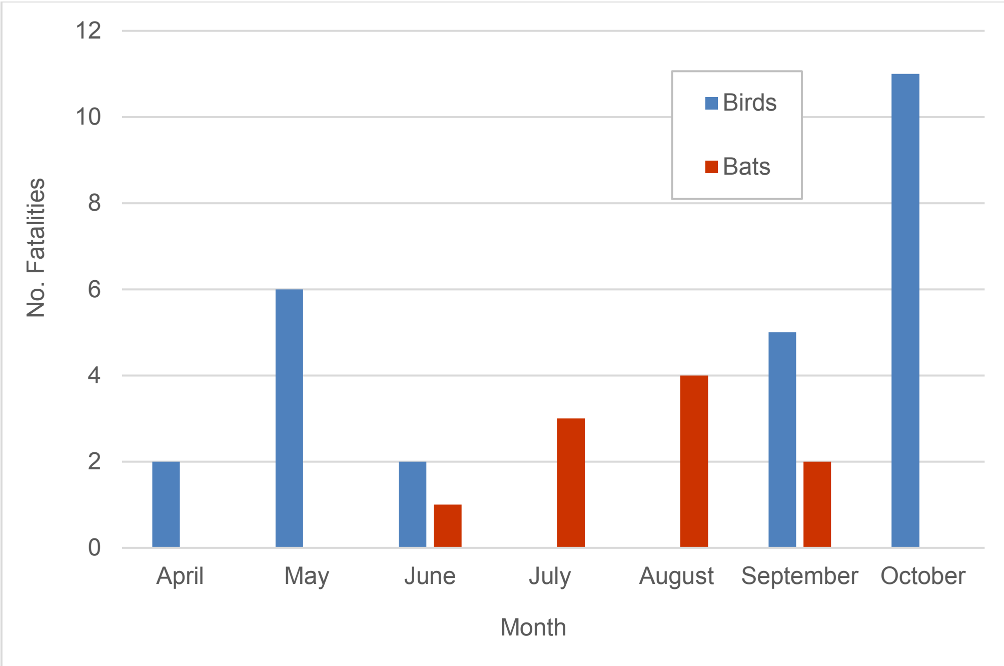
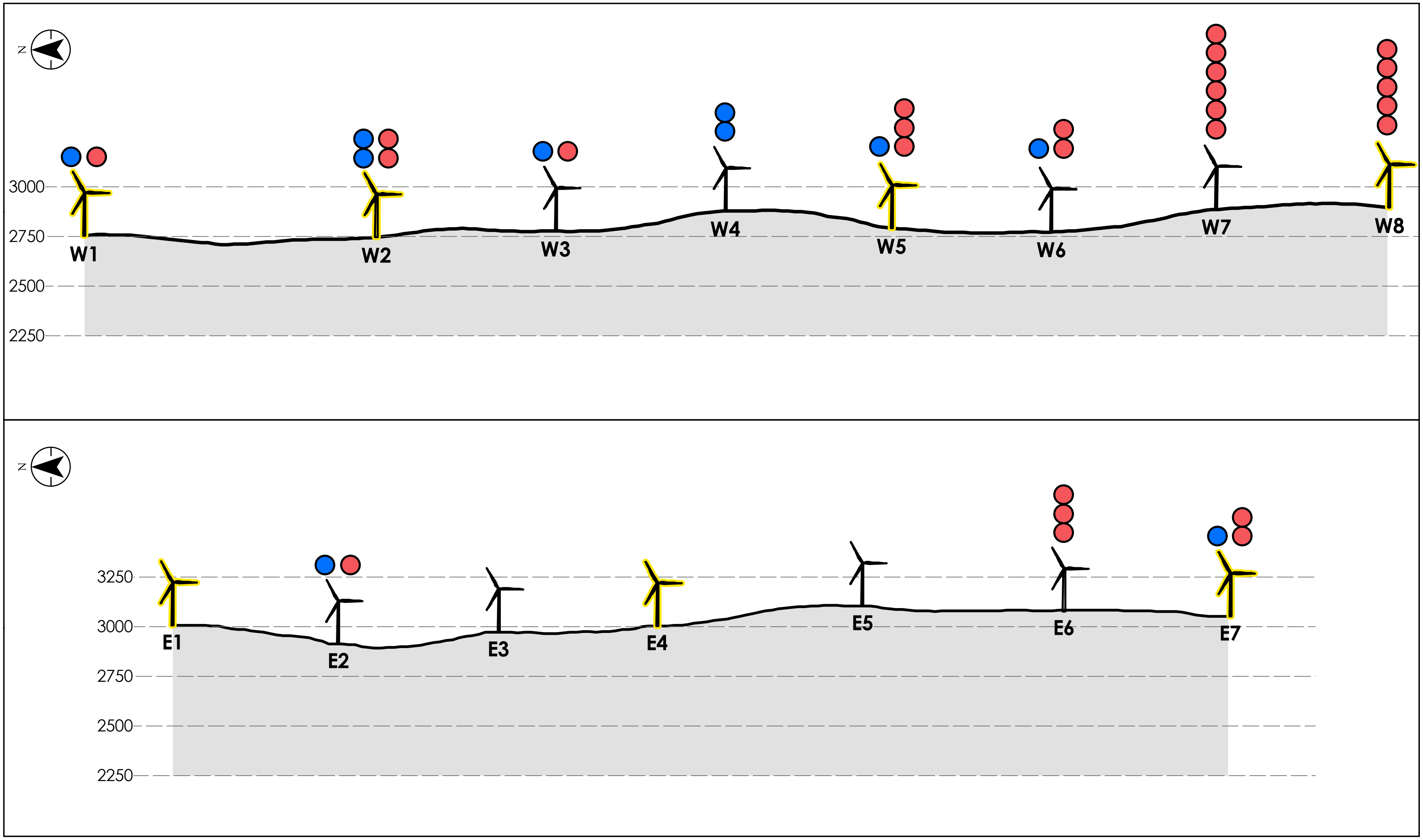


Figure 3-1. Seasonal Timing of Bird and Bat Fatalities, Deerfield Wind Project, 2018.

3.4 SPATIAL DISTRIBUTION OF FATALITIES

The number of birds found at individual turbines ranged from 0 birds (Turbines W4, E1, E3, E4, and E5) to 6 birds (Turbine W7). Bats found at individual turbines ranged from 0 bats (Turbines W7, W8, E1, E3, E4, E5 and E6) to 2 bats (Turbines W2 and W4). Seventy-seven percent of birds (n = 20) and 80% of bats (n = 8) were found on the west ridge. Half of all bird fatalities (n = 13) and half of all bat fatalities (n = 5) were found at FAA lit turbines (**Figure 3-2.** Ridgeline Profile and Distribution of Fatalities, Deerfield Wind Project, 2018.).

Figure 3-3 shows the locations of bird and bat carcasses found within search plots at 10-m distance increments from tower bases. Bird fatalities were found in all 4 quadrants of the search plots, and bat fatalities were found in the northwest, northeast, and southwest quadrants of the search plots. The four birds located beyond 79 m (259 ft) from the turbine bases were found on driveways leading up to turbine pads (**Figure 3-3**).



0 750 Feet
Horizontal and Vertical Scale
1:9,000 (At original document size of 8.5x11)

Notes
1. Digital elevation profile derived from USGS NED 1/3 arc-second digital elevation model.

Stantec

Legend
- 1 Bat Carcass
- 1 Bird Carcass
- Turbine Profile
- FAA Lit Turbine

Project Location 195601468
Searsburg, Vermont
Prepared by GC on 2019-01-03
Reviewed by LJ on 2019-01-04

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
3-2

Title
Ridgeline Profile and Distribution of Fatalities

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat\01468_3-2_ProfileFatalities.mxd Revised: 2019-01-14 By: gcarpentier

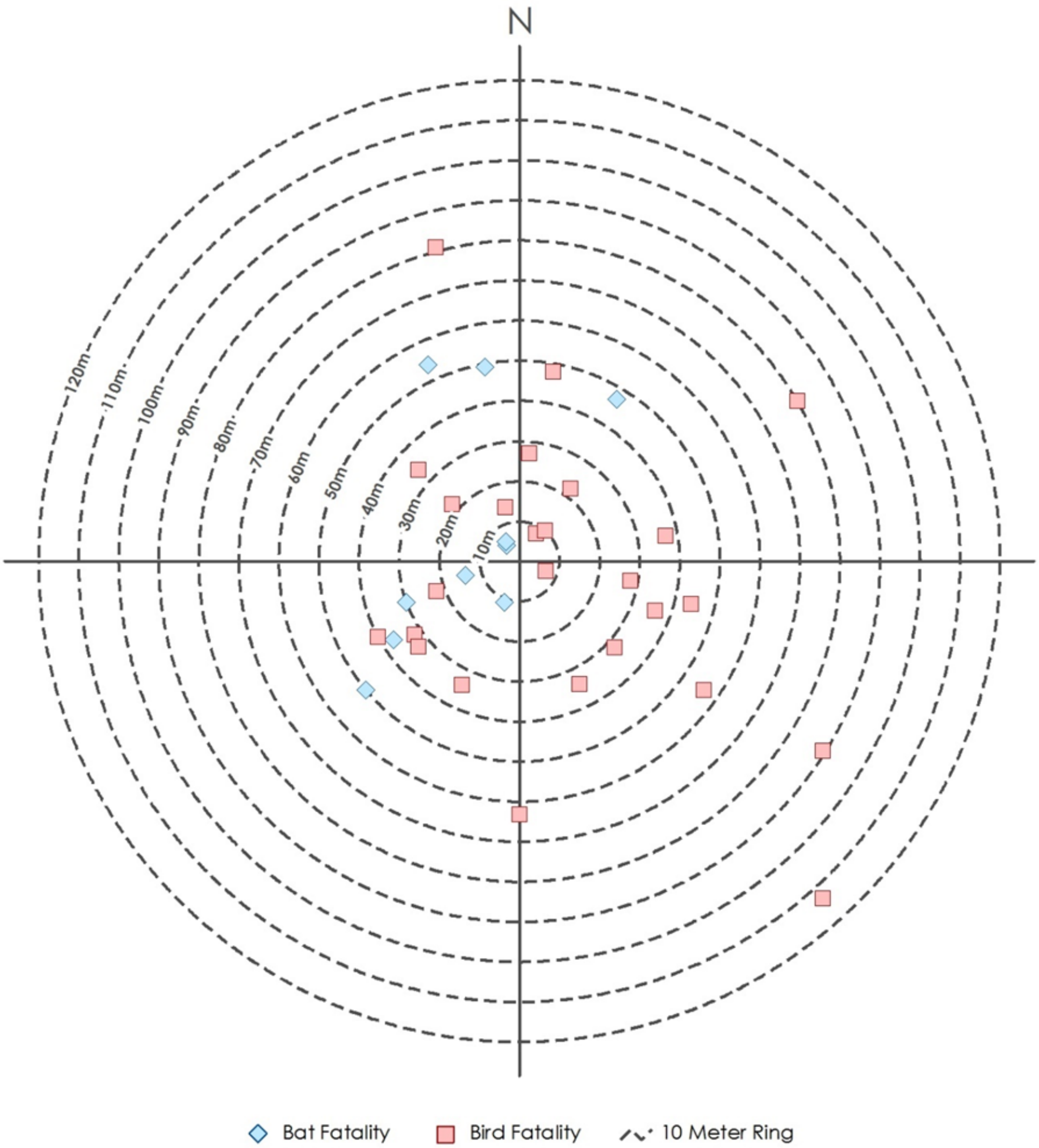


Figure 3-3. Distribution of Bats and Birds Found at Deerfield Wind Project, 2018. (Turbine plots consisted of 120 m by 120 m plots [60-m radius], and a 120 m radius on adjacent access roads, where possible).

3.5 CARCASS DISTANCES FROM TOWERS

The distance birds were found from turbine bases ranged from 7 to 113 m (23 to 371 ft); the average distance birds were found from turbine bases was 40.2 m (132 ft). The distances that bat carcasses were found from turbine bases ranged from 5 to 54 m (16 to 177 ft); the average distance bat carcasses were found from turbine bases was 30.3 m (99 ft). **Figure 3-4** shows the distribution of bird and bat carcasses found within 10-m distance increments from turbine bases. Sixty-nine percent of bird carcasses and 60% of bat carcasses were found 40 m (131 ft) or less from turbines.

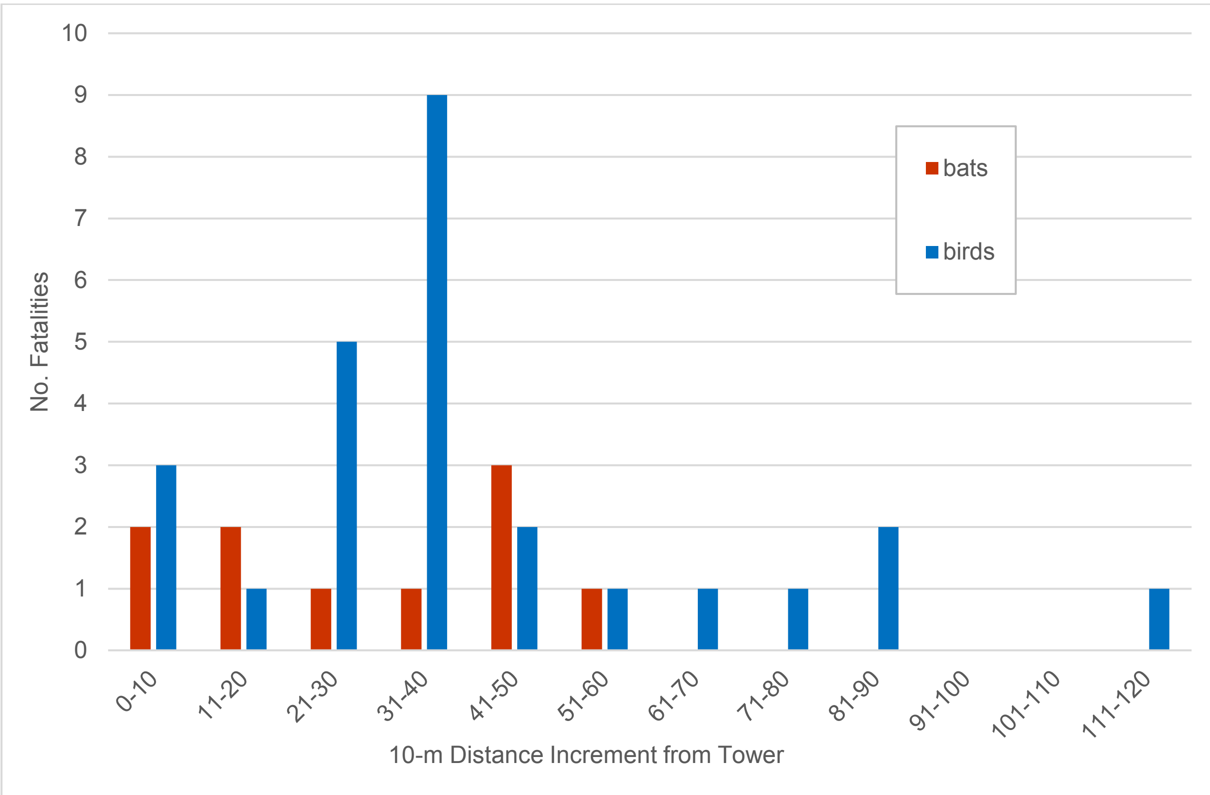


Figure 3-4. Distribution of Bird and Bat Carcasses Found in 10-m Distance Increments from Towers, Deerfield Wind Project, 2018.

3.6 WEATHER CONDITIONS AND FATALITY EVENTS

There were 8 nights for which documented bird fatalities were suspected to occur (carcasses were found fresh the next day). The mean nightly wind speed for these nights was 7.5 m/s and the mean nightly temperature was 11.9ºC. Moon phase was variable among these nights, and five of these nights (63%) were characterized by rain, thunderstorms, or snow for a portion of the night (**Table 3-6**).

There were 5 nights for which documented bat fatalities were suspected to occur (carcasses were found fresh the next day). The mean nightly wind speed for these nights was 6.7 m/s and the mean nightly temperature was 14.7ºC. Moon phase was variable among these nights, and two of these nights (40%) were characterized by rain, thunderstorms, or showers for a portion of the night (**Table 3-6**). **Figure 3-5** shows the suspected night of bird and bat fatality at the Project with average nightly weather conditions during the study period.

Table 3-6. Date of suspected mortality and weather conditions for birds and bats found in excellent condition, Deerfield Wind Project, 2018.

Date Found	Suspected Date of Mortality	No. Bats and/or Birds	Nightly Mean Wind Speed (m/s)[1]	Nightly Mean Temperature (˚C)[1]	Moon Phase[2]	Sky Conditions / Precipitation[3]
Birds						
5/10/2018	5/9/2018	1 bird	6.8	11.3	waning crescent	clear
5/23/2018	5/22/2018	1 bird	8.1	9.6	first quarter	overcast, periods of light rain
9/4/2018	9/3/2018	1 bird	8.1	21.0	last quarter	partly cloudy, thunder in early evening
9/20/2018	9/19/2018	1 bird	4.8	11.8	waxing gibbous	clear to partly cloudy
9/21/2018	9/20/2018	1 bird	6.7	12.5	waxing gibbous	mostly cloudy, brief period of light rain
10/3/2018	10/2/2018	1 bird	7.9	15.0	last quarter	overcast, brief period of light rain
10/5/2018	10/4/2018	2 birds	8.6	11.9	waning crescent	partly cloudy
10/13/2018	10/12/2018	7 birds	8.8	2.2	waxing crescent	cloudy, snow flurries
Bats						
6/12/2018	6/11/2018	1 bat	7.0	10.7	waning crescent	clear
8/13/2018	8/12/2018	1 bat	5.4	17.4	waxing crescent	overcast, rain in early evening
8/18/2018	8/17/2018	1 bat	9.6	18.2	waxing crescent	overcast, thunderstorms and showers
8/21/2018	8/20/2018	2 bats	5.8	14.3	waxing gibbous	partly cloudy
9/1/2018	8/31/2018	2 bats	5.5	13.0	waning gibbous	overcast

[1]Data were downloaded from weather stations on nacelles of turbine towers.

[2]Data were downloaded from www.wunderground.com for the nearest weather station (VTW04; Searsburg, VT).

[3]Data were recorded nights prior to searches by observers at a location proximal to the Project.

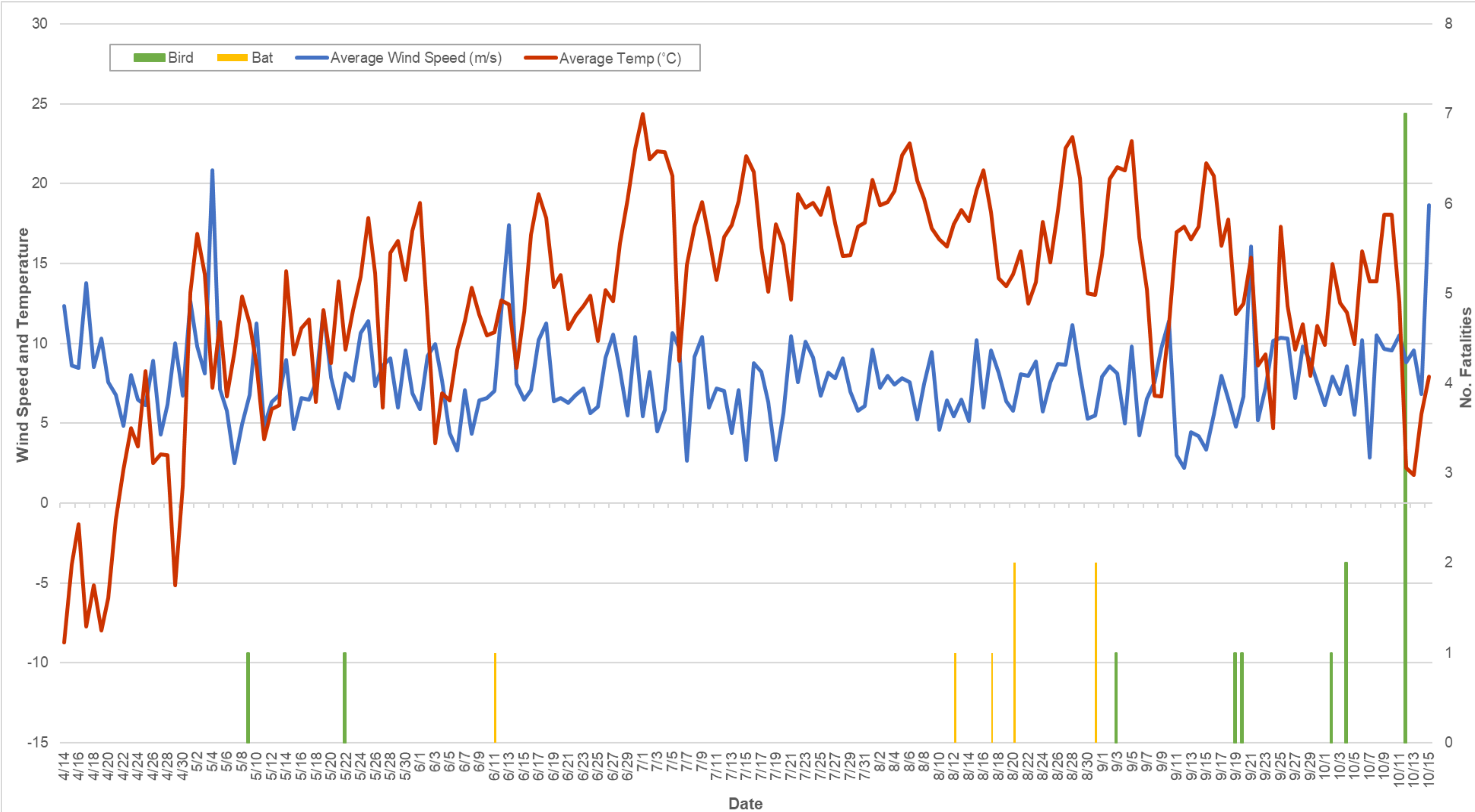


Figure 3-5. Timing and Number of Bird and Bat Carcasses Found in Relation to Average Nightly Wind Speed and Air Temperature, Deerfield Wind Project, 2018.

3.7 OPERATIONAL CONTROL AND FATALITY RESULTS

Turbines at the Project were curtailed from 30-min prior to sunset to sunrise on 122 nights from June 1, 2018 – September 30, 2018 at temperatures above 10°C and wind speeds equal to or below 6 m/s. This meets the requirements set by the PCMP, the ROD, and State Permit.

All bat carcasses were discovered during the curtailment period, which overlaps with the peak period of bat collision risk in the region. Seven bats were found in excellent condition suggesting they died the previous night. For turbines under which fresh bat carcasses were found, the previous night's curtailment activity was summarized (**Table 3-7**).

Table 3-7. Summary of Fresh Bat Carcasses and Turbine Activity the Previous Night, Deerfield Wind Project, 2018.

Turbine	Night of	Species	Curtailment Duration h:mm:ss	Proportion of Night Curtailed
W2	6/11/2018	hoary bat	1:40:00	0.18
W4	8/12/2018	hoary bat	8:50:00	0.84
W6	8/17/2018	hoary bat	0:00:00	0.00
W1	8/20/2018	eastern red bat	3:20:00	0.31
W5	8/20/2018	hoary bat	3:30:00	0.32
W3	8/31/2018	silver-haired bat	5:00:00	0.44
W4	8/31/2018	silver-haired bat	4:30:00	0.40

Operational control is a well-documented and effective method for reducing bat fatalities at wind facilities. Based on the results that showed no Federal or State-listed bat species were found and the Project had low overall bat fatalities (see Section 4.0), the Operational Controls met or exceeded their intended purpose as described in the ROD and the State Permit.

3.8 ESTIMATES OF FATALITY

3.8.1 Searcher Efficiency Results

Searcher efficiency trials were conducted throughout the study period and were conducted on the following dates:

- 5/29/2018
- 5/30/2018
- 6/29/2018
- 8/15/2018
- 8/16/2018
- 9/14/2018

- 10/2/2018
- 10/3/2018

Fifty bats (or surrogate bats) were placed for all searcher efficiency trials combined (Table 3-8). The mean searcher efficiency rate for bats was 60%, which is within the range of 42% to 91% found at other New England projects (Stantec 2009; Curry and Kerlinger 2013).

Table 3-8. Searcher Efficiency Rate (SE) for Trial Bats, 95% Confidence Intervals, Deerfield Wind Project, 2018.

Number trial bats placed	50
Number trial bats found	30
Mean SE	0.60
Lower SE	0.46
Upper SE	0.74

There were 50 birds placed for all searcher efficiency trials combined; however, only 48 remained available for the trials, as 2 were scavenged prior to searches (**Table 3-9**). The mean searcher efficiency rate for birds was 58%, which is within the range of 38% to 69% found at other New England projects (Stantec 2009; TetraTech 2013).

Table 3-9. Searcher Efficiency Rate (SE) for Trial Birds, 95% Confidence Intervals, Deerfield Wind Project, 2018.

Number trial birds placed[1]	48
Number trial birds found	28
Mean SE	0.58
Lower SE	0.44
Upper SE	0.73

[1]Total does not include 2 trial carcasses that were scavenged prior to turbine searches.

3.8.2 Carcass Persistence Results

Carcass persistence trials were conducted throughout the study period and were initiated on the following dates:

- 6/7/2018
- 7/16/2018
- 8/10/2018
- 8/27/2018
- 9/24/2018

There were 50 bats (or surrogate bats) placed for all trials combined. The mean number of days trial bat carcasses persisted was 8.41 days (**Table 3-10**) which was well beyond the 3-day search interval.

Table 3-10. Bat Carcass Persistence (CP) Estimates, 95% Confidence Intervals, Deerfield Wind Project, 2018.

Number trial bats placed	50
Mean number of days CP	8.41
Lower number of days CP	6.51
Upper number of days CP	10.5
CP rate[1]	0.89
CP lower	0.85
CP upper	0.92

[1]Percent of carcasses persisting for the 3-day search interval

There were 50 birds placed for all trials combined. The mean number of days trial bird carcasses persisted was 10.03 days (**Table 3-11**), which was well beyond the 3-day search interval.

Table 3-11. Bird Carcass Persistence (CP) Estimates, 95% Confidence Intervals, Deerfield Wind Project, 2018.

Number trial birds placed	50
Mean number of days CP	10.03
Lower number of days CP	7.6
Upper number of days CP	13.46
CP rate[1]	0.86
CP lower	0.83
CP upper	0.90

[1]Percent of carcasses persisting for the 3-day search interval

Additionally, nine birds found prior to receiving the federal Migratory Bird Special Purpose Utility Permit (SPUP) were monitored for carcass persistence during scheduled search days but were not factored into analysis. Five of these supplemental scavenger trials remained past the 14-day period, which further demonstrates that the 3-day search interval is adequate.

3.8.3 Search Area Corrections

The proportion of carcasses found per 10-m distance bin and the DWP values factored into fatality estimates are available in **Table 3-12** and **Table 3-13**, respectively.

Table 3-12. Number Found and Proportion of Bird and Bat Carcasses per 10-meter Annuli for all Turbines Combined (includes birds and bat carcasses found during standard searches only), Deerfield Wind Project, 2018.

Distance bin (m)	No. bats found	Proportion all bats per bin	Distance bin (m)	No. birds found	Proportion all birds per bin
0-10	2	0.200	0-10	3	0.115
11-20	2	0.200	11-20	1	0.038
21-30	1	0.100	21-30	5	0.192
31-40	1	0.100	31-40	9	0.346
41-50	3	0.300	41-50	2	0.077
51-60	1	0.100	51-60	1	0.038
61-70	0	0.000	61-70	1	0.038
71-80	0	0.000	71-80	1	0.038
81-90	0	0.000	81-90	2	0.077
91-100	0	0.000	91-100	0	0.000
101-110	0	0.000	101-110	0	0.000
111-120	0	0.000	111-120	1	0.038
Total	**10**		**Total**	**26**	

Table 3-13. Density-Weighted Proportion Area Searched Value for Birds and Bats, Deerfield Wind Project, 2018.

Turbine No.	DWP Value	
	Bats	Birds
E1	0.481	0.309
E2	0.489	0.322
E3	0.547	0.376
E4	0.506	0.340
E5	0.609	0.432
E6	0.923	0.795
E7	0.524	0.353
W1	0.632	0.468
W2	0.535	0.378
W3	0.575	0.442
W4	0.620	0.467
W5	0.568	0.393
W6	0.555	0.370
W7	0.457	0.323
W8	0.481	0.359

3.8.4 Fatality Estimates

Estimates for bat and bird fatality were generated with and without area corrections using the Huso estimator (**Table 3-14**).

Table 3-14. Huso Estimates of Bat and Bird Fatality, With and Without Area Corrections, Deerfield Wind Project, 2018.

Result	Bats. Not Area Corrected.	Birds. Not Area Corrected.
Number carcasses found	7	23
Adjusted fatality/turbine/study period	**0.86**	**3.01**
95% CI lower	0.63	1.79
95% CI upper	1.27	4.79
Adjusted fatality/study period	**13**	**46**
95% CI lower	10	27
95% CI upper	20	72
Adjusted fatality/MW/study period	**0.43**	**1.53**
Result	**Bats. Area Corrected.**	**Birds Area Corrected.**
Number carcasses found	7	23
Adjusted fatality/turbine/study period	**1.47**	**8.01**
95% CI lower	1.09	4.24
95% CI upper	2.08	13.61
Adjusted fatality/study period	**23**	**121**
95% CI lower	17	64
95% CI upper	32	205
Adjusted fatality/MW/study period	**0.77**	**4.03**

[1]The number of carcasses included in the Huso model was different than the total found because incidentals were not included and Huso also recommends not including those carcasses believed to have died during a previous search interval.

4.0 DISCUSSION

4.1 BIRD AND BAT FATALITY

4.1.1 Birds

Nocturnal migrant passerines represent bird carcasses most commonly found at operational wind projects (Erickson et al. 2005; NRC 2007; NWCC 2010); this group is one of the most diverse and abundant bird groups in the world. Other post-construction monitoring studies in the northeast region have documented passerines as the most common bird group found during monitoring (Stantec 2011 and 2014; Normandeau Associates 2010 and 2011). Post-construction monitoring studies at three other wind energy facilities in Vermont (Georgia Mountain Community Wind [Georgia], Kingdom Community Wind [Kingdom], and Sheffield Wind [Sheffield]) have all documented passerines as the most common bird group found during surveys (Stantec 2013a, 2013b, 2015a, and 2015b; Martin et al. 2013 and 2014). This group of birds is susceptible to collisions with manmade structures during nocturnal migration in spring and fall, particularly during inclement weather conditions when birds may be flying at lower heights and may become disoriented by sources of artificial light (Erickson et al. 2005).

The loss of 8.01 birds/turbine/period, or 121 birds/period at the Project, is relatively small considering the regional populations of the species of birds that were most commonly found at the Project: blackburnian warbler (*Setophaga fusca*), black-throated green warbler (*Setophaga virens*), magnolia warbler (*Setophaga magnolia*), yellow-bellied sapsucker, and yellow-rumped warbler (*Setophaga coronate*) (n = 2 each, 38.5% combined). The Partners in Flight (PIF) Land-based Bird Population Estimates Database[5] estimates the North American populations of blackburnian warbler, black-throated green warbler, and yellow-bellied sapsucker at 10 million, magnolia warbler at 40 million, and yellow-rumped warbler at 130 million (PIF 2013). Further, impacts associated with wind power remain relatively low compared to other sources of human-induced fatality, including collisions with other manmade structures, destruction of habitat, exposure to chemicals, and predation by domestic and feral cats (Loss et al. 2012). Population-level effects have not been attributed to collision mortality at wind projects or other structures (Loss et al. 2013; Erickson et al. 2014).

4.1.2 Bats

Bat fatalities found at the Project consisted of three migratory tree-roosting bat species, and one cave-dwelling bat species. No Myotis species were found. The migratory tree-roosting bat species group is most commonly found during wind fatality studies in North America, including the northeast region (Kunz et al. 2007; Arnett et al. 2008; Baerwald et al. 2009; Taucher et al. 2012; Arnett and Baerwald 2013; West 2014). Migratory tree-roosting bats were the only bats documented at Georgia in 2013, 2014, and 2015, at Kingdom in 2013 and 2014, and at Sheffield in 2012 and 2013 (Stantec 2013a, 2013b, 2015a, 2015b, and 2016; Martin et al. 2013 and 2014). The Project fatality estimate for bats (1.47 bats/turbine/period) is on the low end of the range of bat fatalities reported at other recent wind projects in the northeast. Little is

[5] Available at http://pif.birdconservancy.org/PopEstimates/Database.aspx

known about the population size or status trends of hoary bats; eastern red bats were once considered one of the most abundant bats within their range, but their population is suspected to have declined substantially over the past 100 years (England et al. 2001). Silver-haired bats are considered one of the most abundant bats in forested areas of northern North America, but their status has not been investigated (England et al. 2001). Regardless of uncertain population sizes, such small impacts (1.47 bats/turbine/period, or 23 bats over the whole study period) are unlikely to have a significant effect on bat species.

4.2 FATALITY TIMING

4.2.1 Birds

During the 2018 study period, 31% of bird fatalities occurred during the spring migration period of April through May, and 62% of bird fatalities occurred during the fall migration period of September through October; no bird fatalities were discovered in July or August. These results are typical compared to the timing of bird fatalities found during previous years at other wind projects in the region (Normandeau Associates 2010 and 2011; Stantec 2011 and 2014; Tidhar et al. 2010 and 2011), and in Vermont specifically (Stantec 2013a, 2013b, 2015a, 2015b, and 2016; Martin et al 2013 and 2014).

4.2.2 Bats

Available information suggests that the majority of bat fatalities in the region occur in the late-summer and fall (Erickson et al. 2002; Johnson 2005; Arnett et al. 2008; Taucher et al. 2012; Arnett and Baerwald 2013). Bat fatality at the Project peaked in August (n = 4; 40%), but carcasses were found throughout the months of June, July, August, and September. There were no bats found during April, May, or October. Although there was a low sample size of 10 bats found at the Project, which makes statistically similar comparisons difficult, the results are consistent with the species composition and timing of bats found at Georgia, Kingdom, and Sheffield in Vermont (Stantec 2013a, 2013b, 2015a, 2015b, and 2016; Martin et al. 2013 and 2014).

4.3 SPATIAL DISTRIBUTION OF CARCASSES

Available studies suggest that the majority of carcasses would be expected to fall within search plots, even within the restricted size of search plots of turbines on forested ridgelines (Fiedler et al. 2007). Other examples include the Meyersdale project in Pennsylvania where Kerns and Kerlinger (2004) reported that the majority of bird and bat fatalities were found within about 30 m of the turbine bases, and Kerns et al. (2005) reported that greater than 80% of bat fatalities were found within 40 m of turbines at Meyersdale, PA and Mountaineer, WV. The mean distances carcasses were found from turbines at Georgia and Kingdom in 2013 and 2014 ranged from 22.3 m to 29.6 m (Stantec 2013a, 2013b, 2015a, and 2015b). These trends and the carcass distance distributions observed at the Project suggest that few carcasses may have landed beyond 70 m from turbines.

There was no observable relationship between bird and bat fatalities at the Project and FAA lit turbines, as 50% of bird fatalities and 50% of bat fatalities occurred at turbines with FAA lighting. FAA lights at the Project are radar-activated and not steady-burning or continuously flashing, and the motion-activate lights at the substation significantly decrease the amount of nighttime lighting at the Project. There is a well-documented relationship between certain types of nighttime lighting (mainly steady-burning lights, which are not present at the Project) on tall, man-made structures, such as buildings and communication towers, and bird collisions — particularly during periods of rain and fog (Kerlinger et al. 2010; Ornithological Council 1999; American Bird Conservancy 2013). However, there have been variable results among studies at wind projects that have investigated the relationship between blinking FAA lights and bird fatalities. A summary of studies conducted at 30 wind projects in North America indicated that, overall, there is not a significant relationship between bird fatalities and FAA lighting (Kerlinger et al. 2010). Other studies indicate that there is not a significant relationship between bat fatalities and FAA lighting (Curry and Kerlinger 2007; Bennett and Hale 2014).

Seventy-seven percent of birds (n = 20) and 80% of bats (n = 8) were found on the west ridge of the Project compared to the east ridge. Elevations of turbines on the west ridge were lower than those on the east ridge (2,745 – 2,895 ft on the west ridge compared to 2,911 – 3,100 ft on the east ridge). The west ridge is predominantly hardwood forest with American beech, red maple, and sugar maple, and the east ridge is predominantly coniferous forest dominated by spruce. It should be noted that 27% of bird fatalities (n = 7) occurred during one night (October 12, 2018), and all were located on the west ridge, which was the only ridge searched the following day. Due to the low sample size of fatalities found and the low number of turbines on each ridge, it cannot be statistically determined whether ridgeline characteristics influenced fatality at the Project.

4.4 WEATHER CONDITIONS AND FATALITY EVENTS

Bat fatalities are observed to be positively correlated with temperature and negatively correlated with wind speed (Fiedler 2004; Reynolds 2006). Most fresh bat fatalities at the Project (n = 6, 86%) were observed in summer, when average temperatures were relatively high; however, bat fatality did not appear to be correlated with nightly temperature or wind speed. Avian collision risk is greater during periods of inclement weather (e.g., fog or mist) (Kerlinger et al. 2010). Sixty-three percent of nights prior to finding fresh bird carcasses were characterized by rain, thunderstorms, or snow for a portion of the night. However, any observable trends in the relationship of bat and bird fatalities to weather events at the Project should be interpreted with caution due to the low sample size of fresh fatalities.

4.5 BIRD AND BAT FATALITY ESTIMATES

Use of the Huso estimator was specified in the PCMP and was chosen because it is one of the more recent methods that has been vetted by accredited statisticians, and it has been used at all operational wind facilities in Vermont to-date.

