Exhibit 12B
Avian and Bat Migration Survey Reports

Fall 2009 Avian and Bat Surveys
for the Bowers Wind Project
in Washington County, Maine

Prepared for

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Executive Summary

During fall 2009 Stantec Consulting (Stantec) conducted field surveys of bird and bat migration activity at the proposed Bowers Wind Project in Carroll Plantation and Kossuth Township, Maine (Project). The surveys included nocturnal marine radar surveys, bat detector surveys, and raptor migration field surveys.

Radar survey

Radar surveys were conducted during 22 nights in fall 2009 (between September 8 and October 14) 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 Bowers Mountain and provided good views in all directions.

The overall passage rate for the entire fall survey period was 344 targets per kilometer per hour (t/km/hr), and nightly passage rates varied from 95 ± 14 to 844 ± 141 t/km/hr. Mean flight direction through the Project area for the season was 231± 65°. The seasonal mean flight height of targets was 315 ±7 meters (m; 1033 ft [']) above the radar site, and nightly flight heights ranged from 210 ± 21 m (672') to 453 ± 24 m (1449'). The percent of targets observed flying below 119 m (390') was 14 percent for the entire season and varied by night, from 7 to 31 percent.

Surveys were conducted simultaneous with radar surveys at Stetson, approximately eight miles north of Bowers, and documented generally similar results, although Stetson recorded higher flight heights and a lower percent of targets were observed below maximum turbine height. The flight height of targets at both projects, as well as at other sites in forested landscapes in the northeast, indicates that the majority of nocturnal migration in the area occurs well above the height of the wind turbines.

Bat detector survey

Six Anabat® acoustic bat detectors were deployed in trees throughout the Project area between early September and early November to document bat activity. 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 342 detector nights of data and a 97 percent detector success rate. During this survey period, 2374 call sequences were recorded, resulting in a detection rate of 6.9 call sequences per detector-night. Forty percent of all calls were recorded at one detector in early September.

Patterns in detection rates are similar to the results of other surveys in the region for tree detectors, including detectors deployed at Stetson during the same timeframe. Tree detectors

are deployed at relatively low heights where increased bat activity levels are generally documented, particularly during the non-migratory periods.

Raptor migration survey

Raptor migration surveys were conducted during 15 days in fall 2009 (September 9 and October 14) to document diurnal migration activity in the Project area. Visual observation surveys were conducted from 9 am to 4 pm from a prominent location in the Project area.

A total of 105 survey hours were conducted and a total of 95 raptors, representing nine species were observed. Turkey vulture (*Cathartes aura*) and sharp-shinned hawk (*Accipiter striatus*) represent the most commonly observed species. Daily counts ranged from 2 to 21 raptors and the overall passage rate was 0.90 birds/hour. Of raptors observed, 94 percent were observed in areas where turbines will be located. Seventy-five percent of observations of raptors within the Project area were documented at heights less than 119 m for at least a portion of their flight through the turbine areas.

Two state species of special concern were observed, including one northern harrier (*Circus cyaneus*) and six bald eagles (*Haliaeetus leucocephalus*), two of which were observed migrating within the Project area.

Patterns in flight characteristics are similar to the results of other surveys in the region, including surveys conducted at Stetson during the same timeframe.

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1.0 Introduction

1.1 PROJECT BACKGROUND

The Bowers Wind Project (Project) in Carroll Plantation and Kossuth Township, Maine (Figure 1-1, Photos 1-1 to 1-4) as proposed is expected to consist of up to 27 turbines. Multiple turbine types are being evaluated and the maximum turbine height would be 131 m (429'). As part of project development, pre-construction avian and bat monitoring was conducted by Stantec Consulting Services Inc. (Stantec), on behalf of Champlain Energy, LLC (Champlain) during fall 2009. The work scope for fall 2009 was developed in July and August 2009 in cooperation with the Maine Department of Inland Fisheries and Wildlife (MDIFW) and United States Fish and Wildlife Service (USFWS).

Stantec conducted field surveys for bird and bat migration during fall 2009. 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;
- species composition and detection rate of bats within the Project area, including the relationship between activity levels and weather factors; and
- species composition, passage rate, flight paths, and flight heights of raptors observed, as well as the passage of any rare, threatened, or endangered species.

Surveys were designed to be conducted simultaneous with similar surveys conducted at the operational Stetson Wind Project (Stetson) which is located eight miles north of Bowers. Throughout this report, results of surveys at Bowers are compared with results of surveys at Stetson.

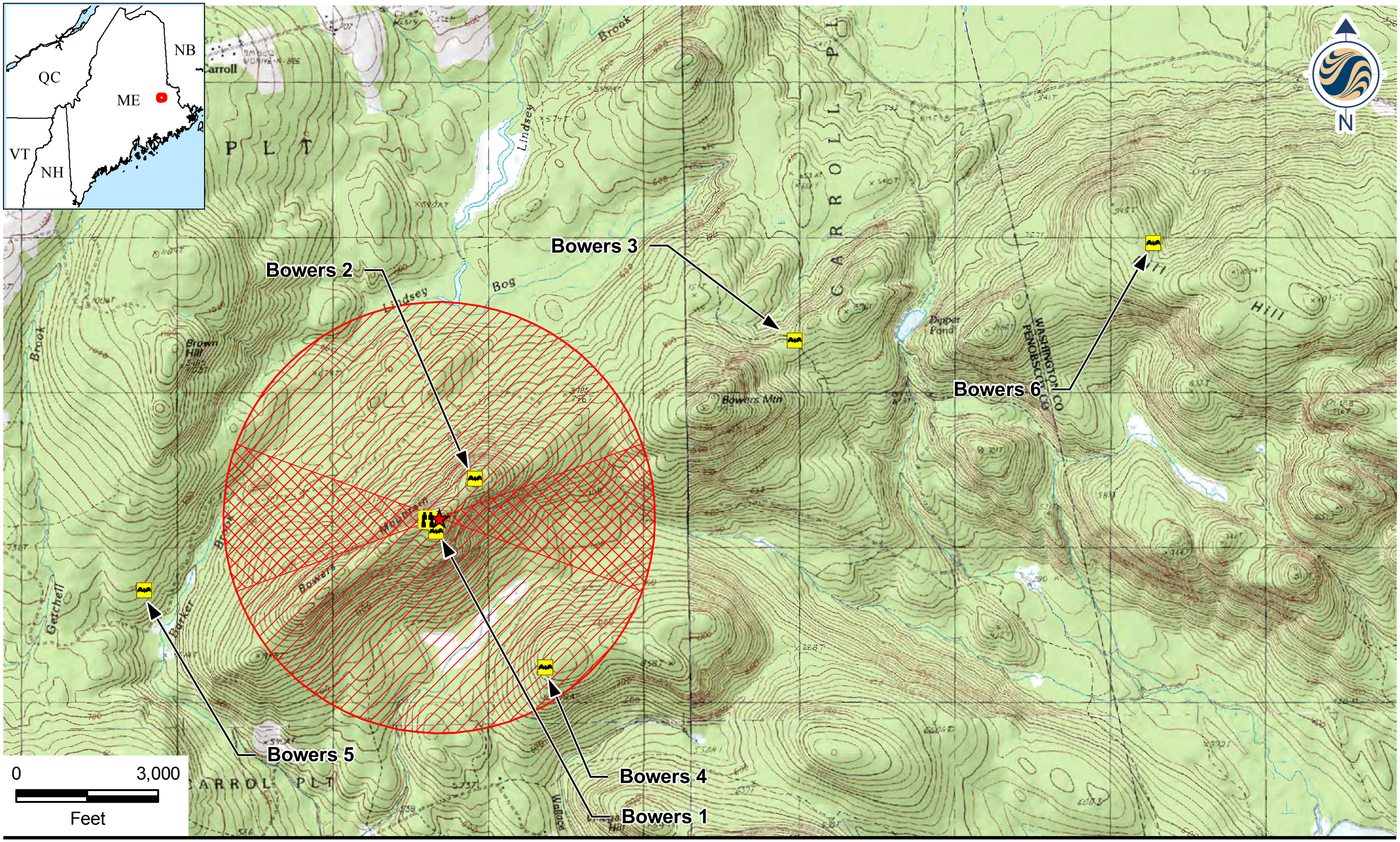
1.2 PROJECT AREA DESCRIPTION

The Project consists of a series of six low elevation ridgelines within the Project area. These ridgelines range in elevation from 750 to 1120 feet above sea level and consist of moderately steep to gentle sloping sides. There is limited access to each of the proposed turbine strings, primarily unimproved logging roads. Most of the Project area has been harvested over the last 10-15 years. The Project is located approximately 8 miles south of Stetson and approximately 15 miles east of the proposed Rollins Wind Project. The Project area is owned primarily by three landowners.

The Project area is primarily dominated by a regenerating Beech-Birch-Maple forest. The entire Project area has been heavily logged in the past. Dominant canopy species include sugar maple (*Acer saccharum*), gray birch (*Betula populifolia*), yellow birch (*Betula alleghaniensis*), and green ash (*Fraxinus pennsylvanica*), with occasional white pine (*Pinus strobus*) scattered throughout. Common shrub species include the aforementioned tree species, along with American beech (*Fagus grandifolia*), striped maple (*Acer pensylvanicum*), hobblebush (*Viburnum lantanoides*), and red raspberry (*Rubus idaeus*). Dominant herbaceous species include wild sarsaparilla (*Aralia nudicaulis*), evergreen wood fern (*Dryopteris intermedia*), and starflower (*Trientalis borealis*). Areas of timber harvesting disturbance were largely dominated by herbaceous and shrub species, including red raspberry, Canada goldenrod (*Solidago canadensis*), and fireweed (*Epilobium angustifolium*).

The Project area is not located within listed Critical Habitat for any federally-listed threatened or endangered species, including Atlantic salmon and Canada lynx. The unofficial agency response to Stantec's letter requesting information from MDIFW identified two mapped Inland Wading Bird and Waterfowl Habitat (IWWH) within the general Project area between turbine strings. There are no known eagle nests within four miles of any turbine[2].

[2] Based on Bald Eagle Nest Survey memo from Stantec, November 30, 2009.



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Legend

- Bat Detectors
- Raptor Location
- Radar Location
- Alignment Vertical Radar Sweep
- Horizontal Radar Detection Range

Client/Project
Bowers Wind Project
Carroll Plt, Maine

Figure No.
1-1

Title
Avian/Bat Survey Locations
January 8, 2010

Photo 1-1 - View to south from radar and raptor location

Photo 1-2 - View to north towards Stetson Wind Project from radar and raptor location

Photo 1-3 - View to west from radar and raptor location

Photo 1-4 - View to east from radar and raptor location

2.0 Nocturnal Radar Survey

2.1 INTRODUCTION

Radar surveys were conducted in the Project area to characterize nocturnal migration patterns during fall 2009. The majority of North American passerines (songbirds) migrate at night and the strategy of migrating at night may have evolved to take advantage of more stable atmospheric conditions for their flapping flight (Kerlinger 1995). Additionally, migration during night, with cooler nighttime temperatures, may provide a more efficient medium to regulate body temperature during more active, flapping flight and reduce predation risk while in flight (Alerstam 1990, Kerlinger 1995). Documenting the patterns of nocturnal migrants requires the use of radar or other non-visual technologies. The goal of the survey 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. Specific methods for this survey were developed in coordination with Champlain, MDIFW and USFWS.

Radar surveys were conducted from sunset to sunrise on 22 nights between September 08, 2009 and October 14, 2009. The radar was located on the summit of Bowers Mountain at an elevation of 355 meters ([m], 1165 feet [']) (Figure 1-1). Surveys included 18 nights of simultaneous operation with radar surveys at Stetson, approximately eight miles north of Bowers Mountain. Efforts were made to maximize the airspace sampled by elevating the antenna to approximately 5.5 m (18') thus reducing the amount of the radar beam reflected back by surrounding vegetation that can cause ground clutter obstructions on the radar screen. Deployment in this fashion allowed the radar to have an unobstructed view of the surrounding airspace within the radar's range settings. The adjacent ridgelines to the northeast and the ridge to the southeast of the radar location caused relatively little ground clutter interference, although vegetation in the immediate location of the radar may have obstructed the lower ten degrees of the radar beam during leaf-on season. Considering that nocturnal migration has been documented to occur in a broad front movement at most all radar studies conducted in the northeast it is expected that the radar data collected from Bowers Mountain provided a good view of the airspace in most directions.

2.2 DATA COLLECTION METHODS

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 which captures past echoes of flight trails, enabling determination of flight direction. 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 birds and bats flying over those areas (Figure 2-1).

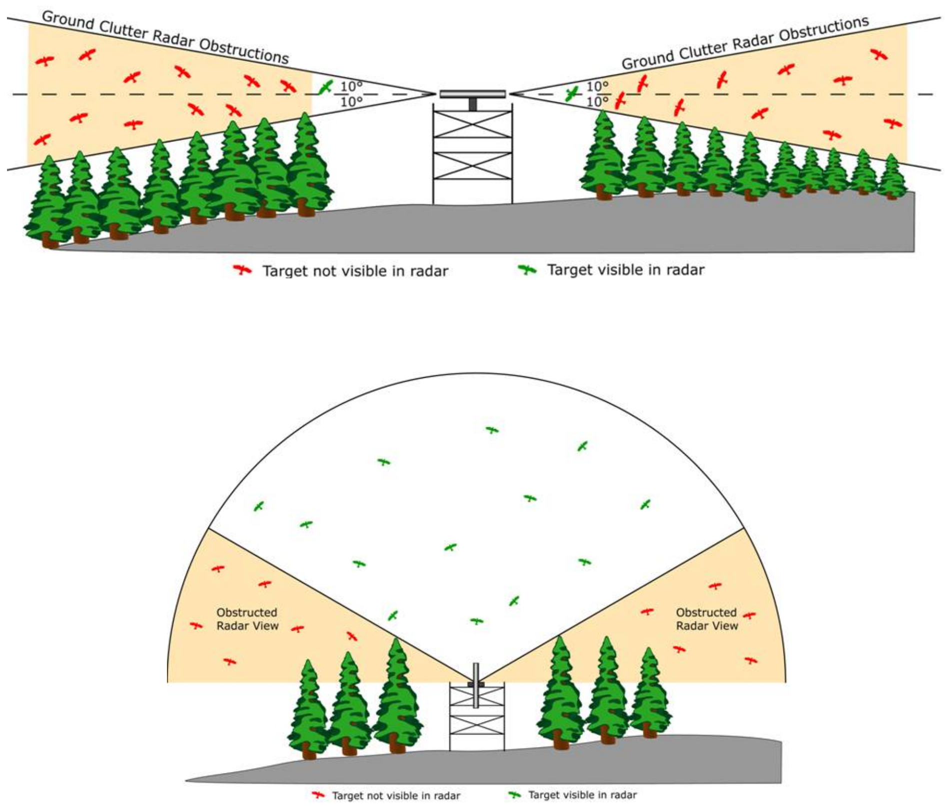

Figure 2-1. An example of ground clutter causing objects in horizontal mode (top) and vertical mode (bottom). Although the radar records three-dimensional space, it is translated by the radar screen into a two dimensional representation, which can cause targets to be obscured from view.

However, 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 – targets are indistinguishable from the "clutter" as represented on the radar screen (Figure 2-2). However, 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.

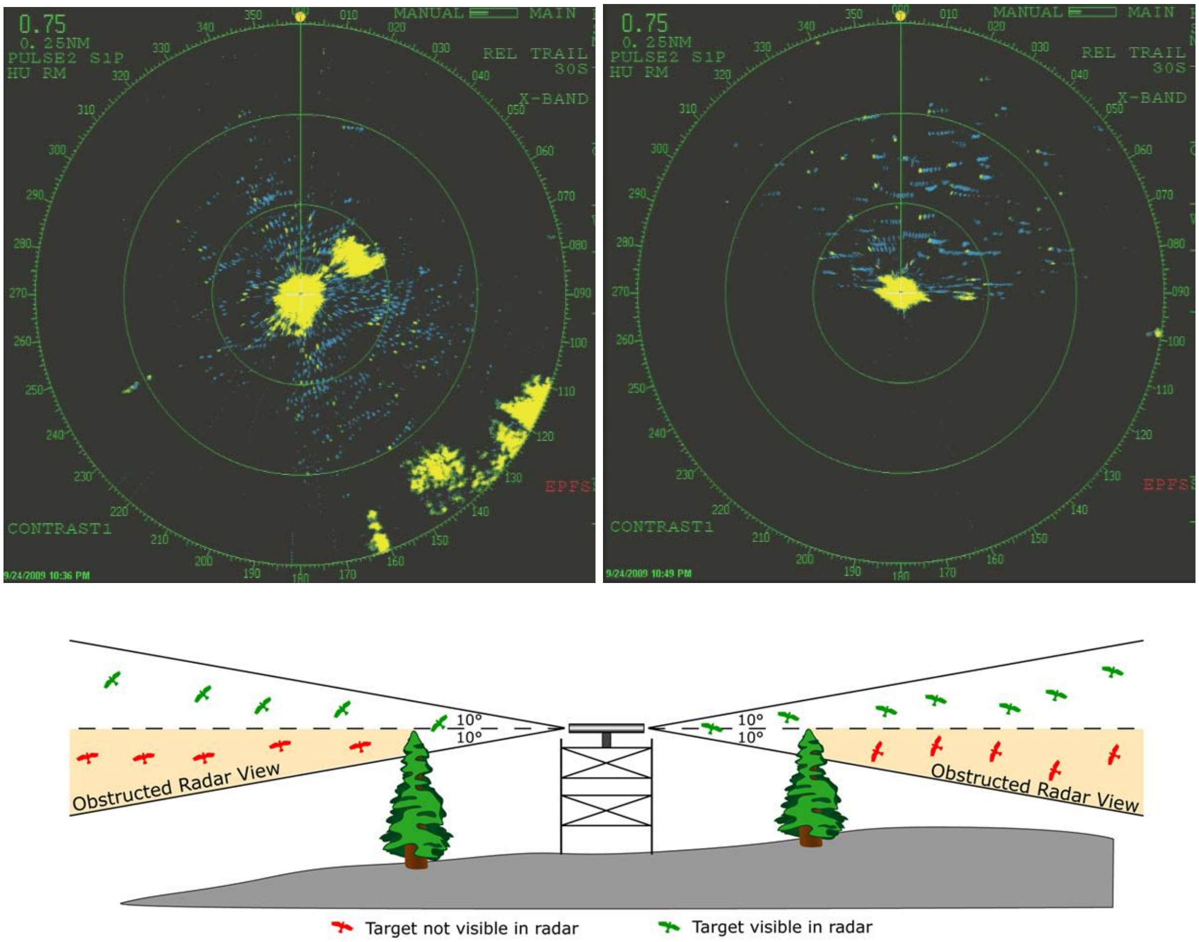

Figure 2-2. Proper site selection can reduce ground clutter to the center of the radar screen (bottom), so that the majority of the two-dimensional radar screen remains relatively uncluttered, allowing targets to be tracked as they both enter and leave the cluttered area (top; horizontal screenshot is on the left and vertical is on the right).

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 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 as they pass through the Project Site (Figure 2-2). By analyzing the echo trail, the flight direction and flight speed of targets can be determined.

In vertical mode, the radar unit is tilted 90º 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 2-3). Both modes of operation were used during each hour of sampling.

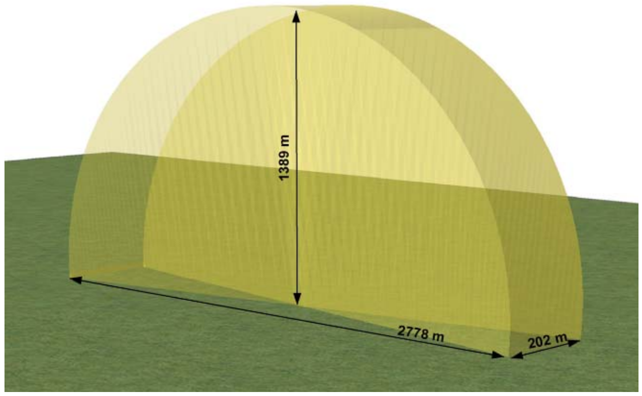

Figure 2-3. Detection Range of the radar in vertical mode

The radar was operated at a range of 1.4 kilometers ([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 birds 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; consequently, 1.4 km is the appropriate detection range for this type of study.

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 during data analysis and prevented double-counting of targets due to the 30-second echo trail used to determine the flight path vector.

2.3 DATA ANALYSIS METHODS

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/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 outputs the data to a spreadsheet. These datasets were then 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), because they 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 119 m (390'), the approximate maximum height of the proposed wind turbines with blades, was also calculated hourly, for each night, and for the entire survey period.

When possible, radar surveys at Bowers were conducted simultaneous with radar surveys at Stetson, approximately eight miles north, and results were compared between the proposed Bowers site and the operational Stetson site. Also provided for comparison are the results of available radar surveys conducted at other proposed wind facilities located in the east.

Wind speed, temperature, and wind direction were collected in 10-minute intervals by a meteorological tower located at the north end of the Stetson Project, near turbine 30. Data was summarized to derive nightly means. Data was used to assess relationship between bat activity levels, wind speed, and temperature. This information was used during data analysis to help characterize any patterns in migration activity for particular nights and for the season overall (Appendix A, Table 1).

2.4 RESULTS

Radar surveys were conducted during 22 nights from September 8 to October 14, 2009. The radar antenna was located approximately 5.5 m (18') off the ground at canopy height. Visibility of the surrounding airspace was good in all directions with some leaf interference in the direct vicinity of the radar, particularly to the south and west.

2.4.1 Passage Rates

The overall passage rate for the entire survey period was 344 ± 17 targets per kilometer per hour (t/km/hr). Nightly passage rates varied from 95 ± 14 t/km/hr on October 11, 2009 to 844 ± 141 t/km/h on September 24, 2009 (Figure 2-4; Appendix A, Table 1). Individual hourly passage rates varied greatly during the sampling period, ranging from a minimum of 0 t/km/hr during the twelfth hour after sunset on September 16, 2009 and the thirteenth hour on October 1 and 12, 2009 to a maximum of 1307 t/km/hr during the third hour on September 24, 2009 (Appendix A, Table 2). For the entire season, passage rates were typically highest three to five hours after sunset, then declined steadily until sunrise (Figure 2-5).

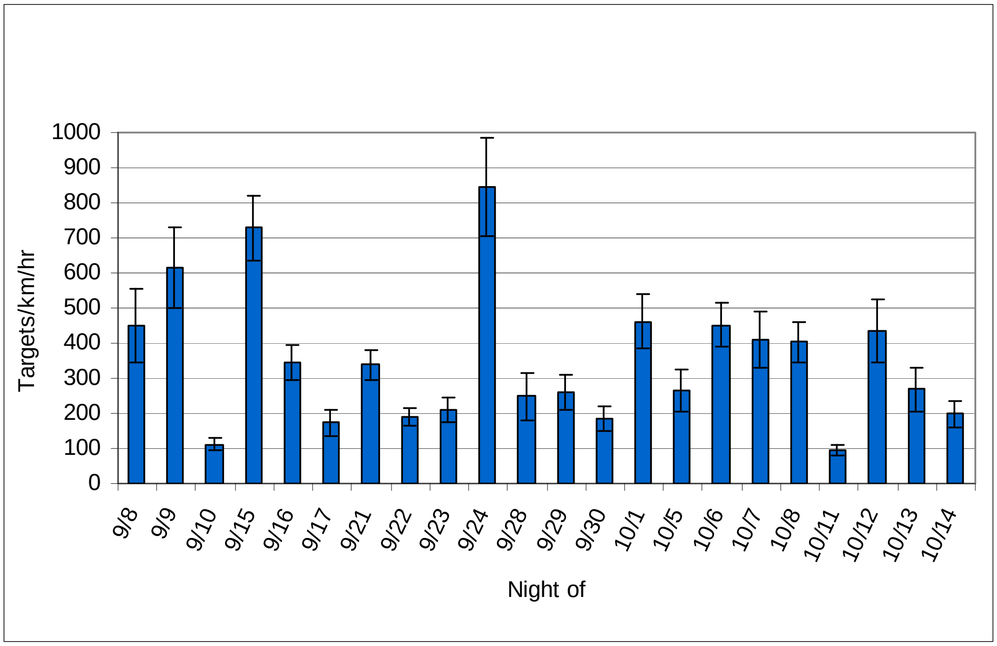

Figure 2-4. Nightly passage rates observed (error bars ± 1 SE) for Bowers, Fall 2009.

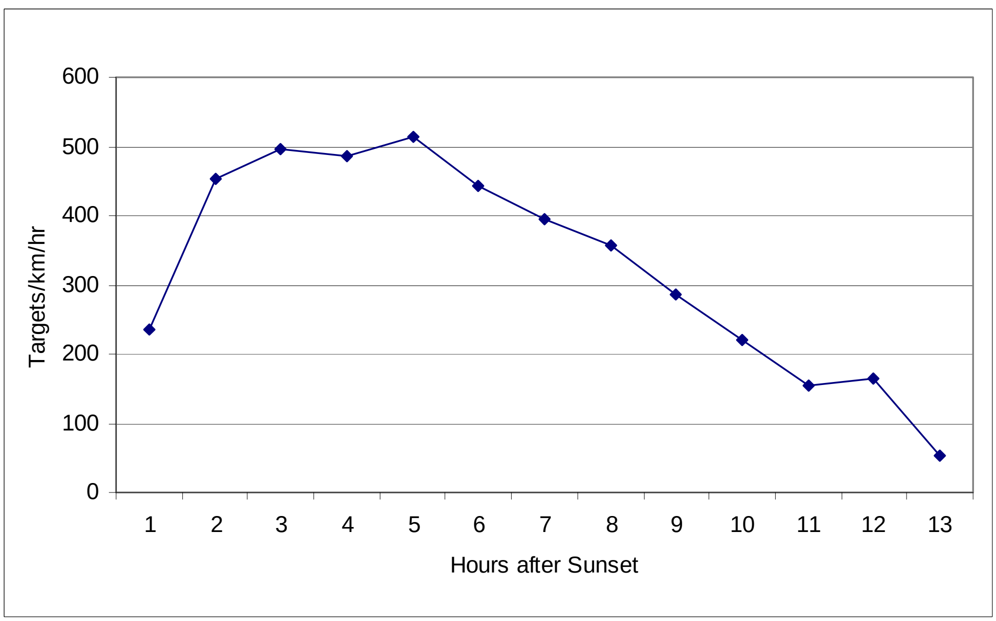

Figure 2-5. Hourly passage rates for entire season for Bowers, Fall 2009.

2.4.2 Flight Direction

Mean flight direction through the Project area was 231˚ ± 65˚ (Figure 2-6). Overall, the mean flight direction was to the southwest which is typical for fall migration. Although four nights (September 10, 17, 21 and 22, 2009) had nightly mean flight directions to the northeast. (Appendix A, Table 3).

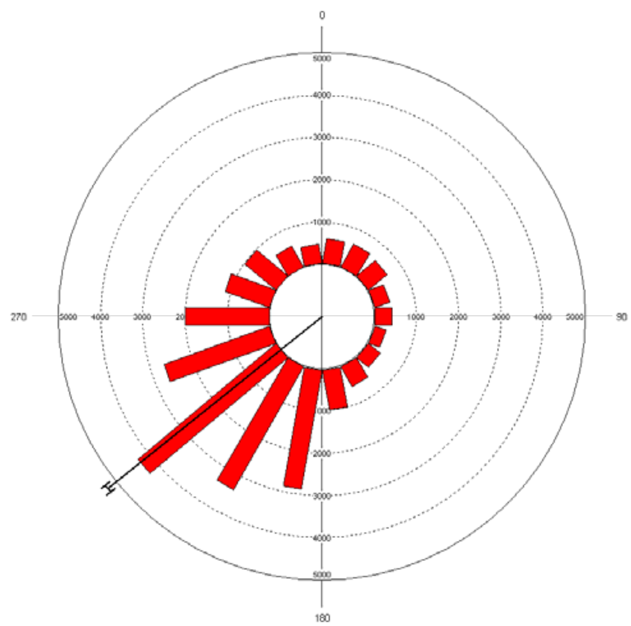

Figure 2-6. Mean flight direction for the entire season (the bracket along the margin of the histogram is the 95% confidence interval)

2.4.3 Flight Altitude

The seasonal average mean flight height of all targets was 315 m ± 7 m (1033‘ ± 23’) above the radar site. The average nightly flight height ranged from 210 m ± 21 m on September 10, 2009 to 453 m ± 24 m on October 8, 2009 (Figure 2-7; Appendix A, Table 4). The percent of targets observed flying below 119 m was 14 percent for the season and varied nightly from 7 percent on October 8, 2009 to 31 percent on October 11, 2009 (Figure 2-8). For the entire season, the mean hourly flight heights were typically highest from the second to seventh hour after sunset (Figure 2-9).

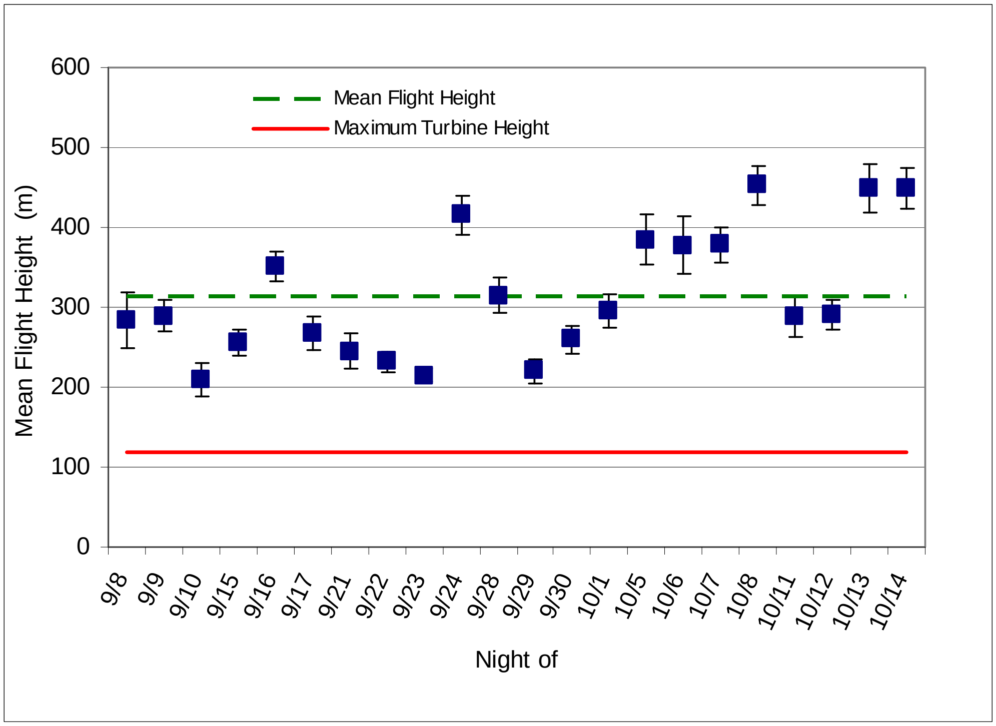

Figure 2-7. Mean nightly flight height of targets (error bars ± 1 SE)

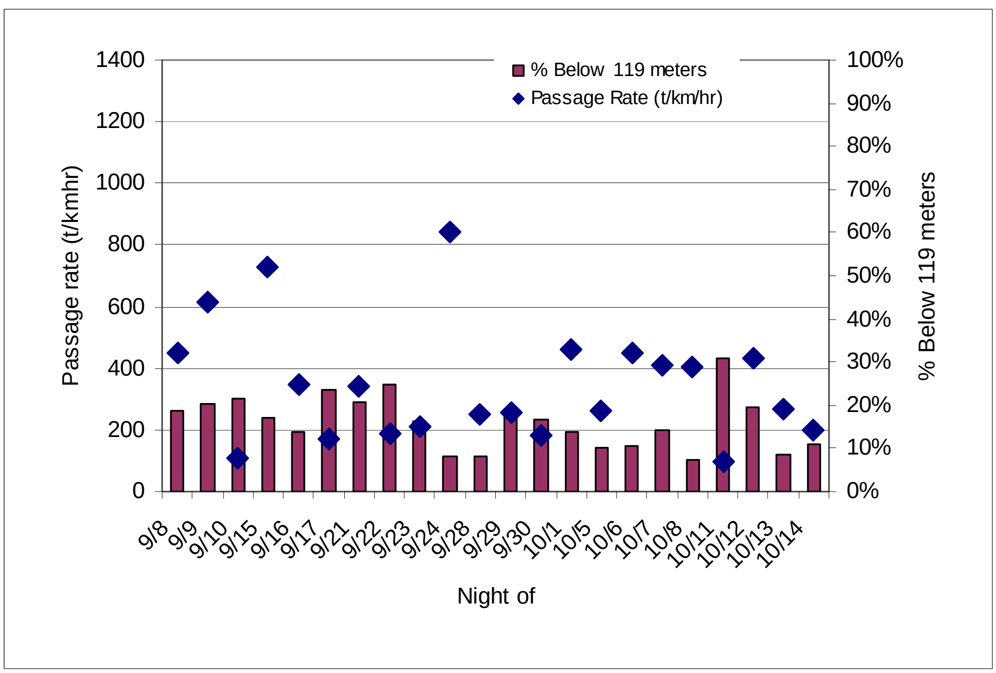

Figure 2-8. Percent of targets observed flying below a height of 119 m (390')

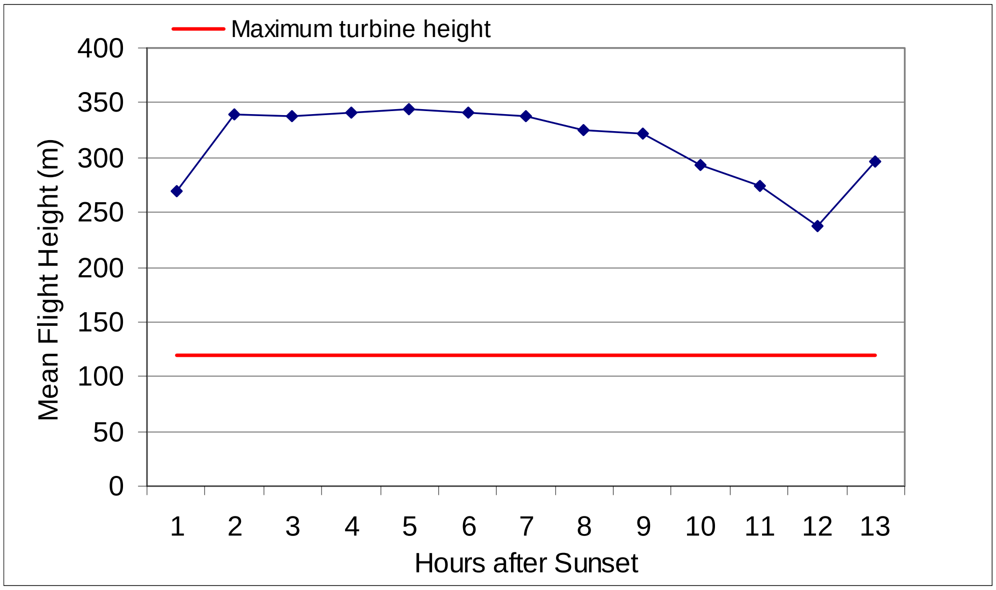

Figure 2-9. Hourly target flight height distribution

2.4.4 Weather Data

Mean nightly wind speeds in the vicinity of the Project area from September 8, 2009 to October 14, 2009 varied between 2.95 and 9.17 meters per second (m/s), with an overall mean of 6.13 m/s (Figure 2-10). Mean nightly temperatures varied between -0.8 °C and 18.1 °C, with an overall mean of 8.7 °C (Figure 2-11).

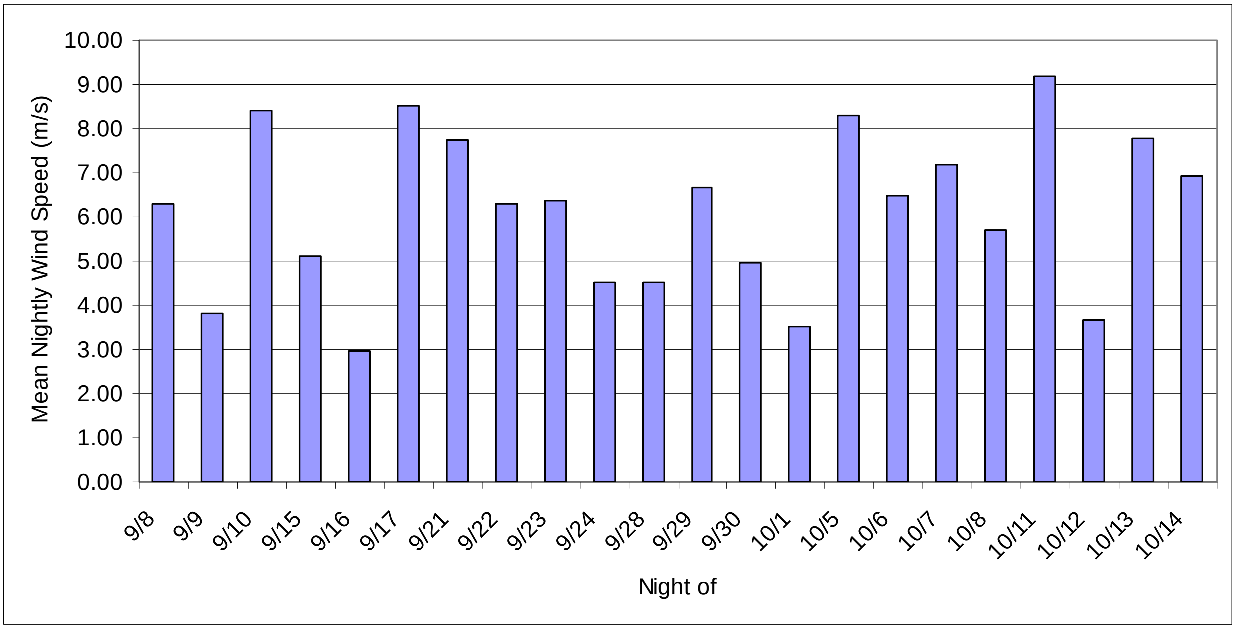

Figure 2-10. Nightly mean wind speed (m/s) for Bowers, Fall 2009.

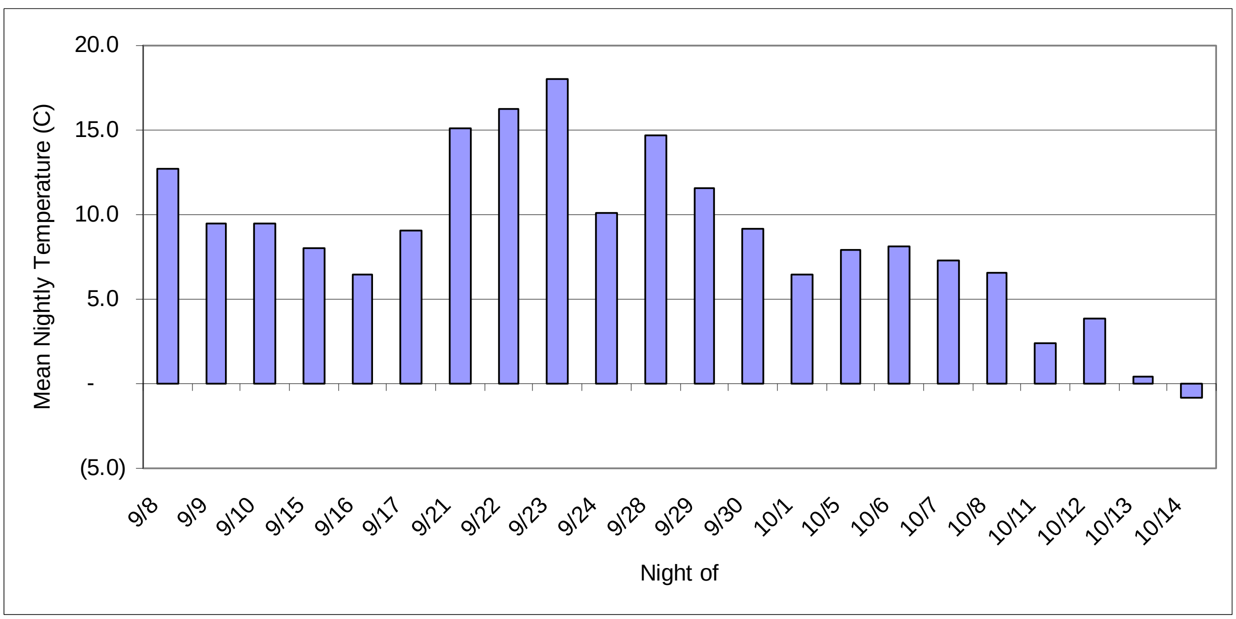

Figure 2-11. Nightly mean temperature (Celsius) for Bowers, Fall 2009.

