Fall 2009 Radar and Acoustic Surveys

Wild Meadows Wind Project
In Grafton and Merrimack Counties, New Hampshire

Prepared for

Atlantic Wind LLC
P.O. Box 326
Concord, NH 03302

Prepared by

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

January 2010

(Revised October 2013)

Executive Summary

Atlantic Wind LLC (a subsidiary of Iberdrola Renewables LLC) contracted Stantec Consulting to conduct field surveys of bird and bat migration activity at the proposed Wild Meadows Wind Project (Project) in Grafton and Merrimack Counties, New Hampshire. Fall 2009 surveys included nocturnal marine radar surveys and acoustic monitoring surveys and were conducted following standard protocol for pre-construction surveys at wind energy projects in the region. In addition, although the Fall 2009 survey had already been conducted, the protocol was detailed in a work plan and discussed with USFWS and NHFGD on April 1, 2010; the agencies confirmed that the 2009 methods and effort were appropriate. This report provides a summary of findings for fall 2009, the first of two seasons of radar and acoustic bat surveys.

Nocturnal Marine Radar Survey

Radar surveys were conducted during 35 nights in fall 2009 (between August 20 and October 15) to characterize nocturnal migration activity in the Project area. Surveys were conducted using X-band radar, sampling from sunset to sunrise. Each hour of sampling included the recording of radar video files during horizontal and vertical operation. The radar was located on the summit of Melvin Mountain and provided good visibility of the surrounding airspace to characterize migration. At the time of the fall 2009 surveys, Melvin Mountain was considered part of the Project area, but as a result of Project reconfiguration in 2013, turbines were no longer proposed on Melvin Mountain. However, the nocturnal radar survey from Melvin Mountain provides an adequate characterization of nocturnal migration in the area of the proposed Project because nocturnal migration has been documented to occur in a broad front pattern, based on over 200 similar studies conducted on forested ridgelines in the U.S.; the results of those studies have been similar in terms of passage rates and flight heights, regardless of variations among the topography, elevation, and habitat settings of different project locations.. Further, the topography and elevation of the radar survey location at Wild Meadows is representative of the Project area, and this location is adjacent to the current Project ridgelines.

The seasonal mean passage rate was 980 ± 39 targets per kilometer per hour (t/km/hr), and nightly passage rates varied from 384 ± 61 t/km/hr to 2442 ± 329 t/km/hr. Mean flight direction through the Project area for the season was 225 ± 49˚. The seasonal mean flight height of targets was 362 ± 1 meters (m; 1186 ft [']) above the radar site, and nightly flight heights ranged from 229 ± 7 m to 468 ± 7 m. The mean percent of targets observed flying below 150 m (492'), the height of the proposed turbines, was 19 percent for the entire season.

The results of the nocturnal radar surveys are similar to values reported at other sites on forested ridges in the Northeast. It should be noted that post construction mortality studies have demonstrated that targets flying at or below turbine height observed during pre-construction

radar surveys do not directly correlate to collision risk in terms of the numbers of fatalities that may occur.

Acoustic Monitoring Survey

Three Anabat® acoustic bat detectors were deployed on ridges in the current 2013 Project area and surrounding area between mid-August and mid-October to document bat activity in the Project area. Detectors were deployed in portable towers at a height of 15 m (49'). Data were summarized by guild and species and tallied per detector on an hourly and nightly basis.

Detectors operated properly for most of the season, resulting in 178 detector nights of data. During this survey period, 191 call sequences were recorded, resulting in an overall detection rate of 1.1 bat call sequences per detector night. Bat call detection rates recorded during the fall 2009 season at the Project are within the range of detection rates at other sites in the Northeast where detectors were deployed at heights above tree canopy.

Table of Contents

Tables

Figures

Appendices

PN19560532[*]

[*] *This report was prepared by Stantec Consulting Services Inc. for Atlantic Wind LLC (a subsidiary of Iberdrola Renewables LLC). The material in it reflects Stantec's judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any suffered by any third party as a result of decisions made or actions based on this report.*

1.0 Introduction

1.1 PROJECT BACKGROUND

Atlantic Wind LLC (Atlantic Wind), a subsidiary of Iberdrola Renewables LLC, is planning the Wild Meadows Wind Project (Project) in Grafton and Merrimack Counties, New Hampshire (Figure 1-1) that will consist of 23 wind turbines, a permanent meteorological (met) tower on Forbes Mountain, and associated infrastructure (transmission, access roads, substation and an operations and maintenance building). The turbines will be 3.3 megawatt machines mounted on tubular steel towers with an approximate hub height of 94 meters (m; 308 feet [']) and a rotor diameter of 112 m (367'). The proposed turbines will have a maximum height of approximately 150 m (492').

Stantec Consulting (Stantec) conducted bird and bat studies including a nocturnal radar survey and acoustic bat survey at the Project in fall 2009. On April 1, 2010, Atlantic Wind and Stantec Consulting (Stantec) met with the U.S. Fish and Wildlife Service (USFWS) and New Hampshire Fish and Game Department (NHFGD) at the USFWS office in Concord, New Hampshire to discuss the methods and results of the fall 2009 surveys and to discuss a work plan detailing surveys planned for spring and summer 2010; USFWS and NHFGD agreed with the methodology for both the fall 2009 and spring 2010 surveys. This report provides a summary of findings for the first season (fall 2009) of radar and acoustic bat surveys. A separate report contains the results of the spring and summer 2010 bird and bat studies. This report was updated in September 2013 after the turbine type and layout for the Project were revised.

1.2 SURVEY OVERVIEW

During the fall of 2009, Stantec conducted field surveys related to bird migration and bat activity in the vicinity of the Project area. The overall goals of the investigations were to document:

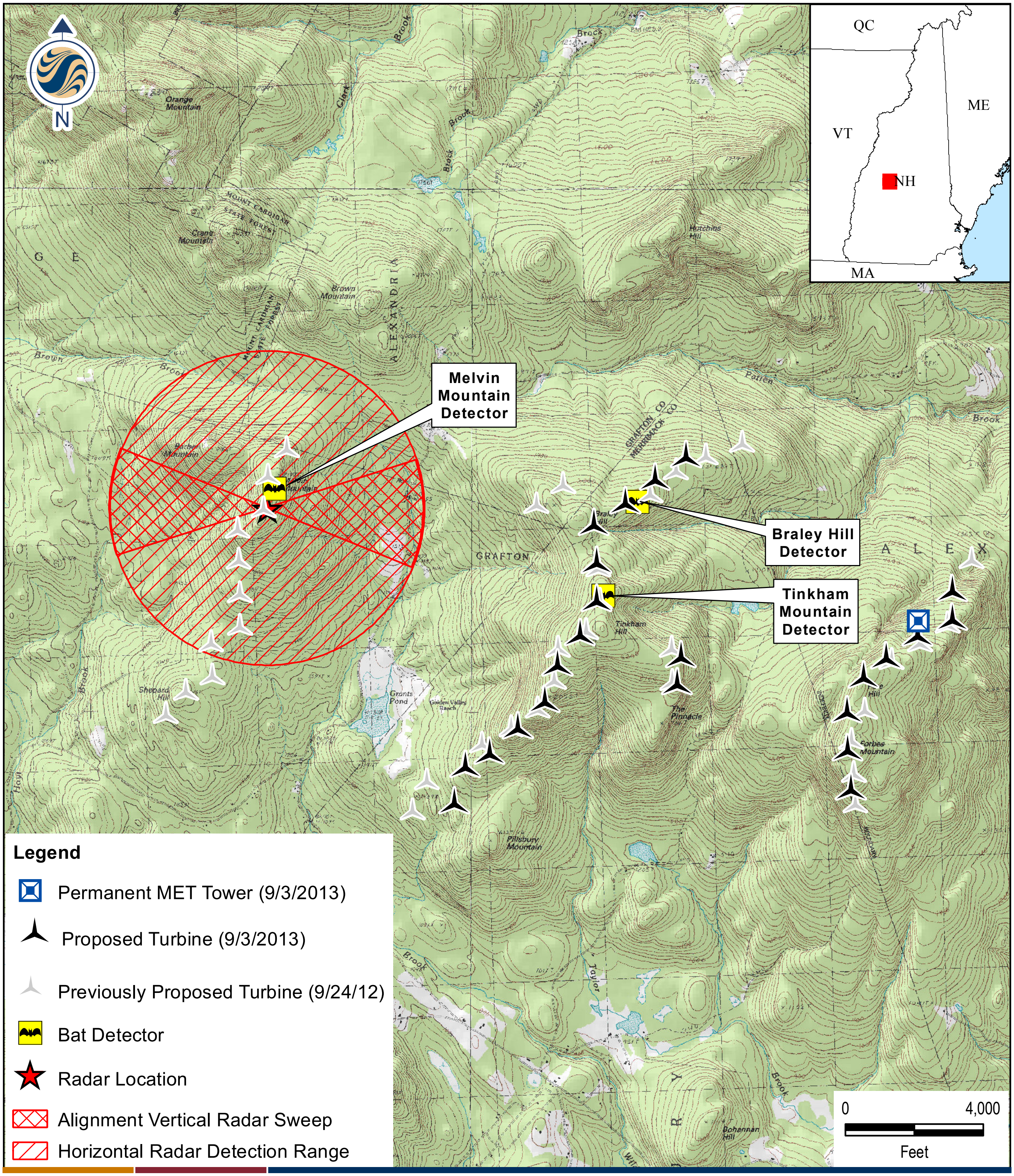
- passage rates for nocturnal migration in the vicinity of the Project area, including the number of migrants, their flight direction, and their flight altitude using nocturnal radar; and
- composition of bat species or guilds present in the Project area and activity patterns of bats including the timing and relationship of activity with weather factors using acoustic bat detectors.

1.3 PROJECT AREA DESCRIPTION

Based upon characterized ecoregions of northern New England and New Hampshire, the Project is located within the Vermont-New Hampshire Upland section and the Sunapee Uplands subsection (Sperduto and Nichols 2004). The Sunapee Uplands subsection is characterized by hills and peaks, principally of granite, that are interspersed with small lakes and narrow stream valleys (Sperduto and Nichols 2004). Topography of this area is generally moderate, and soils are stony, shallow and nutrient poor.

Peaks located partially or entirely within the Project include Braley Hill (635 m; 2,083'), Tinkham Hill (692 m; 2,270') and the Pinnacle (604 m; 1981') on the western portion of the Project. Forbes Mountain (658 m; 2159') and Pine Hill (638 m; 2091') make up the eastern portion of the Project. Tinkham Hill and Braley Hill is generally oriented northeast to southwest and Forbes Mountain is a narrow north-northeast, south-southwest oriented ridgeline. The peaks range in elevation from 604 m (2,100') to 692 m (2,270) at their highest points. Located west and outside of the Project, Barber Mountain (651 meters [m]; 2,136 feet [']), Melvin Mountain (660 m; 2,165'), and Sheppard Hill (550 m; 1,640') were originally part of the Project area but as of the 2013 design, were dropped from the project layout.

Because of the moderate elevation, the dominant tree species in the Project area are hardwood species including sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis)*, and American beech (*Fagus grandifolia*). These tree species are typical of northern hardwood – conifer forest, which is the most common forest community in the northern half of the state of New Hampshire. Conifer species such as red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*) are present, but are generally limited to the ridge summits. On the majority of Project ridgelines, conifer species are mixed with the more dominant hardwood species, or occur as small patches within the hardwood dominated landscape. Common understory species include regenerating canopy species (e.g., sugar maple, yellow birch, and American beech), hobblebush (*Viburnum lantanoides*), striped maple (*Acer pensylvanicum*), and white birch (*Betula papyrifera*). The Project area ridgelines all show signs of timber harvesting activities as evidenced by skidder trails and cuts in various stages of regeneration.



195600532

Stantec Consulting Services Inc.
30 Park Drive
Topsham, ME USA
04086
Phone (207) 729-1199
Fax: (207) 729-2715
www.stantec.com

00532_01_Fall2009SurveyLoc.mxd

Client/Project

Atlantic Wind LLC
Wild Meadows Wind Project
Merrimack & Grafton Counties, New Hampshire

Figure No.

1-1

Title

Fall 2009 Survey Location Map

7/20/2012
REV: 9/6/13

2.0 Nocturnal Radar Survey

2.1 INTRODUCTION

Since the majority of North American passerines (songbirds) migrate at night, nocturnal radar surveys were conducted in the Project area to characterize nocturnal migration patterns during the fall 2009 migration season. In addition to passerines, bats also migrate at night. Documenting the patterns of nocturnal migrants requires the use of radar or other non-visual technologies. The goal of the surveys was to document the overall passage rates for nocturnal migration in the vicinity of the Project area, including the number of migrants, their flight direction, and their flight altitude.

Radar surveys were conducted from sunset to sunrise on 35 nights between August 20 and October 15. The radar was deployed in a clearing on Melvin Mountain (Photo 2-1), at an elevation of approximately 661 m (2,170'). At the time, Melvin Mountain was considered part of the Project area but as of the 2013 design, no turbines are proposed for Melvin Mountain. The antenna was placed on an elevated platform at a height of 7 m (25') allowing the radar beam to detect targets above the height of the majority of the surrounding trees. This effort helped to maximize the airspace sampled by reducing the amount of the radar beam reflected back by surrounding vegetation. This location and set-up provided good views in most directions within the radar's range. It is important to note that surveys from this location provide an accurate assessment of migration activity within the range of the radar at this location; however, the radar is not intended to assess migration over specific turbine locations or various elevations of the Project area (Figure 1-1). Although the radar's view was partially obscured in some areas of the radar detection range, targets could be tracked as they moved in and out of those areas (Figure 2-2).

Photo 2-1. Radar Location at Wild Meadows, Fall 2009

2.2 DATA COLLECTION METHODS

2.2.1 Radar Data

Marine surveillance radar, similar to that described by Cooper *et al.* (1991), was used during field data collection. The radar has a peak power output of 12 kilowatts (kW) and has the ability to track small animals, including birds, bats, and even insects, based on settings selected for the radar functions. It cannot, however, readily distinguish between different types of animals being detected. Consequently, all animals observed on the radar screen were identified as "targets." The radar has an "echo trail" function that captures past echoes of flight trails and allows flight direction to be determined. During all operations, the radar's echo trail was set to 30 seconds. The radar was equipped with a 2 m (6.5') waveguide antenna, deployed 7 m (25') above ground. The antenna has a vertical beam height of 20° (10° above and below horizontal), and the front end of the antenna was inclined approximately 5° to increase the proportion of the beam directed into the sky.

Objects on the ground detected by the radar cause returns on the radar screen (echoes) that appear as blotches called ground clutter. Large amounts of ground clutter reduce the ability of the radar to track targets flying over those areas (Figure 2-1).

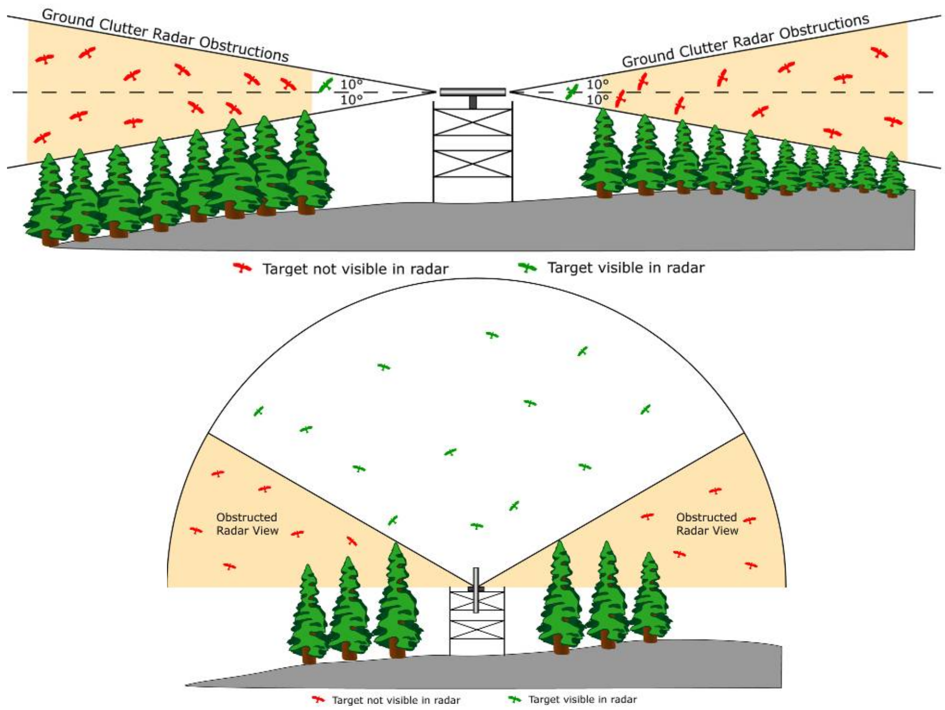


Figure 2-1. Ground clutter in horizontal mode (top) and vertical mode (bottom). Although the radar records three-dimensional space, it is translated by the radar screen into a two dimensional representation, which can cause targets to be obscured from view.

Vegetation and hilltops near the radar can be used to reduce or eliminate ground clutter by "hiding" clutter-causing objects from the radar. These nearby features also cause ground clutter, but their proximity to the radar antenna generally limits the ground clutter to the center of the radar screen (Figure 2-2). Although targets are indistinguishable from the "clutter" as represented on the radar screen, targets traveling into and out of the ground clutter areas can be tracked. The presence or reduction of potential clutter producing objects was carefully considered during site selection and radar station configuration.

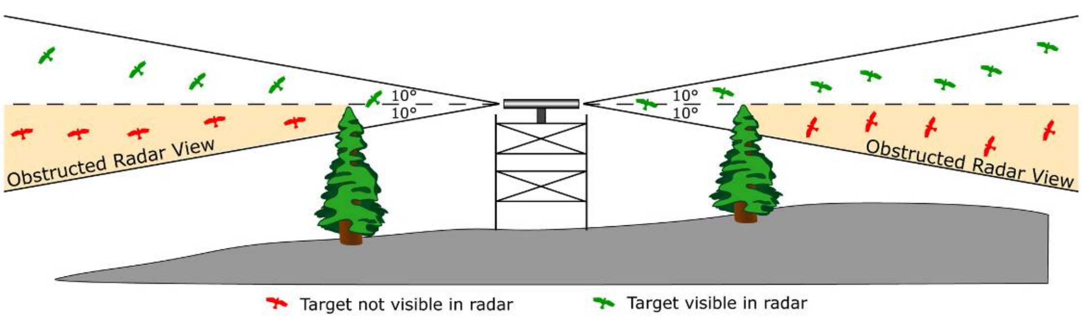


Figure 2-2: Proper site selection can reduce ground clutter to the center of the radar screen, so that the majority of the two-dimensional radar screen remains relatively uncluttered, allowing targets to be tracked as they both enter and leave the cluttered area.

