7.0 WETLANDS, WILDLIFE AND FISHERIES

7.1 PROJECT AREA CONTEXT

Blue Sky West, LLC and Blue Sky West II, LLC (Applicants),[1] subsidiaries of First Wind Energy, LLC, have proposed construction of the Bingham Wind Project (project), a utility-scale wind energy facility in Bingham, Moscow, Mayfield Township, Kingsbury Plantation, Abbot, and Parkman, in Somerset and Piscataquis Counties, Maine (Figure 1). The project includes 62 turbines (63 potential turbine locations are being permitted) in Bingham, Kingsbury Plantation, and Mayfield Township capable of generating up to 191 megawatts (MW) of electricity. Other project features include upgrades to existing roads, and new roads, to access the turbines and crane paths; up to 5 permanent and up to 5 temporary meteorological (met) towers; an Operations and Maintenance (O&M) building in Mayfield Township; above and below ground 34.5 kilovolt (kV) electrical collector lines among the turbines (the majority of which will be buried alongside project roads) and connecting to a new collector substation in Mayfield Township; and an approximately 17-mile 115-kV generator lead connecting to an existing Central Maine Power Company (CMP) substation in Parkman, Maine. It is anticipated that a dynamic reactive device (DRD) such as a synchronous condenser will be required at the project collector substation to meet the interconnection requirements of ISO NE and CMP.

The ridgeline portion of the project area includes several low-elevation ridgelines and hills (i.e., below 1,800 feet in elevation), and the project is located in a landscape exclusively managed for commercial timber products. The generator lead corridor crosses an area of generally lower elevation (600 to 750 feet in elevation), which is primarily forested with small areas of timber management, agriculture, and sparse residential development. There is an extensive network of existing haul roads.

7.2 AGENCY CONSULTATION AND DATA COLLECTION

Prior to permitting activities for the project, Stantec Consulting (Stantec) sought information regarding potential environmental impacts from public resources. Initial agency consultation letters were sent to the Maine Department of Inland Fisheries and Wildlife (MDIFW), Maine Department of Environmental Protection (MDEP), and U.S. Fish and Wildlife Service (USFWS) to request information on any known occurrences of rare, threatened, or endangered (RTE) species or their habitats located in the vicinity of the planned project. The response letters and emails are included in Appendix A. In addition, Stantec reviewed publicly-available information about the existing natural communities and wildlife habitat in the project area.

Stantec conducted a variety of natural resource and wildlife field surveys in the vicinity of the project area. These pre-construction surveys provided data to help assess the project's potential to impact birds and bats, RTE plants and animals, breeding amphibians, and wetlands.

[1] Blue Sky West, LLC is the wind energy project entity; Blue Sky West II, LLC is the electrical generator lead entity.

These surveys included wetland delineations and wildlife surveys, as described below. The scope of the surveys was based on standard pre-construction survey methods within the wind power industry (i.e., guidelines outlined by the USFWS and MDIFW) and is consistent with other studies conducted recently in Maine and the Northeast. Stantec and the Applicant met on several occasions with representatives from both MDIFW and USFWS to confirm the scope and methodology for these surveys. In addition, several tours of the project area were conducted with agency representatives, and additional surveys (i.e., Canada lynx [*Lynx canadensis*] survey, fall 2011 radar migration surveys) were conducted based on feedback from the agencies.

From 2010 to 2013, Stantec completed ecological field surveys in association with the proposed project area that included:

- Wetland Delineations (2010, 2011, 2012, 2013);
- Vernal Pool Surveys (2010, 2011, and 2012);
- Northern Spring Salamander (*Gyrinophilus porphyriticus*) Surveys (Fall 2010 and Summer/Fall 2011);
- Bog Lemming (*Synaptomys borealis*) Surveys (Fall 2010 and Summer/Fall 2011);
- Roaring Brook Mayfly (*Epeorus frisoni*) Surveys (Fall 2010 and Summer/Fall 2011);
- Canada Lynx Habitat Assessment (Winter 2011 and Winter 2013), Winter Tracking, and Camera Surveys (Winter 2011);
- Deer Wintering Area (DWA) Surveys (Winter 2013);
- Aerial Bald Eagle (*Haliaeetus leucocephalus*) Nest Surveys (Fall 2009, Spring 2010, and Spring 2011);[2]
- Nocturnal Radar Migration Surveys (Spring 2010, Fall 2010, and Fall 2011);
- Acoustic Bat Surveys (Spring, Summer, and Fall 2010);
- Diurnal Raptor Migration Surveys (Spring and Fall 2010); and
- Breeding Bird Survey (Spring 2010).

This narrative provides an overview of the natural resources present in the project area and a summary of the natural resource impacts associated with the project. More detailed information about particular resources is found in the following exhibits.

-Exhibit 7A contains descriptions of the wetland, waterbody, and vernal pool resources within the project area.

-Exhibit 7B contains a summary of the wildlife habitat in the project areas.

-Exhibit 7C contains findings from the pre-construction RTE species surveys, Canada lynx assessments, bald eagle surveys, and DWA habitat surveys.

-Exhibit 7D describes the findings of the pre-construction avian, raptor, and bat surveys.

-Exhibit 7E describes the post-construction monitoring plan and curtailment plan.

[2] In addition, spring 2012 aerial nest surveys surrounding the project area were conducted by others. These survey results were provided by MDIFW and are included in Exhibit 7C-4.

7.3 PROJECT IMPACTS

Using the information gathered in these surveys, the project layout and footprint was designed to optimize engineering and wind resource conditions while minimizing environmental impacts to the maximum possible extent. The resource impacts have been further minimized through a multi-year iterative design in which the total project size was significantly reduced, and project elements were relocated to avoid and minimize resource impacts. The resulting resource impacts are summarized in the following Table 7.1.

Table 7.1. Summary of Environmental Impacts from Bingham Wind Project

Environmental Resource	Project Impact
Vegetation and Habitat	No RTE plant species identified. The project area is dominated by Beech-Birch-Maple Forest and Spruce-Northern Hardwoods Forest in various stages of regeneration following timber harvesting.
Wetlands	58,508.63 square feet (1.34 acres) of permanent wetland fill, 275,446.62 square feet (6.32 acres) of temporary wetland fill, and 34.35 acres of permanent cover type conversion.
Vernal Pools	No direct impacts to natural vernal pools. Clearing within the significant vernal pool habitat of four Significant Vernal Pools (SVPs). Total clearing (existing plus proposed) less than 25% of the SVP habitat. SVP_07AL_N: 24.3% SVP_50KN_and SVP_108SK_N: 23.97% SVP_53KN_N: 24.91%
Bald Eagle	The nearest active bald eagle nest is approximately 4.95 miles from the nearest proposed turbine location.
Canada Lynx	The project is located outside of the designated critical habitat for Canada lynx. Track of a single, apparently transient, male observed approximately 1.4 to 1.7 miles from the nearest components of the proposed project.
Atlantic Salmon	Much of the project is located within designated critical habitat for Atlantic salmon. No direct in-stream work is proposed within the project area. Clearing will occur within the vegetated stream buffers of 28 perennial streams.

Table 7.1. Summary of Environmental Impacts from Bingham Wind Project	
Mapped Deer Wintering Areas (DWA)	Clearing and wetland fill within four mapped DWAs for electrical generator lead and access roads: Clearing Fill DWA #080604: 0.93 acres 0 acres DWA #084029: 1.26 acres 0.12 acres DWA #084031: 6.51 acres 0.52 acres DWA #084033: 12.84 acres 0.14 acres
Mapped Inland Waterfowl and Wading Bird Habitat (IWWH)	Clearing of 3.13 acres of IWWH #203972 habitat buffer for generator lead (clearing area overlaps with clearing within DWA #084031).
Northern Spring Salamander Habitat	No direct stream impact, but clearing within the associated stream buffer of 24 streams that provided potential habitat for northern spring salamanders.
Bog Lemming Habitat	No direct impact to wetland habitat where the bog lemming activity was observed, but a portion of the aboveground electrical collector line will be located approximately 600 feet to the south. Clearing is not expected to impact the hydrology of the habitat.
Birds	Passage rates for raptor migration and nocturnal migrants are consistent with other projects in the region.
Bats	Rates are consistent with other Maine sites. Turbines will be curtailed during certain periods of increased risk of collision.

7.4 WETLANDS AND STREAMS

The following is a brief summary of all wetland and waterbody resources identified within the project area.

- A total of 414 wetland resources regulated by the U.S. Army Corps of Engineers (Corps) and MDEP.
- A total of 67 streams within the project area, 36 of which are perennial.
- A total of 66 wetland resources are considered Wetlands of Special Significance. The majority of these resources are within 25 feet of a stream or have more than 20,000 square feet of open water or emergent vegetation.

A complete discussion of the methodology and results for the wetland and stream delineation and vernal pool surveys is included in Exhibit 7A.

7.5 VERNAL POOLS

Stantec completed vernal pool surveys in 2010, 2011, and 2012 under appropriate seasonal conditions. Based on these field surveys, a total of 58 vernal pools were identified within jurisdictional wetlands in the project area. Based on the definitions set forth in the Natural Resources Protection Act (NRPA), a vernal pool must be natural to be considered a Significant Vernal Pool (SVP). Of these 58 vernal pools, 13 are naturally occurring, and 4 meet the criteria to be considered an SVP under Chapter 335 of the NRPA.

A complete discussion of the methodology and results for the vernal pool surveys is included in Exhibit 7A.

7.6 FISHERIES

Stream delineation surveys identified 67 streams within the project area, 36 of which are perennial or have a perennial component (i.e., transition from intermittent to perennial).

Much of the project area occurs within the Piscataquis River watershed (HUC 0102000401), which is designated as critical habitat for Atlantic salmon (*Salmo salar*). The Gulf of Maine DPS of Atlantic salmon is federally listed as Endangered. Approximately half of the turbines and the entire generator lead corridor occur within this designated critical habitat. Several of the streams in Mayfield Township and Kingsbury Plantation, including Bigelow Brook and Bottle Brook, also are identified by MDIFW as valuable fisheries habitat for species such as wild brook trout (*Salvelinus fontinalis*). No in-stream work is proposed within the project area; however, clearing within the vegetated stream buffers of 34 perennial streams will occur (1 along the ridgeline and 33 along the generator lead and Route 16 portion of the aboveground collector).

A complete discussion of the methodology and results for the stream delineation surveys is included in Exhibit 7A. The Applicants have provided details of protection measures during construction to preserve surface water quality, that comply with state and federal requirements, which can be found in Section 10.

7.7 WETLAND AND STREAM IMPACTS

The wetland impacts associated with construction and operation of the project totals 1.34 acres of permanent wetland fill, 0 linear feet of stream impact for culverts, 6.32 acres of temporary wetland fill, and 34.35 acres of permanent cover type conversion. The impacts are in the following locations, which are summarized in Table 7.2 and described further in Appendix B.

Table 7.2. Bingham Wind Project – Wetland and Stream Impact Summary

Project Component	Permanent Fill (acres)	Wetland Clearing (acres)	Temporary Fill** (acres)	Stream Impact - Culvert (linear feet)
Roads*	1.33	0.31	0	0
Electrical Collector	0	3.81	0	0
Generator Lead Line	0.01	30.23	6.32	0
Other	0	0	0	0
Totals	1.34	34.35	6.32	0

*Road impacts include access roads on the project ridgeline and those along the generator lead line.
**Temporary fill represents temporary timber mats for construction.

Within the ridgeline portion of the project area, inclusive of the collector line, Stantec identified three SVPs: SVP_07AL_N, SVP_50KN_and SVP_108SK_N. One SVP, SVP_53KN_N, was identified along the generator lead. Impacts associated with construction of a project access road and an aboveground portion of the collector line combined with existing clearing will result in total clearing of the SVP habitat for SVP_07AL_N of approximately 24.3 percent. Clearing for the aboveground portion of the collector line combined with existing clearing will result in total clearing of the SVP habitat for SVP_50KN_and SVP_108SK_N of approximately 23.97 percent. Clearing for the generator lead line combined with existing clearing will result in total clearing of the SVP habitat for SVP_53KN_N of approximately 24.94 percent.

An alternatives analysis for the project, along with discussion of avoidance and minimization incorporated into the project design can be found in Section 1A.

7.8 WILDLIFE HABITAT

The project area is primarily dominated by a regenerating Beech-Birch-Maple forest and Spruce-Northern Hardwoods. This is a common forest habitat across the state, and as such, the project area includes many common wildlife species. See Exhibit 7B for a complete characterization of the area.

For the ridgeline portion of the project, two DWAs are present to the northwest and southeast of Johnson Mountain in Bingham and are located outside of the current project area. Two IWWHs occur within the ridgeline portion of the project area. One IWWH occurs in association with Withee Pond (UMO-10985) in Mayfield Township, and the other occurs north of Route 16 along Rift Brook (UMO-10813) in Mayfield Township. Each mapped IWWH consists of the wetland community typical utilized by waterfowl and wading birds (e.g., open water and emergent marsh) and a 250-habitat zone surrounding that utilized wetland community. There will be no direct impact to the wetland complex or the 250-foot zone surrounding either the Withee Pond IWWH or the Rift Brook IWWH. The southern edge of the 250-foot zone surrounding the Rift Brook IWWH overlaps with an existing gravel pit and Route 16. The aboveground portion of the proposed electrical collector line corridor will parallel the north side of Route 16 and will not impact the 250-foot IWWH habitat zone.

For the generator lead, four DWAs and one IWWH occur along the corridor. Table 7.3 provides a summary of approximate clearing for these five habitats. Impacts relate principally to crossing by the electrical generator lead. Impacts to DWA #084029 include construction of a segment of new road and upgrades to an existing road. Impacts to DWA #084031 will include clearing associated with upgrades to an existing road and DWA #084033 will include clearing associated with a new access roads. Details of the four DWAs impacted by the project can be found in the Deer Wintering Survey found in Exhibit 7C-4.

Correspondence from MDIFW identified one location in proximity to the project area where northern spring salamanders had been documented. The northern spring salamander is listed as a Species of Special Concern in Maine. During project specific field surveys, Stantec documented two streams within the project area where northern spring salamanders were observed or where surveys identified high quality habitat for the species. Northern spring salamander was documented in one stream, S021. In addition, 6 streams along the aboveground portion of the electrical collector corridor and 17 streams along the generator lead corridor were identified as potential habitat for this species. No direct in-stream work is proposed within the project area; however, clearing within the vegetated buffer of 24 of these streams will occur for one access road, for the aboveground portion of the electrical collector line, and for the electrical generator lead corridor.