2.5 DISCUSSION

The results of this field survey provide useful information about site-specific migration activity and patterns in the Project area, especially when the results are compared with other surveys conducted near the Project, as well as other previous studies conducted in the vicinity and in the region. Currently, there is no reliable way to distinguish birds from bats during radar data analysis, so results refer only to “targets.” Given that the number of potential bird species migrating across the Project area far outweighs the number of species of bats known to occur in Maine, it is likely that the pool of observed targets is composed of a higher percentage of birds than bats. Therefore, results are discussed here primarily in the context of bird migration.

Passage rates varied greatly between nights throughout the survey period (September 8 to October 14) indicating migration occurred in pulses, with rates of migration likely influenced by weather patterns and conditions from night to night. Passage rates during fall 2009 surveys at Bowers are within the middle range of publicly available mean passage rates for projects on forested ridges in the northeast (ranging from 91 to 620 t/km/hr, Appendix A, Table 5). Flight direction was typically to the southwest, typical of fall migration; although four nights had flight directions to the northeast, these nights also had wind direction from the northwest and wind speeds higher than 6.3 m/s, which may have contributed to the varied direction on these nights.

Flight heights remained fairly consistent throughout the survey period, with most mean hourly flight heights documented 400 m (1312’) above the radar location. During the survey period, fewer than 83 hours had mean hourly flight heights less than 250 m above the radar location and only 4 hourly flight heights were less than 120 m above the radar location. Flight height and flight direction observed during 2009 surveys at Bowers are comparable to most publicly available mean flight heights for projects on forested ridges in the northeast, (566 to 309 m, Appendix A, Table 5).

On 18 nights, radar surveys at Bowers were conducted simultaneous with radar surveys at Stetson, approximately eight miles north. Overall, the results of Bowers fall 2009 survey were similar to pre- and post-construction results from Stetson conducted in the fall of 2006 and 2009 (Table 2-1).

Table 2-1. Comparison of fall radar survey results between Bowers and Stetson

Survey Type (year)	Passage Rate (t/km/hr)		Flight height (m)		Percent below Turbine Height[1]		Direction (º)
	Range	Mean	Range	Mean	Range	Mean	Mean
Stetson Pre-construction (2006)	131-1192	476	219-506	378	6-34	13	227
Stetson Post-construction (2009)	106-1745	457	328-514	420	0-9	2	227
Bowers Pre-Construction (2009)	95-844	344	210-458	315	8-31	14	231

[1] Pre-construction surveys in 2006 used a proposed maximum turbine height of 125 m (410'). Post-construction surveys in 2009 used the actual maximum turbine height of 119 m (390').

Passage rates were lower at Bowers than at Stetson during the same timeframe in 2009 and also lower than pre-construction surveys in 2006. Flight heights were lower at Bowers than at Stetson during 2009 but similar to the flight heights in 2006. Flight direction was similar between the two sites. The percentage of birds observed below turbine height was comparable between the two sites during pre-construction surveys (14 and 13%, respectively), although. the percentage of birds flying below turbine height at Stetson during post-construction surveys was much lower (2%).

In addition to results from Stetson, data from other pre-construction surveys in the region using similar methods and equipment conducted within the last several years are rapidly becoming available. There are limitations in comparing data from previous years with data from 2009, as year-to-year variation in continental bird populations may influence how many birds migrate through an area. Additionally, differences in site characteristics, particularly the topography, local landscape conditions, and vegetation surrounding a radar survey location, can play a large role in any radar's ability to detect targets and the subsequent calculation of passage rate. These differences should be recognized as one of the more significant limiting factors in making direct site-to-site comparisons in passage rates. In comparison, there is a relatively consistent pattern in flight altitude, with most birds appearing to fly at altitudes of 300 to 600 meters or more above the ground and the percentage of targets documented at heights below the maximum turbine height is variable, but is usually 10 to 20 percent. Regardless of potential differences between radar survey locations and landscape changes between survey years, comparison of the fall 2009 surveys at Bowers with the pre- and post-construction surveys at Stetson, as well as other regional pre-construction surveys, indicate that the results may be considered typical for forested ridges in the northeast.

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). Acoustic surveys were associated with several major assumptions (Hayes 2000) and results cannot be used to determine the number of bats inhabiting an area or determine the number of bats which may be killed post-construction. However, 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, the current lack of data on this topic precludes quantitative prediction of risk. The goal of this survey was to characterize bat activity patterns in the Project area from September to October and to document bat activity patterns in relation to weather factors including wind speed, temperature, and relative humidity. Specific methods for this survey were developed in coordination with Champlain, MDIFW and USFWS.

Eight species of bats occur in Maine, 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*), big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), and hoary bat (*L. cinereus*) (Whitaker and Hamilton 1998). Four of these are listed as species of special concern in Maine, including eastern small-footed bat, silver-haired bat, eastern red bat, and hoary bat.

3.2 DATA COLLECTION METHODS

Anabat II and Anabat SDI detectors (Titley Electronics Pty Ltd.) were used for the duration of the fall, 2009 acoustic bat survey. Anabat detectors were selected based upon 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. Anabat II detectors were coupled with CF Storage ZCAIM (Titley Electronics Pty Ltd.), which programmed the on/off times and stored data on removable 1 GB compact flash cards; newer SD1 model detectors do not require use of a ZCAIM. Anabat detectors are frequency division detectors, dividing the frequency of echolocation sounds made by bats by a factor of 16, 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 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 or a PVC elbow is used to direct sound toward the microphone. This procedure allows the microphone to record the airspace horizontally surrounding the detector and is only slightly less sensitive than an unmodified Anabat unit.

The survey design included a total of 6 acoustic detectors that were deployed to operate nightly from 7:00 pm to 7:00 am from September 4 to November 4. Because meteorological towers were not available at the time of deployment, detectors were placed in trees at heights between five and ten meters, spaced throughout the project area (Photos 1-6;). 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 Bowers 1 detector was suspended at a height of approximately seven meters in a sugar maple about 30 meters south of the radar site. The detector was located on the edge of a clearing along a regenerating skid road which follows the spine of the ridge on the south side of the summit of Bowers Mountain. Surrounding vegetation includes northern hardwoods and *Rubus* brambles. Elevation is approximately 1,152'.

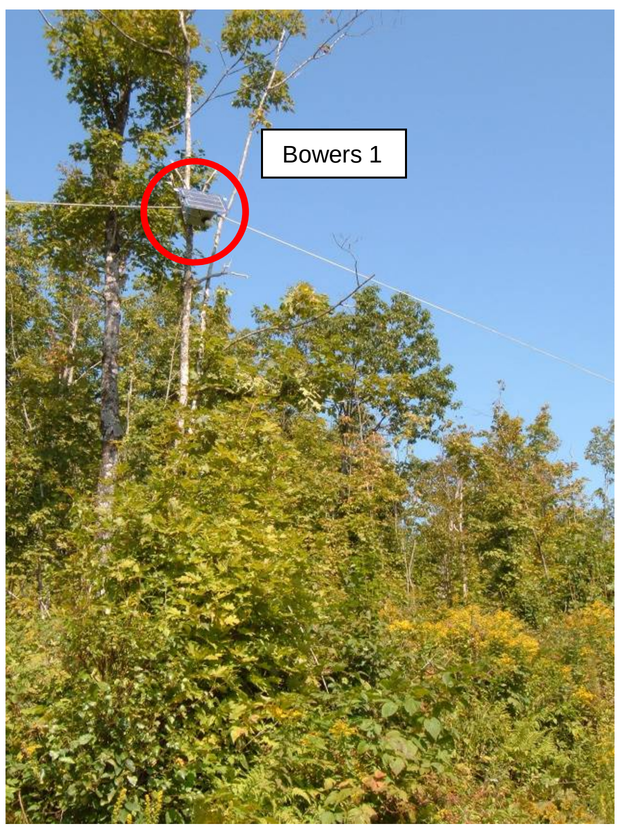

Photo 3-1: Bowers 1 detector

The Bowers 2 detector was suspended at a height of approximately ten meters in a canopy red spruce at the northeastern end of Bowers Mountain ridge. The spruce is located at the edge of a meteorological tower opening, adjacent to a steep slope and outcroppings of exposed ledge. Surrounding vegetation is mixed northern hardwood and conifer. Elevation is approximately 1,132'.

Photo 3-2: Bowers 2 detector

The Bowers 3 detector was suspended from a sugar maple at a height of approximately five meters along a grass road 2.3 km northeast of the Bowers 2 detector. The detector was located at the edge of a meteorological tower opening. Vegetation includes sapling size to mature northern hardwoods with an extensive red spruce plantation 400 m to the north. Elevation is approximately 760'.

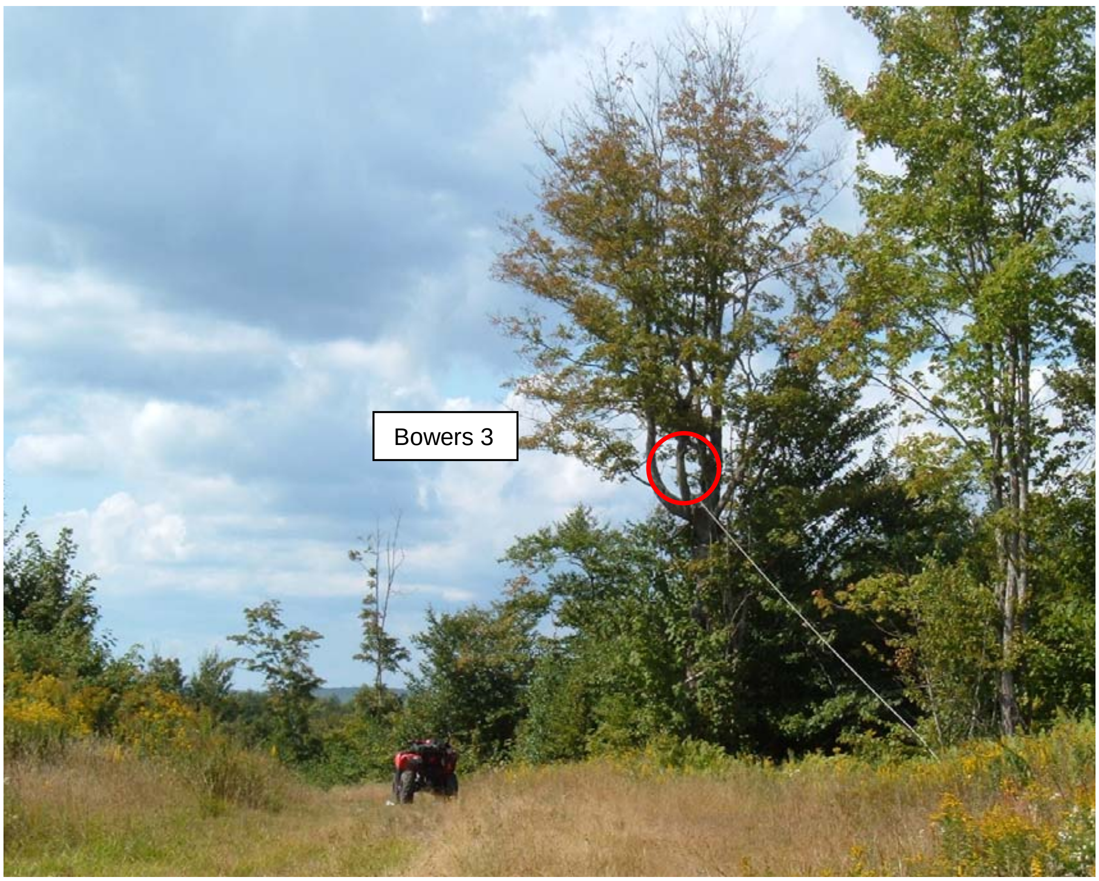

Photo 3-3: Bowers 3 detector

The Bowers 4 detector was suspended at a height of approximately eight meters in a sugar maple next to a small opening on the west end of the ridge approximately 1000 m southeast of Bowers Mountain. Vegetation includes regenerating northern hardwoods with some mature hemlock. Elevation is approximately 844'.

Photo 3-4: Bowers 4 detector

The Bowers 5 detector was suspended at a height of approximately five meters in an Eastern hop-hornbeam (*Ostrya virginiana*). The detector was located next to a human-disturbed meadow approximately 2000 m west of the Bowers Mountain summit. Elevation is approximately 750'.

Photo 3-5: Bowers 5 detector

The Bowers 6 detector was suspended at a height of approximately ten meters in a pine snag along a forest road on Dill Hill. The road is surrounded with sapling to pole-size mixed northern hardwoods and regenerating white pine. Elevation is approximately 905'.

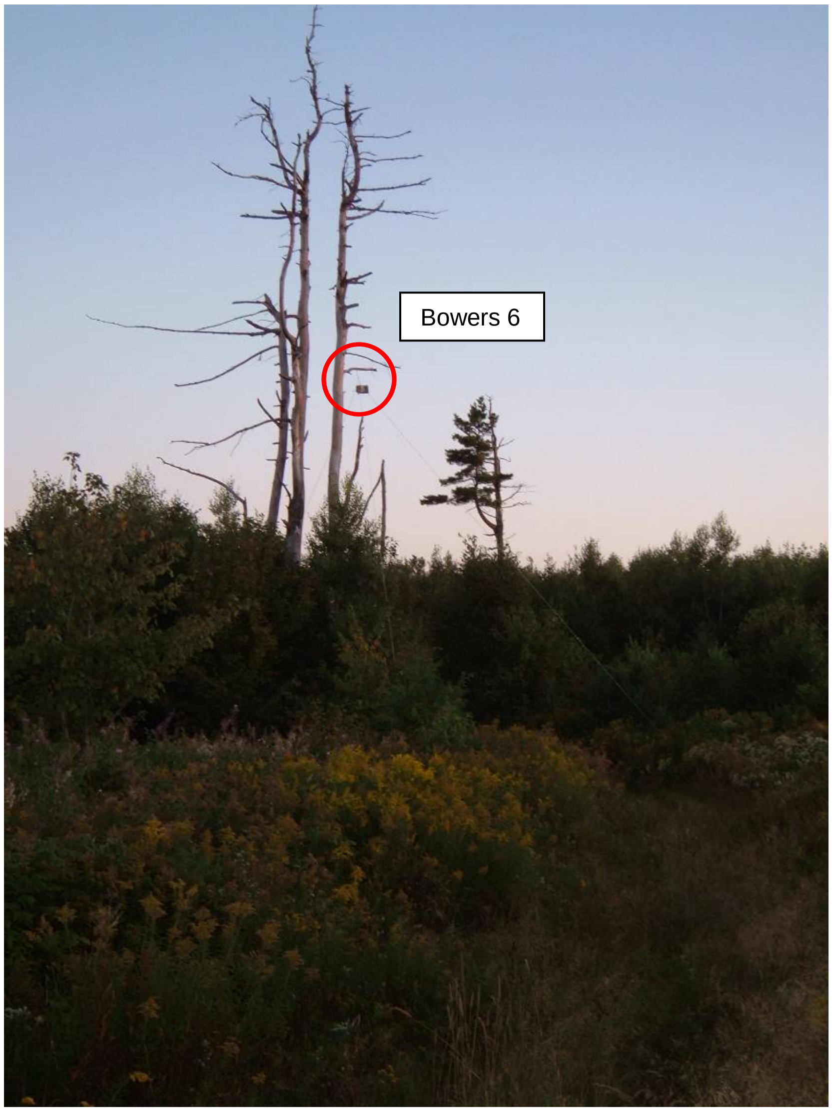

Photo 3-6: Bowers 6 detector

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 northeastern 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 screen 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 can also sometimes 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 was not attempted because the high amount of variability associated with bat detection would required 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 recorded call sequences of sufficient length to reference libraries of bat calls allows 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. However, due to similarity of call signatures between several species, all classified calls have been categorized into five guilds[3] reflecting the bat community in the region of the Project area and is as follows:

- **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.

- **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[4] (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 can also occur.

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

- **Hoary bat (HB)** – Hoary bats. Calls of hoary bats can usually 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.

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 the body of this report will reflect those guilds. However, 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.

Bat detector surveys at Bowers were conducted simultaneous with bat detector surveys at Stetson, approximately eight miles north, and results were compared between the proposed Bowers site and the operational Stetson site. Also provided for comparison are the results of

[3] Gannon *et al.* 2003 categorized bats into guilds based upon similar minimum frequency and call shape. These guilds were: Unidentified, Myotis, LABO-PISU and EPFU-LANO-LACI. We broke hoary bats out into a separate guild due to the importance of reporting activity patterns of migratory species in the context of wind energy development.
[4] The scientific and common name of the eastern pipistrelle (*Pipistrellus subflavus*) has been changed to the tri-colored bat (*Perimyotis subflavus*).

available bat detector surveys conducted at other proposed wind facilities located in similar forested ridges in the east.

Because meteorological towers were not yet installed at Bowers, weather data from Stetson was used for this survey. Wind speed, temperature, and barometric pressure were collected in 10-minute intervals by a meteorological tower located at the north end of the Stetson Project, near turbine 30. Data was summarized to derive nightly means for the period between 19:00 and 07:00 for each night. Data was used to assess relationship between bat activity levels, wind speed, and temperature.

3.4 RESULTS

3.4.1 Timing of Activity

Detectors were deployed on September 4, 2009 and continued to record data through November 4, 2009 for a total survey period of 342 detector nights. The range of dates that each detector was deployed is summarized in Table 3-1. Two of the detectors were removed on October 27 due to met tower installation. Four detectors remained in the field until November 4, although no bat calls were recorded after the night of October 20. Occasional equipment malfunctions caused missed detector-nights resulting in an overall success rate of 97%. Data for all detectors are tabulated in Appendix B, Tables 1-8.

Table 3-1. Summary of bat detector field survey effort and results at Bowers, Fall 2009.

Location	Dates Deployed	Calendar Nights	Detector-Nights*	Recorded Sequences	Detection Rate **	Maximum Sequences recorded ***
Bowers 1	Sept 4 - Nov 4	62	62	22	0.4	6
Bowers 2	Sept 4 - Oct 25	52	47	1705	36.3	932
Bowers 3	Sept 4 - Oct 27	54	54	291	5.4	31
Bowers 4	Sept 4 - Nov 4	62	55	14	0.3	3
Bowers 5	Sept 4 - Nov 4	62	62	318	5.1	152
Bowers 6	Sept 4 - Nov 4	62	62	24	0.4	6
Overall Results		***354***	***342***	***2374***	***6.9***	--

* 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 detection rate for the fall season was 6.9 call sequences per detector night. Individual detection rates varied by detector and from month to month. Bowers 2 had the highest overall activity rate of 36.3 call sequences per detector night and recorded 72 percent of all calls recorded during the fall survey period. Bowers 4 recorded the lowest detection rate of 0.3 call sequences per detector night (Table 3-1).

Nightly detection rates varied from detector to detector and throughout the survey period. In general, detection rates peaked in September then declined to no activity in the last week of October (Figure 3-1). During the first night of recording, September 4, the Bowers 2 detector recorded 40 percent of all bat call sequences and resulted in the highest nightly detection rate for an individual detector (932 bat call sequences).

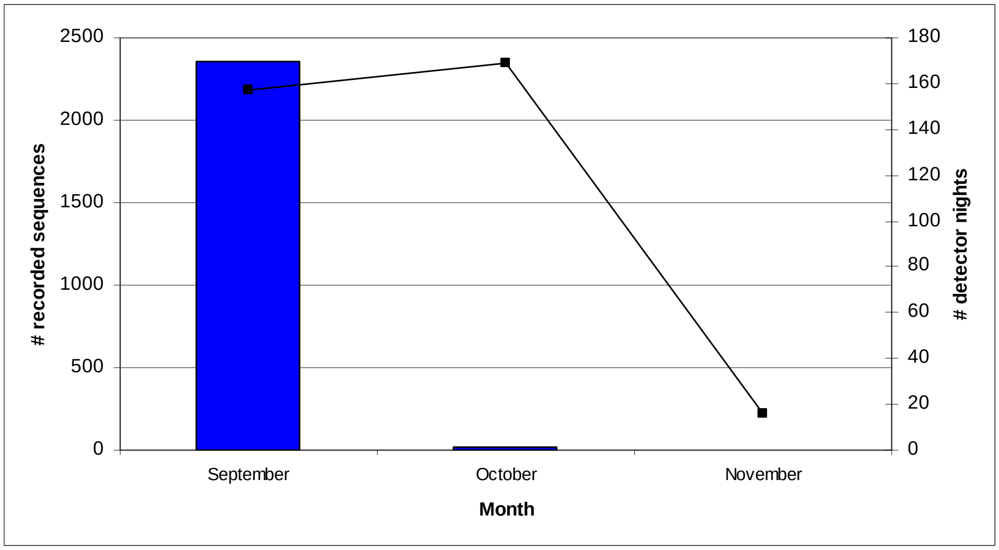

Figure 3-1. Seasonal distribution of bat call detections at Bowers, Fall 2009.

Timing of nightly bat activity was similar for all detectors. Activity rates peaked in the two hours following sunset, dropped during the middle of the night and recorded a smaller peak in activity during the last few hours before dawn (Figure 3-2).

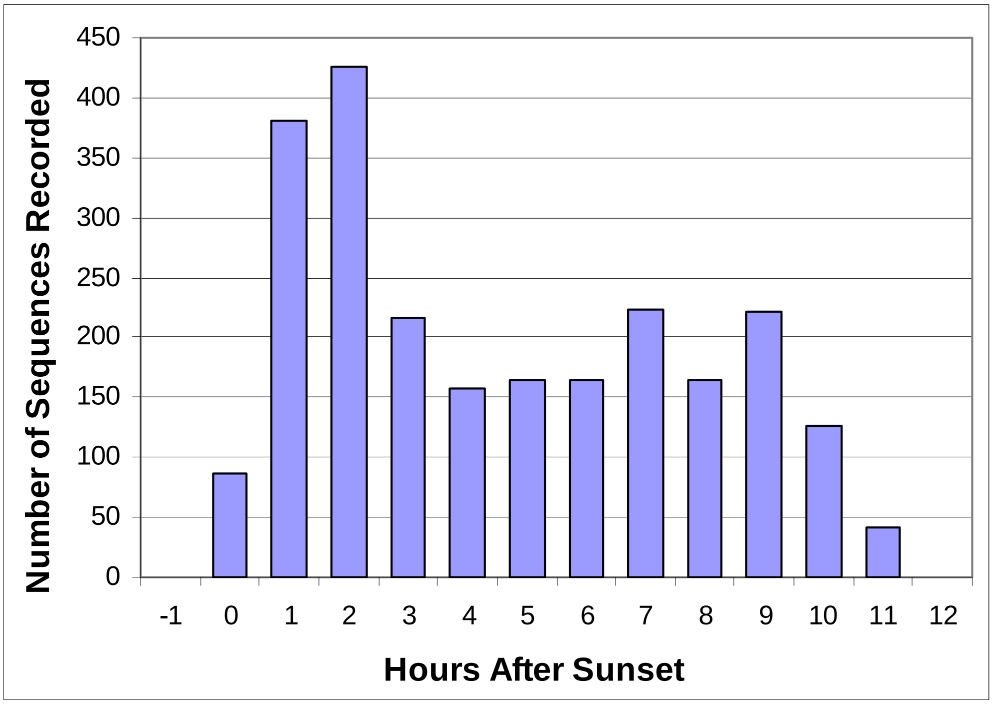

Figure 3-2. Hourly bat call sequence detections at Bowers, Fall 2009.

3.4.2 Species Composition

Call sequences belonging to four of the five guilds were identified during the acoustic survey, with the only guild not represented being hoary bat (Table 3-2). Species within the high frequency call range were the most common species recorded at all six of the Bowers bat detectors. HFUN species comprised 64 percent of all calls recorded during the fall 2009 survey period, while the MYSP guild comprised 35 percent. All other guilds together represented about one percent of all call sequences.

Table 3-2. Distribution of detections by guild for detectors at Bowers, Fall 2009.

Detector	Guild					Total
	BBSH	HB	MYSP	RBTB	UNKN	
Bowers 1	0	0	11	0	11	22
Bowers 2	1	0	679	1	1024	1,705
Bowers 3	11	0	85	4	191	291
Bowers 4	0	0	5	0	9	14
Bowers 5	6	0	57	1	254	318
Bowers 6	1	0	3	0	20	24
Total	**19**	**0**	**840**	**6**	**1,509**	**2,374**
Guild Composition %	**0.8%**	**0.0%**	**35.4%**	**0.3%**	**63.6%**	

Individual detectors recorded similar species compositions across the Project area (Figure 3-3), although Bowers 2 recorded notably higher numbers of all detected species (72% of all bat call sequences). On one night, September 4, this detector recorded 40 percent of all bat call sequences, all but two of which were from MYSP and HFUN species.

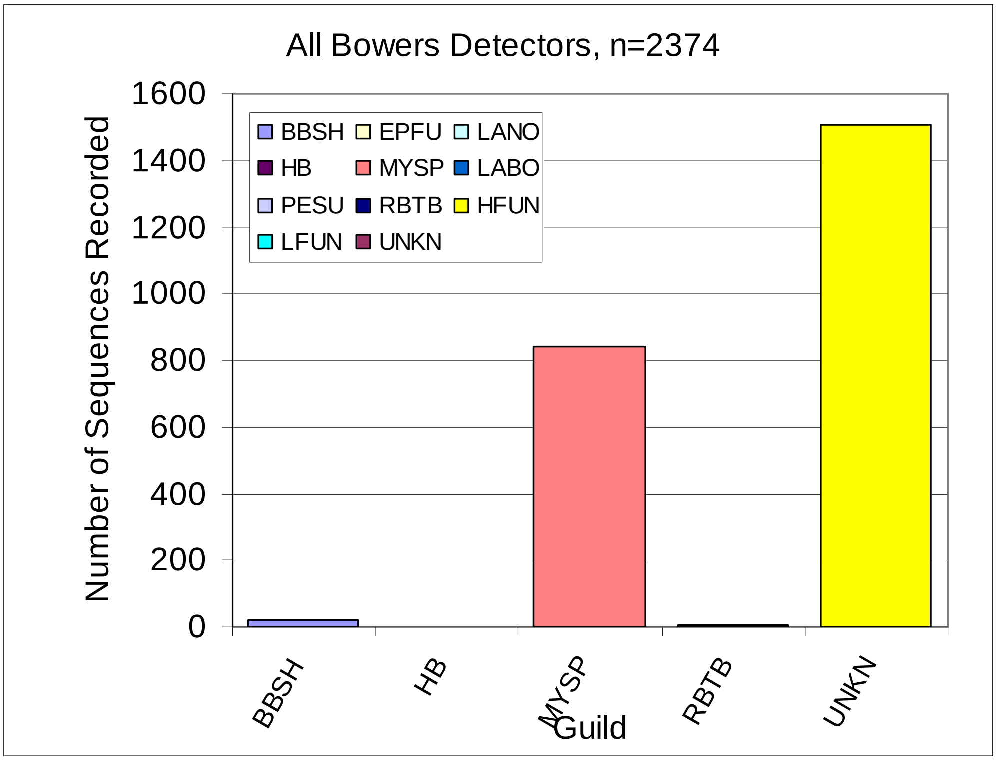

Figure 3-3. Species composition for all detectors at Bowers, Fall 2009.

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 6 provide information on the number of call sequences, by guild and suspected species, recorded at each detector and the weather conditions for that night. Stantec has archived digital copies of all recorded acoustic call sequences, and can provide a copy of these files, including all information about species identification and timing of calls from each detector on an hourly and nightly basis, should that information be desired.

3.4.3 Activity and Weather

Mean nightly wind speeds in the vicinity of the Project area from September 4 to November 4 varied between 1.53 and 9.17 m/s (Figure 3-4; Appendix B, Tables 1-6). Mean nightly temperatures varied between -0.84°C and 18.1°C (Figure 3-5; Appendix B, Table 1-6). Mean nightly barometric pressure varied between 935.45 and 968.60. Nights after October 20 were not included in the Figure 3-4 and 3-5 because no bat activity was recorded after that point. Bat activity was highest on warmer nights when average temperatures were at or above 6°C and declined on nights when temperatures declined.

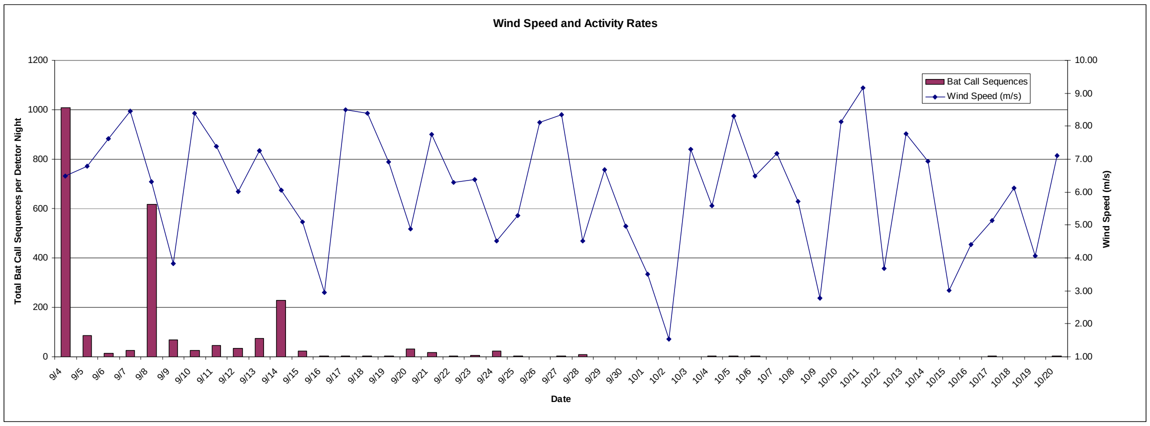

Figure 3-4. Nightly mean wind speed (m/s) and total bat call sequences at Bowers, Fall 2009.

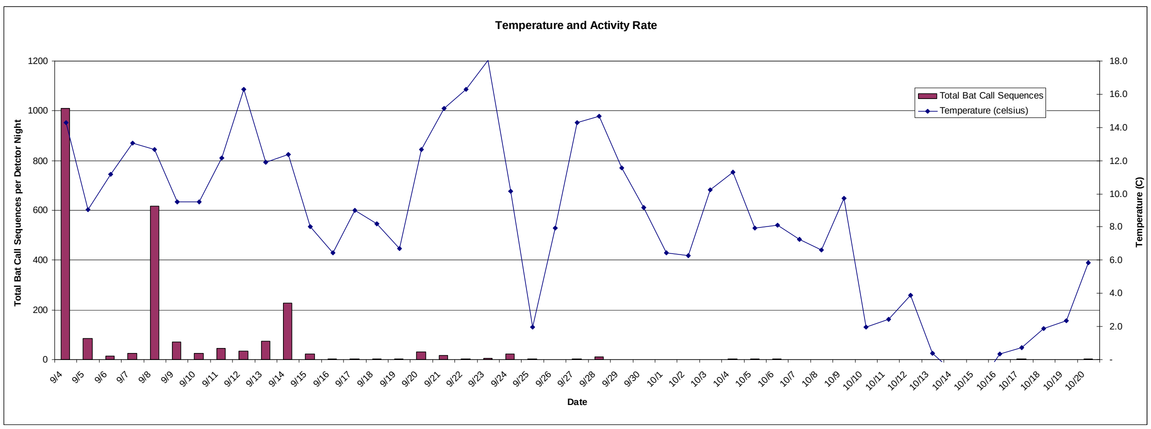

Figure 3-5. Nightly mean temperature (Celsius) and total bat call sequences at Bowers, Fall 2009.

3.5 DISCUSSION

Fall acoustic bat echolocation surveys at Bowers documented typical levels of bat activity for detectors deployed in trees at five of the six detectors. Activity levels were highest in September at all six detectors. The highest nightly detection rate was recorded during the first night of recording on September 4. Rates declined through October and no bat calls were recorded after October 20, although four of the six detectors operated until November 4.

Bat calls were identified to guild within this report, although calls were provisionally 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. The following paragraphs discuss each guild separately and address likely species composition of recorded bats within each guild.

The MYSP guild includes the three species of *Myotis* potentially occurring in the Project area (the little brown bat, northern long-eared bat, and eastern small-footed bat). Of these species, the little brown bat and northern long-eared bat are by far the most common in Maine, although acoustic data recorded during fall surveys did not provide a sufficient number of high quality calls to attempt differentiation between species. Eastern small-footed bats have a limited range in Maine, and while theoretically could be present in the Project area, are expected to be far less common. Thirty-five percent of call sequences recorded at Bowers (n=840) were from the MYSP guild, which is expected due to the canopy and sub-canopy heights of fall detectors. MYSP species are generally found foraging close to ground level in forested habitats and clearings in forested habitat.

The RBTB guild includes the tri-colored bat and eastern red bat. Eastern red bats have relatively unique calls which span a wide range of frequency and have a characteristic hooked shape and variable minimum frequency. Tri-colored bats (formerly called eastern pipistrelles) tend to have relatively uniform calls, with a constant minimum frequency and a sharply curved profile. Six RBTB calls were recorded during fall surveys at three detectors. Only one of the six call sequences was identified as belonging to an Eastern red bat. Bats in the RBTB guild, red bats in particular, likely migrate through the region during fall and are often recorded at detectors above tree canopy height.

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. Certain types of calls by each species are easily distinguishable from the other based on minimum frequency and call profile, but other calls in this range have overlapping characteristics and are difficult to distinguish. When call sequences were not of sufficient length or quality to distinguish between these two species they were labeled as BBSH. A total of 19 BBSH calls during the fall surveys were recorded at Bowers. Whereas the big brown bat would be expected to occur in the Project area throughout the summer and fall, the silver-haired bat is a long-distance migratory species and would likely be present particularly during the fall migration period.

The HB guild consists of the hoary bat, the largest bat species in the northeast. 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. No HB call sequences were identified during fall surveys. Like silver-haired and eastern red bats, hoary bats are long-distance migrants and tend to be detected most frequently in this region during the fall migration period.

Simultaneous with the survey period at Bowers, bat detector surveys were also conducted at Stetson, where six detectors were deployed in trees and on the turbine nacelle from mid July to mid October. The difference in species composition between detectors is similar to results of these surveys (Table 3-3) although results at Bowers are not fully comparable because the survey period did not include the typical peak period in August. At Stetson, monthly detection rates peaked at five of the six tree detectors during the month of August and one tree detector peaked during July. Low-frequency migratory bat species such as the hoary bat and the silver haired bat typically comprise a higher percentage of calls recorded above tree canopy, while high-frequency bats like myotis species are recorded in greater number at detectors deployed below canopy. At the Bowers tree detectors only 0.8 percent of all bat calls were from the BBSH guild, and 35.4 percent were of the MYSP guild.

Table 3-3. Comparison of fall acoustic survey results between Bowers and Stetson.

Survey Type (year)	Detector Type (High, Low, Tree)	Range of Detection Rates (calls/detector night)	Guild Ratios				
			Big brown guild	Red bat/ Tri-colored bat	*Myotis* spp.	Unknown	Total
Bowers Pre-construction (Fall 2009)	Tree	0.3 to 36.3	0.80%	0.30%	*35.40%*	63.60%	2374
Stetson Post-construction (Fall 2009)	Nacelle	0.1 to 0.3	52.00%	0.00%	0.00%	48.00%	31
	Tree	3.8 to 105.7	11.00%	<1%	69.00%	21.00%	22013
Stetson Pre-construction (Fall 2006)	Met High	0.1 to 2.2	9%	2.00%	*9.00%*	25.00%	*178*
	Met Low	1.0 to 6.1	26.00%	1.00%	*25.00%*	48.00%	*759*

Also available for comparison are results of publicly available surveys at other proposed wind facilities where bat detectors were deployed in trees in a forested ridge landscape (Appendix B, Table 7). The species composition and detection rate at Bowers was similar to results reported at other these other sites.

Detection rates vary from year to year and from site to site. Detectors below tree canopy typically record a higher detection rate than detectors recording above tree canopy. This is probably a result of bats foraging below canopy height making multiple passes by one detector over the course of a night. Although some foraging probably occurs within the range of met tower high and nacelle detectors, food sources are much less concentrated at higher elevations making it less likely that a single bat would fly multiple passes by one detector while foraging. During the fall migration period it is likely that a significant percentage of bats recorded at met tower high and nacelle detectors are migratory bat species. Many post-construction acoustic surveys have found a higher percentage of these long distance migratory species during mortality surveys under operating wind turbines (Arnett *et al.* 2008).

The similar acoustic methodology used and the proximity of the Bowers Project area to other wind projects in the region allows for comparison of acoustic data. Yet when comparing acoustic data sets 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 (Hayes 2000). Thus, results of acoustic surveys must be interpreted with caution. Methods surrounding acoustic bat surveys are continually evolving, and it there is currently little data aiding in the interpretation of number of calls per detector nights. Although interpretations are limited, the surveys represent a sample of activity and the general species groups that occur in the Project area.

4.0 Diurnal Raptor Surveys

4.1 INTRODUCTION

Raptor migration surveys were conducted in the Project area to characterize diurnal raptor migration patterns during fall 2009. In the eastern United States, raptor migration tends to concentrate along the shores of large bodies of water including lakes and the Atlantic Coast (Kellogg 2007) as well as along ridgelines, where raptors take advantage of updrafts which form along the side slopes of ridges. Updrafts allow raptors to fly long distances with minimal exertion (Berthold 2001). Raptors also use thermals, which are pockets of warm, rising air that form as the ground's surface is heated by the sun, in order to minimize energy expenditure during migration movements (Bildstein 2006). The nearest eagle nests are 4.4 miles and 4.8 miles south of the nearest turbine.[5] The goal of the raptor surveys was to characterize migration activity at central and prominent locations within the Project area, to document the species that occur in the vicinity of the Project, and to document the specific flight height, flight path locations, and other flight behaviors of raptors within or in the vicinity of the Project. Specific methods for this survey were developed in coordination with Champlain, MDIFW and USFWS.

4.2 DATA COLLECTION METHODS

Diurnal raptor surveys were conducted on days with favorable flight conditions during the outbound migration from breeding locations. Days following the passage of weather fronts bringing favorable weather and days with northerly winds were targeted. Raptor migration is facilitated by tail winds (winds aligned with the preferred direction of travel), which "push" migrating raptors forward (Bildstien 2006); however, some raptors will fly in light or moderate headwinds. Days with headwinds were also sampled as the flight behavior for some raptors differ in moderate to strong headwinds.

Raptor surveys were conducted in the center of the Project area from the ridge of Bowers Mountain (Figure 1-1). Surveys were conducted from the radar platform. To the southwest and east, the platform location provided a panoramic view to the horizon and unimpeded views of the east side of Brown Mt and the south side of the Stetson Mountain Wind Project (Photo 1-2 and 1-3). The radar platform also provided views of Junior Mountain and Vinegar Hill as well as several water bodies including Pleasant Lake, Scraggly Lake and Junior Lake to the south (Photo 1-1).