The Huso (2010) and Huso et al. (2012) estimator model is subject to less bias when searcher efficiency and carcass removal rates remain constant over time. However, when these rates vary over time, the estimator, like most other available estimators, results in greater bias. Huso (2010) indicates that for sites with short persistence time (< 4.2 days) and short search intervals (1–7 days), the estimator tends to overestimate fatality. At the Project, there were relatively long carcass persistence intervals (8.41 days for bats and 10 days for birds) but a relatively short search interval (approximately 3 days); therefore, the estimates of fatality for the Project are believed to be overestimated by the Huso estimator.

Searcher efficiency rates at Deerfield (60% for bats and 58% for birds) were higher than those at other Vermont sites, which ranged from 41% to 49% (pooled for birds and bats combined). Carcass persistence rates (8.41 days for bats and 10.03 days for birds) were characteristic of those in Vermont, which ranged from 8.45 days to 43.00 days (pooled for birds and bats combined) (Stantec 2013a, 2013b, 2015a, and 2015b).

Similar to other studies in the region (Stantec 2013a, 2013b, and 2014), estimates for bird and bat fatality were generated with and without DWP area corrections. Fatality estimates without area corrections are lower because they don’t account for carcasses present in portions of the plots that were not searched. Though fatality estimates with area corrections are considered more accurate due to per-turbine DWP adjustments, fatality estimates without area corrections are also provided to compare to older post construction fatality studies in the region that used estimators that at the time did not include area corrections.

4.5.1 Regional Comparison of Fatality Estimates

Direct comparisons of fatality estimates among sites should be made with caution due to variable methods and survey objectives: studies from the eastern US used a variety of fatality estimators; search plot size at different projects was variable (i.e., studies in relatively flat agricultural areas vs. studies on forested ridge tops); operational control was implemented during some of the regional surveys; and, some studies included search area corrections, while others did not (**Appendix A Table 3**). All of these studies however included adjustments for searcher efficiency and carcass persistence.

When comparing the Project bat fatality estimate (with search area corrections) to recent estimates from other similarly sited projects in the eastern US, the estimate of bat fatality (1.47 bats/turbine/period) is at the very low end of the range of these other studies (range = 0.00 to 63.90 bats/turbine/period), and is below the median estimate (median = 4.89 bats/turbine/period) of fatality based on these other studies. The bat fatality estimate at Deerfield is lower than those at Georgia, Kingdom, and Sheffield, which ranged from 1.94 to 14.65 bats/turbine/period (**Appendix A Table 3; Appendix A Figure 1**).

When comparing the Project bird fatality estimate (with search area corrections) to recent estimates from other projects, the estimate of bird fatality (8.01 birds/turbine/year) is within the range of these other studies (range = 0.29 to 27.40 birds/turbine/period) and is above the median estimate (median = 3.39 birds/turbine/period). The bird fatality estimate at Deerfield is within the range of those at Georgia, Kingdom, and Sheffield, which ranged from 2.13 to 13.17 bats/turbine/period (**Appendix A Table 3; Appendix A Figure 2**).

4.6 OPERATIONAL CONTROL

Operational control is a well-documented and effective method for reducing bat fatalities at wind facilities: multiple research projects have documented the effectiveness of altering turbine cut-in speed to reduce bat fatalities (Baerwald et al. 2009; Arnett et al. 2011; Good et al. 2011; Young et al. 2011; Martin et al.

2013; Arnett and Baerwald 2013; Arnett et al. 2013; Hein et al. 2013). Although studies have varied in design, such as type of treatment (e.g., assigned cut-in speed), number of treatments, treatment duration, and methods of conducting fatality searches, available studies have reported a reduction in bat fatalities (~22 – 95%) when raising turbine cut-in speed and feathering below cut-in.

The Project implemented the most stringent operational curtailment program in Vermont, and accordingly had the lowest overall bat fatality rates (1.47 bats/turbine/period) among Vermont projects. Georgia, which had estimated bat fatality rates of 11.7 bats/turbine/period in 2013 and 2.29 bats/turbine/period in 2014, implemented a regime that was shorter in duration and at a lower wind speed, specifically July 1 – September 30 when temperatures reached 9.4ºC (49ºF) and when wind speeds were less than 5 m/s (Stantec 2013b and 2015b). Kingdom and Sheffield implemented curtailment regimes with turbines randomly assigned to two different cut-in speeds to test the effectiveness. At Kingdom, which had estimated bat fatality rates of 1.94 bats/turbine/period in 2013 and 4.96 bats/turbine/period in 2014, 10 turbines were set to a 5 m/s cut-in speed, and 11 turbines were set to a 6 m/s cut-in speed from June 1 – September 30. Both turbine groups were programmed to curtail when temperatures exceeded 9.4ºC (49ºF) (Stantec 2013a and 2015a). At Sheffield, which had estimated bat fatality rates of 14.65 bats/turbine/period in 2012 and 2.80 bats/turbine/period in 2013, eight turbines were fully operational (i.e., cut-in speed at 4 m/s) and eight turbines were set to a 6 m/s cut-in speed when temperatures exceeded 9.5ºC (49ºF) from June 3 – September 30 (Martin et al. 2013 and 2014). Ultimately, following these tests both Kingdom and Sheffield implemented curtailment at 6 m/s likely due to small sample sizes and inability to test the difference between treatments for significance. Regardless of the differences at each project, all four operational curtailment programs have shown effectiveness in avoiding impacts to Federal- or State-bat species.

Operational control was in effect at the Project for 122 nights from June 1, 2018 – September 30, 2018. While all bat fatalities were documented during this timeframe, this period also represents the peak period of bat activity and fatality in the region. Operational control treatments could not be compared during the first year of study because all turbines underwent operational control during the summer and fall period (e.g., no treatment vs. control). Further, it is impossible to determine the exact time of night a fatality occurs. Therefore, it is difficult to directly assess the effectiveness of operational control; however, in comparison to other projects in Vermont that were also implementing operational control measures, the bat fatality rate was lower at the Project.

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Appendix A FATALITY TABLES AND FIGURES

Appendix A Table 1. Bird Fatality at Deerfield Wind Project, 2018.

Date	Turbine	Common Name	Scientific Name	Subgroup	Age	Sex	Condition	Estimated Time Since Death	Position	Distance from Turbine (m)	Direction from Turbine (Azimuth)
4/23/2018	W6	yellow-bellied sapsucker	*Sphyrapicus varius*	woodpecker	adult	unknown	decomposing - late	7-14 days	on side	32	235
4/25/2018	E6	unidentified passerine	*Passerformes (fam, gen, sp)*	passerine	unknown	unknown	dessicated	2+ weeks	face up	34	312
5/10/2018	E7	black-throated green warbler*	*Setophaga virens*	passerine	unknown	unknown	fresh	24-48 hrs	on side	81	345
5/12/2018	W3	blackburnian warbler	*Setophaga fusca*	passerine	adult	male	fresh	2-3 days	on side	48	10
5/18/2018	W1	magnolia warbler	*Setophaga magnolia*	passerine	juvenile	unknown	fresh	2-3 days	on side	10	40
5/18/2018	E6	Cape May warbler	*Setophaga tigrina*	passerine	adult	male	fresh	2-3 days	on side	27	5
5/23/2018	W2	black-throated green warbler	*Setophaga virens*	passerine	unknown	unknown	fresh	24-48 hrs	on side	56	125
5/26/2018	W7	unidentified passerine	*Passerformes (fam, gen, sp)*	passerine	unknown	unknown	fresh	2-3 days	on side	33	230
6/15/2018	W8	unidentified passerine*	*Passerformes (fam, gen, sp)*	passerine	unknown	unknown	decomposing - late	4-7 days	face up	80	60
6/29/2018	W7	unidentified passerine	*Passerformes (fam, gen, sp)*	passerine	unknown	unknown	decomposing - early	2-3 days	n/a (partial carcass)	34	205
9/4/2018	W5	unidentified passerine	*Passerformes (fam, gen, sp)*	passerine	unknown	unknown	fresh	24-48 hrs	n/a (partial carcass)	40	242
9/10/2018	W5	blackburnian warbler	*Setophaga fusca*	passerine	unknown	unknown	decomposing - early	2-3 days	face down	63	180
9/20/2018	E2	Tennessee warbler	*Oreothlypis peregrina*	passerine	adult	unknown	fresh	24-48 hrs	face up	7	110
9/21/2018	W8	magnolia warbler	*Setophaga magnolia*	passerine	adult	male	fresh	24-48 hrs	on side	36	110
9/29/2018	W7	unidentified warbler	*Parulidae (gen, sp)*	passerine	unknown	unknown	decomposing - early	2-3 days	on side	14	345
10/3/2018	E7	blackpoll warbler	*Setophaga striata*	passerine	juvenile	male	fresh	24-48 hrs	face up	8	31
10/5/2018	E6	yellow-rumped warbler	*Setophaga coronata*	passerine	adult	female	fresh	24-48 hrs	face down	22	250
10/5/2018	W6	black-throated blue warbler	*Setophaga caerulescens*	passerine	adult	male	fresh	24-48 hrs	on side	22	310
10/10/2018	W5	unidentified warbler	*Parulidae (gen, sp)*	passerine	unknown	unknown	decomposing - early	2-3 days	on side	22	35
10/13/2018	W2	ruby-crowned kinglet	*Regulus calendula*	passerine	adult	male	fresh	24-48 hrs	on side	44	104
10/13/2018	W7	unidentified warbler	*Parulidae (gen, sp)*	passerine	unknown	unknown	fresh	24-48 hrs	on side	34	154
10/13/2018	W7	yellow-bellied sapsucker*	*Sphyrapicus varius*	woodpecker	adult	male	fresh	24-48 hrs	face up	113	138
10/13/2018	W7	white-throated sparrow*	*Zonotrichia albicollis*	passerine	adult	unknown	fresh	24-48 hrs	on side	89	122
10/13/2018	W8	yellow-rumped warbler	*Setophaga coronata*	passerine	juvenile	male	fresh	24-48 hrs	on side	28	100
10/13/2018	W8	purple finch	*Haemorhous purpureus*	passerine	adult	male	fresh	24-48 hrs	on side	32	132
10/13/2018	W8	song sparrow	*Melospiza melodia*	passerine	adult	unknown	fresh	24-48 hrs	face down	37	80

*Indicates carcass that was found on turbine driveway or access road during scheduled search.

Appendix A Table 2. Bat Fatality at Deerfield Wind Project, 2018.

Date	Turbine	Common Name	Scientific Name	Subgroup	Age	Sex	Condition	Estimated Time Since Death	Position	Distance from Turbine (m)	Direction from Turbine (Azimuth)
6/12/2018	W2	hoary bat	*Lasiurus cinereus*	tree-roosting bat	adult	unknown	fresh	24-48 hrs	face up	47	31
7/5/2018	E7	big brown bat	*Eptesicus fuscus*	cave-dwelling bat	adult	male	decomposing - early	4-7 days	face up	49	350
7/11/2018	E2	big brown bat	*Eptesicus fuscus*	cave-dwelling bat	adult	male	decomposing - late	7-14 days	face down	11	200
7/13/2018	W2	big brown bat	*Eptesicus fuscus*	cave-dwelling bat	adult	unknown	decomposing - late	7-14 days	face down	30	250
8/13/2018	W4	hoary bat	*Lasiurus cinereus*	tree-roosting bat	adult	male	fresh	24-48 hrs	face up	54	335
8/18/2018	W6	hoary bat	*Lasiurus cinereus*	tree-roosting bat	adult	female	fresh	24-48 hrs	face down	6	325
8/21/2018	W1	eastern red bat	*Lasiurus borealis*	tree-roosting bat	adult	male	fresh	24-48 hrs	face up	14	255
8/21/2018	W5	hoary bat	*Lasiurus cinereus*	tree-roosting bat	adult	male	fresh	24-48 hrs	face up	37	238
9/1/2018	W3	silver-haired bat	*Lasionycteris noctivagans*	tree-roosting bat	adult	male	fresh	24-48 hrs	face up	5	320
9/1/2018	W4	silver-haired bat	*Lasionycteris noctivagans*	tree-roosting bat	adult	male	fresh	24-48 hrs	face up	50	230

Appendix A Table 3. Results of Bird and Bat Fatality Studies in the eastern US.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
Massachusetts								
MMA turbine	coastal (1)	April 24 - November 30, 2006	4-12 searches per week	0	n/a	3	2.15 (2.15)	Vlietstra, L.S. 2007. Potential Impact of the Massachusetts Maritime Academy Wind Turbine on Common and Roseate Terns
Maryland								
Criterion	forested ridgeline (28)	April 5 to November 15, 2011	daily	706	39.03 (1,093)	262	16.01 (449)	Young, D., M. Lout, Z. Courage, S. Nomani, and K. Bay. 2012. 2011 Post-Construction Monitoring Study Criterion Wind Project Garrett County, Maryland, April-November 2011. Technical report prepared for: Criterion Power Partners, LLC, Oakland, Maryland.
Criterion	forested ridgeline (28)	April 1 to November 15, 2012	weekly at 50%	82	19.5 (546)	28	5.47 (153)	Young, D., C. Nations, M. Lout, and K. Bay. 2013. 2012 Post-Construction Monitoring Study Criterion Wind Project Garrett County, Maryland, April-November 2012. Technical report prepared for: Criterion Power Partners, LLC, Oakland, Maryland.
Criterion	forested ridgeline (28)	April 2 to November 15, 2013	weekly at 50%	40	13.3 (373)	23	8.74 (245)	Young, D., M. Kauffman, M. Lout, and K. Bay. 2014. 2013 Post-Construction Monitoring Study Criterion Wind Project Garrett County, Maryland, April-November 2013. Technical report prepared for: Criterion Power Partners, LLC, Oakland, Maryland.
Maine								
Kibby Mountain	forested ridgeline (44)	May 2 to June 20; July 11 to October 14, 2011	22 3 times every 2 wks	6 (3)	spring: (0); fall: 0.37 (16)	17 (4)	spring: 0.72 (32); fall: 0.29 (12)	Stantec Consulting. 2011. 2011 Post-Construction Monitoring Report Kibby Wind Power Project, Franklin County, Maine. Prepared for TransCanada Hydro Northeast, Inc.
Mars Hill	forested ridgeline (28)	April 23-June 3, July 15-Sept 23, 2007	2 of 28 daily, 28 of 28 weekly, seasonal dog searches	22 (2)	0.43-4.4 (12.1-122.5)	19 (3)	0.44-2.5 (27-69)	Stantec Consulting. 2008. Spring, Summer, and Fall Post-construction Bird and Bat Mortality Study at the Mars Hill Wind Farm, Maine. Unpublished report prepared for UPC Wind Management, LLC.
Mars Hill	forested ridgeline (28)	April 19 - June 6, July 15-Oct 8, 2008	28 of 28 weekly, seasonal dog searches	5 (0)	0.17-0.68 (5-19)	17(4)	2.4-2.65 (57-74)	Stantec Consulting. 2009. Post-construction Monitoring at the Mars Hill Wind Farm, Maine – Year 2. Unpublished report prepared for First Wind Management, LLC.
Record Hill	forested ridgeline (22)	April 15 to June 7 and July 7 to October 15, 2012	22 3 times every 2 wks	44 (0)	6.78 (150) [4]	46 (7)	8.46 (187) [4]	Stantec Consulting. 2012. Record Hill Wind Project Post-Construction Monitoring Report, 2012. Prepared for Record Hill Wind, LLC.
Rollins	forested ridgeline (40)	April 15 to October 15, 2012	20 weekly	2 (0)	0.18 (7.2) [4]	9 (7)	2.94 (118) [4]	Stantec Consulting. 2012. RollinsWind Project Post-Construction Monitoring Report, 2012. Prepared for First Wind, LLC.
Stetson Mountain I	forested ridgeline (38)	April 20 to Oct 21, 2009	19 weekly	5 (0)	2.11 (80)	30 (9)	4.03 (153)	Stantec Consulting. 2010. Stetson I Mountain Wind Project, Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC.
Stetson Mountain I	forested ridgeline (38)	April 18 to October 21, 2011	19 weekly	4 (0)	0.43 (16)	7 (0)	1.77 (67)	Normandeau Associates. 2010. Year 3 Post-construction avian and bat casualty monitoring at the Stetson I Wind Farm. Prepared for First Wind, LLC.
Stetson Mountain I	forested ridgeline (38)	April 15 to Oct 25, 2013	19 weekly	1 (0)	0.26 (10)	32 (0)	10.42 (396)	Stantec Consulting. 2014. Stetson I Wind Project, 2013 Post-Construction Monitoring Report, Year 5. Prepared for First Wind Management, LLC.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
Stetson Mountain II	forested ridgeline (17)	April 19 to Oct 15, 2010	17 weekly	14 (0)	2.48 (42.12)	11 (0)	2.14 (36.41)	Normandeau Associates. 2010. Stetson Mountain II Wind Project Year 1 Post-Construction Avian and Bat Mortality Monitoring. Prepared for First Wind, LLC.
Stetson Mountain II	forested ridgeline (17)	April 15 to October 15, 2012	17 weekly	4 (0)	2.06 (36) [4]	5 (0)	2.83 (49) [4]	Stantec Consulting. 2012. Stetson II Wind Project Post-Construction Monitoring Report, 2012. Prepared for First Wind, LLC.
Bull Hill	coastal upland (19)	April 15-Oct 15, 2013	19 weekly April 15-June 14, 10 daily 9 weekly June 15-Oct 15	19	0.94 (9.4)	78 (1)	7.72 (147)	Stantec Consulting. 2014. Bull Hill Year 1 Post-Construction Wildlife Monitoring Report, 2013. Prepared for First Wind, LLC.
Spruce Mountain	forested ridgeline (10)	April 11 to November 1, 2012	10 weekly	6	2.43 (24)	3 (2)	1.49 (15)	TetraTec. 2013. Spruce Mountain Wind Project Post-construction Bird and Bat Fatality and Raptor Monitoring Year 1 Annual Report. Prepared for Patriot Renewables.
Hancock[7]	forested ridgeline (17)	April 15 to Oct 15, 2017	3-day	3	0.89, 1.03, 1.14	8 (1)	2.76, 4.56, 6.99	TRC. 2017b. Hancock Wind Project Post-Construction Bird and Bat Fatality Monitoring Report Year 1 (2017). Prepared for Novatus Energy, LLC.
Hancock[7]	forested ridgeline (17)	April 15 to Oct 15, 2018	2 searches per week	3	0.97, 1.23, 2.6	7 (1)	2.35, 3.94, 6.06	TRC. 2018. Hancock Wind Project Post-Construction Bird and Bat Fatality Monitoring Report Year 2 (2018). Prepared for Novatus Energy, LLC.
Oakfield[7]	forested ridgeline (48)	April 20 to Oct 15, 2017	3-day	6	1, 1.54, 2.32	68 (3)	10.13, 12.7, 27.4	TRC. 2017c. Oakfield Wind Project Post-Construction Bird and Bat Fatality Monitoring Report Year 2 (2017). Prepared for Novatus Energy, LLC.
Bingham[7]	forested ridgeline (56)	April 15 to Oct 15, 2017	3-day	2	0.32, 0.74,1.73	27 (7)	5.98, 11.43, 25.09	TRC. 2017b. Hancock Wind Project Post-Construction Bird and Bat Fatality Monitoring Report Year 1 (2017). Prepared for Novatus Energy, LLC.
Passadumkeag[7]	forested ridgeline (13)	Apr 15 - Oct 14, 2016	3-day	5	0.56, 0.79, 0.87	27 (31)	4.28, 6.32, 8.15	Ritzert, J. P. M. Ritzert, S. Conover, and K. Nasman. 2017. Post-Construction Monitoring Study for the Passadumkeag Wind Project Penobscot County, Maine. April – October 2016. Prepared for Southern Power Company. February 10, 2017.
Passadumkeag[7]	forested ridgeline (13)	Apr 16 - Oct 15, 2018	3-day	7 (1)	0.91, 0.92, 1.02	24 (2)	3.35, 4.01, 4.29	Ritzert, J. P., J. Stein, F. Hornsby, and G. DiDonato. 2018. Post-Construction Monitoring Study for the Passadumkeag Wind Project, Penobscot County, Maine. April – October 2018. Prepared for Southern Power Company. December 2018.
New Hampshire								
Granite Reliable	forested ridgeline (33)	April 22 - October 27, 2012	13 weekly thru Aug 18, 23 weekly thru Oct 27	2 (1)	2.6-3.0 (86-99) [6]	1	2.0-2.8 (66-92) [6]	Curry and Kerlinger. 2013. Post-construction mortality study Granite Reliable Power Wind Park, Coos County, New Hampshire, Annual Report January 2013. Prepared for Granite Reliable Power, LLC.
Groton	forested ridgeline (24)	April 15 - October 31, 2013	24 weekly	18	n/a	23	n/a	*West 2013 preliminary data*
Lempster	forested ridgeline (12)	April 15-June 1; July 15-Oct 31, 2009	4 daily	10 (2)	spring: 0.58 (7); fall: 5.51 (66)	9 (4)	spring: 0.80 (10); fall: 5.95 (71)	Tidhar, D., W. Tidhar, and M. Sonnenberg. 2010. Post-Construction Fatality Surveys for Lempster Wind Project. Prepared for Lempster Wind, LLC.
Lempster	forested ridgeline (12)	April 15-June 1; July 15-Oct 31, 2010	12 weekly	14 (5)	spring (0); fall 7.13 (86)	11 (0)	spring: 1.16 (14); fall: 4.12 (49)	Tidhar, D., W. Tidhar, L. McManus, and Z. Courage. 2011. 2010 Post-Construction Fatality Surveys for Lempster Wind Project. Prepared for Lempster Wind, LLC.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
New York								
Altona	primarily woodlots (65)	April 26 to October 15, 2010	22 weekly, 8 daily from July 18 to Sept 18	24 (7)	daily: 6.51 (423); weekly: 3.87 (252)	14 (6)	daily: 1.55 (101); weekly: 2.76 (180)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2011. Annual Report for the Noble Altona Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC.
Bliss	agricultural, woodland (67)	April 21 to Nov 14, 2008	8 daily, 8 every 3-days, 7 weekly	74 (15)	daily: 7.58 (508); 3-day:14.66 (983); weekly: 13.01 (872)	20 (7)	daily: 4.30 (288); 3-day: 0.66 (44); weekly: 0.74 (50)	Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Quant, D. Pursell. 2009. Annual Report for the Noble Bliss Windpark, LLC. Postconstruction Bird and Bat Fatality Study – 2008. Prepared by Curry and Kerlinger, LLC.
Bliss	agricultural, woodland (67)	April 15 to November 15, 2009	8 daily, 15 weekly	36 (0)	daily: 8.24 (552); weekly: 4.46 (299)	25 (7)	daily: 4.45 (298); weekly: 2.87 (192)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2010. Annual Report for the Noble Bliss Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC.
Chateaugay	agricultural, woodlots (71)	April 26 to Oct 15, 2010	24 weekly	22 (7)	3.66 (260)	19 (9)	2.40 (170)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2011. Annual Report for the Noble Chateaugay Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC.
Clinton	agricultural, woodland (67)	April 26 to October 13, 2008	8 daily, 8 every 3-days, 7 weekly	39 (14)	daily: 5.45 (365); 3-day: 4.81 (322); weekly: 3.76 (252)	14 (9)	daily: 1.43 (956); 3-day: 3.26 (218); weekly: 2.48 (166)	Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Histed, and J. Meacham. 2009. Annual Report for the Noble Clinton Windpark, LLC. Postconstruction Bird and Bat Fatality Study – 2008. Prepared by Curry and Kerlinger, LLC.
Clinton	agricultural, woodland (67)	April 15 to November 15, 2009	8 daily, 15 weekly	36 (6)	daily: 9.72 (651); weekly: 5.16 (3.46)	16 (8)	daily: 1.50 (101); weekly: 1.76 (118)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2010. Annual Report for the Noble Clinton Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC.
Cohocton and Dutch Hill	agricultural, woodland (50)	April 15 to Nov 15, 2009	5 daily, 12 weekly	62 (7)	daily: 40.4 (2002); weekly: 13.8 (804)	15 (3)	2.9 - 4.7 (147-235)	Stantec Consulting. 2010. Cohocton and Dutch Hill Wind FarmsYear 1 Post-Construction Monitoring Report, 2009 for the Cohocton and Dutch Hill Wind Farms In Cohocton, New York. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC.
Cohocton and Dutch Hill	agricultural, woodland (50)	April 26 to October 22, 2010	17 weekly except when 12 weekly and 5 daily from July 15-Sept 17	63 (5)	daily: 25.62 (1281); weekly A): 5.04 (252); weekly B): 10.44 (522)	9 (1)	daily: 2.06 (103); weekly 1: 0.82 (41); weekly 2: 1.16 (58)	Stantec Consulting. 2011. Cohocton and Dutch Hill Wind Farms Year 2 Post-Construction Monitoring Report, 2010 for the Cohocton and Dutch Hill Wind Farms In Cohocton, New York. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC.
Cohocton and Dutch Hill	agricultural, woodland (50)	July 8 to October 15, 2013	17 turbines every 5 days	44	8.03 (401.5)	22 (2)	3.96 (198)	Stantec Consulting. 2014. Cohocton and Dutch Hill Wind Farms 2013 Post-ConstructionWildlife Monitoring Report. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC.
Ellenburg	agricultural, woodland (54)	April 28 to Oct 13, 2008	6 daily, 6 every 3-days, 6 every 7-days	34 (25)	daily: 8.17 (441); 3-day: 6.94 (375); weekly: 4.19 (226)	12 (10)	daily: 2.09 (113); 3-day: 1.37 (74); weekly: 1.18 (64)	Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, A. Fuerst, and C. Hansen. 2009. Annual Report for the Noble Ellenburg Windpark, LLC. Postconstruction Bird and Bat Fatality Study – 2008. Prepared by Curry and Kerlinger, LLC.
Ellenburg	agricultural, woodland (54)	April 15 to November 15, 2009	6 daily, 12 weekly	28 (4)	daily: 8.01 (433); weekly: 3.70 (200)	19 (2)	daily: 5.69 (307); weekly: 2.29 (124)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2010. Annual Report for the Noble Ellenburg Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC.
Hardscrabble	agricultural/woodland (37)	April 15 to October 15, 2012	12 daily (12 weekly supplemental)	171 (7)	21.34 (790)	48 (6)	6.86 (254)	West/Jason P. Ritzert, Rhett Good, and Shay Howlin. 2013. 2012 Post-Construction Study and AnaBat Study Hardscrabble Wind Project Herkimer County, New York April 15 – October 15, 2012. Prepared for: Iberdrola Renewables, LLC.
Howard	agricultural/woodland (27)	April 15-Nov 15, 2012	5 daily, 5 weekly	138 (10)	20.09 (542) [5]	16 (standard and incidental combined)	2.5 (67.5)[5]	West. 2013. 2012 Post-Construction Monitoring Studies for the Howard Wind Projgect Steuben County, New York. Prepared for Howard Wind, LLC.

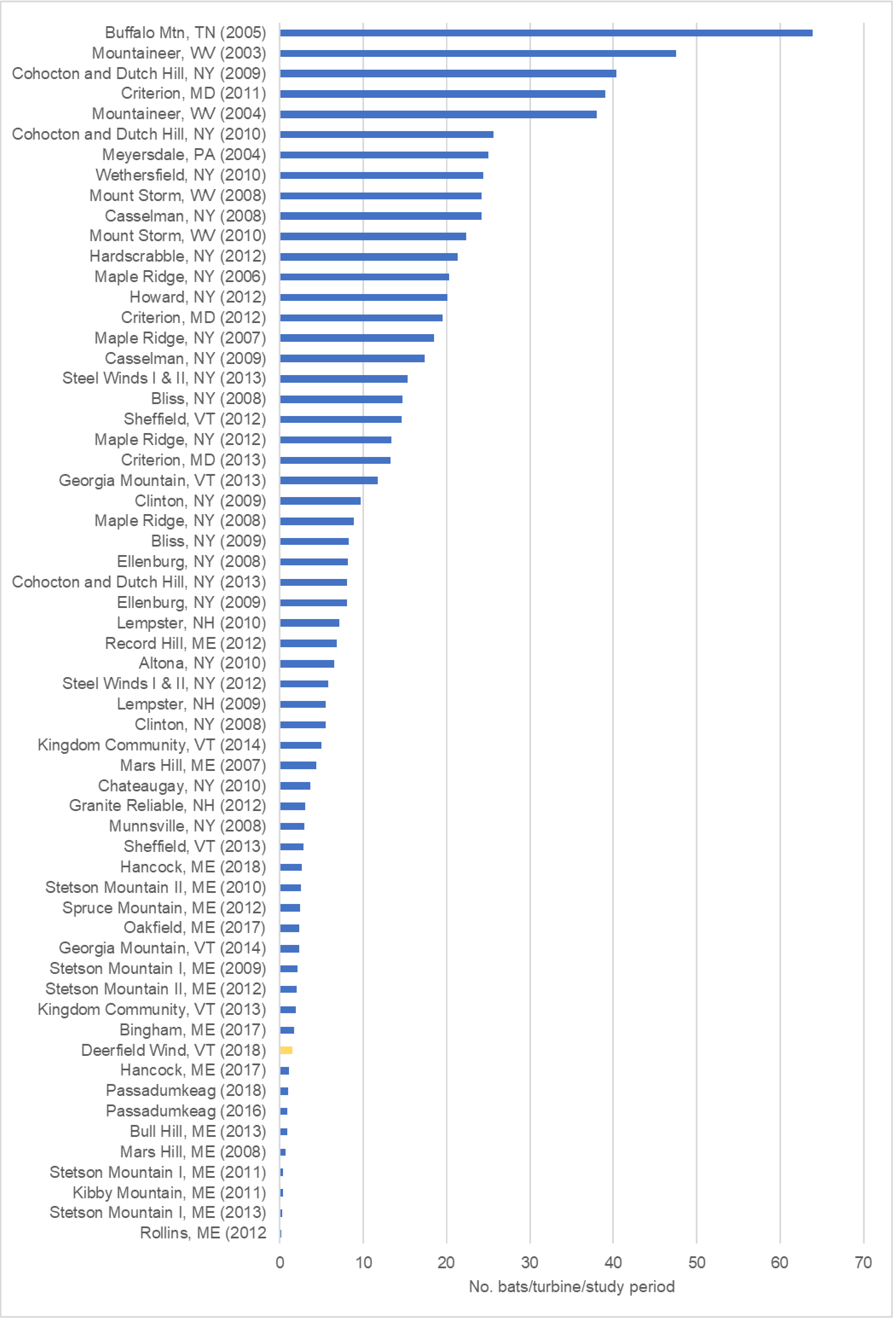
Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
Maple Ridge	woodland, grassland, agricultural (120)	June 17 - Nov 15, 2006	10 every 3-days, 30 7-days, 10 daily	326 (58)	11.39-20.31 (1367-2437.2)	123 (15)	3.10-9.48 (372-1,138)	Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2007. Annual report for the Maple Ridge wind power project post-construction bird and bat fatality study—2006. Prepared for PPM Energy and Horizon Energy. http://www.wind-watch.org/documents/wp-content/uploads/maple_ridge_report_2006_final.pdf
Maple Ridge	woodland, grassland, agricultural (195)	April 30 - Nov 14, 2007	64 weekly	202 (81)	15.54-18.53 (3030-3614)	64 (32)	5.67-6.31 (1,106-1,230)	Jain, A. P. Kerlinger, R. Curry, and L. Slobodnik. 2008. Annual report for the Maple Ridge wind power project post-construction bird and bat fatality study—2007. Annual report prepared for PPM Energy and Horizon Energy. Curry and Kerlinger, Cape May Point, New Jersey, USA.
Maple Ridge	woodland, grassland, agricultural (195)	April 15 - Nov 9, 2008	64 weekly	140 (76)	8.18 - 8.92 (1595-1739)	74 (23)	3.42-3.76 (667-733)	Jain, A. P. Kerlinger, R. Curry, and L. Slobodnik. 2009. Annual report for the Maple Ridge wind power project post-construction bird and bat fatality study—2007. Annual report prepared for PPM Energy and Horizon Energy. Curry and Kerlinger, Cape May Point, New Jersey, USA.
Maple Ridge	woodland, grassland, agricultural (195)	July 12 - October 15, 2012	weekly at 105 small plot and 5 large plots	68 (2)[5]	13.38 (2609)	11	n/a	Tidhar, D., J. Ritzert, M. Sonnenberg, M. Lout, and K. Bay. 2013. 2012 Post-construction Fatality Monitoring Study for the Maple Ridge Wind Farm, Lewis County, New York. Final Report: July 12 – October 15, 2012. Prepared for EDP Renewables North America
Munnsville	agricultural forested uplands (23)	April 15-Nov 15, 2008	12 of 23 weekly, seasonal dog searches	9 (1)	0.70-2.90 (16-67)	7 (3)	1.71-2.22 (39-51)	Stantec Consulting. 2009. Post-construction monitoring at the Munnsville Wind Farm, New York, 2008. Prepared for E.ON Climate and Renewables.
Steel Winds I & II	Lake Erie shoreline (14)	March 10 to May 31, July 15 to Nov 20, 2012	7 weekly	18 (1)	5.83 (82)[4]	6 (5)	3.97 (56)	Stantec Consulting. 2013. Steel Winds I and II Post-Construction Monitoring Report, 2012. Prepared for First Wind Management, LLC
Steel Winds I & II	Lake Erie shoreline (14)	March 10 to May 31, July 15 to September 30, 2013	7 once every 3 days	31 (3)	15.30 (214)	23 (6)	15.50 (217)	Stantec Consulting. 2014. Steel Winds I and II Post-Construction Monitoring Report, 2013. Prepared for First Wind Management, LLC
Wethersfield	agricultural, woodlots (84)	April 15 to Oct 15, 2010	28 weekly	62 (13)	24.45 (2054)	11 (7)	2.55 (214)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K., Harte, A. 2011. Annual Report for the Noble Wethersfield Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC.
Pennsylvania								
Casselman	forested ridge, grassland mine ridge (23)	July 27 - October 9, 2008	22 daily	32 [3]	24.2 (557)	N/A	N/A	Arnett, E.B., M. Schirmacher, M.P. Huso, J.P. Hayes. 2010. Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.
Casselman	forested ridge, grassland mine ridge (23)	July 26 - October 8, 2009	22 daily	39 [3]	17.4 (400)	N/A	N/A	Arnett, E.B., M. Schirmacher, M.P. Huso, J.P. Hayes. 2010. Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.
Meyersdale	forested ridgeline (20)	Aug 2 - Sept 13, 2004	10 daily, 10 weekly	262 (37)	25 (400-660)	13 (4)	n/a	Arnett, E.B., W.P. Erickson, J. Kerns, and J. Horn. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. Bats and Wind Energy Cooperative.
Somerset County	agricultural (8)	2000 (12 months)	n/a	0	n/a	0	n/a	Kerlinger, P. 2006. Supplement to the Phase I Avian Risk Assessment and Breeding Bird Study for the Deerfield Wind Project, Bennington County, Vermont. Prepared for Deerfield Wind, LLC.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
Tennessee								
Buffalo Mtn	reclaimed mine on ridge (18)	April - Dec 10, 2005	18 of 18 every week, every 2 weeks, or every 2-5 days	243 (14)	63.9 (1,149)	9 (2)	1.8 (112)	Fiedler, J.K., T.H. Henry, R.D. Tankersley, and C.P. Nicholson. 2007. Results of Bat and Bird Mortality Monitoring at the Expanded Buffalo Mountain Windfarm, 2005 June 28, 2007. Prepared for Tennessee Valley Authority.
Vermont								
Searsburg	forested (11)	June 30 - Oct 18, 1997	11 total (4 per search) 2 to 6 days per month	0	n/a	0	n/a	Kerlinger, P. 2002. An Assessment of the Impacts of Green Mountain Power Corporation's Wind Power Facility on Breeding and Migrating Birds in Searsburg, Vermont. Prepared for the Vermont Department of Public Service Montpelier, Vermont.
Sheffield	forested ridgeline (16)	April 1 – Oct 31, 2012	daily at 50% April-June, Oct; 100% July, Aug, Sept	87	14.65 (235)	35	13.17 (211)	Martin, C., E. Arnett, M. Wallace. 2013. Evaluating Bird and Bat Post-Construction Impacts at the Sheffield Wind Facility, Vermont 2012 Annual Report. Prepared for Bat Conservation International and First Wind.
Sheffield	forested ridgeline (16)	April 23 - Oct 31, 2013	daily at 8 April 23 – June 2 and October 1–3, daily at 16 June 3–30 and September, 2013	19	2.80 (45)	29 (2)	8.01 (129)	Martin, C., E. Arnett, M. Wallace. 2014. Evaluating Bird and Bat Post-Construction Impacts at the Sheffield Wind Facility, Vermont 2013 Annual Report. Prepared for Bat Conservation International and First Wind.
Kingdom Community	forested ridgeline (21)	April 15-Oct 15, 2013	all 21 weekly April 15-May 31, every 3-days June 1-Oct 15	15 (2)	1.94 (41)	61 (13)	10.76 (226)	Stantec. 2014. Kingdom Community Wind 2013 Post-Construction Monitoring Report - Year 1. Prepared for Green Mountain Power.
Georgia Mountain	forested ridgeline (4)	April 16 - Oct 16, 2013	all 4 every 3 days	12 (1)	11.7 (47)	6 (0)	6 (26)	Stantec. 2014. Georgia Mountain Community Wind 2013 Post-Construction Monitoring Report - Year 1. Prepared for Georgia Mountain Community Wind, LLC.
Kingdom Community	forested ridgeline (21)	April 15-Oct 15, 2014	all 21 weekly April 15-May 31, every 3-days June 1-Oct 15	21	4.96 (105)	36 (6)	9.11 (192)	Stantec. 2015. Kingdom Community Wind 2014 Post-Construction Monitoring Report - Year 2. Prepared for Green Mountain Power.
Georgia Mountain	forested ridgeline (4)	April 16 - Oct 16, 2014	all 4 every 3 days	3	2.29 (9)	1	2.13 (9)	Stantec. 2015. Georgia Mountain Community Wind 2014 Post-Construction Monitoring Report - Year 2. Prepared for Georgia Mountain Community Wind, LLC.
Deerfield Wind	**forested ridgeline (15)**	**April 23-October 15, 2018**	**3-day**	**10**	**1.47 (23)**	**26**	**8.01 (121)**	**This report**
West Virginia								
Mount Storm	forested ridgeline (82)	July 18 - Oct 17, 2008	18 weekly, 9 daily	182 (27)	daily: 24.21 (1985) weekly: 7.76 (636)	29 (8)	2.41-3.81 (198-312)	Young, D.P., W.P. Erickson, K. Bay, S. Normani, W. Tidhar. 2009. Mount Storm Wind Energy Facility, Phase 1: Post-construction Avian and Bat Monitoring. Prepared for: NedPower Mount Storm, LLC.
Mount Storm	forested ridgeline (82)	July-October, 2010	25 daily	308 (73)	22.39 (1836)	36 (11)	2.77 (227)	Young, D.P., S. Nomani, W. Tidhar, and K. Bay. 2010. Mount Storm Wind Energy Facility Post-construction Avian and Bat Monitoring, July-October 2010. Prepared for NedPower Mount Storm, LLC.
Mountaineer	forested ridgeline (44)	April 4 - Nov 11, 2003	2x per week	475	47.53 (2092)	69 [1]	4.04 (178 + 33 due to substation lighting)	Kerns, J., and P. Kerlinger. 2004. A study of bird and bat collision fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia, USA: annual report for 2003.