During project-specific field surveys, Stantec documented one wetland (wetland MAY_W137) within the project area where bog lemming activity such as runways and tunnels, browsed and clipped vegetation, and fecal pellets were observed. The northern bog lemming is listed as Threatened in Maine. This wetland is located north of Route 16 in Mayfield Township. The proposed project will not impact the habitat where the bog lemming activity was observed. The aboveground portion of the electrical collector line will be located approximately 600 feet to the south of the wetland. Clearing at this location will occur at a slightly lower elevation than the habitat where bog lemming activity was observed and is not expected to impact the hydrology of this habitat. There will be no blasting within 600 feet of the habitat, and for the collector line, only small localized charges or drilling will be used for pole placement.

7.9 SUMMARY: POTENTIAL IMPACT AND DESIGN CONSIDERATIONS

Table 7.2 provides a summary of impacts anticipated to occur within or in proximity to identified wildlife habitats. Impacts consist primarily of clearing associated with the aboveground portion of the collector line or the generator lead. Improvements to existing trails/roads also will require limited clearing and fill placement within three of the mapped Deer Wintering Areas. To the extent practicable, the project has been designed to avoid and minimize impacts to these wildlife habitats. Avoidance and minimization efforts included, but were not limited to the placement of structures, construction methods and maintenance methods. Section 1A of this permit application addresses in detail avoidance and minimization efforts. Section 10 of this permit application discusses the 7 basic types of habitat buffers proposed for the project and the clearing and maintenance practices that will be implemented to maintain each type of buffer. The following discussion addresses briefly avoidance and minimization efforts as well as project constraints that influenced these efforts.

<u>Bog Lemming Habitat</u>
As currently proposed the project will not directly impact the habitat where bog lemming activity was documented. The aboveground collector as it parallels the north side of Route 16 will cross approximately 600 feet south of this habitat, which will result in clearing of forested uplands and limited clearing of forested wetlands. Because of the distance and elevation difference between the bog lemming habitat and the proposed clearing, it is not anticipated that the project will impact the hydrology of this habitat.

<u>Northern Spring Salamander and Atlantic Salmon Streams</u>
No direct in-stream work is proposed within the project area, but clearing will occur within the existing vegetated stream buffers. One access road on the ridgeline will be constructed within 100 feet of a stream that represents good potential northern spring salamander habitat. This construction is necessary to replace a previously existing road that washed out when an upstream beaver dam failed. To the extent practicable, poles will not be placed within 100 feet of streams identified as documented/potential northern spring salamander habitat or those perennial streams within the designated critical habitat for Atlantic salmon. Only 28 total poles, 14 on the collector line and 14 on the generator lead, will be located within 100 feet of a perennial stream. In addition, buffers will be maintained along these streams to help protect water quality. In general, only “capable trees” (those expected to reach 15 feet) will be topped or removed within the buffers during construction and maintenance.

Vernal Pools
No direct impacts to natural vernal pool envelopes are proposed, and impacts to SVP habitats will be less than 25 percent at each of the four SVPs. These proposed impacts are principally associated with clearing for either the aboveground collector or generator lead corridor. Where possible, proposed project components have been placed within or in proximity to existing clearings. For example, SVP_07AL_N has an existing gravel road and gravel pit within its critical terrestrial habitat. The project will utilize this existing road with minor upgrades and the aboveground portion of the collector line will parallel the edge of this road and the gravel pit to minimize additional impacts. Similarly, the critical terrestrial habitat for SVP_50KN_N and SVP_108SK_N includes two existing gravel roads and Route 16. The aboveground portion of the collector line will closely parallel Route 16 and cross over the two gravel roads, which will reduce fragmentation and additional clearing.

Deer Wintering Areas
The generator lead will intersect four mapped DWAs. Based upon surveys conducted by Stantec in March 2013, no deer use was documented in two of these DWAs, DWA #080604 and DWA #084029. The other two DWAs, DWA #084031 and DWA #084033, would likely be considered moderate to high value based upon Stantec's surveys. Where possible, the proposed generator lead was designed to cross the edge of the mapped DWAs; however, in some instances, land access did restrict the location of these crossings.

The generator lead will cross approximately 500 linear feet in the northeastern corner of DWA #080604. The proposed clearing and placement of one pole is expected to have limited impact on the current habitat provided by this DWA. The generator lead will cross approximately 500 linear feet near the northwestern corner of DWA #084029. A project access road also will cross through the northwestern corner of this DWA. The project access road will include a segment of new road adjacent to Pease Bridge Road and upgrades to an existing road. The locations of both the generator lead and access road are based upon an agreement between the landowner and the Applicants. The proposed project activity is expected to have limited impact on the current habitat provided by this DWA.

The generator lead will bisect DWA #084031, crossing approximately 2,250 linear feet of the mapped habitat. The location of this proposed crossing is based in part upon an agreement between the landowner and the Applicants. Based upon Stantec's March 2013 surveys, the proposed crossing avoids the area with the highest percentage of conforming DWA canopy cover, which is located north of the crossing on either side of Gales Brook. Because the generator lead will remove some suitable softwood forest cover, it may impact deer winter cover and travel corridors and potentially fragment this existing habitat. To help reduce this impact, construction and maintenance will, to the extent practicable, only remove "capable trees" within the DWA habitat. A proposed project access road also will cross through the western edge of this DWA. Approximately 1,875 linear feet of the access road will be located within the DWA. This proposed project access road is an existing road/trail. Upgrading this existing road/trail will help minimize necessary clearing and grading, and habitat fragmentation.

The generator lead will bisect DWA #084033, crossing approximately 5,250 linear feet of the mapped habitat. The location of this proposed crossing is based on an agreement between the landowner and the Applicants, and an existing CMP easement that will be used for the project. The CMP easement, which will allow connection to the CMP substation in Parkman, is being used for the project because of non-participating landowners in the area. Because the generator lead will remove suitable softwood forest cover, it may impact deer winter cover and travel corridors and potentially fragment this existing habitat. To help reduce this impact, construction and maintenance will, to the extent practicable, only remove “capable trees” within the DWA habitat. A proposed project access road also will cross through the western edge of this DWA. Approximately 500 linear feet of the access road will be located with the DWA. This proposed project access road is a new road. Based upon Stantec 2013 surveys, the road is located in a portion of the DWA that lacks conforming softwood cover therefore impact to cover should be minimized.

Inland Waterfowl and Wading Bird Habitat

The generator lead will intersect one mapped IWWH, IWWH #203972, which is located within DWA #084033. As stated above, the location of this proposed crossing is based in part upon an agreement between the landowner and the Applicants. The proposed crossing will be located south of the existing marsh habitat, but does intersect a small open water area created by beaver (*Castor canadensis*) activity. Clearing for the collector will impact the forested habitat associated with this IWWH. To help reduce this impact, construction and maintenance will, to the extent practicable, only remove “capable trees” within the IWWH habitat buffer.

Table 7.3. Impacts within or in proximity to identified wildlife habitats or the buffers for the Bingham Wind Project[3]

Wildlife Habitat	**Project Impact**
Bog Lemming Habitat	No direct impact to wetland habitat where the bog lemming activity was observed, but a portion of the aboveground electrical collector line will be located approximately 600 feet to the south. Clearing is not expected to impact the hydrology of the habitat.
Northern Spring Salamander Habitat	No direct stream impact, but clearing within the associated stream buffer of 24 streams where northern spring salamander have been documented or that provided potential habitat for this species.

[3] Identified potential SVPs will be surveyed during the 2013 vernal pool season and impacts to the SVP habitat of these resources will be calculated based upon these survey results.

Table 7.3. Impacts within or in proximity to identified wildlife habitats or the buffers for the Bingham Wind Project[3]

Atlantic Salmon	Much of the project is located within designated critical habitat for Atlantic salmon. No direct in-stream work is proposed within the project area. Clearing will occur within the vegetated stream buffers of 28 perennial streams.
Vernal Pools	No direct impacts to natural vernal pools. Clearing within the significant vernal pool habitat of four SVPs. Total clearing (existing plus proposed) less than 25% of the SVP habitat. SVP_07AL_N: 24.3% SVP_50KN_and SVP_108SK_N: 23.97% SVP_53KN_N: 24.91%
Mapped Deer Wintering Areas (DWA)	Clearing and wetland fill within four mapped DWAs for electrical generator lead and access roads: Clearing Fill DWA #080604: 0.93 acres 0 acres DWA #084029: 1.26 acres 0.12 acres DWA #084031: 6.51 acres 0.52 acres DWA #084033: 12.84 acres 0.14 acres
Mapped Inland Waterfowl and Wading Bird Habitat (IWWH)	Clearing of 3.13 acres of IWWH #203972 habitat buffer for generator lead (clearing area overlaps with clearing within DWA #084031).

7.10 COMPENSATION

The Applicants plans to mitigate unavoidable impacts associated with the project in accordance with Maine's Natural Resources Protection Act (NRPA) (38 M.R.S.A. § 480 A – BB) guidelines. The Applicants sought to minimize and avoid project impacts where practicable. In portions of the project where the impacts could not be avoided, the Applicants have evaluated multiple mitigation options but determined that they will satisfy the mitigation requirements via preservation.

The Applicants identified several candidate parcels adjacent to the project within the Upper Kennebec and Piscataquis watersheds that could serve as conservation parcels with appropriate acreages of resources with corresponding functions and values comparable to those being impacted by the proposed project. The candidate parcels are not only proximate to the project but also contain resources representative of those impacted in the ridgeline and generator lead development areas or "in kind "resources. The priority candidate parcels have been vetted for their risk of future development, and an effort to aggregate contiguous parcels and adjacency to protected lands with significant habitat is also a priority. Negotiations with the land owners and due diligence (i.e., review of available GIS data layers and site investigations) are currently underway. The Applicants plan to meet with the appropriate agencies in the short term to present the conservation parcels.

7.11 POST-CONSTRUCTION MORTALITY MONITORING

Fatality rates from other projects can be used as context when evaluating the possible level of impact at the proposed project. The rates observed at other facilities can be considered comparable to a proposed wind project if those projects are representative of the site being assessed (i.e., in the same region with similar landscape and project design characteristics). As described in Exhibit 7B, mortality estimates from post-construction monitoring conducted at 6 projects in Maine are now available, including Mars Hill, Stetson I, Stetson II, Rollins, Record Hill, and Kibby Mountain. In addition, results from other projects in forested landscapes in the Northeast are also available. Like those projects, Bingham is located on a previously harvested forested ridge; therefore, it can be expected that avian and bat mortality documented at the site would be relatively similar to that observed at these other projects.

The Applicants have proposed a post-construction monitoring protocol that is similar to those recently conducted for Rollins and Stetson. For a complete description of the protocol, refer to Exhibit 7E-1.

7.12 CURTAILMENT

To reduce the potential for bat mortality due to operation of the project, the applicant will curtail all 62 turbines, as described in Exhibit 7E-2.

Appendix A: Agency Correspondence

STATE OF MAINE
DEPARTMENT OF INLAND FISHERIES & WILDLIFE

JOHN ELIAS BALDACCI
GOVERNOR

WILDLIFE DIVISION
Region D
689 Farmington Road
Strong, Maine 04983

ROLAND D. MARTIN
COMMISSIONER

Phone (207) 778-3324 FAX (207) 778-3323

October 7, 2009

Sarah Barnum
Normandeau Associates, Inc
25 Nashua Rd.
Bedford, NH 03110-5500

Dear Ms. Barnum:

I received your 25 September 2009 letter requesting Significant and Essential Wildlife Habitat information for a large unnamed project in western Maine. Unfortunately, your project area lies within two wildlife regional jurisdictions. For the Blanchard Twp and Kingsbury Plt. portions of your project area you should contact Doug Kane, Regional Biologist from our Greenville office (PO Box 551, Greenville, ME 04441). I have enclosed are the results of my review for the Bingham, Brighton Plt. and Mayfield Twp of your project area.

Essential Habitats:

Essential Habitats are defined as "areas currently or historically providing physical or biological features essential to the conservation of an endangered or threatened species in Maine and which may require special management considerations". Essential Habitat protection in Maine currently applies to bald eagle, roseate and least tern, and piping plover nest sites, but additional listed species may receive attention in the future.

According to MDIFW records, there are no Essential Habitats known to be associated with this property.

Significant Wildlife Habitats:

The Natural Resources Protection Act, administered by the Maine Department of Environmental Protection, provides protection to certain natural resources including Significant Wildlife Habitats. Significant Wildlife Habitats are defined by the NRPA as:

- Habitat for state and federally listed endangered and threatened species.
- High and moderate value deer wintering areas (DWAs) and travel corridors.
- High and moderate value waterfowl and wading bird habitats (WWHs), including nesting and feeding areas.
- Shorebird nesting feeding and staging areas.
- Seabird nesting islands.

Deer Wintering Areas (DWAs)

According to MDIFW records this parcel is associated with DWA# 060135 and 060136, both located in Bingham. See attached map(s).

- If your project is in an organized town and comes under ***DEP Site Location***, or
- If it is in an unorganized township or plantation and is designated by ***LURC as a P-FW***, you must contact this office for additional input and recommendations before proceeding further.

- If neither of the above applies and you are considering conducting forestry operations, we would appreciate the opportunity to offer recommendations to: 1) accommodate the need to manage for timber production and 2) ensure the continued availability of critical conifer shelter for wintering deer. We can provide time-tested guidelines to satisfy both needs.

Waterfowl and Wading Bird Habitat (WWH):

Regional Wildlife Staff will no longer be providing maps and associated information regarding NRPA or Significant Wildlife Habitats. The Maine Department of Environmental Protection (DEP) is the official state agency with jurisdiction over these habitats and is now the source of consultation regarding these habitats. I have included contact information for each of the DEP Regional Offices:

Augusta:	17 State House Station, Augusta, Maine 04333-0017 – 1-800-452-1942
Bangor:	106 Hogan Road, Bangor, Maine 04401 – 1-888-769-1137
Portland:	312 Canco Road Portland, Maine 04103 – 1-888-769-1036
Presque Isle:	1235 Central Drive, Skyway Park, Presque Isle, Maine 04769 – 1-888-769-1053.

Threatened, Endangered or Special Concern Species

Finally, the department maintains a statewide database of Threatened and Endangered wildlife species and habitats, or Species of Special Concern. In general, these records are not the product of recent or intensive surveys for T/E species. Review of department records show Spring Salamanders to be associated with your project area. Spring salamanders are a species of special concern in this state and are associated with clean, cool, and well-shaded steep mountain streams. These salamanders have been found in Bigelow Brook near Mayfield Pond (Mayfield Twp.)