[5] Based on Bald Eagle Nest Survey memo from Stantec, November 30, 2009.

Surveys were based on Hawk Migration Association of North America (HMANA) methods (HMANA 2009). Surveys were conducted from 9 am to 4 pm, during the peak hours of thermal development and raptor movement. During surveys, observers scanned the sky and surrounding landscape for raptors with binoculars or a spotting scope. Hourly weather observations, including wind speed and direction, temperature, sky conditions, percent cloud cover, and relative cloud height and type were recorded. Detailed information for each observation was recorded on datasheets and Project area maps, including:

- Observation date and time;
- Species, number of individuals, and age (if possible);
- If the raptor occurred within the Project area (as depicted in Figure 1-1);
- The flight positions of each bird in relation to topography of the area;
- The flight height (above ground) of each bird (within each different topographical flight position);
- The specific flight behaviors of each bird;
- The general flight direction of each bird; and
- If the bird was actively migrating as well as other notes describing the general activity of each bird.

Topographical flight positions were summarized into categories that describe the landscape surrounding the observation site (these positions apply to birds observed both within as well as outside of the Project boundary): A1) parallel to ridge, A2) perpendicular to ridge, A3) over saddle, B) flight path over upper slope of ridge, C) flight path over lower slope of ridge, and D) flight path over a valley (see Figure 4-1 below). As individual birds traveled through or in the vicinity of the Project, all position categories in which a bird occurred were recorded.

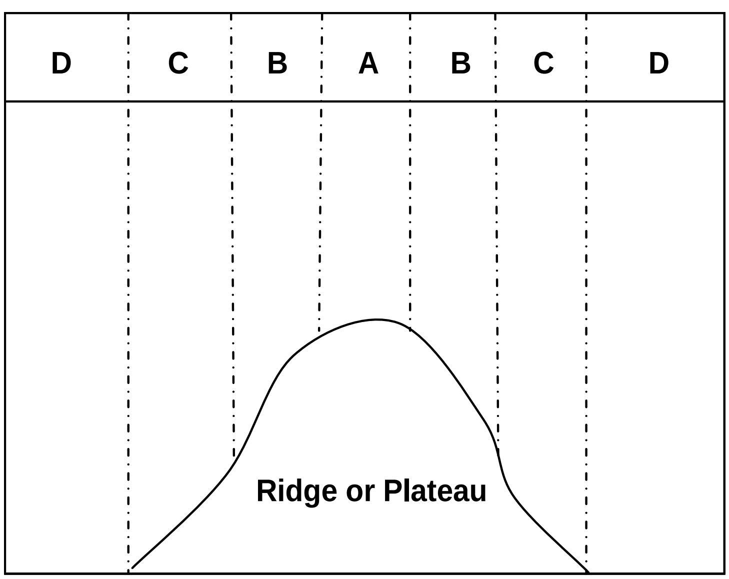

Figure 4-1. Raptor flight position categories in relation to the topography of the Project area.

Nearby objects with known heights, such as the radar unit and tree canopy were used to gauge flight height. Flight behaviors were categorized as: circle soaring, linear soaring (straight-line soaring or slow gliding in a 'thermal street' formed between updrafts), gliding (with wings partially closed and bent wrists), powered flight (flapping wings), banking (breaking with fully extended wings and tail fanned), diving (wings partially to mostly closed while in descent), carrying food, kiting (using wind current to kite with partially closed wings and tail), hovering (maintaining a stationary altitude with some flapping and fanned tail while hunting and looking downward), aerial feeding (eating prey in flight while in a soar or slow glide), aerial hunting low over the ground, aerial display (territorial or courtship aerial display, or perched), and vocalizing. These behaviors among others were used to describe birds as actively migrating or not-actively migrating.

Birds that flew too rapidly or were too far to accurately identify were recorded as unidentified to their genus or, if the identification of genus was not possible, unidentified raptor. Priority was given to raptor observations; however, observers collected incidental data for other avian species observed including passerines and water birds.

4.3 DATA ANALYSIS METHODS

The raptor observation data was summarized by survey day and for the entire survey period. Analysis included a summary of:

- The total number of individuals per species observed each survey day, and for the entire survey period;
- Daily passage rates (birds per hour) calculated for each survey day, as well as for the entire survey period;
- Hourly observation totals per species;
- The percentage of birds within each topographical flight position category;
- The average minimum flight height of birds within each topographical flight position category;
- The percentage of all birds that occurred within the Project boundary;
- For all birds observed within the Project boundary, and within topographical positions where the turbines are to be located, flight heights were categorized as less than or greater than 119m (390') above ground;
- The percentage of birds believed to be actively migrating; and
- A summary of the flight behaviors of all birds observed.

When possible, raptor surveys at Bowers were conducted simultaneous with raptor surveys at Stetson, approximately eight miles north, and results were compared between the proposed Bowers site and the operational Stetson site. Also provided for comparison are the results of available raptor surveys conducted at other proposed wind facilities located in the east.

In addition, results from Bowers were compared to fall 2009 data from HMANA hawk watch sites in New England and Atlantic Canada (HMANA 2009). The hawk watch sites included for comparison with Bowers are Greenlaw Mountain, NB; Cadillac Mountain, ME; Harpswell Peninsula, ME; Pack Monodnock, NH; Pitcher Mountain, NH; and Putney Mountain, VT.

4.4 RESULTS

Surveys were conducted on 15 days from September 9 through October 14, resulting in a total of 105 survey hours. Surveys were generally conducted on clear days allowing for optimal visibility. However, for portions of some of the survey days, visibility was limited due to weather: rain showers reduced visibility for a few hours on the morning of September 29 and October 1 and the afternoon of October 11. Temperatures ranged from 3 to 22° C (37 – 72 °F) during the survey period. Wind speed and direction were variable throughout the survey period. Wind speeds under 9 mph (14kph) occurred during 73 percent of observation hours and wind speeds in excess of 19 mph (31kph) occurred during only 1 percent of observation hours. Wind direction during seven survey days was predominantly from the northwest; from the southeast during three survey days; from the northeast on one survey day; and from the southwest during four days. Similar numbers of birds were observed on days with headwinds and tailwinds.

During fall migration surveys, a total of 95 raptors were observed. Daily counts ranged from 2 to 21 raptors, and daily passage rates ranged from 0.29 to 3.00 birds/hour. The survey days with the highest raptor count was September 16 (n=21), with almost twice the total number of raptors than the second highest survey day, October 14 (n=12; Figure 4-2; Appendix C, Table 3). Survey length per survey day was seven hours, which resulted in a seasonal observation rate of 0.90 birds/hour.

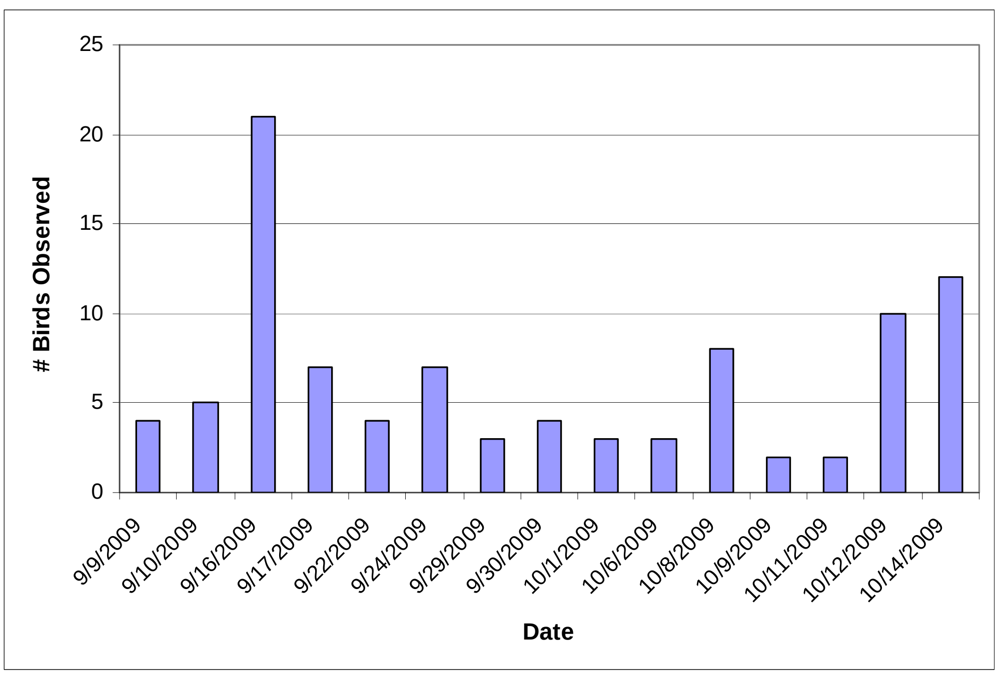

Figure 4-2. Total number of birds observed per survey day at Bowers during Fall 2009.

Nine[6] different species were identified in the Project vicinity, not including birds which could not be identified to species ("unidentified raptor", n=1; Figure 4-3; Appendix C, Table 1). The majority of raptors observed were turkey vulture (*Cathartes aura*) (n=44; 46 %), followed by sharp-shinned hawk (*Accipiter striatus*; n=17; 18 %) and red-tailed hawk (*Buteo jamaicensis;* n=10; 11 %).

No state endangered or threatened raptor species were observed during fall 2009 surveys. Two state listed species of special concern, bald eagle (*Haliaeetus leucocephalus*) and northern harrier (*Circus cyaneus*) were observed during raptor surveys. A total of six bald eagles were seen in the Project vicinity, including two that were observed in the Project area. One northern harrier was also seen flying in the Project area.

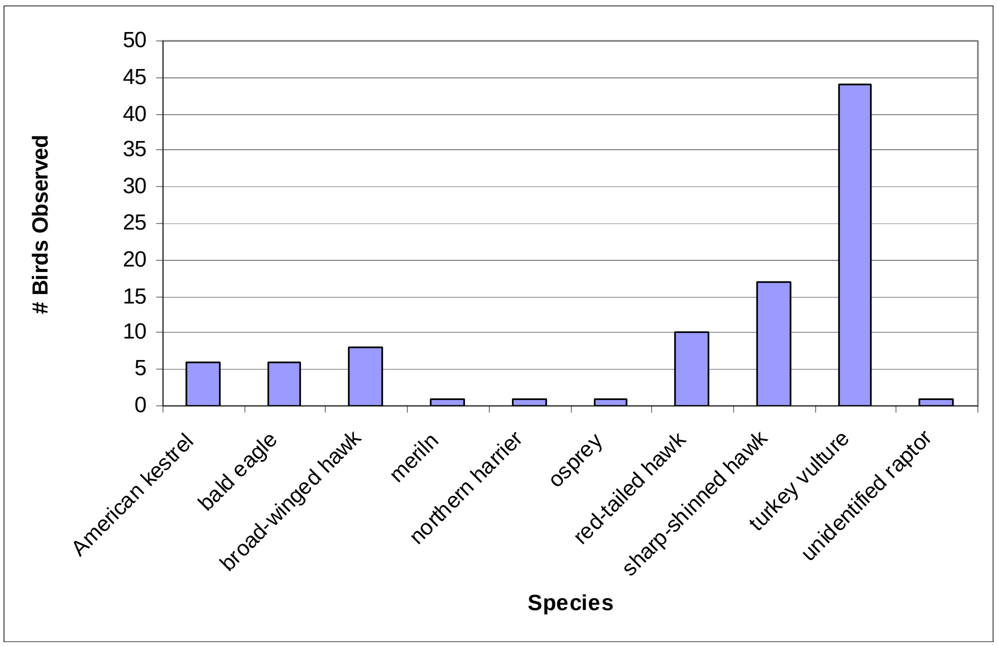

Figure 4-3. Number of individuals of species observed at Bowers during Fall 2009.

On a daily basis, the number of observations per survey hour was relatively constant throughout the day, with one peak period during the late morning when thermal development is at a maximum. The peak hourly activity period was between 11:00 am and 12:00 pm (Figure 4-4; Appendix C, Table 2).

[6] While turkey vultures (*Cathartes aura*) are not phylogenetically considered true raptors, they are diurnal migrants that exhibit flight characteristics similar to *Buteos, Accipiters* and other *Falconiformes* species, therefore vultures are typically included during hawk watch surveys.

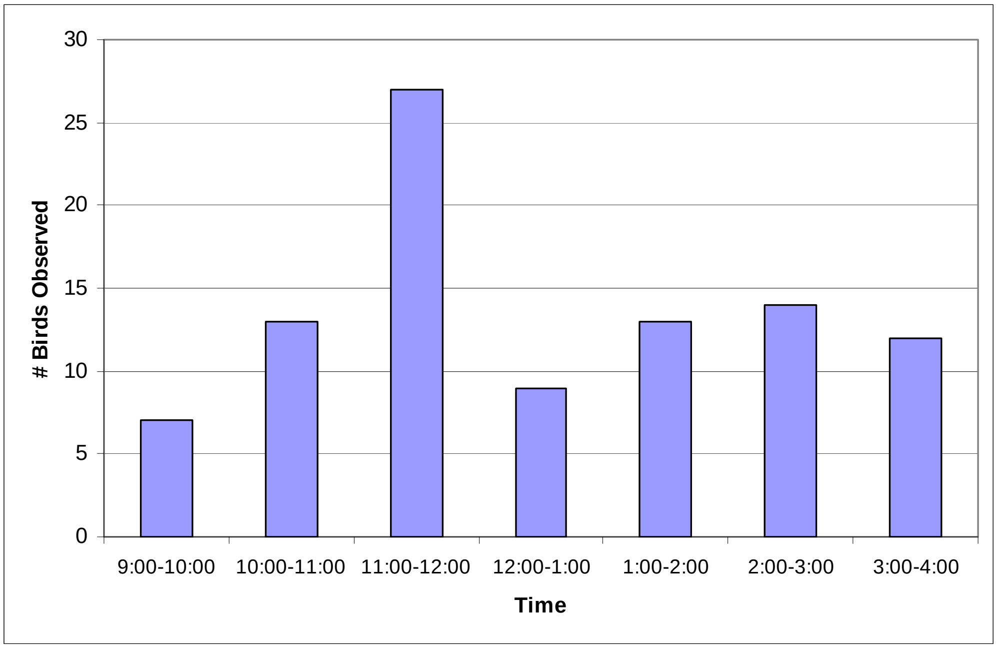

Figure 4-4. Number of individuals observed per survey hour at Bowers during Fall 2009.

Not all raptors observed during the survey season were observed moving through the Project area, which is defined as the ridge summits in horizontal position categories A and B on Bowers Mountain, Brown Hill, Dill Hill, and an unnamed ridge just south of Bowers Mountain. During the fall surveys, 94 percent (n=89) of raptors occurred in the Project area during some point of their flight.

Of the birds passing over Project ridges, the highest percentage of birds was seen flying along the upper slope of the ridge (n=86; 48 %) and crossing the ridge (n=63; 35 %). Flight height in these position category averaged 151 and 90 meters respectively (Table 4-1).

Table 4-1. Number of positions and average flight heights for each position category for birds observed at Bowers, Fall, 2009.

	A1) flight along or parallel to ridge	A2) crossed ridge	A3) flight crossed depression or saddle	B) upper slope	C) lower slope	D) over valley
No. of positions * (percent of total position obs)	3 (2%)	63 (35%)	2 (1%)	86 (48%)	0 (0%)	26 (14%)
Average minimum flight height (m)	57	90	100	151	n/a	219

* Note: Number of positions will be greater than number of observations because individual birds crossed multiple position categories

Flight heights were categorized as above or below 119 m (390') for raptors observed within the Project boundary in flight positions A1, A2, A3, and B, where the proposed turbines are to be located. Seventy-five percent (n=66) of this subset of birds were flying less than or equal to 119 m for at least a portion of their flight through the proposed turbine areas (Figure 4-5; Appendix C, Table 3). The only species with a majority of flights above 119 m in the Project area was broad-winged hawk, (*Buteo platypterus*) with an average flight height of 150 m.

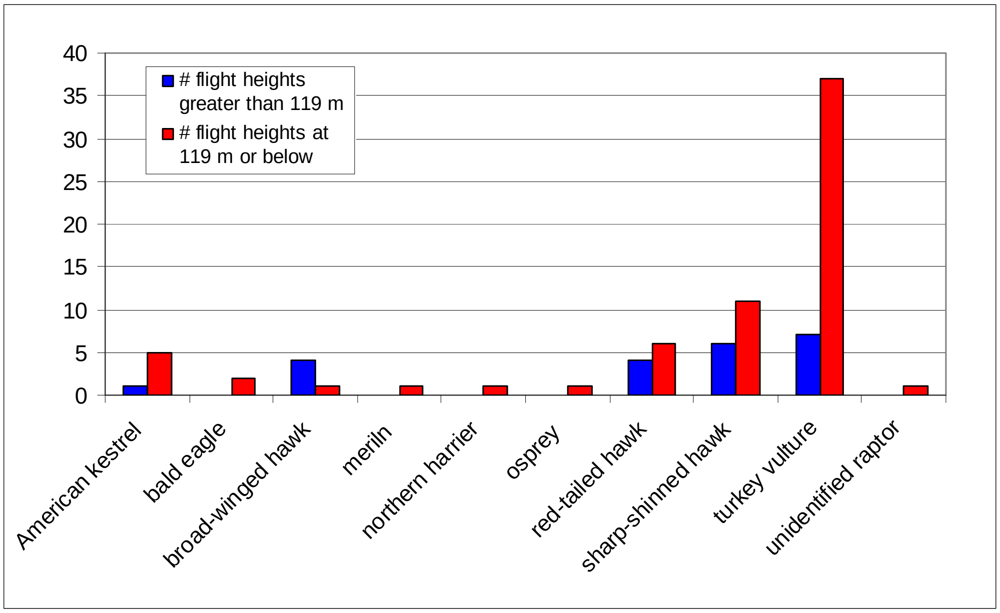

Figure 4-5. Number of individuals of species observed within Bowers boundary in proposed turbine areas (flight positions A1, A2, A3, and B) above or below 119 m during Fall 2009.

Of the total number of birds observed, 44 percent were believed to be migrating, considering flight direction and flight behavior. For the majority of species, most birds observed were migrating; however, only a small portion of turkey vultures (n=8; 18 %) and bald eagles (n=2; 18%) displayed migratory behavior. Most observations for these two species included meandering, localized flights and represent potential stop-over or seasonally local birds. The most common flight behaviors for raptors observed during fall surveys were linear soaring, circle soaring and powered flight, which is consistent with migrating birds (Figure 4-6, Appendix C, Table 4).

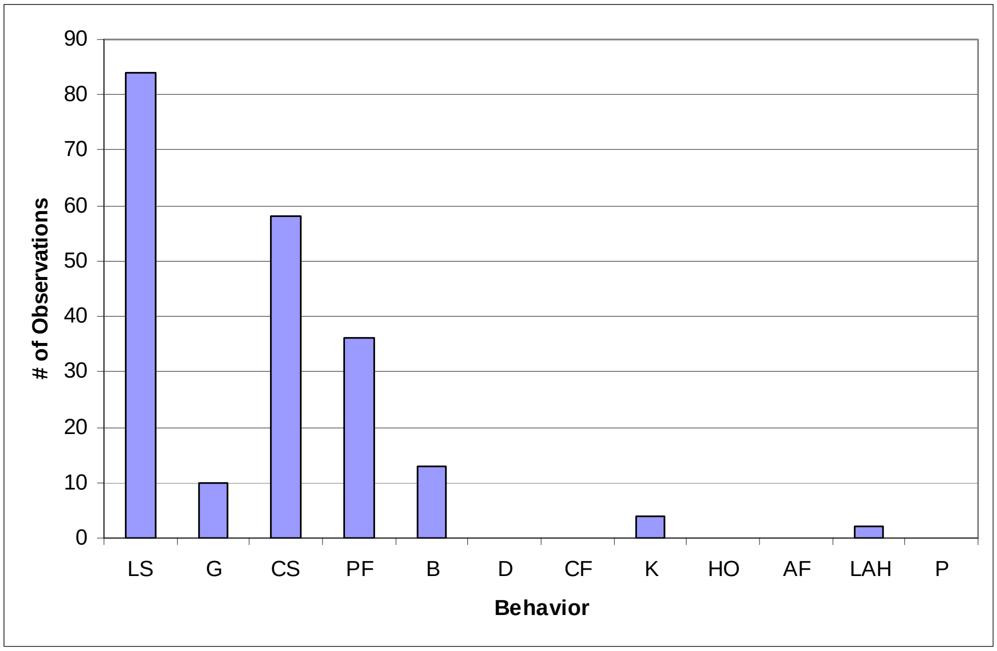

Figure 4-6. Number of observations of flight behaviors at Bowers during Fall 2009.

Stantec has archived digital copies of all observations, and can provide a copy of this file, including all information about species identification and notes on general flight patterns, if requested.

4.4.1 Species of Conservation Concern

No state or federally endangered or threatened raptor species were observed during fall 2009 surveys.

Two state species of special concern were observed during fall 2009 surveys: bald eagle[7] and northern harrier. A total of six bald eagles were observed, many of which were seen flying near the lakes south of the Project area, approximately four to eight miles from turbine locations. On September 16, an adult and juvenile eagle were seen circling together at 150 m and moving southeast in the vicinity of Mack Hill and Duck Lake. On two mornings, October 8 and 11, an eagle was seen moving along the north shores of Junior, Scraggly, and Pleasant Lakes.

Bald eagles were observed in the Project area crossing Bowers Mountain on two occasions, both exhibiting migratory behaviors. A sub-adult II eagle was seen on October 12 approaching the ridge from the north, flying over the lower slope of the ridge in a slow linear soar at 100 m, then perhaps catching a slight updraft from the moderate west-northwest winds, and crossing just south of the observation location at approximately 75 m and continuing south. The second eagle seen in the Project area was observed October 14 approaching from the northwest, also soaring over the lower slope of the ridge at 100 m, then crossing Bowers ridge at 50 m and

[7] The bald eagle is also protected federally by the Bald and Golden Eagle Protection Act.

continuing south-southeast. The total time occurring in airspace below 119 m over Bowers ridge was approximately one minute for each of these birds.

On October 8, one northern harrier was observed gliding over Bowers Mountain from the north, crossing the ridge at approximately 50 m and continuing south.

4.4.2 Incidental bird observations

A total of 24 different non-raptor avian species of were observed incidentally during the Bowers fall 2009 surveys (Appendix C, Table 5). Three incidental passerines that were observed in the Project area, chestnut-sided warbler (*Dendroica pensylvanica*), Tennessee warbler (*Vermivora peregrina*), and white-throated sparrow (*Zonotrichia albicollis*), are listed as state species of special concern.

4.5 DISCUSSION

A total of 95 raptors representing 9 species were observed during 15 survey days between September 9 and October 14. Turkey vulture and sharp-shinned hawk were the most commonly observed species; 82 percent of turkey vultures observed were believed to be seasonally local or migrant stopover birds. The majority of birds (n=89; 94%) were observed within the Project boundary. The location of observed birds is biased by an observer's location in that, due to the limits of visibility, birds closer to the observer are more easily detected.

The flight paths of raptors observed at Bowers varied between survey dates and were influenced by varying wind direction and weather. During raptor migration, flight pathways and flight heights along ridges, side slopes, and across valleys may vary seasonally, daily, or hourly. Raptors may shift and use different ridgelines and cross different valleys from year to year or season to season. Weather and wind are major factors that influence migration paths as well as flight heights. Wind strongly affects the propensity of raptors to congregate along 'leading lines' or topographic features (Richardson 1998). Wind, air temperature, and cloud cover influence the development of updrafts and thermals used by raptors while making long-distance flights.

Eight of 15 days were conducted simultaneous with raptor surveys conducted at Stetson. During these surveys, a total of 45 raptors representing eight species were observed, with a seasonal passage rate of 0.9 birds/hour (Table 4-2, Figure 4-7 Appendix C, Table 6).

Table 4-2. Comparison of fall raptor survey results between Bowers and Stetson.

Result	Bowers Pre-construction (Fall 2009)	Stetson Post-construction (Fall 2009)	Stetson Pre-construction (Fall 2006)
Total number of days surveyed:	15	8	7
Total number of hours surveyed:	105	50	42
Total number of raptors detected:	95	45	86
Overall survey passage rate (birds/hour)	0.90	0.9	2.05
Total number of raptor species detected*	9	8	11
Total number of raptors detected in the Project area (percent of total detections)	89 (94%)	69 (87%)	n/a
Number of raptors observed below (maximum turbine height) (percent of total detections):	66 (69%)	40 (89%)	54 (63%)

* not including raptors unidentified to species (n=1 at Bowers, n=2 at Stetson)

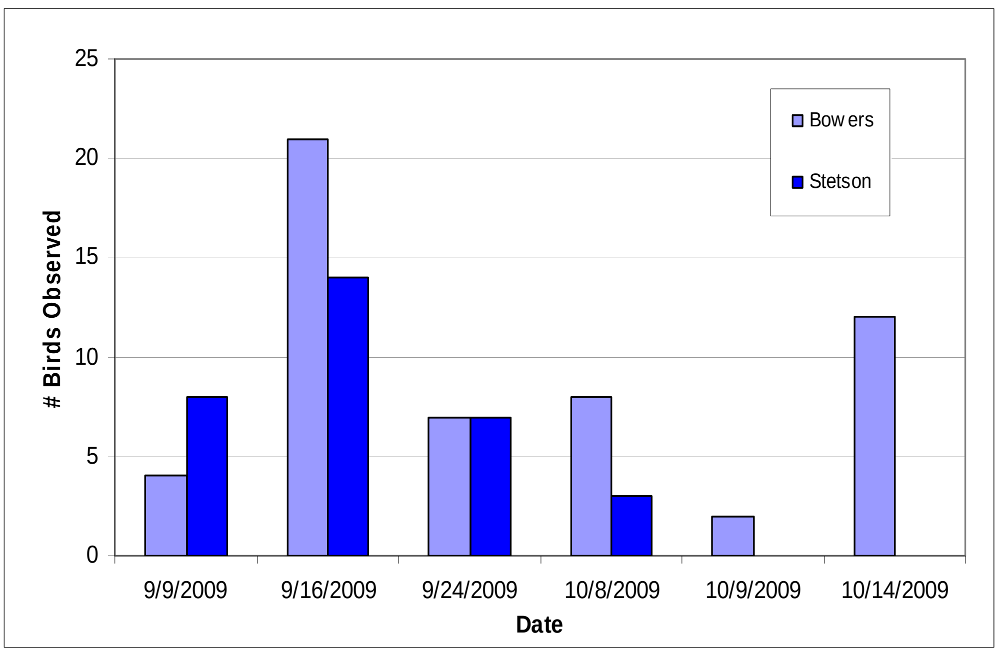

Figure 4-7. Number of raptors observed during simultaneous surveys at Bowers and Stetson Mountain Wind Project during Fall 2009.

Although the total number of raptors observed on each survey day differs between the two sites, a general pattern of higher raptor numbers on specific days is evident across both sites, likely a result of regional weather conditions. Further, the seasonal passage rate for both sites is the same at 0.9 birds/hour, which is expected considering the close geographical proximity between sites. Species assemblage across both sites was similar as well; however, turkey vultures were considerably more common at Bowers and red-tailed hawks were more common at Stetson.

Also available for comparison are results of HMANA hawk watch sites in the region and publicly available surveys at other proposed wind facilities in the east. Between August and November 2009, the passage rates at HMANA hawk watch sites in the region varied between 2.8 birds/hour (Pitcher Mountain, NH) and 18.4 birds/hour (Harpswell Peninsula, ME) (Appendix C, Table 7). The passage rate at Bowers was among the lowest passage rates reported. It should be noted that observers at HMANA sites typically do not count birds suspected to be local to the area while observers at Bowers included all raptors observed in the seasonal passage rate.

Between 1999 to 2008, seasonal passage rates during the fall migration season at proposed wind facilities ranged from 0 raptors/hour (Wethersfield, Wyoming County, New York; agricultural plateau) to 12.72 raptors/hour (Deerfield, Bennington County, Vermont; forested ridge). The range of the percent of flight heights below the maximum turbine height at other wind sites is 9 to 89 percent. Overall, the passage rate and flight height at Bowers was similar to results reported at other wind sites in the east (Appendix C, Table 8)

Variations in flight heights among sites, and among survey days at a single site, are due to variable weather conditions and the particular flight behaviors of different raptor species. Typically, *accipiters* and falcons use up-drafts from side slopes to gain lift and, therefore, usually fly low over ridgelines. *Buteos* tend to use lift from thermals that develop over side slopes and valleys and tend to fly high during hours of peak thermal development. Raptors (*accipiters* in particular) typically fly lower than usual during windy or inclement conditions. Local birds may fly at lower altitudes while making small scale movements between foraging locations (Barrios and Rodriguez, 2004).

There may be some annual variation in the seasonal passage rates at Bowers due to variability in annual populations and weather conditions. However, similarities found in passage rates, flight heights, and species composition between Bowers and other regional fall raptor survey results, suggest that the fall 2009 raptor survey results are typical.

Pre-construction raptor studies can provide baseline data regarding the species of raptor that occur and the general flight behaviors of birds traveling through the area. However, currently there is no clear relationship between pre-construction and post-construction data for the prediction of raptor collision risk at wind sites. That is, at existing wind farms, the passage rates and percentages of birds below turbine height determined during pre-construction surveys have not been directly correlated to the actual number of raptors that have been found during post-construction mortality studies.

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Appendix A

Radar survey results

Appendix A Table 1. Survey dates, results, level of effort, and weather – Bowers Fall 2009

Date	Passage rate	Flight Direction	Flight Height (m)	% below 119 m	Hours of Survey	Temperature (C)	Wind Speed (m/s)	Wind Direction (degrees)
09/08	452	224	284	19%	6	12.7	6.31	108
09/09	615	272	289	21%	11	9.5	3.83	242
09/10	111	34	210	21%	11	9.5	8.40	318
09/15	729	232	255	17%	11	8.0	5.10	112
09/16	347	257	351	14%	12	6.4	2.95	6
09/17	174	71	268	23%	10	9.0	8.51	335
09/21	339	3	245	21%	11	15.1	7.74	314
09/22	190	31	232	25%	12	16.3	6.30	313
09/23	209	208	214	16%	12	18.1	6.37	43
09/24	844	224	416	8%	10	10.1	4.52	84
09/28	248	308	314	8%	8	14.7	4.52	270
09/29	258	310	221	19%	12	11.6	6.68	287
09/30	184	190	260	17%	11	9.2	4.97	3
10/01	460	222	295	14%	13	6.4	3.50	356
10/05	263	184	385	10%	13	7.9	8.31	6
10/06	452	219	377	11%	13	8.1	6.49	271
10/07	411	204	378	14%	9	7.2	7.18	64
10/08	404	213	453	7%	13	6.6	5.71	344
10/11	95	208	289	31%	13	2.4	9.17	354
10/12	435	232	290	20%	13	3.9	3.68	345
10/13	268	211	449	9%	13	0.4	7.77	44
10/14	198	214	450	11%	12	-0.8	6.93	30
Entire Season	**344**	**231**	**315**	**14%**	**249**	**8.7**	**6.13**	**193**

Appendix A Table 2. Summary of passage rates by hour, night, and for entire season - Bowers Fall 2009.

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
09/08	N/A	N/A	N/A	N/A	N/A	518	664	607	514	332	75	N/A	N/A	452	516	256	104
09/09	161	711	1025	1189	1114	700	443	429	389	439	164	N/A	N/A	615	443	363	115
09/10	132	229	154	132	136	118	82	86	71	54	25	N/A	N/A	111	118	56	18
09/15	929	914	789	1075	975	1032	671	646	400	289	293	N/A	N/A	729	789	292	92
09/16	175	336	371	414	375	436	575	589	418	286	189	0	N/A	347	373	167	50
09/17	N/A	N/A	357	311	261	243	150	154	100	86	64	11	N/A	174	152	114	38
09/21	504	618	461	318	339	257	282	300	257	221	168	N/A	N/A	339	300	135	43
09/22	318	343	239	204	189	179	129	129	150	107	100	193	N/A	190	184	78	23
09/23	168	136	136	118	111	89	167	168	421	321	311	364	N/A	209	168	113	34
09/24	621	1225	1307	1136	1264	964	864	682	311	N/A	N/A	64	N/A	844	914	422	141
09/28	N/A	N/A	486	525	407	100	61	64	151	N/A	189	N/A	N/A	248	170	194	68
09/29	143	468	514	389	343	329	357	257	96	86	46	68	N/A	258	293	165	50
09/30	257	279	N/A	221	182	136	164	339	304	57	21	61	N/A	184	182	107	34
10/01	118	550	789	871	711	643	593	479	425	289	164	354	0	460	479	267	77
10/05	118	593	501	436	596	346	254	139	150	107	86	77	11	263	150	208	60
10/06	186	669	757	539	566	536	257	379	339	381	549	711	11	452	536	218	63
10/07	N/A	N/A	N/A	N/A	536	596	689	579	477	386	223	179	32	411	477	222	78
10/08	291	424	566	639	811	464	609	291	253	283	189	219	209	404	291	199	57
10/11	43	64	61	64	60	163	157	157	154	121	91	56	43	95	64	48	14
10/12	71	450	506	521	1007	934	627	636	416	211	150	125	0	435	450	318	92
10/13	11	21	211	411	553	675	519	377	193	189	120	75	129	268	193	217	63
10/14	14	146	189	193	239	304	368	371	318	136	36	57	--	198	191	125	38
Entire Season	**237**	**454**	**496**	**485**	**513**	**444**	**395**	**357**	**287**	**219**	**155**	**163**	**54**	**344**	**283**	**276**	**17**

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

Appendix A Table 3. Mean Nightly Flight Direction - Bowers Fall 2009		
Night of	**Mean Flight Direction**	**Circular Stdev**
09/08	224	28
09/09	272	47
09/10	34	55
09/15	232	28
09/16	257	56
09/17	71	42
09/21	3	70
09/22	31	55
09/23	208	102
09/24	224	35
09/28	308	59
09/29	310	49
09/30	190	76
10/01	222	40
10/05	184	40
10/06	219	58
10/07	204	34
10/08	213	40
10/11	208	108
10/12	232	39
10/13	211	33
10/14	214	41
Entire Season	231	65

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Appendix A Table 4. Summary of mean flight heights by hour, night, and for entire season - Bowers Fall 2009.