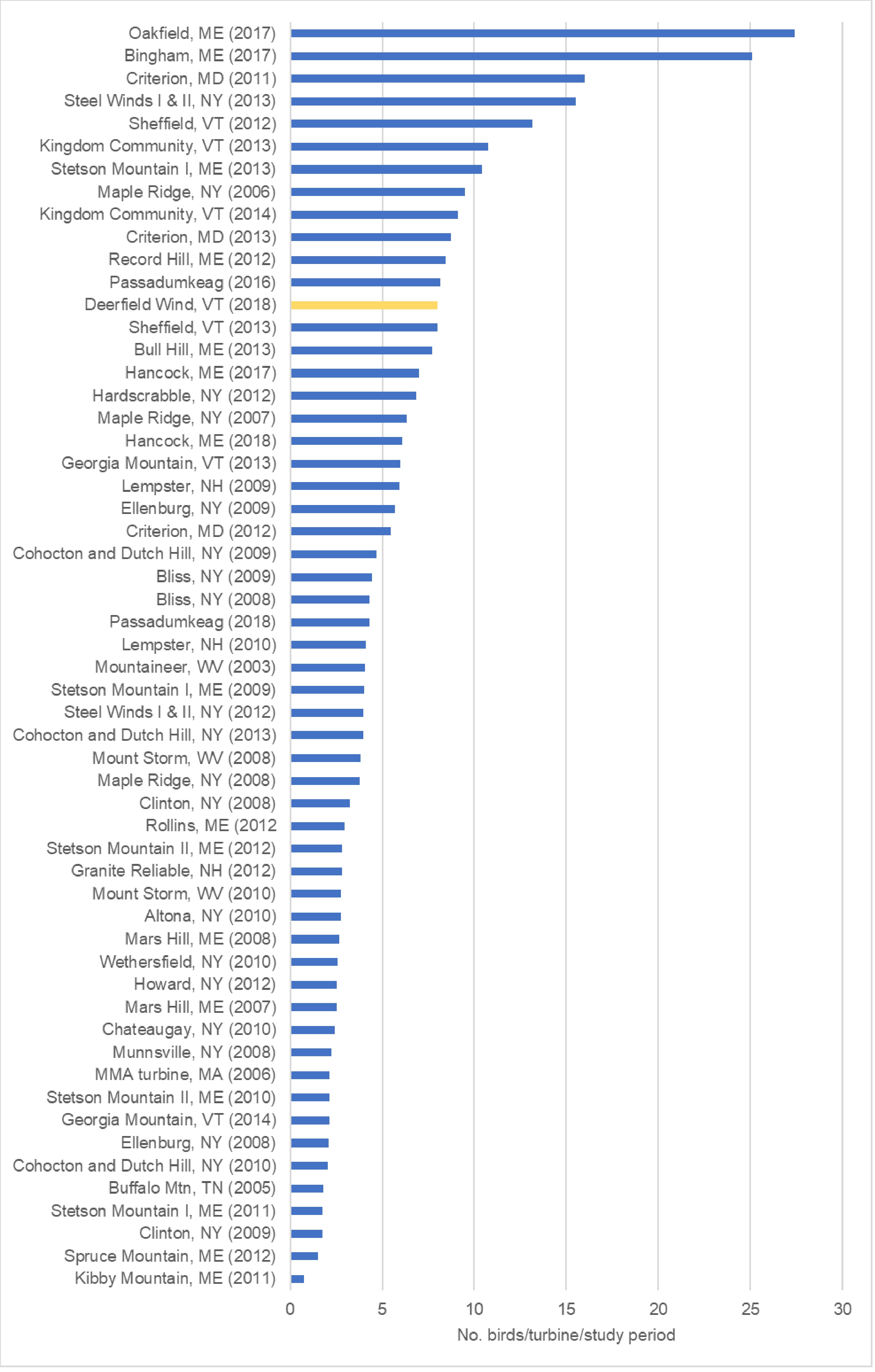
Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
								<http://www.responsiblewind.org/docs/MountaineerFinalAvianRpt3-15-04PKJK.pdf>
Mountaineer	forested ridgeline (44)	July 31- Sept 11, 2004	22 daily, 22 weekly	398 (68)	38 (1364-1980)	15 (n/a)	n/a	Arnett, E.B., W.P. Erickson, J. Kerns, and J. Horn. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. Bats and Wind Energy Cooperative.

*****Comparison of fatality rates across survey sites and survey periods should be interpreted with caution, as Deerfield implemented a 6 m/s curtailment program on all turbines, whereas other sites implemented different or no operational control measures.**

[1]33 birds found on May 23, 2003 at turbines near a substation and at substation associated with sodium vapor lights.
[2]Results of spring interim report, study period April 20 to June 1.
[3]Fresh bats found at curtailment treatment turbines reported only.
[4]Based on the Huso fatality estimator not including search area corrections.
[5]Included incidental carcasses in estimates of fatality.
[6]Based search area corrections on distribution of carcasses found at the Maple Ridge Wind Project, New York.
[7]More than one estimator was used in this analysis.



Appendix A Figure 1. Fatality Rates for Bats (Bats/Turbine/Study Period) from Publicly Available Studies at Wind Energy Facilities in the Eastern US, as Shown in Appendix A Table 3.



Appendix A Figure 2. Fatality Rates for Birds (Birds/Turbine/Study Period) from Publicly Available Studies at Wind Energy Facilities in the Eastern US, as Shown in Appendix A Table 3.

Appendix B TURBINE SEARCH PLOTS

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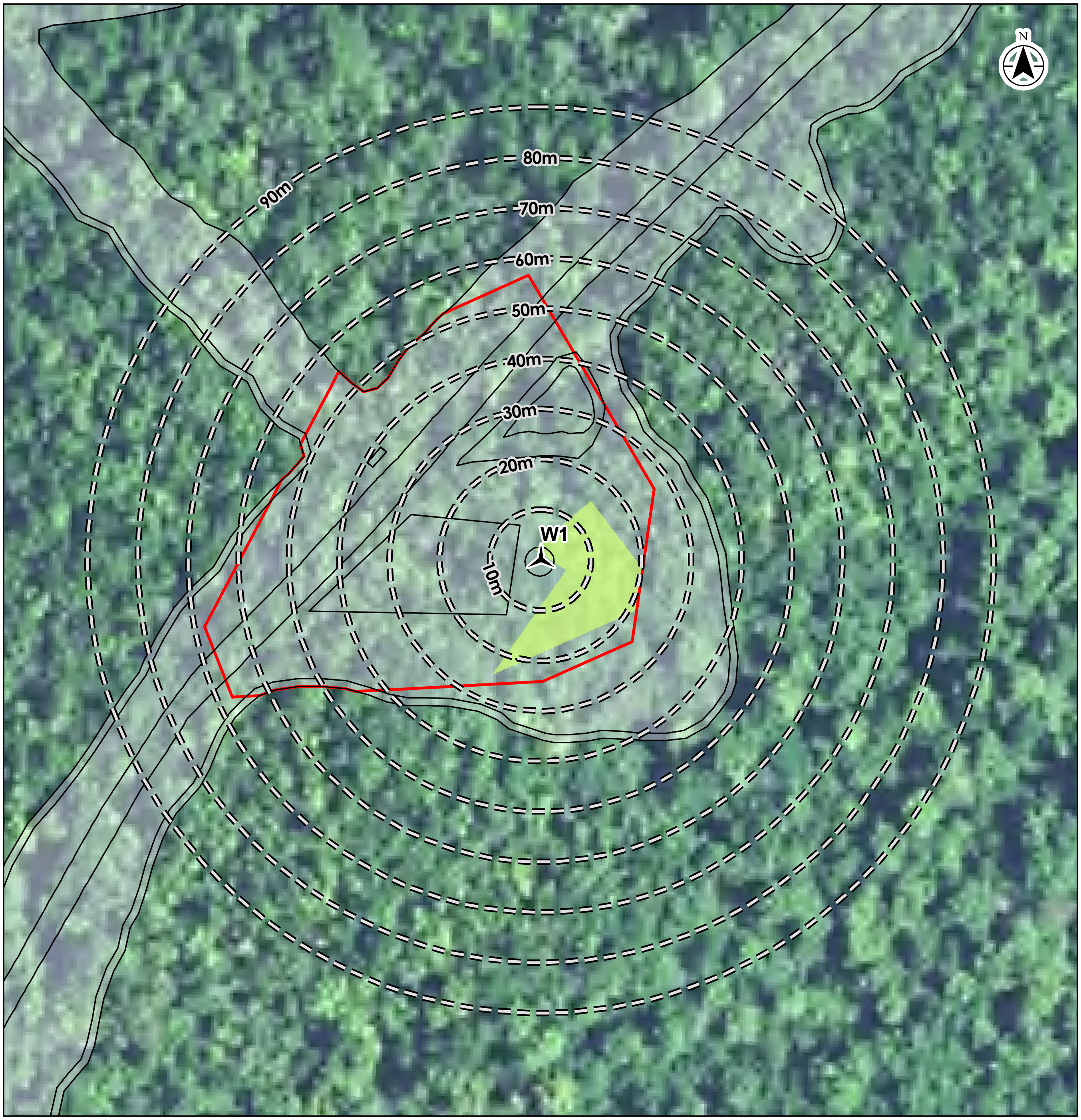

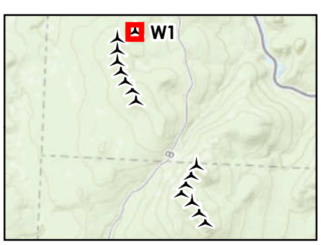

Legend

Turbine Location

10-meter Ring

Deerfield As-built

PCM Search Area

Non-Dominant Vegetation Cover area

Grass

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Stantec

Project Location 195601468

Searburg, Vermont

Prepared by GC on 2019-01-04

Reviewed by LJ on 2019-01-04

Client/Project

Avangrid Renewables, LLC

Deerfield Wind Project

Post Construction Monitoring

Figure No.

Appendix B - Map 1 of 15

Title

Turbine W1 Search Plot

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016

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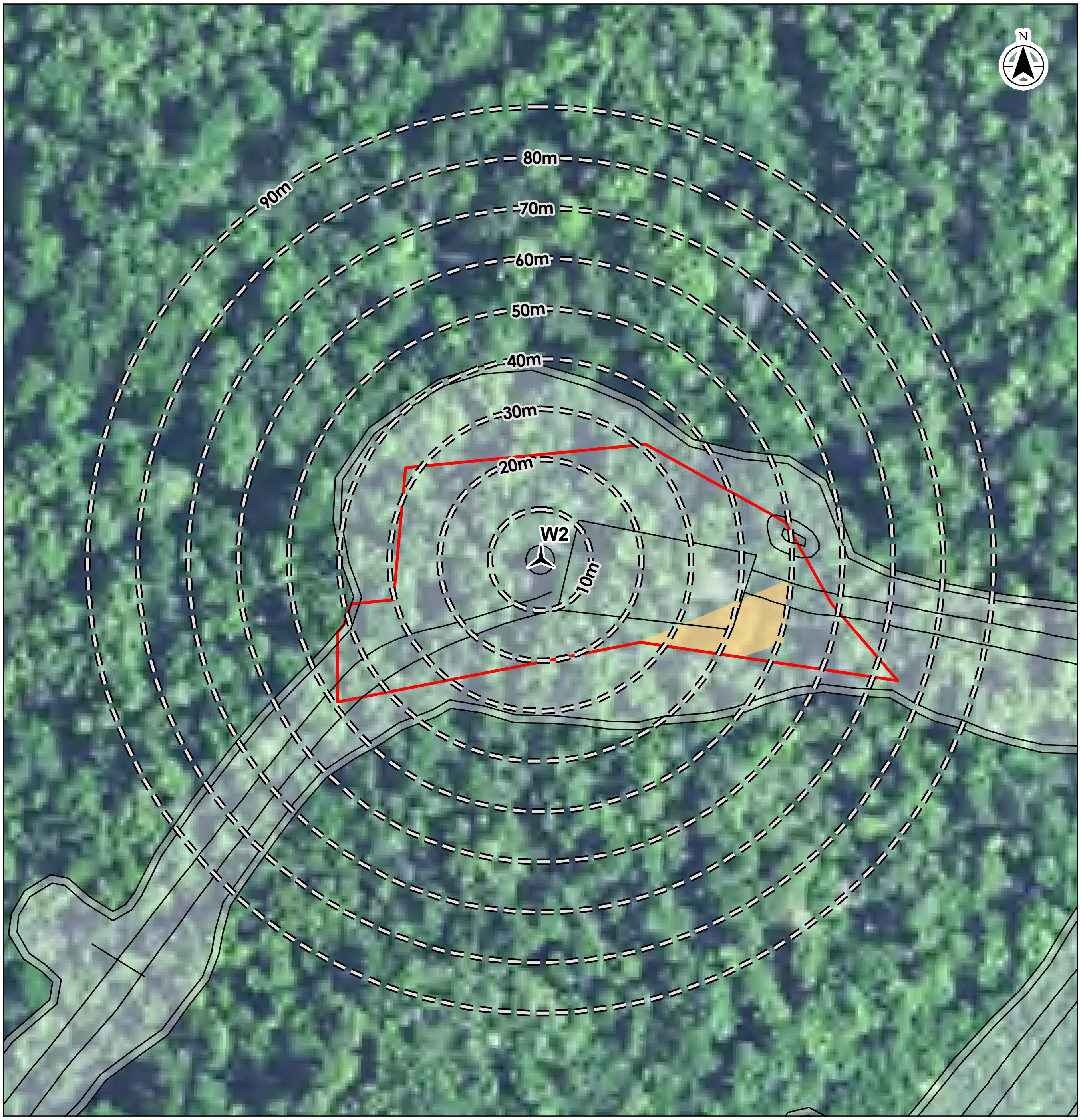
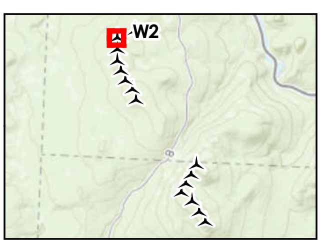




Legend
- Turbine Location
- 10-meter Ring
- Deerfield As-built
- PCM Search Area

Non-Dominant Vegetation Cover area
- Rocks

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Stantec

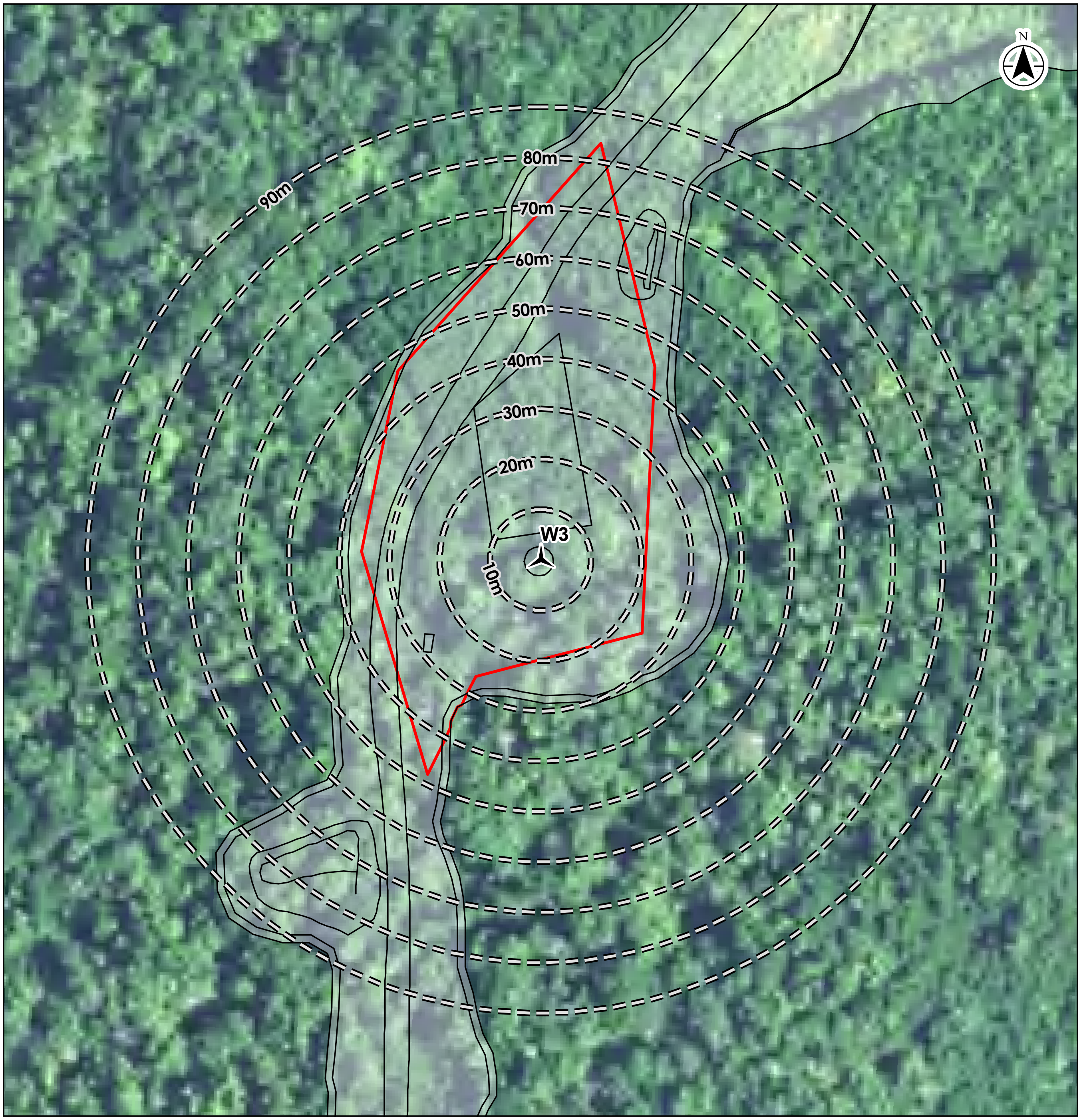
Project Location 195601468
Searburg, Vermont
Prepared by GC on 2019-01-04
Reviewed by LJ on 2019-01-04

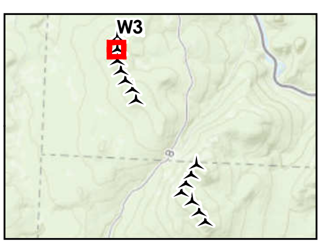
Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
Appendix B - Map 2 of 15

Title
Turbine W2 Search Plot

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016





Legend
- Turbine Location
- 10-meter Ring
- Deerfield As-built
- PCM Search Area

0 100 Feet
1:1,200 (at original document size of 8.5x11)

Stantec

Project Location 195601468
Searsburg, Vermont
Prepared by GC on 2019-01-04
Reviewed by LJ on 2019-01-04

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
Appendix B - Map 3 of 15

Title
Turbine W3 Search Plot

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016

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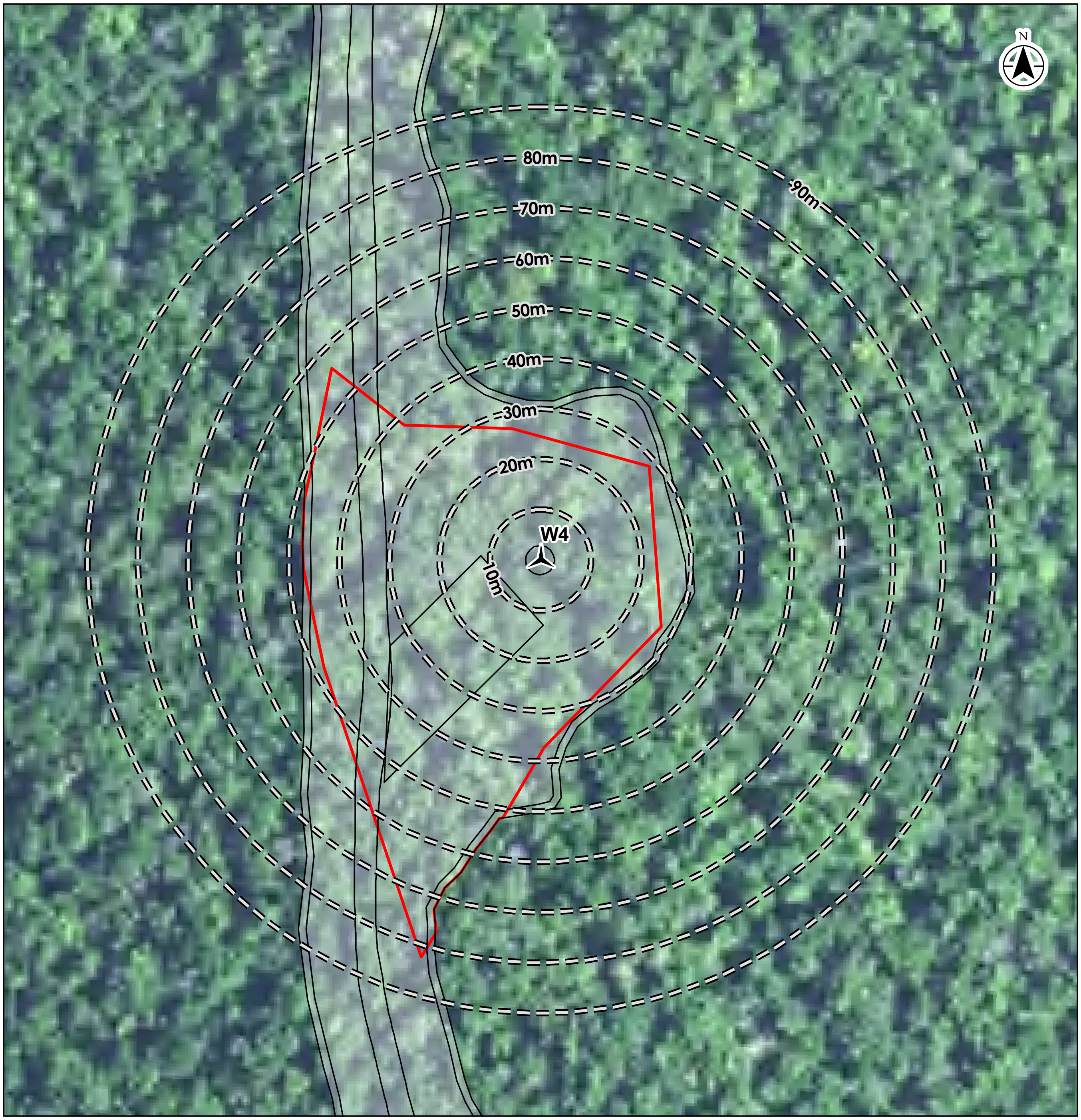

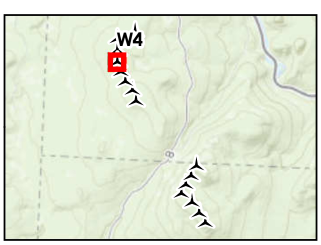

Legend

- Turbine Location
- 10-meter Ring
- Deerfield As-built
- PCM Search Area

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Stantec

Project Location 195601468
Searburg, Vermont
Prepared by GC on 2019-01-04
Reviewed by LJ on 2019-01-04

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
Appendix B - Map 4 of 15

Title
Turbine W4 Search Plot

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016

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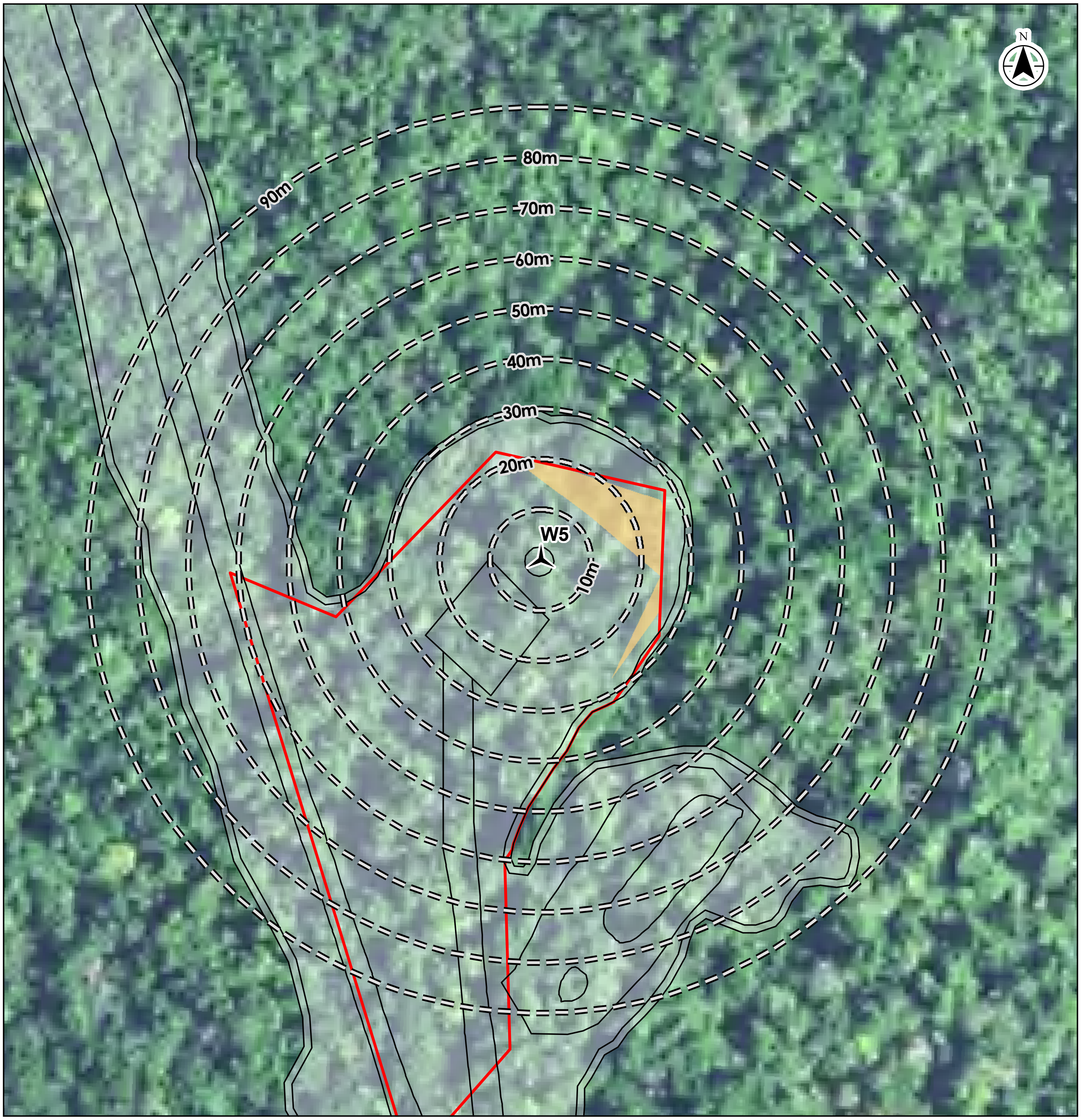
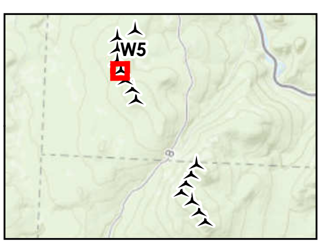




Legend

Turbine Location

10-meter Ring

Deerfield As-built

PCM Search Area

Non-Dominant Vegetation Cover area

Rocks

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Stantec

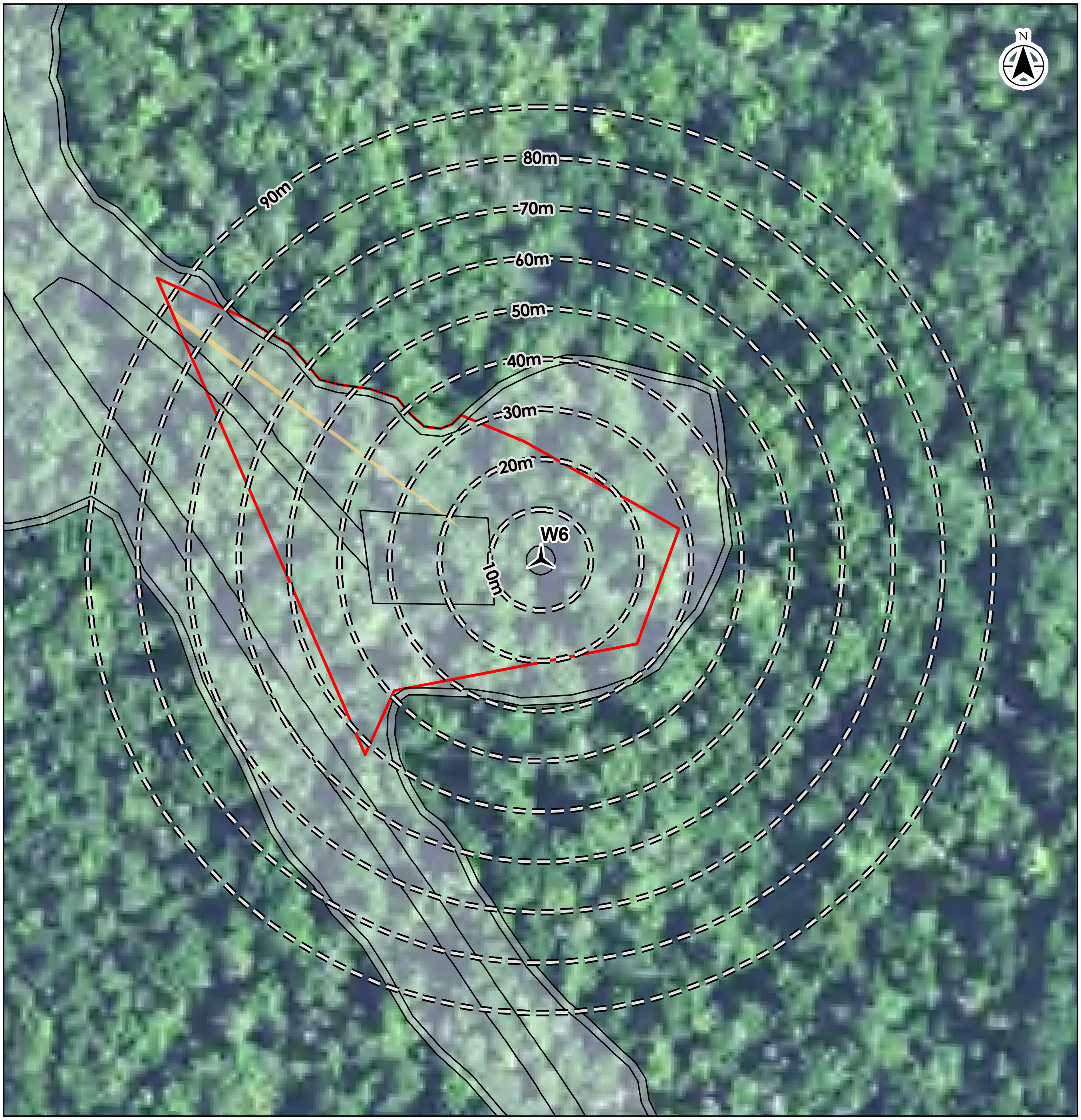
Project Location 195601468
Searburg, Vermont
Prepared by GC on 2019-01-04
Reviewed by LJ on 2019-01-04

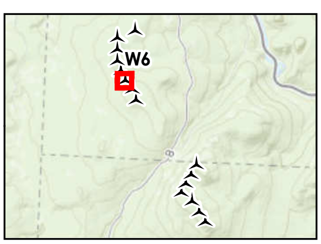
Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
Appendix B - Map 5 of 15

Title
Turbine W5 Search Plot

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016





Legend

- Turbine Location
- 10-meter Ring
- Deerfield As-built
- PCM Search Area

Non-Dominant Vegetation Cover area

- Rocks

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016

Stantec

Project Location 195601468
Searburg, Vermont
Prepared by GC on 2019-01-04
Reviewed by LJ on 2019-01-04

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
Appendix B - Map 6 of 15

Title
Turbine W6 Search Plot

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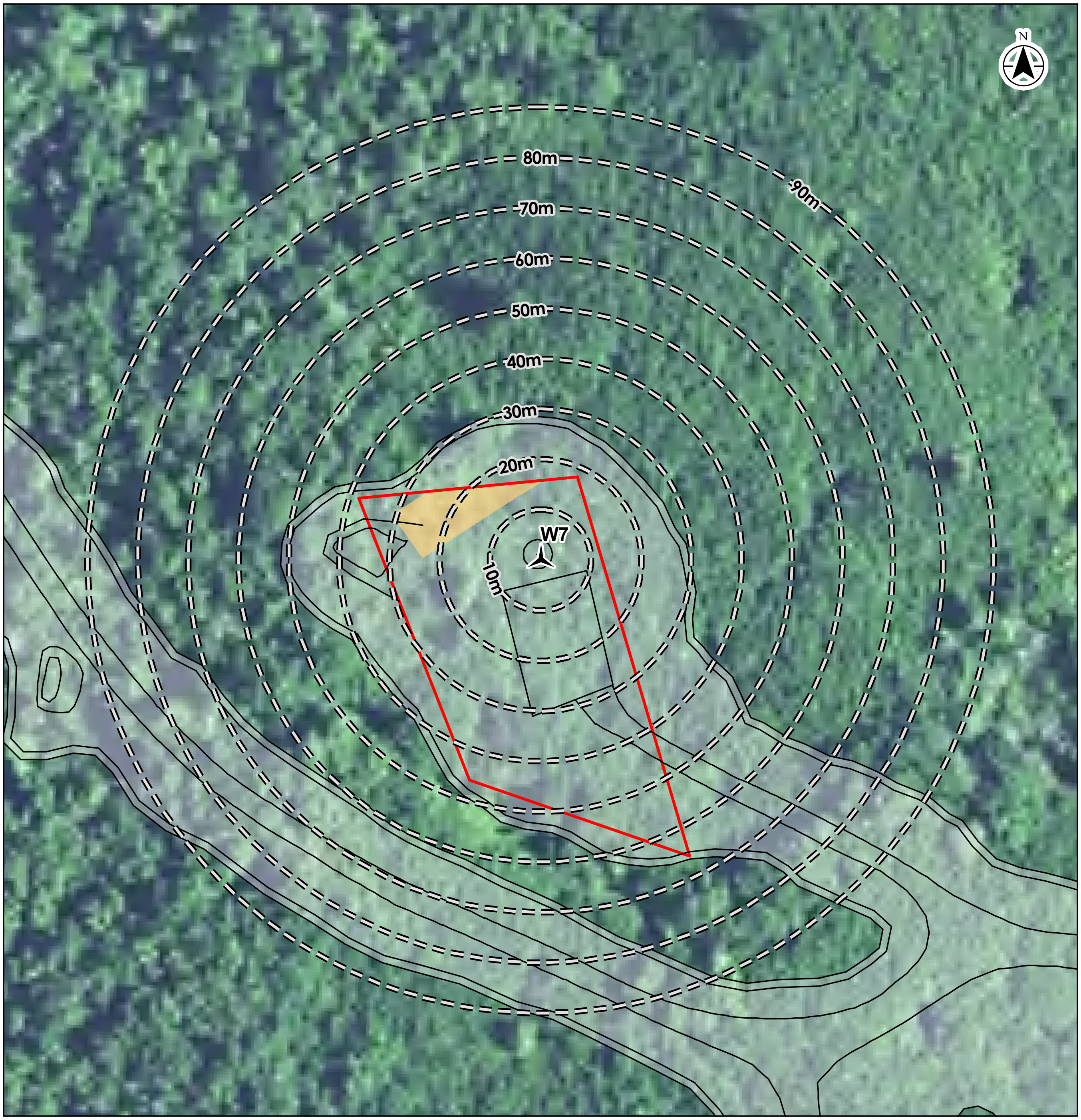

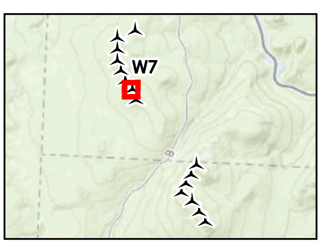

Legend

- Turbine Location
- 10-meter Ring
- Deerfield As-built
- PCM Search Area

Non-Dominant Vegetation Cover area

- Rocks

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Stantec

Project Location 195601468

Searburg, Vermont

Prepared by GC on 2019-01-04

Reviewed by LJ on 2019-01-04

Client/Project

Avangrid Renewables, LLC

Deerfield Wind Project

Post Construction Monitoring

Figure No.