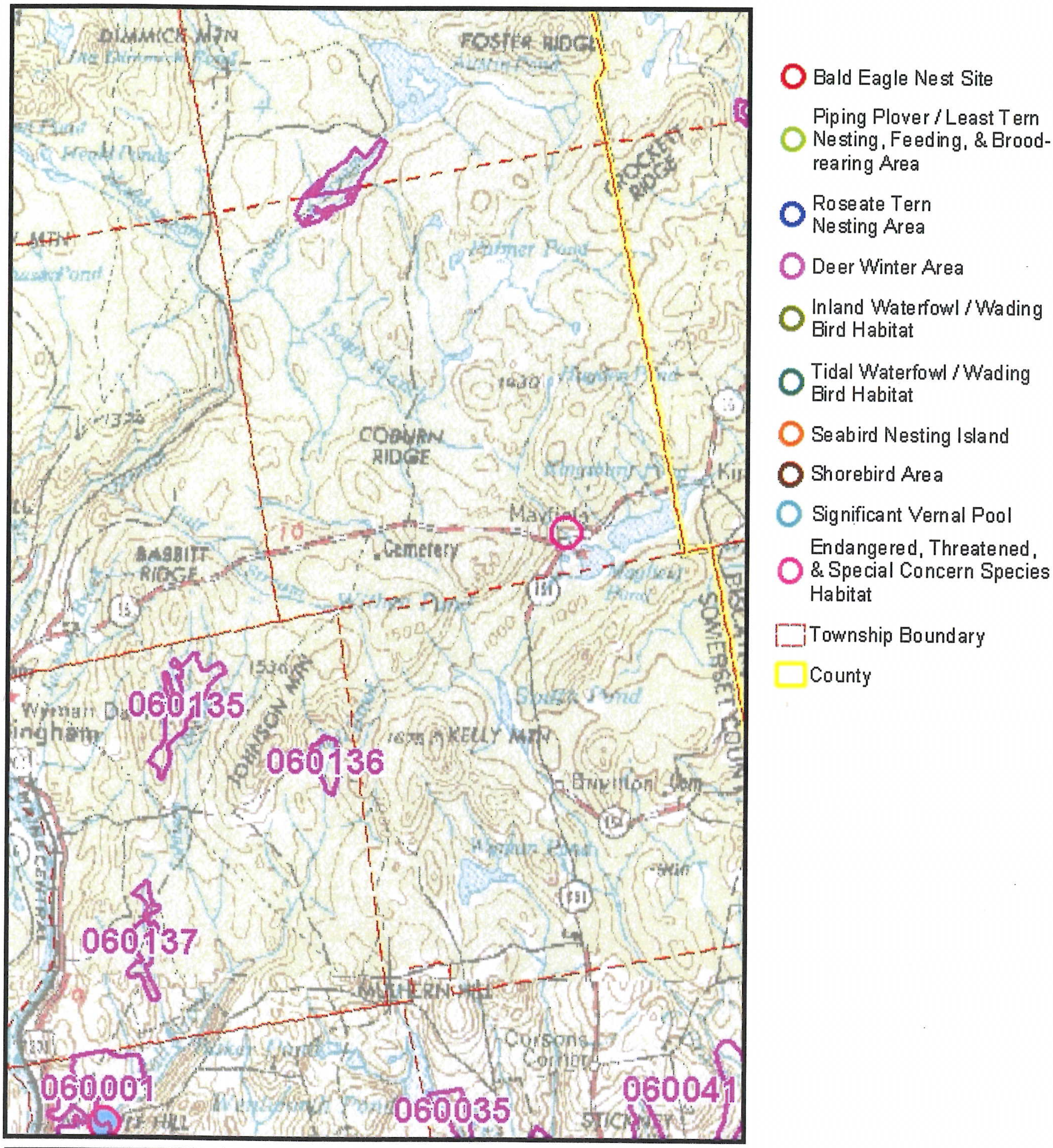
Your project area delineation looks suspiciously like a potential site for a Wind Energy project. MDIFW requests several additional wildlife studies when reviewing Wind Energy projects. If your project is a Wind Energy project I would encourage you to schedule a meeting with us to discuss the nature and extent of these studies. Steve Timpano, MDIFW's environmental coordinator, would be the appropriate contact for such a meeting.

If you have any questions or would like further assistance please feel free to contact this office, we would be glad to help.

Yours truly,
Robert C. Cordes
Asst. Regional Wildlife Biologist

Robert C. Cordes

Search for Wildlife Observations & Habitat



0 1 2 3 4 Miles

1 = 146,440

UTM Projection, Zone 19N, NAD83

N

689 Farmington Road
Strong, ME 04983-9419
Voice: (207) 778-3324
Fax: (207) 778-3323

October 20, 2009

From: Dube, Norm [Norm.Dube@maine.gov]
Sent: Friday, October 02, 2009 8:56 AM
To: Sarah Barnum
Subject: RE: Project Inquiry - Bingham Area
Hi Sarah,

Unfortunately, I was unable to open up the shapefiles; apparently the .DBF file with supporting data is missing. However, the jpg provides some resolution and I can provide some information to you.

The upper Piscataquis River subdrainage and associated tributaries (e.g Kingsbury Stream) contain populations of Atlantic salmon. As you may know, the federal services (USFWS and NMFS) jointly listed the Atlantic salmon in the Penobscot River watershed as endangered under the federal Endangered Species Act and the Services also designated critical habitat for Atlantic salmon in the Penobscot. NMFS also designated Essential Fish Habitat for Atlantic salmon in the Penobscot River watershed.

DMR is actively managing Atlantic salmon in the upper Piscataquis River and would be concerned with development (e.g road-stream crossings) in that area. We are not presently managing Atlantic salmon the that portion of the Kennebec River drainage that could be affected by this project. However, please note that the Kennebec is a historic Atlantic salmon river and we do have some management projects in the watershed, just not in this area. Until I know the extent of the proposed project (e.g. list of water body crossings), I am unable to comment any further.

Sincerely,

Norm

Email correspondence.

From: Obrey, Tim
Sent: Monday, October 26, 2009 8:16 AM
To: Timpano, Steve
Subject: RE: Project Inquiry - Bingham Area

We have Foss Pond in the area which is a B-list pond. Most of the streams contain native brook trout.

From: Boucher, Dave
Sent: Friday, October 23, 2009 11:07 AM
To: Obrey, Tim
Cc: Timpano, Steve
Subject: RE: Project Inquiry - Bingham Area

Tim/Steve:

I don’t have a record of reviewing this earlier. In any event, until I see a more formal application with road construction and power line details, I’ll just say that most of these watersheds support wild brook trout and a variety of native minnows, suckers, sculpins, etc. In addition, several streams in the project area support very unique populations of wild rainbow trout (e.g. Gulf Stream, Austin Stream, Jackson Brook) that provide much of the recruitment to the Kennebec River sport fishery below Wyman Dam. The headwaters (PSL2s) will be particularly sensitive to this change in land use, so we’ll be looking for out-sized buffers, protection of high-elevation hydrological features, good stormwater management, etc.

This good? If not let me know.

Dave

Appendix B: Impacts Table

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
BING_W010	Ridgeline Roads		11.83		8/5/2010, 11/16/2010	PFO	6" organics over rock with depleted matrix between rocks with 10-15% redox concentrations	*Betula alleghaniensis, Fraxinus pennsylvanica, Abies balsamea, Acer rubrum, Impatiens capensis, Glyceria melicaria, Onoclea sensibilis, Doellingeria umbellata*	soil saturation to surface, wetland drainage patterns		
BING_W011	Ridgeline Roads		1.57		8/5/2010	PSS	4-5" dark, mucky horizon over depleted matrix with 10% redox concentrations	*Picea rubens, Acer rubrum, Salix bebbiana, Salix discolor, Abies balsamea, Glyceria melicaria, Scirpus cyperinus, Onoclea sensibilis, Osmunda claytoniana*	soil saturation to surface, hydrogen sulfide odor		
BING_W032	Ridgeline Roads		0.05		7/21/2010; 10/4/2002, 10/23/2012, 11/7/2012	PSS	variable: 3" organics over rock; 3" organics over thin (2") dark horizon to a depleted matrix with redox concentrations over rock	*Abies balsamea, Picea rubens, Acer rubrum, Osmunda cinnamomea, Glyceria melicaria, Glyceria striata, Calamagrostis canadensis, Osmunda claytoniana, Solidago rugosa*	surface water in pits, free water at ground surface, soil saturation to surface		
BING_W037	Ridgeline Roads	1316.69	128.64		7/21/2010; 11/6/2012	PFO	3" organics over a thin dark horizon (1") to a depleted matrix with 5% redox concentration	*Picea rubens, Abies balsamea, Acer rubrum, Carex gynandra, Rubus idaeus, Osmunda claytoniana, Scirpus hattorianus*	soil saturation to surface, free water below rocks at 8"	VP_10SD_M, VP_11SD_M, VP_12SD_N, VP_23SK_M, VP_25SK_M	S003
BING_W045	Ridgeline Roads	14.97			8/9/2010	PFO	variable: 10" organics over rock; 6-8" organics over depleted matrix with 10-15% redox concentrations	*Thuja occidentalis, Abies balsamea, Betula alleghaniensis, Betula populifolia, Fraxinus nigra, Glyceria melicaria, Glyceria striata, Osmunda claytoniana, Chelone glabra*	soils saturation to surface, wetland drainage patterns, shallow rooting		
BING_W047	Ridgeline Roads	68.60			8/9/2010	PFO	disturbed soil: 1-3" organics over 4-6" dark horizon to a depleted matrix with 10-20% redox concentrations	*Acer rubrum, Abies balsamea, Impatiens capensis, Oclemena acuminata, Osmunda cinnamomea, Dryopteris cristata, Carex gynandra*	soil saturation to surface, wetland drainage patterns		
BING_W048	Ridgeline Roads	258.50			8/9/2010	PEM	disturbed soil: 1-3" organics over 4-6" dark horizon to a depleted matrix with 10-20% redox concentrations	*Acer rubrum, Impatiens capensis, Oclemena acuminata, Osmunda cinnamomea, Dryopteris cristata, Carex gynandra*	soil saturation to surface, wetland drainage patterns		
MOS_W050	Ridgeline Roads	159.82			8/17/2010, 9/24/2012, 9/25/2012	PEM/PSS	disturbed and rocky: loam and silt loam with depleted matrix	*Glyceria striata, Scirpus cyperinus, Carex intumescens, Rubus idaeus, Solidago rugosa, Doellingeria umbellata*	standing water, soils saturation within 12"	VP_05SK_M	

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
MOS_W051	Ridgeline Roads	2117.08			8/19/2010	PSS	disturbed and shallow: 3-8" of organics and dark mineral over rock; some areas include a thin depleted matrix with 5-10% redox concentrations.	*Thuja occidentalis, Abies balsamea, Salix bebbiana, Nemopanthus mucronatus, Spiraea alba, Carex trisperma, Osmunda cinnamomea, Osmunda spectabilis*	soil saturation to surface, water stained leaves	VP_06TT_M	
MOS_W059	Ridgeline Roads	10.64			8/19/2010	PFO/PEM	disturbed soil: 2" organic over a depleted matrix to mixed horizon with oxidized rhizospheres to a depleted matrix; organic streaking throughout	*Betula alleghaniensis, Abies balsamea, Thuja occidentalis, Ilex verticillata, Acer rubrum, Alnus incana, Carex trisperma, Osmunda claytoniana*	water stained leaves, soil saturation at 10"		
MAY_W060	Ridgeline Roads	1482.13			8/20/2010	PSS	stratified layers: layers of gravel over a depleted sand with redox concentrations to gravel	*Thuja occidentalis, Larix laricina, Acer rubrum, Abies balsamea, Salix bebbiana, Glyceria striata, Calamagrostis canadensis, Scirpus atrocinctus*	soil saturation at 6", water stained leaves, wetland drainage patterns		
MAY_W061	Ridgeline Roads	1281.55	0.07		8/20/2010	PFO/PEM	variable: 6" organics over rock; 2-3" organics over depleted matrix with 10% redox concentrations	*Thuja occidentalis, Acer rubrum, Abies balsamea, Carex trisperma, Glyceria melicaria, Onoclea sensibilis*	soils saturation to surface, water stained leaves		
MAY_W062	Ridgeline Roads	77.47			8/20/2010	PSS	1" organic over 8" dark gravely horizon with 10% redox concentrations and oxidized rhizospheres	*Alnus incana, Thuja occidentalis, Salix bebbiana, Spiraea alba, Spiraea tomentosa, Calamagrostis canadensis, Carex lurida, Glyceria striata*	soil saturation to surface	VP_01AL_N	
MAY_W063	Ridgeline Roads	7758.57			8/10/2010	PSS	disturbed: 6-8" organics over depleted matrix with redox concentrations	*Betula populifolia, Thuja occidentails, Abies balsamea, Picea rubens, Alnus incana, Carex trisperma, Calamagrostis canadensis, Glyceria canadensis, Scirpus cyperinus*	soil saturation to surface, water stained leaves	VP_04SD_M, VP_07TT_M	
MAY_W064	Ridgeline Roads	270.89			8/20/2010	PSS	disturbed: 1-2" organics over 4-6" dark horizon with oxidized rhizospheres to a depleted matrix with 10-15% redox concentrations	*Abies balsamea, Picea rubens, Alnus incana, Spiraea alba, Salix discolor, Onoclea sensibilis, Glyceria striata, Juncus effusus*	soil saturation to surface		
MAY_W066	Ridgeline Roads	1336.62			8/20/2010	PSS	disturbed: 2-3" organics over 6-8" dark with oxidized rhizospheres	*Abies balsamea, Alnus incana, Salix bebbiana, Picea rubens, Scirpus cyperinus, Glyceria striata, Onoclea sensibilis*	soil saturation to surface	VP_03SD_M	
MAY_W071	Ridgeline Roads	990.77	260.31		8/10/2010	PFO/PSS	3" dark horizon over gleyed matrix with redox concentrations	*Betula alleghaniensis, Thuja occidentalis, Abies balsamea, Glyceria melicaria, Chrysosplenium americanum*	areas of surface water, soil saturation to surface	VP_01SD_M, VP_07SK_M	