Night of	Mean Flight Height (m) by hour after sunset										Entire Night							% of targets below 119 meters
	1	2	3	4	5	6	7	8	9	10	11	12	13	Mean	Median	STDV	SE	
09/08	--	--	--	--	--	278	299	266	438	242	181	--	--	284	272	86	35	19%
09/09	227	354	297	348	367	369	321	299	260	264	216	148	--	289	298	69	20	21%
09/10	167	249	243	301	212	302	210	276	134	182	195	46	--	210	211	73	21	21%
09/15	296	340	326	294	258	228	220	270	216	201	160	--	--	255	258	56	17	17%
09/16	217	282	353	413	443	395	363	352	357	366	320	--	--	351	357	62	19	14%
09/17	--	351	351	283	289	283	281	287	204	294	229	98	--	268	283	71	21	23%
09/21	354	349	329	275	255	253	213	235	220	193	191	75	--	245	244	78	23	21%
09/22	205	326	274	271	212	197	223	254	230	160	216	215	--	232	219	43	13	25%
09/23	193	221	188	194	198	185	242	260	--	248	225	205	--	214	205	26	8	16%
09/24	292	390	404	472	457	485	492	426	322	--	--	--	--	416	426	71	24	8%
09/28	--	--	301	244	288	406	329	318	--	--	--	--	--	314	310	54	22	8%
09/29	259	260	256	227	259	220	240	226	211	247	190	218	57	221	227	54	15	19%
09/30	148	206	--	296	272	268	362	243	267	327	230	244	--	260	267	58	17	17%
10/01	374	349	381	356	339	265	231	238	247	208	218	211	415	295	265	75	21	14%
10/05	186	327	434	467	440	457	488	483	478	407	348	344	141	385	434	113	31	10%
10/06	235	417	462	498	521	490	570	404	341	334	224	165	245	377	404	130	36	11%
10/07	--	--	--	--	359	392	330	446	462	399	440	293	284	378	392	66	22	14%
10/08	337	284	321	443	485	440	479	508	579	537	512	471	494	453	479	88	24	7%
10/11	293	186	175	261	402	261	254	199	412	233	422	223	430	289	261	95	26	31%
10/12	371	332	413	357	252	277	280	272	275	240	218	197	--	290	276	65	19	20%
10/13	--	678	375	323	388	497	514	513	434	499	431	429	306	449	433	101	29	9%
10/14	436	542	523	500	543	547	478	397	360	300	322	447	--	450	462	88	25	11%
Averages for Entire Season	**270**	**339**	**337**	**341**	**345**	**341**	**337**	**326**	**322**	**294**	**274**	**237**	**296**	**315**	**293**	**110**	**7**	**14%**

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

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

Year	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										
2004	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.
Fall 2005										
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
Fall 2006										
2006	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.
2006	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.
Fall 2007										
2007	Errol, 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.
2007	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.
2007	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.
2007	Allegany, Cattaraugus Cty, NY	46	n/a	Forested ridge	451	n/a	230	382	(150 m) 14%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
Fall 2008										
2008	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.
2008	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.
Fall 2009										
2009	Bowers Mountain, Washington Cty, ME	22	n/a	Forested ridge	344	95-844	231	315	(119) 14%	*this report*

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 Bowers 1tree detector – Fall, 2009

		BBSH			HB	MYSP	RBTB			UNKN			Total	Wind Speed (m/s)	Temperature (celsius)	Barometric Pressure
Night of	Operational?	BBSH	Big brown	Silver-haired	Hoary	MYSP	Eastern red	Tri-colored	RBTB	HFUN	LFUN	UNKN				
09/04/09	1					2				2			**4**	6.49	14.3	956.3
09/05/09	1									1			**1**	6.79	9.1	962.8
09/06/09	1					2							**2**	7.63	11.2	965.2
09/07/09	1					1				2			**3**	8.46	13.0	957.2
09/08/09	1									1			**1**	6.31	12.7	958.7
09/09/09	1					3				3			**6**	3.83	9.5	967.5
09/10/09	1												**0**	8.40	9.5	968.6
09/11/09	1												**0**	7.39	12.1	961.2
09/12/09	1												**0**	6.02	16.3	951.8
09/13/09	1									1			**1**	7.25	11.9	946.3
09/14/09	1					2							**2**	6.06	12.4	946.2
09/15/09	1												**0**	5.10	8.0	959.2
09/16/09	1												**0**	2.95	6.4	965.9
09/17/09	1												**0**	8.51	9.0	951.9
09/18/09	1												**0**	8.40	8.2	948.0
09/19/09	1												**0**	6.92	6.7	960.1
09/20/09	1												**0**	4.88	12.7	961.1
09/21/09	1												**0**	7.74	15.1	962.3
09/22/09	1												**0**	6.30	16.3	957.6
09/23/09	1												**0**	6.37	18.1	949.8
09/24/09	1									1			**1**	4.52	10.1	953.6
09/25/09	1												**0**	5.29	2.0	964.7
09/26/09	1												**0**	8.12	7.9	954.4
09/27/09	1												**0**	8.34	14.3	940.5
09/28/09	1												**0**	4.52	14.7	939.3
09/29/09	1												**0**	6.68	11.6	938.5
09/30/09	1												**0**	4.97	9.2	945.4
10/01/09	1												**0**	3.50	6.4	951.3
10/02/09	1												**0**	1.53	6.3	956.9
10/03/09	1												**0**	7.30	10.3	953.8
10/04/09	1												**0**	5.59	11.3	946.0
10/05/09	1					1							**1**	8.31	7.9	943.0
10/06/09	1												**0**	6.49	8.1	945.1
10/07/09	1												**0**	7.18	7.2	935.5
10/08/09	1												**0**	5.71	6.6	951.6
10/09/09	1												**0**	2.78	9.7	943.8
10/10/09	1												**0**	8.13	1.9	951.3
10/11/09	1												**0**	9.17	2.4	954.8
10/12/09	1												**0**	3.68	3.9	958.4
10/13/09	1												**0**	7.77	0.4	951.9
10/14/09	1												**0**	6.93	(0.8)	954.6
10/15/09	1												**0**			
10/16/09	1												**0**			
10/17/09	1												**0**			
10/18/09	1												**0**			
10/19/09	1												**0**			
10/20/09	1												**0**			
10/21/09	1												**0**			
10/22/09	1												**0**			
10/23/09	1												**0**			
10/24/09	1												**0**			
10/25/09	1												**0**			
10/26/09	1												**0**			
10/27/09	1												**0**			
10/28/09	1												**0**			
10/29/09	1												**0**			
10/30/09	1												**0**			
10/31/09	1												**0**			
11/01/09	1												**0**			
11/02/09	1												**0**			
11/03/09	1												**0**			
11/04/09	1												**0**			
By Species		**0**	**0**	**0**	**0**	**11**	**0**	**0**	**0**	**11**	**0**	**0**	**22**			
By Guild		**0**			**0**	**11**	**0**			**11**						
		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 Bowers 2 tree detector – Fall, 2009

		BBSH			HB	MYSP	RBTB			UNKN			Total	Wind Speed (m/s)	Temperature (celsius)	Barometric Pressure
Night of	Operational?	BBSH	Big brown	Silver-haired	Hoary	MYSP	Eastern red	Tri-colored	RBTB	HFUN	LFUN	UNKN				
09/04/09	1			1		477			1	453			**932**	6.49	14.3	956.3
09/05/09	1					15				30			**45**	6.79	9.1	962.8
09/06/09	1												**0**	7.63	11.2	965.2
09/07/09	1												**0**	8.46	13.0	957.2
09/08/09	1					126				448			**574**	6.31	12.7	958.7
09/09/09	1					14				29			**43**	3.83	9.5	967.5
09/10/09	1									3			**3**	8.40	9.5	968.6
09/11/09	1					1				1			**2**	7.39	12.1	961.2
09/12/09	1					2				3			**5**	6.02	16.3	951.8
09/13/09	1					12				40			**52**	7.25	11.9	946.3
09/14/09	1					30				12			**42**	6.06	12.4	946.2
09/15/09	1					1				4			**5**	5.10	8.0	959.2
09/16/09	1					1				1			**2**	2.95	6.4	965.9
09/17/09	1												**0**	8.51	9.0	951.9
09/18/09	0												**0**	8.40	8.2	948.0
09/19/09	0												**0**	6.92	6.7	960.1
09/20/09	0												**0**	4.88	12.7	961.1
09/21/09	0												**0**	7.74	15.1	962.3
09/22/09	0												**0**	6.30	16.3	957.6
09/23/09	1												**0**	6.37	18.1	949.8
09/24/09	1												**0**	4.52	10.1	953.6
09/25/09	1												**0**	5.29	2.0	964.7
09/26/09	1												**0**	8.12	7.9	954.4
09/27/09	1												**0**	8.34	14.3	940.5
09/28/09	1												**0**	4.52	14.7	939.3
09/29/09	1												**0**	6.68	11.6	938.5
09/30/09	1												**0**	4.97	9.2	945.4
10/01/09	1												**0**	3.50	6.4	951.3
10/02/09	1												**0**	1.53	6.3	956.9
10/03/09	1												**0**	7.30	10.3	953.8
10/04/09	1												**0**	5.59	11.3	946.0
10/05/09	1												**0**	8.31	7.9	943.0
10/06/09	1												**0**	6.49	8.1	945.1
10/07/09	1												**0**	7.18	7.2	935.5
10/08/09	1												**0**	5.71	6.6	951.6
10/09/09	1												**0**	2.78	9.7	943.8
10/10/09	1												**0**	8.13	1.9	951.3
10/11/09	1												**0**	9.17	2.4	954.8
10/12/09	1												**0**	3.68	3.9	958.4
10/13/09	1												**0**	7.77	0.4	951.9
10/14/09	1												**0**	6.93	(0.8)	954.6
10/15/09	1												**0**			
10/16/09	1												**0**			
10/17/09	1												**0**			
10/18/09	1												**0**			
10/19/09	1												**0**			
10/20/09	1												**0**			
10/21/09	1												**0**			
10/22/09	1												**0**			
10/23/09	1												**0**			
10/24/09	1												**0**			
10/25/09	1												**0**			
By Species		**0**	**0**	**1**	**0**	**679**	**0**	**0**	**1**	**1024**	**0**	**0**	**1705**			
By Guild		**1**			**0**	**679**	**1**			**1024**						
		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 Bowers 3 tree detector – Fall, 2009

		BBSH			HB	MYSP	RBTB			UNKN			Total	Wind Speed (m/s)	Temperature (celsius)	Barometric Pressure
Night of	**Operational?**	**BBSH**	**Big brown**	**Silver-haired**	**Hoary**	**MYSP**	**Eastern red**	**Tri-colored**	**RBTB**	**HFUN**	**LFUN**	**UNKN**				
09/04/09	1	2	2			15			1	11			**31**	6.49	14.3	956.3
09/05/09	1			1		7				3			**11**	6.79	9.1	962.8
09/06/09	1					6				6			**12**	7.63	11.2	965.2
09/07/09	1		1			2				10			**13**	8.46	13.0	957.2
09/08/09	1		1			8				18			**27**	6.31	12.7	958.7
09/09/09	1					5				10			**15**	3.83	9.5	967.5
09/10/09	1					1				3			**4**	8.40	9.5	968.6
09/11/09	1					3				12			**15**	7.39	12.1	961.2
09/12/09	1	1	1			3				20			**25**	6.02	16.3	951.8
09/13/09	1					2				4			**6**	7.25	11.9	946.3
09/14/09	1					4				26			**30**	6.06	12.4	946.2
09/15/09	1					9			1	7			**17**	5.10	8.0	959.2
09/16/09	1					1							**1**	2.95	6.4	965.9
09/17/09	1									2			**2**	8.51	9.0	951.9
09/18/09	1									3			**3**	8.40	8.2	948.0
09/19/09	1									1			**1**	6.92	6.7	960.1
09/20/09	1					1			1	22			**24**	4.88	12.7	961.1
09/21/09	1		2			5				8			**15**	7.74	15.1	962.3
09/22/09	1									3			**3**	6.30	16.3	957.6
09/23/09	1					1				3			**4**	6.37	18.1	949.8
09/24/09	1					10				7			**17**	4.52	10.1	953.6
09/25/09	1					1							**1**	5.29	2.0	964.7
09/26/09	1												**0**	8.12	7.9	954.4
09/27/09	1									1			**1**	8.34	14.3	940.5
09/28/09	1									1			**1**	4.52	14.7	939.3
09/29/09	1									1			**1**	6.68	11.6	938.5
09/30/09	1									1			**1**	4.97	9.2	945.4
10/01/09	1												**0**	3.50	6.4	951.3
10/02/09	1												**0**	1.53	6.3	956.9
10/03/09	1					1							**1**	7.30	10.3	953.8
10/04/09	1												**0**	5.59	11.3	946.0
10/05/09	1												**0**	8.31	7.9	943.0
10/06/09	1									2			**2**	6.49	8.1	945.1
10/07/09	1												**0**	7.18	7.2	935.5
10/08/09	1												**0**	5.71	6.6	951.6
10/09/09	1												**0**	2.78	9.7	943.8
10/10/09	1												**0**	8.13	1.9	951.3
10/11/09	1												**0**	9.17	2.4	954.8
10/12/09	1												**0**	3.68	3.9	958.4
10/13/09	1												**0**	7.77	0.4	951.9
10/14/09	1												**0**	6.93	(0.8)	954.6
10/15/09	1									1			**1**			
10/16/09	1												**0**			
10/17/09	1									2			**2**			
10/18/09	1									1			**1**			
10/19/09	1						1						**1**			
10/20/09	1									2			**2**			
10/21/09	1												**0**			
10/22/09	1												**0**			
10/23/09	1												**0**			
10/24/09	1												**0**			
10/25/09	1												**0**			
10/26/09	1												**0**			
10/27/09	1												**0**			
By Species		**3**	**7**	**1**	**0**	**85**	**1**	**0**	**3**	**191**	**0**	**0**	**291**			
By Guild		**11**			**0**	**85**	**4**			**191**						
		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 4. Summary of acoustic bat data and weather during each survey night at the Bowers 4 tree detector – Fall 2009

Night of	Operational?	BBSH			HB	MYSP	RBTB			UNKN			Total	Wind Speed (m/s)	Temperature (celsius)	Barometric Pressure
		BBSH	Big brown	Silver-haired	Hoary	MYSP	Eastern red	Tri-colored	RBTB	HFUN	LFUN	UNKN				
09/04/09	1												**0**	6.49	14.3	956.3
09/05/09	1												**0**	6.79	9.1	962.8
09/06/09	1												**0**	7.63	11.2	965.2
09/07/09	1												**0**	8.46	13.0	957.2
09/08/09	1												**0**	6.31	12.7	958.7
09/09/09	1					1							**1**	3.83	9.5	967.5
09/10/09	1					1							**1**	8.40	9.5	968.6
09/11/09	1					1				1			**2**	7.39	12.1	961.2
09/12/09	1					2				1			**3**	6.02	16.3	951.8
09/13/09	1									1			**1**	7.25	11.9	946.3
09/14/09	1									2			**2**	6.06	12.4	946.2
09/15/09	1												**0**	5.10	8.0	959.2
09/16/09	1												**0**	2.95	6.4	965.9
09/17/09	1												**0**	8.51	9.0	951.9
09/18/09	1												**0**	8.40	8.2	948.0
09/19/09	1												**0**	6.92	6.7	960.1
09/20/09	1									1			**1**	4.88	12.7	961.1
09/21/09	1												**0**	7.74	15.1	962.3
09/22/09	1												**0**	6.30	16.3	957.6
09/23/09	1												**0**	6.37	18.1	949.8
09/24/09	1									2			**2**	4.52	10.1	953.6
09/25/09	1												**0**	5.29	2.0	964.7
09/26/09	1												**0**	8.12	7.9	954.4
09/27/09	1												**0**	8.34	14.3	940.5
09/28/09	1									1			**1**	4.52	14.7	939.3
09/29/09	1												**0**	6.68	11.6	938.5
09/30/09	1												**0**	4.97	9.2	945.4
10/01/09	1												**0**	3.50	6.4	951.3
10/02/09	1												**0**	1.53	6.3	956.9
10/03/09	1												**0**	7.30	10.3	953.8
10/04/09	1												**0**	5.59	11.3	946.0
10/05/09	1												**0**	8.31	7.9	943.0
10/06/09	1												**0**	6.49	8.1	945.1
10/07/09	1												**0**	7.18	7.2	935.5
10/08/09	0												**0**	5.71	6.6	951.6
10/09/09	0												**0**	2.78	9.7	943.8
10/10/09	0												**0**	8.13	1.9	951.3
10/11/09	0												**0**	9.17	2.4	954.8
10/12/09	0												**0**	3.68	3.9	958.4
10/13/09	0												**0**	7.77	0.4	951.9
10/14/09	0												**0**	6.93	(0.8)	954.6
10/15/09	1												**0**			
10/16/09	1												**0**			
10/17/09	1												**0**			
10/18/09	1												**0**			
10/19/09	1												**0**			
10/20/09	1												**0**			
10/21/09	1												**0**			
10/22/09	1												**0**			
10/23/09	1												**0**			
10/24/09	1												**0**			
10/25/09	1												**0**			
10/26/09	1												**0**			
10/27/09	1												**0**			
10/28/09	1												**0**			
10/29/09	1												**0**			
10/30/09	1												**0**			
10/31/09	1												**0**			
11/01/09	1												**0**			
11/02/09	1												**0**			
11/03/09	1												**0**			
11/04/09	1												**0**			
By Species		**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**9**	**0**	**0**	**14**			
By Guild		**0**			**0**	**5**	**0**			**9**						
		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 5. Summary of acoustic bat data and weather during each survey night at the Bowers 5 tree detector – Fall, 2009

Night of	Operational?	BBSH			HB	MYSP	RBTB			UNKN			Total	Wind Speed (m/s)	Temperature (celsius)	Barometric Pressure
		BBSH	Big brown	Silver-haired	Hoary	MYSP	Eastern red	Tri-colored	RBTB	HFUN	LFUN	UNKN				
09/04/09	1			1		20				19			**40**	6.49	14.3	956.3
09/05/09	1					5				24			**29**	6.79	9.1	962.8
09/06/09	1									1			**1**	7.63	11.2	965.2
09/07/09	1					5				2	1		**8**	8.46	13.0	957.2
09/08/09	1	1		1		7			1	3			**13**	6.31	12.7	958.7
09/09/09	1					1				1			**2**	3.83	9.5	967.5
09/10/09	1		2			13				3			**18**	8.40	9.5	968.6
09/11/09	1									25			**25**	7.39	12.1	961.2
09/12/09	1									2			**2**	6.02	16.3	951.8
09/13/09	1									11			**11**	7.25	11.9	946.3
09/14/09	1									152			**152**	6.06	12.4	946.2
09/15/09	1												**0**	5.10	8.0	959.2
09/16/09	1												**0**	2.95	6.4	965.9
09/17/09	1												**0**	8.51	9.0	951.9
09/18/09	1												**0**	8.40	8.2	948.0
09/19/09	1												**0**	6.92	6.7	960.1
09/20/09	1												**0**	4.88	12.7	961.1
09/21/09	1												**0**	7.74	15.1	962.3
09/22/09	1												**0**	6.30	16.3	957.6
09/23/09	1					1				1			**2**	6.37	18.1	949.8
09/24/09	1									1			**1**	4.52	10.1	953.6
09/25/09	1									1			**1**	5.29	2.0	964.7
09/26/09	1												**0**	8.12	7.9	954.4
09/27/09	1					1							**1**	8.34	14.3	940.5
09/28/09	1					3				5			**8**	4.52	14.7	939.3
09/29/09	1												**0**	6.68	11.6	938.5
09/30/09	1												**0**	4.97	9.2	945.4
10/01/09	1												**0**	3.50	6.4	951.3
10/02/09	1												**0**	1.53	6.3	956.9
10/03/09	1												**0**	7.30	10.3	953.8
10/04/09	1					1				1			**2**	5.59	11.3	946.0
10/05/09	1												**0**	8.31	7.9	943.0
10/06/09	1									1			**1**	6.49	8.1	945.1
10/07/09	1												**0**	7.18	7.2	935.5
10/08/09	1												**0**	5.71	6.6	951.6
10/09/09	1												**0**	2.78	9.7	943.8
10/10/09	1	1											**1**	8.13	1.9	951.3
10/11/09	1												**0**	9.17	2.4	954.8
10/12/09	1												**0**	3.68	3.9	958.4
10/13/09	1												**0**	7.77	0.4	951.9
10/14/09	1												**0**	6.93	(0.8)	954.6
10/15/09	1												**0**			
10/16/09	1												**0**			
10/17/09	1												**0**			
10/18/09	1												**0**			
10/19/09	1												**0**			
10/20/09	1												**0**			
10/21/09	1												**0**			
10/22/09	1												**0**			
10/23/09	1												**0**			
10/24/09	1												**0**			
10/25/09	1												**0**			
10/26/09	1												**0**			
10/27/09	1												**0**			
10/28/09	1												**0**			
10/29/09	1												**0**			
10/30/09	1												**0**			
10/31/09	1												**0**			
11/01/09	1												**0**			
11/02/09	1												**0**			
11/03/09	1												**0**			
11/04/09	1												**0**			
By Species		**2**	**2**	**2**	**0**	**57**	**0**	**0**	**1**	**253**	**1**	**0**	**318**			
By Guild		**6**			**0**	**57**	**1**			**254**						
		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 6. Summary of acoustic bat data and weather during each survey night at the Bowers 6 tree detector – Fall, 2009

Night of	Operational?	BBSH			HB	MYSP	RBTB			UNKN			Total	Wind Speed (m/s)	Temperature (celsius)	Barometric Pressure
		BBSH	Big brown	Silver-haired	Hoary	MYSP	Eastern red	Tri-colored	RBTB	HFUN	LFUN	UNKN				
09/04/09	1	1				1							**2**	6.49	14.3	956.3
09/05/09	1												**0**	6.79	9.1	962.8
09/06/09	1												**0**	7.63	11.2	965.2
09/07/09	1									1			**1**	8.46	13.0	957.2
09/08/09	1									2			**2**	6.31	12.7	958.7
09/09/09	1					1				2			**3**	3.83	9.5	967.5
09/10/09	1												**0**	8.40	9.5	968.6
09/11/09	1										1		**1**	7.39	12.1	961.2
09/12/09	1												**0**	6.02	16.3	951.8
09/13/09	1					1				1			**2**	7.25	11.9	946.3
09/14/09	1												**0**	6.06	12.4	946.2
09/15/09	1												**0**	5.10	8.0	959.2
09/16/09	1												**0**	2.95	6.4	965.9
09/17/09	1												**0**	8.51	9.0	951.9
09/18/09	1												**0**	8.40	8.2	948.0
09/19/09	1									1			**1**	6.92	6.7	960.1
09/20/09	1									6			**6**	4.88	12.7	961.1
09/21/09	1									2			**2**	7.74	15.1	962.3
09/22/09	1												**0**	6.30	16.3	957.6
09/23/09	1												**0**	6.37	18.1	949.8
09/24/09	1									1			**1**	4.52	10.1	953.6
09/25/09	1												**0**	5.29	2.0	964.7
09/26/09	1												**0**	8.12	7.9	954.4
09/27/09	1												**0**	8.34	14.3	940.5
09/28/09	1												**0**	4.52	14.7	939.3
09/29/09	1												**0**	6.68	11.6	938.5
09/30/09	1												**0**	4.97	9.2	945.4
10/01/09	1												**0**	3.50	6.4	951.3
10/02/09	1												**0**	1.53	6.3	956.9
10/03/09	1												**0**	7.30	10.3	953.8
10/04/09	1												**0**	5.59	11.3	946.0
10/05/09	1									3			**3**	8.31	7.9	943.0
10/06/09	1												**0**	6.49	8.1	945.1
10/07/09	1												**0**	7.18	7.2	935.5
10/08/09	1												**0**	5.71	6.6	951.6
10/09/09	1												**0**	2.78	9.7	943.8
10/10/09	1												**0**	8.13	1.9	951.3
10/11/09	1												**0**	9.17	2.4	954.8
10/12/09	1												**0**	3.68	3.9	958.4
10/13/09	1												**0**	7.77	0.4	951.9
10/14/09	1												**0**	6.93	(0.8)	954.6
10/15/09	1												**0**			
10/16/09	1												**0**			
10/17/09	1												**0**			
10/18/09	1												**0**			
10/19/09	1												**0**			
10/20/09	1												**0**			
10/21/09	1												**0**			
10/22/09	1												**0**			
10/23/09	1												**0**			
10/24/09	1												**0**			
10/25/09	1												**0**			
10/26/09	1												**0**			
10/27/09	1												**0**			
10/28/09	1												**0**			
10/29/09	1												**0**			
10/30/09	1												**0**			
10/31/09	1												**0**			
11/01/09	1												**0**			
11/02/09	1												**0**			
11/03/09	1												**0**			
11/04/09	1												**0**			
By Species		**1**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**19**	**1**	**0**	**24**			
By Guild		**1**			**0**	**3**	**0**			**20**						
		BBSH			**HB**	**MYSP**	**RBTB**			**UNKN**			**Total**			

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

Appendix C

Raptor Survey results

Appendix C Table 1. Daily totals of raptor species observed and daily passage rates - Bowers Fall 2009																
Species	9/9	9/10	9/16	9/17	9/22	9/24	9/29	9/30	10/1	10/6	10/8	10/9	10/11	10/12	10/14	**Grand Total**
American kestrel	0	1	2	1	0	0	0	0	0	0	0	0	0	2	0	6
bald eagle	0	0	2	0	0	0	0	0	0	0	1	0	1	1	1	6
broad-winged hawk	2	3	2	0	1	0	0	0	0	0	0	0	0	0	0	8
merlin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
northern harrier	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
osprey	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
red-tailed hawk	0	0	1	0	0	1	1	0	0	1	1	1	0	2	2	10
sharp-shinned hawk	0	1	7	1	0	2	0	0	0	0	2	0	0	3	1	17
turkey vulture	2	0	6	5	3	4	2	4	3	2	3	1	1	1	7	44
unidentified raptor	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Grand Total	**4**	**5**	**21**	**7**	**4**	**7**	**3**	**4**	**3**	**3**	**8**	**2**	**2**	**10**	**12**	**95**
Daily Passage Rate	0.57	0.71	3.00	1.00	0.57	1.00	0.43	0.57	0.43	0.43	1.14	0.29	0.29	1.43	1.71	**0.90**

Appendix C Table 2. Hourly summary of raptor observations - Bowers Fall 2009								
Species	**9:00-10:00**	**10:00-11:00**	**11:00-12:00**	**12:00-1:00**	**1:00-2:00**	**2:00-3:00**	**3:00-4:00**	**Grand Total**
American kestrel	0	0	5	0	0	0	1	6
bald eagle	2	3	1	0	0	0	0	6
broad-winged hawk	1	1	0	2	1	1	2	8
merlin	0	0	1	0	0	0	0	1
northern harrier	0	1	0	0	0	0	0	1
osprey	0	1	0	0	0	0	0	1
osprey	0	4	2	1	1	2	0	10
sharp-shinned hawk	3	2	6	2	0	2	2	17
turkey vulture	6	1	12	4	5	7	9	44
unidentified raptor	0	0	0	0	0	1	0	1
Hourly totals	**7**	**13**	**27**	**9**	**13**	**14**	**12**	**95**

Appendix C Table 3. Number of individuals of species observed within Project in proposed turbine areas (flight positions A1, A2, A3, and/or B) above or below 119 m - Bowers Fall 2009.

Species	119 m or greater	less than 119 m
American kestrel	1	5
bald eagle	0	2
broad-winged hawk	4	1
merlin	0	1
northern harrier	0	1
osprey	0	1
red-tailed hawk	4	6
sharp-shinned hawk	6	11
turkey vulture	7	37
unidentified raptor	0	1
TOTAL	**22**	**66**

* Note: four bald eagles and three broad-winged hawks were observed outside of the Project area

Appendix C Table 4. Summary of raptor flight behaviors - Bowers Fall 2009.

Species	LS	G	CS	PF	B	D	CF	K	HO	AF	LAH	P	AD	AC	VO	Grand Total
American kestrel	5	0	5	1	0	0	0	0	0	0	0	0	0	0	0	11
bald eagle	6	0	4	4	1	0	0	0	0	0	0	0	0	0	0	15
broad-winged hawk	4	3	2	0	1	0	0	1	0	0	0	0	0	0	0	11
merlin	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
northern harrier	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
osprey	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
red-tailed hawk	9	0	9	0	0	0	0	3	0	0	0	0	0	0	0	21
sharp-shinned hawk	15	1	15	1	1	0	0	0	0	0	0	0	0	0	1	34
turkey vulture	41	5	21	29	10	0	0	0	0	0	2	0	0	0	0	108
unidentified raptor	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Total	**84**	**10**	**58**	**36**	**13**	**0**	**0**	**4**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**208**

LS: Linear Soaring
G: Gliding
CS: Circle Soaring
PF: Powered Flight
B: Banking
D: Diving
CF : Carrying Food
K: Kiting
HO: Hovering
AF Aerial Feeding
LAH : Low Aerial Hunting
P: Perched
AD: Aerial Display
AC: Aerial Courtship
VO: Vocalizing

Appendix C Table 5 . Incidental birds observed in the Project area during raptor survey - Bowers Fall 2009.

American robin	*Turdus migratorius*
black-capped chickadee	*Poecile atricapilla*
blue jay	*Cyanocitta cristata*
black-throated blue warbler	*Dendroica caerulescens*
black-throated green warbler	*Dendroica virens*
common grackle	*Quiscalus quiscula*
common raven	*Corvus corax*
common yellowthroat	*Geothlypis trichas*
chestnut-sided warbler	*Dendroica pensylvanica*
dark-eyed junco	*Junco hyemalis*
downy woodpecker	*Picoides pubescens*
golden-crowned kinglet	*Regulus satrapa*
magnolia warbler	*Dendroica magnolia*
mourning dove	*Zenaida macroura*
Nashville warbler	*Vermivora ruficapilla*
northern flicker	*Colaptes auratus*
red-breasted nuthatch	*Sitta canadensis*
red-eyed vireo	*Vireo olivaceus*
ruffed grouse	*Bonasa umbellus*
song sparrow	*Melospiza melodia*
Tennessee warbler	*Vermivora peregrina*
white-breasted nuthatch	*Sitta carolinensis*
white-throated sparrow	*Zonotrichia albicollis*
yellow-rumped warbler	*Dendroica coronata*

Appendix C, Table 6. Summary of results from simultaneous raptor surveys at Bowers and Stetson

	Species	9/9/2009	9/16/2009	9/24/2009	10/8/2009	10/9/2009	10/14/2009
Bowers	American kestrel	0	2	0	0	0	0
	bald eagle	0	2	0	1	0	1
	broad-winged hawk	2	2	0	0	0	0
	merlin	0	0	0	0	0	1
	northern harrier	0	0	0	1	0	0
	osprey	0	1	0	0	0	0
	red-tailed hawk	0	1	1	1	1	2
	sharp-shinned hawk	0	7	2	2	0	1
	turkey vulture	2	6	4	3	1	7
	unidentified raptor	0	0	0	0	0	0
	Total Raptors	**4**	**21**	**7**	**8**	**2**	**12**
Stetson	American kestrel	0	0	0	0	0	0
	broad-winged hawk	1	6	1	0	0	0
	Cooper's hawk	0	1	0	1	0	0
	northern harrier	0	1	0	0	0	0
	osprey	0	2	0	0	0	0
	peregrine falcon	1	0	0	0	0	0
	red-tailed hawk	5	3	4	1	0	0
	sharp-shinned hawk	1	1	0	0	0	0
	turkey vulture	0	0	2	1	0	0
	unidentified buteo	0	0	0	0	0	0
	unidentified raptor	0	0	1	0	0	0
	Total Raptors	**8**	**14**	**7**	**3**	**0**	**0**

Appendix C Table 7. Summary of Regional Outbound (August to November, 2009) Migration Surveys*

Site #	Location	Site Topography	Distance (miles)**	Observation Hours	BV	TV	OS	BE	NH	SS	CH	NG	RS	BW	RT	RL	GE	AK	ML	PG	UR	UB	UA	UF	UE	TOTAL	BIRDS/ HOUR
1	Bowers Wind Project; Carroll Plt, ME	inland ridge	--	105	0	44	1	6	1	17	0	0	0	8	10	0	0	6	1	0	1	0	0	0	0	95	**0.9**
2	Stetson Mountain Wind Project; T8 R4 Twp; ME	inland ridge	8	50	0	4	3	0	1	2	2	0	0	8	22	0	0	0	0	1	1	1	0	0	0	45	**0.9**
3	Greenlaw Mountain; Saint Andrews, NB	coastal ridge	48	256.75	0	99	111	46	39	593	11	13	5	1457	152	0	0	129	38	13	55	3	1	1	3	2769	**10.8**
4	Cadillac Mountain; Acadia NP, ME	coastal ridge	72	282.75	0	74	154	33	132	1569	20	20	2	225	74	0	1	557	74	35	64	3	3	7	0	3047	**10.8**
5	Harpswell Peninsula/Casco Bay; Harpswell, ME	coastal lowland	150	224.25	0	63	301	51	125	1910	83	10	11	532	55	0	0	602	216	101	39	3	3	19	0	4124	**18.4**
6	Pack Monodnack; Peterborough, NH	inland ridge	258	420.75	0	80	182	51	88	1196	133	25	129	4322	421	0	6	135	56	30	77	14	8	8	2	6963	**16.5**
7	Pitcher Mountain; Stoddard, NH	inland ridge	258	55	0	3	0	14	4	9	0	3	4	0	106	0	2	0	1	0	3	1	0	0	4	154	**2.8**
8	Putney Mountain, Putney, VT	inland ridge	281	391.5	0	164	144	44	41	1080	110	23	41	3627	421	3	5	129	25	35	2	0	0	1	0	5895	**15.1**

* Data obtained from http://hawkcount.org; accessed 1 December 2009.

** Straight-line distance from Bowers Wind Project raptor observation location to HMANA site.

Appendix C Table 8. Summary of available fall raptor survey results at forested ridge wind sites in the east

Project Site	Landscape	Survey Period	# of Survey Days	# of Survey Hours	Total # Observed	# of Species Observed	Ave. Passage Rate (Raptors/Hr)	(Turbine Ht) % Raptors Below Turbine Height	Seasonal Passage Rate (raptors/hr)	(Turbine Ht) and % Raptors Below Turbine Height	Reference
Fall 1996											
Searsburg, Bennington County, VT	Forested ridge	Sept. 11 - Nov. 3	20	80	430	12	5.38	n/a	5.4	n/a	Kerlinger, Paul. 1996. A Study of Hawk Migration at Green Mountain Power Corporation's Searsburg, Vermont, Wind Powewer Site: Autumn 1996. Prepared for the Vermont Public Service Board, Green Mountain Power, National Renewable Ener gy Laboratory, VERA.
Fall 2004											
Deerfield, Bennington Cty, VT (Existing Facility)	Forested ridge	Sept. 2 - Oct. 31	10	60	147	11 for both sites combined	2.45	(100 m) 9% for both sites combined	2.5	(100 m) 9% for sites combined	Woodlot Alternatives, Inc. 2005. Fall 2004 Avian Migration Surveys at the Proposed Deerfield Wind/Searsburg Expansion Project in Searsburg and Readsboro, Vermont. Prepared for Deerfield Wind, LLC and Vermont Environmental Research Associates.
Deerfield, Bennington Cty, VT (Western Expansion)	Forested ridge	Sept. 2 - Oct. 31	10	57	725	11 for both sites combined	12.72	(100 m) 9% for both sites combined	12.7	(100 m) 9% for sites combined	Woodlot Alternatives, Inc. 2005. Fall 2004 Avian Migration Surveys at the Proposed Deerfield Wind/Searsburg Expansion Project in Searsburg and Readsboro, Vermont. Prepared for Deerfield Wind, LLC and Vermont Environmental Research Associates.
Sheffield, Caledonia Cty, VT	Forested ridge	Sept. 11 - Oct. 14	10	60	193	10	3.2	(125 m) 31%	3.2	(125 m) 31%	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.
Fall 2005											
New Grange, Chautauqua Cty, NY	Forested ridge	Sept. 17 - Oct. 15*	6	18	49	5	4.37	n/a	4.4	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
Moresville, Deleware Cty, NY	Forested ridge	Aug. 31 - Nov. 3	11	72	228	11	3.2	n/a	3.2	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
Mars Hill, Aroostook Cty, ME	Forested ridge	Sept. 9 - Oct. 13	8	42.5	115	13	1.52	(120 m) 42%	1.5	(120 m) 42%	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.
Lempster, Sullivan County, NH	Forested ridge	Fall 2005	10	80	264	10	3.3	(125 m) 40%	3.3	(125 m) 40%	Woodlot Alternatives, Inc. 2007. Lempster Wind Farm Wildlife Habitat Summary and Assessment. Prepared for Lempster Wind, LLC.
Fall 2006											
Stetson, Penobscot Cty, ME	Forested ridge	Sept. 14 - Oct. 26	7	42	86	11	2.05	(125 m) 63%	2.1	(125 m) 63%	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.
Lincoln, Penobscot Cty, ME	Forested ridge	Sept. 13 - Oct. 16	12	89	144	12	1.8	(120 m) 82%	1.8	(120 m) 82%	Woodlot Alternatives, Inc. 2007. Fall 2006 Survey of Bird and Bat Migration at the Proposed Stetson Wind Power Project in Washington County, Maine. Prepared for Evergreen Wind V.
Fall 2007											
Roxbury, Oxford Cty, ME	Forested ridge	Sept. 3 - Oct. 15	14	86	96	12	1.1	n/a	1.1	n/a	Stantec Consulting. 2008. Fall 2007 Migration Survey 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.
Errol, Coos Cty, NH	Forested ridge	Sept. 5 - Oct. 16	11	68	44	9	0.7	n/a	0.7	n/a	Stantec Consulting. 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.

(*continued*)

Appendix C Table 8 (cont.)

Laurel Mountain, Preston Cty, WV	Forested ridge	Sept. 12 - Dec. 1	24	147	769	12	5.2	(125 m) 65%	5.2	(125 m) 65%	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.
Greenland, Grant Cty, WV	Forested ridge	Sept. 12 - Dec. 1	27		858	13	5.9	(125 m) 67%	5.9	(125 m) 67%	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.
New Grange, Chautauqua Cty, NY	Forested ridge	Sept. 21 - Oct. 28	6	n/a	n/a	n/a	4.37	n/a	4.4	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
Allegany, Cattaraugus Cty, NY	Forested ridge	Sept. 8 - Oct. 11	11	63.78	125	10	1.96	(150 m) 78%	2.0	78%	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
Fall 2009											
Bowers, Washington Cty, ME	Forested ridge	Sept. 9 - Oct. 14	15	105	95	9			0.9	(119 m) 69%	*this report*

*Calculated for spring and fall combined.

**Calculated for spring and fall 2006 and 2007 combined.

***Non-migrants were not included in seasonal passage rates in NYSDEC 2008 table but were included in passage rates here.

DRAFT 2010 Spring Avian and Spring/Summer Bat Surveys

for the Bowers Wind Project
Carroll Plantation and Kossuth Township, Maine

Prepared for

Champlain Wind Energy, LLC
179 Lincoln St, Suite 500
Boston, MA 02111

Prepared by

Stantec Consulting Services Inc.
30 Park Drive
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Stantec

September 2010

Executive Summary

During spring-summer 2010 Stantec Consulting Services Inc. (Stantec) conducted a second season of field surveys of bird and bat migration activity at the proposed Bowers Wind Project in Carroll Plantation and Kossuth Township, Maine (Project). Surveys included nocturnal marine radar surveys, bat detector surveys, and raptor migration field surveys. This report includes results of spring 2010 radar and raptor surveys and the spring and summer 2010 bat acoustic survey.

Radar Survey

Radar surveys were conducted during 20 nights in spring 2010 (between April 16 and May 25) 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 Bowers Mountain and provided good views in all directions.

The overall passage rate for the entire fall survey period was 289 targets per kilometer per hour (t/km/hr), and nightly passage rates varied from 20 ± 5 to 589 ± 97 t/km/hr. Mean flight direction through the Project area for the season was 56± 56°. The seasonal mean flight height of targets was 243 ± 10 meters (m; 797 ft [']) above the radar site, and nightly flight heights ranged from 110 ± 12 m (661') to 418 ± 82 m (1371'). The percent of targets observed flying below maximum turbine height of 131 m (429') was 26 percent for the entire season and varied by night, from 9 to 74percent.

In summary, results at the Project are within the range of results recorded at other radar studies conducted in the east.

Bat Detector Survey

Six Anabat® acoustic bat detectors were deployed throughout the Project area between April 15 through September 4 to document bat activity. Two detectors were deployed in the Bowers Mountain met tower and four were deployed at or below tree canopy height in trees. 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 784 detector nights of data and 91 percent detector success rate. During this survey period, 9825 call sequences were recorded, resulting in a detection rate of 12.5 call sequences per detector-night.

Patterns in detection rates are similar to the results of other surveys in the region for both tree and met tower detectors. Tree detectors are deployed at relatively low heights where increased bat activity levels are generally documented, particularly during the non-migratory periods. The two met tower detectors were deployed at heights of 20 to 40 m (66' to 131') and recorded increased activity levels during the latter part of May.

Raptor Migration Survey

Raptor migration surveys were conducted during 12 days in spring 2010 (April 21 through May 26) to document diurnal migration activity in the Project area. Visual observation surveys were conducted from 9 am to 4 pm from a prominent location in the Project area.

A total of 84 survey hours were conducted and a total of 131 raptors, representing nine species were observed. Turkey vulture (*Cathartes aura*) and red-tailed hawk (*Buteo jamaicensis*) represent the most commonly observed species. Daily counts ranged from 4 to 18 raptors and the overall passage rate was 1.56 birds/hour. Of raptors observed, 76 percent were observed in areas where turbines will be located. Seventy-five percent of observations of raptors within the Project area were documented at heights less than 131 m for at least a portion of their flight through the turbine areas.

Two state-listed species of special concern were observed, including six northern harrier (*Circus cyaneus*) and seven bald eagles (*Haliaeetus leucocephalus*), three of which were observed within the Project area.

The species composition and flight behaviors documented during the spring 2010 raptor surveys at the Project are typical among the results of other spring raptor migration studies in the region, while the overall passage rate at the Project was comparatively low.

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[*] *This report was prepared by Stantec Consulting Services Inc. for Champlain Wind Energy, 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

The Bowers Wind Project (Project) in Carroll Plantation and Kossuth Township, Maine (Figure 1-1, Photos 1-1 to 1-4) is expected to consist of up to 27 turbines. Multiple turbine types are being evaluated and the maximum turbine height would be 131 m (429'). As part of Project development, pre-construction avian and bat monitoring was conducted by Stantec Consulting Services Inc. (Stantec), on behalf of Champlain Energy, LLC (Champlain) during fall 2009 and spring-summer 2010. The work scope for spring-summer 2010 was developed in March 2010 in cooperation with the Maine Department of Inland Fisheries and Wildlife (MDIFW) and United States Fish and Wildlife Service (USFWS). Fall 2009 surveys included radar, raptor and acoustic surveys.

Stantec conducted field surveys for bird and bat migration during spring-summer 2010. The overall goals of the investigations were to document:

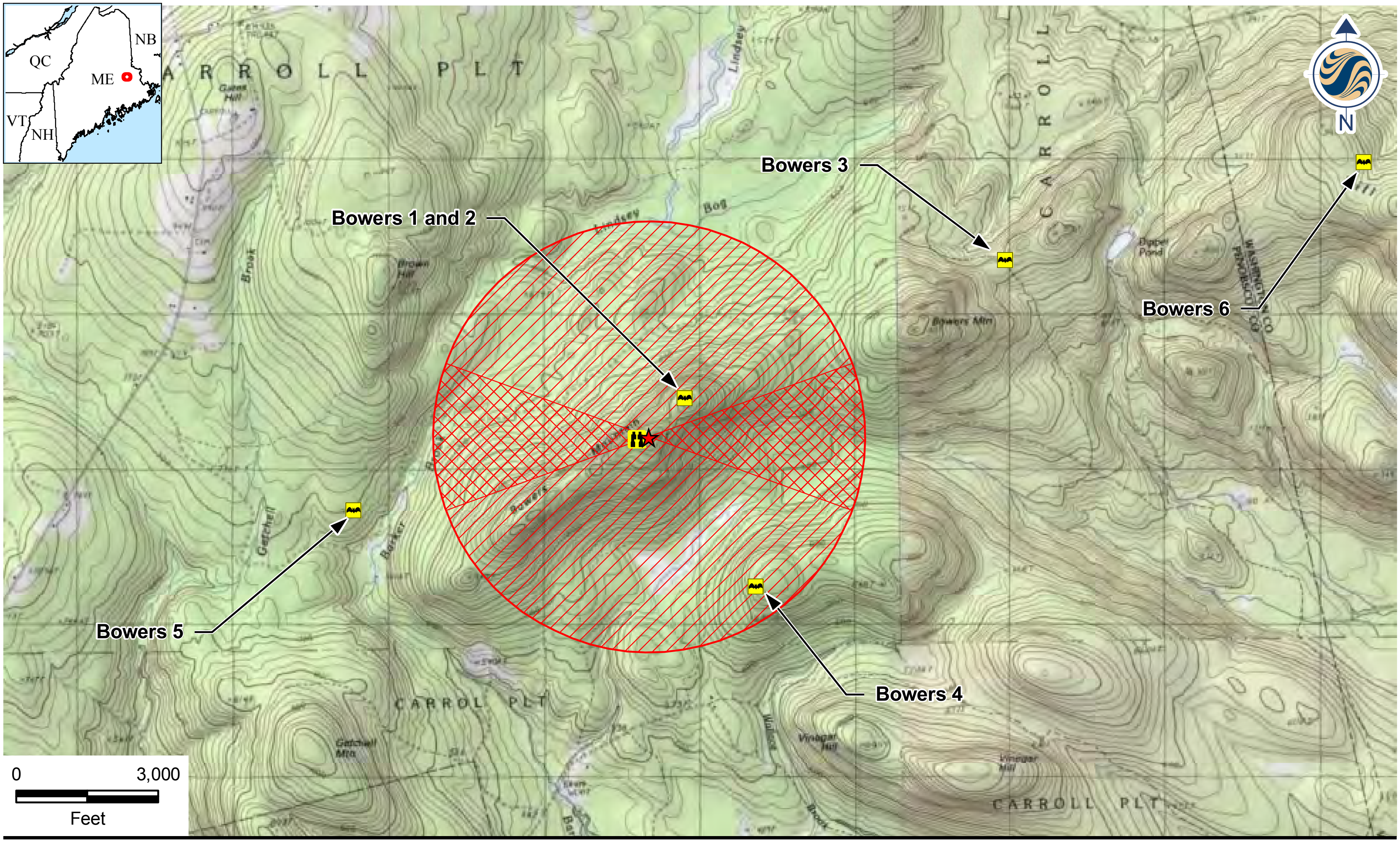
- passage rates for nocturnal migration in the vicinity of the Project area during spring, including the number of migrants, their flight direction, and their flight altitude;
- species composition and detection rate of bats within the area during spring and summer, including the relationship between activity levels and weather factors; and
- species composition, passage rate, flight paths, and flight heights of raptors observed in spring, as well as the passage of any rare, threatened, or endangered raptor species.