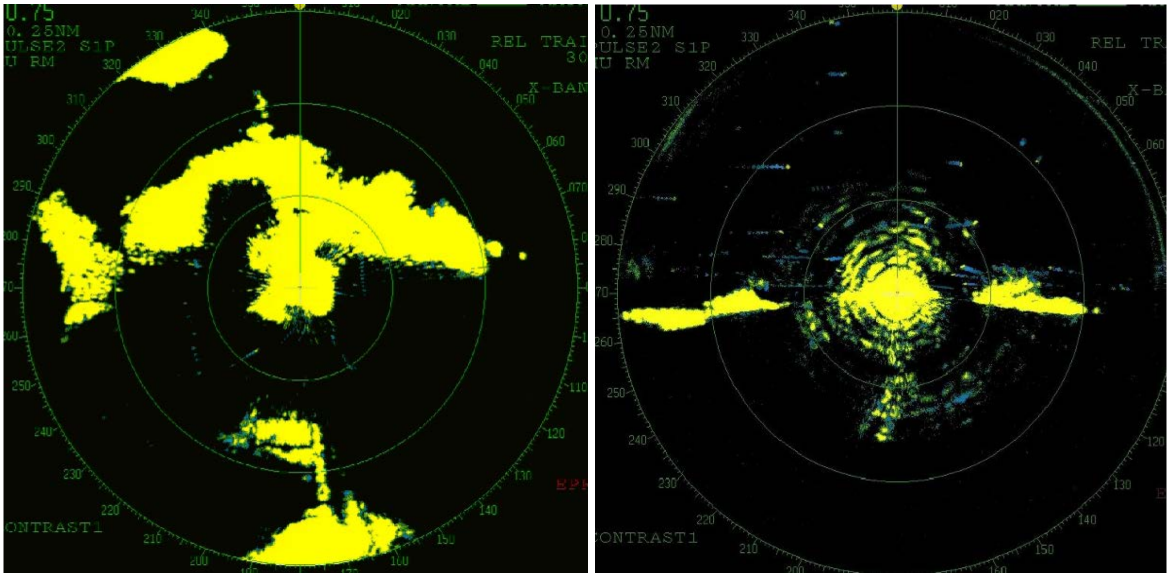


Figure 2-3. Radar screen shots. Horizontal mode left and vertical mode right.

The radar was operated in two modes throughout the course of each night. In surveillance mode, the antenna spins horizontally to survey the airspace around the radar and detects the number of targets and their flight direction (Figure 2-3). By analyzing the echo trail, the flight direction and flight speed of targets can be determined.

In vertical mode, the radar unit is tilted 90° to vertically survey the airspace above the radar (Harmata *et al.* 1999). In vertical mode, target echoes do not provide directional data, but do provide information on the altitude of targets passing through the vertical, 20° radar beam (Figure 2-4). Both modes of operation were used during each hour of sampling.

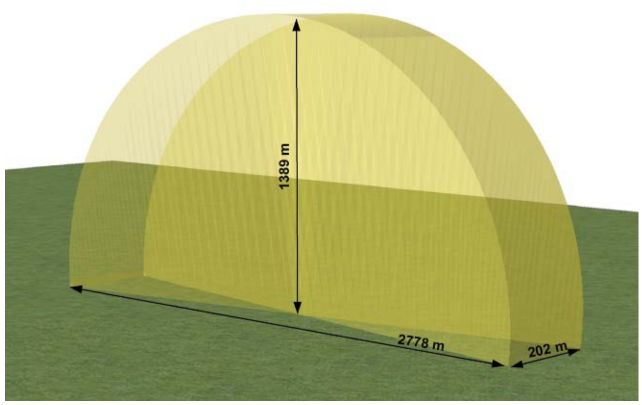


Figure 2-4. Detection range of the radar in vertical mode

Because the anti-rain function of the radar must be turned down to detect small songbirds and bats, surveys could not be conducted during active rainfall. Therefore, surveys were planned largely for nights without rain. However, in order to characterize migration patterns during nights without optimal migration conditions, some nights with weather forecasts including occasional showers, mist, or fog were sampled.

The radar was operated at a range of 1.4 km (0.75 nautical miles) to ensure detection of small targets. When radar is operated at ranges greater than 1.4 km, larger birds can be detected but the echoes of small targets are reduced in size and restricted to a smaller portion of the radar screen, thus limiting the ability to observe the movement pattern of individual targets.

The radar display was connected to the video recording software of a computer enabling digital archiving of the radar data for subsequent analysis. This software recorded and archived video samples continuously every hour from sunset to sunrise of each survey night. By alternating the radar antenna every ten minutes from vertical mode to horizontal mode, a total of 30 minutes of vertical samples and 30 minutes of horizontal samples were collected within each hour. A stratified random sample set was developed by randomly selecting 6 horizontal samples and 6 vertical samples per hour of survey. This sampling schedule allowed for randomization of sample selection and prevented double-counting of targets due to the 30-second echo trail used to determine the flight path vector.

2.2.2 Weather Data

Weather data was collected on site by a remote weather station deployed at the Melvin Mountain radar site. Mean nightly wind speeds, temperature, relative humidity and barometric pressure were recorded for the duration of the survey period at 10-minute intervals by data loggers (HOBO® MicroStation, Onset Computer Corporation).

2.3 DATA ANALYSIS METHODS

2.3.1 Radar Data

Video samples were analyzed using a digital analysis software tool developed by Stantec. For horizontal samples, targets (either birds or bats) were differentiated from insects based on their flight speed. Following adjustment for wind speed and direction, targets traveling faster than approximately 6 m (20’) per second were identified as a bird or bat target (Larkin 1991, Bruderer and Boldt 2001). The software tool recorded the time, location, and flight vector for each target traveling fast enough to be a bird or bat within each horizontal sample, and these results were output to a spreadsheet. For vertical samples, the software tool recorded the entry point of targets passing through the vertical radar beam, the time, and flight altitude above the radar location, and then subsequently output the data to a spreadsheet. These datasets then were used to calculate passage rate (reported as targets per kilometer of migratory front per hour), flight direction, and flight altitude of targets.

Mean target flight directions (± 1 circular standard deviation) were summarized using software designed specifically to analyze directional data (Oriana2© Kovach Computing Services). The statistics used for this analysis are based on those used by Batschelet (1965), which take into account the circular nature of the data.

Flight altitude data were summarized using linear statistics. Mean flight altitudes (± 1 standard error [SE]) were calculated by hour, night, and overall season. The percent of targets flying below 150 m (492'), the approximate maximum height of the proposed wind turbines with blades, also was calculated hourly, for each night, and for the entire survey period.

2.4 RESULTS

Radar surveys were conducted on 35 nights from August 20 to October 15 (Appendix A, Table 1). The radar location provided sufficient views of the surrounding airspace enabling migration patterns to be characterized.

2.4.1 Passage Rates

Mean nightly passage rates varied from 384 ± 61 targets per kilometer per hour (t/km/hr) on October 11 to 2442 ± 329 t/km/h on September 24, with an overall seasonal mean passage rate of 980 ± 39 t/km/hr (Figure 2-5; also Appendix A, Table 1). Individual hourly passage rates varied both within and between nights (Appendix A, Table 2). Over the course of the season, the mean passage rates were typically highest during the third hour after sunset and decreased steadily until sunrise (Figure 2-6). The mean passage rates for hours 12 and 13 after sunset are somewhat skewed because sunrise occurred before these hours for a percentage of the survey dates and therefore no data was collected; however the general trend showed a decrease in mean passage rate from approximately 3 hours after sunset.

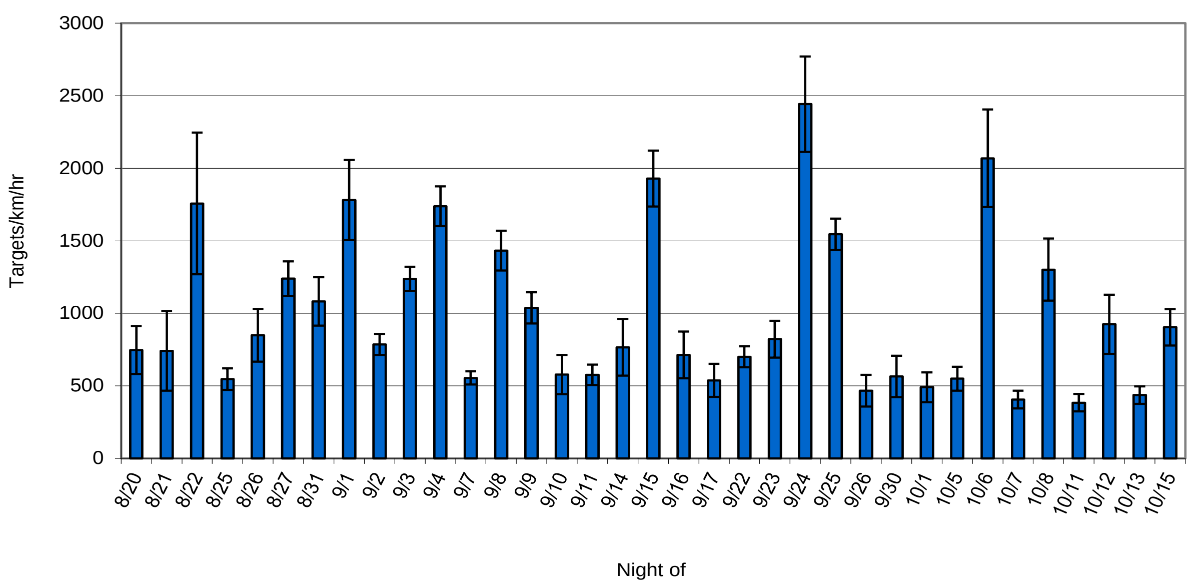


Figure 2-5. Nightly passage rates observed at Wild Meadows in Fall 2009 (error bars ± 1 SE)

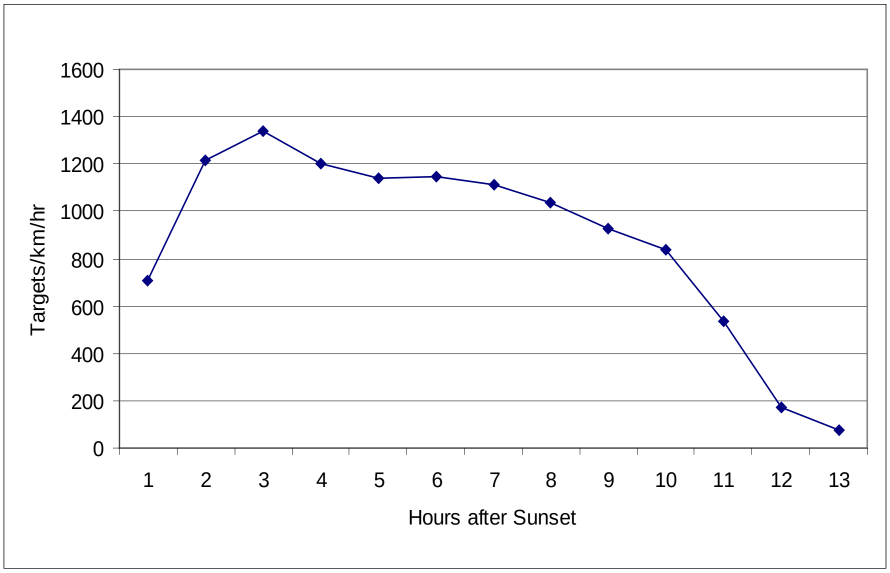


Figure 2-6. Mean hourly passage rates for entire season at Wild Meadows in Fall 2009

2.4.2 Flight Direction

Mean flight direction of targets through the Project area was 225 ± 49° (Figure 2-7). Flight direction for the entire season was to the southwest; however varied between nights (Appendix A, Table 3).

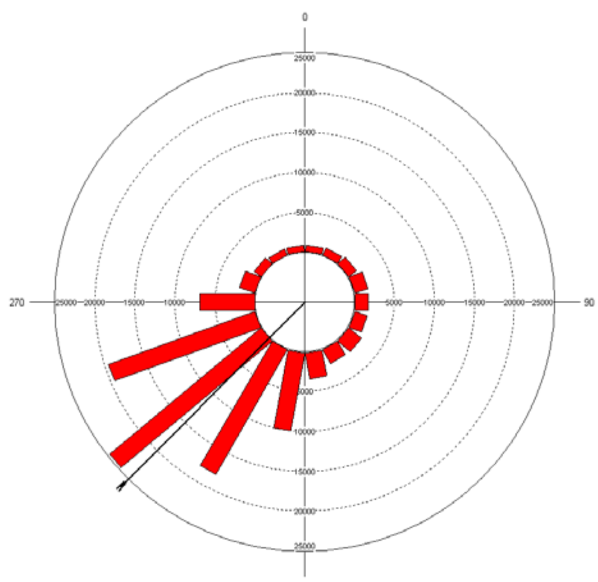


Figure 2-7. Mean flight direction for the entire season at Wild Meadows in Fall 2009 represented by the narrow black line extending to the margin of the histogram. The bracket at the end of this line is the 95% confidence interval.

2.4.3 Flight Altitude

The seasonal mean flight height of all targets was 362 ± 1 m (1186') above the radar site. The average nightly flight height ranged from 229 ± 7 m on September 11 to 468 ± 7 on September 17 (Figure 2-8; Appendix A, Table 4). The percent of targets observed flying below 150 m, the proposed height of the turbines, was 19 percent for the season and varied nightly from 7 percent on August 22 to 38 percent on October 13 (Figure 2-9). Over the course of the survey season, the mean hourly flight height peaked during the second hour after sunset and remained relatively steady until the eighth hour after sunset and then declined until sunrise (Figure 2-10).

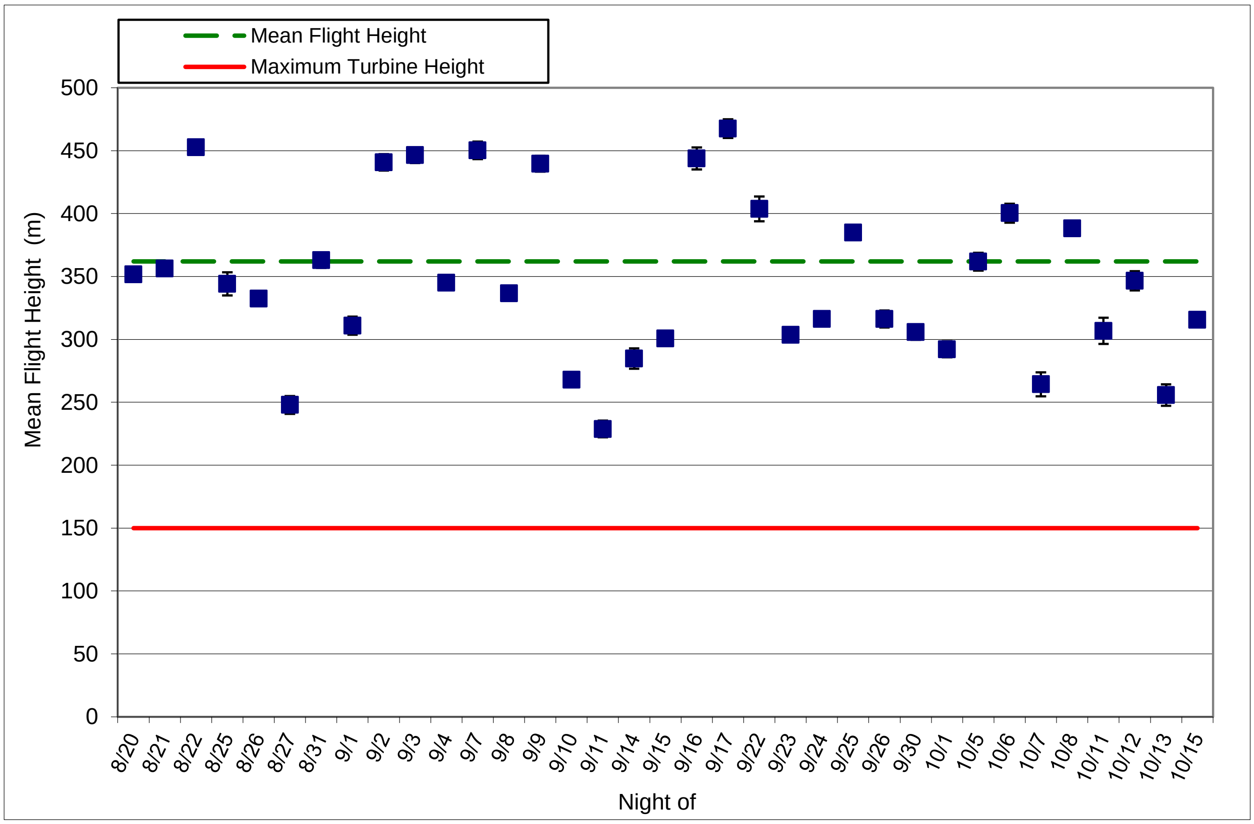


Figure 2-8. Mean nightly flight height of targets at Wild Meadows in Fall 2009 (error bars ± 1 SE)

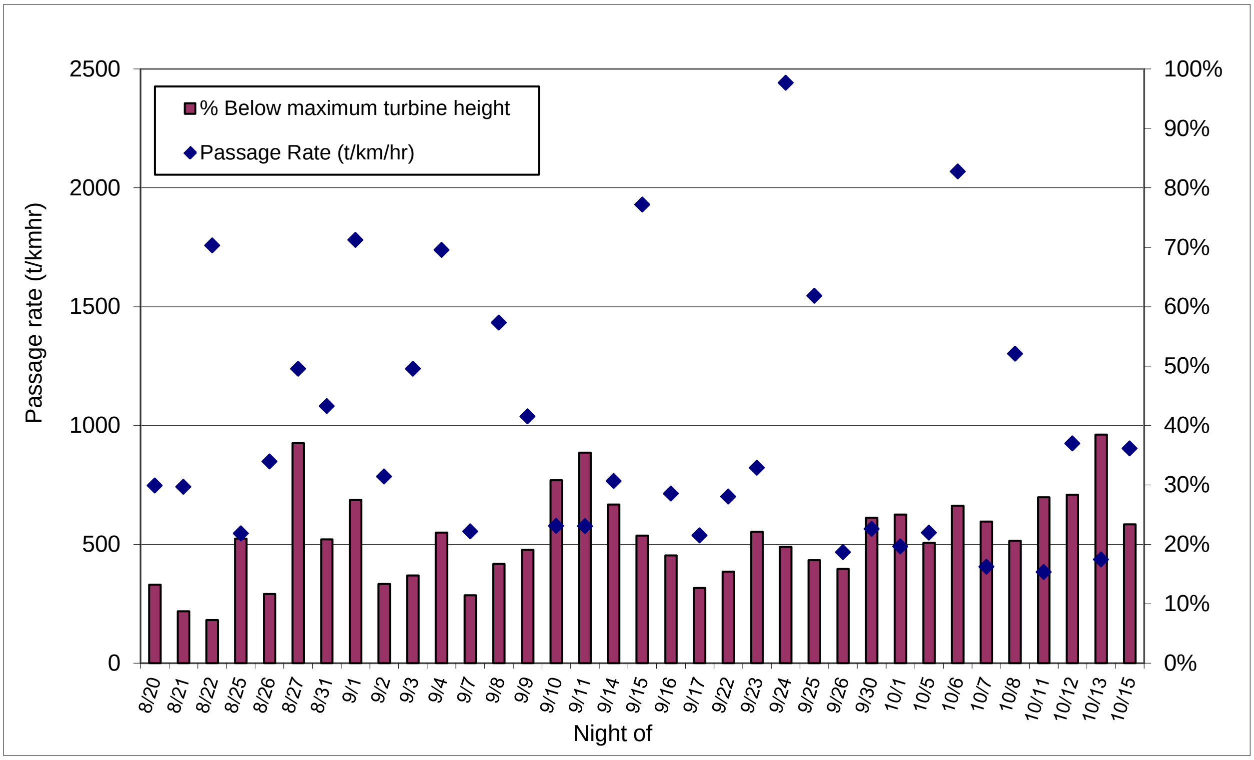


Figure 2-9. Percent of targets observed flying below a height of 150 m (492’) at Wild Meadows in Fall 2009.