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
MAY_W076	Ridgeline Roads	6227.09	1298.17		8/10/2010, 8/13/2010, 11/30/2010, 12/1/2010, 12/2/2010, 12/3/2010; 9/26/2012, 9/27/2012	PFO/PSS	variable: wetland edge & PSS dominated areas 3-6" organics over rock or a depleted matrix with 10-15% redox concentrations; wetland interior & PFO 15-20" organics	*Thuja occidentalis, Abies balsamea, Betula alleghaniensis, Acer rubrum, Betula populifolia, Nemopanthus mucronatus, Carex trisperma, Glyceria melicaria, Glyceria striata, Impatiens capensis*	soil saturation to surface, water stained leaves, wetland drainage patterns		
MAY_W083	Electrical Collector System		13903.85		8/11/2010	PFO	disturbed: 3-5" organics over dark horizon to a depleted matrix with 10-20% redox concentrations	*Acer rubrum, Abies balsamea, Fraxinus pennsylvanica, Betula populifolia, Alnus incana, Spiraea tomentosa, Glyceria striata, Glyceria melicaria, Scirpus cyperinus*	soil saturation to surface, water stained leaves, wetland drainage patterns	VP_12MJ_M	
MAY_W088	Ridgeline Roads		1.09		8/13/2010; 10/4/2012	PSS	disturbed: dark horizon with redox concentrations over depleted matrix with redox concentrations	*Alnus incana, Spiraea alba, Viburnum dentatum, Spiraea tomentosa, Ilex verticillata, Onoclea sensibilis, Iris versicolor, Osmunda claytoniana, Eutrochium maculatum*	water stained leaves, wetland drainage patterns, water marks		
MAY_W094	Electrical Collector System		13301.72		8/25/2010	PFO	variable: wetland edge 6-12" organics over depleted matrix with 10-20% redox concentrations or over rock; wetland center 15-20" organics	*Picea rubens, Picea mariana, Thuja occidentalis, Acer rubrum, Alnus incana, Spiraea alba, Spiraea tomentosa, Glyceria striata, Carex trisperma, Carex gynandra, Scirpus cyperinus*	areas of surface water (2-6"), soil saturation to surface, wetland drainage patterns	VP_09AL_M	
MAY_W096	Electrical Collector System		15712.08		10/27/2010; 9/24/2010; 10/8/2012	PSS/PFO/PUB	variable: histosol (16"+ organics); 10-12" organics over depleted matrix with 10% redox concentrations; 7" dark horizon over depleted matrix	*Abies balsamea, Betula alleghaniensis, Acer rubrum, Alnus incana, Rubus pubescens, Doellingeria umbellata, Osmunda claytoniana, Juncus effusus, Scirpus cyperinus, Glyceria striata*	areas of surface water (4"), soil saturation to surface, water marks, wetland drainage patterns		
MAY_W098	Electrical Collector System	44.25	4912.86		10/27/10 [8/25/10 for 01EBY]	PFO/PSS	variable: histosol (16"+ organics); dark horizon (4") over depleted matrix with redox concentrations	*Thuja occidentalis, Abies balsamea, Betula alleghaniensis, Picea rubens, Alnus incana, Viburnum nudum, Glyceria melicaria, Carex trisperma, Osmunda cinnamomea, Cornus canadensis*	areas of surface water, soil saturation to surface		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
MAY_W099	Ridgeline Roads	580.30	382.66		8/25/2010; 10/8/2012	PFO	disturbed soil: 4-5" gravel over 2-4" organics and depleted matrix with 15% redox concentrations	*Abies balsamea, Acer rubrum, Betula alleghaniensis, Fraxinus pennsylvanica, Alnus incana, Onoclea sensibilis, Glyceria melicaria, Carex gynandra, Impatiens capensis*	soil saturation to surface, wetland drainage patterns		
MAY_W103	Ridgeline Roads	4748.07	1050.81		8/3/2012, 10/28/2010, 11/18/2010, 10/5/2012	PEM/PSS/PFO	disturbed: 2-4" organics over 3-6" dark horizon to a depleted matrix with 5-10% redox concentrations	*Acer rubrum, Abies balsamea, Betula alleghaniensis, Picea rubens, Alnus incana, Carex gynandra, Scirpus cyperinus, Glyceria melicaria, Glyceria striata*	soil saturation to surface		
MAY_W112	Electrical Collector System		10021.90		5/25/2010; 9/3/2010; 10/1/2012	PSS/PFO	variable floodplain soil: 16" dark horizon with 20% redox concentrations; 3" organics over depleted matrix with organic coating on soil particles	*Abies balsamea, Betula alleghaniensis, Alnus incana, Viburnum nudum, Nemopanthus mucronatus, Calamagrostis canadensis, Carex lasiocarpa, Thalictrum pubescens*	areas of surface water, soil saturation to surface	VP_01CF_N	S007
MAY_W113	Electrical Collector System		1954.64		10/1/2012	PSS	variable: 6" organics over rock; 6" organics over depleted matrix	*Acer rubrum, Abies balsamea, Betula populifolia, Spiraea alba, Viburnum nudum, Carex trisperma, Cornus canadensis, Sphagnum* sp.	soil saturation to surface		
MAY_W114	Electrical Collector System		5282.31		10/1/2012	PFO	6-8" organics over depleted matrix or rock	*Acer rubrum, Abies balsamea, Betula alleghaniensis, Picea rubens, Thuja occidentalis, Osmunda cinnamomea, Carex trisperma, Cornus canadensis, Sphagnum* sp.	areas of surface water (2"), soil saturation to surface		
MAY_W115	Electrical Collector System		1434.57		10/1/2012	PSS	disturbed: 6" organics over rock	*Betula alleghaniensis, Abies balsamea, Spiraea alba, Betula populifolia, Acer rubrum, Calamagrostis canadensis, Euthamia graminifolia, Scirpus cyperinus*	surface water (6"), water stained leaves, geomorphic position	PVP_01DB_M	
MAY_W116	Electrical Collector System		16546.50		10/1/2012	PFO/PSS/PEM	8-10" organics over depleted matrix with 10-15% redox concentrations	*Abies balsamea, Acer rubrum, Betula alleghaniensis, Fraxinus nigra, Alnus incana, Onoclea sensibilis, Osmunda cinnamomea, Carex trisperma, Glyceria striata*	areas of surface water (1-4"), soil saturation to surface, water stained leaves, wetland drainage patterns		S009

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
MAY_W118	Electrical Collector System		2894.90		10/1/2012, 10/2/2012	PFO	disturbed and variable: 4-8" organics over depleted matrix with 10% redox concentrations; 4-6" organics to a disturbed horizon over depleted matrix with 10% redox concentrations	*Abies balsamea, Betula alleghaniensis, Acer rubrum, Fraxinus pennsylvanica, Fraxinus nigra, Viburnum nudum, Onoclea sensibilis, Carex gynandra, Scirpus cyperinus, Osmunda cinnamomea*	areas of surface water (1-2" in ruts), soil saturation to surface, water stained leaves, wetland drainage patterns		S010, S011
MAY_W120	Electrical Collector System		1113.95		10/2/2012	PFO	variable: 3-5" organics to depleted matrix with 10% redox concentrations; 2" organics to a dark horizon (5") over a depleted matrix with 15% redox concentrations	*Betula alleghaniensis, Abies balsamea, Acer rubrum, Picea rubens, Glyceria striata, Glyceria melicaria, Onoclea sensibilis, Parathelypteris noveboracensis*	soil saturation to surface, wetland drainage patterns		
MAY_W122	Electrical Collector System		13282.97		10/2/2012	PFO	variable: 4-6" organics over depleted matrix with 10% redox concentrations; 4-6" organics over rock	*Abies balsamea, Betula alleghaniensis, Thuja occidentalis, Acer rubrum, Fraxinus pennsylvanica, Onoclea sensibilis, Glyceria striata, Glyceria melicaria, Carex trisperma, Osmunda cinnamomea*	soil saturation to surface, wetland drainage patterns		S012
MAY_W127	Electrical Collector System		359.32		10/2/2012	PSS/PEM	disturbed: 6-8" mixed organic and dark mineral horizon over depleted matrix with 25% redox concentrations	*Salix discolor, Salix bebbiana, Betula alleghaniensis, Acer rubrum, Calamagrostis canadensis, Glyceria striata, Solidago rugosa, Onoclea sensibilis, Rubus pubescens*	free water at 6" below ground surface, soil saturation to surface, wetland drainage patterns		
MAY_W128	Electrical Collector System		2510.22		10/2/2012	PFO	variable: 6-8" organics over depleted matrix with 5-10% redox concentrations or rock; 10-12" organics over depleted matrix with 5-10% redox concentrations	*Betula alleghaniensis, Fraxinus pennsylvanica, Acer rubrum, Fraxinus nigra, Osmunda claytoniana, Osmunda cinnamomea, Onoclea sensibilis, Glyceria striata, Glyceria melicaria*	soil saturation to surface, water stained leaves, wetland drainage patterns		S013
MAY_W129	Electrical Collector System		35.29		10/2/2012	PFO	12" organics over rock	*Betula alleghaniensis, Acer rubrum, Fraxinus pennsylvanica, Onoclea sensibilis, Glyceria striata, Osmunda cinnamomea, Equisetum sylvaticum*	free water at 6" below ground surface, soil saturation to surface, water stained leaves		S014
MAY_W130	Electrical Collector System		5607.52		10/2/2012	PSS/PFO/PEM	disturbed: 6-10" mixed organic and dark mineral horizon over depleted matrix with 15-20% redox concentrations	*Betula alleghaniensis, Acer rubrum, Fraxinus pennsylvanica, Fraxinus nigra, Salix bebbiana, Carex gynandra, Glyceria melicaria, Glyceria striata, Scirpus cyperinus, Solidago rugosa*	surface water (1") in ruts, soil saturation to surface, water stained leaves, wetland drainage patterns		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
MAY_W131	Electrical Collector System		774.75		10/2/2012	PSS/PFO/PEM	1" organics to 8" dark horizon with 15% redox concentrations over rock	*Abies balsamea, Acer rubrum, Fraxinus nigra, Picea rubens*, Acer saccharum*, Glyceria melicaria, Parathelypteris noveboracensis*	free water at 2" below ground surface, soil saturation to surface, water stained leaves, wetland drainage patterns		
MAY_W134	Electrical Collector System		2299.45		7/27/2010	PFO	disturbed: 3" organics to a dark horizon with redox concentrations and depletions	*Acer rubrum, Acer saccharum, Betula alleghaniensis, Abies balsamea, Carex debilis, Glyceria striata, Cinna latifolia, Agrostis capillaris, Carex stipata*	soil saturation in upper 12", wetland drainage patterns		
MAY_W137	Electrical Collector System		24730.65		7/27/2010; 10/27/2010; 10/2/2012	PFO/PSS	variable: wetland edge 4-8" dark horizon over depleted matrix; wetland center 15" organics over gleyed matrix	*Abies balsamea, Acer rubrum, Fraxinus nigra, Thuja occidentalis, Picea rubens, Alnus incana, Carex trisperma, Glyceria melicaria, Onoclea sensibilis, Osmunda cinnamomea, Sphagnum* sp.	areas of surface water, soil saturation to surface, wetland drainage patterns		S019, S020
MAY_W138	Electrical Collector System		2588.95		10/27/2010	PFO	disturbed: 18" organics	*Fraxinus nigra, Abies balsamea, Acer rubrum, Picea rubens, Alnus incana, Betula alleghaniensis, Glyceria melicaria, Onoclea sensibilis, Solidago rugosa, Scirpus cyperinus*	area of surface water (2"), soil saturation to surface		S020
MAY_W139	Ridgeline Roads		45.02		11/12/2012	PSS	variable: 4-6" organics over rock; 6-8" organics to a thin (2-3") depleted matrix with 5-20% redox concentrations over rock	*Acer rubrum, Alnus incana, Betula alleghaniensis, Abies balsamea, Fraxinus pennsylvanica, Glyceria melicaria, Onoclea sensibilis, Osmunda cinnamomea, Solidago rugosa*	free water at 1" below ground surface; soil saturation to surface		
MAY_W140	Electrical Collector System and Ridgeline Roads	31.70	4703.75		11/5/2012, 11/12/2012	PFO/PSS/PEM	3-4" organics over 6" depleted sandy loam with 20% redox concentrations	*Abies balsamea, Picea rubens, Acer rubrum, Alnus incana, Spiraea alba, Ilex verticillata, Glyceria melicaria, Osmunda cinnamonea*	soil saturation to surface, wetland drainage patterns		
MAY_W141	Electrical Collector System		55.83		11/5/2012	PFO	2-3" organics over depleted matrix with 5% redox concentrations	*Fraxinus nigra, Abies balsamea, Glyceria melicaria, Carex* sp.	soil saturation to surface, wetland drainage patterns		
MAY_W150	Ridgeline Roads		0.01		7/28/2010	PSS	2" organics over depleted matrix with redox concentrations	*Abies balsamea, Acer pensylvanicum, Glyceria melicaria, Carex gynandra, Oclemena acuminata, Phegopteris connectilis, Solidago rugosa*	soil saturation at 3" below surface		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
MAY_W154	Electrical Collector System		2048.49		10/27/2010; 10/3/2012	PSS/PFO	3-10" organics over gleyed matrix	*Abies balsamea, Acer rubrum, Picea rubens, Betula populifolia, Alnus incana, Calamagrostis canadensis, Glyceria striata, Glyceria melicaria, Scirpus cyperinus*	surface water (6"), soil saturation to surface, wetland drainage patterns		
MAY_W155	Electrical Collector System		1371.94		10/3/2012	PSS/PEM	stratified floodplain soils: layers of depleted mucky sand with organic coating and gravel	*Abies balsamea, Glyceria melicaria, Glyceria striata, Thalictrum pubescens, Juncus effusus, Carex crinita*	soil saturation to surface		S022
MAY_W158	Electrical Collector System		7798.62		10/3/2012	PFO	10" dark horizon over gleyed matrix	*Betula alleghaniensis, Acer rubrum, Abies balsamea, Fraxinus pennsylvanica, Thuja occidentalis, Glyceria melicaria, Glyceria striata, Osmunda cinnamomea, Carex crinita, Juncus effusus*	soil saturation to surface, wetland drainage patterns		
MAY_W159	Electrical Collector System		932.86		10/3/2012	PFO	10" dark horizon over gleyed matrix	*Thuja occidentalis, Betula alleghaniensis, Fraxinus pennsylvanica, Acer rubrum, Abies balsamea, Glyceria melicaria, Glyceria striata, Osmunda cinnamomea, Carex crinita*	areas of surface water (1-2"), soils saturation to surface, water stained leaves, wetland drainage patterns		
MAY_W160	Electrical Collector System		904.53		10/3/2012	PSS	8" of mucky gravel over dark horizon	*Abies balsamea, Populus tremuloides, Hamamelis virginiana, Betula alleghaniensis, Osmunda claytoniana, Glyceria melicaria, Oclemena acuminata, Rubus pubescens, Sphagnum* sp.	areas of surface water, soils saturation to surface, water stained leaves		
MAY_W162	Electrical Collector System		26.06		8/6/2010	PSS	6-8" organics to a dark horizon with 10% redox concentrations over rock	*Acer rubrum, Betula alleghaniensis, Alnus incana, Glyceria melicaria, Onoclea sensibilis, Carex gynandra, Solidago rugosa, Rubus idaeus, Rubus hispidus*	soil saturation to surface, wetland drainage patterns		
MAY_W163	Electrical Collector System		1955.93		10/3/2012	PSS	6-8" organics over depleted matrix with 20% redox concentrations	*Alnus incana, Populus tremuloides, Betula alleghaniensis, Salix bebbiana, Acer rubrum, Glyceria melicaria, Onoclea sensibilis, Glyceria striata, Rubus hispidus*	soil saturation to surface, water stained leaves		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
MAY_W164	Electrical Collector System		337.78		10/3/2012	PFO	10-12" organics and dark mineral horizon over depleted matrix	*Fraxinus pennsylvanica, Acer rubrum, Abies balsamea, Betula alleghaniensis, Glyceria melicaria, Onoclea sensibilis, Calamagrostis canadensis, Thalictrum pubescens*	soil saturation to surface, water stained leaves		S025
MAY_W166	Electrical Collector System		113.66		10/3/2012	PSS	3-6" organics to a depleted matrix with 25% redox concentrations over rock	*Abies balsamea, Acer rubrum, Alnus incana, Betula alleghaniensis, Glyceria striata, Onoclea sensibilis, Osmunda cinnamomea, Carex gynandra*	soil saturation to surface, wetland drainage patterns		
MAY_W167	Electrical Collector System		100.04		10/3/2012	PFO	4-6" organics over depleted matrix with 10% redox concentrations	*Fraxinus pennsylvanica, Acer rubrum, Abies balsamea, Alnus incana, Betula alleghaniensis, Glyceria melicaria, Glyceria striata, Carex gynandra, Onoclea sensibilis*	soil saturation in upper 12", wetland drainage patterns		
MAY_W168	Electrical Collector System		657.07		10/3/2012	PFO/PSS	dark horizon (4") over depleted matrix with 10% redox concentrations	*Acer rubrum, Fraxinus nigra, Acer saccharum*, Abies balsamea, Alnus incana, Glyceria melicaria, Athyrium filix-femina, Carex crinita*	free water at 9" below ground surface, soil saturation to surface, wetland drainage patterns		
MAY_W169	Electrical Collector System		94.56		10/3/2012	PSS	dark horizon (9") over depleted matrix with 15% redox concentrations	*Alnus incana, Acer saccharum*, Fraxinus nigra, Acer rubrum, Betula alleghaniensis, Glyceria melicaria, Onoclea sensibilis, Athyrium filix-femina*	free water at 10" below ground surface, soil saturation to surface, wetland drainage patterns		
MAY_W170	Electrical Collector System		2327.36		8/25/2010, 10/3/2012	PFO/PEM	floodplain soil: 6-8" alluvial deposition over depleted matrix with 5-10% redox concentrations	*Betula alleghaniensis, Fraxinus pennsylvanica, Acer rubrum, Alnus incana, Salix bebbiana, Calamagrostis canadensis, Glyceria striata, Solidago rugosa, Glyceria melicaria, Onoclea sensibilis*	soil saturation to surface		S026, S027
MAY_W171	Electrical Collector System		480.68		8/25/2010, 10/3/2012	PSS/PEM	dark horizon (7") over depleted matrix with 10% redox concentrations to rock	*Abies balsamea, Betula alleghaniensis, Fraxinus nigra, Alnus incana, Glyceria melicaria, Athyrium filix-femina*	free water at 7" below ground surface, soil saturation to surface, wetland drainage patterns		S027
MAY_W172	Electrical Collector System		352.91		8/25/2010, 10/3/2012	PSS/PEM	dark horizon (7") over depleted matrix with 10% redox concentrations to rock	*Abies balsamea, Betula alleghaniensis, Fraxinus nigra, Alnus incana, Glyceria melicaria, Athyrium filix-femina*	free water at 7" below ground surface, soil saturation to surface, wetland drainage patterns		S027