The Project consists of a series of low elevation ridgelines within the Project area. These ridgelines range in elevation from 750' to 1120' (feet) above sea level and consist of moderately steep to gentle sloping sides. There is limited access to each of the proposed turbine strings, primarily by way of unimproved logging roads. Most of the Project area has been harvested over the last 10 to 15 years. The Project is located approximately 8 miles south of the operational Stetson Wind Project and approximately 15 miles east of the proposed Rollins Wind Project. The Project area is owned primarily by three landowners.

The Project area is largely dominated by a regenerating Beech-Birch-Maple forest. Dominant canopy species include sugar maple (*Acer saccharum*), gray birch (*Betula populifolia*), yellow birch (*Betula alleghaniensis*), and green ash (*Fraxinus pennsylvanica*), with occasional white pine (*Pinus strobus*) scattered throughout. Common shrub species include the aforementioned tree species, along with American beech (*Fagus grandifolia*), striped maple (*Acer pensylvanicum*), hobblebush (*Viburnum lantanoides*), and red raspberry (*Rubus idaeus*). Dominant herbaceous species include wild sarsaparilla (*Aralia nudicaulis*), evergreen wood fern (*Dryopteris intermedia*), and starflower (*Trientalis borealis*). Areas of timber harvesting disturbance were largely dominated by herbaceous and shrub species, including red raspberry, Canada goldenrod (*Solidago canadensis*), and fireweed (*Epilobium angustifolium*).

The Project area is not located within listed Critical Habitat for any federally-listed threatened or endangered species, including Atlantic salmon and Canada lynx. The unofficial agency response to Stantec's letter requesting information from MDIFW identified two mapped Inland Wading Bird and Waterfowl Habitat (IWWH) within the general Project area between turbine strings. There are no known eagle nests within four miles of any proposed turbine[2].

[2] Based on the Bald Eagle Nest Survey memo from Stantec, June 22, 2010.



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00522-F001-Avian-Bat.mxd

Legend

- Bat Detectors
- Raptor Location
- Radar Location
- Alignment Vertical Radar Sweep
- Horizontal Radar Detection Range

Client/Project
Bowers Wind Project
Carroll Plt, Maine

Figure No.
1-1

Title
Avian/Bat Survey Locations
April 8, 2010

Photo 1-1. View to south from radar and raptor location

Photo 1-2. View to north towards Stetson Wind Project from radar and raptor location

Photo 1-3. View to east from radar and raptor location

Photo 1-4. View to west from radar and raptor location

2.0 Nocturnal Radar Survey

2.1 INTRODUCTION

Nocturnal radar surveys were conducted in the Project area to characterize spring 2010 nocturnal migration patterns. The majority of North American passerines (songbirds) migrate at night; the strategy of migrating at night may have evolved to take advantage of more stable atmospheric conditions for their flapping flight (Kerlinger 1995). Additionally, cooler nighttime temperatures may provide a more efficient medium to regulate body temperature during more active, flapping flight and reduce predation risk while in flight (Alerstam 1990, Kerlinger 1995). 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 Project area, including the number of migrants, their flight direction, and their flight altitude.

Radar surveys were conducted from sunset to sunrise on 20 nights between April 16 and May 25, 2010. The radar was located on the summit of Bowers Mountain at an elevation of 355 meters ([m], 1165'; Figure 1-1). Efforts were made to maximize the airspace sampled by elevating the antenna to approximately 5.5 m (18') to reduce the amount of the radar beam reflected back by surrounding vegetation; such reflection may cause ground clutter obstructions on the radar screen. The elevated radar resulted in an unobstructed view of the surrounding airspace within the radar's range settings. There was relatively little ground clutter interference, although vegetation in the immediate location of the radar obstructed the lower ten degrees of the radar beam. It is expected that the radar data collected from Bowers Mountain provided a good view of the airspace in most directions.

2.2 DATA COLLECTION METHODS

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 which captures past echoes of flight trails, enabling determination of flight direction. 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 5.5 m (18') 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 birds and bats flying over those areas (Figure 2-1).

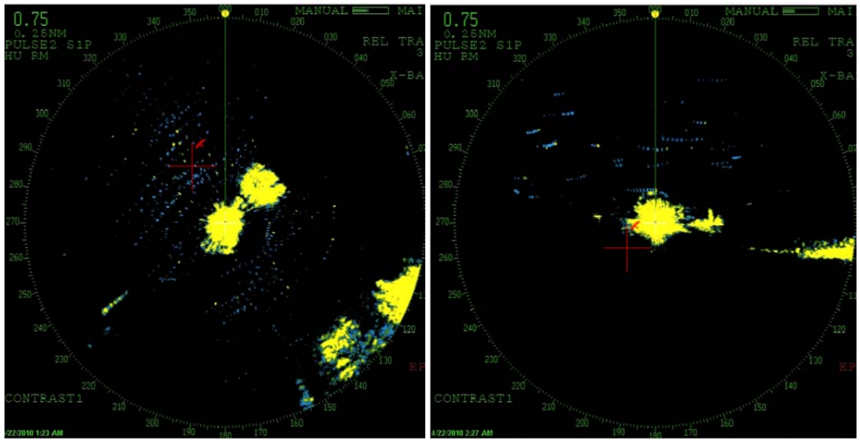

Figure 2-1. Screenshots from actual radar files for the Bowers Wind Project showing ground clutter in horizontal mode (left) and vertical mode (right). Although the radar records three-dimensional space, it is translated by the radar screen into a two dimensional representation, which can cause targets to be obscured from view.

However, vegetation and hilltops near the radar can be used to reduce or eliminate ground clutter by "hiding" clutter-causing objects from the radar (Figure 2-2). 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 – targets are indistinguishable from the "clutter" as represented on the radar screen. However, 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.

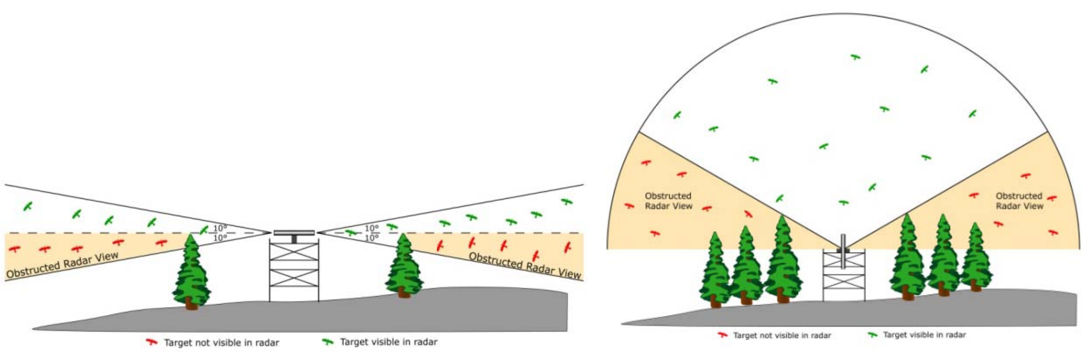

Figure 2-2. An example of ground clutter "hiding" a section of the radar beam, allowing adequate detection of targets (left). The effect of ground clutter on target detection in vertical mode is also shown (right).

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 conditions, some nights with weather forecasts including occasional showers, mist, or fog were sampled.

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 as they pass through the project site (Figure 2-1). 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 2-3). Both modes of operation were used during each hour of sampling.

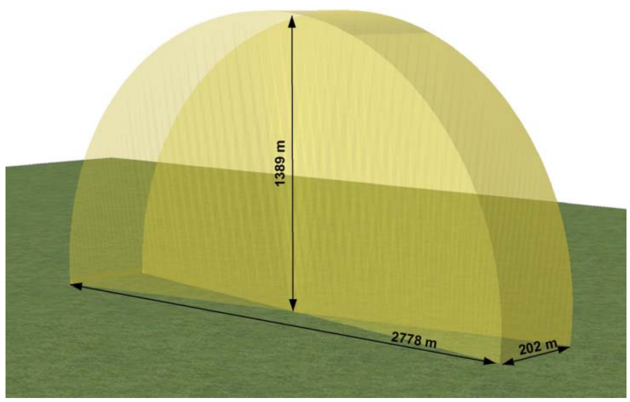

Figure 2-3. Detection Range of the radar in vertical mode

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 birds 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; consequently, 1.4 km is the appropriate detection range for this type of study.

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.

2.2.1 Weather Data

Temperature, wind speed and direction were recorded by an on-site met tower. This information was used during data analysis to help characterize any patterns in migration activity for particular nights and for the season overall. In addition, in order to consider the atmospheric influences on migration, regional surface weather map images were interpreted to determine the dates that daytime pressure systems (high, low, or none) moved through the region. Surface weather maps, prepared by the National Centers for Environmental Prediction, the Hydro-meteorological Prediction Center, and the National Weather Service, were downloaded daily for the majority of the survey window.

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 outputs the data to a spreadsheet. These datasets were then 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), because they 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 131 m (429'), the approximate maximum height of the proposed wind turbines with blades, was also calculated hourly, for each night, and for the entire survey period.

2.3.2 Weather Data

The mean, maximum, and minimum temperature, hourly wind speed, and hourly wind direction were calculated for each night of the survey period.

2.4 RESULTS

Radar surveys were conducted during 20 nights between April 16 and May 25, 2010 (Appendix A, Table 1) resulting in 188 total hours surveyed. The radar location provided a good view of the airspace in most directions

2.4.1 Passage Rates

Nightly passage rates varied from 20 targets per kilometer per hour (t/km/hr) on May 10 to 589 t/km/h on May 21, and the overall passage rate for the entire survey period was 289 t/km/hr (Figure 2-5, Appendix A, Table 1). Individual hourly passage rates varied between nights and throughout the season, and ranged from 0 t/km/hr on the 10th hour of April 16 to 979 t/km/hr on the 4th hour of May 17 (Appendix A, Table 2). For the entire season, passage rates were typically highest during the fifth and sixth hour after sunset, and then steadily declined until sunrise (Figure 2-5).

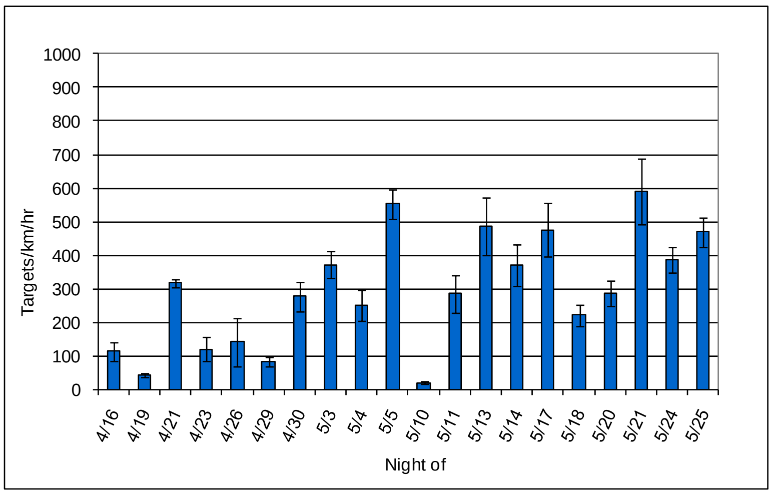

Figure 2-4. Nightly passage rates observed (error bars ± 1 SE) during Spring 2010 at the Bowers Wind Project.

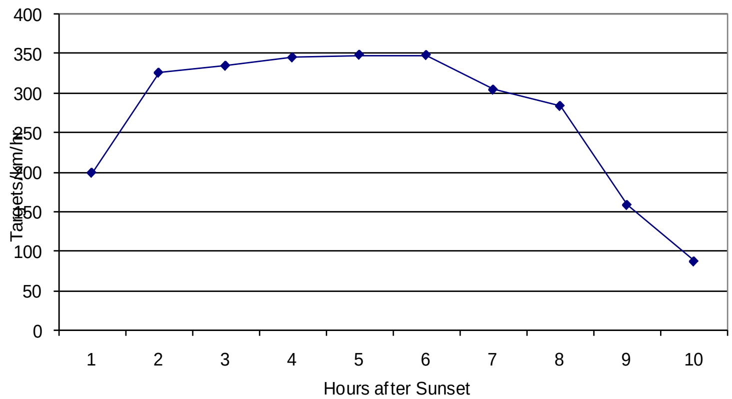

Figure 2-5. Hourly passage rates for entire season during Spring 2010 at the Bowers Wind Project

2.4.2 Flight Direction

Mean flight direction through the Project area was 56° ± 56° (Figure 2-6). Overall, the mean flight direction was to the northeast, but varied between nights (Appendix A, Table 3).

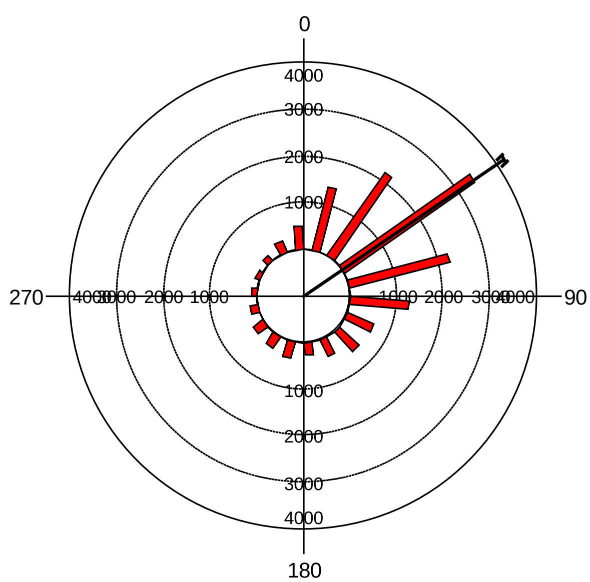

Figure 2-6. Mean flight direction for the entire season during Spring 2010 at the Bowers Wind Project (the bracket along the margin of the histogram is the 95% confidence interval)

2.4.3 Flight Altitude

The seasonal average mean flight height of all targets was 243 ± 10 m above the radar site. The average nightly flight height ranged from 110 ± 12 m on May 13 and May 20 to 418 ± 82 m on April 26 (Figure 2-7, Appendix A, Table 4). The percent of targets observed flying below maximum turbine height of 131 m was 26 percent for the season and varied nightly from 9 percent on May 5 to 74 percent on May 13 (Figure 2-8).

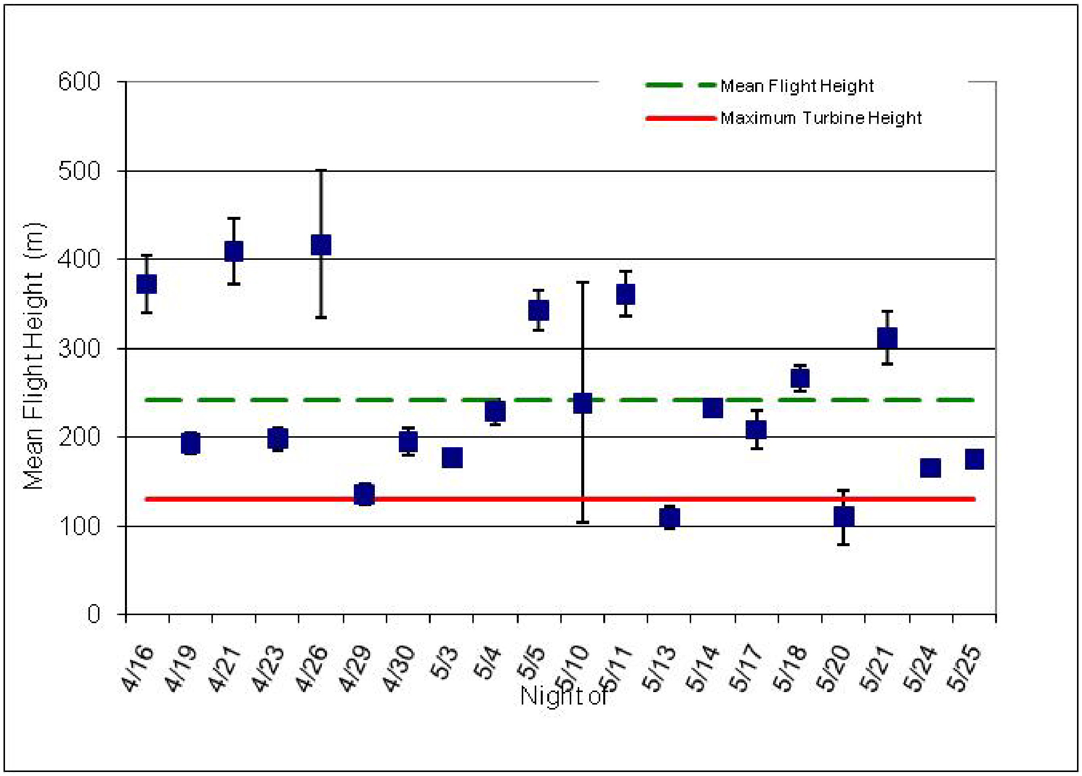

Figure 2-7. Mean nightly flight height of targets during Spring 2010 at the Bowers Wind Project (error bars ± 1 SE)

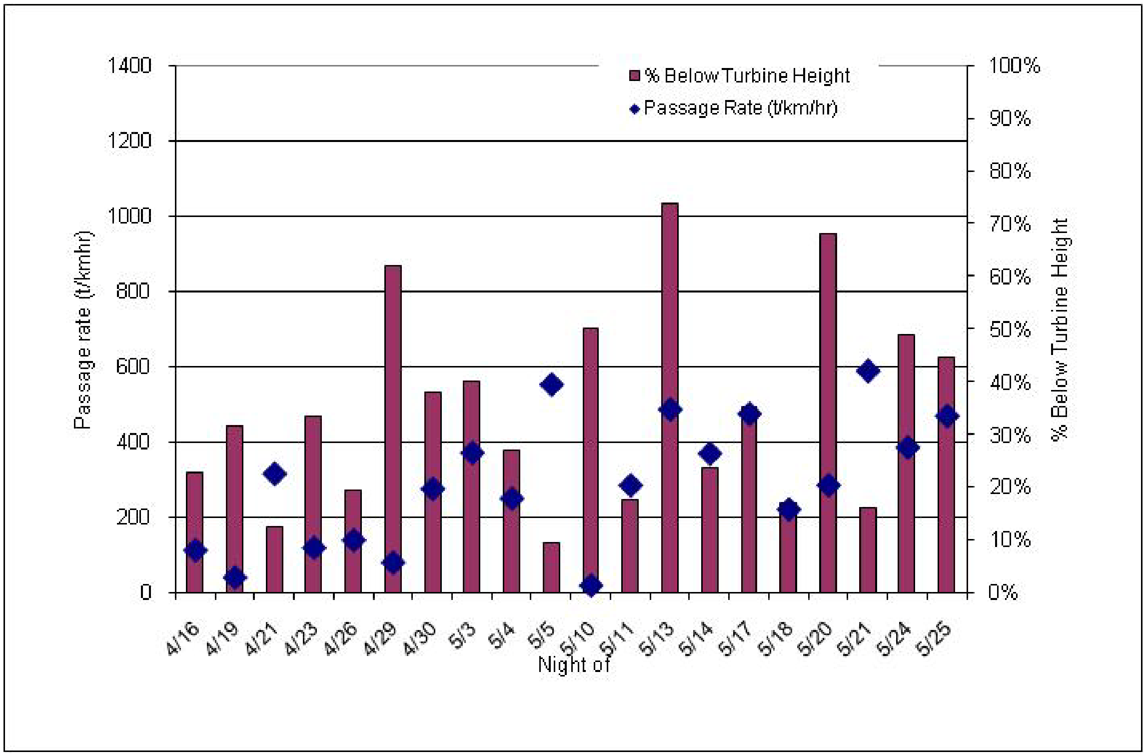

Figure 2-8. Percent of targets observed flying below maximum turbine height of 131 m (429') during Spring 2010 at the Bowers Wind Project

Figure 2-9 displays nightly flight heights in a different format to highlight the range in individual flight heights of all targets recorded each survey night. This figure is different from Figure 2-7 which shows only the mean flight height for all targets each survey night. The "blocks" seen on Figure 2-9 depict 50 percent of targets; the horizontal line indicates median flight height. The error bars depict the statistical outliers, or 25 percent of those birds flying well below the mean and well above the mean. The proposed turbine height is depicted as a red line.

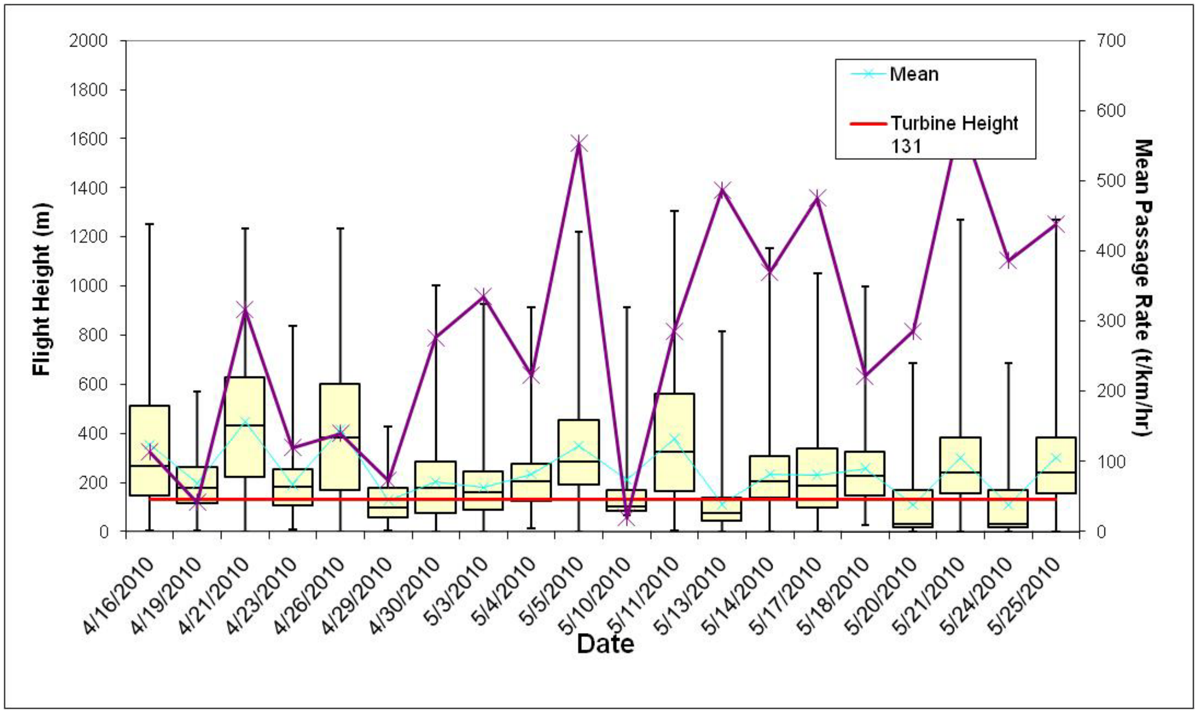

Figure 2-9. Whisker plot depicting the 25th, 50th and 75th percentiles of targets' flight heights for each survey night during Spring 2010 at the Bowers Wind Project

For the entire season, the mean hourly flight heights were typically highest during the fifth hour after sunset (Figure 2-10).

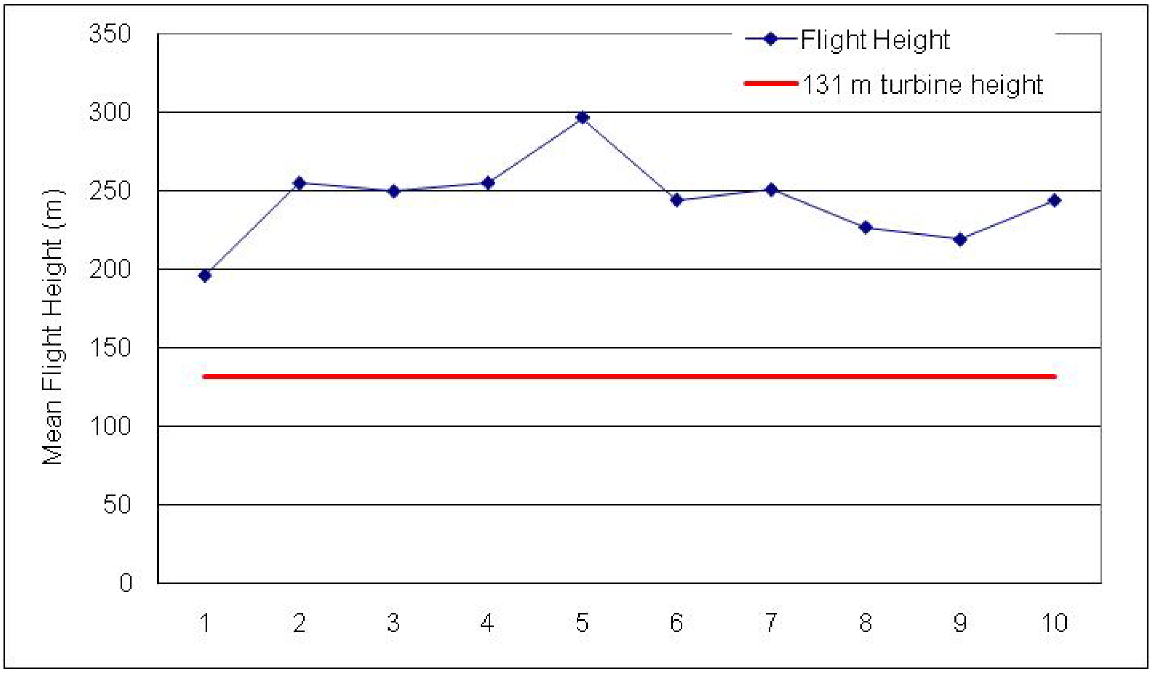

Figure 2-10. Hourly target flight height distribution during Spring 2010 at the Bowers Wind Project

2.4.4 Weather Data

Mean nightly wind speeds in the Project area from April 16 to May 25 varied between 3.5 meters per second (m/s) on May 17 and 13.2 m/s on May 3, with an overall mean of 7.9 m/s. Mean nightly temperatures varied between 0 °C on April 16 and 21.6 °C on May 24, with an overall mean of 9.1°C.

Analysis of regional surface weather maps reveals that spring 2010 surveys were conducted during periods of high atmospheric pressure and favorable conditions for migration. Nights with relatively high passage rates (May 5, May 13, May 17, and May 25) occurred during nights when high pressure systems were either present or had passed through the region the night before. Winds were generally from the south during the night with the nights with the two highest passage rates (May 21 and May 5) and on other nights with relatively high passage rates (May 17 and May 25). A low pressure system lasting from April 25 to April 29 associated with heavy cloud cover, rain, snow, and northwest winds likely contributed to the low passage rates recorded during this survey period.

2.5 DISCUSSION

Spring radar surveys in the Project area documented patterns in nocturnal migration similar to those documented at recent spring radar surveys conducted in the eastern US (Appendix A Table 5). These include highly variable passage rates between nights, a generally northward flight direction, and flight heights primarily occurring between 200 and 500 m above the ridgeline. Within nights, migration activity was generally greatest five to six hours after sunset and declined steadily through the end of the night. Nightly variation in the magnitude and flight characteristics of nocturnally-migrating songbirds 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). As suspected, spring passage rates at the Project were relatively lower than those recorded during fall 2009 surveys, which is a typical migration pattern observed in the east. Fall migrants include juveniles born the same year as well as older birds. Both age classes have a higher mortality rate than adults during fall migration or while over-wintering, resulting in fewer individuals migrating in spring. The radar site was located within a clearing near the highest point Bowers Mountain, surrounded by a forest of relatively short hardwood trees. Consequently, the radar site had unusually good visibility and was capable of detecting targets within nearly all of its theoretical detection range. The average passage rate at the Project (289 t/km/hr) is within the range of results of other radar studies conducted in the east (110 m to 1020 m, Appendix A Table 5). Comparison of passage rates between radar surveys at the Project and similar surveys conducted at other sites must be done with caution, as differences in passage rates are due to a large part to differences in radar view between sites, and not necessarily the amount of migration above a radar site. Indeed, characteristics of individual radar sites, particularly the topography, local landscape conditions, and vegetation surrounding a radar survey location, can dramatically influence the ability of any radar unit to detect targets and the subsequent calculation of passage rate. These differences should be recognized as one of the more significant limiting factors in making direct site-to-site comparisons in passage rates.

The average flight height (243 m) is near the low end of the range of average flight heights recorded at other radar studies conducted in the east (210 m to 552 m), however the overall percent below maximum turbine height (26%) for all targets falls within the range of other results (4% to 26%). Additionally the average flight height is well above the maximum turbine height (131 m). The emerging body of studies characterizing nocturnal bird movements shows a relatively consistent pattern in flight altitude, with most birds appearing to fly at altitudes of several hundred meters or more above the ground (Appendix A, Table 5). Comparison of flight height between survey sites as measured by radar is generally less influenced by site characteristics as 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.

Flight heights were among the highest recorded during the season on nights with relatively high passage rates (343 m on May 5 [553 t/km/hr] and 312 m on May 21 [589 t/km/hr]; Figure 2-9), indicating that the majority of birds tend to fly higher on nights suitable for migration (during or after passage of high pressure systems with southerly winds when cloud cover is light to medium). Nights when flight heights were low (110 m on May 13 and May 20), wind speeds were strong and from the north, which may have "pushed" birds closer to the ground. In addition, light to medium amounts of precipitation occurred on these nights, most likely causing birds to fly lower due to reduced visibility. Throughout the spring migration season as a whole, the majority of birds flew above or well above the maximum turbine height of 131 m (Figure 2-9).

In summary, results at the Project are within the range of results recorded at other radar studies conducted in the east, and provide a sample of baseline migration activity over the Project during spring 2010.

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.* 2007b). Acoustic surveys were associated with several major assumptions (Hayes 2000) and results cannot be used to determine the number of bats inhabiting an area or determine the number of bats which will be killed post-construction. However, 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, the current lack of data on this topic precludes quantitative prediction of risk. The object of acoustic surveys at Bowers were (1) to document bat activity patterns from April through early September in airspace near the rotor zone of the proposed turbines, at an intermediate height, and near the ground; and (2) to document bat activity patterns in relation to weather factors including wind speed and temperature.

Eight species of bats occur in Maine, 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*), big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), and hoary bat (*L. cinereus*) (Whitaker and Hamilton 1998). Four of these are listed as species of special concern in Maine, including eastern small-footed bat, silver-haired bat, eastern red bat, and hoary bat.

3.2 DATA COLLECTION METHODS

3.2.1 Acoustic Detector Site Selection

Anabat II and Anabat SDI detectors (Titley Electronics Pty Ltd.) were used for the duration of the 2010 acoustic bat survey. Anabat detectors were selected based upon 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. Anabat II detectors were coupled with CF Storage ZCAIM (Titley Electronics Pty Ltd.), which programmed the on/off times and stored data on removable 1 GB compact flash cards; newer SD1 model detectors do not require use of a ZCAIM. Anabat detectors are frequency division detectors, dividing the frequency of echolocation sounds made by bats by a factor of 16, 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 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 to 30 meters (33' to 98').

Each Anabat detector was powered by 12-volt batteries charged by solar panels. Each solar-powered Anabat system was deployed in a 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 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.

The survey design included a total of 6 acoustic detectors that were deployed to operate nightly from 7:00 pm to 7:00 am from April 15 to September 4. Meteorological towers were installed in the Project between the end of the fall 2009 survey period and the beginning of the spring 2010 survey period. In order to document movement of tree roosting species, two of the detectors deployed on Bowers Mountain during the fall survey period were moved into one of these met towers. The remaining four detectors were redeployed in the same survey locations as the previous fall season at heights between five and ten meters, and spaced throughout the Project area (Figure 1-1; Photos 3-1 to 3-5). 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 Bowers 1 and 2 detectors from the fall deployment were redeployed in the newly erected Bowers Mountain met tower as high and low detectors and were suspended in the met tower guy lines at heights of approximately 20 m (66') and 40 m (131'). The Bowers Mountain met tower was located central to the Project area and on the northeast end of Bowers Mountain ridgeline. Ground cover in the met tower clearing is minimal; surrounding vegetation includes northern hardwoods and *Rubus* brambles. Elevation is approximately 351 m (1,152').

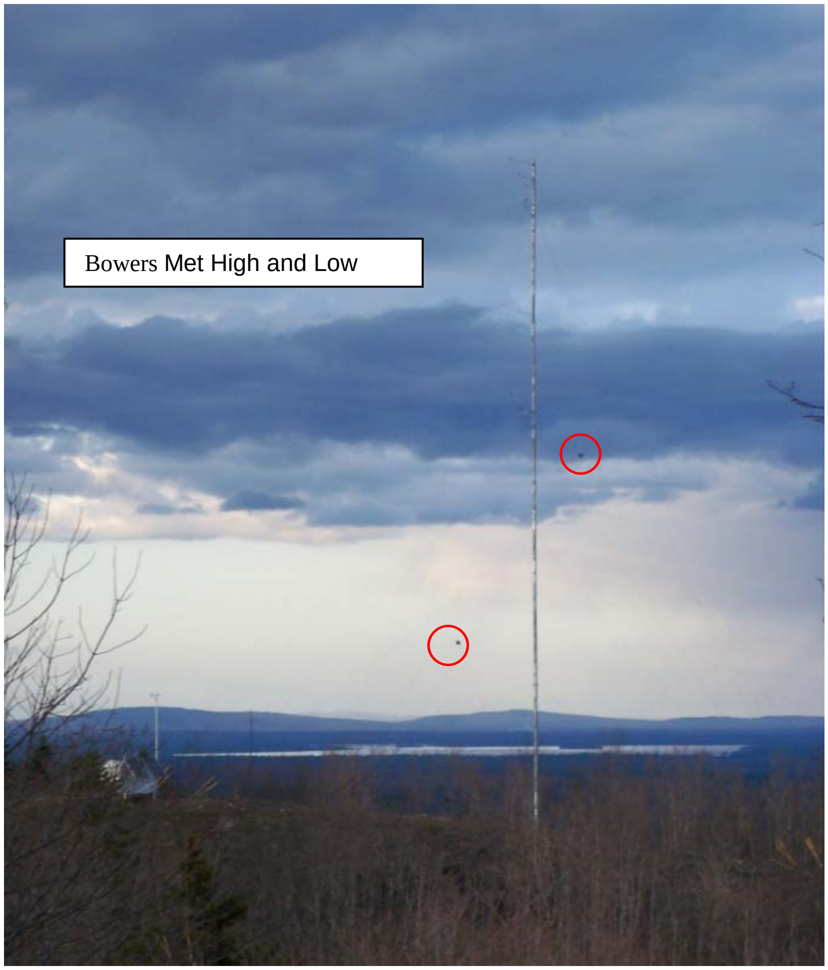

Photo 3-1. Bowers met tower high and low detectors

The Bowers 3 detector was suspended from a sugar maple at a height of approximately five m along a grass road 2.3 km northeast of the Bowers 2 detector. The detector was located at the edge of a meteorological tower opening. Vegetation includes sapling size to mature northern hardwoods with an extensive red spruce plantation 400 m to the north. Elevation is approximately 760'.

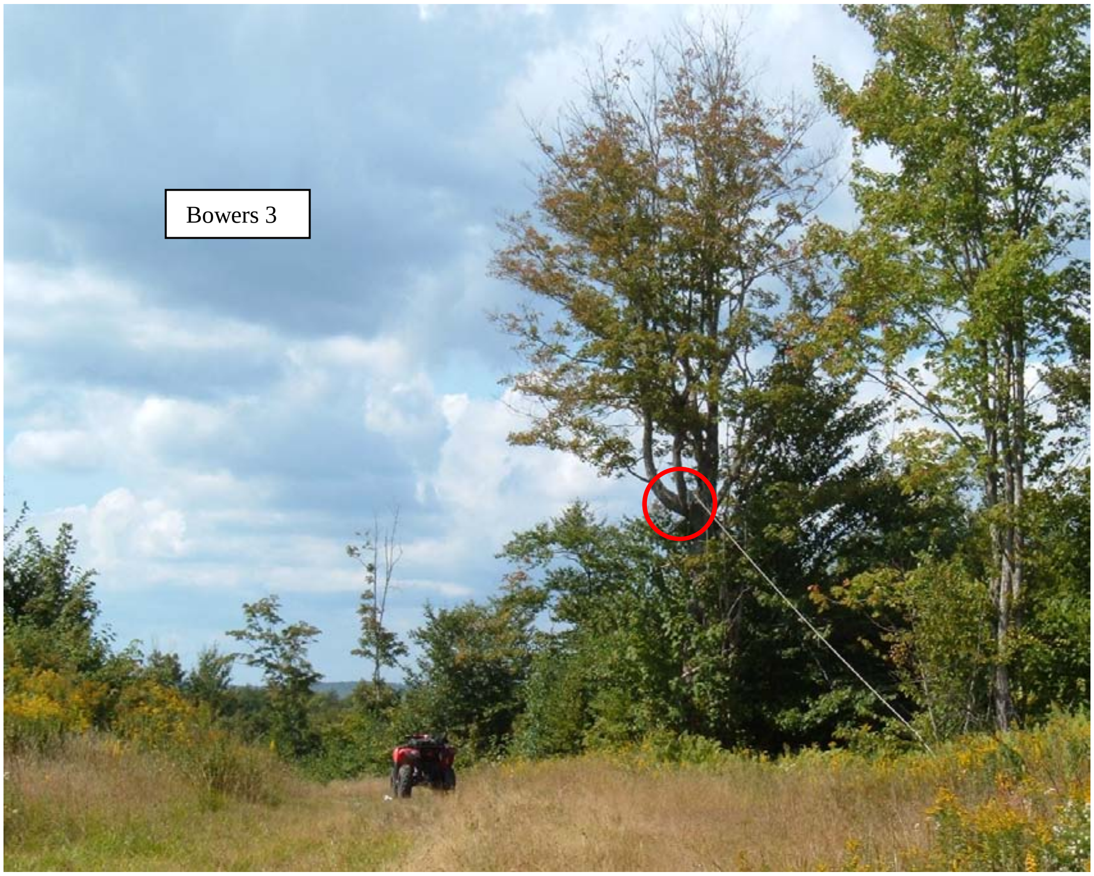

Photo 3-2. Bowers 3 detector

The Bowers 4 detector was suspended at a height of approximately eight meters in a dead tree at the edge of a met tower clearing on the west end of the ridge approximately 1000 m southeast of Bowers Mountain. Surrounding vegetation includes regenerating northern hardwoods with some mature hemlock. Elevation is approximately 844'.