Appendix B - Map 7 of 15

Title

Turbine W7 Search Plot

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016

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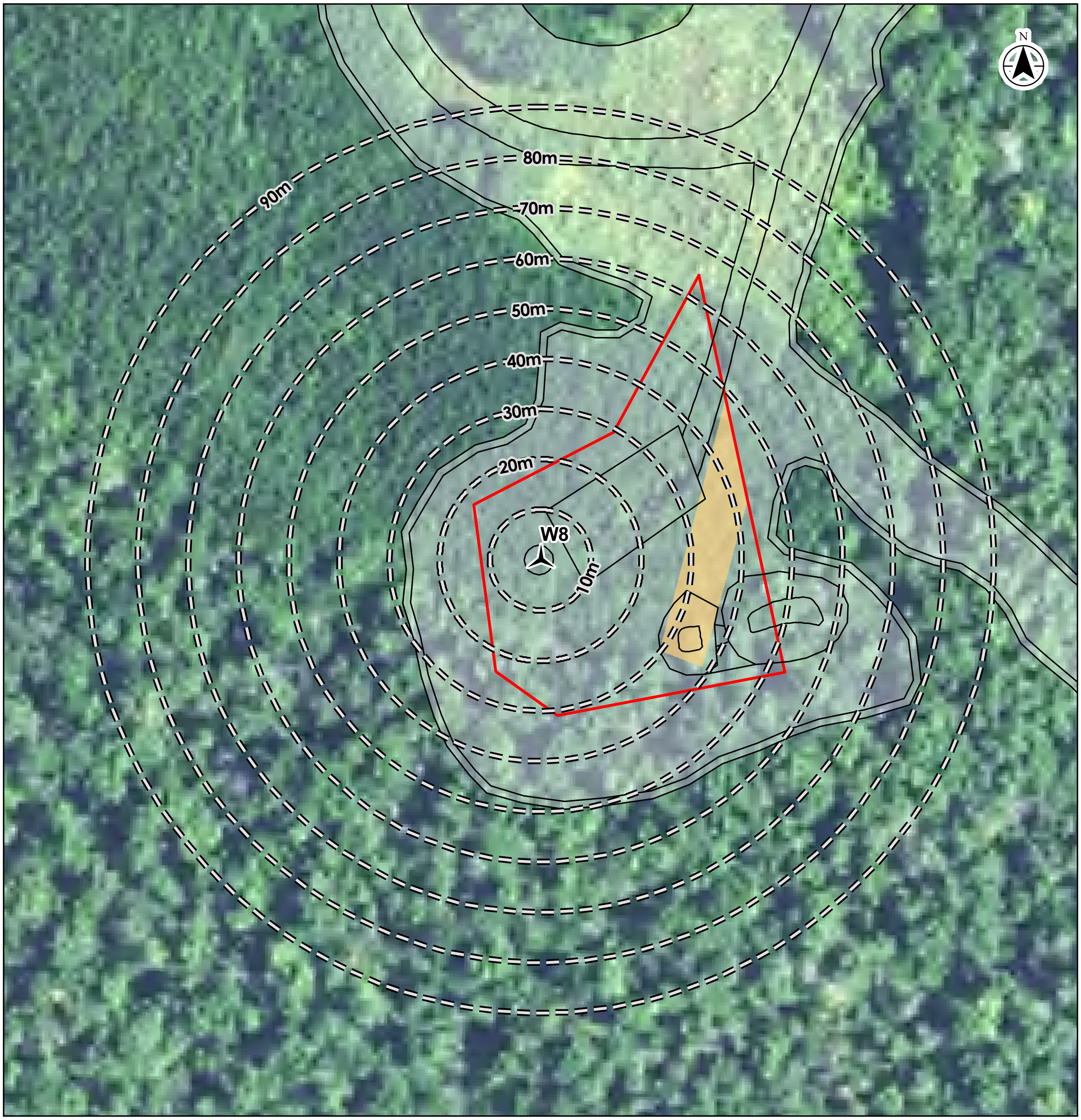

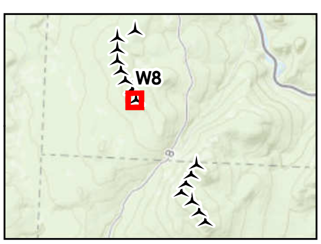

Legend

Turbine Location

10-meter Ring

Deerfield As-built

PCM Search Area

Non-Dominant Vegetation Cover area

Rocks

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Stantec

Project Location 195601468
Searburg, Vermont
Prepared by GC on 2019-01-04
Reviewed by LJ on 2019-01-04

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
Appendix B - Map 8 of 15

Title
Turbine W8 Search Plot

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016

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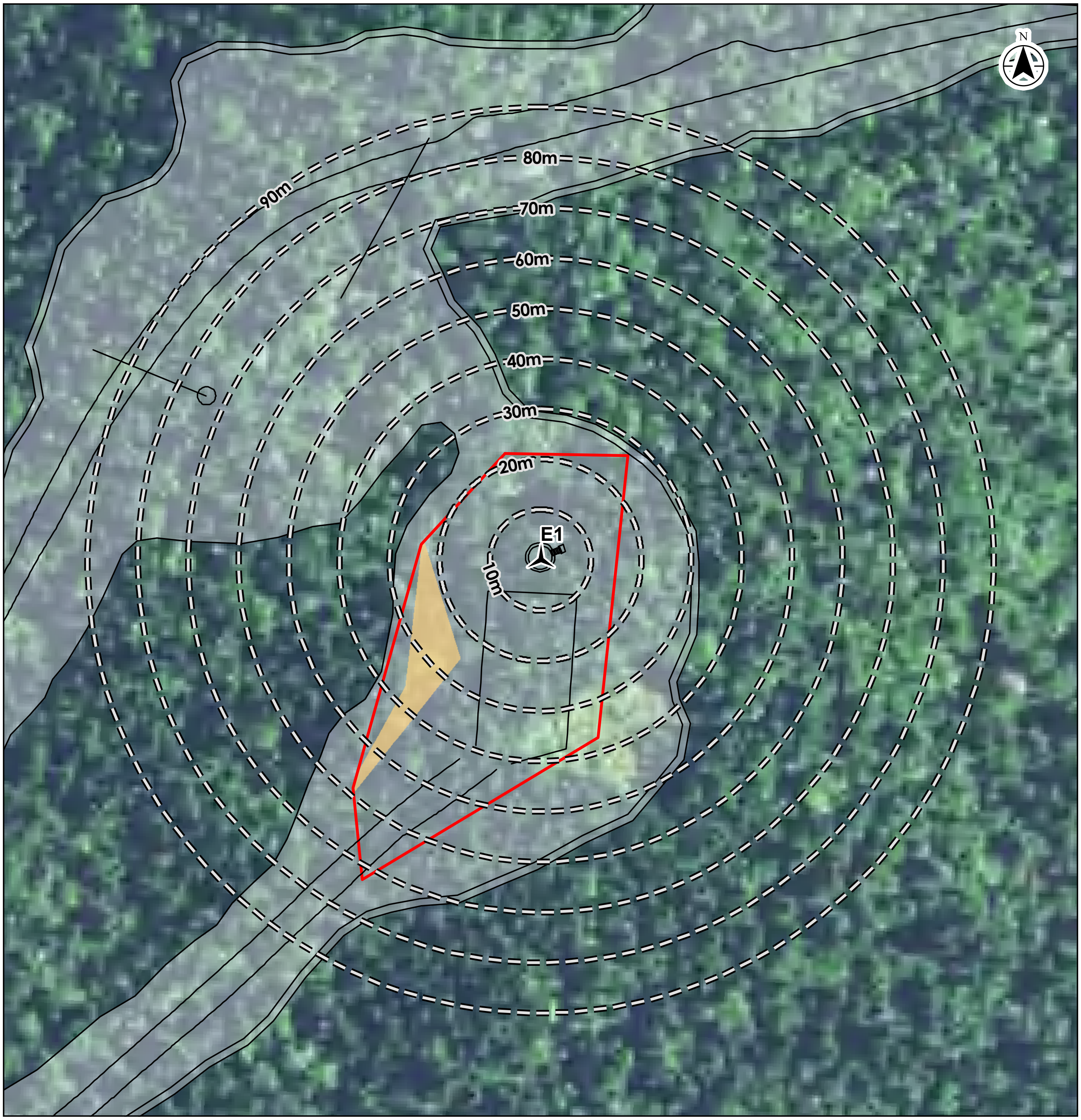

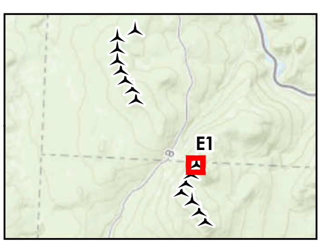

Legend

Turbine Location

10-meter Ring

Deerfield As-built

PCM Search Area

Non-Dominant Vegetation Cover area

Rocks

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Stantec

Project Location 195601468

Searburg, Vermont

Prepared by GC on 2019-01-04
Reviewed by LJ on 2019-01-04

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
Appendix B - Map 9 of 15

Title
Turbine E1 Search Plot

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016

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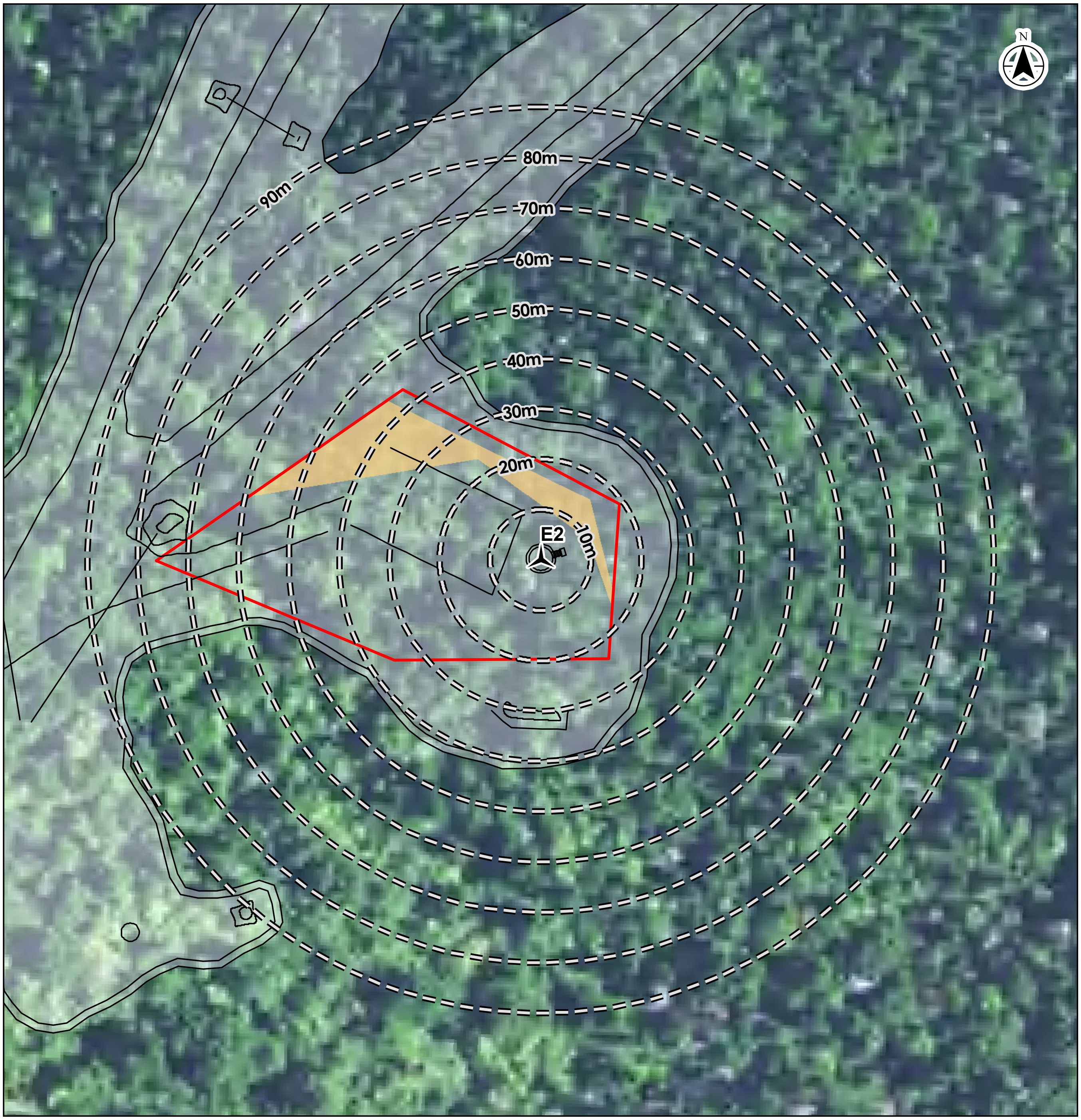

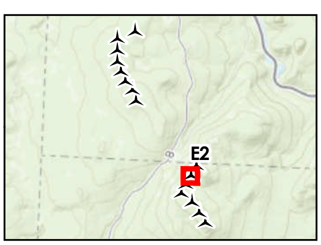

Legend

Turbine Location

10-meter Ring

Deerfield As-built

PCM Search Area

Non-Dominant Vegetation Cover area

Rocks

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Stantec

Project Location 195601468

Searburg, Vermont

Prepared by GC on 2019-01-04

Reviewed by LJ on 2019-01-04

Client/Project

Avangrid Renewables, LLC

Deerfield Wind Project

Post Construction Monitoring

Figure No.

Appendix B - Map 10 of 15

Title

Turbine E2 Search Plot

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016

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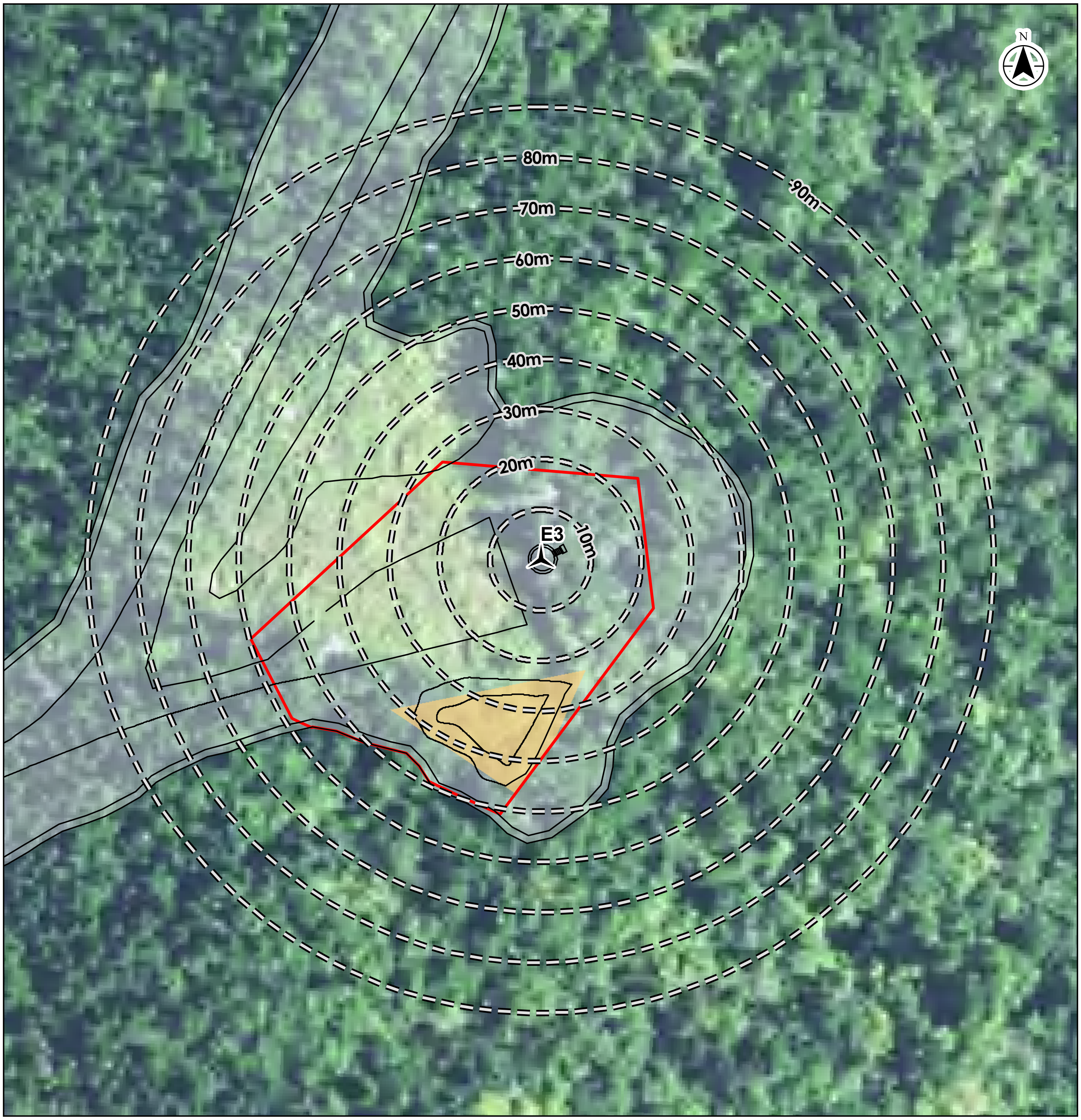

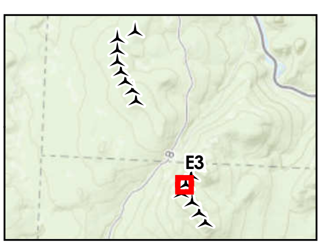

Legend

- Turbine Location
- 10-meter Ring
- Deerfield As-built
- PCM Search Area

Non-Dominant Vegetation Cover area

- Rocks

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Stantec

Project Location 195601468

Searburg, Vermont

Prepared by GC on 2019-01-04

Reviewed by LJ on 2019-01-04

Client/Project

Avangrid Renewables, LLC

Deerfield Wind Project

Post Construction Monitoring

Figure No.

Appendix B - Map 11 of 15

Title

Turbine E3 Search Plot

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016

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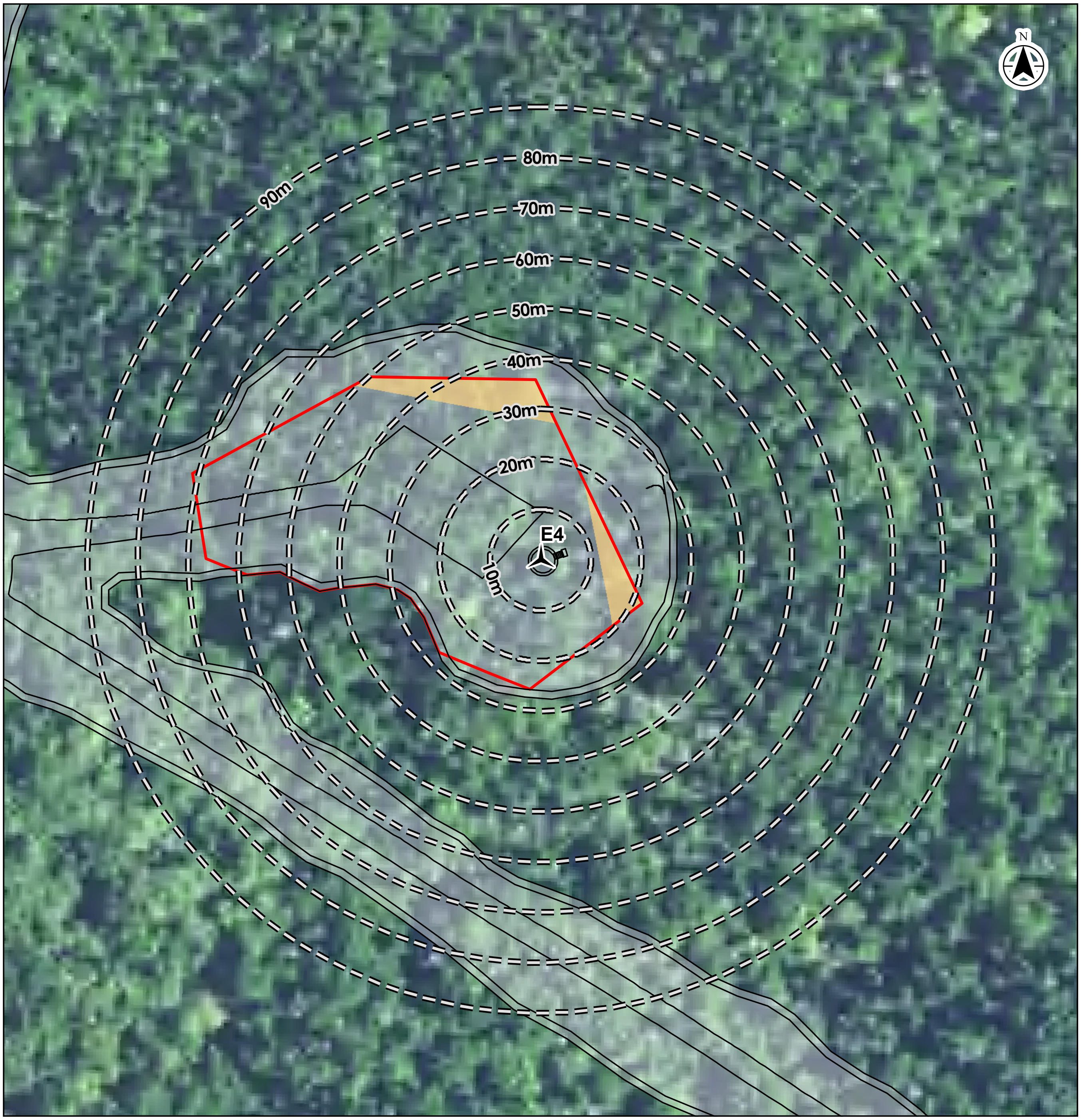

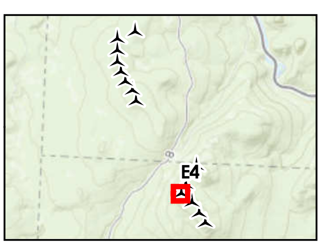

Legend

- Turbine Location
- 10-meter Ring
- Deerfield As-built
- PCM Search Area

Non-Dominant Vegetation Cover area

- Rocks

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Project Location
Searburg, Vermont

195601468
Prepared by GC on 2019-01-04
Reviewed by LJ on 2019-01-04

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
Appendix B - Map 12 of 15

Title
Turbine E4 Search Plot

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016

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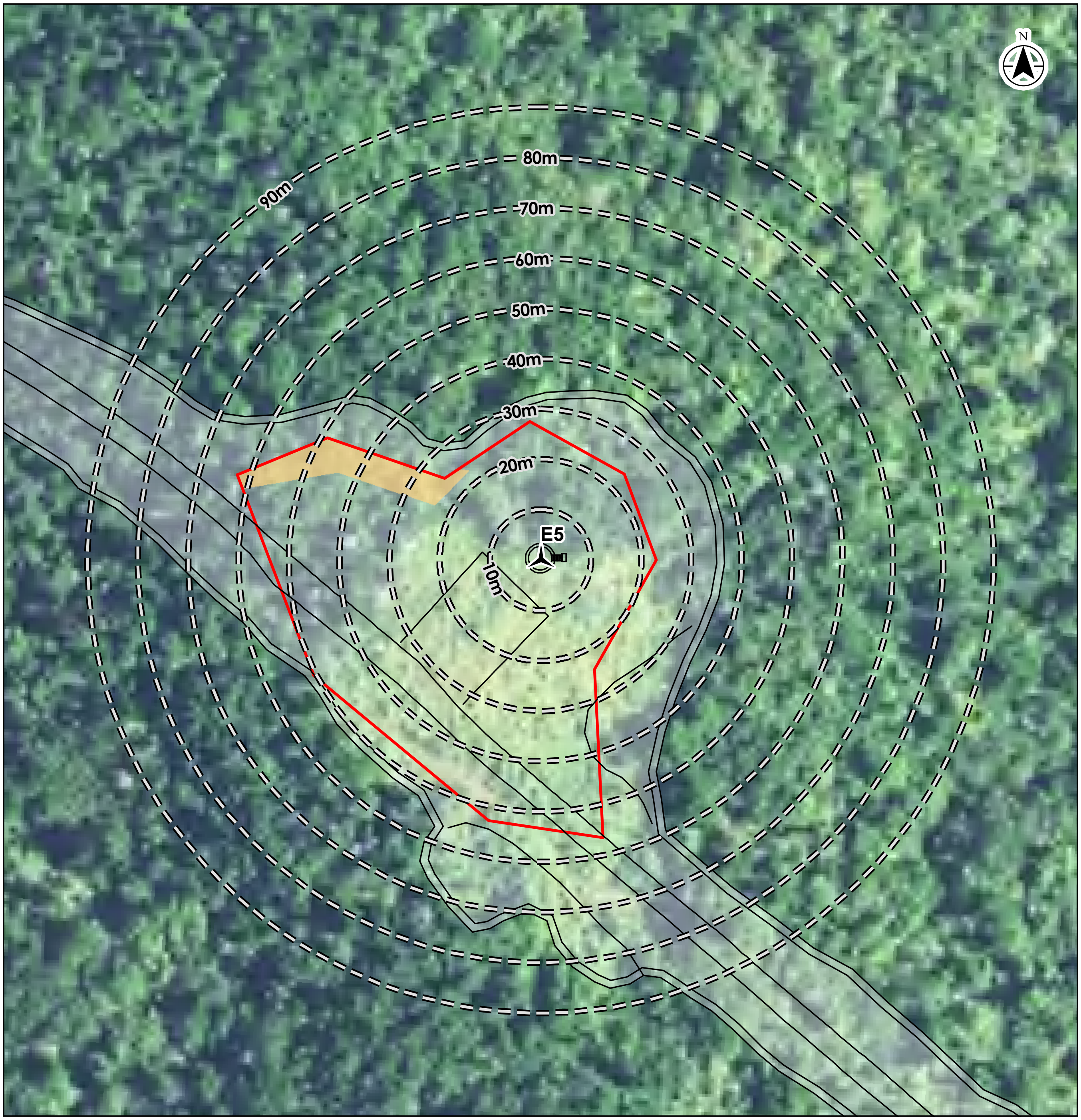
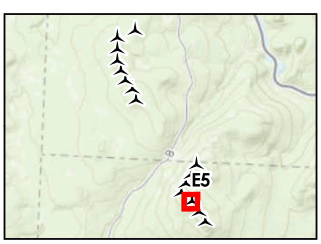




Legend

Turbine Location

10-meter Ring

Deerfield As-built

PCM Search Area

Non-Dominant Vegetation Cover area

Rocks

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Stantec

Project Location 195601468

Searburg, Vermont

Prepared by GC on 2019-01-04

Reviewed by LJ on 2019-01-04

Client/Project

Avangrid Renewables, LLC

Deerfield Wind Project

Post Construction Monitoring

Figure No.

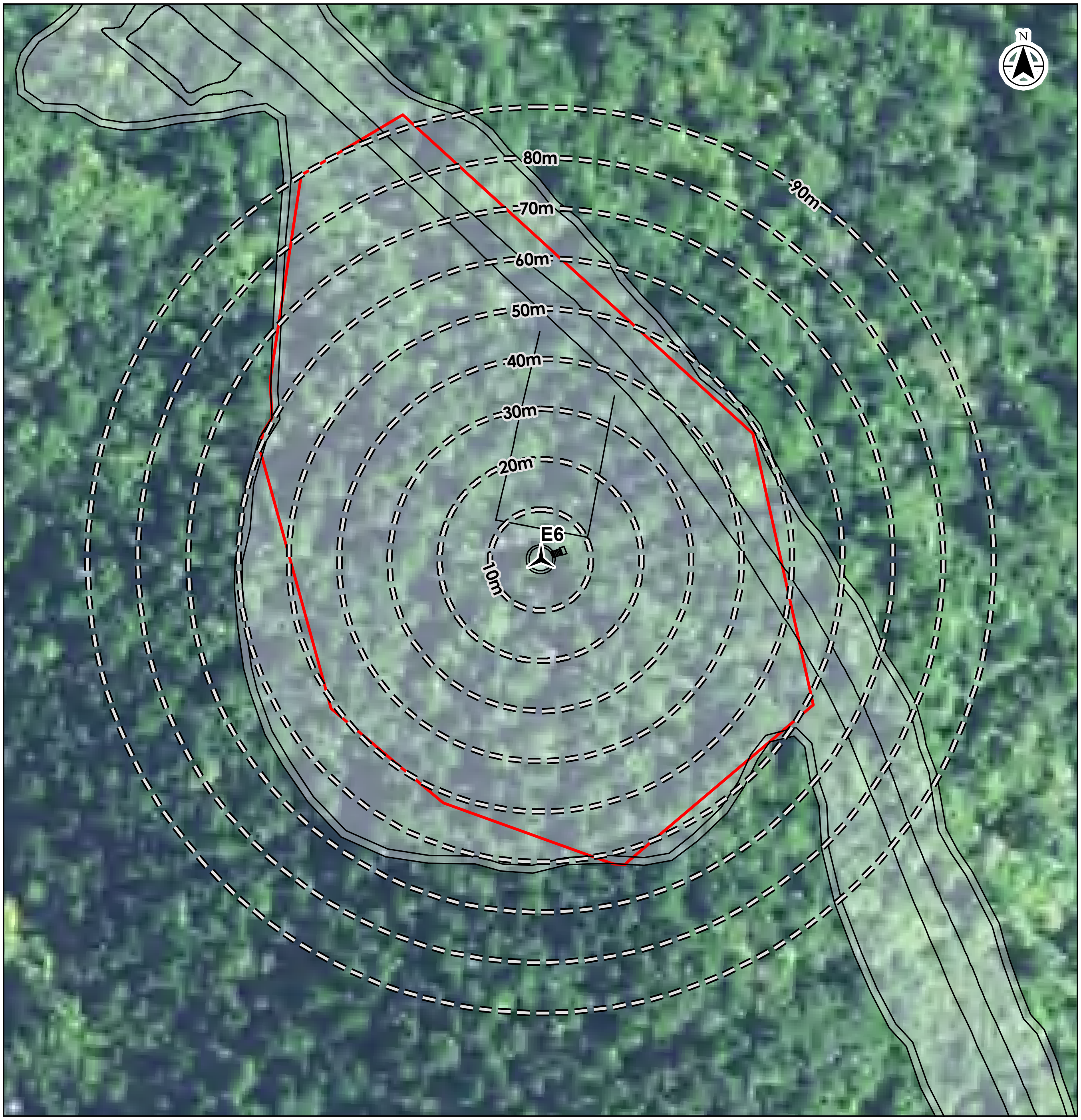
Appendix B - Map 13 of 15

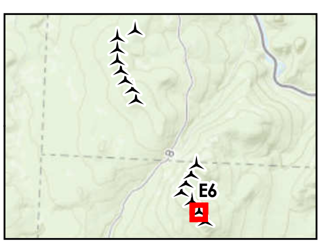
Title

Turbine E5 Search Plot

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016





Legend

- Turbine Location
- 10-meter Ring
- Deerfield As-built
- PCM Search Area

0 100 Feet

1:1,200 (at original document size of 8.5x11)

Stantec

Project Location 195601468
Searburg, Vermont

Prepared by GC on 2019-01-04
Reviewed by LJ on 2019-01-04

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
Appendix B - Map 14 of 15

Title
Turbine E6 Search Plot

Notes
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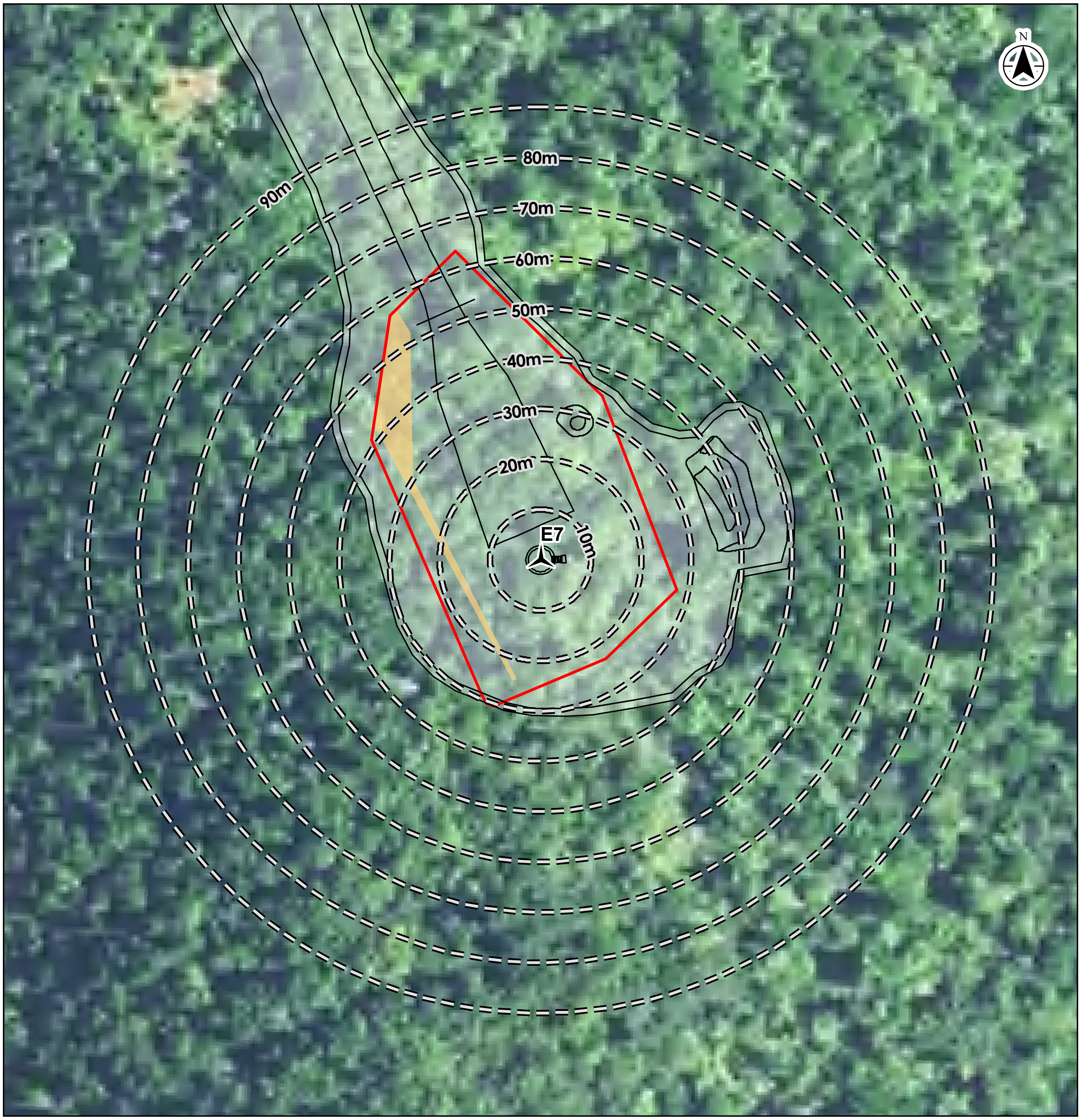
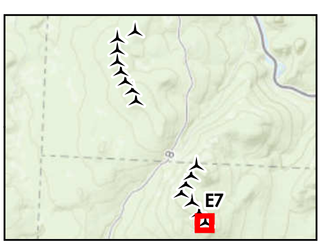
2. Orthoimagery: NAIP 2016





Legend
- Turbine Location
- 10-meter Ring
- Deerfield As-built
- PCM Search Area

Non-Dominant Vegetation Cover area
- Rocks

0 100 Feet
1:1,200 (at original document size of 8.5x11)

Stantec

Project Location: Searburg, Vermont
195601468
Prepared by GC on 2019-01-04
Reviewed by LJ on 2019-01-04

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post Construction Monitoring

Figure No.
Appendix B - Map 15 of 15

Title
Turbine E7 Search Plot

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Orthoimagery: NAIP 2016

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Attachment 2

Post-Construction Monitoring Report Year 2, Deerfield Wind Project

Bennington County, Vermont

February 27, 2021

Prepared for:

Deerfield Wind, LLC

A subsidiary of
Avangrid Renewables, LLC.
1125 NW Couch Street
Portland, OR 97209

Prepared by:

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

Attorney-Client Work Product
Privileged and Confidential

Report Citation

Stantec Consulting Services Inc. (Stantec). 2021. Post-Construction Monitoring Report Year 2, Deerfield Wind Project. Stantec Consulting Services Inc., Topsham, Maine, USA. 37 pages + front matter and appendices.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

The Deerfield Wind Project (Project) is a 15-turbine 30-megawatt (MW) facility located in Searsburg and Readsboro, Bennington County, Vermont. The Project is owned by Deerfield Wind, LLC (Deerfield Wind), a subsidiary of Avangrid Renewables. The Project consists of 8 Gamesa G97 turbines with 97-meter rotor diameters, and 7 Gamesa G87 turbines with 87-meter rotor diameters. The Project became operational in late 2017. Per conditions outlined in the Special Use Permit issued by the United States Forest Service and the Certificate of Public Good from the Vermont Public Service Board, a Post-Construction Monitoring Plan (PCMP) dated September 2017 was developed in consultation with and approved by the Vermont Agency of Natural Resources (VANR) and Green Mountain National Forest (GMNF). Post-construction bird and bat fatality surveys will be conducted during years 1, 3, and 5 following the operational start of the Project. Stantec Consulting Services Inc. (Stantec) conducted post-construction fatality monitoring studies at the Project during Year 1 of operation in 2018, and during Year 3 of operation in 2020. In addition, the Project implemented operational control measures from June 1 to September 30 in accordance with the Threatened and Endangered Species Taking Permit issued to the Project by VANR in 2018, the United States Forest Service Record of Decision dated January 2012, and the PCMP. This report covers the methods and results of the second year (year 3 of operation) of post-construction monitoring surveys at the Project in 2020. Survey results from 2018 monitoring are provided under a separate report dated February 28, 2019.