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
MAY_W173	Ridgeline Roads	156.10			8/24/2010	PEM	3" organics over a 3-5" dark horizon to a depleted matrix with 10% redox concentrations	*Scirpus cyperinus, Carex lurida, Solidago canadensis, Doellingeria umbellata, Carex stricta, Equisetum sylvaticum, Salix bebbiana*	soil saturation to surface	VP_14AL_M	
MAY_W174	Ridgeline Roads	228.23	517.16		8/24/2010	PFO	20" organics over rock	*Thuja occidentalis, Betula alleghaniensis, Picea rubens, Abies balsamea, Carex trisperma, Osmunda cinnamomea, Dryopteris cristata*	free water at 6" below ground surface, soil saturation to surface		
MAY_W175	Ridgeline Roads	941.26	468.53		8/24/2010	PSS	muck over a depleted matrix with 2% redox concentrations	*Alnus incana, Betula alleghaniensis, Abies balsamea, Glyceria melicaria, Carex gynandra*	soil saturation in upper 12", surface water		S028
MAY_W194	Electrical Collector System		2985.91		7/16/2010	PFO	spodosol: 5" very dark horizon over matrix with redox concentrations	*Abies balsamea, Acer rubrum, Picea rubens, Solidago rugosa, Osmunda claytoniana, Symphyotrichum lateriflorum, Galium* sp., *Carex gynandra*	soil saturation to surface, water stained leaves		
MAY_W198	Generator Lead	322.82	17311.12	3407.95	7/15/2010; 7/16/2010	PFO	variable: 7" organics over depleted matrix with redox concentrations; 2-5" organics over rock	*Abies balsamea, Picea rubens, Thuja occidentalis, Salix bebbiana, Spiraea alba, Oclemena acuminata, Carex gynandra, Eutrochium maculatum, Osmunda claytoniana*	soil saturation to surface		
MAY_W199	Ridgeline Roads	629.06	83.31		7/15/2010	PFO	variable: 1-3" organics over depleted matrix with redox concentrations; 1-3" organics over rock	*Abies balsamea, Acer rubrum, Alnus incana, Spiraea alba, Spiraea tomentosa, Osmunda claytoniana, Carex gynandra, Carex projecta, Scirpus cyperinus, Equisetum sylvaticum*	soil saturation in upper 12", water stained leaves, wetland drainage patterns		
MAY_W201	Generator Lead		2928.76	552.68	11/3/2010, 11/23/2010	PFO	2" organics to a dark horizon with oxidized rhizosphers over a depleted matrix with 10% redox concentrations	*Fraxinus pennsylvanica, Betula alleghaniensis, Abies balsamea, Acer rubrum, Corylus cornuta, Glyceria striata, Scirpus cyperinus, Calamagrostis canadensis*	soils saturation to surface, wetland drainage patterns		
MAY_W205	Generator Lead		222.57		11/23/2010	PFO	1" organics to 8" dark horizon over a depleted matrix with 15% redox concentrations	*Thuja occidentalis, Betula alleghaniensis, Picea rubens, Abies balsameaGlyceria melicaria, Dryopteris* sp., *Sphagnum* sp.	soil saturation to surface		
MAY_W206	Generator Lead		203.89		11/23/2010	PSS	4" dark horizon over depleted matrix with 20% redox concentrations to rock	*Acer rubrum, Alnus incana, Glyceria melicaria, Carex gynandra, Dryopteris* sp.	soil saturation to surface		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
MAY_W208	Ridgeline Roads	1461.63	18173.04	3335.98	7/13/2010	PFO/PSS/PEM	4-6" organics over depleted matrix with 5% redox concentrations	*Alnus incana, Spiraea tomentosa, Betula alleghaniensis, Glyceria melicaria, Glyceria striata, Juncus effusus, Onoclea sensibilis*	soil saturation to the surface, areas of inundation, water stained leaves	VP_04MA_N, VP_05MA_N	S036
KING_W213	Generator Lead		2393.22		11/4/2010, 11/23/2010	PFO/PSS	1-2" organics over 2" dark horizon to a depleted matrix with redox concentrations	*Abies balsamea, Acer rubrum, Euthamia graminifolia, Juncus effusus, Solidago rugosa, Calamagrostis canadensis, Glyceria melicaria*	surface water, soil saturation to surface		
KING_W215	Generator Lead		6144.25	1434.70	11/10/2010, 5/24/2011	PFO/PSS	disturbed: 3-5" organics to dark horizon over depleted matrix with redox concentrations	*Abies balsamea, Picea rubens, Betula populifolia, Acer rubrum, Betula alleghaniensis, Salix bebbiana, Spiraea alba, Calamagrostis canadensis, Rubus pubescens, Glyceria canadensis, Scirpus* sp.	areas of surface water, soils saturation to surface, wetland drainage patterns		
KING_W216	Generator Lead		4438.95	1410.45	5/24/2011	PSS	variable: 3-5" organics to dark horizon (3-4") over depleted matrix with 10-15% redox concentrations; 3-5" organics over rock	*Abies balsamea, Acer rubrum, Spiraea alba, Salix bebbiana, Spiraea tomentosa, Calamagrostis canadensis, Scirpus cyperinus, Maianthemum canadense, Carex trisperma,*	areas of surface water (1-3"), soil saturation to surface		
KING_W219	Generator Lead		2465.47	241.57	5/24/2011	PFO	disturbed: 4-6" organics over dark horizon (10-15") with oxidized rhizosphers and redox concentrations to rock	*Acer rubrum, Pinus resinosa, Salix bebbiana, Acer rubrum, Abies balsamea, Glyceria striata, Calamagrostis canadensis, Onoclea sensibilis, Osmunda claytoniana*	soil saturation to surface, wetland drainage patterns		S037
KING_W220	Generator Lead		1132.05		11/10/2010, 5/24/2011, 5/25/2011	PFO/PEM	3-10" organics over depleted matrix with 5-10% redox concentrations	*Abies balsamea, Acer rubrum, Spiraea alba, Salix bebbiana, Glyceria melicaria, Glyceria striata, Calamagrostis canadensis, Scirpus cyperinus, Osmunda cinnamomea*	areas of surface water (2-5"), soil saturation to surface, soil saturation to surface, wetland drainage patterns	VP_04DN_N	S037
KING_W226	Ridgeline Roads	1220.72	543.43		6/1/2011, 6/2/2011	PFO/PSS	3" dark O/A over depleted sandy loam with 20% redox concentrations	*Betula alleghaniensis, Salix discolor, Fraxinus nigra, Alnus incana, Spiraea alba, Ilex verticillata, Viburnum nudum, Onoclea sensibilis, Osmunda claytoniana*	areas of surface water, soil saturation to 4", wetland drainage patterns		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
KING_W232	Ridgeline Roads	417.90			6/6/2011	PEM	depleted matrix with 5% redox concentrations	*Sphagnum* sp, *Viola* sp., *Impatiens capensis, Solidago rugosa, Glyceria melicaria, Thalictrum pubescens, Alnus incana, Betula alleghaniensis*	soil saturation to surface		
KING_W236	Ridgeline Roads	341.74	82.81		6/6/2011	PSS/PEM	3-4" organics over 3-4" dark muck with oxidized rhizospheres to a depleted matrix with 15% redox concentrations	*Abies balsamea, Acer rubrum, Betula alleghaniensis, Nemopanthus mucronatus, Carex gynandra, Solidago rugosa*	soil saturation in upper 10"		
KING_W237	Ridgeline Roads	435.97	195.96		6/6/2011	PFO/PSS	5" organics over a depleted matrix with redox concentrations	*Acer rubrum, Betula alleghaniensis, Viburnum lantanoides, Solidago rugosa, Glyceria melicaria, Thalictrum pubescens*	soil saturation to surface, standing water, water staining, wetland drainage patterns		
KING_W239	Ridgeline Roads	1463.51	167.29		6/3/2011	PSS/PEM	4-5" organics over dark horizon to a depleted matrix with 15% redox concentrations	*Glyceria melicaria, Impatiens capensis, Solidago canadensis, Solidago rugosa, Osmunda claytoniana, Onoclea sensibilis*	standing water in ruts, soil saturation to surface, water stained leaves	VP_84TT_M	
KING_W241	Ridgeline Roads	226.27			6/7/2011	PEM	3" dark A over depleted sandy loam with 10% redox concentrations	*Juncus effusus, Carex gynandra, Solidago rugosa, Rubus idaeus, Abies balsamea, Acer rubrum, Populus* sp.	soil saturation to surface, water stained leaves		
KING_W242	Ridgeline Roads	24.02	72.89		6/7/2011	PSS	3" dark horizon over depleted matrix	*Acer rubrum, Abies balsamea, Betula alleghaniensis, Nemopanthus mucronatus, Carex gynandra, Cornus canadensis, Juncus effusus*	soil saturation to surface		
KING_W246	Ridgeline Roads	580.12			6/20/2011	PEM	depleted sandy loam	*Carex gynandra, Onoclea sensibilis, Thalictrum pubescens, Equisetum arvense, Acer rubrum, Salix bebbiana*	areas of standing water, soil saturation to surface		S038
KING_W251	Ridgeline Roads	48.86	45.12		6/20/2011	PFO/PSS	disturbed soil: 2-3" of organics over depleted sandy loam with 15% redox concentrations	*Betula alleghaniensis, Picea rubens, Acer rubrum, Abies balsamea, Alnus incana, Viburnum nudum, Calamagrostis canadensis, Carex gynandra, Osmunda cinnamomea, Osmunda claytoniana, Solidago rugosa*	soil saturation to surface, water stained leaves		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
KING_W252	Ridgeline Roads	11428.65	2143.29		6/7/2011, 6/21/2011	PFO	6-10" organics over depleted matrix with 5% redox concentrations	*Betula alleghaniensis, Picea rubens, Abies balsamea, Acer rubrum, Alnus incana, Viburnum nudum, Glyceria striata, Glyceria melicaria, Onoclea sensibilis, Osmunda cinnamomea, Tiarella cordifolia*	areas of surface water (2-12"), soil saturation to surface, water stained leaves		S040, S041
KING_W275	Ridgeline Roads	320.09	322.27		6/22/2011	PFO	2" organic over dark horizon to a depleted matrix with 20% redox concentrations	*Fraxinus pennsylvanica, Fraxinus nigra, Betula alleghaniensis, Corylus cornuta, Salix bebbiana, Glyceria striata, Carex gynandra, Onoclea sensibilis, Lycopus uniflorus*	soil saturation in upper 12", water stained leaves		
KING_W276	Ridgeline Roads	658.42	82.25		6/22/2011	PSS	2" organic over dark horizon to a depleted sandy loam with 10% redox concentrations	*Alnus incana, Spiraea alba, Salix bebbiana, Thuja occidentalis, Calamagrostis canadensis, Glyceria striata, Carex gynandra, Onoclea sensibilis*	soil saturation to surface, water stained leaves, wetland drainage patterns		
KING_W297	Ridgeline Roads	4666.65	1316.02		6/14/11 - 6/15/11	PFO/PSS/PEM	variable: wetland interior 24" organics over a depleted matrix with redox concentration; wetland edge 1-4" organics over depleted sandy loam with 20% redox concentrations and depletions	*Betula alleghaniensis, Abies balsamea, Acer rubrum, Fraxinus nigra, Spiraea alba, Spiraea tomentosa, Carex gynandra, Carex trisperma, Osmunda cinnamomea, Glyceria melicaria, Glyceria striata*	soil saturation to the surface, water stained leaves, areas of inundation, wetland drainage patterns	VP_59MJ_M, VP_ 58MJ_N, VP_60MJ_M, VP_61TT_M, VP_65TT_M, VP_ 63TT_M	
KING_W303	Ridgeline Roads	779.85	201.98		6/27/11 - 6/28/11	PFO/PSS	6-8" organics over depleted matrix with 10-20% redox concentrations	*Abies balsamea, Betula alleghaniensis, Acer rubrum, Thuja occidentalis, Fraxinus nigra, Nemopanthus mucronatus, Viburnum nudum, Alnus incana, Ilex verticillata, Carex trisperma, Scirpus cyperinus, Osmunda cinnamomea, Carex gynandra*	soil saturation to the surface, water stained leaves, areas of inundation (1-3"), wetland drainage patterns		
KING_W307	Ridgeline Roads	35.09	41.44		6/23/2011	PSS	stony soil; 8" of organics over depleted sandy loam with 5-10% redox concentrations	*Picea rubens, Abies balsamea, Betula populifolia, Viburnum lantanoides, Carex gynandra, Carex canescens, Carex magellanica, Osmunda cinnamomea, Juncus effusus*	areas of surface water, soil saturation in upper 12", wetland drainage patterns		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
KING_W309	Generator Lead		2889.86	647.46	11/10/2010, 5/24/2011	PFO/PSS	disturbed and variable: dark horizon (3-6") to a depleted matrix with redox concentrations 5-8" organics over depleted matrix with 2% redox concentrations	*Acer rubrum, Abies balsamea, Betula alleghaniensis, Fraxinus nigra, Alnus incana, Carex trisperma, Glyceria melicaria, Glyceria striata, Osmunda cinnamomea, Solidago rugosa*	areas of surface water (1-2"), soils saturation to surface, wetland drainage patterns		
KING_W311	Generator Lead			917.55	11/10/2010	PEM	6" organics/dark horizon with oxidized rhizospheres over depleted matrix with redox concentrations	*Solidago rugosa, Scirpus cyperinus, Glyceria striata*	soils saturation to surface, wetland drainage patterns		
KING_W312	Generator Lead			533.88	11/10/2010	PEM	4" dark horizon over depleted matrix with 10% redox concentrations	*Calamagrostis canadensis, Osmunda claytoniana, Osmunda cinnamomea, Scirpus cyperinus, Glyceria melicaria*	soil saturation to surface, wetland drainage patterns		
KING_W313	Generator Lead		1433.66		11/10/2010	PSS	disturbed: 1" mixed organics and dark mineral soil horizon over depleted matrix with redox concentrations and organic streaking	*Salix* sp., *Betula alleghaniensis, Picea rubens, Abies balsamea, Carex gynandra, Onoclea sensibilis, Solidago rugosa, Rubus idaeus*	surface water in ruts, soil saturation to surface		
KING_W314	Generator Lead			645.39	11/10/2010	PEM	3-5" organics over depleted matrix with 10% redox concentrations	*Glyceria striata, Scirpus cyperinus, Carex gynandra, Juncus effusus, Carex trisperma, Calamagrostis canadensis, Epilobium ciliatum*	soil saturation to surface, wetland drainage patterns		
KING_W315	Generator Lead		1289.58	637.14	11/10/2010	PSS	10" organics over depleted matrix with 2% redox concentrations	*Acer rubrum, Fraxinus pennsylvanica, Fraxinus nigra, Glyceria melicaria, Glyceria striata, Doellingeria umbellata, Solidago rugosa*	soil saturation to surface		
KING_W316	Generator Lead	16		149.01	11/10/2010	PEM	variable: histols; 10-12" organics over depleted matrix with 5% redox concentrations	*Calamagrostis canadensis, Glyceria melicaria, Glyceria striata, Epilobium ciliatum, Scirpus cyperinus, Rubus idaeus*	areas of surface water, soil saturation to surface		
KING_W319	Generator Lead		4485.37	1115.55	11/10/2010	PFO	12-20" organics over depleted matrix	*Betula alleghaniensis, Abies balsamea, Tsuga canadensis, Acer rubrum, Fraxinus nigra, Fraxinus pennsylvanica, Scirpus cyperinus, Glyceria melicaria, Carex gynandra, Epilobium ciliatum*	soil saturation to surface		
KING_W320	Generator Lead		62.24		11/10/2010	PFO	9" organics over depleted matrix with 2% redox concentrations	*Betula alleghaniensis, Fraxinus pennsylvanica, Acer saccharum, Carex scabrata, Epilobium ciliatum, Onoclea sensibilis, Glyceria melicaria*	soil saturation to surface, wetland drainage patterns		