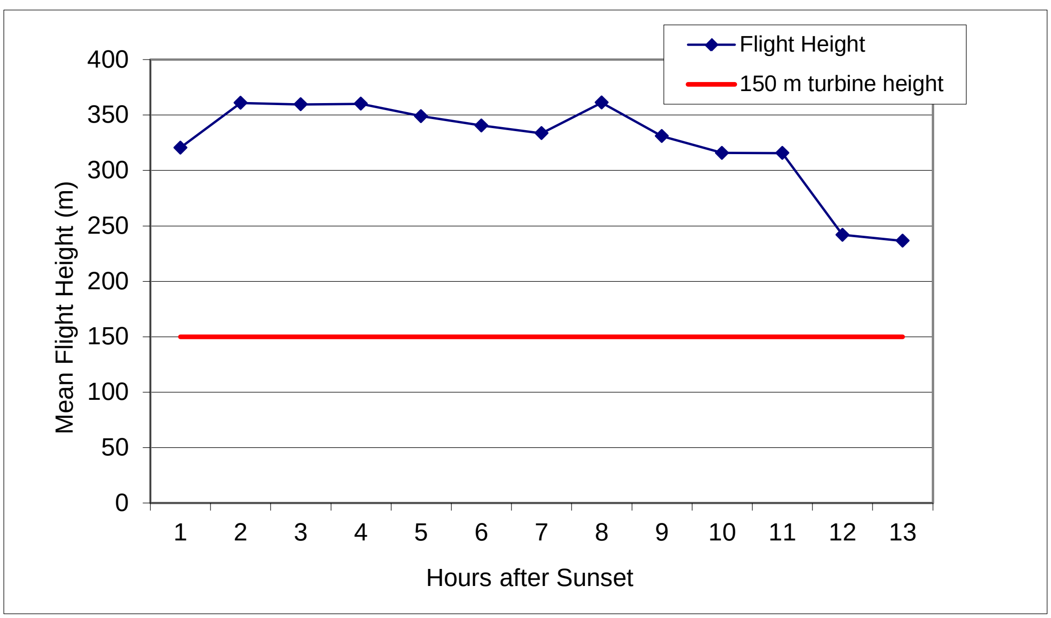


Figure 2-10. Average hourly flight height distribution of targets at Wild Meadows in Fall 2009

2.4.4 Weather Data

Mean nightly wind speeds in the Project area from August 20 to October 15 varied between 1.2 meters per second (m/s) on October 12 and 6.7 m/s on October 7, with an overall mean of 3.1 m/s for the combined nights of the fall survey (Figure 2-11 and Appendix A, Table 1). Mean nightly temperatures varied between -2.4°C on October 15 and 20.0°C on August 20, with an overall mean of 10.0°C (Figure 2-12).

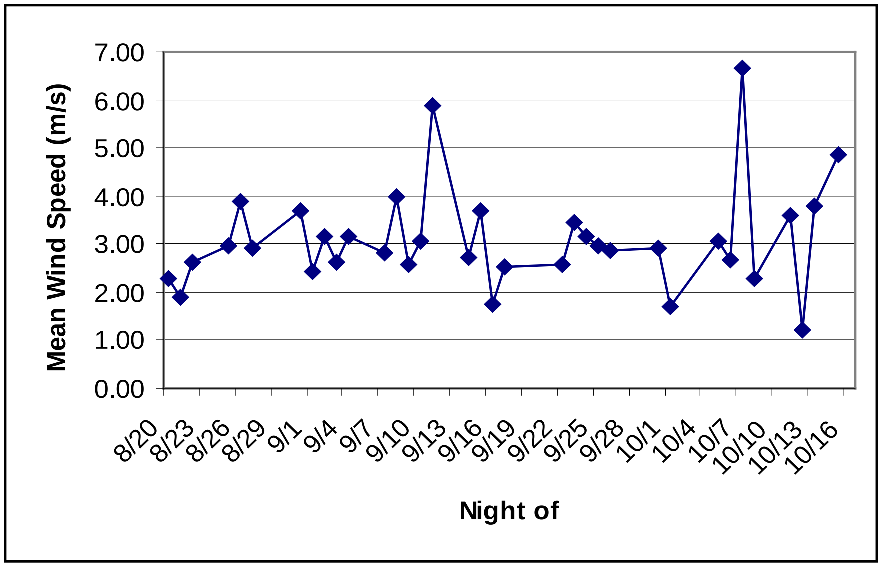


Figure 2-11. Nightly mean wind speed (m/s) at Wild Meadows in Fall 2009

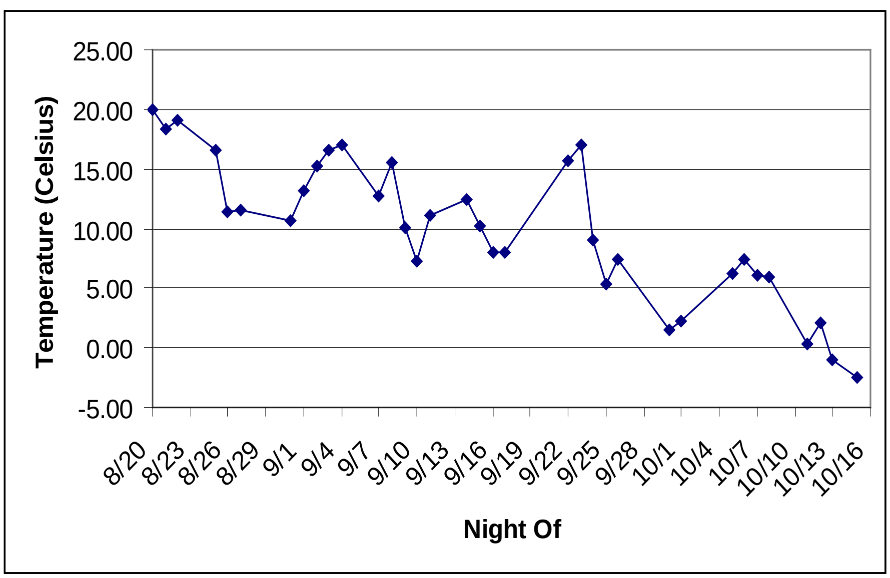


Figure 2-12. Nightly mean temperature (˚Celsius) at Wild Meadows in Fall 2009

2.5 DISCUSSION

Radar surveys are designed and carried out to sample migration activity over a given location to provide baseline site data prior to the construction and operation of proposed wind projects. The results of this nocturnal radar survey provide a snapshot of avian migration in space and time in the vicinity of the Project area during dates typical for fall migration in New Hampshire.

Results for flight height and flight direction at the Project during fall surveys are within the range of results for publicly available fall studies in the East (Appendix A, Table 5). These include flight heights primarily occurring between 300 and 600 m (984' to 1968') above the ridgeline and nightly mean flight directions were generally southward.

Within nights, the mean passage rate peaked at three hours after sunset, which is similar to results recorded for other publicly available studies in the East. Nightly mean passage rates were highly variable, ranging from 384 ± 61 to 2442 ± 329 t/km/hr (Appendix A, Table 2). This indicates that nocturnal migration was pulsed, presumably related to seasonal timing and regional weather conditions. Variability in the range of nightly fall passage rates is common and has been documented at surveys conducted for other projects (Appendix A, Table 5). Nightly variation in the magnitude and flight characteristics of nocturnal migrants is not uncommon and is often attributed to weather patterns, such as cold fronts and winds aloft (Hassler *et al.* 1963, Gauthreaux and Able 1970, Richardson 1972, Able 1973, Bingman *et al*. 1982, Gauthreaux 1991).

The seasonal mean passage rate of 980 ± 39 t/km/hr at the Project was higher than those recorded for other publicly available fall studies in the East (64 t/km/hr to 811 t/km/hr) (Appendix A, Table 5), however average nightly passage rates at the Project (384 t/km/hr to 2442 t/km/hr) were within the range of those recorded for other publicly available studies (2 t/km/hr to 2463 t/km/hr). Nightly mean passage rates appeared to be related to wind direction and temperature. Nightly mean passage rates were highest on September 24 (2442 ± 329 t/km/hr), October 6 (2069 ± 336 t/km/hr), September 15 (1930 ± 192 t/km/hr) and September 1 (n = 1781 ± 276 t/km/hr). Based upon data collected at the weather station, which was located below the flight height of the passing migrants, average wind speed on these nights was approximately 3.0 m/s and wind direction was generally from the northwest (Appendix A, Table 1) which is favorable for fall migration. These nights, including the night of August 22 when the highest hourly passage occurred (n=4739), had relatively mild temperatures (mean temperatures 7 to 19°C). Weather conditions on nights with low mean passage rates did not contrast markedly with weather conditions on those nights with high mean passage rates. The lowest passage rates occurred on September 30 (565 ± 143 t/km/hr), September 17 (537 ± 114 t/km/hr), October 13 (436 ± 60 t/km/hr), and October 11 (384 ± 61 t/km/hr). Average wind speed on this night was approximately 3.0 m/s and generally from the west. Mean nightly temperatures ranged from -1.0 to 8.0 °C, which was generally lower than on nights with relatively high mean passage rates.

The emerging body of studies characterizing nocturnal migration shows a relatively consistent pattern in flight altitude, with most migrants appearing to fly at altitudes of several hundred meters or more above the ground (Appendix A, Table 5). Mean flight height at the Project (362 ± 1 m) is within the range of mean flight heights reported from other fall radar studies conducted in the East (203 m to 644 m). No nights experienced mean flight heights below maximum turbine height (150 m). The mean percentage of targets flying below 150 m was 19 percent which is within the range of those recorded at similar projects conducted in the East (1% to 40%). Comparison of flight height between survey sites as measured by radar is generally less influenced by site characteristics because the main portion of the radar beam is directed skyward, and the potential effects of surrounding vegetation on the radar's view can be more easily controlled.

It should be noted that post construction mortality studies have demonstrated that targets flying at or below turbine height observed during pre-construction radar surveys do not directly correlate to collision risk; in other words, a relatively high percentage of targets observed below turbine height does not equate to high mortality (Stantec 2010). Similarly, relatively high pre-construction passage rates do not appear to equate to high mortality (Stantec 2010). Despite some variations in pre-construction radar survey results, the observed fatality rates at operational projects in New England, including the nearby Lempster, Groton, and Granite Reliable projects in New Hampshire, have been relatively similar and generally low. Regardless, radar surveys conducted at the Project in fall 2009 provide a sample of migration activity over the Project area during baseline, pre-construction conditions.

3.0 Acoustic Bat Survey

3.1 INTRODUCTION

Acoustic sampling of bat activity has become a standard aspect of pre-construction surveys for proposed wind-energy development (Kunz *et al.* 2007). Several major assumptions are involved in acoustic surveys (Hayes 2000) and results cannot be used to determine the number of bats inhabiting an area or to determine the number of bats that may be killed during operation. Acoustic surveys can provide insight into seasonal patterns in activity levels and examine how weather conditions influence bat activity. While this data may be useful in predicting trends in post-construction mortality rates, limited available data on this topic precludes quantitative prediction of risk. The objectives of acoustic surveys at this Project were (1) to document bat activity patterns from August to October in the Project area, which correspond with the late summer resident and fall migration periods for bats; and (2) to document bat activity patterns in relation to weather factors including wind speed and temperature.

Eight species of bats occur in New Hampshire, based upon their normal geographical range. These are the little brown bat (*Myotis lucifugus*), northern long-eared bat, (*M. septentrionalis*), eastern small-footed bat (*M. leibii*), silver-haired bat (*Lasionycteris noctivagans*), tri-colored bat (*Perimyotis subflavus*)[2], big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), and hoary bat (*L. cinereus*) (BCI 2001). Of these, eight species, the eastern small-footed bat is state-listed as endangered, and five species (tri-colored bat, eastern red bat, silver-haired bat, northern long-eared bat, and hoary bat) are state species of special concern. As of 2013, the northern long-eared bat is under consideration for federal listing under the Endangered Species Act.

3.2 DATA COLLECTION METHODS

Anabat II and Anabat SDI detectors (Titley Electronics Pty Ltd.) were used for the duration of this acoustic bat survey. Anabat detectors were selected because of their widespread use for this type of survey, their ability to be deployed for long periods of time, and their ability to detect a broad frequency range, which allows detection of all species of bats that could occur in the Project area. The Anabat II detectors were coupled with CF Storage ZCAIM (Titley Electronics Pty Ltd.) which programs the on/off times and stores data on removable 1 GB compact flash cards. The newer SD1 model detectors do not require use of a ZCAIM because the CF storage is built in to the unit. Anabat detectors are frequency division detectors, dividing the frequency of echolocation sounds made by bats by a factor of 16, and then recording these sounds for subsequent analysis. The audio sensitivity setting of each Anabat system was set between six and seven (on a scale of one to ten) to maximize sensitivity while limiting ambient background

[2] The scientific and common name of the eastern pipistrelle (*Pipistrellus subflavus*) has been changed to the tri-colored bat (*Perimyotis subflavus*).

noise and interference. The sensitivity of individual detectors was then tested using an ultrasonic Bat Chirp (Reno, NV) to ensure that the detectors would be able to detect bats up to a distance of at least 10 m (33').

Each Anabat detector was powered by 12-volt batteries charged by solar panels. Each solar-powered Anabat system was deployed in waterproof housing enabling the detector to record while unattended for the duration of the survey. The housing suspends the Anabat microphone downward to give maximum protection from precipitation. To compensate for the downward position, a reflector shield of smooth plastic is placed at a 45-degree angle directly below the microphone. The angled reflector allows the microphone to record the airspace horizontally surrounding the detector and is only slightly less sensitive than an unmodified Anabat unit.

To document bat activity patterns within the Project and surrounding area, three detectors were deployed from August 19 to October 22. One detector was deployed on Melvin Mountain (no longer part of the current Project area), one detector was located on Tinkham Hill and one was deployed on Braley Hill north of Tinkham Hill (both within the current Project area). At the time of the surveys, Melvin Mountain was part of the Project area but as of 2013, the Project layout was reduced and Melvin Mountain was dropped from the Project area; however, the data collected at Melvin Mountain was included in this analysis and report. Where applicable, the results from each detector location are reported separately..

Each detector was deployed in a portable tower at a height of approximately 15 m (49') above the ground. All detectors were programmed to record every night from 7:00 pm to 7:00 am. Maintenance visits were conducted approximately every two weeks to check the condition of the detectors and to download data to a computer for analysis.

The detector on Braley Hill was located along the eastern side of the hill in a recently harvested clearing (Photo 3-1). The detector was initially deployed in the portable tower, but this tower collapsed September 7, possibly as the result of strong winds. Although the detector remained on it did not record data from September 7 to September 9. On September 10, the detector was re-deployed in a tree adjacent to the portable tower location at a height of approximately 10 m (33').

Photo 3-1. Braley Hill Detector. The red circle shows the location of the detector on the portable tower and the black circle shows the tree top location of the detector after the tower collapsed.

The detector on Tinkham Hill was deployed on the northern portion of the ridge in an area of mixed hardwoods and softwoods (Photo 3-2). Evidence of recent harvesting was apparent in the area and logging trails were common. The detector was aimed over the surrounding forest canopy.

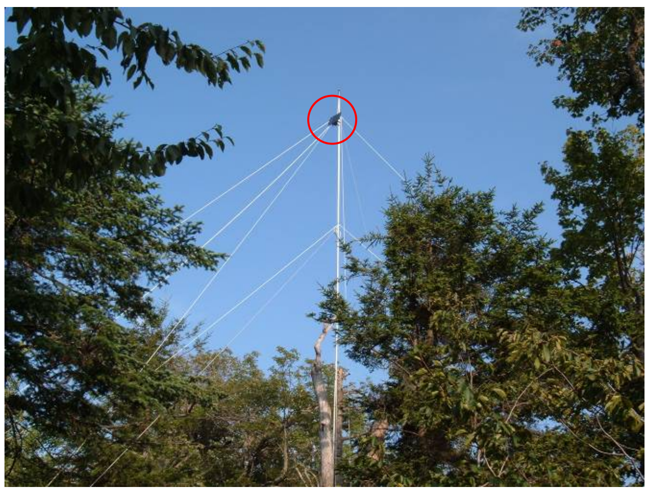


Photo 3-2. Tinkham Hill Detector

The detector on Melvin Mountain was deployed on the southern portion of the ridge in a clearing created by previous timber harvesting (Photo 3-3). The surrounding landscape was predominately mature spruce. The area appeared to have been recently harvested and the western side of the ridge had many dead standing spruce and deciduous trees. Patches of open grassy areas with relatively thin soil or exposed granite were common on along the ridgeline. Small sections of standing water were observed in the vicinity of the detector.

Photo 3-3. Melvin Mountain Detector

3.3 DATA ANALYSIS METHODS

Ultrasound recordings of bat echolocation may be broken into recordings of a single bat call or recordings of bat call sequences. A call is a single pulse of sound produced by a bat, while a call sequence is a combination of two or more pulses recorded in an Anabat file. Recordings containing less than two calls were eliminated from analysis as has been done in similar studies (Arnett *et al*. 2006). Call sequences typically include a series of calls characteristic of normal flight or prey location ("search phase") and capture periods (feeding "buzzes").

Potential call files were extracted from data files using CFCread© software. The default settings for CFCread© were used during this file extraction process, as these settings are recommended for the calls that are characteristic of central New Hampshire bats. This software screens all data recorded by the bat detector and extracts call files using a filter. Using the default settings for this initial screening also ensures comparability between data sets. Settings used by the filter include a max TBC (time between calls) of 5 seconds, a minimum line length of 5 milliseconds, and a smoothing factor of 50. The smoothing factor refers to whether or not adjacent pixels can be connected with a smooth line. The higher the smoothing factor, the less restrictive the filter is and the more noise files and poor quality call sequences are retained within the data set.

Following extraction of call files, each file was visually inspected for species identification and to ensure that only bat calls were included in the data set. Insect activity, wind, and interference sometimes can produce Anabat files that pass through the initial filter and need to be visually inspected and removed from the data set. Call sequences are easily differentiated from other recordings, which typically form a diffuse band of dots at either a constant frequency or widely varying frequency.