Photo 3-3. Bowers 4 detector

The Bowers 5 detector was suspended at a height of approximately five meters in an Eastern hop-hornbeam (*Ostrya virginiana*). The detector was located next to a human-disturbed meadow approximately 2000 m west of the Bowers Mountain summit. Elevation is approximately 750'.

Photo 3-4. Bowers 5 detector

The Bowers 6 detector was suspended at a height of approximately ten meters in a pine along a forest road on Dill Hill. The road is surrounded with sapling to pole-size mixed northern hardwoods and regenerating white pine. Elevation is approximately 905'.

Photo 3-5. Bowers 6 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 northeast 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 screen 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 can also sometimes 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. Hourly detection rates were summarized by hour after sunset, as recommended by Kunz *et al*. (2007). Quantitative comparisons among these temporal periods was not attempted because the high amount of variability associated with bat detection would required 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 recorded call sequences of sufficient length to reference libraries of bat calls allows 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. However, due to similarity of call signatures between several species, all classified calls have been categorized into five guilds[3] reflecting the bat community in the region of the Project area and is as follows:

- **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.

- **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.

[3] Gannon *et al.* 2003 categorized bats into guilds based upon similar minimum frequency and call shape. These guilds were: Unidentified, Myotis, LABO-PISU and EPFU-LANO-LACI. We broke hoary bats out into a separate guild due to the importance of reporting activity patterns of migratory species in the context of wind energy development.

- **Eastern red bat/tri-colored bat[4] (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 can also occur.

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

- **Hoary bat (HB)** – Hoary bats. Calls of hoary bats can usually 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.

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 the body of this report will reflect those guilds. However, 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

During the spring of 2010, three 60-meter tall met towers were installed within the Project area. The towers collected the nightly mean wind speed and temperature data (Celsius) near the elevation of the two met tower detectors. Temperature (degrees Celsius [°C]) and wind speed (meters per second [m/s]) were recorded at 10-minute intervals by a project area met tower. Wind speed data was collected from a sensor located 59 m above ground level, and temperature data was collected by a sensor located 2.5 m above ground level. The mean, maximum, and minimum temperature and wind speed were calculated for each night.

3.4 RESULTS

3.4.1 Timing of Activity

Detectors were deployed April 15 and continued to record data through September 4, for a total survey period of 784 detector nights. The range of dates that each detector was deployed is summarized in Table 3-1. Occasional equipment malfunctions occurred during the survey period resulting in some missed nights of survey. The majority of detectors recorded for the entire survey period, resulting in 91% success rate.

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

Table 3.1 Summary of bat detector field survey effort and results

Location	Dates Deployed	Calendar Nights	Detector-Nights*	Recorded Sequences	Detection Rate **	Maximum Sequences recorded ***
Bowers Met High (1)	April 15 - Sept 4	143	143	280	2.0	31
Bowers Met Low (2)	April 15 - Sept 4	143	143	152	1.1	18
Bowers 3	April 15 - Sept 4	143	105	2512	23.9	32
Bowers 4	April 15 - Sept 4	143	127	227	1.8	28
Bowers 5	April 15 - Sept 4	143	123	3399	27.6	104
Bowers 6	April 15 - Sept 4	143	143	3255	22.8	550
Overall Results		***858***	***784***	***9825***	12.5	--

* 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.

A total of 9825 bat call sequences were recorded over 784 detector nights from April 15 through September 4 resulting in an overall detector rate for the spring survey period of 12.5 bat call sequences per detector night. Detection rates varied between individual detectors and between tree detectors and met tower detectors. Tree detector recorded from 1.8 to 27.6 call sequences per detector night, while met tower detection rates ranged from 1.1 to 2.0 call sequences per detector night.

Activity rates were low during April then peaked in mid August. None of the six detectors recorded bat calls during the first five nights of surveys and the met tower detectors did not record call sequences until April 30. Pulses in activity varied between detector types and increased in magnitude as the spring season progressed. During the month of April the largest pulse in bat activity was 8 bat call sequences and was recorded during one night at a single tree detector, while only one bat call sequence was recorded by the met tower detectors during April. The frequency and magnitude of bat call pulses recorded at individual detectors continued to increase through the month of August with the largest amount of bat activity recorded by the tree detectors (Table 3-2).

Table B. Distribution of detections by guild for detectors at Bowers, 2010.

Detector	Guild					Total
	BBSH	HB	MYSP	RBTB	UNKN	
Bowers Met High (1)	191	8	0	2	79	280
Bowers Met Low (2)	90	8	7	0	47	152
Bowers 3	375	14	1040	93	990	2,512
Bowers 4	28	5	105	1	88	227
Bowers 5	61	19	1136	24	2159	3,399
Bowers 6	38	3	2178	43	993	3,255
Total	**783**	**57**	**4,466**	**163**	**4,356**	**9,825**
Guild Composition %	**8.0%**	**0.6%**	**45.5%**	**1.7%**	**44.3%**	

A small portion of bat activity occurred before and during the sunset hour however activity peaked in the second hour after sunset followed by a decline in activity and a second smaller peak in activity in the sixth hour after sunset (Figure 3-1).

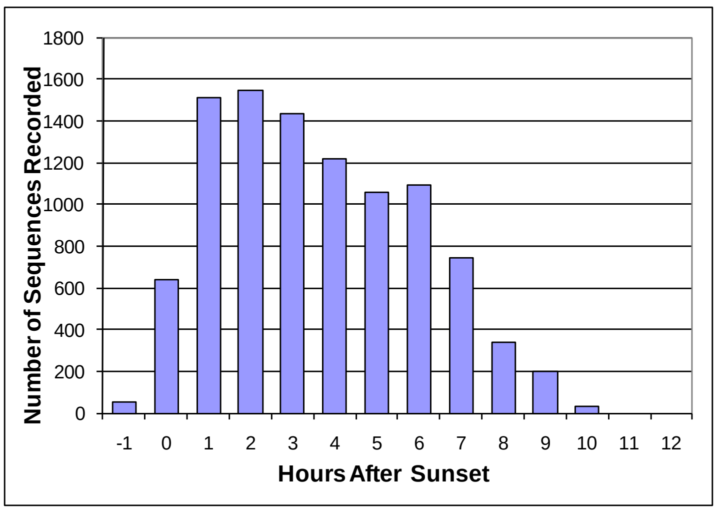

Figure 3-1. Hourly bat call sequence detections during 2010 at the Bowers Wind Project

3.4.2 Species Composition

Species composition varied between tree detectors and met tower detectors. Detectors deployed in trees recorded a higher percentage of myotis and high-frequency unknown species while the majority of calls recorded at the met tower detectors were silver-haired and low-frequency unknown species (Figure 3-2). A small number of myotis and high-frequency unknown calls were recorded at the low met tower detectors while only low-frequency unknown and BBSH and hoary bat calls were recorded at the high met tower detector.

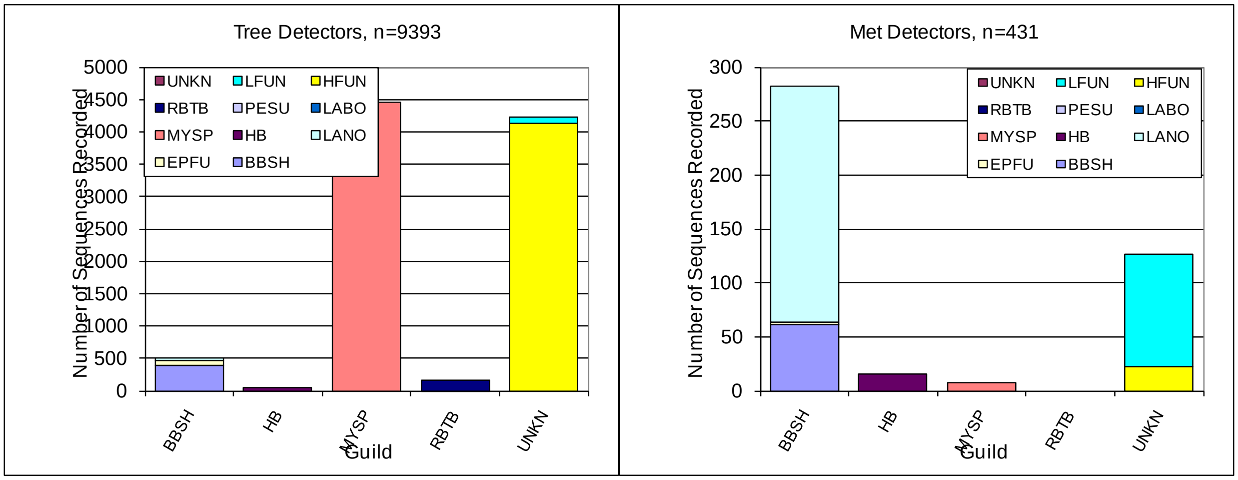

Figure 3-2. Species composition for tree detectors and met tower detectors during 2010 at the Bowers Wind Project

Appendix B provides a series of tables with more specific information on the number, and species composition of recorded bat call sequences. Specifically, Appendix B Tables 1 through 6 provide information on the number of call sequences, by guild and suspected species, recorded at each detector and the weather conditions for that night. Stantec has archived digital copies of all recorded acoustic call sequences, and can provide a copy of these files, including all information about species identification and timing of calls from each detector on an hourly and nightly basis, should that information be desired.

3.4.3 Activity and Weather

Weather data from April 15 through September 4 was available for this report. Mean nightly wind speeds in the Project area varied between 2 and 15 m/s (Figure 3-3), and mean nightly temperatures varied between -1 °C and 24 °C (Figure 3-4). Although activity was highly variable over the course of the survey, sixty-four percent of all call sequences were recorded on nights with a mean nightly wind speed of seven meters per second or less; seventy-one percent of all calls were recorded on nights with a mean nightly temperature of 16°C or higher. The highest nightly activity rate was recorded on August 21, when mean nightly wind speed was 5 m/s and the mean nightly temperature was 16 °C.

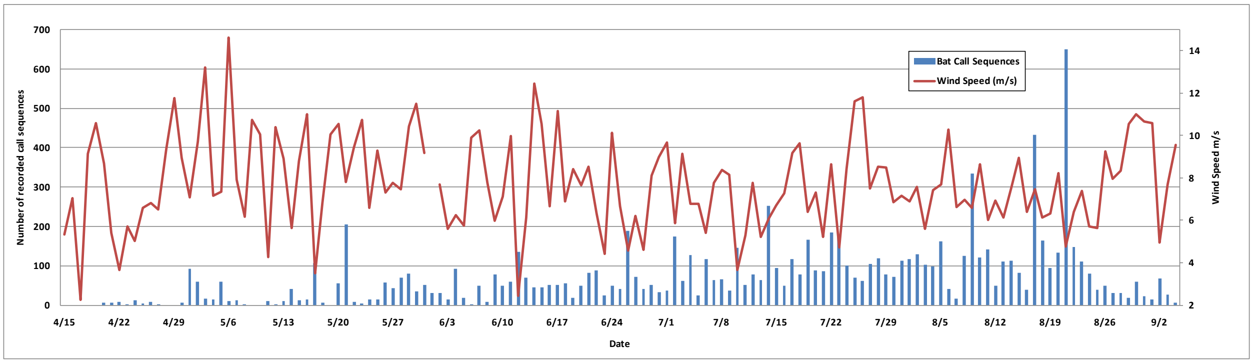

Figure 3-3. Nightly mean wind speed (m/s) (blue line) and bat call detections during 2010 at the Bowers Wind Project

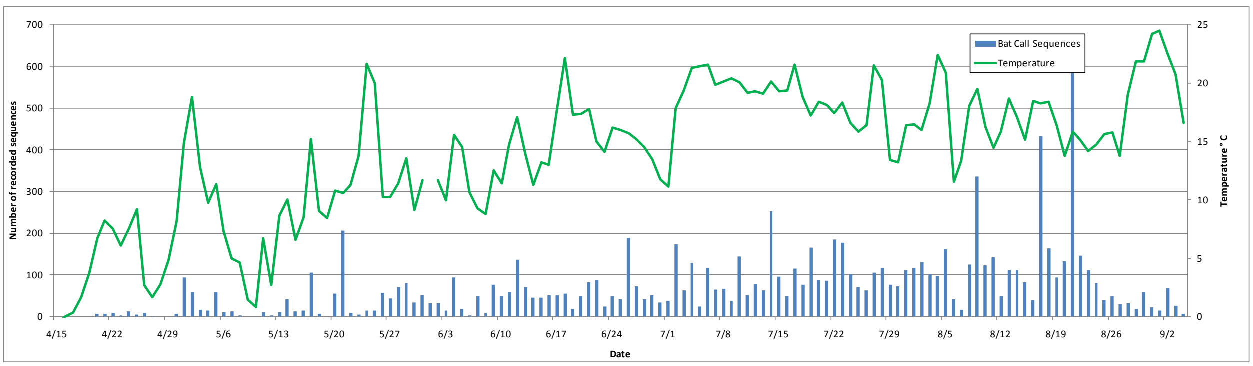

Figure 3-4. Nightly mean temperature (Celsius) (blue line) and bat detections during 2010 at the Bowers Wind Project (nightly maximum and minimum temperatures not available)

3.4.4 Activity Comparisons Among Groups

Myotis and high-frequency unknown represent the two most frequently occurring species guilds recorded in the Project area. During the first two weeks of survey 54 call sequences from the myotis and high-frequency unknown species were recorded while only three call sequences of BBSH were recorded. Call sequences identified as silver haired bats were not recorded until May 5 with the first pulse in activity occurring on May 17. Hoary bat calls were the latest call sequences to be recorded with the first call identified on May 28.

3.5 DISCUSSION

2010 acoustic bat echolocation surveys at the Project recorded trends in bat activity comparable to other acoustic surveys conducted throughout the northeast. The erection of met towers in the Project area allowed for deployment of two detectors near the potential rotor swept zone on Bowers Mountain. Four detectors were redeployed at tree height at the locations used during the fall 2009 acoustic survey. As is typically seen at similar types of acoustic surveys, the met tower detectors recorded a higher percentage of tree-roosting species, while detectors deployed in trees recorded more myotis and high-frequency unknown species. No call sequences were recorded during the first five nights of survey and no calls were recorded at the met tower detector until April 30. Activity rates increased at all detectors through the month of June/July and appeared to correspond to an increase in mean nightly temperatures and nights with moderate to low wind speeds.

Bat calls were identified to guild within this report, although calls were provisionally 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. The following paragraphs discuss each guild separately and address likely species composition of recorded bats within each guild.

The MYSP guild includes the three species of *Myotis* potentially occurring in the Project area (the little brown bat, northern long-eared bat, and eastern small-footed bat). Of these species, the little brown bat and northern long-eared bat are by far the most common in Maine, although acoustic data recorded during 2010 surveys did not provide a sufficient number of high quality calls to attempt differentiation between species. Eastern small-footed bats have a limited range in Maine, and while theoretically could be present in the Project area, are expected to be far less common. Mist netting surveys conducted by the state of Maine in 2005 documented a non-reproductive female small-footed bat approximately 11 miles north east of the Project area (Hodgman, 2009). Fifty-two percent of call sequences recorded at the Project (n=609) were from the MYSP guild. Four of the six detectors recorded bat activity at canopy and sub-canopy heights where myotis species are generally found foraging close to ground level in forested habitats and clearings in forested habitat.

The RBTB guild includes the tri-colored bat and eastern red bat. Eastern red bats have relatively unique calls which span a wide range of frequency and have a characteristic hooked shape and variable minimum frequency. Tri-colored bats (formerly called eastern pipistrelles) tend to have relatively uniform calls, with a constant minimum frequency and a sharply curved profile. Mortality patterns recorded across the northeast during post-construction surveys suggest that bats in the RBTB guild, red bats in particular, likely migrate through the region during fall and are often recorded at detectors above tree canopy height. Only two RBTB calls were recorded during spring surveys at one tree detector located in the western portion of the Project area. Neither of the call sequences had sufficient enough detail to be classified as belonging to an Eastern red bat or a tri-colored bat.

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. Certain types of calls by each species are easily distinguishable from the other based on minimum frequency and call profile, but other calls in this range have overlapping characteristics and are difficult to distinguish. When call sequences were not of sufficient length or quality to distinguish between these two species they were labeled as BBSH. A total of 56 BBSH calls, one big brown bat call and 89 silver-haired bat calls were recorded at the project during the spring surveys. The majority of silver-haired bat calls were recorded at the higher elevation met tower detectors during the last two weeks of May.

The HB guild consists of the hoary bat, the largest bat species in the northeast. 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. Thirteen hoary bat call sequences were recorded during the spring survey, eleven of which were recorded by tree detectors. Similar to the later arrival of the silver-haired bats, the hoary bat calls were only detected during the last four days of the spring survey period.

Many factors can affect acoustic detection rates from year to year and from site to site. Where possible, reducing the amount of variability between seasonal surveys allows for a more direct comparison of year to year trends in acoustic data. In an attempt to reduce variability, four of the tree detectors were redeployed in the same locations as the fall, 2009 survey. The two Bowers Mountain detectors were moved into the newly erected met tower to record bat activity at and near the rotor swept zone. Detectors below tree canopy typically record a higher detection rate than detectors recording above tree canopy. This is probably a result of bats foraging below canopy height making multiple passes by one detector over the course of a night. Although some foraging probably occurs within the range of met tower high, food sources are much less concentrated at higher elevations making it less likely that a single bat would fly multiple passes by one detector while foraging. During the spring migration period it is likely that a significant percentage of bats recorded at met tower high detectors are migratory bat species. Many post-construction acoustic surveys have found a higher percentage of these long distance migratory species during mortality surveys under operating wind turbines (Arnett et al. 2008). The majority of bat mortality events documented at post construction surveys conducted from 2007 to 2009 in northern Maine have occurred during the month of August (Woodlot, 2007, 2008, 2009)

The similar acoustic methodology used and the proximity of the Project area to other proposed and operational wind projects in the region allows for comparison of acoustic data. Yet when comparing acoustic data sets 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 (Hayes 2000). Thus, results of acoustic surveys must be interpreted with caution. Methods surrounding acoustic bat surveys are continually evolving, and it there is currently little data aiding in the interpretation of number of calls per detector nights. Although interpretations are limited, the surveys represent a sample of activity and the general species groups that occur in the Project area.

4.0 Diurnal Raptor Surveys

4.1 INTRODUCTION

Based Raptor migration surveys were conducted in the Project area to characterize raptor migration patterns during spring 2010. The goal of the raptor surveys was to characterize migration activity at central and prominent locations within the Project area, to document the species that occur in the vicinity of the Project, and to document the specific flight height, flight path locations, and other flight behaviors of raptors within or in the vicinity of the Project. Specific methods for this survey were developed in coordination with Champlain, MDIFW and USFWS.

4.2 RAPTOR DATA COLLECTION METHODS

4.2.1 Field Surveys

Field surveys were conducted on twelve days from late-April through late-May. Visual observation survey methods were based on Hawk Migration Association of North America (HMANA) methods (HMANA 2007). Surveys were conducted for seven consecutive hours between 9 am and 4 pm, during the peak hours of thermal development and raptor movement.

During surveys the observer scanned the sky and surrounding landscape by naked eye or with binoculars. Each raptor observation, or pass, was documented. Each time a bird was observed it was recorded, regardless of whether it was suspected to be a local bird observed previously. Therefore, daily count totals include all observations, or passes, of birds observed throughout a survey day[5]. Detailed information for each observation was recorded on standardized data sheets, including:

- Observation date and time;
- Species[6], number of individuals, and age (if possible);
- The location of each bird depicted on a topographical map;
- The flight height[7] and behaviors observed in each of the topographical positions where birds occurred[8];

[5] It should be noted that HMANA observers typically do not count birds suspected to be local or seen previously that day; therefore, this should be considered when comparing results between datasets.

[6] Birds that flew too rapidly or were too far to accurately identify were recorded as unidentified to their genus or, if the identification of genus was not possible, unidentified raptor.

[7] Nearby objects with known heights, such as met towers, telecommunication towers, and trees, were used to estimate flight height.

- The general flight direction of each bird; and
- An estimate of the length of time birds spent below maximum turbine height.

Additionally, observations of non-raptor species including passerines and water birds were often documented by the observer; however, this data was not collected uniformly or systematically.

The study area is considered the observable airspace as seen from the observation location on Bowers Mountain (Figure 1-1). The observation location was located on the western ridge of Bowers Mountain (Figure 1-1) in the same location as Fall 2009. The view from a raised platform at the observation location provided excellent 360 degree views. For the purposes of data summary, the study area has been categorized into four separate locations: the ridges of Bowers Mountain, Dill Hill, the valleys north of Project ridges, and the valleys south of Project ridges.

Topographical flight positions were summarized into categories that describe the landscape surrounding the observation site (these positions apply to birds observed both within as well as outside of the Project area): A1) parallel to ridge, A2) perpendicular to ridge, A3) over saddle, B) flight path over upper slope of ridge, C) flight path over lower slope of ridge, and D) flight path over a valley (see Figure 4-1 below). As individual birds traveled through or in the vicinity of the Project, all position categories in which a bird occurred were recorded.

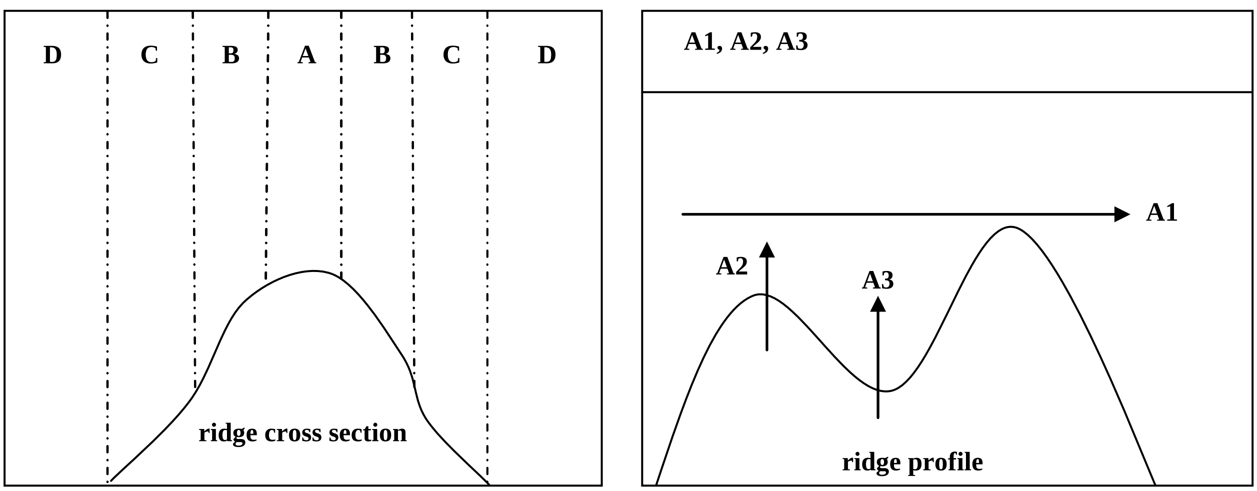

Figure 4-1. Raptor flight position categories in relation to the topography of the study area (codes apply to locations within and outside of Project area). A1) parallel to ridge, A2) perpendicular to ridge, A3) over saddle, B) flight path over upper slope of ridge, C) flight path over lower slope of ridge, and D) flight path over a valley.

4.2.2 Weather Data

Wind direction, wind speed, and the development of thermals largely influence raptor flight behaviors and flight paths. Therefore, throughout each survey day, the observer recorded

[8] As individual birds traveled through or in the vicinity of the Project, all topographical position categories in which a bird occurred were recorded.

hourly weather conditions including wind speed and direction, temperature, sky condition, percent cloud cover, cloud type, and relative cloud height.

Specific seasonal weather conditions result in accentuated raptor migration movements. Atmospheric instability and updrafts are conditions that accompany low pressure systems and storms and raptors will move in advance of these conditions (Drennan 1981). Additionally, soaring on southerly winds is more efficient for northbound migrants (Drennan 1981). Raptor migration in the spring is most intense during the approach of a low pressure system and a cold front, and on days with southerly winds and rising air temperatures (Drennan 1981). In order to consider the atmospheric influences on raptor activity during the days that were sampled in spring 2010, regional surface weather map images were interpreted to determine the dates that daytime pressure systems (high, low, or none) moved through the region. Surface weather maps, prepared by the National Centers for Environmental Prediction, the Hydro-meteorological Prediction Center, and the National Weather Service, were downloaded daily for the majority of the survey window. The Surface Weather Maps show station data and the analysis for 7:00 am, EST.

4.3 RAPTOR DATA ANALYSIS METHODS

Raptor observation data were summarized by survey day and for the entire survey period. Data analysis included a summary of:

- Daily and seasonal observation rates (raptors observed per hour);
- Total observations of the different species observed;
- Hourly observation totals;
- The percentage of birds observed in the study area which occurred specifically within the Project area;
- The percentage of birds suspected to be actively migrating;
- A summary of flight behaviors observed in the topographical positions of the different locations of the study area;
- The average minimum flight height of birds within each topographical position category; and
- For those birds observed within proposed turbine areas (topographical positions A and B only), the percentage of birds seen below 131 m (429’).

The daily results of the spring 2010 surveys were compared to the daily results of available regional raptor surveys. Survey results are available from the following sites: Bradbury Mountain, Pownal, ME; Barre Falls, Barre, MA; Pitcher Mountain, Stoddard, NH; Pilgrim Heights, North Truro, MA; Plum Island, Newburyport, MA.

4.4 RESULTS

A total of twelve survey days were sampled between April 21 and May 26, resulting in a total of 84 survey hours.

4.4.1 Weather Summary

Among survey days, the average hourly temperature was 18° C (64° F). Temperatures ranged from 8° C to 29° C (47 to 85° F). Sky conditions were generally partly cloudy to overcast; however, there were a total of 4 hourly periods (out of 85) during which fog or drizzle reduced visibility. Wind direction was generally from the northwest, north and west; however, two survey days were characterized by northeast winds, and one day with south winds. Wind speeds ranged from calm to 19-24 miles per hour (mph) (30-36 kilometers per hour [kph]).

Analysis of regional surface weather maps shows that there was a low pressure system causing showers to the south of the Project area on the first survey day followed by high pressure on the second survey day with clearing skies. In May, low pressure caused cloudy skies on the 4th and light showers to develop late in the afternoon on the 5th. High pressure on the 13th gave way to a low pressure system on the 14th bringing clouds but no precipitation. On the 18th skies were clear at the site on the northern edge of an east bound low pressure system to the south. On the 20th a cold front moved south out of Canada clearing skies through the last survey day on the 26th.

4.4.2 Raptor Data

Over the course of the survey period a total of 131 observations of raptors were made. The seasonal passage rate was 1.56 raptors/hour. Table 4-1 summarizes the spring 2010 raptor migration survey results.

Table 4-1. A summary of the Spring 2010 survey effort and results for the Bowers Wind Project in Washington County, Maine

Range of survey dates		**4/21/2010 to 5/26/2010**
No. survey days		**12 days**
Total survey hours		**84**
Total raptor species observed		**9**
Raptor species observed		**State Listing**
(Common Name)	**(Scientific Name)**	
American kestrel	*Falco sparverius*	
bald eagle	*Haliaeetus leucocephalus*	Special Concern
broad-winged hawk	*Buteo platypterus*	
Cooper's hawk	*Accipiter cooperii*	
northern harrier	*Circus cyaneus*	Special Concern
osprey	*Pandion haliaetus*	
red-tailed hawk	*Buteo jamaicensis*	
sharp-shinned hawk	*Accipiter striatus*	
turkey vulture	*Cathartes aura*	
Total no. observations of raptors in study area		**131**
Seasonal passage rate (raptor observation/hour)		**1.56**
Total no. observations of raptors within Project area (percent of total observations in study area)		**100 (76%)**
Total no. observations of raptors seen in Project area below max turbine height (131m) (percent of total observations in study area)		**98 (75%)**

Daily passage rates ranged from 0.57 (5/21/2010) to 2.57 (5/18/2010) raptors/hour. Survey day totals ranged from 4 to 18 observations per day. The day with the highest passage, May 18 (n=18), experienced very light southerly winds, high cirrus clouds, and an average hourly temperature of 21° C (70° F) (Figure 4-2, Appendix C Table 1).

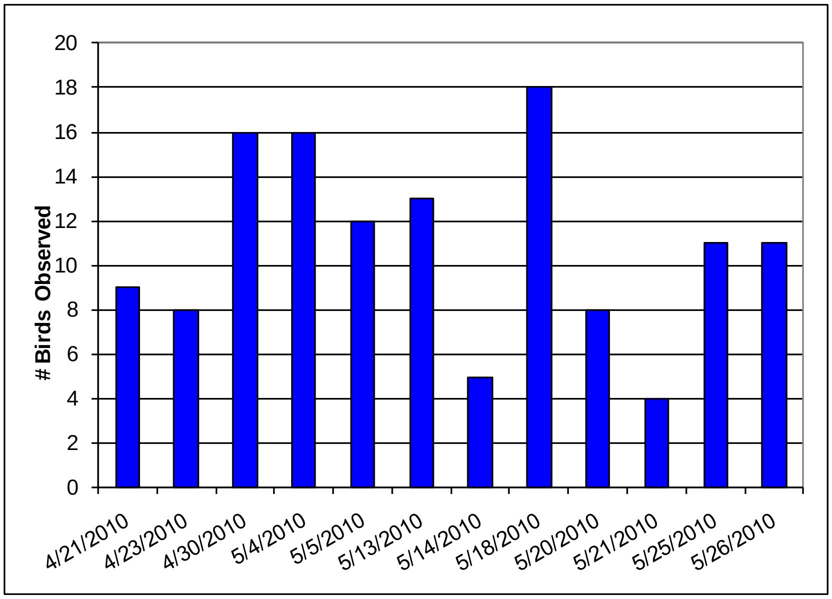

Figure 4-2. Survey day totals of raptors observed during Spring 2010 surveys at Bowers Wind Project.

There were nine species of raptors observed (not including unidentified birds, n=7) (Figure 4-5). The majority of raptor observations were turkey vulture (n=75; 57%). Of the 75 vultures observed, five were believed to be migrating. Numbers of red-tailed hawk (n=9; 7%). sharp-shinned hawk (n=8, 6%), American kestrel (n=8, 6%), broad-winged hawk (n=8; 6%), bald eagle (n=7, 5%), and northern harrier (n=6, 5%) observations were similar (Appendix C Table 1, Figure 4-3).

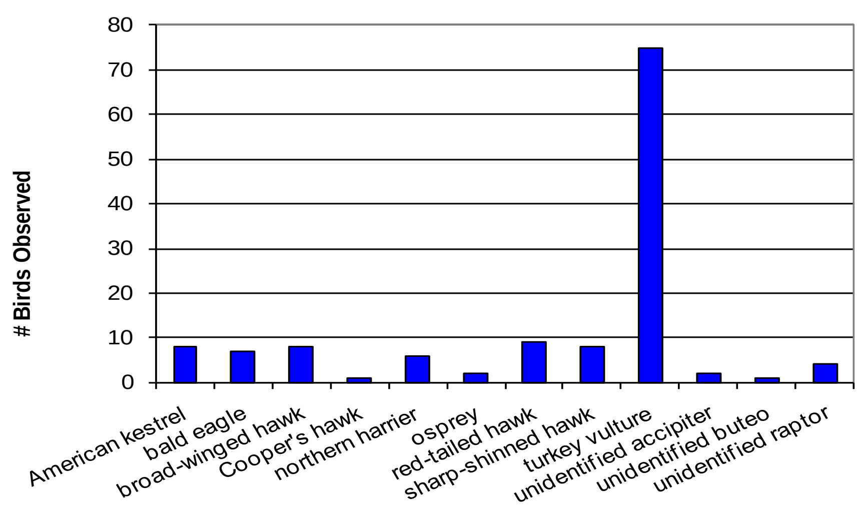

Figure 4-3. Number of observations of raptor species observed during Spring 2010 surveys at Bowers Wind Project.

4.4.3 Hourly observations

Throughout the survey season, the majority of observations peaked in the morning hours between 10 am and 11 am and gradually decreased throughout the afternoon. (Figure 4-4; Appendix C Table 2).

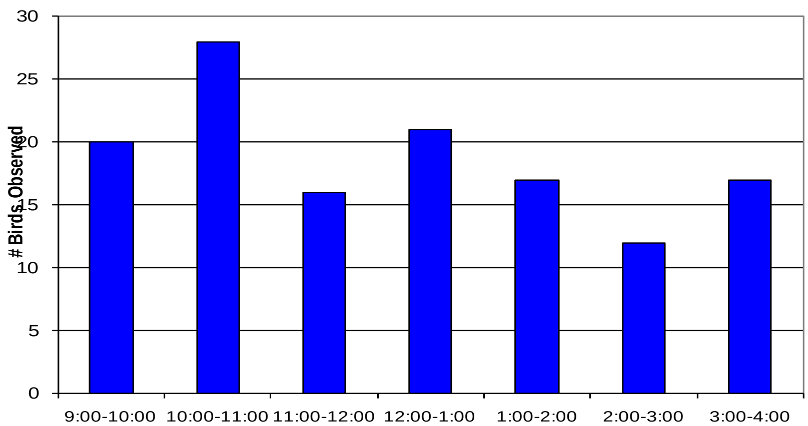

Figure 4-4. Number of observations of raptors per survey hour during Spring 2010 surveys at Bowers Wind Project.

4.4.4 Raptor locations

Of the 131 total raptor observations made within the study area, 100 (76%) observations occurred specifically within the Project area (Figure 4-5; Appendix C Table 3). Observations of the most commonly observed species were most frequently made over Bowers ridge (n=64; 49%). Of the raptor observations within the Project area, the majority of observations (n=98; 98%) occurred over Bowers ridge, and the rest were observed over Dill Hill (n=2; 2%) (Appendix C Table 3).

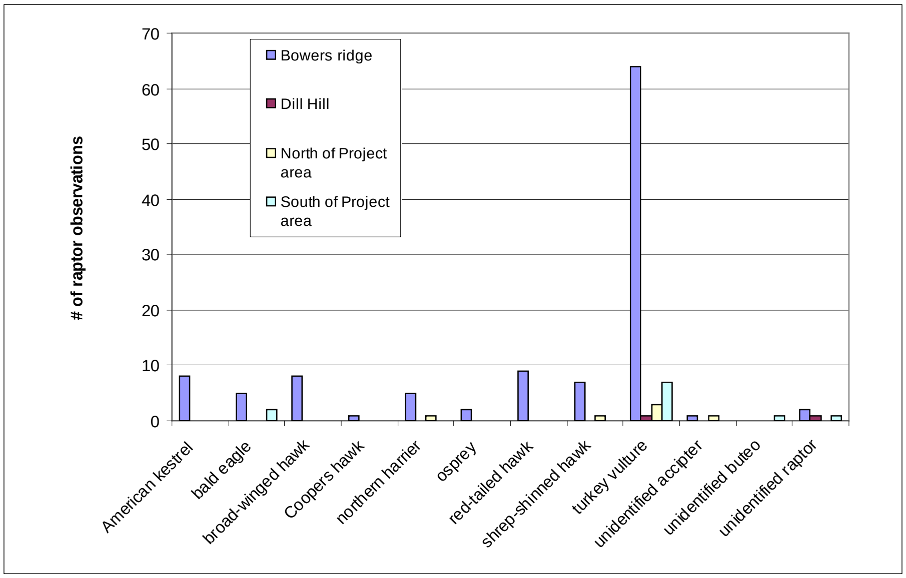

Figure 4-5. Number of observations of raptors within different study area location categories during Spring 2010 surveys at Bowers Wind Project.

4.4.5 Raptor behaviors

Raptor behaviors observed in the topographical positions of the different study area location categories are summarized in Table 4-2. Note that there are more behavior observations than there were total raptors observed because some raptors exhibited multiple behaviors while passing through multiple topographical positions in the vicinity of the study area.

Table 4-2. Raptor behaviors summarized by location in study area and flight position during Spring 2010 surveys at Bowers Wind Project

Location in Study Area	Behavior	Soaring, Gliding						Powered Flight						Foraging Behaviors						territorial or courtship behavior						Perched					
	Flight position where bahavior observed	**A1**	**A2**	**A3**	**B**	**C**	**D**	**A1**	**A2**	**A3**	**B**	**C**	**D**	**A1**	**A2**	**A3**	**B**	**C**	**D**	**A1**	**A2**	**A3**	**B**	**C**	**D**	**A1**	**A2**	**A3**	**B**	**C**	**D**
	Bowers Ridge	33	30	9	49	19	3	1	3	2	4	4	1	1	1	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0
	Dill Hill	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	South of Project area	0	0	0	0	5	6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	North of Project area	1	0	0	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total behavior obs = 188	**34**	**31**	**9**	**50**	**26**	**13**	**1**	**3**	**2**	**4**	**5**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

For those birds seen over Bowers Ridge as well as Dill Hill portions of the Project area, the majority were soaring or gliding along the upper slope of the ridge, parallel to the ridge, and perpendicular to the ridge (positions B and A1, and A2 respectively). For birds observed outside of the Project area, most were soaring or gliding in positions C and D.

Based on their flight behaviors, raptors suspected to be actively migrating (assumed if the bird was seen flying directly in a generally northward direction during the typical migration time-frame for the species) or not actively migrating (birds hunting, feeding, resting or courting; possible stop-over or seasonally local birds) are summarized in Table 4-3. Fifteen percent of raptors observed were suspected to be migrants. Raptors were considered actively migrating if their flight path was generally direct and in a northerly direction. Raptors were suspected to be stop-over or seasonally local birds if they were traveling in a non-direct manner and in a non-migratory direction, or if they exhibited perched or foraging flight behaviors. The majority of turkey vultures, the most commonly observed raptor during the surveys, were not actively migrating (n=57; 76%).

Table 4-3. Observations of raptors suspected to be actively migrating during Spring 2010 surveys at Bowers Wind Project

Species	not actively migrating	actively migrating	Unknown	TOTAL
American kestrel	3	2	3	**8**
bald eagle	5	0	2	**7**
broad-winged hawk	4	4	0	**8**
Cooper's hawk	1	0	0	**1**
northern harrier	2	1	3	**6**
osprey	2	0	0	**2**
red-tailed hawk	7	1	1	**9**
sharp-shinned hawk	2	5	1	**8**
turkey vulture	57	5	13	**75**
unidentified accipiter	0	1	1	**2**
unidentified buteo	0	1	0	**1**
unidentified raptor	1	0	3	**4**
Totals:	**84**	**20**	**27**	**131**

4.4.6 Flight heights

The average minimum flight heights of birds observed in the different topographical positions of the study area are summarized in Table 4-4 below.

Table 4-4. Number of observations and average flight heights for each position category of birds observed during Spring 2010 at Bowers Wind Project

	A1) flight along or parallel to ridge	A2) crossed ridge	A3) flight crossed depression or saddle	B) upper slope	C) lower slope	D) over valley
No. of position observations (n=179)	37	29	11	55	29	18
Average minimum flight height (m)	37	43	34	55	52	244

Of the 131 raptor observations that occurred within the study area, 100 observations took place in topographical positions (A or B) near where turbines may be sited in the Project area (Figure 4-8; Appendix C Table 3). Within these positions, 75 percent (n=98) of observed flight heights occurred below the proposed maximum turbine height of 131 m (Figure 4-6; Appendix C Table 4).