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KING_W321	Generator Lead	16	6021.05	1282.24	11/10/2010	PFO	10-20" organics over depleted matrix with 2% redox concentrations	*Acer rubrum, Fraxinus pennsylvanica, Fraxinus nigra, Carex gynandra, Corylus cornuta, Glyceria melicaria, Carex gynandra, Onoclea sensibilis, Glyceria striata*	soil saturation to surface, wetland drainage patterns		
KING_W322	Generator Lead		5479.81	1120.89	11/10/2010	PFO	10-20" organics over depleted matrix with 2% redox concentrations	*Acer rubrum, Fraxinus pennsylvanica, Fraxinus nigra, Carex gynandra, Corylus cornuta, Glyceria melicaria, Carex gynandra, Onoclea sensibilis, Glyceria striata*	soil saturation to surface, wetland drainage patterns		
KING_W323	Generator Lead		84.73		11/11/2010	PSS	6" organics over depleted matrix with 2% redox concentrations	*Acer rubrum, Fraxinus nigra, Betula alleghaniensis, Carex gynandra, Onoclea sensibilis, Carex stricta, Osmunda cinnamomea*	soil saturation in upper 12"		
KING_W324	Generator Lead			391.69	11/11/2010	PEM	2-3" organics to thin (3-4") dark horizon over depleted matrix with 5-10% redox concentrations	*Glyceria striata, Glyceria melicaria, Carex gynandra, Epilobium ciliatum, Scirpus cyperinus, Juncus effusus, Onoclea sensibilis*	soil saturation to surface		
KING_W325	Generator Lead			1018.67	11/11/2010	PEM	2-3" organics to thin (3-4") dark horizon over depleted matrix with 5-10% redox concentrations	*Glyceria striata, Glyceria melicaria, Carex gynandra, Epilobium ciliatum, Scirpus cyperinus, Juncus effusus, Onoclea sensibilis*	soil saturation to surface		
KING_W326	Generator Lead			1484.34	11/11/2010	PEM/PSS/PFO	disturbed and variable: 2-3" organics to thin (3-4") dark horizon over depleted matrix with 5-10% redox concentrations; depleted matrix with 20% redox concentrations and organic streaking	*Glyceria striata, Carex gynandra, Epilobium ciliatum, Carex stipata, Carex scabrata, Carex gynandra, Scirpus cyperinus, Betula alleghaniensis, Tsuga canadensis, Acer rubrum, Rubus idaeus, Salix* sp.	areas of surface water, soil saturation to surface, wetland drainage patterns	VP_115TT_M	
KING_W327	Generator Lead		1060.44		11/11/2010	PSS	6" organics over depleted matrix with redox concentrations	*Acer rubrum, Betula alleghaniensis, Glyceria melicaria, Glyceria striata, Calamagrostis canadensis, Onoclea sensibilis, Dryopteris intermedia*	soil saturation to surface		
KING_W328	Generator Lead		2231.16	216.33	11/11/2010	PSS	6" organics over depleted matrix with redox concentrations	*Acer rubrum, Betula alleghaniensis, Glyceria melicaria, Glyceria striata, Calamagrostis canadensis, Onoclea sensibilis, Dryopteris intermedia*	soil saturation to surface		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
KING_W329	Generator Lead	16	67217.13	13834.58	11/11/2010	PFO	6" organics over thin (3") depleted matrix with 15% redox concentrations to rock	*Fraxinus nigra, Abies balsamea, Acer rubrum, Alnus incana, Ilex verticillata, Glyceria striata, Osmunda cinnamomea, Onoclea sensibilis, Glyceria melicaria*	areas of surface water, free water at 1" below ground surface, soil saturation to surface	VP_116TT_M, VP_117TT_M	
KING_W330	Generator Lead		15803.99	3870.57	11/11/2010	PFO	6" organics over thin (3") depleted matrix with 15% redox concentrations to rock	*Fraxinus nigra, Picea rubens, Abies balsamea, Acer rubrum, Alnus incana, Ilex verticillata, Glyceria striata, Osmunda cinnamomea, Onoclea sensibilis, Glyceria melicaria, Scirpus* sp.	areas of surface water, free water at 1" below ground surface, soil saturation to surface		
KING_W331	Generator Lead		9673.33	1379.58	11/11/2010	PFO	variable: 8-12" organics over depleted matrix with 5% redox concentrations; histosols (25"+ organics)	*Betula alleghaniensis, Abies balsamea, Thuja occidentalis, Acer rubrum, Alnus incana, Ilex verticillata, Glyceria striata, Calamagrostis canadensis, Onoclea sensibilis, Epilobium ciliatum*	areas of surface water (<1"), soil saturation to surface		
KING_W332	Generator Lead		15891.22	3672.97	11/11/2010	PFO	4-8" organics over depleted matrix with 5-10% redox concentrations	*Fraxinus nigra, Fraxinus pennsylvanica, Betula alleghaniensis, Acer rubrum, Alnus incana, Calamagrostis canadensis, Glyceria striata, Onoclea sensibilis, Scirpus cyperinus*	areas of surface water (2-4"), soil saturation to surface	VP_118TT_M	
KING_W333	Generator Lead		4688.46	3.77	12/6/2010	PFO	dark mucky mineral horizon (8") over depleted matrix with 5% redox concentrations	*Betula alleghaniensis, Picea rubens, Fagus grandifolia, Fraxinus pennsylvanica, Acer pensylvanicum, Scirpus* sp., *Osmunda cinnamomea*	areas of surface water, soil saturation to surface		
KING_W334	Generator Lead		6266.55	1478.45	5/4/2011	PFO	3-4" dark mucky mineral horizon over depleted matrix with redox concentrations	*Betula alleghaniensis, Acer rubrum, Abies balsamea, Fraxinus pennsylvanica, Oxalis* sp., *Osmunda cinnamomea, Cornus canadensis*	areas of surface water, free water at surface, soil saturation to surface		
KING_W335	Access road	1700	2101.28		2/14/2013	PFO/PSS	frozen soil conditions	*Betula alleghaniensis, Fraxinus nigra, Acer rubrum, Ulmus americana, Alnus incana, Hamamelis virginiana, Onoclea sensibilis*	surface water (1-2" in ruts and pits)		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
KING_W336	Generator Lead		30629.14	7145.98	12/6/2010, 5/4/2011	PFO	disturbed & mixed soil with redox concentration	*Fraxinus pennsylvanica, Fraxinus nigra, Abies balsamea, Picea rubens, Cornus amomum, Osmunda cinnamomea, Osmunda claytoniana, Carex gynandra, Calamagrostis canadensis*	soil saturation to surface, geomorphic position	VP_119TT_M	
KING_W337	Generator Lead		158.42		12/7/2010	PFO	disturbed: thin organics to dark mucky mineral horizon over depleted matrix with 5+% redox concentrations	*Abies balsamea, Betula alleghaniensis, Alnus incana, Fraxinus pennsylvanica, Acer rubrum, Osmunda cinnamomea, Calamagrostis canadensis, Onoclea sensibilis, Osmunda claytoniana*	areas of surface water, soil saturation to surface, geomorphic position		
KING_W338	Generator Lead		3185.08	341.71	12/7/2010	PFO	disturbed: thin organics to dark mucky mineral horizon over depleted matrix with 40+% redox concentrations	*Alnus incana, Acer rubrum, Abies balsamea, Solidago rugosa, Osmunda cinnamomea, Scirpus cyperinus, Calamagrostis canadensis*	areas of surface water (0.5-1.5"), geomorphic position		
KING_W339	Generator Lead		2033.72	89.55	12/7/2010	PFO	disturbed: thin organics to dark mucky mineral horizon over depleted matrix with 40+% redox concentrations	*Alnus incana, Acer rubrum, Abies balsamea, Solidago rugosa, Osmunda cinnamomea, Scirpus cyperinus, Calamagrostis canadensis*	areas of surface water (0.5-1.5"), geomorphic position		
KING_W340	Generator Lead		3700.63	937.32	12/7/2010	PSS	disturbed: thin organics over till	*Thuja occidentalis, Betula alleghaniensis, Fraxinus* sp., *Alnus incana, Rubus idaeus, Glyceria* sp., *Onoclea sensibilis, Calamagrostis canadensis*	areas of surface water, wetland drainage patterns		S053
KING_W341	Generator Lead		22615.38	5259.22	12/7/2010	PFO	stony soil - not further characterized	*Fraxinus* sp., *Populus tremuloides, Alnus incana, Corylus cornuta, Solidago rugosa, Onoclea sensibilis, Osmunda claytoniana, Glyceria* sp.	area of surface water, soil saturation to surface, wetland drainage patterns		
KING_W342	Generator Lead		2960.62	593.82	12/7/2010	PFO	disturbed and variable: thin organic over rock; thin organic over depleted matrix with 20%+ redox concentrations	*Abies balsamea, Onoclea sensibilis, Viburnum nudum, Rubus idaeus, Onoclea sensibilis, Osmunda claytoniana, Solidago rugosa*	areas of surface water (0.5-1"), wetland drainage patterns, geomorphic position		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
KING_W343	Generator Lead		413.33		12/7/2010	PFO	disturbed and variable: thin organic over rock; thin organic over depleted matrix with 20%+ redox concentrations	*Abies balsamea, Onoclea sensibilis, Viburnum nudum, Rubus idaeus, Onoclea sensibilis, Osmunda claytoniana, Solidago rugosa*	areas of surface water (0.5-1"), wetland drainage patterns, geomorphic position		
KING_W344	Generator Lead		6490.24	1815.75	12/7/2010	PSS	histic epipedon	*Alnus incana, Picea rubens, Betula papyrifera, Osmunda claytoniana,Onoclea sensibilis, Sphagnum* sp.	areas of surface water, soil saturation to surface, geomorphic position		
KING_W345	Generator Lead		12971.90	1092.74	12/7/2010	PFO	think dark horizon over depleted matrix with 5% redox concentrations	*Abies balsamea, Picea rubens, Alnus incana, Osmunda claytoniana, Glyceria* sp., *Scirpus cyperinus, Sphagnum* sp.	surface water, soil saturated to surface		
KING_W346	Generator Lead		15558.89	2490.03	12/8/2010; 12/13/2012	PFO	12" organics over till	*Betula alleghaniensis, Thuja occidentalis, Picea rubens, Abies balsamea, Alnus incana, Glyceria* sp., *Calamagrostis canadensis, Ribes lacustre, Osmunda claytoniana*	areas of surface water, wetland drainage patterns		S054
KING_W347	Generator Lead		3529.73	876.88	12/8/2010	PFO	thin organics to dark mineral horizon over depleted matrix with 10+% redox concentrations	*Fraxinus pennsylvanica, Fraxinus nigra, Betula alleghaniensis, Alnus incana, Dryopteris, Carex gynandra, Onoclea sensibilis, Dryopteris* sp., *Glyceria* sp.	areas of surface water, soil saturation to surface, wetland drainage patterns		
KING_W348	Generator Lead		2723.42	639.21	12/8/2010	PFO	thin organics to very dark mineral horizon over depleted matrix with 20+% redox concentrations	*Betula papyrifera, Fraxinus nigra, Fraxinus pennsylvanica, Acer pensylvanicum, Rubus idaeus, Osmunda claytoniana, Glyceria* sp., *Onoclea sensibilis*	areas of surface water, wetland drainage patterns		
KING_W349	Generator Lead		250.67		12/8/2010	PSS	depleted matrix with 5% redox concentrations	*Fraxinus pennsylvanica, Acer rubrum, Onoclea sensibilis, Glyceria* sp., *Juncus effusus, Osmunda claytoniana*	areas of surface water, soil saturation to surface		
KING_W350	Generator Lead		2086.82	1070.62	12/8/2010	PSS	thin organics to dark mineral horizon over depleted matrix with 10% redox concentrations	*Acer rubrum, Fraxinus pennsylvanica, Acer pensylvanicum, Fagus grandifolia, Rubus idaeus, Scirpus cyperinus*	areas of surface water, soil saturation to surface, wetland drainage patterns		
KING_W351	Generator Lead		15615.02	3015.03	12/8/2010	PFO	histic epipedon	*Betula alleghaniensis, Picea rubens, Abies balsamea, Fraxinus nigra, Acer rubrum, Alnus incana, Onoclea sensibilis, Glyceria* sp., *Osmunda claytoniana*	areas of surface water, soil saturation to surface, wetland drainage patterns		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
KING_W352	Generator Lead		10926.21	2705.33	12/8/2010, 5/5/2011	PFO/PSS	6" organics over depleted matrix with 5-10% redox concentrations	*Abies balsamea, Betula alleghaniensis, Fraxinus nigra, Alnus incana, Acer rubrum, Calamagrostis canadensis, Osmunda cinnamomea, Rubus hispidus, Cornus canadensis*	free water at surface, soil saturation to surface		
KING_W353	Generator Lead		7150.69	1381.67	12/8/2010; 12/13/2012	PFO	dark mineral horizon over depleted matrix	*Abies balsamea, Fraxinus pennsylvanica, Betula alleghaniensis, Fraxinus nigra, Acer rubrum, Athyrium filix-femin, Sphagnum* sp.	areas of surface water, soil saturation to surface, wetland drainage patterns		S055
KING_W354	Generator Lead		61512.02	12193.28	12/8/2010; 12/13/2012	PFO	depleted matrix with redox concentrations	*Betula alleghaniensis, Picea rubens, Fraxinus pennsylvanica, Fraxinus nigra, Alnus incana, Onoclea sensibilis, Glyceria* sp., *Calamagrostis canadensis*	areas of surface water, soil saturation to surface	VP_120TT_N, VP_117MG_N, VP_121TT_M	S056
KING_W355	Generator Lead		15194.95	3201.42	12/9/2010; 12/13/2012	PFO	thin organics to mucky mineral horizon over depleted matrix with 10% redox concentrations and depletions	*Fraxinus pennsylvanica, Thuja occidentalis, Fraxinus nigra, Picea rubens, Betula alleghaniensis, Alnus incana, Onoclea sensibilis, Solidago gigantea, Carex gynandra*	areas of surface water, soil saturation to surface, wetland drainage patterns		S057
PARK_W356	Generator Lead		1270.49		12/17/2010; 12/13/2012	PFO	3" organics to thin dark mineral horizon (2") over depleted matrix with 20% redox concentrations	*Thuja occidentalis, Ulmus americana, Fraxinus nigra, Abies balsamea, Alnus incana, Corylus cornuta, Glyceria* sp., *Scirpus* sp., *Onoclea sensibilis*	areas of surface water, soil saturation to surface, wetland drainage patterns		S058, S059
PARK_W357	Generator Lead		56123.12	10892.76	12/17/2010, 5/5/2011	PFO	1-2" organics over depleted matrix with 15-20% redox concentrations	*Thuja occidentalis, Abies balsamea, Ulmus americana, Fraxinus nigra, Alnus incana, Spiraea alba, Osmunda cinnamomea, Glyceria* sp., *Scirpus* sp.	areas of surface water, soil saturation to surface		
PARK_W358	Generator Lead	16.00	64283.63	13370.84	12/16/2010	PSS/PFO	think (3") dark horizon over depleted matrix with 20% redox concentrations	*Alnus incana, Spiraea alba, Spiraea tomentosa, Abies balsamea, Betula alleghaniensis, Picea rubens, Scirpus* sp., *Glyceria melicaria, Juncus effusus*	soil saturation to surface, wetland drainage patterns	VP_110SK_M	