Because bat activity levels are highly variable among individual nights and individual hours (Hayes 1997, Arnett *et al*. 2006), detection rates are summarized on both of these temporal scales. Nightly detection rates were summarized by month as well as for the entire sampling period. Hourly detection rates were summarized by hour after sunset, as recommended by Kunz *et al*. (2007). Quantitative comparisons among these temporal periods were not attempted because the high amount of variability associated with bat detection would require much larger sample sizes (Arnett *et al*. 2006, Hayes 1997).

Bat call sequences were individually marked and categorized by species group, or "guild" based on visual comparison to reference calls. Qualitative visual comparison of those recorded call sequences of sufficient length were made to reference libraries of bat calls allowing for relatively accurate identification of bat species (O'Farrell *et al*. 1999, O'Farrell and Gannon 1999). Call sequences were classified to species whenever possible, based on criteria developed from review of reference calls collected by Chris Corben, the developer of the Anabat system, as well as other bat researchers. In a study conducted by other researchers, bat calls were categorized into guilds (groups) based upon similar minimum frequency and call shape. These guilds were: Myotis spp., eastern red bat-eastern pipistrelle (LABO-PISU), big brown bat-silver-haired bat-hoary bat (EPFU-LANO-LACI), and unidentified (Gannon *et al.* 2003). A comparable approach was followed for this Project where species with similar call signatures were placed in a single guild. All calls were classified into five guilds reflecting the bat community in the region of the Project area. These guilds were:

- **Unknown (UNKN)** – All call sequences with less than five calls, or poor quality sequences (those with indistinct call characteristics or background static). These sequences were further identified as either "high frequency unknown" (HFUN) for sequences with a minimum frequency above 30 to 35 kHz, or "low frequency unknown" (LFUN) for sequences with a minimum frequency below 30 to 35 kHz. The unknown calls are separated into these specific high frequency and low frequency groups because some inferences can be made as to the possible guilds based upon bats known to occur in this area. For this area, HFUN most likely represents eastern red bats, tri-colored bats and *Myotis* species since these species typically produce ultrasound sequences of more than 30 kHz. Big brown, silver-haired and hoary bats would be the species in this area typically producing ultrasound sequences of less than 30 kHz.

- **Myotis (MYSP)** – All bats of the genus *Myotis*. While there are some general characteristics believed to be distinctive for several of the species in this genus, these characteristics do not occur consistently enough for any one species to be relied upon at all times when using Anabat recordings.

- **Eastern red bat/tri-colored bat (RBTB)** – Eastern red bats and tri-colored bats. These two species can produce calls distinctive only to each species. However, significant overlap in the call pulse shape, frequency range, and slope also can occur.

- **Big brown/silver-haired bat (BBSH)** – Big brown and silver-haired bats. The call signatures of these species commonly overlap and therefore have been included as one guild in this report.

- **Hoary bat (HB)** – Hoary bats. Calls of hoary bats usually can be distinguished from those of big brown and silver-haired bats by minimum frequency extending below 20 kHz or by calls varying widely in minimum frequency across a sequence.

Because long-distance migratory species have been shown to experience higher mortality at commercial wind farms, additional effort was made to report the activity of these species where possible. Within the Project area, three species are considered to be long-distance migrants: eastern red bat, hoary bat, and silver-haired bat. Of these three species, the hoary bat has a sufficiently distinct call and was placed into a guild by itself to allow more specific reporting of its activity patterns. This method of guild identification represents a conservative approach to bat call identification. Since some species sometimes produce calls unique only to that species, all calls were identified to the lowest possible taxonomic level before being grouped into the listed guilds. Tables and figures in this report will reflect those guilds. Since species-specific identification did occur in some cases, each guild will also be briefly discussed with respect to potential species composition of recorded call sequences.

Once all of the call files were identified and categorized in appropriate guilds, nightly tallies of detected calls were compiled. Mean detection rates (number of recordings/detector-night) for the entire sampling period were calculated for each detector and for all detectors combined.

3.3.1 Weather Data

Weather data was collected on site by a remote weather station deployed at the Melvin Mountain radar site. Mean nightly wind speeds, temperature, relative humidity and barometric pressure were recorded for the duration of the survey period at 10-minute intervals by data loggers (HOBO® MicroStation, Onset Computer Corporation).

3.4 RESULTS

3.4.1 Timing of Activity

Detectors were deployed on August 19 and 20 and continued to record data through October 22, for a total survey period of 178 detector nights. The range of dates that each detector was deployed is summarized in Table 3-1. Equipment malfunction caused occasional lapse in data collection resulting in an overall success rate of 92 percent. The portable tower supporting the Braley Hill detector collapsed on September 7 and the detector did not function again until September 10 when it was re-deployed to the top of a nearby tree (Photo 3-1).

Table 3-1. Summary of bat detector field survey effort and results at Wild Meadows, Fall 2009						
Location	**Dates Deployed**	**Calendar Nights**	**Detector-Nights***	**Recorded Sequences**	**Detection Rate ****	**Maximum Sequences recorded *****
Braley Hill	Aug 20 to Oct 22	64	49	55	1.1	15
Melvin Mountain	Aug 19 to Oct 22	65	65	59	0.9	8
Tinkham Hill	Aug 20 to Oct 22	64	64	77	1.2	11
Overall Results		***193***	***178***	***191***	***1.1***	--
* One detector-night is equal to a one detector successfully operating throughout the night.						
** Number of bat echolocation sequences recorded per detector-night.						
*** Maximum number of bat passes recorded from any single detector for a detector-night.						

The overall mean detection rate for all detectors combined was 1.1 bat call sequences per detector night. Individual detection rates ranged from 0.9 bat call sequences per detector night at the Melvin Mountain detector to 1.2 at the Tinkham Hill detector (Table 3-1). Forty-nine percent (n=94) of all bat call sequences were recorded during the month of August, 49 percent (n=93) were recorded in September and 2 percent (n=4) were recorded in October (Figure 3-1). Detection rates varied throughout the night. In general, activity peaked within two hours of sunset and declined for the next five hours with a slight increase just before sunrise. (Figure 3-2).

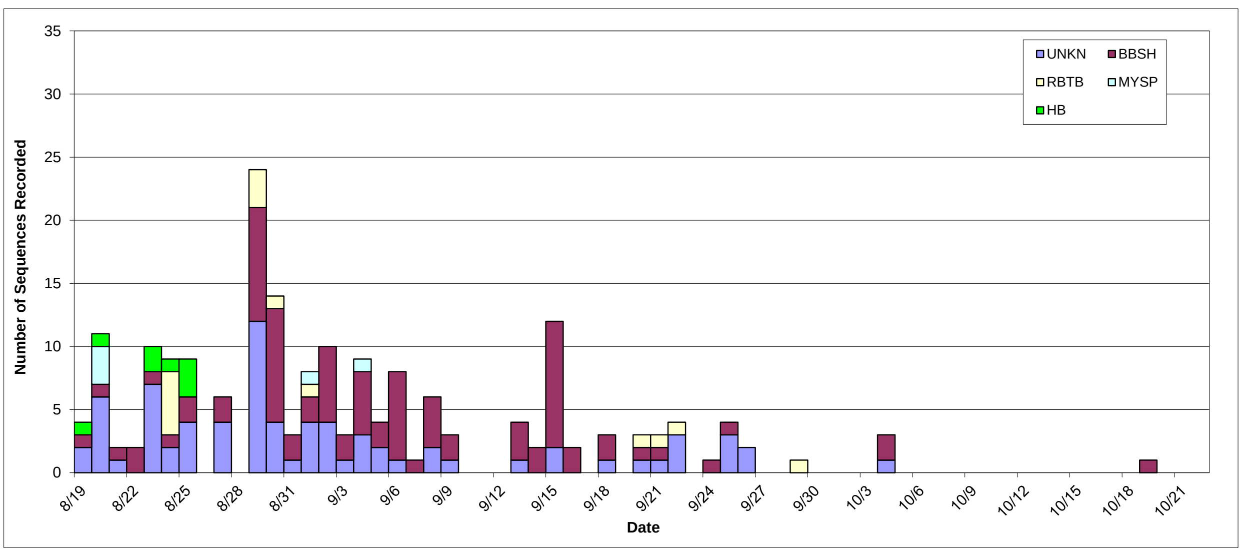


Figure 3-1. Total nightly bat call sequence detections at Wild Meadows, Fall 2009

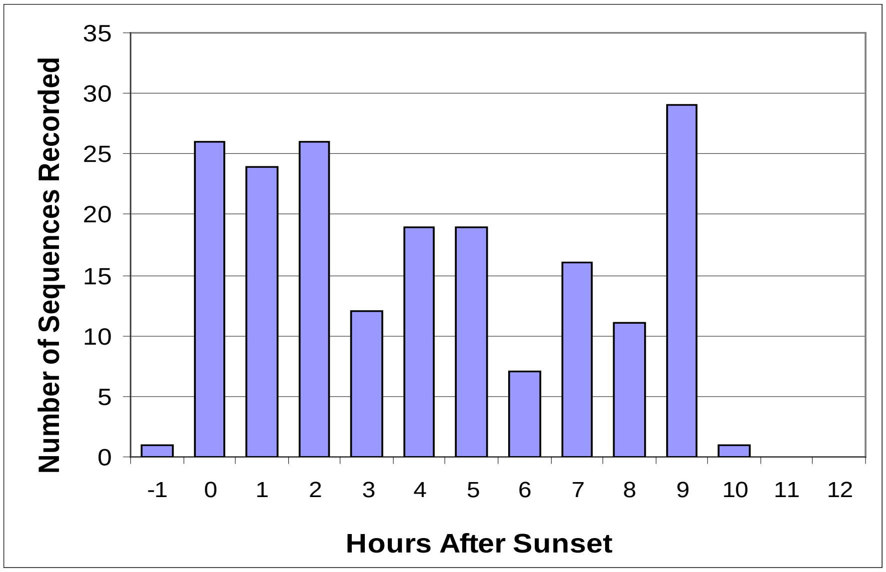


Figure 3-2. Hourly bat call sequence detections in relationship to sunset, Wild Meadows, Fall 2009. The hour of sunset is represented by the zero hour and the detectors began recording data an hour before sunset.

3.4.2 Species Composition

The most frequently recorded guild found during acoustic surveys was the BBSH guild (n=88: 46.1%) followed by the UNKN guild (n=76; 39.8%). Remaining sequences were split roughly evenly between RBTB (n=14; 7.3%), HB (n=8; 4.2%) and MYSP guild (n=5; 2.6%). The UNKN guild was represented by nearly equal parts HFUN (20%) and LFUN (18%) (Appendix B Tables 1-3).

Table 3-2. Distribution of detections by guild for detectors at Wild Meadows, Fall 2009						
Detector	**Guild**					**Total**
	BBSH	**HB**	**MYSP**	**RBTB**	**UNKN**	
Braley Hill	24	0	1	2	28	55
Melvin Mountain	25	6	2	7	19	59
Tinkham Hill	39	2	2	5	29	77
Total	**88**	**8**	**5**	**14**	**76**	**191**
Guild Composition %	**46.1%**	**4.2%**	**2.6%**	**7.3%**	**39.8%**	

Appendix B provides a series of tables with more specific information on the nightly timing, number, and species composition of recorded bat call sequences. Specifically, Appendix B Tables 1 through 3 provide information on the number of call sequences by guild, suspected species recorded at each detector, and the weather conditions for that night. All call files are available upon request.

3.4.3 Activity and Weather

Mean nightly wind speeds in the Project area from August 19 to October 22 varied between 0.8 and 6.6 m/s, with an overall mean of 3.0 m/s (Figure 3-3). Mean nightly temperatures varied between -3°C and 20°C, with an overall mean of 9°C (Figure 3-4).

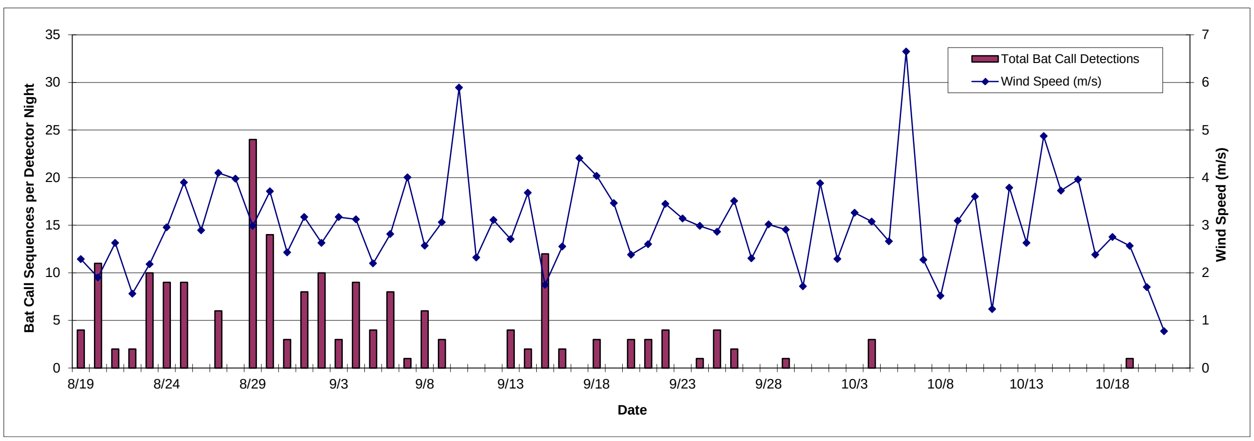


Figure 3-3. Nightly mean wind speed (m/s) (blue line) and bat call detections at Wild Meadows, Fall 2009

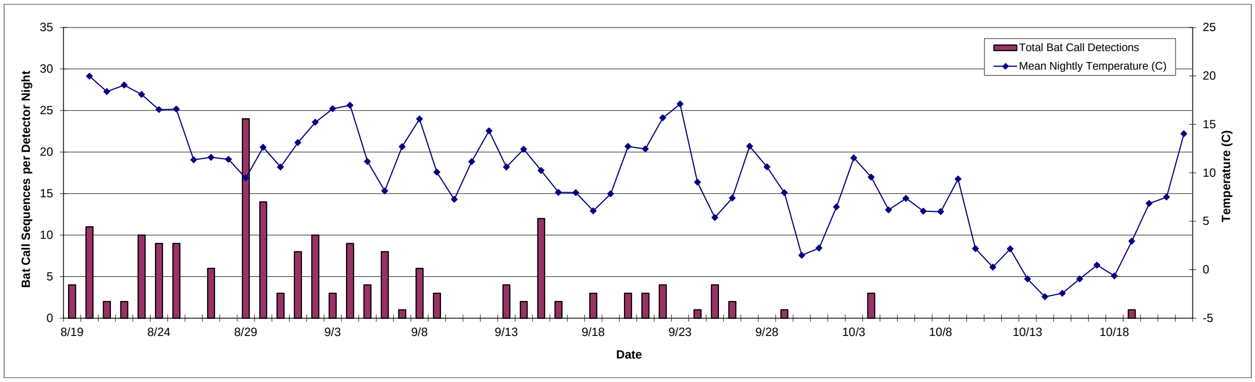


Figure 3-4. Nightly mean temperature (˚Celsius) (blue line) and bat detections at Wild Meadows, Fall 2009

3.5 DISCUSSION

Call volumes remained consistent throughout August and September (49% of all call sequences for both months) then declined during October when all detectors recorded a monthly average of less than 1.0 call/detector night. The Melvin Mountain and Tinkham Hill detectors both recorded the highest average monthly detection rate during the month of August (1.9 bat call sequences per night), the majority of which were from the BBSH guild and HFUN guilds. The mean detection rate for the three detectors was 1.1 calls/detector night, and individual detector rates ranged from 0.9 calls/detector night at the Melvin Mountain detector to 1.2 calls/detector night at the Tinkham Hill detector. These detection rates are at the low end of the range of individual detector detection rates at other wind projects in the East (0 to 126.2 call/detector night) at (Appendix B, Table 4). At other proposed wind development sites in New Hampshire (Groton, Lempster, and Granite Reliable Project), fall detection rates ranged from 0.3 to 0.6 calls/detector night (Granite Reliable Project in fall 2007 [Stantec 2008]) to 4.5 calls per detector night (Groton Wind Project in fall 2009 [Stantec 2009]). Bat fatality rates at the Lempster, Groton, and Granite Reliable Project in New Hampshire were low relative to the range in bat fatality rates at operational wind facilities in the northeast and is similar to the results at most projects in New England. Bat calls were identified to guild within this report, although calls were categorized by species when possible during analysis. Certain species, such as the eastern red bat and hoary bat, have easily identifiable calls, whereas other species, such as the big brown bat and silver-haired bat, are difficult to distinguish acoustically. Similarly, certain members of the *Myotis* genus, such as the little brown bat, are far more common and have slightly more distinguishable calls than other species. Only five *Myotis* call sequences (2.6% of total call sequences recorded) were detected in the Project area during these surveys.

The RBTB guild includes the tri-colored bat and eastern red bat. Fourteen call sequences, 7.3 percent of total call sequences recorded by detectors during the fall survey, belonged to the RBTB guild. Eastern red bats have relatively unique calls that span a wide range of frequency and have a characteristic hooked shape and variable minimum frequency. Tri-colored bats tend to have relatively uniform calls, with a constant minimum frequency and a sharply curved profile.

The BBSH guild includes the big brown bat and silver-haired bat, both of which produce search-phase calls with minimum frequencies in the 25-30 kHz range. This guild composed the greatest percentage of all calls recorded during the fall 2009 survey period (46.1%, n=88). Of the two species in this guild, the silver-haired bat is considered a long-distance migrant and as such would more likely be detected during the fall migration period. In contrast, the big brown bat would be expected to occur in the Project area throughout the summer and fall.

The HB guild, which consists only of the hoary bat, represented eight (4.2%) of call sequences recorded at the Project. Hoary bat calls are generally distinguishable from all other species in the region and are characterized by highly variable minimum frequencies often extending below 20 kHz, and a hooked profile similar to the eastern red bat.

The UNKN guild includes both low-frequency and high-frequency bat calls of either insufficient call length or quality to be categorized to species. Those species included in the high-frequency unknown guild are the *Myotis* species, eastern red bat and tri-colored bats. The low-frequency guild range includes the hoary bat, silver-haired bat and big brown bat. Thirty-nine calls were classified as high-frequency unknown (20.4%) and 35 calls (18.3%) were low-frequency unknown.

The height of a detector likely influences the species that are recorded as well as the number of call sequences recorded. Recent research using Anabat detectors recorded *Myotis* species more frequently at lower heights and larger species such as big brown and hoary bats were recorded more frequently at higher heights (Arnett *et al*. 2006). The three detectors deployed during the fall 2009 survey were above canopy height and recorded a greater percentage of these larger bats, particularly those in the BBSH guild, as opposed to the *Myotis* species. It is possible, particularly during the spring and fall migration periods that detectors deployed above canopy height are recording bats making a single pass through the airspace during their migration whereas lower detectors are recording individuals that are foraging and making multiple passes through the immediate airspace (Arnett *et al.* 2006). This pattern was not clearly evident during the Project area surveys. Of the long-distance migrants or guilds including long -distance migrants, few hoary bats (n=8) and few of the RBTB guild (n=14) were recorded. The highest percentage of bats recorded were in the BBSH guild, but it cannot be determined if these bats were the long-distance migrating silver-haired bat or the resident big brown bat.