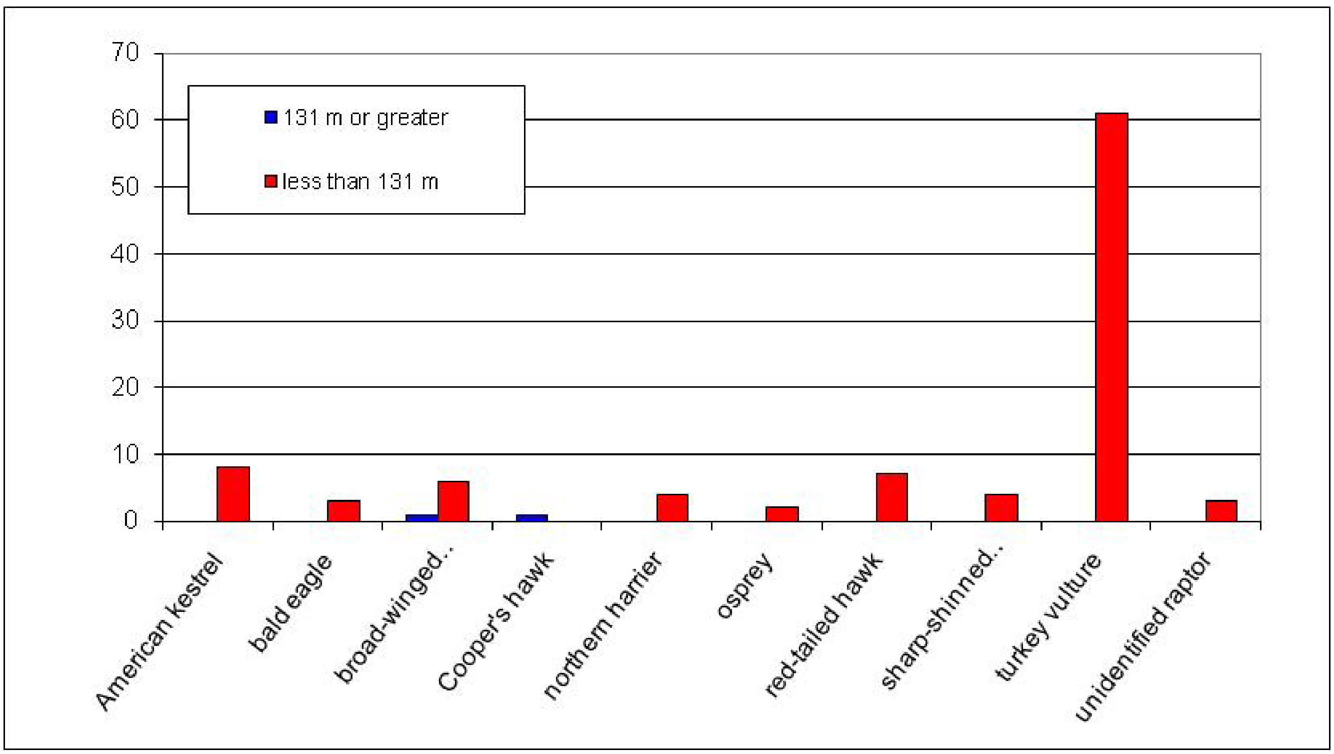

Figure 4-6. Number of observations of raptor species observed within proposed turbine areas (positions A and B within Project area) at heights above and below 131 m during Spring 2010 surveys at Bowers Wind Project.

4.5 RARE, THREATENED AND ENDANGERED SPECIES

No state or federally-listed endangered or threatened raptor species were observed during spring 2010 surveys. Two state-listed species of special concern were observed during spring 2010 surveys: bald eagle and northern harrier.

Seven bald eagles were observed in the study area, three of which occurred within the Project area[9]. Two birds crossed the Bowers Ridge moving north then returning south crossing through a saddle on April 30th at a height of around 100 m (328') and the third eagle was observed along the upper slope of the ridge moving northeast on May 26th at heights between 120 and 200 m (394 to 656').

Six northern harriers observations were made on five separate days within the study area. Four of the sightings were believed to be a local female that had been observed earlier in the day or in a similar area on previous survey days. Only one sighting was thought to be a migrating individual. Northern harriers observed were located in positions B, C and D at elevations ranging from 10 to 15 m (33 to 50') up to 140 m (500') moving north to northeast in direction.

4.6 INCIDENTAL NON-RAPTOR OBSERVATIONS

There were 42 non-raptor avian species observed incidentally to the spring 2010 raptor surveys (Table 4-5). Among these species, eight species are state-listed as special concern: black and white warbler, chimney swift, chestnut-sided warbler, eastern wood-pewee, olive-sided flycatcher, tree swallow, veery, and winter wren (Table 4-5).

[9] The nearest eagle nests are 4.4 miles and 4.8 miles south of the nearest turbine. (Bald Eagle Nest Survey memo from Stantec, June 22, 2010).[9]

Table 4-5. Non-raptor avian species observed incidentally during Spring 2010 raptor migration surveys at Bowers Wind Project.

Common Name	Scientific Name	Listing
American crow	*Corvus brachyrhynchos*	
American goldfinch	*Carduelis tristis*	
American robin	*Turdus migratorius*	
barred owl	*Strix varia*	
black and white warbler	*Mniotilta varia*	concern
black-capped chickadee	*Poecile atricapilla*	
blackburnian warbler	*Dendroica fusca*	
blue jay	*Cyanocitta cristata*	
black-throated blue warbler	*Dendroica caerulescens*	
black-throated green warbler	*Dendroica virens*	
chimney swift	*Chaetura pelagica*	concern
common raven	*Corvus corax*	
common yellowthroat	*Geothlypis trichas*	
chestnut-sided warbler	*Dendroica pensylvanica*	concern
double-crested cormorant	*Phalacrocorax auritus*	
dark-eyed junco	*Junco hyemalis*	
downy woodpecker	*Picoides pubescens*	
eastern pheobe	*Sayornis phoebe*	
eastern wood-pewee	*Contopus virens*	concern
golden-crowned kinglet	*Regulus satrapa*	
hairy woodpecker	*Picoides villosus*	
hermit thrush	*Catharus guttatus*	
magnolia warbler	*Dendroica magnolia*	
mourning dove	*Zenaida macroura*	
mourning warbler	*Oporornis philadelphia*	
olive-sided flycatcher	*Contopus cooperi*	concern
ovenbird	*Seiurus aurocapillus*	
pine warbler	*Dendroica pinus*	
pileated woodpecker	*Dryocopus pileatus*	
rose-breasted grosbeak	*Pheucticus ludovicianus*	
red-breasted nuthatch	*Sitta canadensis*	
red-eyed vireo	*Vireo olivaceus*	
ruby-throated hummingbird	*Archilochus colubris*	
ruffed grouse	*Bonsa umbellus*	
scarlet tanager	*Piranga olivaca*	
tree swallow	*Tachycineta bicolor*	concern
unidentified nuthatch species	n/a	
unidentified passerine	n/a	
veery	*Catharus fuscescens*	concern
warbling vireo	*Vireo gilvus*	
white-breasted nuthatch	*Sitta carolinensis*	
winter wren	*Troglodytes troglodytes*	concern
white-throated sparrow	*Zonotrichia albicollis*	
yellow-rumped warbler	*Dendroica coronata*	

4.7 DISCUSSION

Of the 131 raptor observations made in the study area during the spring 2010 surveys, 76 percent of observations occurred within the Project area. Of these birds within the Project area, the majority (84%) occurred over or along Bowers Ridge. It should be noted that the locations where raptors were observed in the study area are subject to observer bias. Birds in closer vicinity to the observer positioned along the ridgeline would be more likely to be seen than birds that occur at greater distances from the observer. Also birds that traveled outside of the observer's viewshed would have gone undetected.

The survey effort and results of regional spring 2010 HMANA raptor surveys are available in Appendix C Table 5. The passage rate at the Project is comparable to the rates reported at regional HMANA locations in Maine, New Hampshire, and Massachusetts; however, when comparing the Bowers results to HMANA survey results, it should be considered that HMANA surveys typically do not count birds not actively migrating. The Bowers passage rate for migrants only (0.24 raptors/hour) is much lower than the results at the other HMANA survey locations.

The flight paths of raptors observed at the Project varied between survey dates and were influenced by varying wind direction and weather. During raptor migration, flight pathways and flight heights along ridges, side slopes, and across valleys may vary seasonally, daily, or hourly. Raptors may shift and use different ridgelines and cross different valleys from year to year or season to season. Weather and wind are major factors that influence migration paths as well as flight heights. Wind strongly affects the propensity of raptors to congregate along 'leading lines' or topographic features (Richardson 1998). Wind, air temperature, and cloud cover influence the development of updrafts and thermals used by raptors while making long-distance flights.

The behaviors and flight heights of raptors observed in the different topographical positions of the study area were typical of actively migrating raptors as well as non-migrant raptors traveling between locations in the general area. Raptors observed were primarily moving between resources in the area; few foraging behaviors were seen during the spring 2010 surveys. Variations in flight heights among sites, and among survey days at a single site, are due to variable weather conditions and the particular flight behaviors of different raptor species. Typically, *accipiters* and falcons use up-drafts from side slopes to gain lift and, therefore, usually fly low over ridgelines. *Buteos* tend to use lift from thermals that develop over side slopes and valleys and tend to fly high during hours of peak thermal development. Raptors (*accipiters* in particular) typically fly lower than usual during windy or inclement conditions. Local birds may fly at lower altitudes while making small scale movements between foraging locations (Barrios and Rodriguez, 2004).

The species composition and flight behaviors documented during the spring 2010 raptor surveys at the Bowers Wind Project are typical among the results of regional raptor migration studies, while the overall passage rate at the Project was comparatively low. Pre-construction raptor studies can provide baseline data regarding the species of raptor that occur in the area and the general flight behaviors of birds traveling through the area. However, currently there is no clear relationship between pre-construction and post-construction data for the prediction of raptor collision risk at wind sites.

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Appendix A

Radar survey results

Appendix A Table 1. Survey dates, results, level of effort, and weather - Spring 2010									
Date	**Sunset**	**Sunrise**	**Passage rate**	**Flight Direction**	**Flight Height (m)**	**% below 119 m**	**Temperature (C)**	**Wind Speed (m/s)**	**Wind Direction (degrees)**
4/16	19:20	5:46	114	11	373	23%	-0.01	7.06	131.20
4/19	19:23	5:40	42	124	193	32%	3.75	10.58	328.95
4/21	19:26	5:37	316	31	410	12%	8.21	5.39	208.89
4/23	19:29	5:34	120	190	199	33%	6.10	5.70	164.13
4/26	19:32	5:29	140	234	418	19%	2.70	6.80	45.85
4/29	19:36	5:24	81	73	136	62%	4.81	11.77	292.01
4/30	19:38	5:23	276	69	195	38%	8.13	8.96	287.00
5/3	19:41	5:18	372	78	177	40%	12.78	13.22	290.12
5/4	19:43	5:17	251	119	229	27%	9.78	7.15	248.82
5/5	19:44	5:15	553	28	343	9%	11.35	7.34	199.25
5/10	19:50	5:09	20	79	239	50%	0.83	10.06	318.11
5/11	19:51	5:07	286	41	362	17%	6.67	4.28	100.60
5/13	19:54	5:05	487	70	110	74%	8.64	8.91	310.32
5/14	19:55	5:04	370	34	234	24%	10.06	5.63	215.19
5/17	19:58	5:00	475	30	209	35%	15.21	3.50	194.55
5/18	19:59	4:59	222	39	267	17%	9.08	6.80	187.76
5/20	20:02	4:57	286	88	110	68%	10.77	10.53	341.04
5/21	20:03	4:56	589	41	312	16%	10.58	7.80	197.74
5/24	20:06	4:54	387	84	166	49%	21.63	6.57	284.71
5/25	20:07	4:53	470	93	176	45%	19.95	9.30	302.86
Entire Season			**289**	**56**	**243**	**26%**	**9.05**	**7.87**	**232.46**

Appendix A Table 1. Survey dates, results, level of effort, and weather - Spring 2010									
Date	Sunset	Sunrise	Passage rate	Flight Direction	Flight Height (m)	% below 131 m	Temperature (C)	Wind Speed (m/s)	Wind Direction (degrees)
4/16	19:20	5:46	114	11	373	23%	-0.01	7.06	131.20
4/19	19:23	5:40	42	124	193	32%	3.75	10.58	328.95
4/21	19:26	5:37	316	31	410	12%	8.21	5.39	208.89
4/23	19:29	5:34	120	190	199	33%	6.10	5.70	164.13
4/26	19:32	5:29	140	234	418	19%	2.70	6.80	45.85
4/29	19:36	5:24	81	73	136	62%	4.81	11.77	292.01
4/30	19:38	5:23	276	69	195	38%	8.13	8.96	287.00
5/3	19:41	5:18	372	78	177	40%	12.78	13.22	290.12
5/4	19:43	5:17	251	119	229	27%	9.78	7.15	248.82
5/5	19:44	5:15	553	28	343	9%	11.35	7.34	199.25
5/10	19:50	5:09	20	79	239	50%	0.83	10.06	318.11
5/11	19:51	5:07	286	41	362	17%	6.67	4.28	100.60
5/13	19:54	5:05	487	70	110	74%	8.64	8.91	310.32
5/14	19:55	5:04	370	34	234	24%	10.06	5.63	215.19
5/17	19:58	5:00	475	30	209	35%	15.21	3.50	194.55
5/18	19:59	4:59	222	39	267	17%	9.08	6.80	187.76
5/20	20:02	4:57	286	88	110	68%	10.77	10.53	341.04
5/21	20:03	4:56	589	41	312	16%	10.58	7.80	197.74
5/24	20:06	4:54	387	84	166	49%	21.63	6.57	284.71
5/25	20:07	4:53	470	93	176	45%	19.95	9.30	302.86
Entire Season			**289**	**56**	**243**	**26%**	**9.05**	**7.87**	**232.46**

Appendix A Table 3. Mean Nightly Flight Direction		
Night of	**Mean Flight Direction**	**Circular Stdev**
4/16	11	56
4/19	124	65
4/21	31	45
4/23	190	44
4/26	234	40
4/29	73	33
4/30	69	45
5/3	78	48
5/4	119	73
5/5	28	35
5/10	79	68
5/11	41	62
5/13	70	34
5/14	34	32
5/17	30	37
5/18	39	39
5/20	88	51
5/21	41	27
5/24	84	45
5/25	93	48
Entire Season	**56**	**56**

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 131 meters**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Mean**	**Median**	**STDV**	**SE**	
4/16	196	418	315	393	343	370	397	350	--	574	373	370	100	33	23%
4/19	171	221	185	188	192	181	235	256	111	195	193	190	39	12	32%
4/21	227	386	373	488	542	521	481	443	440	201	410	442	117	37	12%
4/23	Rain	177	176	217	Rain	234	223	220	216	125	199	217	36	13	33%
4/26	166	244	494	623	607	555	614	--	36	N/A	418	525	233	82	19%
4/29	151	179	98	107	135	126	79.9	168	174	Rain	136	135	36	12	62%
4/30	231	269	239	174	190	190	213	155	192	101	195	191	47	15	38%
5/3	151	203	181	168	191	192	147	177	186	Rain	177	181	19	6	40%
5/4	234	202	230	287	Rain	Rain	Rain	240	181	Rain	229	232	36	15	27%
5/5	204	344	384	368	403	291	339	427	323	Rain	343	344	66	22	9%
5/10	148	95	--	113	914	--	--	80	85	N/A	239	104	332	135	50%
5/11	260	247	401	468	438	400	331	331	378	N/A	362	378	76	25	17%
5/13	157	185	120	98	87.2	74.4	81.6	91	97	N/A	110	97	37	12	74%
5/14	232	257	237	220	203	201	301	226	226	N/A	234	226	30	10	24%
5/17	190	325	294	216	149	150	154	168	237	N/A	209	190	65	22	35%
5/18	305	261	259	244	265	240	220	242	364	N/A	267	259	43	14	17%
5/20	137	313	60	194	77.3	34.6	69.7	54	53	N/A	110	70	91	30	68%
5/21	255	417	340	194	219	260	323	349	456	N/A	312	323	89	30	16%
5/24	153	160	163	146	174	167	159	188	180	N/A	166	163	13	4	49%
5/25	154	189	189	189	202	202	139	140	N/A	N/A	176	189	27	9	45%
Entire Season	**196**	**255**	**249**	**255**	**296**	**244**	**250**	**227**	**219**	**244**	**243**	**204**	**133**	**10**	**26%**
-- indicates no targets counted for that hour										N/A indicates no data for that hour					

Appendix A Table 5. Summary of available avian spring 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
Spring 2005									
Ellenberg, Clinton Cty, NY	40	n/a	Great Lakes plain/ADK foothills	110	n/a	30	338	(125 m) 20%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
Sheldon, Wyoming Cty, NY	38	272	Agricultural plateau	112	6-558	25	422	(120 m) 6%	Woodlot Alternatives, Inc. 2006. A Spring 2005 Radar Survey of Bird Migration at the Proposed High Sheldon Wind Project in Sheldon, New York. Prepared for Invenergy.
Munnsville, Madison Cty, NY	41	388	Agricultural plateau	160	6-1065	31	291	(118 m) 25%	Woodlot Alternatives, Inc. 2005. A Spring 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.
Sheffield, Caledonia Cty, VT	20	180	Forested ridge	166	12-440	40	552	(125 m) 6%	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.
Stamford, Delaware Cty, NY	35	301	Forested ridge	210	10-785	46	431	(110 m) 8%	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.
Churubusco, Clinton Cty, NY	39	310	Great Lakes plain/ADK foothills	254	3-728	40	422	(120 m) 11%	Woodlot Alternatives, Inc. 2005. A Spring 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.
Prattsburgh, Steuben Cty, NY	20	183	Agricultural plateau	277	70-621	22	370	(125 m) 16%	Woodlot Alternatives, Inc. 2005. A Spring 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.
Deerfield, Bennington Cty, VT	20	183	Forested ridge	404	74-973	69	523	(100 m) 4%	Woodlot Alternatives, Inc. 2005. Spring 2005 Bird and Bat Migration Surveys at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy, Inc.
Jordanville, Herkimer Cty, NY	40	364	Agricultural plateau	409	26-1410	40	371	(125 m) 21%	Woodlot Alternatives, Inc. 2005. A Spring 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Jordanville Wind Project in Jordanville, New York. Prepared for Community Energy, Inc.
Franklin, Pendleton Cty, NY	21	204	Forested ridge	457	34-1240	53	492	(125 m) 11%	Woodlot Alternatives, Inc. 2005. A Spring 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.
Clayton, Jefferson Cty, NY	36	303	Agricultural plateau	460	71-1769	30	443	(150 m) 14%	Woodlot Alternatives, Inc. 2005. A Spring 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.
Dans Mountain, Allegany Cty, MD	23	189	Forested ridge	493	63-1388	38	541	(125 m) 15%	Woodlot Alternatives, Inc. 2005. A Spring 2005 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.
Fairfield, Herkimer Cty, NY	40	369	Agricultural plateau	509	80-1175	44	419	(145 m) 16%[1]	Woodlot Alternatives, Inc. 2005. A Spring 2005 Radar Survey of Bird and Bat Migration at the Proposed Top Notch Wind Project in Fairfield, New York. Prepared for PPM Atlantic Renewable.
Spring 2006									
Kibby, Franklin Cty, ME (Range 1)	10	80	Forested ridge	197	6-471	50	412	(120 m) 22%	Woodlot Alternatives, Inc. 2006. A Spring 2006 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Deerfield, Bennington Cty, VT	26	236	Forested ridge	263	5-934	58	435	(100 m) 11%	Woodlot Alternatives, Inc. 2006. Spring 2006 Bird and Bat Migration Surveys at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy, Inc.
Centerville, Allegany Cty, NY	42	n/a	Agricultural plateau	290	25-1140	22	351	(125 m) 16%	Mabee, T.J., J.H. Plissner, and B.A. Cooper. 2006a. A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Centerville and Wethersfield Windparks, New York, Spring 2006. Report prepared for Ecology and Environment, LLC and Noble Environmental Power, LLC. July 2006.
Wethersfield, Wyoming Cty, NY	44	n/a	Agricultural plateau	324	41-907	12	355	(125 m) 19%	Mabee, T.J., J.H. Plissner, and B.A. Cooper. 2006a. A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Centerville and Wethersfield Windparks, New York, Spring 2006. Report prepared for Ecology and Environment, LLC and Noble Environmental Power, LLC. July 2006.
Mars Hill, Aroostook Cty, ME	15	85	Forested ridge	338	76-674	58	384	(120 m) 14%	Woodlot Alternatives, Inc. 2006. A Spring 2006 Radar, Visual, and Acoustic Survey of Bird Migration at the Mars Hill Wind Farm in Mars Hill, Maine. Prepared for Evergreen Windpower, LLC.
Chateaugay, Franklin Cty, NY	35	300	Agricultural plateau	360	54-892	48	409	(120 m) 18%	Woodlot Alternatives, Inc. 2006. Spring 2006 Radar Surveys at the Proposed Chateaugay Windpark in Chateaugay, New York. Prepared for Ecology and Environment, Inc. and Noble Power, LLC.
Howard, Steuben Cty, NY	42	440	Agricultural plateau	440	35-2270	27	426	(125 m) 13%	Woodlot Alternatives, Inc. 2006. A Spring 2006 Survey of Bird and Bat Migration at the Proposed Howard Wind Power Project in Howard, New York. Prepared for Everpower Global.
Kibby, Franklin Cty, ME (Valley)	2	14	Forested ridge	443	45-1242	61	334	(120 m) n/a	Woodlot Alternatives, Inc. 2006. A Spring 2006 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Kibby, Franklin Cty, ME (Mountain)	6	33	Forested ridge	456	88-1500	67	368	(120 m) 14%	Woodlot Alternatives, Inc. 2006. A Spring 2006 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Kibby, Franklin Cty, ME (Range 2)	7	57	Forested ridge	512	18-757	86	378	(120 m) 25%	Woodlot Alternatives, Inc. 2006. A Spring 2006 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Spring 2007									
Stetson, Washington Cty, ME	21	138	Forested ridge	147	3-434	55	210	(120 m) 22%	Woodlot Alternatives, Inc. 2007. A Spring 2007 Survey of Bird and Bat Migration at the Stetson Wind Project, Washington County, Maine. Prepared for Evergreen Wind V, LLC.
Cape Vincent, Jefferson Cty, NY	50	300	Great Lakes plain	166	n/a	34	441	(125 m) 14%	Western EcoSystems Technology, Inc. (WEST). 2007. Avian and Bat Studies for the Proposed Cape Vincent Wind Power Project, Jefferson County, NY. Prepared for BP Alternative Energy North America.
New Grange, Chautauqua Cty, NY	41	n/a	Great Lakes plain	175	n/a	18	450	(125 m) 13%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
Laurel Mountain, Barbour Cty, WV	20	197	Forested ridge	277	13-646	27	533	(130 m) 3%	Stantec Consulting Services Inc. 2007. A Spring 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.
Errol, Coos County, NH	30	212	Forested ridge	342	2 to 870	76	332	(125 m) 14%	Stantec Consulting Inc. 2007. Spring 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.
Villenova, Chautauqua Cty, NY	40	n/a	Great Lakes plain	419	22-1190	10	493	(120 m) 3%	Stantec Consulting Services Inc. 2008. A Spring 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.
Roxbury, Oxford Cty, ME	20	n/a	Forested ridge	539	137-1256	52	312	(130) 18%	Woodlot Alternatives, Inc. 2007. A Spring 2007 Survey of Bird and Bat Migration at the Record Hill Wind Project, Roxbury, Maine. Prepared for Roxbury Hill Wind LLC.
Lempster, Sullivan Cty, NH	30	277	Forested ridge	542	49-1094	49	358	(125 m) 18%	Woodlot Alternatives, Inc. 2007.A Spring 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.
Spring 2008									
Lincoln, Penobscot Cty, ME	20	189	Forested ridge	247	40-766	75	316	(120 m) 13%	Stantec Consulting Services Inc. 2008.A Spring 2008 Survey of Bird and Bat Migration at the Rollins Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
Allegany, Cattaraugus Cty, NY	30	275	Forested ridge	268	53-755	18	316	(150 m) 19%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
Oakfield, Penobscot Cty, ME	20	194	Forested ridge	498	132-899	33	276	(120 m) 21%	Stantec Consulting Services Inc. 2008.A Spring 2008 Survey of Bird and Bat Migration at the Oakfield Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
Hounsfield, Jefferson Cty, NY	42	379	Great Lakes island	624	74-1630	51	319	(125 m) 19%	Stantec Consulting Services Inc. 2008. A Spring 2008 Survey of Bird Migration at the Hounsfield Wind Project, New York. Prepared for American Consulting Professionals of New York, PLLC.
New Creek, Grant Cty, WV	20	n/a	Forested ridge	1020	289-2610	30	354	(130 m) 13%	Stantec Consulting Services Inc. 2008. A Spring 2008 Survey of Bird Migration at the New Creek Wind Project, West Virginia. Prepared for AES New Creek, LLC.
Tenney, Grafton Cty, NH	40	373	Forested ridge	234	35-549	77	321	(125m) 12%	Stantec Consulting Services Inc. 2008. Spring 2008 Radar Survey Report for the Groton Wind Project. Prepared for Groton Wind, LLC.
Rollins, Penobscot Cty, ME	20	189	Forested ridge	247	40 - 766	75	316	(120 m) 13%	Stantec Consulting. 2008. Spring 2008 Bird and Bat Migration Survey Report: Visual, Radar and Acoustic Bat Surveys for the Rollins Wind Project. Prepared for First Wind, LLC.
Spring 2009									
Sisk (Kibby Expansion), Franklin Cty, ME	21	193	Forested ridge	207	50-452	28	293	(125m) 18%	Stantec Consulting Services Inc. 2009. Spring 2009 Nocturnal Migration Survey Report for the Kibby Expansion Wind Project. Prepared for TRC Engineers LLC.
Vermont Community Wind Farm, Orleans Cty, VT	15	90	Forested ridge	435	49-771	48	320	(130m) 22%	Stantec Consulting Services Inc. 2009. Spring and Summer 2009 Bird and Bat Survey Report. Prepared for Vermont Community Wind Farm, LLC.
Moresville, Delaware Cty, NY	30	275	Forested ridge	230	30-575	53	314	(125m)12%	Stantec Consulting Services Inc. 2009. 2009 Spring Nocturnal Radar Survey Report for the Moresville Energy Center. Prepared for Moresville Energy LLC.
Highland, Somerset Cty, ME (location 1)	21	192	Forested ridge	496	10-1262	47	287	(130.5m) 26%	Stantec Consulting Services Inc. 2009. Spring 2009 Ecological Surveys for the Highland Wind Project. Prepared for Highland Wind LLC
Highland, Somerset Cty, ME (location 2)	19	161	Forested ridge	511	8-1735	53	314	(130.5m) 23%	Stantec Consulting Services Inc. 2009. Spring 2009 Ecological Surveys for the Highland Wind Project. Prepared for Highland 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 S

Appendix B

Bat survey results

Appendix B Table 1. Summary of acoustic bat data and weather during each survey night at the Bowers Met High detector, 2010.

		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)
04/15/10	1												0	5.34	-0.56
04/16/10	1												0	7.06	-0.01
04/17/10	1												0	2.26	0.36
04/18/10	1												0	9.14	1.64
04/19/10	1												0	10.58	3.75
04/20/10	1												0	8.67	6.71
04/21/10	1												0	5.39	8.21
04/22/10	1												0	3.64	7.56
04/23/10	1												0	5.70	6.10
04/24/10	1												0	5.05	7.54
04/25/10	1												0	6.60	9.23
04/26/10	1												0	6.80	2.70
04/27/10	1												0	6.53	1.65
04/28/10	1												0	9.38	2.77
04/29/10	1												0	11.77	4.81
04/30/10	1	1											1	8.96	8.13
05/01/10	1												0	7.10	14.88
05/02/10	1												0	9.71	18.79
05/03/10	1												0	13.22	12.78
05/04/10	1												0	7.15	9.78
05/05/10	1	2											2	7.34	11.35
05/06/10	1												0	14.62	7.32
05/07/10	1												0	7.90	4.99
05/08/10	1												0	6.19	4.60
05/09/10	1												0	10.74	1.42
05/10/10	1												0	10.06	0.83
05/11/10	1												0	4.28	6.67
05/12/10	1												0	10.41	2.69
05/13/10	1												0	8.91	8.64
05/14/10	1			1									1	5.63	10.06
05/15/10	1												0	8.79	6.54
05/16/10	1												0	11.00	8.53
05/17/10	1	1		14							5		20	3.50	15.21
05/18/10	1												0	6.80	9.08
05/19/10	1												0	10.07	8.46
05/20/10	1												0	10.53	10.77
05/21/10	1			21							10		31	7.80	10.58
05/22/10	1	1		1									2	9.44	11.23
05/23/10	1												0	10.73	13.74
05/24/10	1	2											2	6.57	21.63
05/25/10	1												0	9.30	19.95
05/26/10	1	9		14							6		29	7.30	10.26
05/27/10	1	2											2	7.78	10.22
05/28/10	1			13							10		23	7.45	11.38
05/29/10	1	1											1	10.42	13.54
05/30/10	1												0	11.52	9.11
05/31/10	1	2		2	1						2		7	9.18	11.70
06/01/10	1										1		1		
06/02/10	1			2									2		
06/03/10	1												0		
06/04/10	1			3									3		
06/05/10	1												0		
06/06/10	1												0		
06/07/10	1				1						1		2		
06/08/10	1												0		
06/09/10	1			4							2		6		
06/10/10	1												0		
06/11/10	1												0		
06/12/10	1			12									12		
06/13/10	1			3							2		5		
06/14/10	1												0		
06/15/10	1												0		
06/16/10	1												0		
06/17/10	1												0		
06/18/10	1										1		1		
06/19/10	1												0		
06/20/10	1												0		
06/21/10	1												0		
06/22/10	1			2									2		
06/23/10	1												0		
06/24/10	1												0		
06/25/10	1												0		
06/26/10	1			4						1	4		9		
06/27/10	1			1							1		2		
06/28/10	1	1											1		
06/29/10	1												0		
06/30/10	1												0		
07/01/10	1												0		
07/02/10	1			3									3		
07/03/10	1												0		
07/04/10	1										1		1		
07/05/10	1			1									1		
07/06/10	1			13							5		18		
07/07/10	1												0		
07/08/10	1												0		
07/09/10	1			1									1		
07/10/10	1												0		
07/11/10	1												0		
07/12/10	1				1								1		
07/13/10	1	2											2		
07/14/10	1									1	2		3		
07/15/10	1									1			1		
07/16/10	1												0		
07/17/10	1												0		
07/18/10	1												0		
07/19/10	1												0		
07/20/10	1												0		
07/21/10	1												0		
07/22/10	1												0		
07/23/10	1			1						1	1		3		
07/24/10	1												0		
07/25/10	1												0		
07/26/10	1												0		
07/27/10	1			1									1		
07/28/10	1												0		
07/29/10	1												0		
07/30/10	1									1			1		
07/31/10	1			3							1		4		
08/01/10	1												0		
08/02/10	1												0		
08/03/10	1												0		
08/04/10	1									1			1		
08/05/10	1				1						1		2		
08/06/10	1												0		
08/07/10	1												0		
08/08/10	1												0		
08/09/10	1												0		
08/10/10	1												0		
08/11/10	1			3	1						3		7		
08/12/10	1												0		
08/13/10	1			1									1		
08/14/10	1												0		
08/15/10	1								1		1		2		
08/16/10	1												0		
08/17/10	1	1									1		2		
08/18/10	1												0		
08/19/10	1	2		3							1		6		
08/20/10	1												0		
08/21/10	1	1		4							2		7		
08/22/10	1			21							6		27		
08/23/10	1												0		
08/24/10	1												0		
08/25/10	1												0		
08/26/10	1				1								1		
08/27/10	1				1								1		
08/28/10	1	1									1		2		
08/29/10	1												0		
08/30/10	1										1		1		
08/31/10	1												0		
09/01/10	1								1	1			2		
09/02/10	1	1		9									10		
09/03/10	1				1								1		
09/04/10	1												0		
By Species		**30**	**0**	**161**	**8**	**0**	**0**	**0**	**2**	**7**	**72**	**0**	**280**		
By Guild		**191**			**8**	**0**	**2**			**79**					
		BBSH			**HB**	**MYSP**	**RBTB**			**UNKN**			**Total**		

* 1 = Detector functioned for the 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 Bowers Met Low detector, 2010

		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)
04/15/10	1												**0**	5.34	-0.56
04/16/10	1												**0**	7.06	-0.01
04/17/10	1												**0**	2.26	0.36
04/18/10	1												**0**	9.14	1.64
04/19/10	1												**0**	10.58	3.75
04/20/10	1												**0**	8.67	6.71
04/21/10	1												**0**	5.39	8.21
04/22/10	1												**0**	3.64	7.56
04/23/10	1												**0**	5.70	6.10
04/24/10	1												**0**	5.05	7.54
04/25/10	1												**0**	6.60	9.23
04/26/10	1												**0**	6.80	2.70
04/27/10	1												**0**	6.53	1.65
04/28/10	1												**0**	9.38	2.77
04/29/10	1												**0**	11.77	4.81
04/30/10	1												**0**	8.96	8.13
05/01/10	1												**0**	7.10	14.88
05/02/10	1												**0**	9.71	18.79
05/03/10	1												**0**	13.22	12.78
05/04/10	1												**0**	7.15	9.78
05/05/10	1												**0**	7.34	11.35
05/06/10	1												**0**	14.62	7.32
05/07/10	1												**0**	7.90	4.99
05/08/10	1												**0**	6.19	4.60
05/09/10	1												**0**	10.74	1.42
05/10/10	1												**0**	10.06	0.83
05/11/10	1												**0**	4.28	6.67
05/12/10	1												**0**	10.41	2.69
05/13/10	1												**0**	8.91	8.64
05/14/10	1												**0**	5.63	10.06
05/15/10	1												**0**	8.79	6.54
05/16/10	1												**0**	11.00	8.53
05/17/10	1	2				1							**3**	3.50	15.21
05/18/10	1												**0**	6.80	9.08
05/19/10	1												**0**	10.07	8.46
05/20/10	1	1											**1**	10.53	10.77
05/21/10	1	4		1							1		**6**	7.80	10.58
05/22/10	1	3									1		**4**	9.44	11.23
05/23/10	1												**0**	10.73	13.74
05/24/10	1										1		**1**	6.57	21.63
05/25/10	1	1											**1**	9.30	19.95
05/26/10	1	3		8							7		**18**	7.30	10.26
05/27/10	1	1									2		**3**	7.78	10.22
05/28/10	1			8	1					1	2		**12**	7.45	11.38
05/29/10	1	1											**1**	10.42	13.54
05/30/10	1												**0**	11.52	9.11
05/31/10	1			2							2		**4**	9.18	11.70
06/01/10	1			1									**1**		
06/02/10	1												**0**		
06/03/10	1												**0**		
06/04/10	1			1									**1**		
06/05/10	1												**0**		
06/06/10	1												**0**		
06/07/10	1												**0**		
06/08/10	1												**0**		
06/09/10	1			2									**2**		
06/10/10	1									1	1		**2**		
06/11/10	1												**0**		
06/12/10	1			6							2		**8**		
06/13/10	1	3		1									**4**		
06/14/10	1												**0**		
06/15/10	1												**0**		
06/16/10	1												**0**		
06/17/10	1												**0**		
06/18/10	1												**0**		
06/19/10	1					1							**1**		
06/20/10	1												**0**		
06/21/10	1				1								**1**		
06/22/10	1			1						1	1		**3**		
06/23/10	1												**0**		
06/24/10	1										2		**2**		
06/25/10	1					1				1			**2**		
06/26/10	1			5						1			**6**		
06/27/10	1					1							**1**		
06/28/10	1												**0**		
06/29/10	1												**0**		
06/30/10	1												**0**		
07/01/10	1												**0**		
07/02/10	1			1		1				2			**4**		
07/03/10	1												**0**		
07/04/10	1				2								**2**		
07/05/10	1												**0**		
07/06/10	1			2		2				1	3		**8**		
07/07/10	1												**0**		
07/08/10	1												**0**		
07/09/10	1												**0**		
07/10/10	1			2									**2**		
07/11/10	1												**0**		
07/12/10	1												**0**		
07/13/10	1			1									**1**		
07/14/10	1												**0**		
07/15/10	1	2											**2**		
07/16/10	1												**0**		
07/17/10	1												**0**		
07/18/10	1									1			**1**		
07/19/10	1												**0**		
07/20/10	1												**0**		
07/21/10	1												**0**		
07/22/10	1												**0**		
07/23/10	1												**0**		
07/24/10	1				1								**1**		
07/25/10	1	1											**1**		
07/26/10	1												**0**		
07/27/10	1			2									**2**		
07/28/10	1												**0**		
07/29/10	1	1											**1**		
07/30/10	1												**0**		
07/31/10	1										1		**1**		
08/01/10	1												**0**		
08/02/10	1		1										**1**		
08/03/10	1												**0**		
08/04/10	1												**0**		
08/05/10	1		1		1								**2**		
08/06/10	1												**0**		
08/07/10	1												**0**		
08/08/10	1												**0**		
08/09/10	1			1									**1**		
08/10/10	1												**0**		
08/11/10	1	1	1	1	1						3		**7**		
08/12/10	1												**0**		
08/13/10	1												**0**		
08/14/10	1									1			**1**		
08/15/10	1									1			**1**		
08/16/10	1												**0**		
08/17/10	1	3		1									**4**		
08/18/10	1	1											**1**		
08/19/10	1			2									**2**		
08/20/10	1												**0**		
08/21/10	1			2									**2**		
08/22/10	1	2		2							1		**5**		
08/23/10	1												**0**		
08/24/10	1									2			**2**		
08/25/10	1												**0**		
08/26/10	1			1							1		**2**		
08/27/10	1									1			**1**		
08/28/10	1									1			**1**		
08/29/10	1												**0**		
08/30/10	1				1								**1**		
08/31/10	1												**0**		
09/01/10	1												**0**		
09/02/10	1	1		2									**3**		
09/03/10	1										1		**1**		
09/04/10	1												**0**		
By Species		**31**	**3**	**56**	**8**	**7**	**0**	**0**	**0**	**15**	**32**	**0**	**152**		
By Guild		**90**			**8**	**7**	**0**			**47**					
		BBSH			**HB**	**MYSP**	**RBTB**			**UNKN**			**Total**		

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

Spring 2010 Avian and Bat Surveys
Bowers Wind Project; Washington County, Maine
September 2010

Appendix B Table 3. Summary of acoustic bat data and weather during each survey night at the Bowers 3 tree detector, 2010

		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)
04/15/10	0												0	5.34	-0.56
04/16/10	0												0	7.06	-0.01
04/17/10	0												0	2.26	0.36
04/18/10	0												0	9.14	1.64
04/19/10	0												0	10.58	3.75
04/20/10	0												0	8.67	6.71
04/21/10	0												0	5.39	8.21
04/22/10	0												0	3.64	7.56
04/23/10	0												0	5.70	6.10
04/24/10	0												0	5.05	7.54
04/25/10	0												0	6.60	9.23
04/26/10	0												0	6.80	2.70
04/27/10	0												0	6.53	1.65
04/28/10	0												0	9.38	2.77
04/29/10	0												0	11.77	4.81
04/30/10	0												0	8.96	8.13
05/01/10	0												0	7.10	14.88
05/02/10	0												0	9.71	18.79
05/03/10	0												0	13.22	12.78
05/04/10	0												0	7.15	9.78
05/05/10	1	4				20				8			32	7.34	11.35
05/06/10	1									2			2	14.62	7.32
05/07/10	1					3				3			6	7.90	4.99
05/08/10	1					1							1	6.19	4.60
05/09/10	0												0	10.74	1.42
05/10/10	0												0	10.06	0.83
05/11/10	0												0	4.28	6.67
05/12/10	0												0	10.41	2.69
05/13/10	0												0	8.91	8.64
05/14/10	0												0	5.63	10.06
05/15/10	0												0	8.79	6.54
05/16/10	0												0	11.00	8.53
05/17/10	0												0	3.50	15.21
05/18/10	0												0	6.80	9.08
05/19/10	0												0	10.07	8.46
05/20/10	0												0	10.53	10.77
05/21/10	0												0	7.80	10.58
05/22/10	0												0	9.44	11.23
05/23/10	0												0	10.73	13.74
05/24/10	0												0	6.57	21.63
05/25/10	0												0	9.30	19.95
05/26/10	0												0	7.30	10.26
05/27/10	1					16				3	1		20	7.78	10.22
05/28/10	1			1		10				1	1		13	7.45	11.38
05/29/10	1					9				3	1		13	10.42	13.54
05/30/10	1				1	10				3			14	11.52	9.11
05/31/10	1					2				1			3	9.18	11.70
06/01/10	1					8				2			10		
06/02/10	1	2				2				4			8		
06/03/10	1					6				4			10		
06/04/10	1					17				2			19		
06/05/10	1					6				5			11		
06/06/10	1									1			1		
06/07/10	1					15				26			41		
06/08/10	1					6				1			7		
06/09/10	1					10				3			13		
06/10/10	1					23				7			30		
06/11/10	1	1	1		2	8				8			20		
06/12/10	1		1	1		25			2	24	1		54		
06/13/10	1				1	8				21			30		
06/14/10	1				1	11				10			22		
06/15/10	1	3			1	7				6	2		19		
06/16/10	1	2				7			1	3	1		14		
06/17/10	1	1				13				15			29		
06/18/10	1			1		11				8			20		
06/19/10	1					1				3			4		
06/20/10	1	1		1		10				17			29		
06/21/10	1	1				13				31			45		
06/22/10	1			1		9				21	1		32		
06/23/10	1					10				1			11		
06/24/10	1	1				16				10	1		28		
06/25/10	1					8				18			26		
06/26/10	1			1		19				42			62		
06/27/10	1					11				17			28		
06/28/10	1				1	10				16			27		
06/29/10	1					17				15			32		
06/30/10	1	1				8				15			24		
07/01/10	1					8				24			32		
07/02/10	1	3				7			1	59			70		
07/03/10	1					5			1	14	1		21		
07/04/10	1	1				18				46			65		
07/05/10	1					2		1		6			9		
07/06/10	1	1				6				16	2		25		
07/07/10	1	2				8				2	3		15		
07/08/10	1					3				1			4		
07/09/10	1					4				1			5		
07/10/10	1	1	11		1	21				10			44		
07/11/10	1		3			23				6	1		33		
07/12/10	1		4			11				4	1		20		
07/13/10	1		2		1	8				5			16		
07/14/10	1		20			27				21			68		
07/15/10	1	3	6			16				6	1		32		
07/16/10	1	1	2			14				3			20		
07/17/10	1	3	2			10				3			18		
07/18/10	1		2		2	9	1						14		
07/19/10	1	6	4		3	25				5	2		45		
07/20/10	1		6			29				8	2		45		
07/21/10	1					7				2			9		
07/22/10	1	8				25			62	47			142		
07/23/10	1	26		1		14				14			55		
07/24/10	1	3				5				4			12		
07/25/10	1	1				12			1	3			17		
07/26/10	1	1				5			1	3	1		11		
07/27/10	1	12				10				15	1		38		
07/28/10	1	1				4			1	2			8		
07/29/10	1	6				14				6			26		
07/30/10	1	4				12			1	6	2		25		
07/31/10	1	28		1		4				14	3		50		
08/01/10	1	41				4				28	1		74		
08/02/10	1	34		2		3			1	18			58		
08/03/10	1	16		3						3	5		27		
08/04/10	1	3		2		7				6			18		
08/05/10	1	7				6			1	3			17		
08/06/10	1					9			2	4			15		
08/07/10	1					6				2			8		
08/08/10	1	4				7				3			14		
08/09/10	1	5		1		49				11			66		
08/10/10	1	8				13			1	11			33		
08/11/10	1	11		2		10				5	1		29		
08/12/10	1					9				4	1		14		
08/13/10	1	8				4				5	1		18		
08/14/10	1	4		1		6				5			16		
08/15/10	1					1				3			4		
08/16/10	1					2				1			3		
08/17/10	1	6				35			2	19			62		
08/18/10	1					8				2			10		
08/19/10	1	1				4			1	4			10		
08/20/10	1					7			4	2			13		
08/21/10	1			2		4			2	5	2		15		
08/22/10	1	2		1		4				3			10		
08/23/10	1					7				3			10		
08/24/10	1					4				2			6		
08/25/10	1									3			3		
08/26/10	1	3		1		5				6	1		16		
08/27/10	1	3				2			3	10			18		
08/28/10	1					2			1	7			10		
08/29/10	1								1	7			8		
08/30/10	1					44			1	7			52		
08/31/10	1	1		1		6				3			11		
09/01/10	1					2				1			3		
09/02/10	1	1		1		16				9	1		28		
09/03/10	1					2				7			9		
09/04/10	1												0		
By Species		**286**	**64**	**25**	**14**	**1040**	**1**	**1**	**91**	**948**	**42**	**0**	**2512**		
By Guild		**375**			**14**	**1040**	**93**			**990**					
		BBSH			**HB**	**MYSP**	**RBTB**			**UNKN**			**Total**		

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

Appendix B Table 4. Summary of acoustic bat data and weather during each survey night at the Bowers 4 tree detector, 2010.