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
PARK_W359	Generator Lead		12158.56	3254.82	12/16/2010	PSS/PFO	dark mucky mineral horizon (8") over depleted matrix with 30% redox concentrations	*Thuja occidentalis, Fraxinus nigra, Betula alleghaniensis, Abies balsamea, Alnus incana, Corylus cornuta, Spiraea alba, Glyceria* sp., *Onoclea sensibilis, Dryopteris intermedia*	areas of surface water, soil saturation to surface		
PARK_W360	Generator Lead		3041.50		12/16/2010	PFO	3" organics over depleted matrix with 5% redox concentrations	*Populus tremuloides, Thuja occidentalis, Abies balsamea, Betula alleghaniensis, Fraxinus nigra, Alnus incana, Corylus cornuta, Glyceria melicaria, Calamagrostis canadensis, Onoclea sensibilis, Dryopteris intermedia*	areas of surface water, soil saturation to surface		
PARK_W361	Generator Lead		15217.92	3475.54	12/16/2010	PFO	4-12" organics over depleted matrix with 5-15% redox concentrations	*Thuja occidentalis, Betula alleghaniensis, Acer rubrum, Abies balsamea, Alnus incana, Fraxinus nigra, Glyceria melicaria, Osmunda claytoniana, Osmunda cinnamomea, Onoclea sensibilis*	areas of surface water, free water within upper 12", soil saturation to surface, wetland drainage patterns		
PARK_W362	Generator Lead		8845.59	2045.72	12/16/2010	PSS	4-7" organics over depleted matrix with 2% redox concentrations	*Picea mariana, Thuja occidentalis, Abies balsamea, Betula alleghaniensis, Scirpus cyperinus, Carex trisperma, Carex gynandra*	areas of surface water, soil saturation to surface		
PARK_W363	Generator Lead		33041.83	6272.48	12/16/2010	PFO/PSS	3" organics over depleted matrix with 10-12% redox concentrations	*Thuja occidentalis, Abies balsamea, Betula alleghaniensis, Spiraea tomentosa, Spiraea alba, Glyceria* sp., *Scirpus* sp., *Carex intumescens*	areas of surface water, free water at 2" below ground surface, soil saturation to surface		S060
PARK_W364	Generator Lead		22519.10	4367.56	12/16/2010	PFO	8-10" organics over depleted matrix with 15% redox concentrations	*Thuja occidentalis, Abies balsamea, Picea rubens, Ilex verticillata, Kalmia angustifolia, Glyceria melicaria, Carex trisperma*	areas of surface water, soil saturation to surface		
PARK_W365	Generator Lead		8464.65	1968.13	12/16/2010, 5/4?/2011	PSS	6-10" dark mucky mineral horizon over depleted matrix with 15% redox concentrations	*Thuja occidentalis, Abies balsamea, Betula alleghaniensis, Acer rubrum, Alnus incana, Calamagrostis canadensis, Glyceria canadensis, Glyceria melicaria*	areas of surface water, soil saturation to surface		
PARK_W366	Generator Lead		5752.02	1574.92	2/12/2013	PFO	8" organics over depleted matrix over rock	*Betula alleghaniensis, Fraxinus nigra, Abies balsamea, Onoclea sensibilis*	soil saturated at 6" below surface		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
PARK_W367	Generator Lead		1281.55	191.49	2/12/2013	PFO	12-18" organics	*Betula alleghaniensis, Acer rubrum, Tsuga canadensis, Abies balsamea, Onoclea sensibilis*	stream, soil saturated to surface		S061
PARK_W368	Generator Lead		13623.38	1711.87	2/12/2013	PFO	frozen soil conditions	*Tsuga canadensis, Abies balsamea, Betula alleghaniensis, Acer rubrum*	soil frozen at surface	VP_109SK_M	
PARK_W369	Generator Lead	1230	24482.24	4933.86	2/12/2013	PFO	8-10" organics over rock	*Fraxinus nigra, Betula alleghaniensis, Tsuga canadensis, Abies balsamea, Acer rubrum*	soil saturation to surface		
PARK_W370	Generator Lead		444.82		2/12/2013	PFO	flooded and frozen soil conditions	*Fraxinis nigra, Betual alleghaniensis, Abies balsamea, Alnus incana, Onoclea sensibilis, Calamagrostis canadensis*	surface water, water marks		S062
PARK_W373	Generator Lead		1.70		1/31/2013	PFO	8" organics over depleted matrix	*Abies balsamea, Fraxinis nigra, Acer rubrum, Alnus incana, Calamagrostis canadensis*	soil saturation to surface		S064
PARK_W375	Generator Lead	16	2948.89	2988.52	1/30/2013	PFO	6" organics over depleted matrix	*Fraxinis nigra, Abies balsamea, Alnus incana, Spiraea alba, Onoclea sensibilis,*	soil saturation to surface		
ABB_W377	Generator Lead		227.43	227.43	1/30/2013	PFO	4" organics over depleted matrix	*Thuja occidentalis, Abies balsamea, Fraxinis nigra, Alnus incana, Onoclea sensibilis*	soil saturation to surface		
ABB_W378	Generator Lead		2077.08	1947.05	1/30/2013	PFO	3-5" dark horizon with frozen soil conditions in most areas	*Abies balsamea, Fraxinis nigra, Thuja occidentalis*			
ABB_W381	Generator Lead		165.99	226.74	1/29/2013	PFO	disturbed: 6" mixed organic and dark mineral horizon over depleted matrix with 5% redox concentrations	*Thuja occidentalis, Acer rubrum, Populus tremuloides, Abies balsamea, Fraxinus pennsylvanica, Alnus incana, Onoclea sensibilis, Osmunda cinnamomea, Calamagrostis canadensis*	2" of ice in pits		
ABB_W382	Generator Lead		660.23	957.12	1/29/2013	PFO	disturbed: 6" mixed organic and dark mineral horizon over depleted matrix with 5% redox concentrations	*Thuja occidentalis, Acer rubrum, Populus tremuloides, Abies balsamea, Fraxinus pennsylvanica, Alnus incana, Onoclea sensibilis, Osmunda cinnamomea, Calamagrostis canadensis*	2" of ice in pits		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
ABB_W385	Generator Lead	32	11387.13	8065.17	12/12/2012, 1/29/2013	PFO	20"+ organics	*Thuja occidentalis, Populus tremuloides, Abies balsamea, Betula populifolia, Fraxinus nigra, Osmunda cinnamomea, Typha latifolia, Calamagrostis canadensis*	free water at soil surface, soil saturation to surface	SVP_53KN_N	S069
ABB_W386	Generator Lead		33984.37	7116.73	12/12/2012, 1/29/2013	PFO	variable: 10-20" organic over rock or depleted matrix	*Thuja occidentalis, Abies balsamea, Betula alleghaniensis, Fraxinus nigra, Acer rubrum, Salix bebbiana, Alnus incana, Osmunda cinnamomea, Onoclea sensibilis, Calamagrostis canadensis*	free water at soil surface, soil saturation to surface, wetland drainage patterns		S069
ABB_W387	Generator Lead		13726.83	2900.87	12/12/2012	PFO	variable: 10-20" organic over rock or depleted matrix	*Thuja occidentalis, Abies balsamea, Betula alleghaniensis, Fraxinus nigra, Acer rubrum, Alnus incana, Osmunda cinnamomea, Onoclea sensibilis, Scirpus cyperinus*	free water at soil surface, soil saturation to surface		S070
ABB_W388	Generator Lead		1072.23		12/12/2012	PFO/PEM	disturbed: 8" dark mineral horizon over depleted matrix	*Thuja occidentalis, Abies balsamea, Osmunda cinnamomea, Onoclea sensibilis, Calamagrostis canadensis*	free water at 6" below ground surface, soil saturation to surface		
ABB_W389	Generator Lead		15604.69	3256.27	12/12/2012, 2/13/2013	PSS/PFO	8-12" organics over depleted matrix with 15% redox concentrations	*Thuja occidentalis, Abies balsamea, Picea rubens, Fraxinus nigra, Betula alleghaniensis, Alnus incana, Osmunda cinnamomea, Onoclea sensibilis, Calamagrostis canadensis*	surface water in pits (<1"), free water at soil surface, soil saturation to surface, wetland drainage patterns		
ABB_W390	Generator Lead		1978.79	339.34	12/12/2012	PSS	8" organics over rock	*Alnus incana, Betula populifolia, Salix bebbiana, Fraxinus nigra, Abies balsamea, Osmunda cinnamomea, Onoclea sensibilis*	soil saturation to surface, wetland drainage patterns		
ABB_W391	Generator Lead		15884.47	2894.33	12/12/2012	PFO	4-10" organics over rock	*Abies balsamea, Populus tremuloides, Salix bebbiana, Acer rubrum, Betula populifolia, Osmunda cinnamomea, Onoclea sensibilis, Typha latifolia*	free water at soil surface, soil saturation to surface, wetland drainage patterns		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
PARK_W392	Generator Lead		8993.35	984.53	12/12/2012	PFO/PSS	variable: 5-10" organics over depleted matrix or rock	*Abies balsamea, Acer rubrum, Betula populifolia, Betula alleghaniensis, Salix bebbiana, Onoclea sensibilis, Osmunda cinnamomea, Solidago rugosa, Typha latifolia*	areas of surface water (1"), free water at soil surface, soil saturation to surface, wetland drainage patterns		
PARK_W394	Generator Lead		535.89		12/12/2012	PSS	variable: 10" organics over depleted matrix or rock	*Abies balsamea, Salix bebbiana, Viburnum lantanoides, Glyceria striata, Solidago rugosa*	soil saturation to surface, wetland drainage patterns		
PARK_W395	Generator Lead	16	78309.34	15588.37	12/12/2012	PFO/PUB	variable: 16" organics over depleted matrix with 15% redox concentrations; 24"+ organics	*Thuja occidentalis, Abies balsamea, Betula alleghaniensis, Fraxinus pennsylvanica, Acer rubrum, Osmunda cinnamomea, Onoclea sensibilis, Glyceria striata*	free water at surface, soil saturation to surface		
PARK_W396	Generator Lead	16	53111.93	9917.68	12/12/2012	PFO	variable: 8-12" over rock; 16" organics over depleted matrix with 15% redox concentrations	*Thuja occidentalis, Acer rubrum, Betula alleghaniensis, Abies balsamea, Fraxinus nigra, Viburnum lantanoides, Osmunda cinnamomea, Onoclea sensibilis*	surface water in pits (1-2"), free water at soil surface, soil saturation to surface		S071
PARK_W397	Generator Lead		2361.13		12/11/2012	PSS	4-6" organics over depleted matrix with redox concentrations	*Betula populifolia, Abies balsamea, Onoclea sensibilis, Prunella vulgaris*	free water at surface, soil saturation to surface		
PARK_W398	Generator Lead		11726.09	1274.94	12/11/2012	PFO	variable: 6" organics over depleted matrix with 10% redox concentrations; 12" dark mineral horizon over depleted matrix	*Thuja occidentalis, Betula alleghaniensis, Fraxinus pennsylvanica, Abies balsamea, Acer rubrum, Calamagrostis canadensis, Onoclea sensibilis, Osmunda cinnamomea*	free water at surface, soil saturation to surface, wetland drainage patterns		
PARK_W399	Generator Lead	32	53515.04	10621.35	12/11/2012	PFO	8-10" organics over rock	*Abies balsamea, Populus tremuloides, Betula alleghaniensis, Fraxinus nigra, Acer rubrum, Calamagrostis canadensis, Onoclea sensibilis, Juncus effusus*	free water between 4" and ground surface, soil saturation to surface		
PARK_W401	Generator Lead		1042.46	204.34	12/11/2012	PSS	disturbed: 6" organics and dark mineral horizon over depleted matrix with 10% redox concentrations	*Acer rubrum, Spiraea alba, Betula populifolia, Betula alleghaniensis, Osmunda cinnamomea, Typha latifolia, Solidago rugosa, Juncus effusus*	areas of surface water (<1"), soil saturation to surface, wetland drainage patterns		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
ABB_W402	Generator Lead		19890.34	3609.80	12/11/2012	PFO	6-8" organics over depleted matrix with 15% redox concentrations	*Thuja occidentalis, Abies balsamea, Tsuga canadensis, Betula alleghaniensis, Acer rubrum, Fraxinus pennsylvanica, Osmunda cinnamomea, Onoclea sensibilis, Scirpus cyperinus*	surface water in pits (1-2"), free water at soil surface, soil saturation to surface, wetland drainage patterns		S073
ABB_W403	Generator Lead	16	51910.77	9896.80	12/11/2012	PFO	variable: 4-8" organics over rock; 5-7" organics over depleted matrix with 10% redox concentrations	*Thuja occidentalis, Betula alleghaniensis, Tsuga canadensis, Abies balsamea, Acer rubrum, Ilex verticillata, Osmunda cinnamomea, Onoclea sensibilis, Typha latifolia*	free water at surface, soil saturation to surface, wetland drainage patterns		S073
ABB_W404	Generator Lead		13104.49	2606.02	12/11/2012	PSS/PEM	variable: 18"+ organics; depleted matrix at surface; 10" dark mineral horizon over depleted matrix	*Acer rubrum, Betula alleghaniensis, Alnus incana, Larix laricina, Calamagrostis canadensis, Typha latifolia, Onoclea sensibilis, Equisetum sylvaticum*	areas of surface water (2-4"), free water at ground surface, soil saturation to surface, wetland drainage patterns		S074
PARK_W405	Generator Lead		11526.56	2371.09	12/11/2012; 2/7/2013	PFO	8" organics over depleted matrix or rock	*Betula alleghaniensis, Acer rubrum, Abies balsamea, Thuja occidentalis, Viburnum lantanoides, Rubus idaeus, Osmunda cinnamomea, Onoclea sensibilis, Scirpus cyperinus, Carex* sp.	surface water in pits (1-3"), free water at soil surface, soil saturation to surface		
PARK_W406	Generator Lead		22308.74	4025.31	12/11/2012	PFO	6-8" organics over depleted matrix with 5-10% redox concentrations	*Betula alleghaniensis, Acer rubrum, Abies balsamea, Thuja occidentalis, Alnus incana, Hamamelis virginiana, Osmunda cinnamomea, Onoclea sensibilis, Carex gynandra*	surface water in pits (1"), soil saturation to surface	VP_101SD_M	
PARK_W408	Generator Lead		11885.91	2171.85	11/8/2011, 12/11/2012	PFO	4-8" organics over rock or depleted matrix	*Populus tremuloides, Populus tremuloides, Acer rubrum, Abies balsamea, Betula alleghaniensis, Spiraea alba, Osmunda cinnamomea, Onoclea sensibilis, Calamagrostis canadensis*	surface water in pits (1"), free water at ground surface, soil saturation to surface		
PARK_W409	Generator Lead	16	53076.63	10386.72	11/7/2011, 12/10/2012	PFO	4-12" organics and dark mineral horizon over depleted matrix with 5% redox concentrations	*Thuja occidentalis, Abies balsamea, Acer rubrum, Fraxinus nigra, Fraxinus pennsylvanica, Onoclea sensibilis, Osmunda cinnamomea, Juncus effusus*	areas of surface water, soil saturation to surface		