Some trends have emerged during pre- and post-construction acoustic and mortality surveys at wind power sites in North American giving light to the timing of seasonal migration of certain bat species. Although some mortality of long distance migrants occurs at wind power sites during the spring migration period, a greater percentage of mortality events typically occurs during fall migration (Arnett *et al*, 2008). Recent studies have found that bat activity patterns are influenced by weather conditions (Arnett *et al*. 2006, Arnett *et al*. 2008, Reynolds 2006). Acoustic surveys have documented a decrease in bat activity rates as wind speeds increase and temperatures decrease, and bat activity has been shown to correlate negatively to low nightly mean temperatures (Hayes 1997, Reynolds 2006). Similarly, weather factors appeared related to bat collision mortality rates documented at two facilities in the southeastern United States, with mortality rates negatively correlated with both wind speed and relative humidity, and positively correlated to barometric pressure (Arnett *et al*. 2005). These patterns suggest that bats are more likely to migrate on nights with low wind speeds (less than 4 to 6 m/s) and generally warm temperatures. Thus, several weather variables can individually affect bat activity, as does the interaction among variables (i.e., warm nights with low wind speeds). The highest nightly average wind speed recorded at the portable weather station on Melvin Mountain recorded a nightly average wind speed of 6.6 m/s and an overall mean nightly temperature of 9˚C. The results of the surveys fell within the mid-range of other pre-construction surveys conducted in the Northeast where detectors were deployed in met towers. For these other surveys, detection results ranged from 0 to 6.8. It is not clear if migration rates through the vicinity of the Project area reflect a clear pattern related to weather conditions. To continue the assessment of bat activity patterns in the Project area, additional surveys were conducted in the spring and summer of 2010 (Stantec 2010).

When considering the level of activity documented at the Project during fall 2009 acoustic surveys, it is important to acknowledge that numbers of recorded bat call sequences cannot be correlated with the number of bats in an area because acoustic detectors do not allow for differentiation between individuals. While these data may be useful in predicting species composition and activity trends, as well as the species that may be susceptible to collision and the timing of peak periods of fatality during operation of the Project, the current lack of data on this topic precludes quantitative prediction of risk of the actual numbers of bats that may be involved in collisions.

4.0 Literature Cited

Able, K.P. 1973. The role of weather variables and flight direction in determining the magnitude of nocturnal migration. Ecology 54(5):1031–1041.

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.

Arnett, E. B., J. P. Hayes, and M. M. P. Huso. 2006. An evaluation of the use of acoustic monitoring to predict bat fatality at a proposed wind facility in south central Pennsylvania. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Arnett, E.B., W.K. Brown, W.P. Erickson, J.K. Fiedler, B.L. Hamilton, T.H. Henry, A. Jain, G.D. Johnson, J. Kerns, R.R. Koford, C.P. Nicholson, T.J. O'Connell, M.D. Piorkowski, and R.D. Takersley Jr. 2008. Patterns of bat fatalities at wind energy facilities in North America. Journal of Wildlife Management 72:61-78.

Batschelet, E. 1965. Statistical Methods for the Analysis of Problems in Animal Orientation and Certain Biological Rhythms. AIBS Monograph. American Institute of Biological Sciences. Washington, DC.

(BCI) Bat Conservation International. 2001. Bats in Eastern Woodlands. http://www.batcon.org/nabcp/newsite/forrep.pdf. Accessed Jaunary 2010.

Bingman, V.P., K.P. Able, and P. Kerlinger. 1982. Wind drift, compensation, and the use of landmarks by nocturnal bird migrants. Animal Behavior 30:49–53.

Bruderer, B. and A. Boldt. 2001. Flight characterstics of birds: I. Radar measurements of speeds. Ibis. 143:178-204.

Cooper, B.A., R.H. Day, R.J. Ritchie, and C.L. Cranor. 1991. An improved marine radar system for studies of bird migration. Journal of Field Ornithology 62:367–377.

Gannon, W.L., R.E. Sherwin, and S. Haywood. 2003. On the importance of articulating assumptions when conducting acoustic studies of habitat use by bats. Wild. Soc. Bull. 31 (1):45–61.

Gauthreaux, S.A., Jr. 1991. The flight behavior of migrating birds in changing wind fields: radar and visual analyses. American Zoologist 31:187–204.

Gauthreaux, S.A., Jr., and K.P. Able. 1970. Wind and the direction of nocturnal songbird migration. Nature 228:476–477.

Harmata, A., K. Podruzny, J. Zelenak, and M. Morrison. 1999. Using marine surveillance radar to study bird movements and impact assessment. Wildlife Society Bulletin 27(1):44–52.

Hassler, S.S., R.R. Graber, and F.C. Bellrose. 1963. Fall migration and weather, a radar study. The Wilson Bulletin 75(1):56–77.

Hayes, J. P. 1997. Temporal variation in activity of bats and the design of echolocation-monitoring studies. Journal of Mammalogy 78:514-524.

Hayes, J.P. 2000. Assumptions and practical considerations in the design and interpretation of echolocation-monitoring studies. Acta Chiropterologica 2(2):225-236.

Kunz, T.H., E.B. Arnett, B.P. Cooper, W.P. Erickson, R.P. Larkin, T. Mabee, M.L. Morrison, M.D. Strickland, and J.M. Szewczak. 2007. Assessing impacts of wind-energy development on nocturnally active birds and bats: A guidance document. Journal of Wildlife Management 71:2449-2486.

Larkin, R.P. 1991. Flight speeds observed with radar, a correction; slow "birds" are insects. Behavioral Ecology and Sociobiology. 29:221-224.

O'Farrell, M.J., and W.L. Gannon. 1999. A comparison of acoustic versus capture techniques for the inventory of bats. Journal of Mammalogy 80(1):24–30.

O'Farrell, M.J., B.W. Miller, and W.L. Gannon. 1999. Qualitative identification of free-flying bats using the anabat detector. Journal of Mammalogy 80(1):11–23.

Reynolds, D. S. 2006. Monitoring the potential impacts of a wind development site on bats in the Northeast. Journal of Wildlife Management 70(5):1219 – 1227.

Richardson, W.J. 1972. Autumn migration and weather in eastern Canada: a radar study. American Birds 26(1):10–16.

Sperduto, D.D. and W.F. Nichols. 2004. Natural Communities of New Hampshire. New Hampshire Natural Heritage Bureau and The Nature Conservancy. Concord, NH.

Stantec Consulting. 2008. Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Windpark in Coos County, New Hampshire by Granite Reliable Power, LLC. Prepared for Granite Reliable Power, LLC.

Stantec Consulting. 2009. 2009 Spring, Summer, and Fall Avian and Bat Surveys for the Groton Wind Project in Groton, New Hampshire. Prepared for Groton Wind, LLC.

Stantec Consulting. 2010. Stetson I Mountain Wind Project; Year 1 Post-Construction Monitoring Report, 2009 for the Stetson Mountain Wind Project in Penobscot and Washington Counties, Maine. Prepared for First Wind Management, LLC.

Appendix A

Radar survey results

Appendix A Table 1. Survey dates, results, level of effort, and weather - Fall 2009								
Date	**Passage rate**	**Flight Direction**	**Flight Height (m)**	**% below 138.5 m**	**Hours of Survey**	**Temperature (C)**	**Wind Speed (m/s)**	**Wind Direction (degrees)**
8/20	747	274	352	13%	10	19.96	2.29	108.10
8/21	742	282	356	9%	9	18.38	1.90	154.85
8/22	1757	219	453	7%	10	19.05	2.63	176.29
8/25	546	105	344	21%	11	16.56	2.95	285.73
8/26	848	197	332	12%	11	11.34	3.90	283.12
8/27	1239	233	248	37%	11	11.59	2.89	316.19
8/31	1082	212	363	21%	9	10.59	3.71	304.55
9/1	1781	232	311	27%	11	13.12	2.43	324.57
9/2	785	207	441	13%	11	15.22	3.17	289.62
9/3	1238	219	446	15%	11	16.61	2.63	290.39
9/4	1739	224	345	22%	10	16.97	3.17	320.67
9/7	555	199	450	11%	11	12.69	2.81	252.38
9/8	1433	225	337	17%	11	15.55	4.00	328.60
9/9	1038	256	440	19%	12	10.06	2.57	75.74
9/10	577	247	268	31%	12	7.26	3.06	101.47
9/11	576	236	229	35%	9	11.15	5.89	85.82
9/14	766	127	285	27%	12	12.43	2.71	291.59
9/15	1930	234	301	21%	12	10.23	3.68	316.88
9/16	713	267	444	18%	12	7.98	1.75	89.71
9/17	537	190	468	13%	12	7.95	2.55	159.33
9/22	700	85	404	15%	9	15.67	2.60	255.27
9/23	822	155	304	22%	11	17.09	3.45	254.62
9/24	2442	213	316	20%	11	9.03	3.14	302.52
9/25	1545	248	385	17%	11	5.38	2.98	340.63
9/26	467	10	316	16%	9	7.38	2.86	160.83
9/30	565	208	306	24%	13	1.49	2.91	285.94
10/1	490	219	292	25%	13	2.23	1.72	280.94
10/5	549	197	362	20%	13	6.17	3.08	288.80
10/6	2069	245	400	26%	8	7.36	2.66	274.07
10/7	405	151	264	24%	6	6.04	6.65	217.28
10/8	1301	218	388	21%	13	5.99	2.27	292.48
10/11	384	209	307	28%	13	0.27	3.60	274.23
10/12	924	228	347	28%	8	2.14	1.24	284.10
10/13	436	220	256	38%	13	-0.96	3.79	260.20
10/15	903	228	316	23%	12	-2.44	4.87	8.10
Entire Season	**980**	**225**	**362**	**19%**	**380**	**9.93**	**3.10**	**292**

Appendix A Table 2. Summary of passage rates by hour, night, and for entire season.

Night of	Passage Rate (targets/km/hr) by hour after sunset													Entire Night			
	1	2	3	4	5	6	7	8	9	10	11	12	13	Mean	Median	Stdev	SE
8/20	1696	1375	932	643	232	264	196	404	561	1164	N/A	N/A	N/A	747	602	524	166
8/21	2814	900	150	125	329	463	468	857	568	N/A[1]	N/A	N/A	N/A	742	468	823	274
8/22	Rain	96	1579	780	750	1239	4739	3916	2447	1807	220	N/A	N/A	1757	1409	1543	488
8/25	479	1004	779	718	557	518	411	561	521	429	32	N/A	N/A	546	521	244	74
8/26	764	1829	1836	1450	964	629	571	536	361	293	100	N/A	N/A	848	629	604	182
8/27	954	1482	1479	1575	1293	1361	1414	1429	1386	1075	182	N/A	N/A	1239	1386	395	119
8/31	271	1579	1586	1732	1393	827	820	767	761	N/A[1]	N/A[1]	N/A	N/A	1082	827	502	167
9/1	904	1854	2679	2146	2414	3214	2409	1607	993	1303	64	N/A	N/A	1781	1854	916	276
9/2	364	929	657	525	768	1032	1157	1043	825	694	643	N/A	N/A	785	768	240	72
9/3	789	1432	1149	1214	1046	1000	1121	1300	1718	1650	1200	N/A	N/A	1238	1200	276	83
9/4	718	1843	1929	1775	1500	1529	1757	1993	1977	2366	N/A[1]	N/A	N/A	1739	1809	435	138
9/7	229	429	511	607	800	689	621	511	639	564	500	N/A	N/A	555	564	149	45
9/8	686	1625	2000	1454	1569	1621	1554	2036	1547	893	775	N/A	N/A	1433	1554	457	138
9/9	796	1139	918	1154	1080	1204	1257	1097	1371	1493	921	21	N/A	1038	1118	374	108
9/10	111	1257	1296	1057	961	754	436	393	325	254	86	0	N/A	577	414	467	135
9/11	Rain	632	Rain	Rain	279	554	568	763	804	786	600	204	N/A	576	600	213	71
9/14	493	1843	1757	1443	1211	1039	757	4	270	182	186	7	N/A	766	625	676	195
9/15	1371	2550	2771	2194	1771	2264	2354	1918	2250	1818	1668	225	N/A	1930	2056	666	192
9/16	921	1718	1779	636	671	536	850	429	250	125	643	0	N/A	713	639	556	161
9/17	336	696	1111	1082	1114	729	390	225	282	289	186	7	N/A	537	363	394	114
9/22	N/A[1]	N/A[1]	N/A[1]	849	959	831	743	754	739	699	514	214	N/A	700	743	219	73
9/23	646	1046	Rain	689	675	889	420	975	1100	846	1711	43	N/A	822	846	422	127
9/24	3279	4093	3643	3402	2803	2297	1882	2086	1530	1149	700	N/A[1]	N/A	2442	2297	1092	329
9/25	932	1475	1736	1921	1836	1939	1556	1586	1629	1539	846	N/A[1]	N/A	1545	1586	360	109
9/26	268	1129	846	632	343	296	236	279	175	Rain	Rain	Rain	N/A	467	296	329	110
9/30	304	1204	1518	1214	1046	736	421	257	250	132	161	96	0	565	304	514	143
10/1	163	379	604	775	1164	661	700	1011	536	114	154	71	43	490	536	370	103
10/5	521	793	882	561	657	907	829	686	650	264	200	157	32	549	650	295	82
10/6	475	1634	1893	3379	2775	2964	2100	1332	Rain	Rain	Rain	Rain	Rain	2069	1996	950	336
10/7	393	575	471	146	489	357	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	405	432	148	60
10/8	396	1229	1744	2036	2739	2387	1593	1329	1036	741	896	600	193	1301	1229	772	214
10/11	304	464	539	461	504	432	646	732	433	271	107	86	9	384	433	218	61
10/12	89	236	729	1086	1493	1768	1132	861	Rain	Rain	Rain	Rain	Rain	924	974	575	203
10/13	39	429	836	693	507	539	589	564	404	282	304	321	167	436	429	217	60
10/15	25	461	621	746	1150	1643	1189	1000	1357	1111	811	725	N/A[1]	903	905	433	125
Entire Season	**704**	**1216**	**1342**	**1203**	**1138**	**1146**	**1114**	**1036**	**928**	**839**	**534**	**174**	**74**	**980**	**783**	**757**	**39**

0 indicates no targets counted for that hour N/A indicates no data for that hour

N/A[1] indicates equiment failure during that hour

Appendix A Table 3. Mean Nightly Flight Direction		
Night of	**Mean Flight Direction**	**Circular Stdev**
8/20	274	46
8/21	282	69
8/22	219	30
8/25	105	75
8/26	197	28
8/27	233	27
8/31	212	20
9/1	232	30
9/2	207	61
9/3	219	46
9/4	224	27
9/7	199	54
9/8	225	27
9/9	256	38
9/10	247	33
9/11	236	25
9/14	127	99
9/15	234	23
9/16	267	57
9/17	190	67
9/22	85	63
9/23	155	84
9/24	213	30
9/25	248	28
9/26	10	69
9/30	208	30
10/1	219	54
10/5	197	52
10/6	245	39
10/7	151	31
10/8	218	29
10/11	209	39
10/12	228	30
10/13	220	26
10/15	228	19
Entire Season	225	49

Stantec

Appendix A Table 4. Summary of mean flight heights by hour, night, and for entire season.

Night of	Mean Flight Height (m) by hour after sunset													Entire Night				# of targets below 150 meters	% of targets below 150 meters
	1	2	3	4	5	6	7	8	9	10	11	12	13	Mean	Median	STDV	SE		
8/20	296	310	297	450	476	375	420	334	341	377	N/A	N/A	N/A	352	334	177	5	165	13%
8/21	300	337	387	461	442	395	386	354	329	366	N/A	N/A	N/A	356	344	159	4	110	9%
8/22	Rain	Rain	353	468	465	476	448	445	458	450	494	N/A	N/A	453	432	214	4	243	7%
8/25	357	303	366	297	354	312	381	409	359	301	261	N/A	N/A	344	291	235	9	138	21%
8/26	302	286	326	319	366	369	342	330	340	331	677	N/A	N/A	332	312	166	4	181	12%
8/27	337	340	231	229	182	187	172	195	170	196	--	N/A	N/A	248	206	206	7	313	37%
8/31	325	404	408	337	310	376	361	320	318	N/A	N/A	N/A	N/A	363	302	254	6	383	21%
9/1	366	280	283	333	289	308	283	374	340	321	226	N/A	N/A	311	241	246	7	322	27%
9/2	289	522	592	538	485	399	414	394	311	270	205	N/A	N/A	441	406	259	7	212	13%
9/3	268	415	528	510	538	490	502	365	257	248	277	N/A	N/A	446	403	274	6	287	15%
9/4	312	370	335	336	328	389	417	369	311	240	N/A[1]	N/A	N/A	345	278	260	5	582	22%
9/7	356	440	514	480	392	462	509	512	440	362	319	N/A	N/A	450	417	257	7	158	11%
9/8	357	414	363	341	373	359	296	327	288	295	N/A[1]	N/A	N/A	337	296	210	4	532	17%
9/9	368	518	570	555	444	336	335	361	299	275	266	N/A	N/A	440	373	296	6	411	19%
9/10	237	258	230	246	293	296	266	368	297	288	240	--	N/A	268	249	189	6	303	31%
9/11	Rain	Rain	212	Rain	Rain	236	226	233	222	235	236	177	N/A	229	224	142	7	162	35%
9/14	266	298	295	246	273	263	294	834	338	362	248	--	N/A	285	255	209	8	178	27%
9/15	276	337	309	314	369	330	345	304	210	212	201	269	N/A	301	284	179	3	741	21%
9/16	411	424	358	384	507	512	410	481	794	653	381	140	N/A	444	380	302	9	219	18%
9/17	353	604	500	409	393	374	296	310	243	250	282	--	N/A	468	425	280	7	178	13%
9/22	N/A[1]	N/A[1]	N/A[1]	476	373	399	437	523	347	295	279	198	N/A	404	315	286	10	131	15%
9/23	298	325	Rain	344	320	224	281	367	303	305	261	298	N/A	304	296	179	5	333	22%
9/24	266	368	368	329	280	311	331	284	264	249	274	N/A[1]	N/A	316	293	196	3	707	20%
9/25	309	450	427	436	394	359	326	344	368	352	268	N/A[1]	N/A	385	318	273	4	665	17%
9/26	325	284	256	235	233	400	386	392	338	Rain	Rain	Rain	N/A	316	300	168	7	99	16%
9/30	274	236	344	341	300	309	274	376	321	199	347	127	N/A	306	278	200	6	265	24%
10/1	204	329	334	275	236	224	240	228	368	394	429	461	--	292	275	188	6	211	25%
10/5	290	323	335	275	378	347	399	423	440	439	325	251	201	362	332	230	7	210	20%
10/6	600	423	411	332	315	259	145	130	Rain	Rain	Rain	Rain	Rain	400	351	304	8	420	26%
10/7	244	341	224	171	183	218	271	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	264	241	159	10	66	24%
10/8	273	341	379	325	296	380	486	507	398	391	346	245	215	388	344	260	4	723	21%
10/11	222	272	317	394	237	336	274	288	240	340	467	319	294	307	267	217	10	122	28%
10/12	550	539	444	434	311	241	248	337	Rain	Rain	Rain	Rain	Rain	347	285	260	8	323	28%
10/13	252	244	278	265	350	319	170	169	273	183	292	160	--	256	209	212	8	242	38%
10/15	375	217	294	361	377	351	307	293	267	297	289	258	N/A[1]	316	289	201	4	597	23%
Entire Season	**321**	**361**	**360**	**360**	**349**	**340**	**334**	**361**	**331**	**316**	**316**	**242**	**237**	**362**	**315**	**241**	**1**	**10932**	**19%**