Stantec conducted standardized fatality searches from May 8 to October 15, 2020. While the PCMP states that surveys are to be initiated on April 15, VANR approved delay of the monitoring season until May 8 due to the COVID-19 pandemic in an email dated May 7, 2020. Based on fatality and weather data collected in 2018, this unanticipated delay did not likely substantively affect the study (See Section 2.1).

Weather and site maintenance activities permitting, all 15 turbines were searched at least once every 3 days. During the 2020 surveys, 837 turbine searches were completed. Twenty-one bird carcasses were found. Twelve bird carcasses (57% of all bird carcasses) were found incidentally outside of a scheduled turbine search day. Ten of these incidental bird carcasses were found at the Operations and Maintenance building by the Plant manager on September 18, one was found during a supplemental turbine sweep during the same day, and one was found during a scavenger trial check on October 4. Twenty-six bat carcasses were found. One live bat was found on August 22 and was monitored, given water, and released the same day. Ten bird species and 5 bat species were documented.

In both 2018 and 2020, there were no federally or state-listed endangered or threatened bird species found. Two bird species of Vermont Greatest Conservation Need were found in 2020: bay-breasted warbler (***Setophaga castanea***; n = 3) and black-throated blue warbler (***Setophaga caerulescen;*** n = 1). There were no federally listed endangered or threatened bat species found in either monitoring year. One state-endangered bat species, little-brown bat (***Myotis lucifugus***; n = 1) was found in 2020. All other bats identified are species of Vermont Greatest Conservation Need: hoary bat (***Lasiurus cinereus***; n = 15), silver-haired bat (***Lasionycteris noctivagans***; n = 5), big brown bat (***Eptesicus fuscus***; n = 3), eastern red bat (***Lasiurus borealis***; n = 1), and little brown bat.

Fatality data, searcher efficiency trial data, and carcass persistence data were used to estimate bat and bird fatality rates (with and without a correction factor for area searched) using the Huso fatality estimator.

Searcher efficiency for bats and birds was 70% and 54%, respectively, and carcass persistence for bats and birds was 16.78 days and 5.27 days, respectively. Based on the Huso Estimator, estimates of bat and bird fatality were 2.53 bats and 0.56 birds per turbine (with area corrections). Estimates of bat and bird fatality by rated power were 1.27 bats and 0.30 birds per MW per period (with area corrections).

The estimates of bat and bird fatality at the Project is at the low end of the range of other standardized post-construction wind energy studies in the northeast (0.18 to 63.90 bats/turbine/period and 0.29 to 27.40 birds/turbine/period). The 2020 bat fatality estimate at Deerfield (2.53 bats/turbine/period) is at the low end of the range of other Vermont sites such as Georgia Mountain Community Wind (Georgia), Kingdom Community Wind (Kingdom), and Sheffield Wind Facility (Sheffield), which ranged from 1.94 to 14.65 bats/turbine/period. The 2020 bird fatality estimate at Deerfield (0.56 birds/turbine/period) is lower than the range of those at Georgia, Kingdom, and Sheffield, which ranged from 2.13 to 13.17 birds/turbine/period.

Bat fatality rates at the Project are lower compared to those reported for the Northeast region (median = 3.99 bats/MW/period) and nationally (median = 3.01 bats/MW/period) (AWWI 2020a). Bird fatality rates across the Northern Forest region, which include New England and portions of the upper Midwest, are slightly lower than those of other regions (AWWI 2020b). Bird fatality rates at the Project in 2020 are lower compared to the Northern Forest region (median = 1.43 birds/MW/period) and nationally (median = 1.26 birds/MW/period) (AWWI 2020b).

The most common species documented at the Project are hoary bats (n = 15, 56%), though such small impacts (2.53 bats/turbine/period, or 38 bats over the whole study period) are unlikely to have a significant effect on the species. The impact of 0.56 birds/turbine/period, or 9 birds/period at Project turbines, is small considering the regional populations of the species of birds that were most commonly found at the Project, including red-eyed vireo (***Vireo olivaceus***; estimated population of 130 million) and ovenbird (***Seiurus aurocapilla***; estimated population of 26 million) (PIF 2020).

1.0 INTRODUCTION

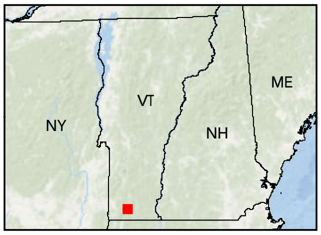
1.1 PROJECT DESCRIPTION

The Deerfield Wind Project (Project) is a 15-turbine 30-megawatt (MW) facility located in Searsburg and Readsboro, Bennington County, Vermont (Figure 1-1). The Project was issued a Certificate of Public Good by the Vermont Public Service Board in 2009 and a Record of Decision (ROD) by the United States Forest Service in 2012. The January 2012 ROD (USDA 2012) approved a Special Use Permit for construction of the Project in the Green Mountain National Forest (GMNF). The Project is operated by Deerfield Wind, LLC (Deerfield Wind), a subsidiary of Avangrid Renewables, LLC. The Project consists of 8 Gamesa G97 turbines with 97-meter (m) rotor diameters, and 7 Gamesa G87 turbines with 87-m rotor diameters. The Project became operational in late 2017.

The maximum rotor-swept height of the turbines is 126.5 m (415 feet [ft]), with a rotor diameter of 97 m (318 ft) and a hub height of 78 m (256 ft). Seven of the 15 turbines are lit with a single L-864 aviation red-colored synchronized flashing light mounted on top of the nacelle, which is activated by a radar-activated Federal Aviation Administration (FAA) lighting Aircraft Detection Lighting System (ADLS). Other light sources at the Project are located at the substation, which was designed with downward facing lights, sloped covers, and motion-detector activation. The use of the ADLS and motion-control substation lighting significantly decreases the amount of lighting at night at the Project.

The Project is split between two ridges: eight turbines are located on the west ridge (Gamesa G97 turbines), and seven turbines are located on the east ridge (Gamesa G87 turbines). The east ridge, located approximately 1.5 miles southeast of the west ridge, is shared with the existing 12-turbine 6-MW Searsburg Wind Energy Facility. Elevations of turbines range from 837 to 882 m (2,746 to 2,894 ft) on the west ridge and from 887 to 945 m (2,910 – 3,100 ft) on the east ridge. The west ridge is predominantly hardwood forest with American beech (***Fagus grandifolia***), red maple (***Acer rubrum***), and sugar maple (***Acer saccharum***), and the east ridge is predominantly coniferous forest dominated by spruce (***Picea*** sp.). Each ridge contains one access road, with turbines located less than 50 m (164 ft) to over 100 m (328 ft) from the road. Driveways to individual turbines consist of crushed rock.

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat\01468_1-1_Location.mxd Revised: 2019-01-14 By: gcarpentier



Legend

- Turbine Location
- Edge of Gravel/Collector

0 0.5
Miles
1:31,680 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 18N
2. Orthoimagery: NAIP 2016

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants, and agents, from any and all claims arising in any way from the content or provision of the data.

Stantec

Project Location
Searburg, Vermont

195601468
Prepared by GC on 2019-01-03
Reviewed by LJ on 2019-01-04

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
1-1

Title
Project Location Map

1.2 POST-CONSTRUCTION WILDLIFE MONITORING BACKGROUND AND OBJECTIVES

The ***Deerfield Wind Project Post-Construction Monitoring Plan: Birds and Bats*** (PCMP; Stantec 2017a) was developed in consultation with and approved by the Vermont Agency of Natural Resources (VANR) and GMNF. The PCMP incorporates recommendations provided by the GMNF in ***Recommendations for the Bird and Bat Post-Construction Monitoring Plan Deerfield Wind Project Green Mountain National Forest***, dated August 9, 2013, and additional review and comments provided by the GMNF and VANR between 2013 and 2017. The PCMP also incorporates recommendations from the most current VANR Fish and Wildlife Department Bat-Wind Guidelines (VANR 2016).

This report summarizes the methods and results of the second year of post-construction monitoring surveys at the Project. The first year of surveys was conducted in 2018. Consistent with 2018 monitoring, the objectives of 2020 monitoring were to:

- Estimate annual fatality of birds and bats at the Project;
- Investigate if there are project design characteristics (e.g., east versus west ridge), habitat or landscape features, weather conditions, or other factors that may increase risk of collision of birds and/or bats;
- Evaluate the effectiveness of operational control measures by comparing fatality at the Project to other projects in the region and investigating if and when bat fatalities were documented during the curtailment period; and
- If necessary, evaluate the effectiveness of adaptive management strategies, and modify adaptive management strategies if found to be ineffective at reducing fatalities.

2.0 METHODS

2.1 FATALITY SEARCHES

Surveys occurred between May 8 and October 15, 2020. While the PCMP states that surveys are to be initiated on April 15, VANR approved delay of the monitoring season until May 8 due to the COVID-19 pandemic in an email dated May 7, 2020. Based on fatality and weather data collected in 2018, only two birds were found prior to May 8, and site conditions during this period (snow and rain) were similar in 2018 and 2020. While it is possible that a late start missed a low number of early fatalities, it is unlikely that it significantly affected fatality estimates, since the peak of spring migration typically occurs in late May and early June. Monitoring covered the following wildlife activity periods:

- Spring and fall migration when nocturnal migrant passerines are found to be most at risk of collision, as well as the summer breeding period. Monitoring covered breeding and migration periods of bird species of conservation concern in the region, including Bicknell's thrush (***Catharus bicknelli***)

- Spring and fall migration periods of migratory raptors, as well as the summer breeding period of local raptors
- Spring dispersal, summer breeding, and late-summer and fall swarming period for bats

Stantec conducted turbine searches at all 15 turbines once every 3 days. If a scheduled search could not be conducted due to weather, turbine maintenance, or construction activities, it was visited later that day or the next day, as feasible.

Search areas included the same 120-m by 120-m (394-ft by 394-ft) plots (60 m [197 ft] distance from the towers) as 2018 surveys; areas that were unsafe for surveyors (e.g., steep slopes, hazardous walking conditions) and areas with dense vegetation (e.g., forest, thick and tall brush) were not searched. Search areas at the Project are consistent with those at other ridgeline wind facilities in New England since the landscape generally consists of densely forested areas and the search plots contain minimal cleared area. Transects spaced 6 m (20 ft) in width were established within search plots, oriented north-to-south and perpendicular to the dominant wind direction (west-to-east). Transects were numbered and marked with flagging on rocks or trees for easy navigation and consistency of search area. Upon initial site visit and plot boundary mapping in 2018, Stantec determined that the searchable areas cleared of forest were variable and occasionally limited in size; therefore, a search radius out to a maximum of 120 m on adjacent access roads was included where possible to maximize the amount of searchable area. Upon initial site visit in 2020, Stantec refreshed turbine transect markings that had been established in 2018, including search areas surrounding turbines and portions of access roads searched in 2018. Search plot areas are provided in Appendix B.

Surveyors were trained by a Stantec project manager and field lead experienced in conducting and managing post-construction monitoring surveys. Searches began at sunrise and continued until early afternoon. Search order on each turbine string varied during each search day so that any one turbine would not be searched during the same time during consecutive search days. During searches, the surveyors walked slowly (at a rate of approximately 10 to 20 m/minute) along each transect searching up to 3 m (10 ft) on both sides for bird or bat fatalities. Any fatality found along or between transects was documented. All intact bird or bat carcasses or remnants of scavenged carcasses (a cluster of feathers representing more than a molt, or a patch of skin and bone) were documented as fatalities. Carcasses found outside of standardized search times, or outside defined search areas, were considered incidental.

In addition to standard turbine plot searches, surveyors also searched driveways extending from the access road to each turbine. The driveway searches were an extension of turbine plots where turbine plot size was limited and were conducted using the same methods as the turbine plot searches. Carcasses found on turbine driveways were documented and treated the same as those found on the turbine plots.

For each carcass found, multiple distinguishing photographs were taken, and the following information was recorded on standardized datasheets:

- Turbine number
- Carcass distance from turbine (determined with a laser range finder)
- Carcass azimuth from turbine (compass reading)

- Date
- Surveyor
- Time discovered
- Ground conditions (vegetation type and height, wet, dry, etc.)
- Species identification (including age and sex when possible)
- Carcass position
- Stage of decomposition of the carcass (fatality estimated to occur on previous night, in the last 2 to 3 days, 4 to 7 days, 7 to 14 days, or greater than 2 weeks)
- Evidence of scavenger activity
- Additional notes as necessary

Each carcass was collected in an individual re-sealable plastic bag marked with a unique carcass identification number and stored in a freezer at the Project Operations and Maintenance (O&M) building. Stantec's post-construction field lead or project manager (both experienced wildlife biologists) confirmed identification of carcasses collected by surveyors through photographs.

Weather information such as sky conditions and precipitation were recorded prior to each turbine search. On nights prior to scheduled searches, the surveyors recorded weather conditions including sky conditions, percent cloud cover, and moon phase from a nearby location. Operations data and weather including wind speed (m per second [m/s]) and temperature (degrees Celsius [°C]), were obtained from archived weather data from stations on turbine nacelles at the Project for the survey period.

2.2 VEGETATION MAPPING

Ground cover types within plots were characterized by visibility class as designated in Table 2-1Table 2-1. Ground Cover Visibility Class Descriptions (Based on PGC 2007, as described in Arnett et al. 2010), Deerfield Wind, 2020., and the dominant visibility class was recorded during each turbine search. Any significant changes in ground cover type were noted throughout the survey period (e.g., reclamation, mowing). The aerial extent of each cover type within search plots was mapped using a global positioning system unit once during the 2018 survey period and updated during the 2020 survey period to account for vegetation growth.

Table 2-1. Ground Cover Visibility Class Descriptions (Based on PGC 2007, as described in Arnett et al. 2010), Deerfield Wind, 2020.

Visibility Class	% Vegetative Cover	Vegetation Height
1 (easy)	≥ 90% bare ground	≤ 6 inches
2 (moderate)	≥ 25% bare ground	≤ 6 inches
3 (difficult)	≤ 25% bare ground	≤ 25% of cover > 12 inches
4 (very difficult)	< 5% bare ground	> 25% of cover > 12 inches

2.3 SEARCHER EFFICIENCY TRIALS

Searcher efficiency trials were conducted to quantify the percent of carcasses observed by searchers during standardized surveys. The study targeted the placement of 50 bird carcasses and 50 bat carcasses throughout the survey period. The same individual trial carcasses were re-used in multiple trials over the course of the survey period until they became too decomposed. Due to the limited number of fatalities found onsite and additional bat and bird carcasses obtained from VANR, 4- to 5-week-old domestic quail obtained from a feed supply lab were used as surrogates for birds.

The trial coordinator placed carcasses at search turbines prior to sunrise on the day of scheduled searches. Surveyors being tested were unaware of trial dates and locations, and the trial coordinator tried to leave no evidence of trial set-up (e.g., vehicle or footprints in wet grass or mud). Carcasses were marked discreetly so they could be identified as trials upon inspection and were placed in search plots at arbitrary distances and azimuths from turbines and distributed among representative visibility classes. The trial coordinator recorded the following information for each carcass placed:

- Date, time of set-up, and surveyors being tested
- Turbine number
- Species identification
- Carcass distance and direction from tower
- Vegetation type and visibility class where carcass was placed

Trial carcasses found by the surveyors were documented, and the trial coordinator was notified. After all scheduled turbine searches were completed, the trial coordinator picked up any carcasses not found by the surveyors and determined the number of carcasses recovered during the trial or if any carcasses had been scavenged during the trial.

2.4 CARCASS PERSISTENCE TRIALS

Carcass persistence trials were conducted to determine the percent of carcasses that remained visible (i.e., not removed by scavengers or weather) between search intervals. The study targeted the placement of 50 bird carcasses and 50 bat carcasses throughout the survey period, in good disposition. Due to the limited number of fatalities found onsite and additional bat and bird carcasses obtained from VANR, 4- to 5-week-old domestic quail obtained from a feed supply lab were used as surrogates for birds. VANR supplied carcasses of native species; native species are presumed to provide more realistic carcass persistence data (DeVault et al. 2017).

Trial carcasses were randomly placed at multiple turbines throughout the study area and were checked daily for 14 days. On each trial day, surveyors indicated whether the trial carcass was present (intact, or partially scavenged but readily detectable) or absent (completely removed, or with so few feathers or tissue that it would not be readily detectable). The following additional information was recorded on standardized datasheets for each trial carcass:

- Date, time of set-up, trial coordinator
- Turbine number
- Species identification
- Carcass distance and direction from tower
- Ground cover type and vegetation height where carcass was placed
- Detailed notes describing any scavenging, evidence of scavenger identification, and stage of decomposition

2.5 OPERATIONAL CONTROL

Per ROD and State Takings Permit conditions, operational control measures were implemented for 122 nights from June 1 to September 30, 2020, except for a 3-week period in august when a sensor was down presumably struck by lightning during a passing storm. The Supervisory Control and Data Acquisition (SCADA) system was programmed to incorporate curtailment treatments into nightly operation. Treatments were implemented from one half hour before sunset to sunrise during periods when ambient air temperature was greater than 10°C and wind speeds were equal to or less than 6 m/s. Curtailment was achieved by switching all the turbines into a “pause mode” to prevent normal turbine operations, when blades would rotate at a rate less than or equal to 1 revolution per minute (RPM). Once criteria for one of the weather conditions (i.e., temperature or wind speed) stopped being met for a total of 10 consecutive minutes, the turbines returned to normal operations.

2.6 STATISTICAL ANALYSIS

2.6.1 Temporal Distribution

Seasonal timing of bat and bird fatalities were summarized in tabular and graphical format.

2.6.2 Spatial Distribution

The range of distances that birds and bats were found from the towers, the average distances birds and bats were found from towers, and the dispersion of fatalities at turbines on east versus west ridges were summarized. The distances and azimuths of carcasses from towers were plotted on a scatterplot diagram within 10-m concentric distance increments. A ridge profile figure showing the elevations and numbers of fatalities at each turbine was also prepared.

2.6.3 Weather Conditions and Fatality Events

The weather conditions for nights when collisions were believed to have occurred (i.e., for nights following which fresh carcasses or live individuals were found) were summarized, including:

- Nightly mean wind speed (m/s)[1];
- Nightly mean temperature (ºC)[2];
- Moon phase[3]; and
- Sky conditions (precipitation events)[4].

The average nightly wind speed and temperature were also plotted for each night when fatalities were believed to have occurred.

2.6.4 Operational Control and Fatality Events

The following summaries were prepared to address survey objectives specified in the PCMP:

- Timing of bat fatalities during the curtailment period (June 1 to September 30, 2020)
- Weather conditions for the night prior to fresh carcass discovery from the specific turbine where a carcass was found
- Effectiveness of operational control measures, which was evaluated by comparing fatality at the Project to other projects in the region

2.6.5 Bat and Bird Fatality Estimates

The Huso estimator, developed in 2010 (and updated in 2012) based on Thompson (1992), is one of the leading methods for developing fatality rates in the United States and is available in a U.S. Geological Survey software application. This estimator has been developed and thoroughly tested with simulated data by leading statisticians and is geared specifically for estimating fatalities at wind turbines. The model is suitable for fatality studies because it is stochastic, meaning it can generate estimates of probability distributions of potential results by allowing for random variation in 1 or more model inputs over a period of time. As such, the Huso estimator was used to estimate fatality at the Project in 2018 and again in 2020. Only carcasses found during standardized turbine searches were included in estimates of fatality due to bias that may be introduced into the model by carcasses found incidentally. Injured birds and bats found during searches were also included in fatality estimates. A detailed description of the software is available in Huso (2010) and Huso et al. (2012). The software, available at http://pubs.usgs.gov/ds/729/, was run with the statistical program R (R Core 2016; Korner-Nievergelt et al. 2015).

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[1] Data were downloaded from weather stations on the nacelles of turbines in the Project area.
[2] Data were downloaded from weather stations on the nacelles of turbines in the Project area.
[3] Data were downloaded from www.wunderground.com for the nearest weather station (VTW04; Searsburg, VT).
[4] Data were recorded nights prior to searches by observers at a location proximal to the Project.

The Huso estimator assumes carcass equilibrium between search intervals, where all carcasses are either found by searchers or scavenged prior to the next search (M. Huso, U.S. Geological Survey, personal communication). The estimator assumes a zero probability of searchers observing a carcass on a subsequent search if it was missed on the first search. However, field data indicate that some carcasses do persist on the ground for longer than a single interval and that searchers find some of these carcasses. To account for this bias in the model, Huso recommends that only those carcasses that died since the previous search (based on stage of decomposition) be input into the model. Otherwise, the software could overestimate fatality rates because the proportion of older carcasses are separately accounted for in the measurement of searcher efficiency (i.e., if searcher efficiency is determined to be 50% then there is a 50% probability of a carcass being missed on the first search). Therefore, only carcasses believed to have died since the last turbine search were input into the model for this analysis.

The formula for Huso's model is available in Bernardino et al. (2013):

$$\hat{M} = \frac{1}{\pi} \frac{C}{p\left[\frac{\bar{t}(1-e^{-i/\bar{t}})}{d}\right] v}$$

- $\hat{M}$ is the estimated dead animal population size (including variance parameters);
- C is the actual (unadjusted) number of dead animals found;
- π is defined as the product of the proportion of actual fatalities contained in the searchable area of the plot, and the probability of including that plot in the sample;
- p is the average probability that the carcass is detected by the searchers;
- $\bar{t}$ is the mean carcass persistence time;
- d = min(i, $\tilde{i}$), with $\tilde{i}$ representing the length of time beyond which the probability of a carcass persisting is ≤ 1% (i.e., $\tilde{i}$ is such that P[T > $\tilde{i}$] ≤ 0.01);
- $\tilde{i}$ can be estimated as $\tilde{i}$= -log(0.01)x$\bar{t}$ (based on an exponential distribution [e]);
- v is the effective search interval, where v = min (1, $\tilde{i}$ / i), with i representing the interval between searches (i is measured in days).

Because turbine towers were not centered within turbine clearings at the Project, and due to the narrow ridgeline, carcasses may have landed over forested areas. To account for this, the empirical distribution of bird and bat carcass distances was determined to apply a density-weighted proportion (DWP) area searched value in the model (the value for *π*). Area corrections were based on methods proposed by Korner-Nievergelt et al. (2015) and Huso and Dalthorp (2014), which assume that carcass density decreases with distance from turbine, and unsearched area increases with distance from turbine. The proportion of the total birds and bats found during searches was determined per 10-m concentric distance increment radiating out from tower bases. The proportion of the area that was searchable (i.e., not cut off by forest edge) within each of these distance bands was determined. The percent area searched per distance band was multiplied by the proportion of bat and bird carcasses found within each distance band to find a DWP value per distance band. The DWP value for each band was summed to find a value for each turbine for birds and for bats. Turbine-specific DWP values were input into the model to adjust the number of carcasses by the proportion of carcasses found within the proportion of the plots that was searchable. This DWP analysis provides a per-turbine adjustment for the total number of bird and bat carcasses that would have been found out to 120 m from the turbine (the maximum distance searched from towers along turbine access roads or pad), had that entire area at each plot been available to be searched. It should be noted that a small sample size of carcasses found does not allow for a robust estimate of DWP.

For the Huso estimator to calculate estimates of fatality for birds and bats separately, a sample size of at least 10 bird and 10 bat carcasses for both the searcher efficiency and carcass persistence trials is required. The results of searcher efficiency trials were input into the model as 1 (if trial carcass was found) and 0 (if trial carcass was not found). These values are distributed as binary random variables within the model, with ‘Found’ indicated by the highest numeric value. A generalized linear model of the binary response is fit to the data, with a modeled response of $\log_e$ (odds of observing a carcass = $\log_e$ (p/1-p)).

The results of carcass persistence trials were input into the model based on the following trial outcomes:

- Carcass gone at first check on ‘Day 1’ of trial, left censoring = 2
- Carcass still present (visible) on last day of trial, right censoring = 0
- Carcass was removed between checks, interval censoring = 3

Carcass persistence times are modeled with a log-linear parametric accelerated failure time model and are assumed to follow a probability distribution. When persistence time is not known or is censored, the model is appropriately modified. Each time the model is run, one of the following distributions of carcass persistence must be selected by the user for the model: Exponential, Loglogistic, Lognormal, or Weibull. Huso recommends running trials of the dataset with each distribution to compare values of Akaike information criterion (AIC), the measure of the relative goodness of fit of the model, where ***k*** is the number of parameters in the statistical model, and ***L*** is the maximized value of the likelihood function for the estimated model.

$$AIC = 2k - \ln(L)$$

The preferred distribution for the model is the one with the minimum AIC value. For this analysis, carcass persistence was modeled using Lognormal distribution for bats and Loglogistic distribution for birds.

Because detection bias, persistence bias, and proportion of carcasses within search areas are estimated, the Huso estimator uses a bootstrapped estimate of variance based on methods proposed by Erickson et al. (2004), where the fatality adjustment (π) and total fatality (***M***) are calculated for each bootstrapped sample. This analysis used 5,000 bootstrap resample iterations, as recommended by Huso et al. (2012). The alpha value was defined as 0.05; therefore, all confidence intervals were calculated at 95%.

3.0 RESULTS

3.1 SURVEY EFFORT AND SEARCH PLOT VISIBILITY

Stantec conducted 837 turbine searches from May 8 to October 15, 2020. No searches were missed during this timeframe due to turbine maintenance, weather conditions, or other factors.

Visibility class, project attributes (FAA lighting and elevation) and size of searchable areas within plots are described in Table 3-1. The average visibility class within search plots on the east ridge was 2 (moderate) throughout the survey period, and the average visibility class within search plots on the west ridge was 2 to 3 (moderate to difficult), as grass grew throughout the survey period. The majority (75%) of search areas consisted of grass and included portions of areas with bare cover and large rocks. Appendix B Figures 1 through 15 show the search plot boundaries and ground cover at each search turbine.

Table 3-1. Description of Search Turbines, Deerfield Wind Project, 2020.

Turbine No.[1]	FAA Lighting	Primary Visibility Class[2]	Elevation (m)	Search Area (m^2)	Search Area Ground Cover Description
E1	Y	2	919	2,860	64% grass, 27% bare cover, 9% large rocks
E2	N	2	887	3,095	61% grass, 23% bare cover, 16% large rocks
E3	N	2	906	3,508	64% grass, 23% bare cover, 13% large rocks
E4	Y	2	914	3,385	70% grass, 22% bare cover, 8% large rocks
E5	N	2	945	4,286	74% grass, 21% bare cover, 6% large rocks
E6	N	2	940	10,529	88% grass, 12% bare cover
E7	Y	2	930	3,210	71% grass, 22% bare cover, 7% large rocks
W1	Y	2-3	839	4,925	77% grass, 23% bare cover
W2	Y	3	837	3,445	69% grass, 25% bare cover, 6% large rocks
W3	N	3	846	4,373	73% grass, 27% bare cover
W4	N	3	877	4,741	78% grass, 22% bare cover
W5	Y	2-3	850	5,900	76% grass, 20% bare cover, 5% large rocks
W6	N	2-3	845	4,083	82% grass, 16% bare cover, 1% large rocks
W7	N	2-3	879	2,723	74% grass, 19% bare cover, 7% large rocks
W8	Y	2-3	882	3,023	68% grass, 19% bare cover, 13% large rocks

[1] E = east ridge; W = west ridge.

[2] Ground cover visibility class descriptions based on PGC 2007, as described in Arnett et al. 2010.

3.2 BIRD AND BAT FATALITIES

There were 21 birds found, 9 of which were found during standard searches. Twelve bird fatalities were found incidentally by Stantec and operations staff and were not included in fatality estimates. There were 10 species found, all of which were passerines. Red-eyed vireo (***Vireo olivaceus***) was the species most commonly found (n = 6; 29%), followed by bay-breasted warbler (***Setophaga castanea***) and ovenbird

(***Seiurus aurocapilla***) (n = 3; 14% each). Ten of the incidental bird fatalities were found at the O&M building by operations staff on September 18. After notification of the incidental fatalities, Stantec conducted spot checks at turbines that day and determined that it was not a facility-wide event (Table 3-2; Appendix A Table 1).

Twenty-seven bats were found, including hoary bat (***Lasiurus cinereus***; n = 15, 56%), silver-haired bat (***Lasionycteris noctivagans***; n = 5, 19%), big brown bat (***Eptesicus fuscus***; n = 3, 11%), and eastern red bat (***Lasiurus borealis***; n = 1, 4%). One ***Myotis*** species was found, little brown bat (***Myotis lucifugus;*** n = 1, 4%), and two bats were found that could not be identified to species. One unidentified bat was too desiccated to determine species identification, and one was discovered with no flesh or fur (i.e., bones only). Forearm measurements taken onsite for both unidentified bats (50 mm and 47 mm) ruled out ***Myotis*** species (Table 3-2; Appendix A Table 2). Three of the bat species found (silver-haired bat, hoary bat, and eastern red bat) are tree-roosting bats, and two species (big brown bat and little brown bat) commonly roosts in caves or rock structures. All bats were found during standard searches. One of the hoary bats found was alive on the ground and was monitored and released the same day by Stantec[5].

Table 3-2. Total Number and Species Composition of Bird and Bat Carcasses Discovered at Deerfield Wind Project, 2020.

Species		No. Carcasses	% of Carcasses
Birds			
red-eyed vireo	***Vireo olivaceus***	6	29%
bay-breasted warbler	***Setophaga castanea***	3	14%
ovenbird	***Seiurus aurocapilla***	3	14%
common yellowthroat	***Geothlypis trichas***	2	10%
golden-crowned kinglet	***Regulus satrapa***	2	10%
American redstart	***Setophaga ruticilla***	1	5%
black-throated blue warbler	***Setophaga caerulescens***	1	5%
black-throated green warbler	***Setophaga virens***	1	5%
scarlet tanager	***Piranga olivacea***	1	5%
Tennessee warbler	***Oreothlypis peregrina***	1	5%
	Total Birds	**21**	**100%**
Bats			
hoary bat	***Lasiurus cinereus***	15	56%
silver-haired bat	***Lasionycteris noctivagans***	5	19%
big brown bat	***Eptesicus fuscus***	3	11%
unidentified non-***Myotis*** bat	***n/a***	2	7%
eastern red bat	***Lasiurus borealis***	1	4%
little brown bat	***Myotis lucifugus***	1	4%
	Total Bats	**27**	**100%**

[5] The bat found live on the ground is counted as a fatality when running the Huso fatality estimator, since it was found during turbine searches.

There were no federally or state-listed endangered or threatened bird species found (VFWD 2015a). Two bird species of Vermont Greatest Conservation Need were found—bay-breasted warbler (n = 3) and black-throated blue warbler (***Setophaga caerulescen;*** n = 1)—both of which are listed as medium priority in Vermont (VFWD 2015b).

There were no federally listed endangered or threatened bat species found. One state-endangered species, little-brown bat (n = 1) was found (VFWD 2015a). All bat species found are species of Vermont Greatest Conservation Need. Little brown bat, hoary bat, silver-haired bat, and eastern red bat are listed as species of high priority in Vermont, and big brown bat is listed as a species of medium priority (VFWD 2015b).

Based on carcass condition, most birds found (n = 13, 62%) were estimated to have died the night prior to discovery, 11 of which were found on a single day, September 18. Most bats found (n = 14, 52%) were estimated to have died between 2 and 3 days prior to discovery (Table 3-3).

Table 3-3. Summary of Estimated Time of Death for Bird and Bat Carcasses Found at Deerfield Wind Project, 2020.

Species Type	Estimated Time of Death	Number of Carcasses	Percent of Carcasses
Birds	last night	13	62%
	2–3 days	2	10%
	4–7 days	4	19%
	7–14 days	1	5%
	2+ weeks	1	5%
Bats	last night	6	22%
	2–3 days	14	52%
	4–7 days	1	4%
	2+ weeks	3	11%
	1+ month	1	4%
	unknown	1	4%
	n/a (found alive)	1	4%

3.3 SEASONAL TIMING OF FATALITIES

The majority of birds were found during the month of September (n = 11, 52%), followed by June (n = 4, 19%), which is consistent with the timing of seasonal migration. The 11 birds found during September were found incidentally on September 18, 10 of which were found at the O&M building (Table 3-4; Figure 3-1; Appendix A Table 1).

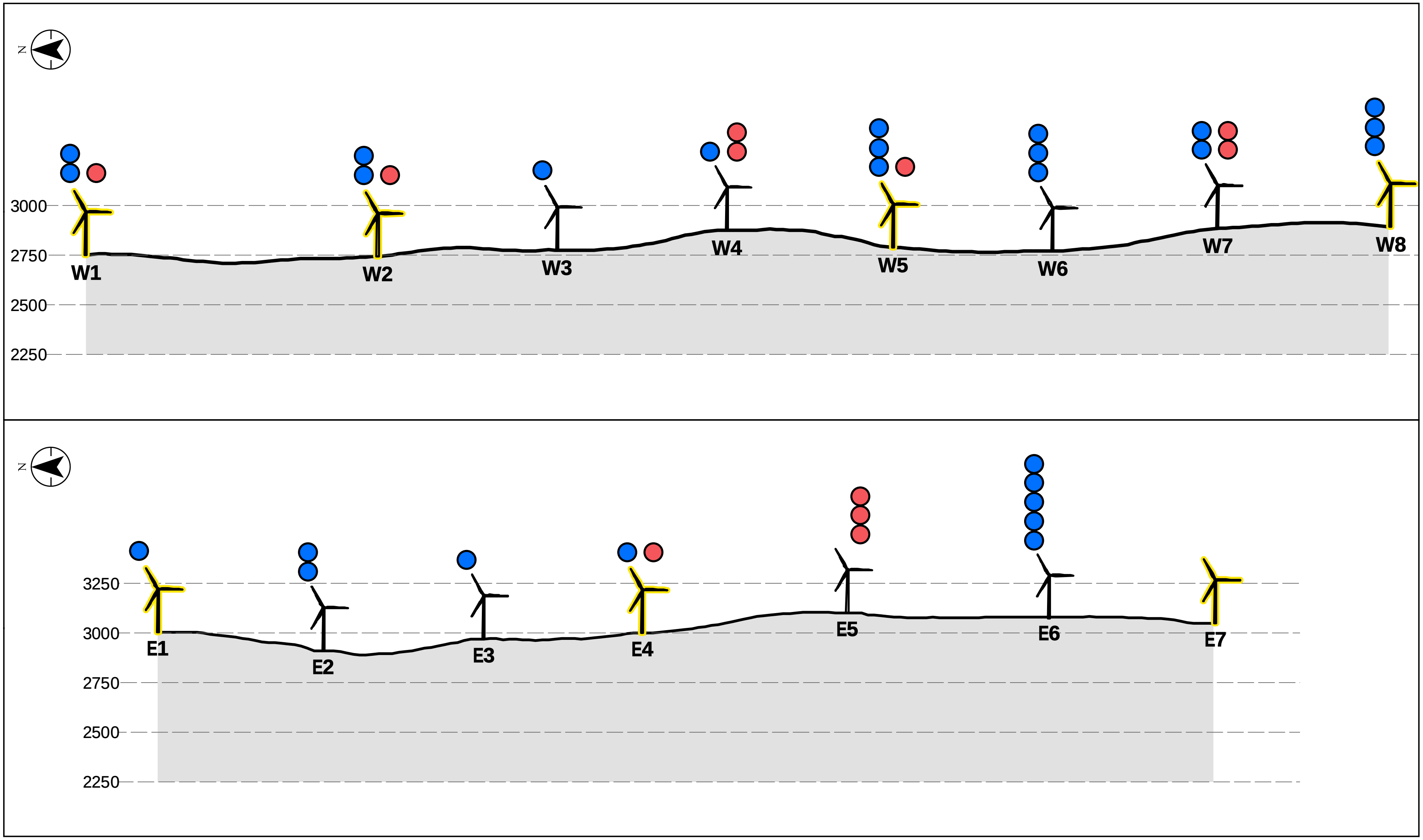
Table 3-4. Seasonal Timing of Bird Fatalities, Deerfield Wind Project, 2020.

Month	No. Birds	% Total
May	2	10%
June	4	19%
July	0	0%
August	2	10%
September	11	52%
October	2	10%
Total	**21**	**100%**

The majority of bats were found in August (n = 13, 48%), followed by September and June (n = 4, 15% each) (Table 3-5; Figure 3-1; Appendix A Table 2).

Table 3-5. Seasonal Timing of Bat Fatalities, Deerfield Wind Project, 2020.

Month	No. Bats	% Total
May	3	11%
June	4	15%
July	1	4%
August	13	48%
September	4	15%
October	2	7%
Total	**27**	**100%**



0 750 Feet

Horizontal and Vertical Scale
1:9,000 (At original document size of 8.5x11)

Notes
1. Digital elevation profile derived from USGS NED 1/3 arc-second digital elevation model.