		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)
04/15/10	1												0	5.34	-0.56
04/16/10	1												0	7.06	-0.01
04/17/10	1												0	2.26	0.36
04/18/10	1												0	9.14	1.64
04/19/10	1												0	10.58	3.75
04/20/10	1					4				1			5	8.67	6.71
04/21/10	1					3				1			4	5.39	8.21
04/22/10	1					7							7	3.64	7.56
04/23/10	1		1										1	5.70	6.10
04/24/10	1					5				3			8	5.05	7.54
04/25/10	1									1			1	6.60	9.23
04/26/10	1					2				1			3	6.80	2.70
04/27/10	1												0	6.53	1.65
04/28/10	1												0	9.38	2.77
04/29/10	1												0	11.77	4.81
04/30/10	1					2							2	8.96	8.13
05/01/10	1					1							1	7.10	14.88
05/02/10	1												0	9.71	18.79
05/03/10	1										1		1	13.22	12.78
05/04/10	1									1			1	7.15	9.78
05/05/10	1												0	7.34	11.35
05/06/10	1												0	14.62	7.32
05/07/10	1												0	7.90	4.99
05/08/10	1												0	6.19	4.60
05/09/10	1												0	10.74	1.42
05/10/10	1												0	10.06	0.83
05/11/10	1												0	4.28	6.67
05/12/10	1									1			1	10.41	2.69
05/13/10	1												0	8.91	8.64
05/14/10	1												0	5.63	10.06
05/15/10	1												0	8.79	6.54
05/16/10	1					2					1		3	11.00	8.53
05/17/10	1									2			2	3.50	15.21
05/18/10	1												0	6.80	9.08
05/19/10	1												0	10.07	8.46
05/20/10	1												0	10.53	10.77
05/21/10	1										1		1	7.80	10.58
05/22/10	1	1									1		2	9.44	11.23
05/23/10	1												0	10.73	13.74
05/24/10	1	1				2				1			4	6.57	21.63
05/25/10	1												0	9.30	19.95
05/26/10	1					2							2	7.30	10.26
05/27/10	1					9					2		11	7.78	10.22
05/28/10	1	1		1		1				1	1		5	7.45	11.38
05/29/10	1										1		1	10.42	13.54
05/30/10	1												0	11.52	9.11
05/31/10	1	1		1									2	9.18	11.70
06/01/10	1												0		
06/02/10	1	6									1		7		
06/03/10	1												0		
06/04/10	1					1				2			3		
06/05/10	1												0		
06/06/10	1												0		
06/07/10	1												0		
06/08/10	1												0		
06/09/10	1					3				2			5		
06/10/10	1									5			5		
06/11/10	1										1		1		
06/12/10	1	1		1		2				2	1		7		
06/13/10	1					1							1		
06/14/10	1												0		
06/15/10	1		6		1	1				1	1		10		
06/16/10	1												0		
06/17/10	1												0		
06/18/10	1												0		
06/19/10	1												0		
06/20/10	1												0		
06/21/10	1												0		
06/22/10	1												0		
06/23/10	1					1							1		
06/24/10	1												0		
06/25/10	1												0		
06/26/10	1					1					1		2		
06/27/10	1					1				5			6		
06/28/10	1									1			1		
06/29/10	1												0		
06/30/10	1												0		
07/01/10	1												0		
07/02/10	1									3			3		
07/03/10	1					2				3			5		
07/04/10	1					1				1	1		3		
07/05/10	1					3							3		
07/06/10	1					20				8			28		
07/07/10	1					2				2			4		
07/08/10	1				1								1		
07/09/10	1	1								1			2		
07/10/10	1				1								1		
07/11/10	1												0		
07/12/10	1					1				2			3		
07/13/10	1					2				1			3		
07/14/10	1				1	2				1			4		
07/15/10	1					2				4			6		
07/16/10	1												0		
07/17/10	1		1			3							4		
07/18/10	1				1	2							3		
07/19/10	1			1									1		
07/20/10	1					1				3			4		
07/21/10	1												0		
07/22/10	1												0		
07/23/10	1												0		
07/24/10	1												0		
07/25/10	1												0		
07/26/10	0												0		
07/27/10	0												0		
07/28/10	0												0		
07/29/10	0												0		
07/30/10	0												0		
07/31/10	0												0		
08/01/10	0												0		
08/02/10	0												0		
08/03/10	0												0		
08/04/10	0												0		
08/05/10	0												0		
08/06/10	0												0		
08/07/10	0												0		
08/08/10	0												0		
08/09/10	0												0		
08/10/10	0												0		
08/11/10	1	1				1				1			3		
08/12/10	1					1				1			2		
08/13/10	1												0		
08/14/10	1					2							2		
08/15/10	1									1			1		
08/16/10	1												0		
08/17/10	1					2							2		
08/18/10	1	1				2							3		
08/19/10	1			1		3							4		
08/20/10	1									1			1		
08/21/10	1					1					1		2		
08/22/10	1									1			1		
08/23/10	1												0		
08/24/10	1												0		
08/25/10	1												0		
08/26/10	1												0		
08/27/10	1												0		
08/28/10	1									3			3		
08/29/10	1												0		
08/30/10	1												0		
08/31/10	1									1			1		
09/01/10	1	1				1			1		1		4		
09/02/10	1										1		1		
09/03/10	1												0		
09/04/10	1									2			2		
By Species		**15**	**8**	**5**	**5**	**105**	**0**	**0**	**1**	**71**	**17**	**0**	**227**		
By Guild		**28**			**5**	**105**	**1**			**88**					
		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 5. Summary of acoustic bat data and weather during each survey night at the Bowers 5 tree detector, 2010.

		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)
04/15/10	1												**0**	5.34	-0.56
04/16/10	1												**0**	7.06	-0.01
04/17/10	1												**0**	2.26	0.36
04/18/10	1												**0**	9.14	1.64
04/19/10	1												**0**	10.58	3.75
04/20/10	1												**0**	8.67	6.71
04/21/10	1									1			**1**	5.39	8.21
04/22/10	1					1							**1**	3.64	7.56
04/23/10	1												**0**	5.70	6.10
04/24/10	1					3							**3**	5.05	7.54
04/25/10	1									1			**1**	6.60	9.23
04/26/10	1	1				3				1			**5**	6.80	2.70
04/27/10	1					1							**1**	6.53	1.65
04/28/10	1												**0**	9.38	2.77
04/29/10	1												**0**	11.77	4.81
04/30/10	1					1							**1**	8.96	8.13
05/01/10	1					77				6			**83**	7.10	14.88
05/02/10	1					42				17			**59**	9.71	18.79
05/03/10	1					10				5			**15**	13.22	12.78
05/04/10	1					2				7			**9**	7.15	9.78
05/05/10	1					10				11	2		**23**	7.34	11.35
05/06/10	1	1				3				4			**8**	14.62	7.32
05/07/10	1					3				4			**7**	7.90	4.99
05/08/10	1					1							**1**	6.19	4.60
05/09/10	1												**0**	10.74	1.42
05/10/10	1												**0**	10.06	0.83
05/11/10	1	1				7							**8**	4.28	6.67
05/12/10	1					1							**1**	10.41	2.69
05/13/10	1					9							**9**	8.91	8.64
05/14/10	1	2				18				18	1		**39**	5.63	10.06
05/15/10	1					7				4			**11**	8.79	6.54
05/16/10	1	2				4				5			**11**	11.00	8.53
05/17/10	0												**0**	3.50	15.21
05/18/10	0												**0**	6.80	9.08
05/19/10	0												**0**	10.07	8.46
05/20/10	0												**0**	10.53	10.77
05/21/10	0												**0**	7.80	10.58
05/22/10	0												**0**	9.44	11.23
05/23/10	0												**0**	10.73	13.74
05/24/10	0												**0**	6.57	21.63
05/25/10	0												**0**	9.30	19.95
05/26/10	0												**0**	7.30	10.26
05/27/10	1					4			1	1			**6**	7.78	10.22
05/28/10	1					2							**2**	7.45	11.38
05/29/10	1				10	22			1	29			**62**	10.42	13.54
05/30/10	1					10				7			**17**	11.52	9.11
05/31/10	1	1				24				10			**35**	9.18	11.70
06/01/10	1				2	8				4			**14**		
06/02/10	1					5				6	2		**13**		
06/03/10	1					3				2			**5**		
06/04/10	1					21				32	1		**54**		
06/05/10	1					1				3			**4**		
06/06/10	1												**0**		
06/07/10	1												**0**		
06/08/10	1												**0**		
06/09/10	1					1				9			**10**		
06/10/10	1				1	1				4			**6**		
06/11/10	1					9				26			**35**		
06/12/10	1					27				12	1		**40**		
06/13/10	1					6				12			**18**		
06/14/10	1					10				9			**19**		
06/15/10	1				1	3				2	3		**9**		
06/16/10	1					11				23			**34**		
06/17/10	1				1	5			1	8			**15**		
06/18/10	1					15				13	1		**29**		
06/19/10	1					5				7	1		**13**		
06/20/10	1	1				7			1	11			**20**		
06/21/10	1	1				10				14			**25**		
06/22/10	1	1				11			1	30			**43**		
06/23/10	1					1				10			**11**		
06/24/10	1	1				5				8			**14**		
06/25/10	1					3				5			**8**		
06/26/10	1				1	21				14			**36**		
06/27/10	1									23			**23**		
06/28/10	1									7			**7**		
06/29/10	1									6			**6**		
06/30/10	1									3			**3**		
07/01/10	1									2			**2**		
07/02/10	1									5			**5**		
07/03/10	1									28			**28**		
07/04/10	1									16			**16**		
07/05/10	1									2			**2**		
07/06/10	1									18			**18**		
07/07/10	1					28				15	1		**44**		
07/08/10	1	1				32			1	24			**58**		
07/09/10	1					15				13			**28**		
07/10/10	1					13				23			**36**		
07/11/10	1					8				10			**18**		
07/12/10	1	2				18				24			**44**		
07/13/10	1					22				13			**35**		
07/14/10	1					8				14	1		**23**		
07/15/10	1	1				7				35			**43**		
07/16/10	1	1				2				17	2		**22**		
07/17/10	1					6				34			**40**		
07/18/10	1	1				6				29			**36**		
07/19/10	1					18				49	1		**68**		
07/20/10	1	2			1	6			1	16			**26**		
07/21/10	1	3				13				28			**44**		
07/22/10	1	2				6				18			**26**		
07/23/10	1			1		14				39			**54**		
07/24/10	1	1				12				69			**82**		
07/25/10	1					8			1	37			**46**		
07/26/10	1					17				30			**47**		
07/27/10	1					12				23			**35**		
07/28/10	1	3				13			2	86			**104**		
07/29/10	1	1				15				21			**37**		
07/30/10	1					11				9			**20**		
07/31/10	1			1		14			1	20			**36**		
08/01/10	1					9				30			**39**		
08/02/10	1	2				3			2	56			**63**		
08/03/10	1	3				5				59			**67**		
08/04/10	1	3			1	7				59			**70**		
08/05/10	1	2				17				83	1		**103**		
08/06/10	1					7				15			**22**		
08/07/10	1									3	1		**4**		
08/08/10	1					16		1		73	1		**91**		
08/09/10	1					10			1	43	1		**55**		
08/10/10	1	1				7				18	1		**27**		
08/11/10	1					15				15	1		**31**		
08/12/10	1	1				6				15			**22**		
08/13/10	1	1				18				36			**55**		
08/14/10	1	2				20			1	51			**74**		
08/15/10	1					21			2	45			**68**		
08/16/10	1								1	29			**30**		
08/17/10	1	2			1	19				62	1		**85**		
08/18/10	1	3		1		24			1	73			**102**		
08/19/10	1	1		1		30			2	30			**64**		
08/20/10	1	1				34				4	1		**40**		
08/21/10	1	1		2		35				35			**73**		
08/22/10	1					20			2	49			**71**		
08/23/10	1	1		1		14				13			**29**		
08/24/10	1					17				12	1		**30**		
08/25/10	1					4				24			**28**		
08/26/10	0												**0**		
08/27/10	0												**0**		
08/28/10	0												**0**		
08/29/10	0												**0**		
08/30/10	0												**0**		
08/31/10	0												**0**		
09/01/10	0												**0**		
09/02/10	0												**0**		
09/03/10	0												**0**		
09/04/10	0												**0**		
By Species		**54**	**0**	**7**	**19**	**1136**	**0**	**1**	**23**	**2133**	**26**	**0**	**3399**		
By Guild		**61**			**19**	**1136**	**24**			**2159**					
		BBSH			**HB**	**MYSP**	**RBTB**			**UNKN**			**Total**		

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

Appendix B Table 6. Summary of acoustic bat data and weather during each survey night at the Bowers 6 tree detector, 2010.

		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)
04/15/10	1												0	5.34	-0.56
04/16/10	1												0	7.06	-0.01
04/17/10	1												0	2.26	0.36
04/18/10	1												0	9.14	1.64
04/19/10	1												0	10.58	3.75
04/20/10	1									2			2	8.67	6.71
04/21/10	1					1				1			2	5.39	8.21
04/22/10	1					1							1	3.64	7.56
04/23/10	1									1			1	5.70	6.10
04/24/10	1									1			1	5.05	7.54
04/25/10	1					2				1			3	6.60	9.23
04/26/10	1												0	6.80	2.70
04/27/10	1												0	6.53	1.65
04/28/10	1												0	9.38	2.77
04/29/10	1												0	11.77	4.81
04/30/10	1					1				1			2	8.96	8.13
05/01/10	1					3				6			9	7.10	14.88
05/02/10	1												0	9.71	18.79
05/03/10	1												0	13.22	12.78
05/04/10	1	1				2					1		4	7.15	9.78
05/05/10	1			1		2							3	7.34	11.35
05/06/10	1									1			1	14.62	7.32
05/07/10	1												0	7.90	4.99
05/08/10	1					1							1	6.19	4.60
05/09/10	1												0	10.74	1.42
05/10/10	1												0	10.06	0.83
05/11/10	1					2							2	4.28	6.67
05/12/10	1					1							1	10.41	2.69
05/13/10	1					1							1	8.91	8.64
05/14/10	1					1							1	5.63	10.06
05/15/10	1					1							1	8.79	6.54
05/16/10	1					1							1	11.00	8.53
05/17/10	1					14				67			81	3.50	15.21
05/18/10	1	1				2				4			7	6.80	9.08
05/19/10	1												0	10.07	8.46
05/20/10	1					41				13			54	10.53	10.77
05/21/10	1					122				46			168	7.80	10.58
05/22/10	1												0	9.44	11.23
05/23/10	1	1				1				2			4	10.73	13.74
05/24/10	1					6				2			8	6.57	21.63
05/25/10	1					6				7			13	9.30	19.95
05/26/10	1					6				2			8	7.30	10.26
05/27/10	1									2			2	7.78	10.22
05/28/10	1					11				4			15	7.45	11.38
05/29/10	1					1				2			3	10.42	13.54
05/30/10	1					2				1			3	11.52	9.11
05/31/10	1									1			1	9.18	11.70
06/01/10	1					2				3			5		
06/02/10	1									1			1		
06/03/10	1												0		
06/04/10	1				3	3				6	1		13		
06/05/10	1					2				1			3		
06/06/10	1									1			1		
06/07/10	1					6				1			7		
06/08/10	1					2							2		
06/09/10	1					20				21			41		
06/10/10	1					5				1			6		
06/11/10	1					3							3		
06/12/10	1					12				2	1		15		
06/13/10	1		1			9				2			12		
06/14/10	1					4				1			5		
06/15/10	1					3				5			8		
06/16/10	1									3			3		
06/17/10	1					2			1	4			7		
06/18/10	1					4			1		1		6		
06/19/10	1									1			1		
06/20/10	1												0		
06/21/10	1		1			6				5			12		
06/22/10	1					2				7			9		
06/23/10	1					2							2		
06/24/10	1					3				2			5		
06/25/10	1					4				2			6		
06/26/10	1					60			2	11	1		74		
06/27/10	1					8				4			12		
06/28/10	1					2				3			5		
06/29/10	1					8				6			14		
06/30/10	1					2				4			6		
07/01/10	1					1			1	2			4		
07/02/10	1					54				35			89		
07/03/10	1	1				5				2			8		
07/04/10	1					28				13			41		
07/05/10	1					3				7			10		
07/06/10	1					12				8			20		
07/07/10	1									1			1		
07/08/10	1									3			3		
07/09/10	1									1			1		
07/10/10	1			1		41			2	18			62		
07/11/10	1												0		
07/12/10	1	1				9				1			11		
07/13/10	1					2				4			6		
07/14/10	1					109				45			154		
07/15/10	1					8				3			11		
07/16/10	1					5				2			7		
07/17/10	1					37				17			54		
07/18/10	1	1				10				12			23		
07/19/10	1		1			30			2	18	1		52		
07/20/10	1	1				9				4			14		
07/21/10	1					15			1	18			34		
07/22/10	1					14				3			17		
07/23/10	1	2				39		1	1	23			66		
07/24/10	1					3				3			6		
07/25/10	1					4				2			6		
07/26/10	1	1				3							4		
07/27/10	1					20				8	1		29		
07/28/10	1	1				2				3			6		
07/29/10	1					9				4			13		
07/30/10	1	1				10			1	14			26		
07/31/10	1	1				9			3	8			21		
08/01/10	1					2		1		1			4		
08/02/10	1	1				6				1			8		
08/03/10	1					4				4			8		
08/04/10	1	1				2			1	5			9		
08/05/10	1	1				20				17			38		
08/06/10	1					2				2			4		
08/07/10	1					2				3			5		
08/08/10	1	2				3			1	14			20		
08/09/10	1	3				116				94			213		
08/10/10	1	1				53				8			62		
08/11/10	1	4				31		1	13	16			65		
08/12/10	1					8		1	1	2			12		
08/13/10	1	2				19				16			37		
08/14/10	1	1				12				6			19		
08/15/10	1					3				4			7		
08/16/10	1					2				4			6		
08/17/10	1					212			1	65			278		
08/18/10	1					38				10			48		
08/19/10	1					6				2			8		
08/20/10	1					68				11			79		
08/21/10	1	3				472			2	65	8		550		
08/22/10	1					26				7			33		
08/23/10	1					44			5	23			72		
08/24/10	1					26				17			43		
08/25/10	1					7				1			8		
08/26/10	1					27				3			30		
08/27/10	1					6				4			10		
08/28/10	1					13				2			15		
08/29/10	1	1				7				2			10		
08/30/10	1					6							6		
08/31/10	1					7				3			10		
09/01/10	1					3				3			6		
09/02/10	1					17				9			26		
09/03/10	1					8				7			15		
09/04/10	1					3				1			4		
By Species		33	3	2	3	2178	0	4	39	978	15	0	3255		
By Guild		38			3	2178	43			993					
		BBSH			HB	MYSP	RBTB			UNKN			Total		

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

Appendix C

Raptor Data Tables

Appendix C Table 1. Daily total and species composition of raptor observations during Spring 2010 surveys at Bowers Wind Project

Species	4/21/2010	4/23/2010	4/30/2010	5/4/2010	5/5/2010	5/13/2010	5/14/2010	5/18/2010	5/20/2010	5/21/2010	5/25/2010	5/26/2010	Entire Season
American kestrel		1	1	1	2	1	1			1			**8**
bald eagle	1	1	2			2						1	**7**
broad-winged hawk				2			1	2		1		2	**8**
Cooper's hawk												1	**1**
northern harrier				2	1	1		1		1			**6**
osprey				2									**2**
red-tailed hawk		2	2		1		1	3					**9**
sharp-shinned hawk	1		3	3				1					**8**
turkey vulture	5	4	7	6	7	9	1	10	7	1	11	7	**75**
unidentified accipiter	1						1						**2**
unidentified buteo	1												**1**
unidentified raptor			1		1			1	1				**4**
Daily Totals:	**9**	**8**	**16**	**16**	**12**	**13**	**5**	**18**	**8**	**4**	**11**	**11**	**131**

Appendix C Table 2. Hourly summary of raptor observations during Spring 2010 surveys at Bowers Wind Project

Species	9:00-10:00	10:00-11:00	11:00-12:00	12:00-1:00	1:00-2:00	2:00-3:00	3:00-4:00	Total
American kestrel		3	1	2			2	**8**
bald eagle		4				1	2	**7**
broad-winged hawk	1	4	1			1	1	**8**
Cooper's hawk	1							**1**
northern harrier	2		2			2		**6**
osprey	2							**2**
red-tailed hawk		1	1	2	4	1		**9**
sharp-shinned hawk	1	1	1	1	3	1		**8**
turkey vulture	12	12	10	13	10	6	12	**75**
unidentified accipiter				2				**2**
unidentified buteo				1				**1**
unidentified raptor	1	3						**4**
Hourly Totals:	**20**	**28**	**16**	**21**	**17**	**12**	**17**	**131**

Appendix C Table 3. Total observations of raptor species at locations within the Spring 2010 study area at Bowers Wind Project

Species	Bowers ridge	Dill Hill	North of Project area	South of Project area	Total
American kestrel	8	0	0	0	**8**
bald eagle	5	0	0	2	**7**
broad-winged hawk	8	0	0	0	**8**
Coopers hawk	1	0	0	0	**1**
northern harrier	5	0	1	0	**6**
osprey	2	0	0	0	**2**
red-tailed hawk	9	0	0	0	**9**
shrep-shinned hawk	7	0	1	0	**8**
turkey vulture	64	1	3	7	**75**
unidentified accipter	1	0	1	0	**2**
unidentified buteo	0	0	0	1	**1**
unidentified raptor	2	1	0	1	**4**
Total:	**112**	**2**	**6**	**11**	**131**

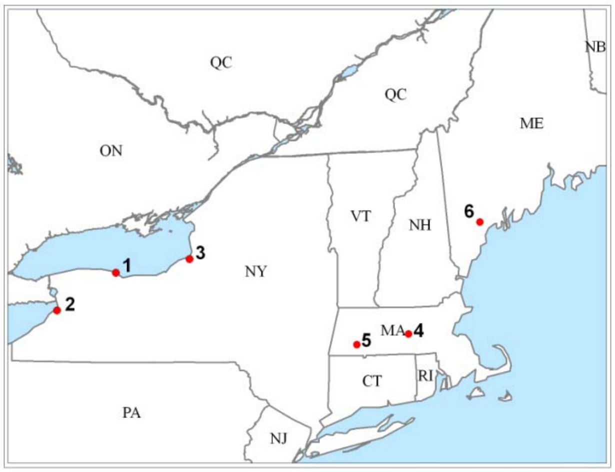
Appendix C Table 4. Number of individuals of species observed within Study area in proposed turbine areas (flight positions A and B) above or below 131m, Spring 2010 surveys at Bowers Wind Project

Species	131 m or greater	less than 131 m
American kestrel	0	8
bald eagle	0	3
broad-winged hawk	1	6
Cooper's hawk	1	0
northern harrier	0	4
osprey	0	2
red-tailed hawk	0	7
sharp-shinned hawk	0	4
turkey vulture	0	61
unidentified raptor	0	3
TOTAL	**2**	98

Appendix C Table 5. Summary of Regional Spring 2010 Migration Surveys*

Site Number**	Season & Year	Location	Observation Hours	BV	TV	OS	BE	NH	SS	CH	NG	RS	BW	RT	RL	GE	AK	ML	PG	UA	UB	UF	UE	UR
1	Spring 2010	Bowers Wind Project; Washington County, Maine	84	0	75	2	7	6	8	1	0	0	8	9	0	0	8	0	0	2	1	0	0	4
2	Spring 2010	Bradbury Mountain; Pownal, Maine	432.75	1	354	500	52	106	724	97	7	67	1746	292	0	0	450	44	3	10	5	3	0	13
3	Spring 2010	Barre Falls, Barre, MA	150.50	0	104	80	18	10	118	20	0	11	1101	66	0	0	31	1	0	0	0	0	0	13
4	Spring 2010	Pitcher Mountain; Stoddard, NH	23.25	0	28	3	1	2	5	1	2	2	50	8	0	2	4	0	0	0	1	0	0	8
5	Spring 2010	Pilgrim Heights; North Truro, MA	280.00	10	794	174	19	13	527	39	2	15	331	155	0	0	119	72	26	1	3	3	0	2
6	Spring 2010	Plum Island; Newburyport, MA	121.33	0	18	27	0	39	133	9	0	0	0	0	0	0	305	88	5	5	1	6	0	4

* Data obtained from HMANA 2010.
** See map to right for site location.



BV - Black Vulture
TV - Turkey Vulture
OS - Osprey
BE - Bald Eagle
NH - Northern Harrier
SS - Sharp-shinned Hawk
CH - Cooper's Hawk
NG - Northern Goshawk
RS - Red-shouldered Hawk
BW - Broad-winged Hawk
RT - Red-tailed Hawk
RL - Rough-legged Hawk
GE - Golden Eagle
AK - American Kestrel
ML - Merlin
PG - Peregrine Falcon
SW - Swainson's Hawk
UR - unidentified Raptor
UB - unidentified Buteo
UA - unidentified Accipiter
UF - unidentified Falcon
UE - unidentified Eagle

Memo

To:	Geoff West First Wind	From:	Bryan Emerson Stantec Consulting
File:	195600522	Date:	June 22, 2010

Reference: Spring 2010 Aerial Survey
Bowers Wind Project

As requested, Stantec Consulting (Stantec) conducted aerial surveys for bald eagle (*Haliaeetus leucocephalus*) nests, osprey (*Pandion haliaetus*) nests, and great blue heron (*Ardea herodias*) rookeries[1] in the vicinity of the proposed Bowers Wind Project (project). The survey area included waterbodies in Carroll Plt, Kossuth Twp, T6R1 NBPP, Pukakon Twp, and Lakeville, Maine. Prior to the survey, Stantec reviewed information provided by the Maine Department of Inland Fisheries and Wildlife (MDIFW) regarding known active and historic bald eagle nest locations and documented great blue heron nesting activity in the vicinity of the project area. Stantec also consulted with Charlie Todd of the MDIFW, who confirmed that the aerial survey was performed at an appropriate time of year and employed methods consistent with MDIFW and U.S. Fish and Wildlife Service (USFWS) aerial survey protocol. In compliance with USFWS National Bald Eagle Management Guidelines (May 2007), Stantec also notified Mark McCullough of the USFWS Maine Field Office that flights were planned in this area and that Stantec was coordinating with MDIFW on the timing and methods of the flights.

Survey Methods

Stantec conducted two aerial surveys. The first flight was conducted on April 21, 2010. The purpose of the first flight was to identify new nests and to assess eagle nesting activity at known nest locations in the survey area. The timing of the first flight was chosen in consultation with MDIFW to correspond with the time period when bald eagles are actively incubating eggs. The second flight was conducted on June 9, 2010, to check the status of active nests in the survey area and to perform a second search on areas where a nest was suspected but not seen during the first flight. The timing of the second flight was chosen to correspond to the time period when eaglets have hatched and are visible in the nest to determine hatching success.

The survey consisted of low altitude passes, approximately 500 feet above ground level, along the shoreline of 9 waterbodies and a stretch of Baskahegan Stream, within an approximately 4-mile radius of the proposed turbine locations for the project. A four-mile radius is recommended by the Maine Field Office of the USFWS in the Guidelines for Building and Operating Wind Energy Facilities in Maine (November 2009). Four miles is the average distance that Maine bald eagles may be expected to travel within their nesting territory. The waterbodies surveyed are shown on Figure 1 and include Lindsay Bog, Lowell Lake, Duck Lake, Keg Lake, Mill Privilege Lake, Junior Lake, Scraggly Lake, Shaw Lake, and Pleasant Lake. Because the southern portion of Junior Lake is located outside of the four-mile radius of the project area, Stantec surveyed only the northern half of the lake. The shorelines of all waterbodies were surveyed for bald eagle and osprey nest sites, as well as for great blue heron rookeries. Incidental observations of adult and sub-adult bald eagles were also recorded. Note that those lakes and ponds with known active bald eagle nests were not further surveyed for new nests. Based on consultation with MDIFW, bald eagles are territorial and multiple active nests on

[1] A "rookery" is a nesting colony of great blue heron nests generally located in woodlands or in swamps, bogs, and other large, open wetland areas. In Maine, rookeries range in size from 1 to 120 nests, with the average between 8 and 12 nests according to MDIFW. Individual nests are approximately 1-meter in size and can be found in either hardwood or softwood trees. Nests are generally located in the tops of trees to avoid predators, but multiple nests can be found in a single tree.

smaller lakes and ponds are uncommon. Therefore, additional searching was not required on the lakes and ponds with active nests in the survey area.

Survey Results

Stantec identified one active bald eagle nest in the general vicinity of the Project, located more than four miles from the proposed turbine locations; it was surveyed because it is located on a waterbody that is partially located within four miles.

During the first flight, Stantec located a known nest located on an island on Scraggly Lake (MDIFW Nest #189). One adult bald eagle was observed sitting in the nest in an incubating position, and another adult bald eagle was seen perched on the island. Stantec attempted to locate the known bald eagle nest locations on Junior Lake (MDIFW Nest #258A/B), but no nests were observed at either location. Stantec observed an adult bald eagle perched on an island on Junior Lake and observed a sub-adult bald eagle perched near nest location #258A. Stantec also observed an adult bald eagle flying over Pleasant Lake. No other nests or bald eagles were observed. Stantec attempted to locate the mapped great blue heron rookery site located along Baskahegan Stream (MDIFW #142) but was unable to find any evidence of a nesting site. No other great blue heron rookeries or osprey nests were observed.

During the second flight, Stantec surveyed Nest #189 on Scraggly Lake and observed one eaglet standing in the nest. An adult bald eagle was also seen flying along the southern shoreline of the lake. Stantec searched the nest locations on Junior Lake during this flight, but no nests were observed. One adult bald eagle was observed flying south of these nest locations. No other nests or bald eagles were observed during the flight, and no osprey nests or great blue heron rookeries were observed.

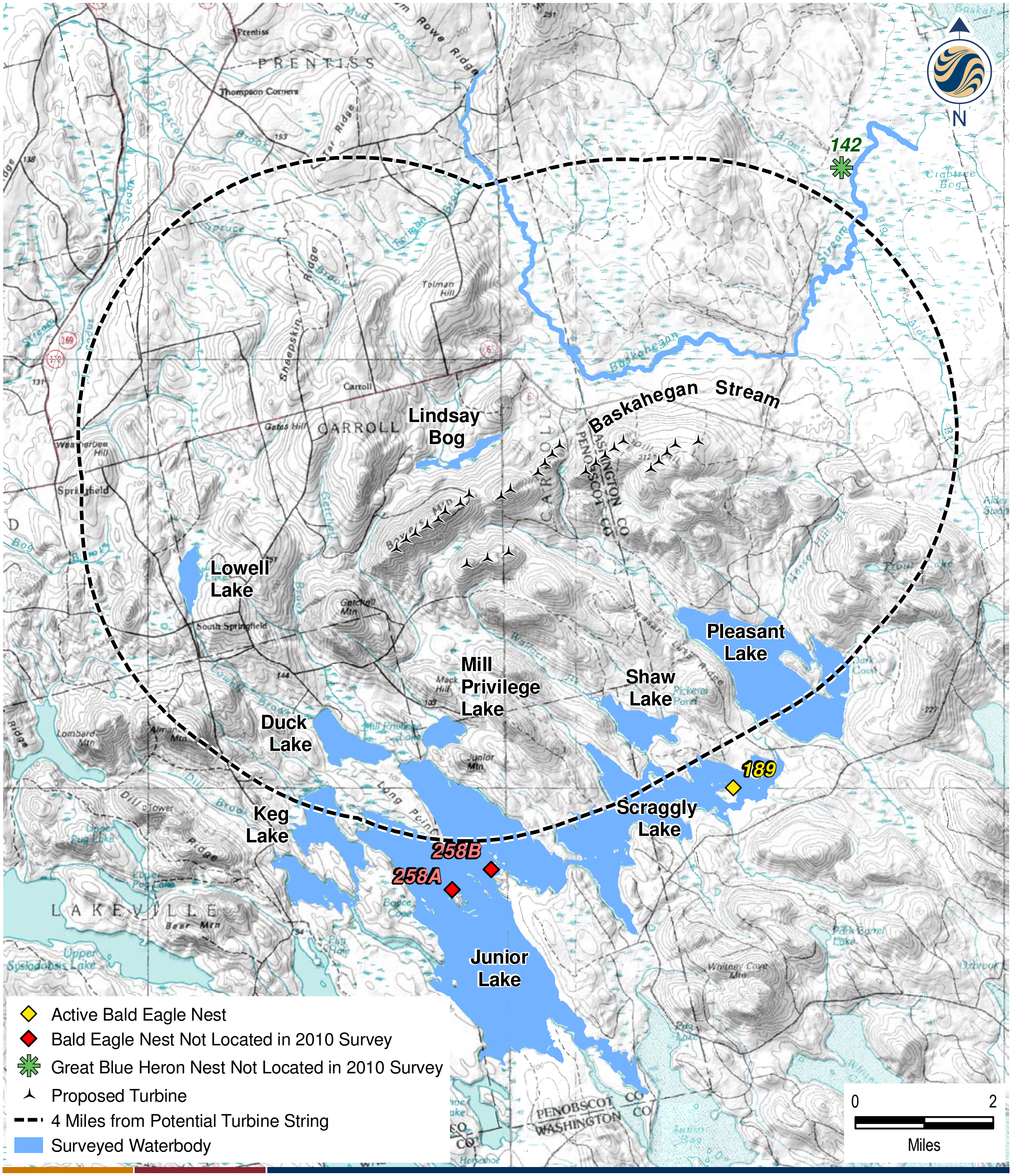
Please contact our office if you have any questions regarding the information presented in this report or if we can be of further assistance.

STANTEC CONSULTING

Bryan Emerson

Bryan Emerson
Project Manager/Wetland Scientist

Cc: Neil Kiely, First Wind
Robert Roy, First Wind
Joy Prescott, Stantec
File 195600522



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Client/Project
FirstWind
Bowers Wind Project
Carroll Plt., Maine

Figure No.
1

Title
Bald Eagle Nest Survey

6/22/2010