-- indicates no targets counted for that hour N/A indicates no data for that hour

N/A[1] indicates equiment failure during that hour

Appendix A Table 5. Summary of available avian fall radar survey results conducted at proposed (pre-construction) US wind power facilities in eastern US, using X-band mobile radar systems (2004-present)

Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Reference
Fall 2004									
Maple Ridge, Lewis Cty, NY	57	n/a	Agricultural plateau	158	n/a	181	415	(125 m) 8%	Mabee, T. J., J. H. Plissner, B. A. Cooper. 2005. A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Flat Rock Wind Power Project, New York, Fall 2004. Prepared by ABR, Inc. for Atlantic Renewable Energy Coorporation
Sheffield, Caledonia Cty, VT	18	176	Forested ridge	91	19-320	200	566	(125 m) 1%	Woodlot Alternatives, Inc. 2006. Avian and Bat Information Summary and Risk Assessment for the Proposed Sheffield Wind Power Project in Sheffield, Vermont. Prepared for UPC Wind Management, LLC.
Dans Mountain, Allegany Cty, MD	34	318	Forested ridge	188	2-633	193	542	(125 m) 11%	Woodlot Alternatives, Inc. 2004. A Fall 2004 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Dan's Mountain Wind Project in Frostburg, Maryland. Prepared for US Wind Force.
Prattsburgh, Steuben Cty, NY	30	315	Agricultural plateau	193	12-474	188	516	(125 m) 3%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Windfarm Prattsburgh Project in Prattsburgh, New York. Prepared for UPC Wind Management, LLC.
Franklin, Pendleton Cty, WV	34	349	Forested ridge	229	7-926	175	583	(125 m) 8%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Liberty Gap Wind Project in Franklin, West Virginia. Prepared for US Wind Force, LLC.
Fall 2005									
Dairy Hills, Wyoming Cty, NY	57	n/a	Agricultural plateau	64	n/a	180	466	(125 m) 10%	Young, D. P., C. S. Nations, V. K. Poulton, J. Kerns, L. Pavalonis. 2006. Avian and Bat Studies for the Proposed Dairy Hills Wind Project, Wyoming County, New York. Final Report prepared by WEST, Inc. for Horizon Wind Energy.
Alabama, Genesee Cty, NY	59	n/a	Agricultural plateau	67	n/a	219	489	(125 m) 11%	Young, D. P., C. S. Nations, V. K. Poulton, J. Kerns. 2007. Avian and Bat Studies for the Proposed Alabama Ledge Wind Project, Genesee County, New York. Final Report prepared by WEST, Inc. for Horizon Wind Energy.
Churubusco, Clinton Cty, NY	38	414	Great Lakes plain/ADK foothills	152	9-429	193	438	(120 m) 5%	Woodlot Alternatives, Inc. 2005. A Fall Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Marble River Wind Project in Clinton and Ellenburg, New York. Prepared for AES Corporation.
Sheldon, Wyoming Cty, NY	36	347	Agricultural plateau	197	43-529	213	422	(120 m) 3%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Radar Survey of Bird Migration at the Proposed High Sheldon Wind Project in Sheldon, New York. Prepared for Invenergy.
Noble C/E/A, Clinton Cty, NY	57	n/a	Great Lakes plain/ADK foothills	197	n/a	162	333	(125 m) 12%	Mabee, T. J., J. H. Plissner, B. A. Cooper, J. B. Barna. 2006. A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Clinton County Windparks, New York, Spring and Fall 2005. Final Report prepared by ABR, Inc. for Ecology and Environment, Inc. and Noble Environmental Power, LLC.
Prattsburgh, Steuben Cty (Ecogen), NY	45	n/a	Agricultural plateau	200	n/a	177	365	(125 m) 9%	Mabee, T. J., Plissner, J. H., Cooper, B. A. 2004. A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Prattsbugh-Italy Wind Power Project, New York, Fall 2004. Final Report prepared by ABR, Inc. for Ecogen, LLC.
Kibby, Franklin Cty, ME (Range 1)	12	101	Forested ridge	201	12-783	196	352	(125 m) 12%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Stamford, Delaware Cty, NY	48	418	Forested ridge	315	22-784	251	494	(110 m) 3%	Woodlot Alternatives, Inc. 2007. A Spring and Fall 2005 Radar and Acoustic Survey of Bird Migration at the Proposed Moresville Energy Center in Stamford and Roxbury, New York. Prepared for Invenergy, LLC. Rockville, MD.
Preston Cty, WV	26	n/a	Forested ridge	379	n/a	n/a	420	(125 m) 10%	Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2006 A radar and visual study of nocturnal bird and bat migration at the proposed Preston Wind Development project, Virginia, Fall 2005. Report to Highland New Wind Development, LLC.
Jordanville, Herkimer Cty, NY	38	404	Agricultural plateau	380	26-1019	208	440	(125 m) 6%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Jordanville Wind Project in Stark and Warren, NY. Fall 2005 Final Report prepared for Community Energy, Inc.
Highland, VA	58	n/a	Forested ridge	385	n/a	n/a	442	(125 m) 12%	Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2006 A radar and visual study of nocturnal bird and bat migration at the proposed Highland New Wind Development project, Virginia, Fall 2005. Report to Highland New Wind Development, LLC.
Clayton, Jefferson Cty, NY	37	385	Agricultural plateau	418	83-877	168	475	(150 m) 10%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Clayton Wind Project in Clayton, New York. Prepared for PPM Atlantic Renewable.
Bliss, Wyoming Cty, NY	8	n/a	Agricultural plateau	444	n/a	n/a	411	(125 m) 13%	Ecology and Environment, Inc. 2006. Avian and Bat Risk Assessment Bliss Windpark Town of Eagle, Wyoming County, New York. Prepared for Noble Environmental Power, LLC.
Kibby, Franklin Cty, ME (Valley)	5	13	Forested ridge	452	52-995	193	391	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Mars Hill, Aroostook Cty, ME	18	117	Forested ridge	512	60-1092	228	424	(120 m) 8%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird Migration at the Mars Hill Wind Farm in Mars Hill, Maine. Prepared for Evergreen Windpower, LLC.
Howard, Steuben Cty, NY	39	405	Agricultural plateau	481	18-1434	185	491	(125 m) 5%	Woodlot Alternatives, Inc. 20065 A Fall 2005 Survey of Bird and Bat Migration at the Proposed Howard Wind Power Project in Howard, New York. Prepared for Everpower Global.
Deerfield, Bennington Cty, VT	32	324	Forested ridge	559	3-1736	221	395	(100 m) 13%	Woodlot Alternatives, Inc. 2006. Fall 2005 Bird and Bat Migration Surveys at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy, Inc.
Kibby, Franklin Cty, ME (Mountain)	12	115	Forested ridge	565	109-1107	167	370	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Fairfield, Herkimer Cty, NY	38	423	Agricultural plateau	691	116-1351	198	516	(145 m) 6%[1]	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar Survey of Bird and Bat Migration at the Proposed Top Notch Wind Project in Fairfield, New York. Prepared for PPM Atlantic Renewable.
Munnsville, Madison Cty, NY	31	292	Agricultural plateau	732	15-1671	223	644	(118 m) 2%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Munnsville Wind Project in Munnsville, New York. Prepared for AES-EHN NY Wind, LLC.
Fall 2006									
Villenova, Chautauqua Cty, NY	36	n/a	Great Lakes plain	189	16-604	216	353	(120 m) 9%	Stantec Consulting Services Inc. 2008. A Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Ball Hill Windpark in Villenova and Hanover, New York. Prepared for Noble Environmental Power, LLC and Ecology and Environment.
Wethersfield, Wyoming Cty, NY	56	n/a	Agricultural plateau	256	31-701	203	344	(125 m) 11%	Mabee, T. J., J. H. Plissner, J. B. Barna, B. A. Cooper. 2006. A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Centerville and Wethersfield windparks, New York, Fall 2006. Final Report prepared by ABR, Inc. for Ecology and Environment and Noble Environmental Power, LLC
Centerville, Allegany Cty, NY	57	n/a	Agricultural plateau	259	12-877	208	305	(125 m) 12%	Mabee, T. J., J. H. Plissner, J. B. Barna, B. A. Cooper. 2006. A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Centerville and Wethersfield windparks, New York, Fall 2006. Final Report prepared by ABR, Inc. for Ecology and Environment and Noble Environmental Power, LLC
Cape Vincent, Jefferson Cty, NY	60	n/a	Great Lakes plain	346	n/a	209	490	(125 m) 8%	Young, D. P., J. J. Kerns, C. S. Nations, V. K. Poulton. 2007. Avian and Bat Studies for the Proposed Cape Vincent Wind Project Jefferson County, New York. Final Report prepared by WEST, Inc. for BP Alternative Energy.
Stetson, Washington Cty, ME	12	77	Forested ridge	476	131-1192	227	378	(125 m) 13%	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Stetson Wind Project, Washington County, Maine. Prepared for Evergreen Wind V, LLC.
Dutch Hill, Steuben Cty, NY	21	n/a	Agricultural plateau	535	n/a	215	358	(125 m) 11%	Woodlot Alternatives, Inc. 2006. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Dutch Hill Wind Project Cohocton, New York. Prepared for UPC Wind Management, LLC.
Lempster, Sullivan Cty, NH	32	290	Forested ridge	620	133-1609	206	387	(125 m) 8%	Woodlot Alternatives, Inc. 2007. A Fall 2007 Survey of Nocturnal Bird Migration, Breeding Birds, and Bicknell's Thrush at the Proposed Lempster Mountain Wind Power Project Lempster, New Hampshire. Prepared for Lempster Wind, LLC.
Chateaugay, Franklin Cty, NY	35	327	Agricultural plateau	643	38-1373	212	431	(120 m) 8%	Woodlot Alternatives, Inc. 2006. Fall 2006 Radar Surveys at the Proposed Chateaugay Windpark in Chateaugay, New York. Prepared for Ecology and Environment, Inc. and Noble Power, LLC.
Granite Reliable Power, Coos Cty, NH	30	328	Forested ridge	469	22-1098	223	455	(125 m) 1%	Stantec Consulting Inc. 2007. Fall 2006 Radar Surveys of Nighttime Migration Activity at the Proposed Windpark in Coos County, New Hampshire by Granite Reliable Power, LLC. Prepared for Granite Reliable Power, LLC.
Fall 2007									
Arkwright, Chautauqua Cty, NY	57	n/a	Great Lakes plain	112	n/a	208	458	(125 m) 10%	Kerns, J., D. P. Young, C. S. Nations, V. K. Poulton. 2008. Avian and Bat Studies for the Proposed New Grange Wind Project, Chautauqua County, New York. Final Report prepared by WEST, Inc. for New Grange Wind Farm LLC.
Laurel Mountain, Barbour Cty, WV	20	212	Forested ridge	321	76-513	209	533	(130 m) 6%	Stantec Consulting Services Inc. 2007. A Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Laurel Mountain Wind Energy Project near Elkins, West Virginia. Prepared for AES Laurel Mountain, LLC.
Granite Reliable Power, Coos County, NH	29	232	Forested ridge	366	54 to 1234	223	343	(125 m) 15%	Stantec Consulting Inc. 2007. Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Windpark in Coos County, New Hampshire by Granite Reliable Power, LLC. Prepared for Granite Reliable Power, LLC.
Rollins, Lincoln, Penobscot Cty, ME	22	231	Forested ridge	368	82-953	284	343	(120 m) 13%	Woodlot Alternatives, Inc. 2008. A Fall 2007 Survey of Bird and Bat Migration at the Rollins Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
Roxbury, Oxford Cty, ME	20	220	Forested ridge	420	88-1006	227	365	(130 m) 14%	Woodlot Alternatives, Inc. 2007. A Fall 2007 Survey of Bird and Bat Migration at the Record Hill Wind Project, Roxbury, Maine. Prepared for Roxbury Hill Wind LLC.
Allegany, Cattaraugus Cty, NY	46	n/a	Forested ridge	451	n/a	230	382	(150 m) 10%	Stantec Consulting. 2008. Fall Bird and Bat Migration Survey Report, Visual, Radar, and Acoustic Bat Surveys for the Allegany Wind Project in Allegany, New York. Prepared for Allegany Wind, LLC. March 2008 (updated January 2010).
New Creek, Grant Cty, WV	20	n/a	Forested ridge	811	263-1683	231	360	(130 m) 17%	Stantec Consulting Services Inc. 2008. A Fall 2007 Survey of Bird and Bat Migration at the New Creek Wind Project, West Virginia. Prepared for AES New Creek, LLC.
Fall 2008									
Hounsfield, Jefferson Cty, NY	60	674	Great Lakes island	281	64-835	207	298	(125 m) 17%	Stantec Consulting Services Inc. 2008. A Fall 2008 Survey of Bird Migration at the Hounsfield Wind Project, New York. Prepared for American Consulting Professionals of New York, PLLC.
Georgia Mountain, VT	21	n/a	Forested ridge	326	56-700	230	371	(120 m) 7%	Stantec Consulting Services Inc. 2008. A Fall 2008 Survey of Bird Migration at the Georgia Mountain Wind Project, Vermont. Prepared for Georgia Mountain Community Wind.
Oakfield, Penobscot Cty, ME	20	n/a	Forested ridge	501	116-945	200	309	(125 m) 18%	Woodlot Alternatives, Inc. 2008. A Fall 2008 Survey of Bird and Bat Migration at the Oakfield Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
Groton Wind, Grafton Cty, NH	45	509	Forested ridge	470	94-1174	260	342	(125m) 13%	Stantec Consulting Services Inc. 2008. Fall 2008 Radar Survey Report for the Groton Wind Project. Prepared for Groton Wind, LLC.
Highland, Somerset Cty, ME	20	216	Forested ridge	549	68-1201	227	348	(130.5m) 17%	Stantec Consulting. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC
Fall 2009									
Sisk (Kibby Expansion) Franklin Cty, ME	20	210	Forested ridge	458	44-1067	206	287	(125m) 23%	Stantec Consulting Services. 2009. Fall 2009 Nocturnal Migration Survey Report. Prepared for TRC Engineers LLC.
Stetson, Washington Cty, ME	18	201	Forested ridge	457	106-1746	227	420	(119m) 2%	Stantec Consulting Services. 2010. Stetson I Mountain Wind Project Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC.
Bull Hill, Hancock Cty, ME	20	232	Forested ridge	614	188-1500	260	357	(145m) 20%	Stantec Consulting Services. 2010. Summer and Fall 2009 Avian and Bat Survey Report for the Bull Hill Project. Prepared for Blue Sky East Wind, LLC.
Bowers, Washington Cty, ME	22	249	Forested ridge	344	95-844	231	453	(119m) 14%	Stantec Consulting Services Inc. 2010. 2010 Spring Avian and Spring/Summer Bat Surveys for the Bowers Wind Project. Prepared for Champlain Wind Energy, LLC.
Wild Meadows, Merrimack and Grafton Cty, NH	35	n/a	Forested ridge	980	384-2442	225	362	(150m) 19%	*this report*
Fall 2010									
Bingham, Somerset Cty, ME	20	232	Forested ridge	803	194-2463	234	378	(152m) 20%	Stantec Consulting Services Inc. 2010. 2010 Spring Avian and Spring/Summer Bat Surveys for the Bowers Wind Project. Prepared for Champlain Wind Energy, LLC.
Fall 2011									
Antrim, Hillsborough Cty,NH	30	327	Forested ridge	138	4-538	217	203	(150m) 40%	Stantec Consulting Services. 2011. Summer and Fall 2011 Radar and Acoustic Bat Survey Report for the Antrim Wind Energy Project in Antrim, New Hampshire. Prepared for Antrim Wind Energy, LLC.
Passadumkeag, Grand Falls Township, ME	20	222	Forested ridge	394	65-1281	251	325	(140m) 22%	Stantec Consulting Services. 2011. Summer and Fall 2011 Avian and Bat Survey Report for the Passadumkeag Wind Project in Grand Falls Township, Maine. Prepared for Passadumkeag Windpark LLC.
Bull Hill, T16 MD, ME	10	112	Forested ridge	431	111-747	282	279	(145m) 26%	Stantec Consulting Services Inc. 2011. Fall 2011 Radar Survey Results and Comparison to Fall 2009 Radar Results:Memo for the Bull Hill Wind Project. Prepared for Blue Sky East Wind, LLC.

Note:
[1] The percent targets below turbine height can be found in the addendum to the report "Effect of Top Notch (now Hardscrabble) Wind Project revision to turbine layout and model changes on the spring and fall 2005 nocturnal radar survey reports." Prepared August 26, 2009, by Stantec Consulting Services Inc.