Legend
1 Bat Carcass
1 Bird Carcass
Turbine Profile
FAA Lit Turbine

Stantec

Project Location 195601468
Searburg, Vermont
Prepared by HT on 2020-11-18
TR Review by GC on 2020-11-18
IR Review by LJ on 2020-11-18

Client/Project
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
3-1

Title
Ridgeline Profile and Distribution of Fatalities 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat2020\01468_3-2_ProfileFatalities2020.mxd Revised: 2020-11-18 By: hturner

3.4 SPATIAL DISTRIBUTION OF FATALITIES

The number of birds found at individual turbines ranged from 0 birds (Turbines W3, W6, W8, E1, E2, E3, E6, and E7) to 3 birds (Turbine E5), and 10 birds were found incidentally at the O&M building by operations staff. Birds found at the O&M building were found between 3 and 14 m from the structure, either near a fence or in the back field. Bats found at individual turbines ranged from 0 bats (Turbines E5 and E7) to 5 bats (Turbine E6). Eighty-one percent of birds (n = 17), including 10 birds found incidentally at the O&M building, and 63% of bats (n = 17) were found on the west ridge. Among fatalities found at turbines, 36% of birds (n = 4) and 44% of bats (n = 12) were found at FAA lit turbines (Figure 3-1).

Figure 3-2 shows the locations of birds and bats found within search plots at 10-m distance increments from tower bases. Bat fatalities were found in all 4 quadrants of the search plots, and bird fatalities were found in the northwest, northeast, and southeast quadrants. The bird located 59 m (194 ft) from the turbine base was found on the road leading up to the turbine driveway and was reported as an incidental find (Figure 3-2).

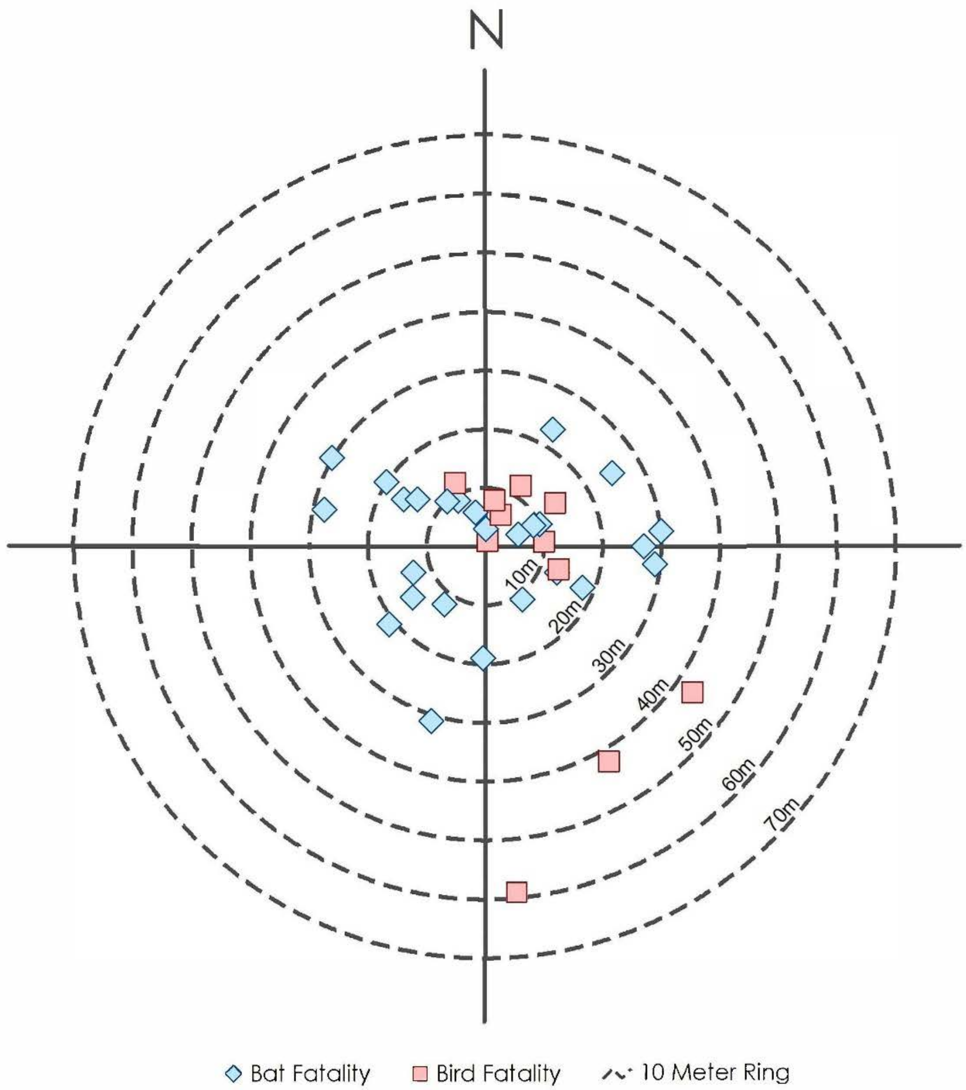


Figure 3-2. Distribution of Bats and Birds Found at Deerfield Wind Project, 2020. (Turbine plots consisted of 120 m by 120 m plots [60-m radius], and a 120 m radius on adjacent access roads, where possible).

3.5 CARCASS DISTANCES FROM TOWERS

The distance birds were found from turbine bases ranged from <1 to 59 m (<1 to 194 ft); the average distance birds were found from turbine bases was 22 m (72 ft). The distances that bat carcasses were found from turbine bases ranged from 3 to 31 m (10 to 102 ft); the average distance bat carcasses were found from turbine bases was 15.8 m (52 ft). Figure 3-3 shows the distribution of bird and bat carcasses found within 10-m distance increments from turbine bases. Seventy-three percent of bird carcasses found at turbines and 96% of bat carcasses found at turbines were found 30 m (98 ft) or less from turbines.

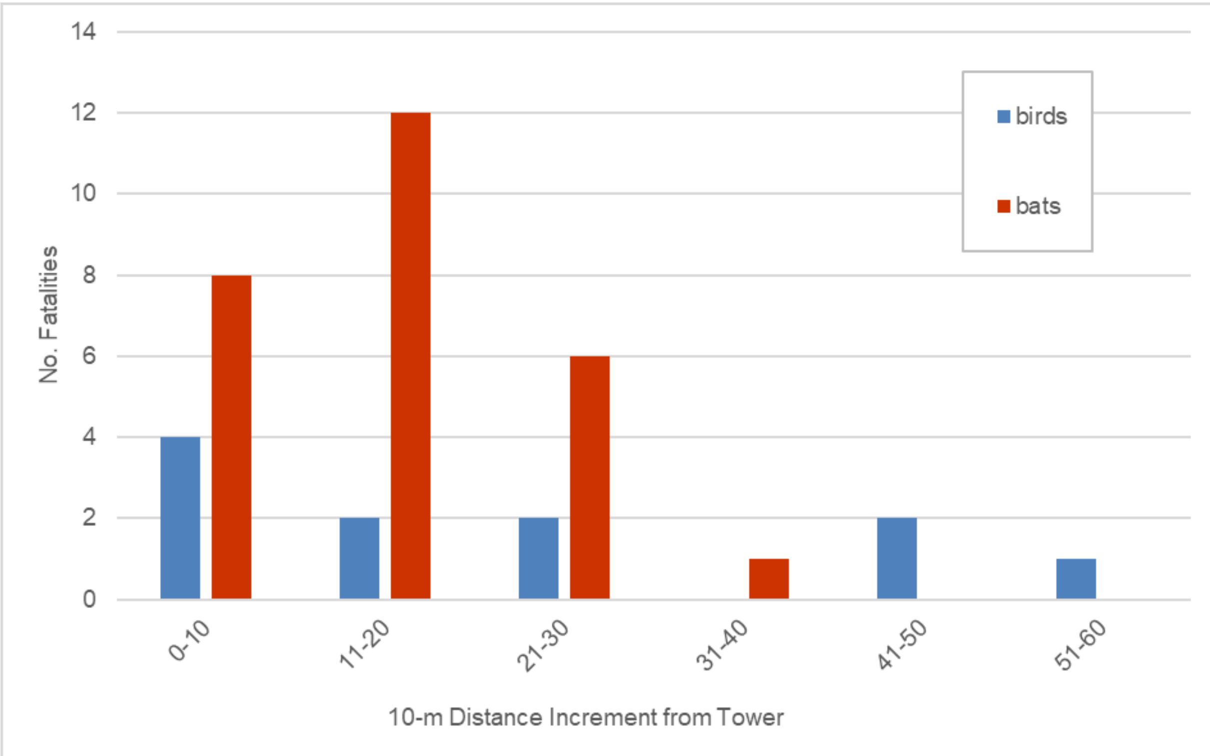


Figure 3-3. Distribution of Bird and Bat Carcasses Found in 10-m Distance Increments from Towers, Deerfield Wind Project, 2020.

3.6 WEATHER CONDITIONS AND FATALITY EVENTS

There were three nights for which bird fatalities were suspected to occur (carcasses were found fresh the next day). The mean nightly wind speed for these nights ranged from 2.9 to 8.3 m/s and the mean nightly temperature for these nights ranged from 4.4 to 10.3°C. Moon phase was variable among these nights. The night prior to the discovery of 11 bird carcasses (10 of which were discovered at the O&M building), September 17, was mostly cloudy to overcast and foggy (Table 3-6).

There were seven nights for which bat fatalities were suspected to occur (carcasses were found fresh or bat was found alive on the ground the next day). The mean nightly wind speed for these nights ranged from 3.6 to 9.9 m/s and the mean nightly temperature for these nights when temperature data was available ranged from 0.9 to 17.2ºC. Moon phase was variable among these nights, and two of these nights (29%) were characterized by either thunderstorms or a severe thunderstorm watch (Table 3-6). Figure 3-4 shows the suspected night of bird and bat fatality at the Project with average nightly weather conditions during the study period.

Table 3-6. Date of suspected mortality and weather conditions for birds and bats found in excellent condition, Deerfield Wind Project, 2020.

Date Found	Suspected Date of Collision	No. Bats and/or Birds	Nightly Mean Wind Speed (m/s)[1]	Nightly Mean Temperature (˚C)[1]	Moon Phase[2]	Sky Conditions / Precipitation[3]
Birds						
9/18/2020	9/17/2020	11 birds[4]	2.9	10.3	new moon	mostly cloudy to overcast, low clouds, fog
10/4/2020	10/3/2020	1 bird[5]	5.1	4.4	waning gibbous	clear
10/12/2020	10/11/2020	1 bird	8.3	4.8	waning crescent	clear
Bats						
5/30/2020	5/29/2020	1 bat	9.9	17.2	first quarter	mostly cloudy, severe thunderstorm watch
6/29/2020	6/28/2020	1 bat	3.6	0.9	first quarter	overcast, thunderstorms
8/13/2020	8/12/2020	1 bat	4.3	not available[6]	last quarter	mostly clear
8/16/2020	8/15/2020	1 bat	7.5		waning crescent	overcast
8/18/2020	8/17/2020	1 bat	5.6		waning crescent	mostly cloudy
8/22/2020	8/21/2020	1 bat (live)	8.6		waxing crescent	partly cloudy
10/6/2020	10/5/2020	1 bat	5.4	9.5	waning gibbous	partly cloudy

[1] Data were downloaded from weather stations on nacelles of turbine towers.

[2] Data were downloaded from www.wunderground.com for the nearest weather station (VTW04; Searsburg, VT).

[3] Data were recorded nights prior to searches by observers at a location proximal to the Project.

[4] All were incidental carcasses, 10 of which were found at the O&M building.

[5] Incidental carcass, found on road 59 m from turbine.

[6] Temperature sensor malfunctioned, presumably as a result of a lightning strike.

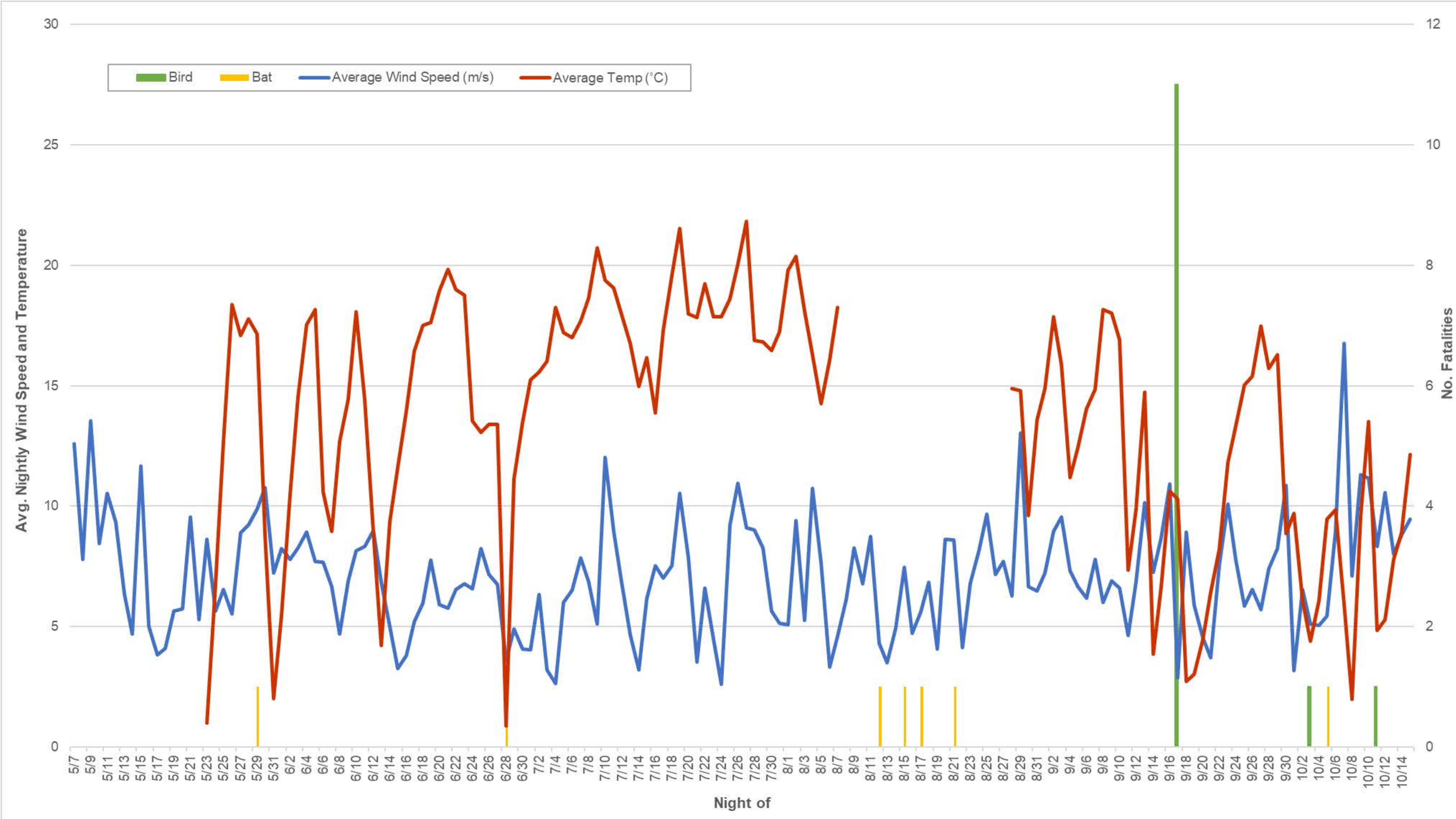


Figure 3-4. Timing and Number of Bird and Bat Carcasses Found in Relation to Average Nightly Wind Speed and Air Temperature, Deerfield Wind Project, 2020.

3.7 OPERATIONAL CONTROL AND FATALITY RESULTS

Turbines at the Project were curtailed from 30 minutes prior to sunset to sunrise from June 1 to September 30, 2020, at temperatures above 10°C and wind speeds equal to or below 6 m/s. This meets the requirements set by the PCMP, the ROD, and State Permit, except for three weeks in August where the curtailment system was not functioning correctly due to a temperature sensor malfunction presumably as a result of a lightning strike. Operational control is a well-documented and effective method for reducing bat fatalities at wind facilities. Aside from a brief period in August when equipment malfunctioned due to a ligtning strike, curtailment was implemented to meet the purpose of reducing bat fatalities. This is reflected in the results from the second year of Deerfield monitoring, for which the Project documented bat fatality rates on the lower end of the range at other northeastern projects (see Appendix A Table 3).

3.8 ESTIMATES OF FATALITY

3.8.1 Searcher Efficiency Results

Searcher efficiency trials were conducted throughout the study period and were conducted on the following dates:

- 5/19/2020
- 5/20/2020
- 6/28/2020
- 6/29/2020
- 7/27/2020
- 8/24/2020
- 8/25/2020
- 9/17/2020

Fifty-one bats were placed for all searcher efficiency trials combined; however, 50 remained available for the trials, as 1 was scavenged prior to searches (Table 3-7). The mean searcher efficiency rate for bats was 70%, which is within the range of 42% to 91% found at other New England projects (Stantec 2009; Curry and Kerlinger 2013).

Table 3-7. Searcher Efficiency Rate (SE) for Trial Bats, 95% Confidence Intervals, Deerfield Wind Project, 2020.

Number trial bats placed[1]	50
Number trial bats found	35
Mean SE	0.70
Lower SE	0.58
Upper SE	0.82

[1] Total does not include 1 trial carcass that was scavenged prior to turbine searches.

Fifty birds were placed for all searcher efficiency trials combined (Table 3-8). Thirty-two were native bird species, and 18 were quail surrogates. The mean searcher efficiency rate for birds was 54%, which is within the range of 38% to 69% found at other New England projects (Stantec 2009; TetraTech 2013).

Table 3-8. Searcher Efficiency Rate (SE) for Trial Birds, 95% Confidence Intervals, Deerfield Wind Project, 2020.

Number trial birds placed	50
Number trial birds found	27
Mean SE	0.54
Lower SE	0.4
Upper SE	0.68

3.8.2 Carcass Persistence Results

Carcass persistence trials were conducted throughout the study period and were initiated on the following dates:

- 5/28/2020
- 7/7/2020
- 7/29/2020
- 9/6/2020
- 9/28/2020

There were 50 bats placed for all trials combined. Based on Huso estimate outputs, the mean number of days trial bat carcasses persisted was 16.78 days (Table 3-9), which was well beyond the 3-day search interval confirming the search interval was sufficient.

Table 3-9. Bat Carcass Persistence (CP) Estimates, 95% Confidence Intervals, Deerfield Wind Project, 2020.

Number trial bats placed	50
Mean number of days CP	16.78
Lower number of days CP	9.98
Upper number of days CP	39.00
CP rate[1]	0.92
CP lower	0.87
CP upper	0.97

[1] Percent of carcasses persisting for the 3-day search interval

There were 50 birds placed for all trials combined. Thirty-two were native bird species, and 18 were quail surrogates. Based on Huso estimate outputs, the mean number of days trial bird carcasses persisted was 5.27 days (Table 3-10), which was well beyond the 3-day search interval confirming the search interval was sufficient.

Table 3-10. Bird Carcass Persistence (CP) Estimates, 95% Confidence Intervals, Deerfield Wind Project, 2020.

Number trial birds placed	50
Mean number of days CP	5.27
Lower number of days CP	3.68
Upper number of days CP	7.6
CP rate[1]	0.85
CP lower	0.78
CP upper	0.90

[1] Percent of carcasses persisting for the 3-day search interval

3.8.3 Search Area Corrections

The proportion of carcasses found per 10-m distance bin and the DWP values factored into fatality estimates are available in Table 3-11 and Table 3-12, respectively.

Table 3-11. Number Found and Proportion of Bird and Bat Carcasses per 10-meter Annuli for all Turbines Combined (includes birds and bat carcasses found during standard searches only), Deerfield Wind Project, 2020.

Distance bin (m)	No. bats found	Proportion all bats per bin	Distance bin (m)	No. birds found	Proportion all birds per bin
0–10	8	0.296	0–10	4	0.444
11–20	12	0.444	11–20	2	0.222
21–30	6	0.222	21–30	1	0.111
31–40	1	0.037	31–40	0	0.000
41–50	0	0.000	41–50	2	0.222
Total	**27**		**Total**	**9**	

Table 3-12. Density-Weighted Proportion Area Searched Value for Birds and Bats, Deerfield Wind Project, 2020.

Turbine No.	DWP Value	
	Bats	Birds
E1	0.790	0.713
E2	0.766	0.711
E3	0.858	0.767
E4	0.795	0.727
E5	0.883	0.807
E6	1.000	0.985
E7	0.876	0.759
W1	0.906	0.820
W2	0.887	0.766
W3	0.894	0.781
W4	0.921	0.820
W5	0.872	0.776
W6	0.857	0.772
W7	0.732	0.686
W8	0.742	0.699

3.8.4 Fatality Estimates

Estimates for bat and bird fatality were generated with and without area corrections using the Huso estimator (Table 3-13).

Table 3-13. Huso Estimates of Bat and Bird Fatality, With and Without Area Corrections, Deerfield Wind Project, 2020.

Result	Bats Without Area Corrections	Birds Without Area Corrections
Number carcasses found	21	3
Adjusted fatality/turbine/study period	2.16	0.44
95% CI lower	1.47	0.34
95% CI upper	3.14	0.59
Adjusted fatality/study period	33	7
95% CI lower	23	6
95% CI upper	48	9
Adjusted fatality/MW/study period	1.10	0.23
Result	**Bats With Area Correction**	**Birds With Area Correction**
Number carcasses found	21	3
Adjusted fatality/turbine/study period	2.53	0.56
95% CI lower	1.72	0.44
95% CI upper	3.62	0.77
Adjusted fatality/study period	38	9
95% CI lower	26	7
95% CI upper	55	12
Adjusted fatality/MW/study period	1.27	0.30

[1]The number of carcasses included in the Huso model was different than the total found because incidentals were not included and Huso also recommends not including those carcasses believed to have died during a previous search interval.

4.0 DISCUSSION

4.1 BIRD AND BAT FATALITY

4.1.1 Birds

Nocturnal migrant passerines represent bird carcasses most commonly found at operational wind projects (Erickson et al. 2005; NRC 2007; NWCC 2010); this group is one of the most diverse and abundant bird groups in the world. Other standardized post-construction monitoring studies at wind energy projects in the northeast region, which include New England and mid-Atlantic states, have documented passerines as the most common bird group found during monitoring (Stantec 2011, 2014; Normandeau Associates 2010, 2011). Standardized post-construction monitoring studies at three other wind energy facilities in Vermont (Georgia Mountain Community Wind [Georgia], Kingdom Community Wind [Kingdom], and

Sheffield Wind [Sheffield]), and 2018 post-construction monitoring at the Project have all documented passerines as the most common bird group found during standardized post-construction monitoring studies (Stantec 2013a,b, 2015a,b, 2019; Martin et al. 2013, 2014). This group of birds is susceptible to collisions with manmade structures during nocturnal migration in spring and fall, particularly during inclement weather conditions when birds may be flying at lower heights and may become disoriented by sources of artificial light (Erickson et al. 2005). More than half of all passerine fatalities at the Project in 2020 (n = 11; 52%) occurred during the night of September 17, which was during the peak of fall migration and characterized by overcast skies, low clouds, and fog. Ten of these bird fatalities were not turbine related and were incidentally found at the O&M building by operations staff on September 18.

The loss of 0.56 birds/turbine/period, or 9 birds/period at Project turbines[6], is small considering the regional populations of the species of birds that were most commonly found at the Project: red-eyed vireo, bay-breasted warbler, ovenbird, common yellowthroat (***Geothlypis trichas***), and golden-crowned kinglet (***Regulus satrapa***) (n = 16 combined, 76% combined). The Partners in Flight Land-based Bird Population Estimates Database[7] estimates the North American populations of red-eyed vireo and golden-crowned kinglet at 130 million, common yellowthroat at 76 million, ovenbird at 26 million, and bay-breasted warbler at 9.9 million (PIF 2020). Further, impacts associated with wind power remain relatively low compared to other sources of human-induced fatality, including collisions with other manmade structures, destruction of habitat, exposure to chemicals, and predation by domestic and feral cats (Loss et al. 2012). Population-level effects have not been attributed to collision mortality at wind projects or other structures (Loss et al. 2013; Erickson et al. 2014).

There were no federally or state-listed endangered or threatened bird species found during 2020 surveys (VFWD 2015a). Two bird species of Vermont Greatest Conservation Need were found—bay-breasted warbler (n = 3) and black-throated blue warbler (***Setophaga caerulescen;*** n = 1)—both of which are listed as medium priority in Vermont (VFWD 2015b).

4.1.2 Bats

Bat fatalities found at the Project consisted of three migratory tree-roosting bat species, and two cave-dwelling bat species. The migratory tree-roosting bat species group is most commonly found during standardized post-construction monitoring studies at wind energy facilities in North America, including the northeast region (Kunz et al. 2007; Arnett et al. 2008; Baerwald et al. 2009; Taucher et al. 2012; Arnett and Baerwald 2013; West 2014). The Project fatality estimate for bats (2.53 bats/turbine/period) is on the low end of the range of bat fatalities reported at other recent wind projects in the northeast. Though there is less certainty regarding population sizes of migratory tree bats, such small impacts (2.53 bats/turbine/period, or 38 bats over the whole study period) are unlikely to have a significant effect on their populations.

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[6] Avian fatality estimates represent fatalities at turbines only, and do not incorporate the 10 incidental fatalities documented at the O&M building.
[7] Available at http://pif.birdconservancy.org/

There were no federally listed endangered or threatened bat species found during 2020 surveys. One state-endangered species, little-brown bat (n = 1) was found and reported to VFWD per state permit conditions. All bat species found are species of Vermont Greatest Conservation Need.Fatality Timing

4.1.3 Birds

During the 2020 study period, 29% of bird fatalities occurred during the spring migration period of May through early June, and 62% of bird fatalities occurred during the fall migration period of September through October; no bird fatalities were discovered in July, and only two were discovered in August. These results are typical compared to the timing of bird fatalities found during previous years at other wind projects in the region (Normandeau Associates 2010, 2011; Stantec 2011, 2014; Tidhar et al. 2010, 2011), at the Project in 2018, and at other similar projects in Vermont (Stantec 2013a,b, 2015a,b, 2016, 2019; Martin et al 2013, 2014).

4.1.4 Bats

Available information suggests that the majority of bat fatalities in the region occur in the late-summer and fall (Erickson et al. 2002; Johnson 2005; Arnett et al. 2008; Taucher et al. 2012; Arnett and Baerwald 2013). Bat fatality at the Project peaked in August (n = 13; 48%), but carcasses were found during each month of surveys. These results are consistent with the species composition and timing of bats found at the Project in 2018, and at Georgia, Kingdom, and Sheffield in Vermont (Stantec 2013a,b, 2015a,b, 2016, 2019; Martin et al. 2013, 2014).

4.2 SPATIAL DISTRIBUTION OF CARCASSES

Available studies suggest that the majority of carcasses would be expected to fall within search plots, even within the restricted size of search plots of turbines on forested ridgelines (Fiedler et al. 2007). Other examples include the Meyersdale project in Pennsylvania where Kerns and Kerlinger (2004) reported that the majority of bird and bat fatalities were found within about 30 m of the turbine bases, and Kerns et al. (2005) reported that greater than 80% of bat fatalities were found within 40 m of turbines at Meyersdale, PA, and Mountaineer, WV. The mean distances carcasses were found from turbines at the Project in 2020 was 20 m for birds and 15.8 m for bats, and the mean distances carcasses were found from turbines at the Project in 2018 was 40.2 m for birds and 30.3 m (Stantec 2019). The mean distances carcasses were found from turbines at Georgia and Kingdom in 2013 and 2014 ranged from 22.3 m to 29.6 m (Stantec 2013a,b, 2015a,b). These trends and the carcass distance distributions observed at the Project suggest that few carcasses may have landed beyond 60 m from turbines.

Sixty-four percent of bird fatalities at turbines (n = 11) and 63% of bats (n = 17) were found on the west ridge of the Project compared to the east ridge. These results are consistent with 2018 surveys at the Project, where 77% of birds (n = 20) and 80% of bats (n = 8) were found on the west ridge of the Project compared to the east ridge. Elevations of turbines on the west ridge are lower than those on the east ridge (2,745–2,895 ft on the west ridge compared to 2,911–3,100 ft on the east ridge). The west ridge is predominantly hardwood forest with American beech, red maple, and sugar maple, and the east ridge is predominantly coniferous forest dominated by spruce. Due to the low sample size of fatalities found and the low number of turbines on each ridge, it cannot be statistically determined whether ridgeline characteristics influenced fatality at the Project.

4.3 WEATHER CONDITIONS AND FATALITY EVENTS

Bat fatalities are observed to be positively correlated with temperature and negatively correlated with wind speed (Fiedler 2004; Reynolds 2006). Most bat fatalities at the Project (n = 13, 48%) were observed in August, when average temperatures were relatively high, and most nights when bat fatalities were suspected to occur were characterized by average nightly wind speeds of less than 6 m/s (n = 4; 57%). Avian collision risk is greater during periods of inclement weather (e.g., fog or mist) (Kerlinger et al. 2010). The night prior to the discovery of 11 fresh bird carcasses (10 of which were found at the O&M building) was characterized by overcast skies, low clouds, and fog. However, any observable trends in the relationship of bat and bird fatalities to weather events at the Project should be interpreted with caution due to the low sample size of fresh fatalities.

4.4 BIRD AND BAT FATALITY ESTIMATES

Use of the Huso estimator was specified in the PCMP and was chosen because it is one of the more recent methods that has been vetted by accredited statisticians, and it has been used for 2018 surveys at the Project, and at all operational wind facilities in Vermont to-date.

The Huso (2010) and Huso et al. (2012) estimator model is subject to less bias when searcher efficiency and carcass removal rates remain constant over time. However, when these rates vary over time, the estimator, like most other available estimators, results in greater bias. Huso (2010) indicates that for sites with short persistence time (< 4.2 days) and short search intervals (1–7 days), the estimator tends to overestimate fatality. At the Project, there were relatively long carcass persistence intervals (16.78 days for bats and 5.27 days for birds) but a relatively short search interval (approximately 3 days); therefore, the estimates of fatality for the Project may be overestimated by the Huso estimator.

Searcher efficiency rates (70% for bats and 54% for birds) were higher than those at other Vermont sites, which ranged from 41% to 49% (pooled for birds and bats combined). Carcass persistence rates for bats (16.78 days) were characteristic of those at other Vermont sites, and carcass persistence rates for birds (5.27 days) were lower than those at other Vermont sites, which ranged from 8.45 days to 43.00 days (pooled for birds and bats combined) (Stantec 2013a,b, 2015a,b, 2019).

Similar to other studies in the region, estimates for bird and bat fatality were generated with and without DWP area corrections (Stantec 2013a,b, 2014). Fatality estimates without area corrections are lower because they don’t account for carcasses present in portions of the plots that were not searched. Though fatality estimates with area corrections are considered more accurate due to per-turbine DWP adjustments, fatality estimates without area corrections are also provided to compare to older post construction fatality studies in the region that used estimators that at the time did not include area corrections.

4.4.1 Regional Comparison of Fatality Estimates

Direct comparisons of fatality estimates among sites should be made with caution due to variable methods and survey objectives: studies from the eastern US used a variety of fatality estimators; search plot size at different projects was variable (i.e., studies in relatively flat agricultural areas vs. studies on forested ridge tops); operational control was implemented during some of the regional surveys; and, some studies included search area corrections, while others did not (Appendix A Table 3). All of these studies, however, included adjustments for searcher efficiency and carcass persistence.

When comparing the Project bat fatality estimate (with search area corrections) to recent estimates from other similarly sited projects in the eastern US, the estimate of bat fatality (2.53 bats/turbine/period) is at the very low end of the range of these other studies (range = 0.00 to 63.90 bats/turbine/period) and is below the median estimate (median = 4.89 bats/turbine/period) of fatality based on these other studies. The bat fatality estimate at Deerfield in 2020 is at the lower end of estimates at Georgia, Kingdom, and Sheffield, which ranged from 1.94 to 14.65 bats/turbine/period (Appendix A Table 3; Appendix A Figure 1).

When comparing the Project bird fatality estimate (with search area corrections) to recent estimates from other projects, the estimate of bird fatality (0.56 birds/turbine/year) is at the low end of the range of these other studies (range = 0.29 to 27.40 birds/turbine/period) and is below the median estimate (median = 3.39 birds/turbine/period). The bird fatality estimate at Deerfield is lower than those at Georgia, Kingdom, and Sheffield, which ranged from 2.13 to 13.17 bats/turbine/period (Appendix A Table 3; Appendix A Figure 2).

4.5 2018 AND 2020 COMPARISON

Standardized post-construction fatality monitoring at the Project followed the same survey methods in 2018 and 2020, though 2020 surveys were delayed due to the COVID-19 pandemic. As outlined in the PCMP, all 15 turbines were searched every 3 days, and carcass persistence and searcher efficiency trials occurred throughout both survey years. Surveys in 2020 included the same plot boundaries as in 2018, though most of the ground cover classified as bare ground in 2018 was re-classified as grass in 2020.

Species composition was similar between both survey years, as bird fatalities consisted of primarily passerines and bat fatalities consisted of primarily tree-roosting species. The bird fatality rate was significantly lower in 2020 (0.56 fatalities/turbine/period) than in 2018 (10.03 fatalities/turbine/period). The Huso estimator only includes carcasses that were found during standardized turbine searches, and those that were believed to have died within the 3-day search interval. Due to the small number of carcasses that fit these criteria in 2020 (3 out of 21 total carcasses), the estimator generated a significantly lower value. Bat fatality rates were higher in 2020 (2.53 fatalities/turbine/period) than in 2018 (1.47 fatalities/turbine/period) (Table 4-1).

Searcher efficiency rates at Deerfield in 2020 (70% for bats and 54% for birds) were similar to rates in 2018 (60% for bats and 58% for birds). Carcass persistence rates for bats were approximately two times higher in 2020 (16.78 days) compared to 2018 (8.41 days) (Table 4-1). This difference may possibly be attributed to the large number of mouse surrogates used in 2018 (64% of bat persistence trials) due to the limited number of bats available for trials that year. Carcass persistence rates were approximately twice as low for birds in 2020 (5.27 days) compared to 2018 (10.03 days) (Table 4-1). More quail surrogates were used in 2018 (64% of bird persistence trials) than in 2020 (36% of bird surrogate trials), which may partially account for the difference between years. Native species are presumed to provide more realistic carcass persistence data (DeVault et al. 2017).

Table 4-1. 2018 and 2020 Survey Results, Deerfield Wind Project

	2018	2020
survey period	4/15–10/15	5/8–10/15
no. searches	993	837
no. bird fatalities	26 (0 incidental)	21 (12 incidental)
no. bat fatalities	10 (0 incidental)	27 (0 incidental)
bird SE	0.58	0.54
bat SE	0.6	0.7
bird CP	10.03	5.27
bat CP	8.41	16.78
bird fatality rate (adjusted fatality/ turbine/study period)	8.01	0.56
bat fatality rate (adjusted fatality/ turbine/study period)	1.47	2.53

4.6 OPERATIONAL CONTROL

Operational control is a well-documented and effective method for reducing bat fatalities at wind facilities: multiple research projects have documented the effectiveness of altering turbine cut-in speed to reduce bat fatalities (Baerwald et al. 2009; Arnett et al. 2011, 2013; Martin et al. 2013; Arnett and Baerwald 2013; Hein et al. 2013). Although studies have varied in design, such as type of treatment (e.g., assigned cut-in speed), number of treatments, treatment duration, and methods of conducting fatality searches, available studies have reported a reduction in bat fatalities (~22 93%) when raising turbine cut-in speed and feathering below cut-in (Arnett et al. 2011, 2013; Baerwald et al. 2009).

The Project implemented the most stringent operational curtailment program in Vermont, and accordingly had two of the lowest overall bat fatality rates in 2018 and 2020 (1.47 bats/turbine/period and 2.53 bats/turbine/period, respectively) among Vermont projects. Georgia, which had estimated bat fatality rates of 11.7 bats/turbine/period in 2013 and 2.29 bats/turbine/period in 2014, implemented a regime that was shorter in duration and at a lower wind speed, specifically July 1 to September 30 when temperatures reached 9.4ºC (49ºF) and when wind speeds were less than 5 m/s (Stantec 2013b, 2015b). Kingdom and Sheffield implemented curtailment regimes with turbines randomly assigned to two different cut-in speeds to test the effectiveness. At Kingdom, which had estimated bat fatality rates of 1.94 bats/turbine/period in 2013 and 4.96 bats/turbine/period in 2014, 10 turbines were set to a 5 m/s cut-in speed, and 11 turbines were set to a 6 m/s cut-in speed from June 1 to September 30. Both turbine groups were programmed to curtail when temperatures exceeded 9.4ºC (49ºF) (Stantec 2013a, 2015a). At Sheffield, which had estimated bat fatality rates of 14.65 bats/turbine/period in 2012 and 2.80 bats/turbine/period in 2013, 8 turbines were fully operational (i.e., cut-in speed at 4 m/s) and 8 turbines were set to a 6 m/s cut-in speed when temperatures exceeded 9.5ºC (49ºF) from June 3 to September 30 (Martin et al. 2013, 2014). Ultimately, following these tests both Kingdom and Sheffield implemented curtailment at 6 m/s likely due to small sample sizes and inability to test the difference between treatments for significance. Regardless of the differences at each project, all four operational curtailment programs have shown effectiveness in avoiding impacts to federal or state-listed bat species.

Operational control was in effect at the Project for from June 1 to September 30, 2020, except for three weeks in August where the curtailment system was not operating due to a temperature sensor malfunction. Aside from this brief period, curtailment was implemented to meet the purpose of reducing bat fatalities. This is reflected in the results for which the Project documented bat fatality rates at the lower end of the range of other projects in the northeast (2.53 bats/turbine/period).

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Appendix A FATALITY TABLES AND FIGURES

Appendix A Table 1. Bird Fatality at Deerfield Wind Project, 2020.