Appendix B

Bat survey results

Appendix B Table 1. Summary of acoustic bat data and weather during each survey night at the Braley detector – Fall, 2009

		BBSH			HB	MYSP	RBTB			UNKN							
Night of	**Operational?**	**BBSH**	**Big brown**	**Silver-haired**	**Hoary**	**MYSP**	**Eastern red**	**Tri-colored**	**RBTB**	**HFUN**	**LFUN**	**UNKN**	**Total**	**Wind Speed (m/s)**	**Temperature (celsius)**	**Barometric Pressure**	**Relative Humidity (%)**
08/20/09	1					1				2			**3**	2.3	20	28	92
08/21/09	1	1											**1**	1.9	18	28	98
08/22/09	1			2									**2**	2.6	19	28	97
08/23/09	1										1		**1**	1.6	18	28	95
08/24/09	1	1											**1**	2.2	17	28	88
08/25/09	1										1		**1**	3.0	17	28	85
08/26/09	1												**0**	3.9	11	28	81
08/27/09	1												**0**	2.9	12	28	54
08/28/09	1												**0**	4.1	11	28	89
08/29/09	1	4		1						6	4		**15**	4.0	9	28	98
08/30/09	1										1		**1**	3.0	13	28	85
08/31/09	1										1		**1**	3.7	11	28	67
09/01/09	1												**0**	2.4	13	28	61
09/02/09	1	2								1			**3**	3.2	15	28	75
09/03/09	1	2											**2**	2.6	17	28	74
09/04/09	1	4								1	1		**6**	3.2	17	28	69
09/05/09	1									1			**1**	3.1	11	28	64
09/06/09	1	3		1									**4**	2.2	8	28	75
09/07/09	1												**0**	2.8	13	28	91
09/08/09	1												**0**	4.0	16	28	77
09/09/09	1												**0**	2.6	10	28	71
09/10/09	1												**0**	3.1	7	28	90
09/11/09	1												**0**	5.9	11	28	95
09/12/09	1												**0**	2.3	14	28	96
09/13/09	1	1									1		**2**	3.1	11	28	91
09/14/09	1												**0**	2.7	12	28	86
09/15/09	1												**0**	3.7	10	28	78
09/16/09	1												**0**	1.7	8	28	92
09/17/09	1												**0**	2.6	8	28	92
09/18/09	1												**0**	4.4	6	28	84
09/19/09	1												**0**	4.0	8	28	59
09/20/09	1										1		**1**	3.5	13	28	53
09/21/09	1						1				1		**2**	2.4	12	28	73
09/22/09	1						1			2			**3**	2.6	16	28	93
09/23/09	1												**0**	3.4	17	28	95
09/24/09	1												**0**	3.1	9	28	80
09/25/09	1										1		**1**	3.0	5	28	70
09/26/09	1									1			**1**	2.9	7	28	83
09/27/09	1												**0**	3.5	13	27	98
09/28/09	1												**0**	2.3	11	27	94
09/29/09	1												**0**	3.0	8	27	96
09/30/09	1												**0**	2.9	1	28	95
10/01/09	1												**0**	1.7	2	28	94
10/02/09	1												**0**	3.9	6	28	92
10/03/09	1												**0**	2.3	12	28	98
10/04/09	1	2									1		**3**	3.3	10	28	89
10/05/09	1												**0**	3.1	6	28	95
10/06/09	1												**0**	2.7	7	27	88
10/07/09	1												**0**	6.6	6	27	93
10/08/09	0												**0**	2.3	6	28	85
10/09/09	0												**0**	1.5	9	27	97
10/10/09	0												**0**	3.1	2	28	81
10/11/09	0												**0**	3.6	0	28	71
10/12/09	0												**0**	1.2	2	28	77
10/13/09	0												**0**	3.8	-1	28	94
10/14/09	0												**0**	2.6	-3	28	78
10/15/09	0												**0**	4.9	-2	28	76
10/16/09	0												**0**	3.7	-1	28	66
10/17/09	0												**0**	4.0	0	28	75
10/18/09	0												**0**	2.4	-1	28	73
10/19/09	0												**0**	2.8	3	28	52
10/20/09	0												**0**	2.6	7	28	79
10/21/09	0												**0**	1.7	7	28	87
10/22/09	0												**0**	0.8	14	28	75
By Species		**20**	**0**	**4**	**0**	**1**	**2**	**0**	**0**	**14**	**14**	**0**	**55**				
By Guild			**24**		**0**	**1**		**2**			**28**						
			BBSH		**HB**	**MYSP**		**RBTB**			**UNKN**		**Total**				

* 1 = Detector functioned for then entire night; 0 = Non-operational for all or part of the night

Appendix B Table 2. Summary of acoustic bat data and weather during each survey night at the Melvin detector – Fall, 2009

		BBSH			HB	MYSP	RBTB			UNKN							
Night of	Operational?	BBSH	Big brown	Silver-haired	Hoary	MYSP	Eastern red	Tri-colored	RBTB	HFUN	LFUN	UNKN	Total	Wind Speed (m/s)	Temperature (celsius)	Barometric Pressure	Relative Humidity (%)
08/19/09	1	1			1					2			**4**				
08/20/09	1				1	2				2		1	**6**	2	20	28	92
08/21/09	1												**0**	2	18	28	98
08/22/09	1												**0**	3	19	28	97
08/23/09	1				2					2			**4**	2	18	28	95
08/24/09	1				1		2			2			**5**	2	17	28	88
08/25/09	1				1								**1**	3	17	28	85
08/26/09	1												**0**	4	11	28	81
08/27/09	1	1		1							1		**3**	3	12	28	54
08/28/09	1												**0**	4	11	28	89
08/29/09	1						3			1			**4**	4	9	28	98
08/30/09	1	6					1				1		**8**	3	13	28	85
08/31/09	1												**0**	4	11	28	67
09/01/09	1								1				**1**	2	13	28	61
09/02/09	1	3											**3**	3	15	28	75
09/03/09	1									1			**1**	3	17	28	74
09/04/09	1												**0**	3	17	28	69
09/05/09	1	1											**1**	3	11	28	64
09/06/09	1	3											**3**	2	8	28	75
09/07/09	1	1											**1**	3	13	28	91
09/08/09	1										2		**2**	4	16	28	77
09/09/09	1	1									1		**2**	3	10	28	71
09/10/09	1												**0**	3	7	28	90
09/11/09	1												**0**	6	11	28	95
09/12/09	1												**0**	2	14	28	96
09/13/09	1	2											**2**	3	11	28	91
09/14/09	1	1											**1**	3	12	28	86
09/15/09	1									1			**1**	4	10	28	78
09/16/09	1	2											**2**	2	8	28	92
09/17/09	1												**0**	3	8	28	92
09/18/09	1												**0**	4	6	28	84
09/19/09	1												**0**	4	8	28	59
09/20/09	1												**0**	3	13	28	53
09/21/09	1			1									**1**	2	12	28	73
09/22/09	1												**0**	3	16	28	93
09/23/09	1												**0**	3	17	28	95
09/24/09	1												**0**	3	9	28	80
09/25/09	1										1		**1**	3	5	28	70
09/26/09	1									1			**1**	3	7	28	83
09/27/09	1												**0**	4	13	27	98
09/28/09	1												**0**	2	11	27	94
09/29/09	1												**0**	3	8	27	96
09/30/09	1												**0**	3	1	28	95
10/01/09	1												**0**	2	2	28	94
10/02/09	1												**0**	4	6	28	92
10/03/09	1												**0**	2	12	28	98
10/04/09	1												**0**	3	10	28	89
10/05/09	1												**0**	3	6	28	95
10/06/09	1												**0**	3	7	27	88
10/07/09	1												**0**	7	6	27	93
10/08/09	1												**0**	2	6	28	85
10/09/09	1												**0**	2	9	27	97
10/10/09	1												**0**	3	2	28	81
10/11/09	1												**0**	4	0	28	71
10/12/09	1												**0**	1	2	28	77
10/13/09	1												**0**	4	-1	28	94
10/14/09	1												**0**	3	-3	28	78
10/15/09	1												**0**	5	-2	28	76
10/16/09	1												**0**	4	-1	28	66
10/17/09	1												**0**	4	0	28	75
10/18/09	1												**0**	2	-1	28	73
10/19/09	1		1										**1**	3	3	28	52
10/20/09	1												**0**	3	7	28	79
10/21/09	1												**0**	2	7	28	87
10/22/09	1												**0**	1	14	28	75
By Species		**22**	**1**	**2**	**6**	**2**	**6**	**0**	**1**	**12**	**6**	**1**	**59**				
By Guild		**25**			**6**	**2**	**7**			**19**							
		BBSH			**HB**	**MYSP**	**RBTB**			**UNKN**			**Total**				

* 1 = Detector functioned for then entire night; 0 = Non-operational for all or part of the night

Appendix B Table 3. Summary of acoustic bat data and weather during each survey night at the Tinkham detector – Fall, 2009

		BBSH			HB	MYSP	RBTB			UNKN							
Night of	**Operational?**	**BBSH**	**Big brown**	**Silver-haired**	**Hoary**	**MYSP**	**Eastern red**	**Tri-colored**	**RBTB**	**HFUN**	**LFUN**	**UNKN**	**Total**	**Wind Speed (m/s)**	**Temperature (celsius)**	**Barometric Pressure**	**Relative Humidity (%)**
08/20/09	1	1								1			**2**	2	20	28	92
08/21/09	1										1		**1**	2	18	28	98
08/22/09	1												**0**	3	19	28	97
08/23/09	1			1							3	1	**5**	2	18	28	95
08/24/09	1						1		2				**3**	2	17	28	88
08/25/09	1	2			2					2	1		**7**	3	17	28	85
08/26/09	1												**0**	4	11	28	81
08/27/09	1									1	2		**3**	3	12	28	54
08/28/09	1												**0**	4	11	28	89
08/29/09	1	2	1	1							1		**5**	4	9	28	98
08/30/09	1	3								1	1		**5**	3	13	28	85
08/31/09	1	2											**2**	4	11	28	67
09/01/09	1	1		1		1				1	3		**7**	2	13	28	61
09/02/09	1	1								3			**4**	3	15	28	75
09/03/09	1												**0**	3	17	28	74
09/04/09	1	1				1				1			**3**	3	17	28	69
09/05/09	1	1								1			**2**	3	11	28	64
09/06/09	1									1			**1**	2	8	28	75
09/07/09	1												**0**	3	13	28	91
09/08/09	1	3		1									**4**	4	16	28	77
09/09/09	1	1											**1**	3	10	28	71
09/10/09	1												**0**	3	7	28	90
09/11/09	1												**0**	6	11	28	95
09/12/09	1												**0**	2	14	28	96
09/13/09	1												**0**	3	11	28	91
09/14/09	1	1											**1**	3	12	28	86
09/15/09	1	3		7							1		**11**	4	10	28	78
09/16/09	1												**0**	2	8	28	92
09/17/09	1												**0**	3	8	28	92
09/18/09	1			2							1		**3**	4	6	28	84
09/19/09	1												**0**	4	8	28	59
09/20/09	1	1							1				**2**	3	13	28	53
09/21/09	1												**0**	2	12	28	73
09/22/09	1									1			**1**	3	16	28	93
09/23/09	1												**0**	3	17	28	95
09/24/09	1	1											**1**	3	9	28	80
09/25/09	1	1									1		**2**	3	5	28	70
09/26/09	1												**0**	3	7	28	83
09/27/09	1												**0**	4	13	27	98
09/28/09	1												**0**	2	11	27	94
09/29/09	1								1				**1**	3	8	27	96
09/30/09	1												**0**	3	1	28	95
10/01/09	1												**0**	2	2	28	94
10/02/09	1												**0**	4	6	28	92
10/03/09	1												**0**	2	12	28	98
10/04/09	1												**0**	3	10	28	89
10/05/09	1												**0**	3	6	28	95
10/06/09	1												**0**	3	7	27	88
10/07/09	1												**0**	7	6	27	93
10/08/09	1												**0**	2	6	28	85
10/09/09	1												**0**	2	9	27	97
10/10/09	1												**0**	3	2	28	81
10/11/09	1												**0**	4	0	28	71
10/12/09	1												**0**	1	2	28	77
10/13/09	1												**0**	4	-1	28	94
10/14/09	1												**0**	3	-3	28	78
10/15/09	1												**0**	5	-2	28	76
10/16/09	1												**0**	4	-1	28	66
10/17/09	1												**0**	4	0	28	75
10/18/09	1												**0**	2	-1	28	73
10/19/09	1												**0**	3	3	28	52
10/20/09	1												**0**	3	7	28	79
10/21/09	1												**0**	2	7	28	87
10/22/09	1												**0**	1	14	28	75
By Species		**25**	**1**	**13**	**2**	**2**	**1**	**0**	**4**	**13**	**15**	**1**	**77**				
By Guild		**39**			**2**	**2**	**5**			**29**							
		BBSH			**HB**	**MYSP**	**RBTB**			**UNKN**			**Total**				

Stantec

Appendix B Table 4. Summary of available fall bat detector surveys conducted in forest habitat in the East (results reported for individual detectors)

Year	Project	Project Location	Habitat	Height (m)	Detector Nights	Start	End	Calls	Rate	Reference
Tree or Low Tower detectors (10 m or below)										
2005	Lempster	Lempster, Sullivan Cty, NH	forest edge	7.5	34	9/20	10/31	27	0.8	Woodlot Alternatives, Inc. 2005. Summary of fall 2005 Lempster bat survey. Memorandum to Jeff Keeler (CEI) from Bob Roy (Woodlot Alternatives, Inc.) dated November 18, 2005.
2005	Lempster	Lempster, Sullivan Cty, NH	forest edge	2	42	9/20	10/31	2	0	Woodlot Alternatives, Inc. 2005. Summary of fall 2005 Lempster bat survey. Memorandum to Jeff Keeler (CEI) from Bob Roy (Woodlot Alternatives, Inc.) dated November 18, 2005.
2005	Horse Creek	Clayton, Jefferson Cty, NY	forest edge	2	33	8/19	9/20	154	4.7	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Clayton Wind Project in Clayton, New York. Prepared for PPM Atlantic Renewable.
2005	Moresville	Stamford, Delaware Cty, NY	forest edge	2	58	8/15	10/15	280	4.8	Woodlot. 2007. A Spring and Fall 2005 Radar and Acoustic Survey of Bird Migration at the Proposed Moresville Energy Center in Stamford and Roxbury, New York. Prepared for Invenergy, LLC. Rockville, MD.
2006	Lempster	Lempster, Sullivan Cty, NH	forest edge	10	29	9/9	10/24	2	0.1	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Lempster Mountain Wind Power Project in Lempster, New Hampshire. Prepared for Lempster Wind, LLC.
2006	Lempster	Lempster, Sullivan Cty, NH	forest edge	3	44	9/9	10/24	384	8.7	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Lempster Mountain Wind Power Project in Lempster, New Hampshire. Prepared for Lempster Wind, LLC.
2007	Rollins	Rollins, Penobscot Cty, ME	forest edge	3	114	7/12	11/2	12291	107.8	Stantec Consulting Services Inc. 2007. Fall 2007 Bird and Bat Migration Survey Report: Visual, Radar and Acoustic Bat Surveys for the Rollins Wind Project. Prepared for First Wind Management, LLC.
2007	Rollins	Rollins, Penobscot Cty, ME	forest edge	3	53	8/2	10/16	5360	101.1	Stantec Consulting Services Inc. 2007. Fall 2007 Bird and Bat Migration Survey Report: Visual, Radar and Acoustic Bat Surveys for the Rollins Wind Project. Prepared for First Wind Management, LLC.
2007	Rollins	Rollins, Penobscot Cty, ME	forest edge	3	107	7/12	11/2	8996	84.1	Stantec Consulting Services Inc. 2007. Fall 2007 Bird and Bat Migration Survey Report: Visual, Radar and Acoustic Bat Surveys for the Rollins Wind Project. Prepared for First Wind Management, LLC.
2007	Record Hill	Roxbury, Oxford Cty, ME	forest edge	2	13	8/9	8/21	148	11.4	Stantec Consulting Services Inc. 2007. Fall 2007 Migration Report: Visual, Acoustic and Radar Surveys of Bird and Bat Migration Conducted at the Proposed Record Hill Wind Project in Roxbury, Maine. Prepared for Independence Wind, LLC.
2007	Record Hill	Roxbury, Oxford Cty, ME	forest edge	5	4	8/9	8/21	1	0.3	Stantec Consulting Services Inc. 2007. Fall 2007 Migration Report: Visual, Acoustic and Radar Surveys of Bird and Bat Migration Conducted at the Proposed Record Hill Wind Project in Roxbury, Maine. Prepared for Independence Wind, LLC.
2007	Record Hill	Roxbury, Oxford Cty, ME	forest edge	3	13	8/9	8/21	524	40.3	Stantec Consulting Services Inc. 2007. Fall 2007 Migration Report: Visual, Acoustic and Radar Surveys of Bird and Bat Migration Conducted at the Proposed Record Hill Wind Project in Roxbury, Maine. Prepared for Independence Wind, LLC.
2007	Record Hill	Roxbury, Oxford Cty, ME	forest edge	10	13	8/9	8/21	1576	121.2	Stantec Consulting Services Inc. 2007. Fall 2007 Migration Report: Visual, Acoustic and Radar Surveys of Bird and Bat Migration Conducted at the Proposed Record Hill Wind Project in Roxbury, Maine. Prepared for Independence Wind, LLC.
2008	New Creek	New Creek, Grant Cty, WV	forest edge	1.5	64	8/15	10/17	565	38.3	Stantec Consulting Services Inc. 2008. Spring, Summer, and Fall 2008 Bird and Bat Migration Survey Report: Visual, Radar, and Acoustic Bat Surveys for the New Creek Mountain Project. Prepared for AES New Creek, LLC
2008	Allegany	Allegany, Cattaraugus Cty, NY	forest edge	2	85	8/16	11/14	62	9	Stantec Consulting Services. 2008. Summer-Fall 2008 Acoustic Survey Report. Prepared for EverPower Wind Holdings, Inc.
2008	Highland, ME	Highland, Somerset Cty, ME	forest edge	5	17	8/12	8/28	3731	219.5	Stantec Consulting Services. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC.
2008	Highland, ME	Highland, Somerset Cty, ME	forest edge	5	23	8/11	9/2	37	1.6	Stantec Consulting Services. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC.
2008	Highland, ME	Highland, Somerset Cty, ME	forest edge	8	17	8/11	8/27	5475	322.2	Stantec Consulting Services. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC.
2008	Highland, ME	Highland, Somerset Cty, ME	forest edge	5	29	8/11	9/8	2197	75.8	Stantec Consulting Services. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC.
2008	Highland, ME	Highland, Somerset Cty, ME	forest edge	2	23	8/11	9/2	73	3.2	Stantec Consulting Services. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC.
2009	Sisk	Sisk (Kibby Expansion) Franklin Cty, ME	forest edge	5	66	8/11	10/15	7	0.6	Stantec Consulting Services. 2009. Fall 2009 Nocturnal Migration Survey Report. Prepared for TRC Engineers LLC.
2009	Stetson	Stetson, Washington Cty, ME	forest edge	4	97	7/10	10/14	57	6.2	Stantec Consulting Services. 2010. Stetson I Mountain Wind Project Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC.
2009	Stetson	Stetson, Washington Cty, ME	forest edge	6	72	7/13	10/14	26	3.8	Stantec Consulting Services. 2010. Stetson I Mountain Wind Project Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC.
2009	Stetson	Stetson, Washington Cty, ME	forest edge	1.8	94	7/13	10/14	951	91.2	Stantec Consulting Services. 2010. Stetson I Mountain Wind Project Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC.
2009	Stetson	Stetson, Washington Cty, ME	forest edge	7	86	7/10	10/14	67	5.9	Stantec Consulting Services. 2010. Stetson I Mountain Wind Project Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC.
2011	Antrim	Antrim, Hillsborough Cty,NH	forest edge	10	134	6/1	10/23	7039	52.5	Stantec Consulting Services. 2011. Summer and Fall 2011 Radar and Acoustic Bat Survey Report for the Antrim Wind Energy Project in Antrim, New Hampshire. Prepared for Antrim Wind Energy, LLC.
2011	Antrim	Antrim, Hillsborough Cty,NH	forest edge	5	123	6/1	10/20	8470	68.9	Stantec Consulting Services. 2011. Summer and Fall 2011 Radar and Acoustic Bat Survey Report for the Antrim Wind Energy Project in Antrim, New Hampshire. Prepared for Antrim Wind Energy, LLC.
2011	Antrim	Antrim, Hillsborough Cty,NH	forest edge	5	113	6/1	10/20	7143	63.2	Stantec Consulting Services. 2011. Summer and Fall 2011 Radar and Acoustic Bat Survey Report for the Antrim Wind Energy Project in Antrim, New Hampshire. Prepared for Antrim Wind Energy, LLC.
2011	Antrim	Antrim, Hillsborough Cty,NH	forest edge	5	85	6/1	10/20	224	2.6	Stantec Consulting Services. 2011. Summer and Fall 2011 Radar and Acoustic Bat Survey Report for the Antrim Wind Energy Project in Antrim, New Hampshire. Prepared for Antrim Wind Energy, LLC.
2011	Passadumkeag	Passadumkeag, Grand Falls Township, ME	forest edge	3.5	138	6/1	10/16	304	2.2	Stantec Consulting Services. 2011. Summer and Fall 2011 Avian and Bat Survey Report for the Passadumkeag Wind Project in Grand Falls Township, Maine. Prepared for Passadumkeag Windpark LLC.
2011	Passadumkeag	Passadumkeag, Grand Falls Township, ME	forest edge	3	138	6/1	10/16	13828	100.2	Stantec Consulting Services. 2011. Summer and Fall 2011 Avian and Bat Survey Report for the Passadumkeag Wind Project in Grand Falls Township, Maine. Prepared for Passadumkeag Windpark LLC.
2011	Passadumkeag	Passadumkeag, Grand Falls Township, ME	forest edge	8	126	6/1	10/16	2699	21.4	Stantec Consulting Services. 2011. Summer and Fall 2011 Avian and Bat Survey Report for the Passadumkeag Wind Project in Grand Falls Township, Maine. Prepared for Passadumkeag Windpark LLC.
2011	Passadumkeag	Passadumkeag, Grand Falls Township, ME	forest edge	2	132	6/1	10/16	661	5	Stantec Consulting Services. 2011. Summer and Fall 2011 Avian and Bat Survey Report for the Passadumkeag Wind Project in Grand Falls Township, Maine. Prepared for Passadumkeag Windpark LLC.

continued

Appendix B Table 4 *cont.*

MET or Tower Detectors (> 10 m)										
2004	Liberty Gap	Franklin, Pendleton Cty, WV	forest edge	15	14	Sep	Nov	168	0.35	Woodlot Alternatives, Inc. 2005. A Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Liberty Gap Wind Project in Franklin, West Virginia – Fall 2004. Prepared for US Wind Force, LLC.
2004	Liberty Gap	Franklin, Pendleton Cty, WV	forest edge	30	14	Sep	Nov	165	0.19	Woodlot Alternatives, Inc. 2005. A Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Liberty Gap Wind Project in Franklin, West Virginia – Fall 2004. Prepared for US Wind Force, LLC.
2004	Sheffield	Sheffield, Caledonia Cty, VT	forest edge	15	6	9/10	9/15	30	0.23	Woodlot Alternatives, Inc. 2006. Avian and Bat Information Summary and Risk Assessment for the Proposed Sheffield Wind Pow er Project in Sheffield, Vermont. Prepared for UPC Wind Management, LLC.
2004	Sheffield	Sheffield, Caledonia Cty, VT	forest edge	30	5	10/17	10/21	0	0	Woodlot Alternatives, Inc. 2006. Avian and Bat Information Summary and Risk Assessment for the Proposed Sheffield Wind Pow er Project in Sheffield, Vermont. Prepared for UPC Wind Management, LLC.
2005	Mars Hill	Mars Hill, Aroostook Cty, ME	forest edge	20	22	8/31	9/21	25	n/a	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Mars Hill Wind Project in Mars Hill, Maine. Prepared for UPC Wind Management, LLC.
2005	Mars Hill	Mars Hill, Aroostook Cty, ME	forest edge	20	22	8/31	9/21	25	n/a	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Mars Hill Wind Project in Mars Hill, Maine. Prepared for UPC Wind Management, LLC.
2005	Lempster	Lempster, Sullivan Cty, NH	forest edge	15	42	9/20	10/31	14	0.3	Woodlot Alternatives, Inc. 2005. Summary of fall 2005 Lempster bat survey. Memorandum to Jeff Keeler (CEI) from Bob Roy (Woodlot Alternatives, Inc.) dated November 18, 2005.
2005	Clayton	Clayton, Jefferson Cty, NY	forest edge	30	0	8/19	9/20	0	0	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Clayton Wind Project in Clayton, New York. Prepared for PPM Atlantic Renew able.
2005	Moresville	Stamford, Delaw are Cty, NY	forest edge	15	43	8/15	10/15	293	6.8	Woodlot. 2007. A Spring and Fall 2005 Radar and Acoustic Survey of Bird Migration at the Proposed Moresville Energy Center in Stamford and Roxbury, New York. Prepared for Invenergy, LLC. Rockville, MD.
2005	Moresville	Stamford, Delaw are Cty, NY	forest edge	30	54	8/15	10/15	285	5.3	Woodlot. 2007. A Spring and Fall 2005 Radar and Acoustic Survey of Bird Migration at the Proposed Moresville Energy Center in Stamford and Roxbury, New York. Prepared for Invenergy, LLC. Rockville, MD.
2005	Dans Mountain	Loarville, Allegany Cty, MD	forest edge	11	53	8/1	9/22	574	10.8	Woodlot Alternatives, Inc. 2005. Fall 2005 Bat Echolocation Surveys at the Proposed Dan's Mountain Wind Project in Frostburg, Maryland. Prepared for US Wind Force.
2005	Dans Mountain	Loarville, Allegany Cty, MD	forest edge	23	31	8/1	9/22	388	12.5	Woodlot Alternatives, Inc. 2005. Fall 2005 Bat Echolocation Surveys at the Proposed Dan's Mountain Wind Project in Frostburg, Maryland. Prepared for US Wind Force.
2006	Kibby	Kibby, Franklin Cty, ME	forest edge	45	72	6/20	10/25	18	0.3	Woodlot Alternatives, Inc. 2006. Summer/Fall 2006 Survey of Bat Activity at the Proposed Kibby Wind Pow er Project in Kibby and Skinner Tow nships, Maine. Prepared for TransCanada Maine Wind Development Inc.
2006	Kibby	Kibby, Franklin Cty, ME	forest edge	45	76	6/20	10/25	0	0	Woodlot Alternatives, Inc. 2006. Summer/Fall 2006 Survey of Bat Activity at the Proposed Kibby Wind Pow er Project in Kibby and Skinner Tow nships, Maine. Prepared for TransCanada Maine Wind Development Inc.
2006	Kibby	Kibby, Franklin Cty, ME	forest edge	20	44	6/20	10/25	4	0.1	Woodlot Alternatives, Inc. 2006. Summer/Fall 2006 Survey of Bat Activity at the Proposed Kibby Wind Pow er Project in Kibby and Skinner Tow nships, Maine. Prepared for TransCanada Maine Wind Development Inc.
2006	Kibby	Kibby, Franklin Cty, ME	forest edge	45	20	6/20	10/25	0	0	Woodlot Alternatives, Inc. 2006. Summer/Fall 2006 Survey of Bat Activity at the Proposed Kibby Wind Pow er Project in Kibby and Skinner Tow nships, Maine. Prepared for TransCanada Maine Wind Development Inc.
2006	Redington	Redington, Franklin Cty, ME	forest edge	15	21	8/10	10/24	0	0	Woodlot Alternatives, Inc. 2006. Fall 2006 Bat Detector Surveys at the Proposed Redington Wind Project. Prepared for Maine Mountain Pow er.
2006	Redington	Redington, Franklin Cty, ME	forest edge	15	48	8/10	10/24	0	0	Woodlot Alternatives, Inc. 2006. Fall 2006 Bat Detector Surveys at the Proposed Redington Wind Project. Prepared for Maine Mountain Pow er.
2006	Redington	Redington, Franklin Cty, ME	forest edge	30	29	8/10	10/24	0	0	Woodlot Alternatives, Inc. 2006. Fall 2006 Bat Detector Surveys at the Proposed Redington Wind Project. Prepared for Maine Mountain Pow er.
2006	Redington	Redington, Franklin Cty, ME	forest edge	30	37	8/10	10/24	0	0	Woodlot Alternatives, Inc. 2006. Fall 2006 Bat Detector Surveys at the Proposed Redington Wind Project. Prepared for Maine Mountain Pow er.
2006	Stetson	Stetson, Penobscot Cty, ME	forest edge	30	73	6/28	10/16	8	0.1	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Stetson Mountain Wind Pow er Project in Washington County, Maine. Prepared for Evergreen Wind V, LLC.
2006	Stetson	Stetson, Penobscot Cty, ME	forest edge	30	76	6/28	10/16	170	2.2	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Stetson Mountain Wind Pow er Project in Washington County, Maine. Prepared for Evergreen Wind V, LLC.
2006	Stetson	Stetson, Penobscot Cty, ME	forest edge	15	105	6/28	10/16	108	1	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Stetson Mountain Wind Pow er Project in Washington County, Maine. Prepared for Evergreen Wind V, LLC.

continued

Appendix B Table 4 *cont.*

Year	Project	Project Location	Habitat	Height (m)	Detector Nights	Start	End	Calls	Rate	Reference
2006	Stetson	Stetson, Penobscot Cty, ME	forest edge	15	107	6/28	10/16	651	6.1	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Stetson Mountain Wind Power Project in Washington County, Maine. Prepared for Evergreen Wind V, LLC.
2006	Lempster	Lempster, Sullivan Cty, NH	forest edge	40	43	9/9	10/24	16	0.4	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Lempster Mountain Wind Power Project in Lempster, New Hampshire. Prepared for Lempster Wind, LLC.
2007	Rollins	Rollins, Penobscot Cty, ME	forest edge	40	95	7/12	11/2	66	0.7	Stantec Consulting Services Inc. 2007. Fall 2007 Bird and Bat Migration Survey Report: Visual, Radar and Acoustic Bat Surveys for the Rollins Wind Project. Prepared for First Wind Management, LLC.
2007	Rollins	Rollins, Penobscot Cty, ME	forest edge	20	106	7/12	11/2	155	1.5	Stantec Consulting Services Inc. 2007. Fall 2007 Bird and Bat Migration Survey Report: Visual, Radar and Acoustic Bat Surveys for the Rollins Wind Project. Prepared for First Wind Management, LLC.
2007	Record Hill	Roxbury, Oxford Cty, ME	forest edge	45	46	8/22	10/18	7	0.2	Stantec Consulting Services Inc. 2007. Fall 2007 Migration Report: Visual, Acoustic and Radar Surveys of Bird and Bat Migration Conducted at the Proposed Record Hill Wind Project in Roxbury, Maine. Prepared for Independence Wind, LLC.
2007	Record Hill	Roxbury, Oxford Cty, ME	forest edge	20	58	8/22	10/18	93	1.6	Stantec Consulting Services Inc. 2007. Fall 2007 Migration Report: Visual, Acoustic and Radar Surveys of Bird and Bat Migration Conducted at the Proposed Record Hill Wind Project in Roxbury, Maine. Prepared for Independence Wind, LLC.
2007	Record Hill	Roxbury, Oxford Cty, ME	forest edge	45	59	8/22	10/19	18	0.4	Stantec Consulting Services Inc. 2007. Fall 2007 Migration Report: Visual, Acoustic and Radar Surveys of Bird and Bat Migration Conducted at the Proposed Record Hill Wind Project in Roxbury, Maine. Prepared for Independence Wind, LLC.
2007	Record Hill	Roxbury, Oxford Cty, ME	forest edge	20	59	8/22	10/19	252	5.1	Stantec Consulting Services Inc. 2007. Fall 2007 Migration Report: Visual, Acoustic and Radar Surveys of Bird and Bat Migration Conducted at the Proposed Record Hill Wind Project in Roxbury, Maine. Prepared for Independence Wind, LLC.
2008	New Creek	New Creek, Grant Cty, WV	forest edge	40	64	8/15	10/17	34	9.1	Stantec Consulting Services Inc. 2008. Spring, Summer, and Fall 2008 Bird and Bat Migration Survey Report: Visual, Radar, and Acoustic Bat Surveys for the New Creek Mountain Project. Prepared for AES New Creek, LLC
2008	New Creek	New Creek, Grant Cty, WV	forest edge	20	64	8/15	10/17	46	16.9	Stantec Consulting Services Inc. 2008. Spring, Summer, and Fall 2008 Bird and Bat Migration Survey Report: Visual, Radar, and Acoustic Bat Surveys for the New Creek Mountain Project. Prepared for AES New Creek, LLC
2008	New Creek	New Creek, Grant Cty, WV	forest edge	40	58	8/15	10/17	55	10.6	Stantec Consulting Services Inc. 2008. Spring, Summer, and Fall 2008 Bird and Bat Migration Survey Report: Visual, Radar, and Acoustic Bat Surveys for the New Creek Mountain Project. Prepared for AES New Creek, LLC
2008	New Creek	New Creek, Grant Cty, WV	forest edge	20	64	8/15	10/17	84	22.2	Stantec Consulting Services Inc. 2008. Spring, Summer, and Fall 2008 Bird and Bat Migration Survey Report: Visual, Radar, and Acoustic Bat Surveys for the New Creek Mountain Project. Prepared for AES New Creek, LLC
2008	Allegany	Allegany, Cattaraugus Cty, NY	forest edge	40	85	8/16	11/14	15	2.6	Stantec Consulting Services. 2008. Summer-Fall 2008 Acoustic Survey Report. Prepared for EverPower Wind Holdings, Inc.
2008	Allegany	Allegany, Cattaraugus Cty, NY	forest edge	20	91	8/16	11/14	55	10.4	Stantec Consulting Services. 2008. Summer-Fall 2008 Acoustic Survey Report. Prepared for EverPower Wind Holdings, Inc.
2008	Allegany	Allegany, Cattaraugus Cty, NY	forest edge	12	91	8/16	11/14	41	5.5	Stantec Consulting Services. 2008. Summer-Fall 2008 Acoustic Survey Report. Prepared for EverPower Wind Holdings, Inc.
2008	Highland	Highland, Somerset Cty, ME	forest edge	45	54	8/28	10/20	21	0.4	Stantec Consulting Services. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC.
2008	Highland	Highland, Somerset Cty, ME	forest edge	25	53	8/29	10/20	10	0.2	Stantec Consulting Services. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC.
2008	Highland	Highland, Somerset Cty, ME	forest edge	45	48	9/3	10/20	17	0.4	Stantec Consulting Services. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC.
2008	Highland	Highland, Somerset Cty, ME	forest edge	25	54	8/28	10/20	15	0.3	Stantec Consulting Services. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC.
2008	Highland	Highland, Somerset Cty, ME	forest edge	45	42	9/9	10/20	4	0.1	Stantec Consulting Services. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC.
2009	Sisk	Sisk (Kibby Expansion) Franklin Cty, ME	forest edge	20	60	8/12	10/14	3	0.5	Stantec Consulting Services. 2009. Fall 2009 Nocturnal Migration Survey Report. Prepared for TRC Engineers LLC.
2009	Sisk	Sisk (Kibby Expansion) Franklin Cty, ME	forest edge	20	62	8/13	10/13	4	0.4	Stantec Consulting Services. 2009. Fall 2009 Nocturnal Migration Survey Report. Prepared for TRC Engineers LLC.
2009	Sisk	Sisk (Kibby Expansion) Franklin Cty, ME	forest edge	45	16	9/29	10/14	0	0.0	Stantec Consulting Services. 2009. Fall 2009 Nocturnal Migration Survey Report. Prepared for TRC Engineers LLC.
2009	Groton	Groton Wind, Grafton Cty, NH	forest edge	10	41	8/22	10/17	108	3.0	Stantec Consulting Services Inc. 2009. Fall 2009 Bird and Bat Migration Survey Report for the Groton Wind Project Grafton County, New Hampshire. Prepared for Groton Wind, LLC.
2009	Groton	Groton Wind, Grafton Cty, NH	forest edge	10	63	8/21	10/22	79	1.0	Stantec Consulting Services Inc. 2009. Fall 2009 Bird and Bat Migration Survey Report for the Groton Wind Project Grafton County, New Hampshire. Prepared for Groton Wind, LLC.
2009	Groton	Groton Wind, Grafton Cty, NH	forest edge	45	72	8/11	10/21	184	3.0	Stantec Consulting Services Inc. 2009. Fall 2009 Bird and Bat Migration Survey Report for the Groton Wind Project Grafton County, New Hampshire. Prepared for Groton Wind, LLC.
2009	Groton	Groton Wind, Grafton Cty, NH	forest edge	22	70	8/13	10/21	802	11.0	Stantec Consulting Services Inc. 2009. Fall 2009 Bird and Bat Migration Survey Report for the Groton Wind Project Grafton County, New Hampshire. Prepared for Groton Wind, LLC.
2009	Groton	Groton Wind, Grafton Cty, NH	forest edge	2	39	8/13	10/20	253	6.0	Stantec Consulting Services Inc. 2009. Fall 2009 Bird and Bat Migration Survey Report for the Groton Wind Project Grafton County, New Hampshire. Prepared for Groton Wind, LLC.
2009	Groton	Groton Wind, Grafton Cty, NH	forest edge	45	71	8/13	10/22	231	3.0	Stantec Consulting Services Inc. 2009. Fall 2009 Bird and Bat Migration Survey Report for the Groton Wind Project Grafton County, New Hampshire. Prepared for Groton Wind, LLC.
2009	Groton	Groton Wind, Grafton Cty, NH	forest edge	22	70	8/13	10/21	231	3.0	Stantec Consulting Services Inc. 2009. Fall 2009 Bird and Bat Migration Survey Report for the Groton Wind Project Grafton County, New Hampshire. Prepared for Groton Wind, LLC.
2009	Groton	Groton Wind, Grafton Cty, NH	forest edge	2	40	8/18	10/21	216	5.0	Stantec Consulting Services Inc. 2009. Fall 2009 Bird and Bat Migration Survey Report for the Groton Wind Project Grafton County, New Hampshire. Prepared for Groton Wind, LLC.
2009	Wild Meadows	Wild Meadows, Grafton and Merrimack Counties, NH	forest edge	10-15	49	8/20	10/22	55	1.1	*this report*
2009	Wild Meadows	Wild Meadows, Grafton and Merrimack Counties, NH	forest edge	15	64	8/20	10/22	77	1.2	*this report*
2009	Wild Meadows	Wild Meadows, Grafton and Merrimack Counties, NH	forest edge	15	65	8/19	10/22	59	0.9	*this report*
2011	Antrim	Antrim, Hillsborough Cty,NH	forest edge	15	95	6/1	10/20	11989	126.2	Stantec Consulting Services. 2011. Summer and Fall 2011 Radar and Acoustic Bat Survey Report for the Antrim Wind Energy Project in Antrim, New Hampshire. Prepared for Antrim Wind Energy, LLC.
2011	Antrim	Antrim, Hillsborough Cty,NH	forest edge	30	127	6/1	10/20	585	4.6	Stantec Consulting Services. 2011. Summer and Fall 2011 Radar and Acoustic Bat Survey Report for the Antrim Wind Energy Project in Antrim, New Hampshire. Prepared for Antrim Wind Energy, LLC.