Date	Location	Search Type	Common Name	Scientific Name	Subgroup	Age	Sex	Condition	Estimated Time of Death	Position	Distance from Turbine (m)	Direction from Turbine (Azimuth)
5/14/2020	W07	search	golden-crowned kinglet	***Regulus satrapa***	passerine	unknown	male	decomposing - late	7–14 days	face down	42	150
5/23/2020	W04	search	American redstart	***Setophaga ruticilla***	passerine	unknown	male	decomposing - early	4–7 days	on side	12	335
6/11/2020	E05	search	red-eyed vireo	***Vireo olivaceus***	passerine	unknown	unknown	desiccated	2+ weeks	on side	10	85
6/12/2020	W02	search	red-eyed vireo	***Vireo olivaceus***	passerine	unknown	unknown	decomposing - early	4–7 days	face down	43	125
6/12/2020	W07	search	red-eyed vireo	***Vireo olivaceus***	passerine	unknown	unknown	decomposing - late	4–7 days	face up	1	20
6/28/2020	E05	search	red-eyed vireo	***Vireo olivaceus***	passerine	unknown	unknown	fresh	2–3 days	face down	<1	270
8/16/2020	W05	search	red-eyed vireo	***Vireo olivaceus***	passerine	unknown	unknown	desiccated	4–7 days	face down	14	305
8/19/2020	W01	search	scarlet tanager	***Piranga olivacea***	passerine	unknown	female	fresh	2–3 days	on side	6	345
9/18/2020	O&M	incidental	common yellowthroat	***Geothlypis trichas***	passerine	juvenile	unknown	fresh	last night	on side	11	7
9/18/2020	O&M	incidental	black-throated blue warbler	***Setophaga caerulescens***	passerine	adult	male	fresh	last night	face down	14	347
9/18/2020	O&M	incidental	ovenbird	***Seiurus aurocapilla***	passerine	unknown	unknown	fresh	last night	face up	8	24
9/18/2020	O&M	incidental	bay-breasted warbler	***Setophaga castanea***	passerine	unknown	unknown	fresh	last night	on side	7	10
9/18/2020	O&M	incidental	ovenbird	***Seiurus aurocapilla***	passerine	unknown	unknown	fresh	last night	face down	11	11
9/18/2020	O&M	incidental	bay-breasted warbler	***Setophaga castanea***	passerine	unknown	unknown	fresh	last night	on side	12	55
9/18/2020	O&M	incidental	common yellowthroat	***Geothlypis trichas***	passerine	adult	male	fresh	last night	on side	10	84
9/18/2020	O&M	incidental	Tennessee warbler	***Oreothlypis peregrina***	passerine	unknown	unknown	fresh	last night	face up	11	100
9/18/2020	O&M	incidental	ovenbird	***Seiurus aurocapilla***	passerine	unknown	unknown	fresh	last night	face up	11	110
9/18/2020	O&M	incidental	black-throated green warbler	***Setophaga virens***	passerine	juvenile	unknown	fresh	last night	on side	3	340
9/18/2020	W04	incidental	bay-breasted warbler	***Setophaga castanea***	passerine	unknown	unknown	fresh	last night	on side	25	60
10/4/2020	E05	incidental	red-eyed vireo	***Vireo olivaceus***	passerine	unknown	unknown	fresh	last night	on side	59	175
10/12/2020	E04	search	golden-crowned kinglet	***Regulus satrapa***	passerine	adult	unknown	fresh	last night	on side	30	300

Appendix A Table 2. Bat Fatality at Deerfield Wind Project, 2020.

Date	Location	Search Type	Common Name	Scientific Name	Subgroup	Age	Sex	Condition	Estimated Time of Death	Position	Distance from Turbine (m)	Direction from Turbine (Azimuth)
5/20/2020	W6	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	fresh	2–3 days	face down	18	113
5/20/2020	W8	search	silver-haired bat	***Lasionycteris noctivagans***	tree-roosting bat	adult	unknown	fresh	2–3 days	face down	9	330
5/30/2020	E6	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	fresh	last night	face down	27	90
6/11/2020	E6	search	unidentified bat	***n/a***	unknown	unknown	unknown	desiccated	1+ month	face down	30	85
6/19/2020	E2	search	big brown bat	***Eptesicus fuscus***	cave-dwelling bat	adult	unknown	fresh	2–3 days	face down	3	3
6/23/2020	W8	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	fresh	2–3 days	face up	10	68
6/29/2020	W8	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	fresh	last night	face down	6	26
7/8/2020	W5	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	desiccated	2+ weeks	face up	10	320
8/11/2020	W3	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	fresh	2–3 days	face up	23	30
8/13/2020	E6	search	big brown bat	***Eptesicus fuscus***	cave-dwelling bat	adult	unknown	decomposing - late	2–3 days	face down	29	96
8/13/2020	W1	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	male	fresh	last night	face down	16	300
8/16/2020	W1	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	fresh	2–3 days	face up	28	283
8/16/2020	W6	search	little brown bat	***Myotis lucifugus***	cave-dwelling bat	unknown	male	fresh	last night	face up	21	231
8/16/2020	W2	search	big brown bat	***Eptesicus fuscus***	cave-dwelling bat	adult	unknown	fresh	2–3 days	face up	20	303
8/18/2020	E6	search	silver-haired bat	***Lasionycteris noctivagans***	tree-roosting bat	unknown	male	fresh	last night	face up	12	30
8/22/2020	W2	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	fresh	2–3 days	face up	8	11
8/22/2020	W4	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	alive on ground	n/a	face up	9	67
8/22/2020	W5	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	fresh	2–3 days	face up	11	145
8/24/2020	E1	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	fresh	2–3 days	face up	15	235
8/25/2020	W6	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	fresh	2–3 days	face up	12	215
8/27/2020	E2	search	silver-haired bat	***Lasionycteris noctivagans***	tree-roosting bat	adult	unknown	decomposing - early	4–7 days	face up	13	250
9/2/2020	E3	search	unidentified bat	***n/a***	unknown	unknown	unknown	bones only	unknown	n/a	31	197
9/2/2020	W5	search	eastern red bat	***Lasiurus borealis***	tree-roosting bat	unknown	unknown	desiccated	2+ weeks	face up	13	110
9/10/2020	E4	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	female	decomposing - early	2–3 days	face down	6	70
9/23/2020	W7	search	hoary bat	***Lasiurus cinereus***	tree-roosting bat	adult	unknown	desiccated	unknown	face up	13	107
10/4/2020	W7	search	silver-haired bat	***Lasionycteris noctivagans***	tree-roosting bat	adult	male	fresh	2–3 days	face down	19	181
10/6/2020	E6	search	silver-haired bat	***Lasionycteris noctivagans***	tree-roosting bat	unknown	unknown	fresh	last night	face down	14	58

Appendix A Table 3. Results of Bird and Bat Fatality Studies in the eastern US.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
Massachusetts								
MMA turbine	coastal (1)	April 24 - November 30, 2006	4-12 searches per week	0	n/a	3	2.15 (2.15)	Vlietstra, L.S. 2007. Potential Impact of the Massachusetts Maritime Academy Wind Turbine on Common and Roseate Terns
Maryland								
Criterion	forested ridgeline (28)	April 5 to November 15, 2011	daily	706	39.03 (1,093)	262	16.01 (449)	Young, D., M. Lout, Z. Courage, S. Nomani, and K. Bay. 2012. 2011 Post-Construction Monitoring Study Criterion Wind Project Garrett County, Maryland, April-November 2011. Technical report prepared for: Criterion Power Partners, LLC, Oakland, Maryland.
Criterion	forested ridgeline (28)	April 1 to November 15, 2012	weekly at 50%	82	19.5 (546)	28	5.47 (153)	Young, D., C. Nations, M. Lout, and K. Bay. 2013. 2012 Post-Construction Monitoring Study Criterion Wind Project Garrett County, Maryland, April-November 2012. Technical report prepared for: Criterion Power Partners, LLC, Oakland, Maryland.
Criterion	forested ridgeline (28)	April 2 to November 15, 2013	weekly at 50%	40	13.3 (373)	23	8.74 (245)	Young, D., M. Kauffman, M. Lout, and K. Bay. 2014. 2013 Post-Construction Monitoring Study Criterion Wind Project Garrett County, Maryland, April-November 2013. Technical report prepared for: Criterion Power Partners, LLC, Oakland, Maryland.
Maine								
Kibby Mountain	forested ridgeline (44)	May 2 to June 20; July 11 to October 14, 2011	22 3 times every 2 wks	6 (3)	spring: (0); fall: 0.37 (16)	17 (4)	spring: 0.72 (32); fall: 0.29 (12)	Stantec Consulting. 2011. 2011 Post-Construction Monitoring Report Kibby Wind Power Project, Franklin County, Maine. Prepared for TransCanada Hydro Northeast, Inc.
Mars Hill	forested ridgeline (28)	April 23-June 3, July 15-Sept 23, 2007	2 of 28 daily, 28 of 28 weekly, seasonal dog searches	22 (2)	0.43-4.4 (12.1-122.5)	19 (3)	0.44-2.5 (27-69)	Stantec Consulting. 2008. Spring, Summer, and Fall Post-construction Bird and Bat Mortality Study at the Mars Hill Wind Farm, Maine. Unpublished report prepared for UPC Wind Management, LLC.
Mars Hill	forested ridgeline (28)	April 19 - June 6, July 15-Oct 8, 2008	28 of 28 weekly, seasonal dog searches	5 (0)	0.17-0.68 (5-19)	17(4)	2.4-2.65 (57-74)	Stantec Consulting. 2009. Post-construction Monitoring at the Mars Hill Wind Farm, Maine – Year 2. Unpublished report prepared for First Wind Management, LLC.
Record Hill	forested ridgeline (22)	April 15 to June 7 and July 7 to October 15, 2012	22 3 times every 2 wks	44 (0)	6.78 (150) [4]	46 (7)	8.46 (187) [4]	Stantec Consulting. 2012. Record Hill Wind Project Post-Construction Monitoring Report, 2012. Prepared for Record Hill Wind, LLC.
Rollins	forested ridgeline (40)	April 15 to October 15, 2012	20 weekly	2 (0)	0.18 (7.2) [4]	9 (7)	2.94 (118) [4]	Stantec Consulting. 2012. RollinsWind Project Post-Construction Monitoring Report, 2012. Prepared for First Wind, LLC.
Stetson Mountain I	forested ridgeline (38)	April 20 to Oct 21, 2009	19 weekly	5 (0)	2.11 (80)	30 (9)	4.03 (153)	Stantec Consulting. 2010. Stetson I Mountain Wind Project, Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC.
Stetson Mountain I	forested ridgeline (38)	April18 to October 21, 2011	19 weekly	4 (0)	0.43 (16)	7 (0)	1.77 (67)	Normandeau Associates. 2010. Year 3 Post-construction avian and bat casualty monitoring at the Stetson I Wind Farm. Prepared for First Wind, LLC.
Stetson Mountain I	forested ridgeline (38)	April 15 to Oct 25, 2013	19 weekly	1 (0)	0.26 (10)	32 (0)	10.42 (396)	Stantec Consulting. 2014. Stetson I Wind Project, 2013 Post-Construction Monitoring Report, Year 5. Prepared for First Wind Management, LLC.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
Stetson Mountain II	forested ridgeline (17)	April 19 to Oct 15, 2010	17 weekly	14 (0)	2.48 (42.12)	11 (0)	2.14 (36.41)	Normandeau Associates. 2010. Stetson Mountain II Wind Project Year 1 Post-Construction Avian and Bat Mortality Monitoring. Prepared for First Wind, LLC.
Stetson Mountain II	forested ridgeline (17)	April 15 to October 15, 2012	17 weekly	4 (0)	2.06 (36) [4]	5 (0)	2.83 (49) [4]	Stantec Consulting. 2012. Stetson II Wind Project Post-Construction Monitoring Report, 2012. Prepared for First Wind, LLC.
Bull Hill	coastal upland (19)	April 15-Oct 15, 2013	19 weekly April 15-June 14, 10 daily 9 weekly June 15-Oct 15	19	0.94 (9.4)	78 (1)	7.72 (147)	Stantec Consulting. 2014. Bull Hill Year 1 Post-Construction Wildlife Monitoring Report, 2013. Prepared for First Wind, LLC.
Spruce Mountain	forested ridgeline (10)	April 11 to November 1, 2012	10 weekly	6	2.43 (24)	3 (2)	1.49 (15)	TetraTec. 2013. Spruce Mountain Wind Project Post-construction Bird and Bat Fatality and Raptor Monitoring Year 1 Annual Report. Prepared for Patriot Renewables.
Hancock[7]	forested ridgeline (17)	April 15 to Oct 15, 2017	3-day	3	0.89, 1.03, 1.14	8 (1)	2.76, 4.56, 6.99	TRC. 2017b. Hancock Wind Project Post-Construction Bird and Bat Fatality Monitoring Report Year 1 (2017). Prepared for Novatus Energy, LLC.
Hancock[7]	forested ridgeline (17)	April 15 to Oct 15, 2018	2 searches per week	3	0.97, 1.23, 2.6	7 (1)	2.35, 3.94, 6.06	TRC. 2018. Hancock Wind Project Post-Construction Bird and Bat Fatality Monitoring Report Year 2 (2018). Prepared for Novatus Energy, LLC.
Oakfield[7]	forested ridgeline (48)	April 20 to Oct 15, 2017	3-day	6	1, 1.54, 2.32	68 (3)	10.13, 12.7, 27.4	TRC. 2017c. Oakfield Wind Project Post-Construction Bird and Bat Fatality Monitoring Report Year 2 (2017). Prepared for Novatus Energy, LLC.
Bingham[7]	forested ridgeline (56)	April 15 to Oct 15, 2017	3-day	2	0.32, 0.74,1.73	27 (7)	5.98, 11.43, 25.09	TRC. 2017b. Hancock Wind Project Post-Construction Bird and Bat Fatality Monitoring Report Year 1 (2017). Prepared for Novatus Energy, LLC.
Passadumkeag[7]	forested ridgeline (13)	Apr 15 - Oct 14, 2016	3-day	5	0.56, 0.79, 0.87	27 (31)	4.28, 6.32, 8.15	Ritzert, J. P. M. Ritzert, S. Conover, and K. Nasman. 2017. Post-Construction Monitoring Study for the Passadumkeag Wind Project Penobscot County, Maine. April – October 2016. Prepared for Southern Power Company. February 10, 2017.
Passadumkeag[7]	forested ridgeline (13)	Apr 16 - Oct 15, 2018	3-day	7 (1)	0.91, 0.92, 1.02	24 (2)	3.35, 4.01, 4.29	Ritzert, J. P., J. Stein, F. Hornsby, and G. DiDonato. 2018. Post-Construction Monitoring Study for the Passadumkeag Wind Project, Penobscot County, Maine. April – October 2018. Prepared for Southern Power Company. December 2018.
New Hampshire								
Granite Reliable	forested ridgeline (33)	April 22 - October 27, 2012	13 weekly thru Aug 18, 23 weekly thru Oct 27	2 (1)	2.6-3.0 (86-99) [6]	1	2.0-2.8 (66-92) [6]	Curry and Kerlinger. 2013. Post-construction mortality study Granite Reliable Power Wind Park, Coos County, New Hampshire, Annual Report January 2013. Prepared for Granite Reliable Power, LLC.
Groton	forested ridgeline (24)	April 15 - October 31, 2013	24 weekly	18	n/a	23	n/a	***West 2013 preliminary data***
Lempster	forested ridgeline (12)	April 15-June 1; July 15-Oct 31, 2009	4 daily	10 (2)	spring: 0.58 (7); fall: 5.51 (66)	9 (4)	spring: 0.80 (10); fall: 5.95 (71)	Tidhar, D., W. Tidhar, and M. Sonnenberg. 2010. Post-Construction Fatality Surveys for Lempster Wind Project. Prepared for Lempster Wind, LLC.
Lempster	forested ridgeline (12)	April 15-June 1; July 15-Oct 31, 2010	12 weekly	14 (5)	spring (0); fall 7.13 (86)	11 (0)	spring: 1.16 (14); fall: 4.12 (49)	Tidhar, D., W. Tidhar, L. McManus, and Z. Courage. 2011. 2010 Post-Construction Fatality Surveys for Lempster Wind Project. Prepared for Lempster Wind, LLC.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
New York								
Altona	primarily woodlots (65)	April 26 to October 15, 2010	22 weekly, 8 daily from July 18 to Sept 18	24 (7)	daily: 6.51 (423); weekly: 3.87 (252)	14 (6)	daily: 1.55 (101); weekly: 2.76 (180)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2011. Annual Report for the Noble Altona Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC.
Bliss	agricultural, woodland (67)	April 21 to Nov 14, 2008	8 daily, 8 every 3-days, 7 weekly	74 (15)	daily: 7.58 (508); 3-day:14.66 (983); weekly: 13.01 (872)	20 (7)	daily: 4.30 (288); 3-day: 0.66 (44); weekly: 0.74 (50)	Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Quant, D. Pursell. 2009. Annual Report for the Noble Bliss Windpark, LLC. Postconstruction Bird and Bat Fatality Study – 2008. Prepared by Curry and Kerlinger, LLC.
Bliss	agricultural, woodland (67)	April 15 to November 15, 2009	8 daily, 15 weekly	36 (0)	daily: 8.24 (552); weekly: 4.46 (299)	25 (7)	daily: 4.45 (298); weekly: 2.87 (192)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2010. Annual Report for the Noble Bliss Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC.
Chateaugay	agricultural, woodlots (71)	April 26 to Oct 15, 2010	24 weekly	22 (7)	3.66 (260)	19 (9)	2.40 (170)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2011. Annual Report for the Noble Chateaugay Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC.
Clinton	agricultural, woodland (67)	April 26 to October 13, 2008	8 daily, 8 every 3-days, 7 weekly	39 (14)	daily: 5.45 (365); 3-day: 4.81 (322); weekly: 3.76 (252)	14 (9)	daily: 1.43 (956); 3-day: 3.26 (218); weekly: 2.48 (166)	Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Histed, and J. Meacham. 2009. Annual Report for the Noble Clinton Windpark, LLC. Postconstruction Bird and Bat Fatality Study – 2008. Prepared by Curry and Kerlinger, LLC.
Clinton	agricultural, woodland (67)	April 15 to November 15, 2009	8 daily, 15 weekly	36 (6)	daily: 9.72 (651); weekly: 5.16 (3.46)	16 (8)	daily: 1.50 (101); weekly: 1.76 (118)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2010. Annual Report for the Noble Clinton Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC.
Cohocton and Dutch Hill	agricultural, woodland (50)	April 15 to Nov 15, 2009	5 daily, 12 weekly	62 (7)	daily: 40.4 (2002); weekly: 13.8 (804)	15 (3)	2.9 - 4.7 (147-235)	Stantec Consulting. 2010. Cohocton and Dutch Hill Wind FarmsYear 1 Post-Construction Monitoring Report, 2009 for the Cohocton and Dutch Hill Wind Farms In Cohocton, New York. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC.
Cohocton and Dutch Hill	agricultural, woodland (50)	April 26 to October 22, 2010	17 weekly except when 12 weekly and 5 daily from July 15-Sept 17	63 (5)	daily: 25.62 (1281); weekly A): 5.04 (252); weekly B): 10.44 (522)	9 (1)	daily: 2.06 (103); weekly 1: 0.82 (41); weekly 2: 1.16 (58)	Stantec Consulting. 2011. Cohocton and Dutch Hill Wind Farms Year 2 Post-Construction Monitoring Report, 2010 for the Cohocton and Dutch Hill Wind Farms In Cohocton, New York. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC.
Cohocton and Dutch Hill	agricultural, woodland (50)	July 8 to October 15, 2013	17 turbines every 5 days	44	8.03 (401.5)	22 (2)	3.96 (198)	Stantec Consulting. 2014. Cohocton and Dutch Hill Wind Farms 2013 Post-ConstructionWildlife Monitoring Report. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC.
Ellenburg	agricultural, woodland (54)	April 28 to Oct 13, 2008	6 daily, 6 every 3-days, 6 every 7-days	34 (25)	daily: 8.17 (441); 3-day: 6.94 (375); weekly: 4.19 (226)	12 (10)	daily: 2.09 (113); 3-day: 1.37 (74); weekly: 1.18 (64)	Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, A. Fuerst, and C. Hansen. 2009. Annual Report for the Noble Ellenburg Windpark, LLC. Postconstruction Bird and Bat Fatality Study – 2008. Prepared by Curry and Kerlinger, LLC.
Ellenburg	agricultural, woodland (54)	April 15 to November 15, 2009	6 daily, 12 weekly	28 (4)	daily: 8.01 (433); weekly: 3.70 (200)	19 (2)	daily: 5.69 (307); weekly: 2.29 (124)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2010. Annual Report for the Noble Ellenburg Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC.
Hardscrabble	agricultural, woodland (37)	April 15 to October 15, 2012	12 daily (12 weekly supplemental)	171 (7)	21.34 (790)	48 (6)	6.86 (254)	West/Jason P. Ritzert, Rhett Good, and Shay Howlin. 2013. 2012 Post-Construction Study and AnaBat Study Hardscrabble Wind Project Herkimer County, New York April 15 – October 15, 2012. Prepared for: Iberdrola Renewables, LLC.
Howard	agricultural, woodland (27)	April 15-Nov 15, 2012	5 daily, 5 weekly	138 (10)	20.09 (542) [5]	16 (standard and incidental combined)	2.5 (67.5)[5]	West. 2013. 2012 Post-Construction Monitoring Studies for the Howard Wind Projgect Steuben County, New York. Prepared for Howard Wind, LLC.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
Maple Ridge	woodland, grassland, agricultural (120)	June 17 - Nov 15, 2006	10 every 3-days, 30 7-days, 10 daily	326 (58)	11.39-20.31 (1367-2437.2)	123 (15)	3.10-9.48 (372-1,138)	Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2007. Annual report for the Maple Ridge wind power project post-construction bird and bat fatality study—2006. Prepared for PPM Energy and Horizon Energy. http://www.wind-watch.org/documents/wp-content/uploads/maple_ridge_report_2006_final.pdf
Maple Ridge	woodland, grassland, agricultural (195)	April 30 - Nov 14, 2007	64 weekly	202 (81)	15.54-18.53 (3030-3614)	64 (32)	5.67-6.31 (1,106-1,230)	Jain, A. P. Kerlinger, R. Curry, and L. Slobodnik. 2008. Annual report for the Maple Ridge wind power project post-construction bird and bat fatality study —2007. Annual report prepared for PPM Energy and Horizon Energy. Curry and Kerlinger, Cape May Point, New Jersey, USA.
Maple Ridge	woodland, grassland, agricultural (195)	April 15 - Nov 9, 2008	64 weekly	140 (76)	8.18 - 8.92 (1595-1739)	74 (23)	3.42-3.76 (667-733)	Jain, A. P. Kerlinger, R. Curry, and L. Slobodnik. 2009. Annual report for the Maple Ridge wind power project post-construction bird and bat fatality study —2007. Annual report prepared for PPM Energy and Horizon Energy. Curry and Kerlinger, Cape May Point, New Jersey, USA.
Maple Ridge	woodland, grassland, agricultural (195)	July 12 - October 15, 2012	weekly at 105 small plot and 5 large plots	68 (2)[5]	13.38 (2609)	11	n/a	Tidhar, D., J. Ritzert, M. Sonnenberg, M. Lout, and K. Bay. 2013. 2012 Post-construction Fatality Monitoring Study for the Maple Ridge Wind Farm, Lewis County, New York. Final Report: July 12 – October 15, 2012. Prepared for EDP Renewables North America
Munnsville	agricultural forested uplands (23)	April 15-Nov 15, 2008	12 of 23 weekly, seasonal dog searches	9 (1)	0.70-2.90 (16-67)	7 (3)	1.71-2.22 (39-51)	Stantec Consulting. 2009. Post-construction monitoring at the Munnsville Wind Farm, New York, 2008. Prepared for E.ON Climate and Renewables.
Steel Winds I & II	Lake Erie shoreline (14)	March 10 to May 31, July 15 to Nov 20, 2012	7 weekly	18 (1)	5.83 (82)[4]	6 (5)	3.97 (56)	Stantec Consulting. 2013. Steel Winds I and II Post-Construction Monitoring Report, 2012. Prepared for First Wind Management, LLC
Steel Winds I & II	Lake Erie shoreline (14)	March 10 to May 31, July 15 to September 30, 2013	7 once every 3 days	31 (3)	15.30 (214)	23 (6)	15.50 (217)	Stantec Consulting. 2014. Steel Winds I and II Post-Construction Monitoring Report, 2013. Prepared for First Wind Management, LLC
Wethersfield	agricultural, woodlots (84)	April 15 to Oct 15, 2010	28 weekly	62 (13)	24.45 (2054)	11 (7)	2.55 (214)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K., Harte, A. 2011. Annual Report for the Noble Wethersfield Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC.
Pennsylvania								
Casselman	forested ridge, grassland mine ridge (23)	July 27 - October 9, 2008	22 daily	32 [3]	24.2 (557)	N/A	N/A	Arnett, E.B., M. Schirmacher, M.P. Huso, J.P. Hayes. 2010. Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.
Casselman	forested ridge, grassland mine ridge (23)	July 26 - October 8, 2009	22 daily	39 [3]	17.4 (400)	N/A	N/A	Arnett, E.B., M. Schirmacher, M.P. Huso, J.P. Hayes. 2010. Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.
Meyersdale	forested ridgeline (20)	Aug 2 - Sept 13, 2004	10 daily, 10 weekly	262 (37)	25 (400-660)	13 (4)	n/a	Arnett, E.B., W.P. Erickson, J. Kerns, and J. Horn. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. Bats and Wind Energy Cooperative.
Somerset County	agricultural (8)	2000 (12 months)	n/a	0	n/a	0	n/a	Kerlinger, P. 2006. Supplement to the Phase I Avian Risk Assessment and Breeding Bird Study for the Deerfield Wind Project, Bennington County, Vermont. Prepared for Deerfield Wind, LLC.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
Tennessee								
Buffalo Mtn	reclaimed mine on ridge (18)	April - Dec 10, 2005	18 of 18 every week, every 2 weeks, or every 2-5 days	243 (14)	63.9 (1,149)	9 (2)	1.8 (112)	Fiedler, J.K., T.H. Henry, R.D. Tankersley, and C.P. Nicholson. 2007. Results of Bat and Bird Mortality Monitoring at the Expanded Buffalo Mountain Windfarm, 2005 June 28, 2007. Prepared for Tennessee Valley Authority.
Vermont								
Searsburg	forested (11)	June 30 - Oct 18, 1997	11 total (4 per search) 2 to 6 days per month	0	n/a	0	n/a	Kerlinger, P. 2002. An Assessment of the Impacts of Green Mountain Power Corporation's Wind Power Facility on Breeding and Migrating Birds in Searsburg, Vermont. Prepared for the Vermont Department of Public Service Montpelier, Vermont.
Sheffield	forested ridgeline (16)	April 1 – Oct 31, 2012	daily at 50% April-June, Oct; 100% July, Aug, Sept	87	14.65 (235)	35	13.17 (211)	Martin, C., E. Arnett, M. Wallace. 2013. Evaluating Bird and Bat Post-Construction Impacts at the Sheffield Wind Facility, Vermont 2012 Annual Report. Prepared for Bat Conservation International and First Wind.
Sheffield	forested ridgeline (16)	April 23 - Oct 31, 2013	daily at 8 April 23 – June 2 and October 1–3, daily at 16 June 3–30 and September, 2013	19	2.80 (45)	29 (2)	8.01 (129)	Martin, C., E. Arnett, M. Wallace. 2014. Evaluating Bird and Bat Post-Construction Impacts at the Sheffield Wind Facility, Vermont 2013 Annual Report. Prepared for Bat Conservation International and First Wind.
Kingdom Community	forested ridgeline (21)	April 15-Oct 15, 2013	all 21 weekly April 15-May 31, every 3-days June 1-Oct 15	15 (2)	1.94 (41)	61 (13)	10.76 (226)	Stantec. 2014. Kingdom Community Wind 2013 Post-Construction Monitoring Report - Year 1. Prepared for Green Mountain Power.
Georgia Mountain	forested ridgeline (4)	April 16 - Oct 16, 2013	all 4 every 3 days	12 (1)	11.7 (47)	6 (0)	6 (26)	Stantec. 2014. Georgia Mountain Community Wind 2013 Post-Construction Monitoring Report - Year 1. Prepared for Georgia Mountain Community Wind, LLC.
Kingdom Community	forested ridgeline (21)	April 15-Oct 15, 2014	all 21 weekly April 15-May 31, every 3-days June 1-Oct 15	21	4.96 (105)	36 (6)	9.11 (192)	Stantec. 2015. Kingdom Community Wind 2014 Post-Construction Monitoring Report - Year 2. Prepared for Green Mountain Power.
Georgia Mountain	forested ridgeline (4)	April 16 - Oct 16, 2014	all 4 every 3 days	3	2.29 (9)	1	2.13 (9)	Stantec. 2015. Georgia Mountain Community Wind 2014 Post-Construction Monitoring Report - Year 2. Prepared for Georgia Mountain Community Wind, LLC.
Deerfield Wind	forested ridgeline (15)	April 23-October 15, 2018	3-day	10	1.47 (23)	26	8.01 (121)	Stantec. 2019. Post-Construction Monitoring Report Year 1, Deerfield Wind Project. Stantec Consulting Services Inc., Topsham, Maine, USA. 37 pages + appendices.
Deerfield Wind	**forested ridgeline (15)**	**May 8-October 15, 2018**	**3-day**	**27**	**2.53 (38)**	**21 (12)**	**0.56 (9)**	**This report**
West Virginia								
Mount Storm	forested ridgeline (82)	July 18 - Oct 17, 2008	18 weekly, 9 daily	182 (27)	daily: 24.21 (1985) weekly: 7.76 (636)	29 (8)	2.41-3.81 (198-312)	Young, D.P., W.P. Erickson, K. Bay, S. Normani, W. Tidhar. 2009. Mount Storm Wind Energy Facility, Phase 1: Post-construction Avian and Bat Monitoring. Prepared for: NedPower Mount Storm, LLC.
Mount Storm	forested ridgeline (82)	July-October, 2010	25 daily	308 (73)	22.39 (1836)	36 (11)	2.77 (227)	Young, D.P., S. Nomani, W. Tidhar, and K. Bay. 2010. Mount Storm Wind Energy Facility Post-construction Avian and Bat Monitoring, July-October 2010. Prepared for NedPower Mount Storm, LLC.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (# found incidentally)	Estimated BATS/turbine/period (total)	# BIRDS found during surveys (# found incidentally)	Estimated BIRDS/turbine/period (total)	Reference
Mountaineer	forested ridgeline (44)	April 4 - Nov 11, 2003	2x per week	475	47.53 (2092)	69 [1]	4.04 (178 + 33 due to substation lighting)	Kerns, J., and P. Kerlinger. 2004. A study of bird and bat collision fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia, USA: annual report for 2003. <http://www.responsiblewind.org/docs/MountaineerFinalAvianRpt3-15-04PKJK.pdf>
Mountaineer	forested ridgeline (44)	July 31- Sept 11, 2004	22 daily, 22 weekly	398 (68)	38 (1364-1980)	15 (n/a)	n/a	Arnett, E.B., W.P. Erickson, J. Kerns, and J. Horn. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. Bats and Wind Energy Cooperative.

*****Comparison of fatality rates across survey sites and survey periods should be interpreted with caution, as Deerfield implemented a 6 m/s curtailment program on all turbines, whereas other sites implemented different or no operational control measures.**

[1] 33 birds found on May 23, 2003 at turbines near a substation and at substation associated with sodium vapor lights.

[2] Results of spring interim report, study period April 20 to June 1.

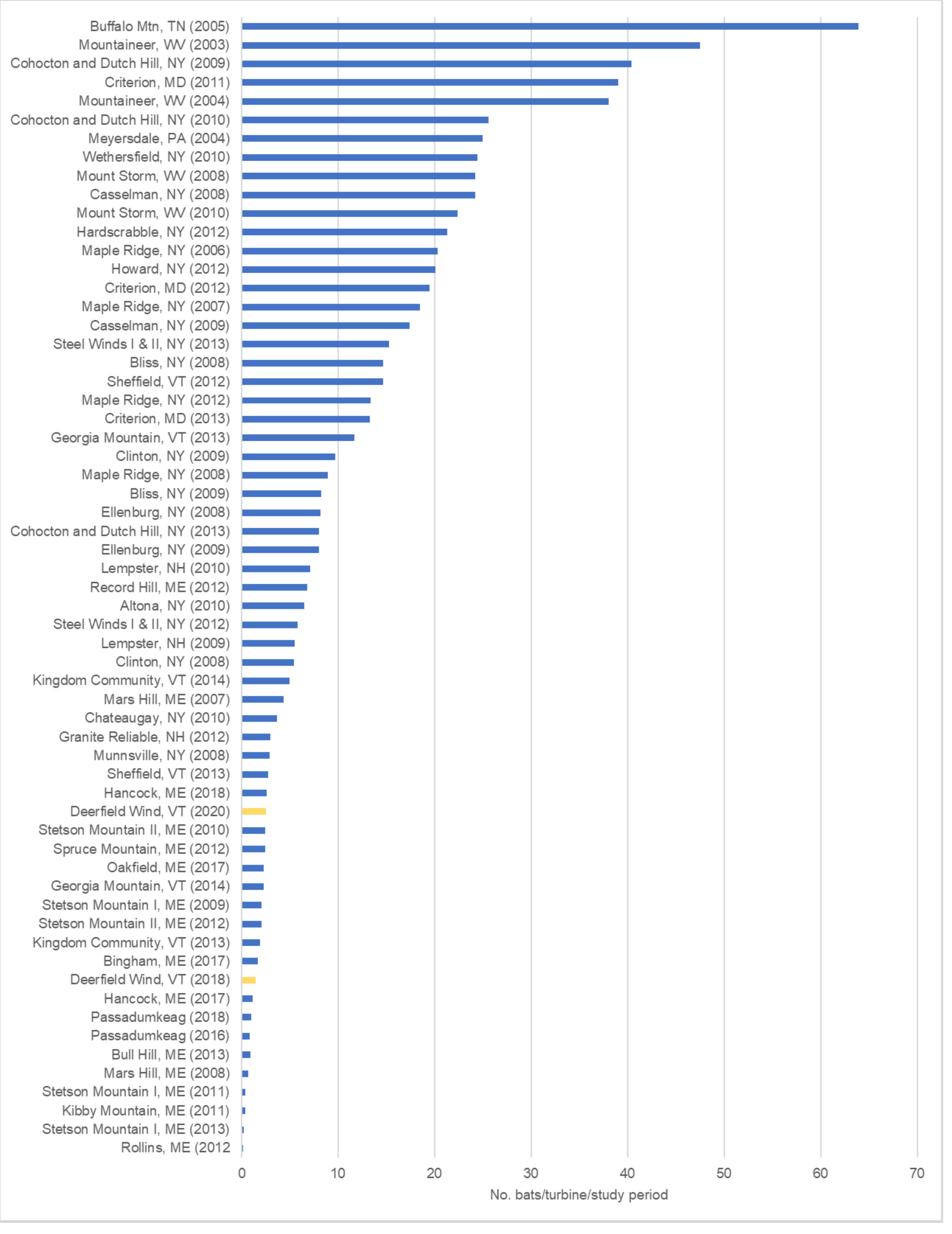
[3] Fresh bats found at curtailment treatment turbines reported only.

[4] Based on the Huso fatality estimator not including search area corrections.

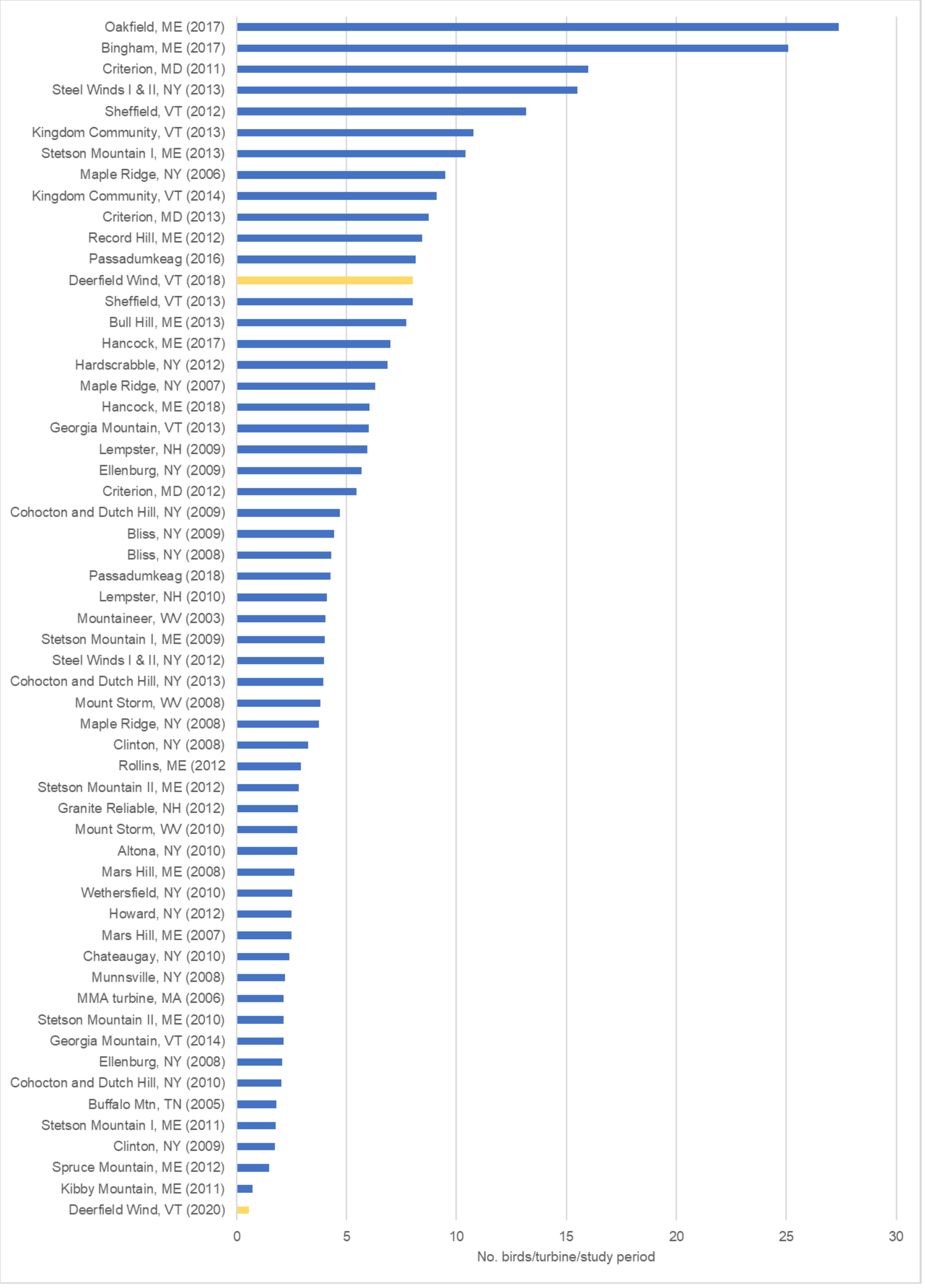
[5] Included incidental carcasses in estimates of fatality.

[6] Based search area corrections on distribution of carcasses found at the Maple Ridge Wind Project, New York.

[7] More than one estimator was used in this analysis.

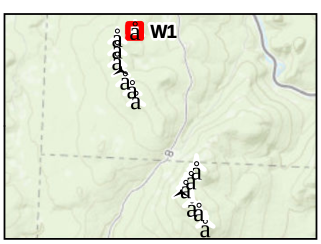


Appendix A Figure 1. Fatality Rates for Bats (Bats/Turbine/Study Period) from Publicly Available Studies at Wind Energy Facilities in the Eastern US, as Shown in Appendix A Table 3 (For studies with multiple rates, the highest rate is shown).



Appendix A Figure 2. Fatality Rates for Birds (Birds/Turbine/Study Period) from Publicly Available Studies at Wind Energy Facilities in the Eastern US, as Shown in Appendix A Table 3 (For studies with multiple rates, the highest rate is shown).

Appendix B TURBINE SEARCH PLOTS



Legend

å Turbine Location

Deerfield As-built

10-meter Ring

PCM Search Area

Vegetation Cover

Bare Ground

Grass

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400

2. Data Sources:Stantec

3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Stantec

Project Location
Searburg, Vermont

Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

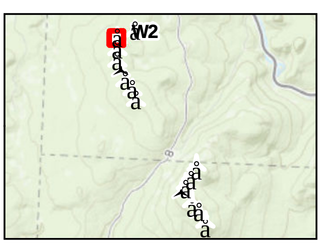
Client/Project
195601468

Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
1 of 15

Title
Turbine W1 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner



Legend
- Turbine Location
- Deerfield As-built
- 10-meter Ring
- PCM Search Area

Vegetation Cover
- Bare Ground
- Grass
- Rocks

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Data Sources:Stantec
3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

0 100 Feet
(At original document size of 8.5x11)
1:1,200

Stantec

Project Location
Searburg, Vermont

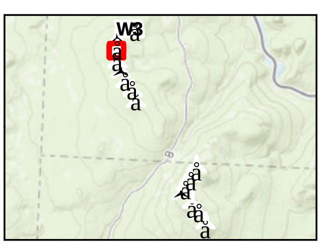
Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

Client/Project
195601468
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
2 of 15

Title
Turbine W2 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner



Legend

Turbine Location

Deerfield As-built

10-meter Ring

PCM Search Area

Vegetation Cover

Bare Ground

Grass

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400

2. Data Sources:Stantec

3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Stantec

Project Location
Searburg, Vermont

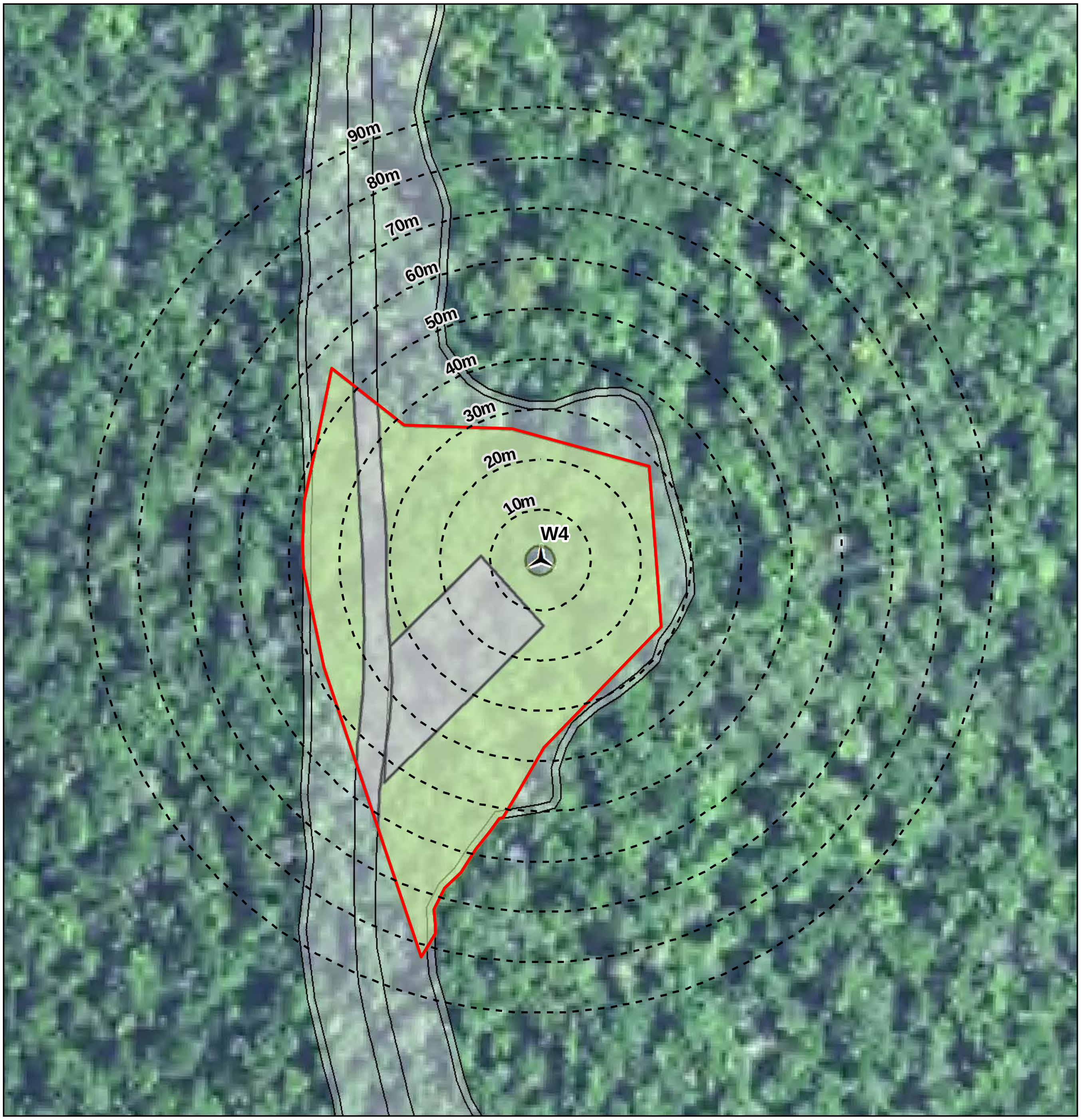
Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

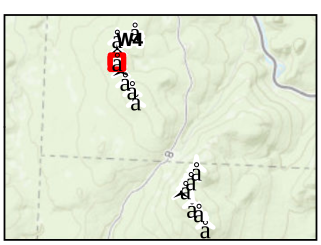
Client/Project
195601468
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
3 of 15

Title
Turbine W3 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat\01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner





Legend

å Turbine Location

Deerfield As-built

10-meter Ring

PCM Search Area

Vegetation Cover

Bare Ground

Grass

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Data Sources:Stantec
3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

Stantec

Project Location
Searburg, Vermont

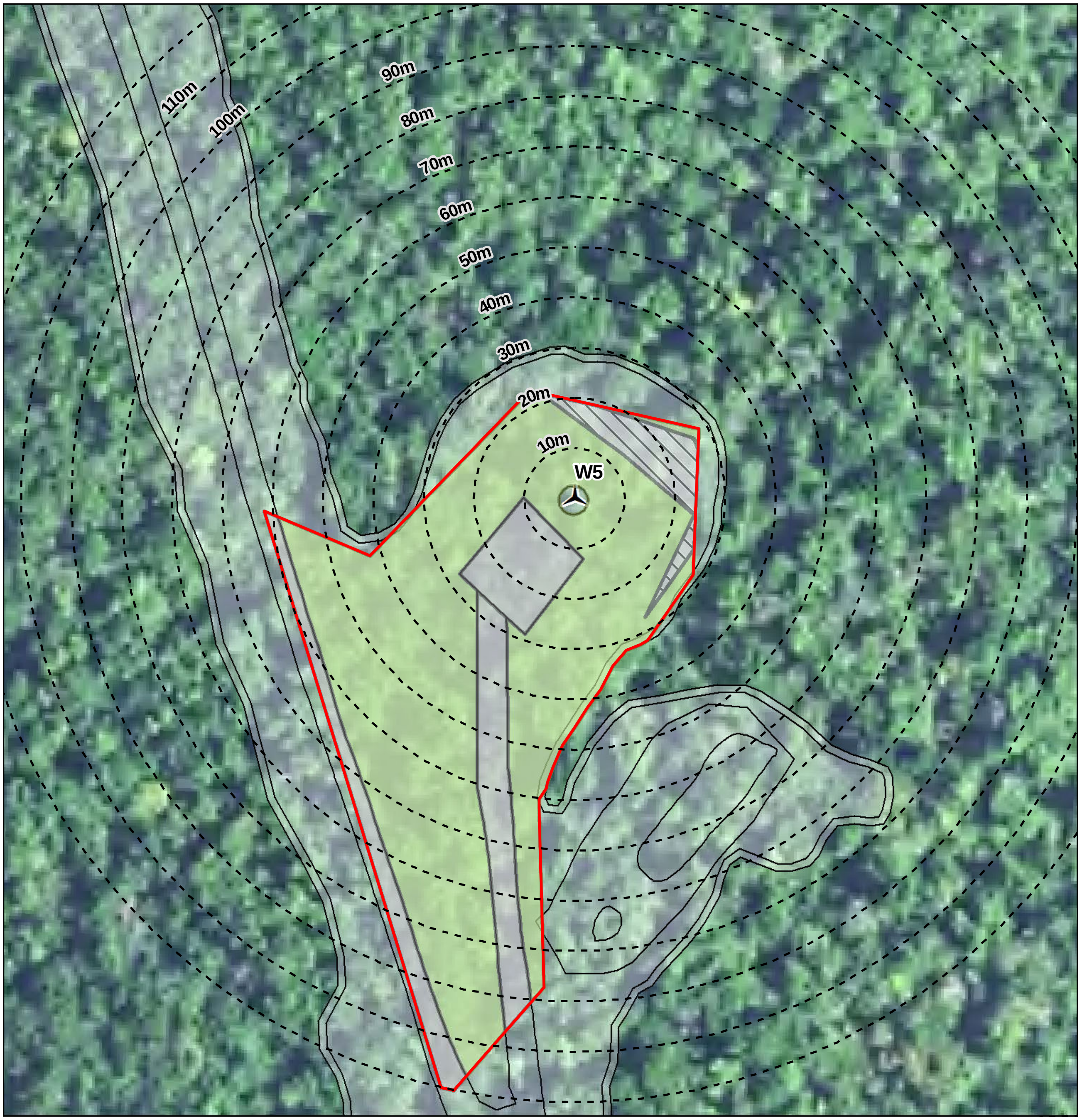
Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

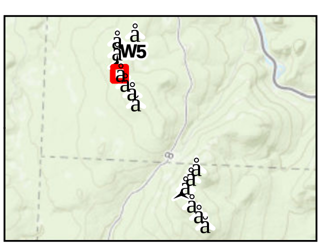
Client/Project
195601468
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
4 of 15

Title
Turbine W4 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat\01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner





Legend

â Turbine Location

Deerfield As-built

10-meter Ring

PCM Search Area

Vegetation Cover

Bare Ground

Grass

Rocks

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400

2. Data Sources:Stantec

3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Stantec

Project Location
Searburg, Vermont

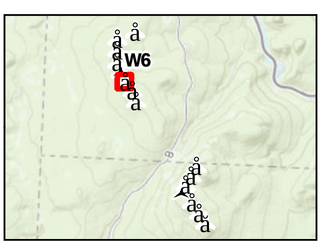
Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

Client/Project
195601468
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
5 of 15

Title
Turbine W5 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat\01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner



Legend

å Turbine Location

Deerfield As-built

10-meter Ring

PCM Search Area

Vegetation Cover

Bare Ground

Grass

Rocks

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400

2. Data Sources:Stantec

3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Stantec

Project Location
Searburg, Vermont

Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

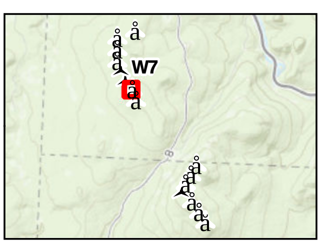
Client/Project
195601468

Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
6 of 15

Title
Turbine W6 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner



Legend
- Turbine Location
- Deerfield As-built
- 10-meter Ring
- PCM Search Area

Vegetation Cover
- Bare Ground
- Grass
- Rocks

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Data Sources:Stantec
3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Stantec

Project Location
Searburg, Vermont

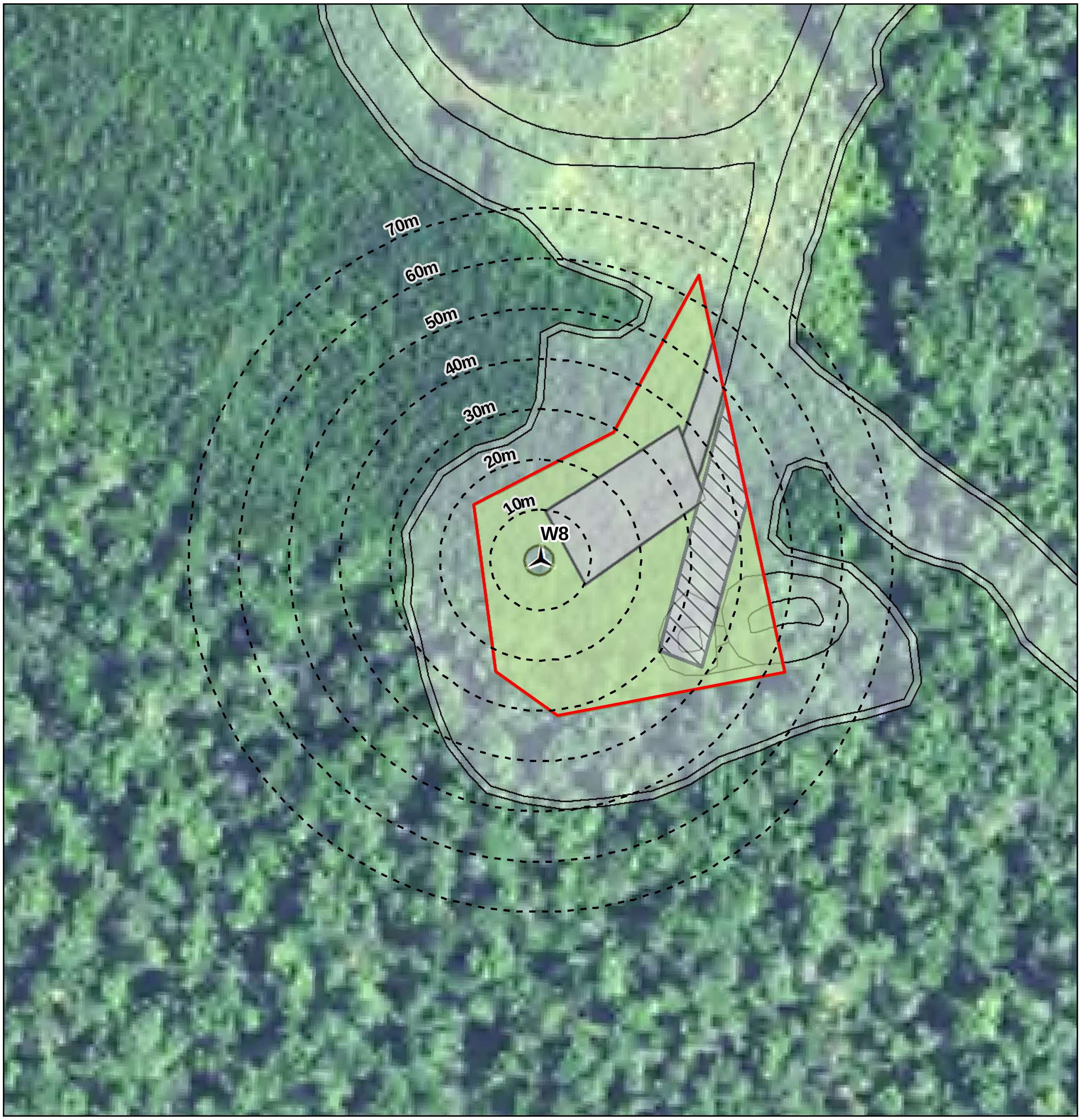
Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

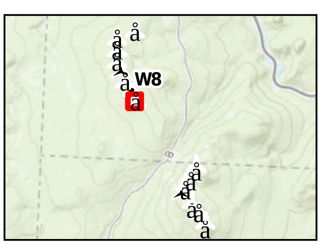
Client/Project
195601468
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
7 of 15

Title
Turbine W7 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner





Legend

å Turbine Location

Deerfield As-built

10-meter Ring

PCM Search Area

Vegetation Cover

Bare Ground

Grass

Rocks

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400

2. Data Sources:Stantec

3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Stantec

Project Location
Searburg, Vermont

Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

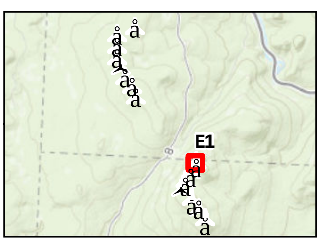
Client/Project
195601468

Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
8 of 15

Title
Turbine W8 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner



Legend

å Turbine Location

Deerfield As-built

10-meter Ring

PCM Search Area

Vegetation Cover

Bare Ground

Grass

Rocks

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Data Sources:Stantec
3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

Stantec

Project Location
Searburg, Vermont

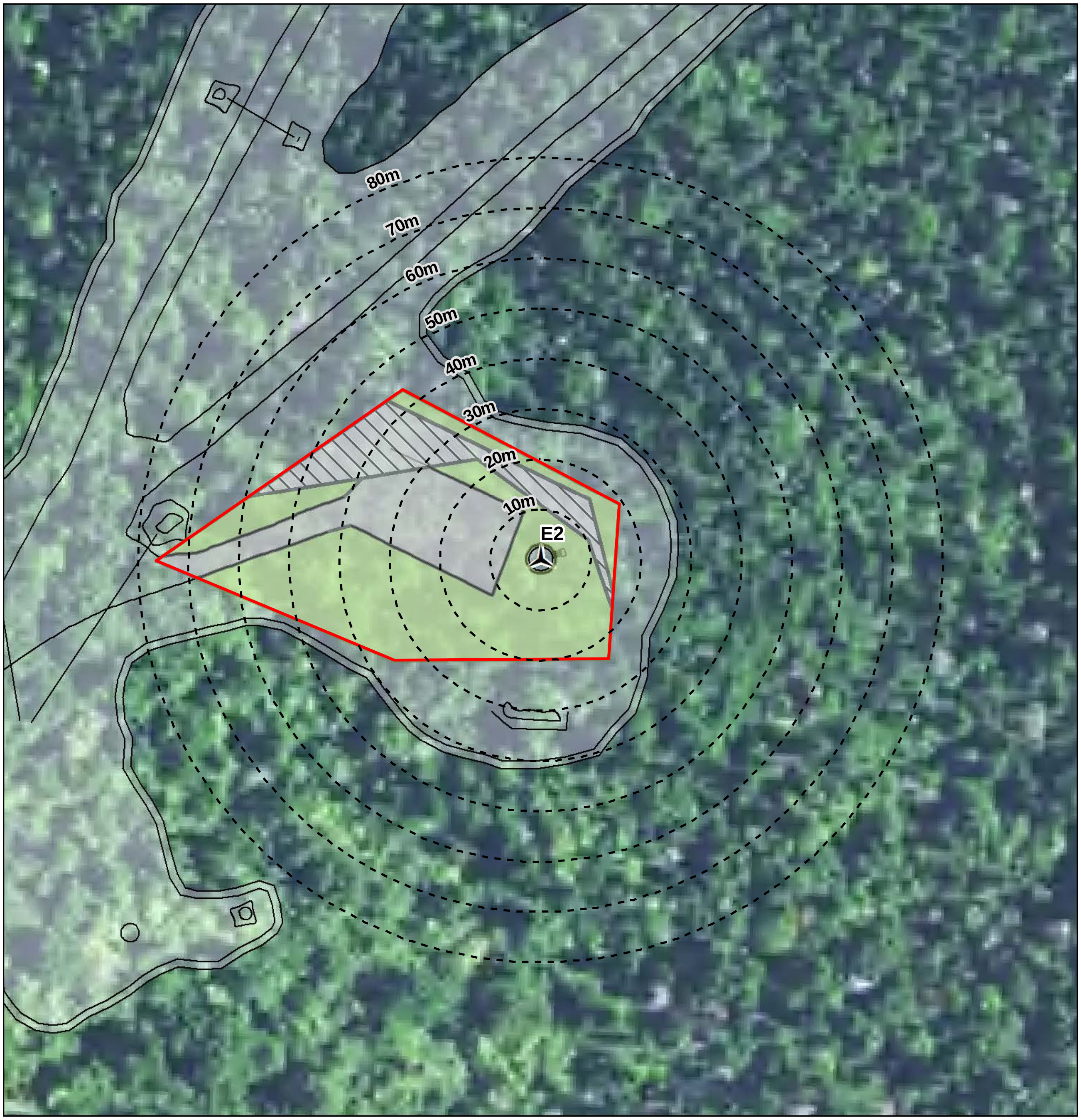
Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

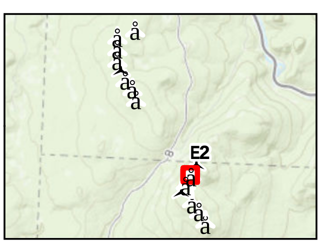
Client/Project
195601468
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
9 of 15

Title
Turbine E1 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner





Legend
å Turner Location
Deerfield As-built
10-meter Ring
PCM Search Area
Vegetation Cover
Bare Ground
Grass
Rocks

0 100 Feet
(At original document size of 8.5x11)
1:1,200

Stantec

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Data Sources:Stantec
3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

Project Location
Searburg, Vermont

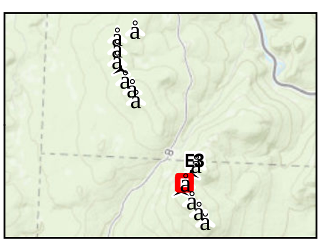
Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

Client/Project
195601468
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
10 of 15

Title
Turbine E2 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat\01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner



Legend

å Turbine Location

Deerfield As-built

10-meter Ring

PCM Search Area

Vegetation Cover

Bare Ground

Grass

Rocks

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400

2. Data Sources:Stantec

3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Stantec

Project Location
Searburg, Vermont

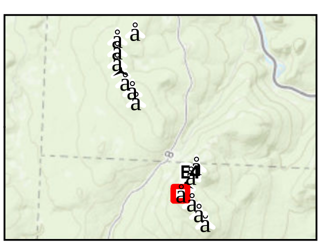
Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

Client/Project
195601468
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
11 of 15

Title
Turbine E3 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner



Legend

å Turbine Location

Deerfield As-built

10-meter Ring

PCM Search Area

Vegetation Cover

Bare Ground

Grass

Rocks

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400

2. Data Sources:Stantec

3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Stantec

Project Location
Searburg, Vermont

Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

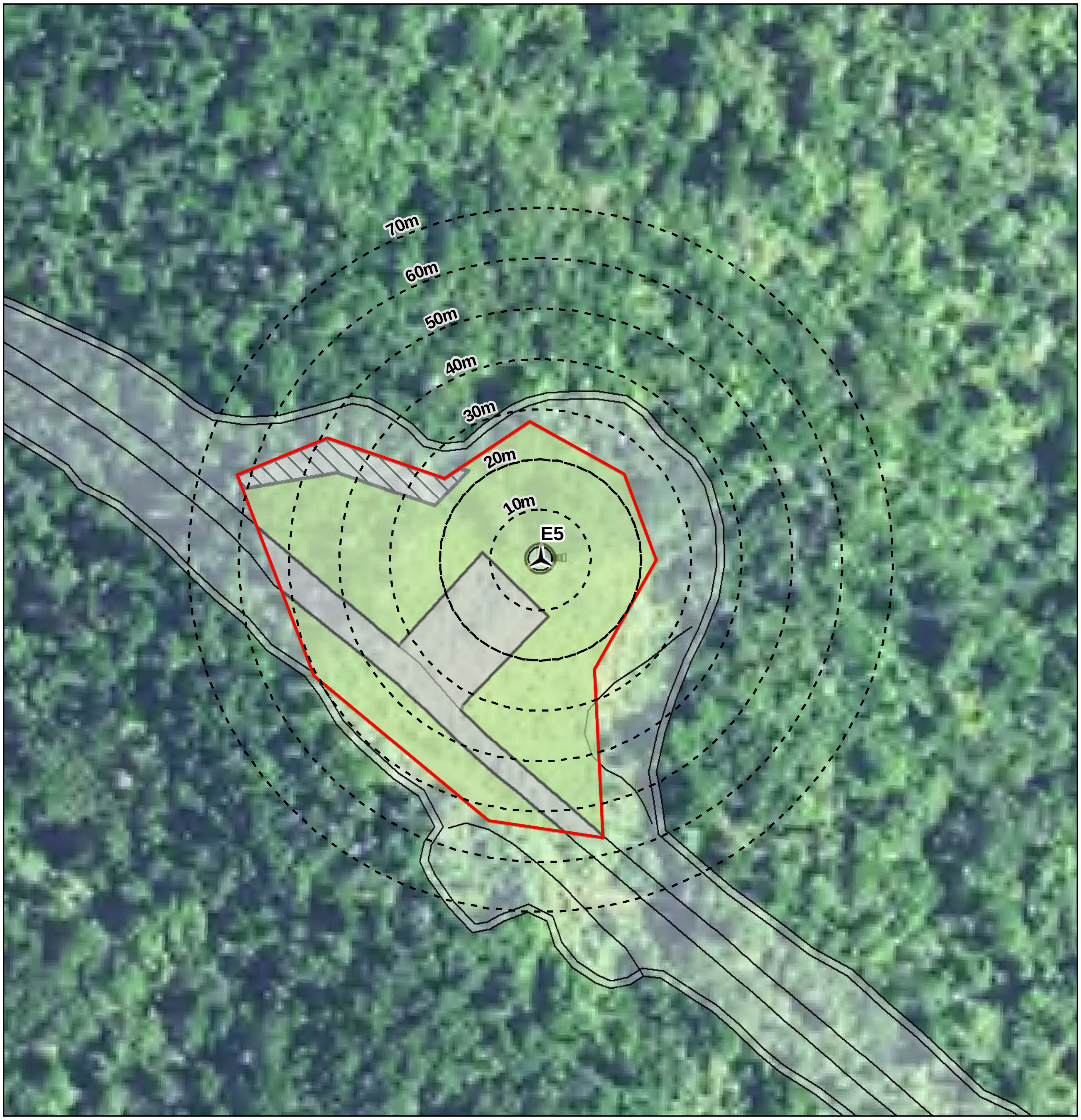
Client/Project
195601468

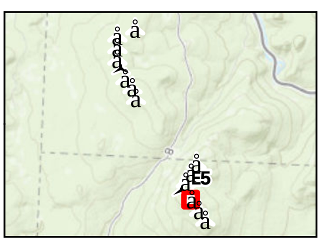
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
12 of 15

Title
Turbine E4 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner





Legend

å Turbine Location

Deerfield As-built

10-meter Ring

PCM Search Area

Vegetation Cover

Bare Ground

Grass

Rocks

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400

2. Data Sources:Stantec

3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

Project Location
Searburg, Vermont

Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

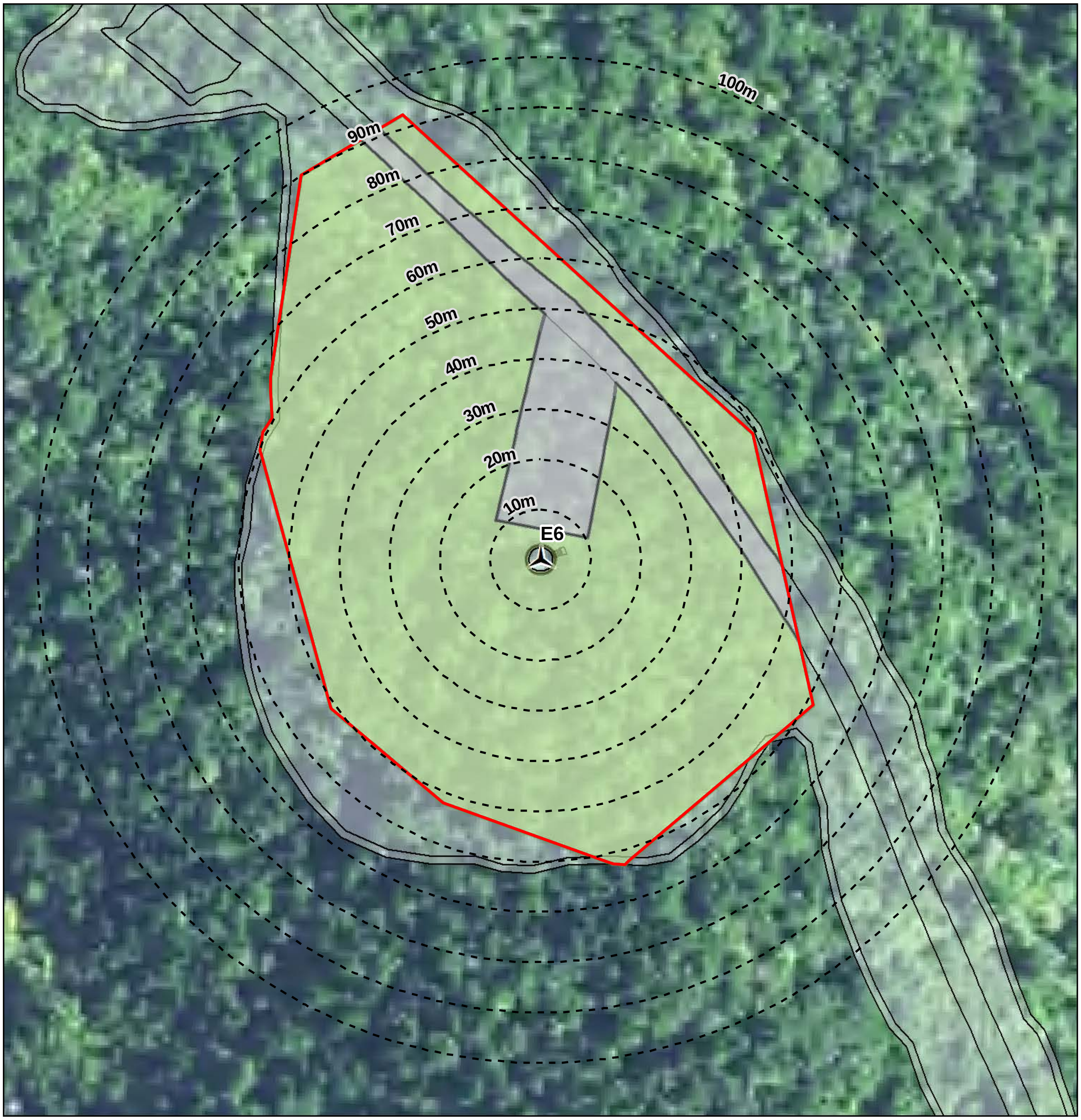
Client/Project
195601468

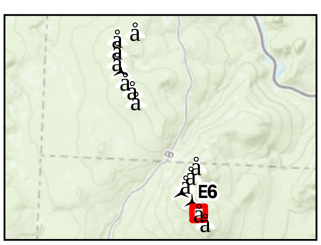
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
13 of 15

Title
Turbine E5 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner





Legend
- Turbine Location
- Deerfield As-built
- 10-meter Ring
- PCM Search Area

Vegetation Cover
- Bare Ground
- Grass

0 100 Feet
(At original document size of 8.5x11)
1:1,200

Stantec

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Data Sources:Stantec
3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

Project Location
Searburg, Vermont

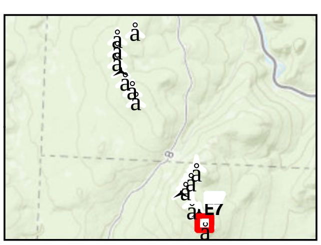
Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

Client/Project
195601468
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
14 of 15

Title
Turbine E6 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat\01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner



Legend

Turbine Location

Deerfield As-built

10-meter Ring

PCM Search Area

Vegetation Cover

Bare Ground

Grass

Rocks

0 100 Feet

(At original document size of 8.5x11)
1:1,200

Notes
1. Coordinate System: NAD 1983 StatePlane Vermont FIPS 4400
2. Data Sources:Stantec
3. Background: 2016 National Agriculture Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency

Stantec

Project Location
Searburg, Vermont

Prepared by HCT on 2021-01-22
TR Review by GC on 2021-01-25
IR Review by LJ on 2021-01-25

Client/Project
195601468
Avangrid Renewables, LLC
Deerfield Wind Project
Post-Construction Monitoring

Figure No.
15 of 15

Title
Turbine E7 Search Plot 2020

V:\1956\active\195601468\03_data\gis_cad\gis\MXDs\AvianBat\01468_AppB_SearchPlots2020.mxd Revised: 2021-01-25 By: hturner

STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Amended Petition of Deerfield Wind, LLC for a certificate of public good authorizing it to construct and operate 15 turbine, 30 MW wind generation facility, and associated transmission and interconnection facilities, on approximately 80 acres in the Green Mountain National Forest, located in Searsburg and Readsboro, Vermont, with 7 turbines to be placed on the east side of Route 8 on the same ridgeline as the existing GMP Searsburg wind facility (Eastern Project Area), and 8 turbines along the ridgeline to the west of Route 8 in the northwesterly orientation (Western Project Area)	)	Docket No. 7250

CERTIFICATE OF SERVICE

I, Catie Michael, certify that on November 28, 2022, I forwarded copies of Deerfield Wind, LLC's: *Letter to the PUC re Status Update* to the following service list by the delivery method noted:

By Email and First-Class Mail:
Ms. Holly Anderson, Clerk
Vermont Public Utility Commission
112 State Street, Drawer 20
Montpelier, VT 05620-2701
PUC.Clerk@vermont.gov

By First-Class Mail:
Ms. Deidre Matthews
National Grid
40 Sylvan Road
Waltham, MA 02451

By Email:
Erin Brennan, Esq.
Vermont Dept. of Public Service
112 State Street, Drawer 20
Montpelier, VT 05620-2601
erin.brennan@vermont.gov

Kristin Carlson
Green Mountain Power
163 Acorn Lane
Colchester, VT 05446
Kristin.Carlson@greenmountainpower.com

Catherine Gjessing, Esq.
John Zaikowski, Esq.
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Montpelier, VT 05620-3901
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john.zaikowski@vermont.gov

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Duncan Cable TV Services
P.O. Box 685
Wilmington, VT 05363
c.duncan@duncancable.com

Vermont Dept. of Housing & Comm. Affairs
Agency of Commerce and Community Dev.
c/o John Kessler, Esq.
One National Life Drive
Deane C. Davis Building, 6th Floor
Montpelier, VT 05620-0501
john.kessler@vermont.gov

Jamey D. Fidel, Esq.
Vermont Natural Resources Council
9 Bailey Avenue
Montpelier, VT 05602
jfidel@vnrc.org

Owen J. McClain, Esq.
Sheehey Furlong & Behm P.C.
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P.O. Box 66
Burlington, VT 05402-0066
(For Green Mountain Power)
omcclain@sheeheyvt.com

Chris Campany, Executive Director
John Bennett, Senior Planner
Windham Regional Commission
139 Main Street, Suite 505
Brattleboro, VT 05301
ccampany@windhamregional.org

Nancy S. Malmquist, Esq
Downs Rachlin Martin PLLC
90 Prospect Street
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St. Johnsbury, VT 05819-0099
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Lisa Linowes, Executive Director
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Lyman, NH 03585
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Thomas Shea
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Unit 11-144
Seabrook, NH 03874
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Paul Burns, Executive Director
Vermont Public Interest Research Group
141 Main Street, Suite 6
Montpelier, VT 05602
pburns@vpirg.org

Sandra Levine, Senior Attorney
Conservation Law Foundation
15 East State Street, Suite #4
Montpelier, VT 05602
SLevine@clf.org

Gerald DeGray
P.O. Box 1717
Wilmington, VT 05363-1717
gerryd161@aol.com

Robert Batarags
Deerfield Wind, LLC
Avangrid Renewables
1125 NW Couch St., Suite 700
Portland, Oregon 97209
Rob.Batarags@avangrid.com

Dated at Burlington, Vermont, this 18th day of November 2022.

By:

Catie Michael
Junior Paralegal