Resource ID	Location	Permanent Fill (sq. ft.)	Wetland Conversion / Clearing (sq. ft.)	Temporary Fill	Survey Date	Type	Soil	Vegetation	Hydrology	Associated VP ID	Associated Stream ID
PARK_W410	Generator Lead	32	67407.59	14257.16	11/7/2011	PFO	disturbed: 4-8" organics and dark mineral horizon over depleted matrix with 5-10% redox concentrations	*Thuja occidentalis, Fraxinus pennsylvanica, Abies balsamea, Acer rubrum, Betula alleghaniensis, Alnus incana, Osmunda cinnamomea, Onoclea sensibilis, Calamagrostis canadensis, Juncus effusus*	areas of surface water, soil saturation to surface		
PARK_W411	Generator Lead	112	57119.48	10965.01	11/7/2011, 12/10/2012	PFO	3-5" organics over depleted matrix with 10% redox concentrations	*Larix laricina, Thuja occidentalis, Abies balsamea, Fraxinus pennsylvanica, Alnus incana, Onoclea sensibilis, Osmunda cinnamomea, Calamagrostis canadensis, Glyceria melicaria*	1-2" of surface water, soil saturation to surface, water stained leaves		
PARK_W412	Generator Lead	64	10449.30	1953.18	11/17/2011	PEM/PFO	variable: 18-20" organics; 5-6" organics to depleted matrix with 10-20% redox concentrations	*Thuja occidentalis, Abies balsamea, Acer rubrum, Larix laricina, Alnus incana, Spiraea alba, Calamagrostis canadensis, Typha latifolia, Glyceria striata*	1-3" surface in ruts and holes, soil saturation to surface		
ABB_W413	Generator Lead		10.54		3/13/2013	PFO	thick organics over depleted matrix with redox concentrations	*Fraxinus americana, Acer rubrum, Abies balsamea, Acer saccharum, Corylus cornuta*	soil saturation to surface		
	Total sq. ft. impact	58508.63	1496336.21	275446.62							
	Total acres impact	1.34	34.35	6.32							

Exhibit 7A: Wetland and Waterbody Delineation and Vernal Pool Report

Exhibit 7B: Wildlife Habitat Report

Wildlife Habitat Report

Bingham Wind Project
Bingham, Moscow, Mayfield Township, Kingsbury Plantation,
Abbot, and Parkman
Somerset and Piscataquis Counties, Maine

Prepared for:

Blue Sky West, LLC and Blue Sky West II, LLC

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April 2013

Stantec

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1.0 Introduction

Blue Sky West, LLC and Blue Sky West II, LLC (Applicants) have proposed construction of the Bingham Wind Project (project), a utility-scale wind energy facility with an installed generating capacity of up to 191 megawatts (MW). Turbines will be located along several ridgelines, which occur north and south of Route 16, in Mayfield Township, Kingsbury Plantation, Moscow, and Bingham, in Somerset and Piscataquis Counties, Maine (Figure 1). As currently proposed, the project includes approximately 62 turbines; associated access roads; up to 5 permanent meteorological (met) towers; an Operations and Maintenance (O&M) building; electrical collector system; an electrical substation; and an approximately 17-mile generator lead extending easterly to an existing Central Maine Power Company (CMP) substation in Parkman. It is anticipated that a dynamic reactive device such as a synchronous condenser will be required at the project collector substation to meet the interconnection requirements of ISO NE and CMP. Turbines will have a maximum height of 151.5 meters (m; 497 feet [ft]), and permanent met towers will be 104-meters (341 ft). In addition, up to 5 104-m temporary met towers may be installed at or near turbine locations before turbines are erected; however these temporary towers will be removed prior to the completion of construction. For a more detailed project description, please refer to Section 1 of this application.

The proposed project has the potential to affect wildlife species. The ridgeline portion of the project area falls entirely within lands actively managed for timber production, with forested habitats that are periodically harvested and a landscape that is crossed by an extensive network of logging roads. The proposed project will involve additional clearing of land for various project components and will result in temporary and permanent changes to habitat. Direct and indirect impacts to wildlife have the potential to occur during clearing, construction, and operation of the project. These direct and indirect impacts include injury, mortality, displacement, disturbance, or habitat loss. Direct impacts to birds and bats also could result from collisions with the project turbines during operation. To assess these potential impacts, detailed ecological surveys to identify available habitats and existing wildlife use of the project area were conducted.

In the course of project development, Stantec Consulting (Stantec) conducted a variety of ecological surveys in the project area. These pre-construction surveys provided data to help assess the project's potential to impact birds and bats; rare, threatened and endangered (RTE) plants and animals; breeding amphibians; and wetlands. The scope of the surveys was based on evolving standard pre-construction survey methods within the wind power industry (i.e., guidelines outlined by the U.S. Fish and Wildlife Service [USFWS] and Maine Department of Inland Fisheries and Wildlife [MDIFW]) and is consistent with other studies conducted recently within the State of Maine and the Northeast. Through consultation with the USFWS and the MDIFW, Stantec developed the scope and methodology for the bird and bat surveys that were conducted. At a March 5, 2010, meeting, the scope and methodology for these surveys were discussed and approved by the attending agency representatives. In addition, representatives from MDIFW and USFWS toured the project site on several occasions with the Applicants to discuss these studies and the corresponding results. The scope of work and methodology for species under federal jurisdiction, including Canada lynx (*Lynx canadensis*) and bald eagle (*Haliaeetus leucocephalus*), were developed and approved in coordination with the USFWS. Details regarding correspondence from the various natural resource review agencies, including Maine Department of Conservation Maine Natural Areas Program (MNAP; Section 9), MDFIW; USFWS; and Maine Department of Environmental Protection (MDEP) can be found in Section 7, Appendix A of this application.

Stantec conducted the following ecological field surveys between 2009 and 2013:

- Aerial Bald Eagle Nest Surveys (Fall 2009, Spring 2010, and Spring 2011);[1]
- Nocturnal Radar Migration Surveys (Spring 2010, Fall 2010, and Fall 2011);
- Acoustic Bat Surveys (Spring, Summer, and Fall 2010);
- Diurnal Raptor Migration Surveys (Spring and Fall 2010);

[1] Spring 2012 aerial nest surveys surrounding the project area were conducted by others, and these survey results were provided by MDIFW.

- Breeding Bird Survey (Spring 2010);
- Canada Lynx (*Lynx canadensis*) Habitat Assessment (Winter 2011 and 2013), Winter Tracking, and Camera Surveys (Winter 2011);
- Wetland Delineations (2010, 2011, 2012, 2013);
- Vernal Pool Surveys (2010, 2011, and 2012);
- Northern Spring Salamander (*Gyrinophilus porphyriticus*) Surveys (Fall 2010 and Summer/Fall 2011);
- Northern Bog Lemming (*Synaptomys borealis*) Surveys (Fall 2010 and Summer/Fall 2011);
- Roaring Brook Mayfly (*Epeorus frisoni*) Surveys (Fall 2010 and Summer/Fall 2011); and
- Deer Wintering Area (DWA) Surveys (Winter 2013).

In addition to conducting field surveys, Stantec reviewed public information about the existing natural communities in the project area. Information used to characterize the existing wildlife communities and their habitats included consultation with state agencies and review of available wildlife habitat databases and published natural resource classifications, including the Database of Essential Habitats and Sensitive Natural Areas, as categorized by MDIFW (http://megisims.state.me.us); Land Use Planning Commission (LUPC) Land Use Maps (http://www.maine.gov/doc/lupc/); and Natural Landscapes of Maine – A Guide to Natural Communities and Ecosystems (Gawler and Cutko 2010).

The following sections describe the dominant cover types found in the project area, the wildlife species that occur or are likely to occur within the project area based on the cover types present, and the potential for adverse impacts to wildlife and measures to minimize these impacts. Similar discussion for wetland resources and unusual natural areas can be found in application Exhibits 7A and 9A, respectively.

2.0 Ecological Setting of the Project Area

The project is located in the Central Mountains and Western Foothills biophysical regions (McMahon 1998). The ridgelines and hills in Mayfield Township, Kingsbury Plantation and Bingham fall within the Central Mountains Region or straddle the boundary between the Central Mountains and Western Foothills regions. The proposed generator lead crosses through the Western Foothills biophysical region. Although the Central Mountains Region includes some of the highest peaks in Maine, the physiography of the project area more closely represents that described for the Western Foothills Region. The Western Foothills Region is characterized by hilly terrain with elevations that average between 600 and 1,000 feet. The western boundary of this region generally marks the transition from temperate forest to boreal forest species.

The ridgeline portion of the project area includes several low-elevation ridgelines and hills (i.e., below 1,800 feet in elevation) located north and south of Route 16, including Johnson Mountain; unnamed hills north and northeast of Johnson Mountain; and an unnamed ridge north of Route 16 (Figure 1). The highest point on Johnson Mountain is approximately 455 m (1,500 ft), and the highest elevation within the project area north of Route 16 is approximately 538 m (1,775 ft). These ridgelines occur within a landscape managed exclusively for commercial timber products. A network of unpaved logging roads occurs throughout this portion of the project area. Stonewalls, foundations, and small family cemeteries, including the Adams and Clark cemeteries, are evidence of former homesteads and agricultural use of the area. Much of the evidence of these former homesteads is located in Kingsbury Plantation north of Kingsbury Pond, surrounding Old Mountain Road. Evidence of a commercial slate mining operation is present north of Route 16 along the west side of Bigelow Brook. The generator lead corridor crosses through an area of generally lower elevation; dropping to approximately 750 feet in elevation in southeastern Kingsbury Plantation to an elevation typically less than 600 feet across the remainder of the corridor. The current landscape is primarily forested with small areas of agriculture and sparse residential development.

3.0 Existing Cover Types and Wildlife Communities

Dominant land cover types dictate the wildlife communities in the project area. Climate conditions, geology, and past land use (i.e., forest harvesting are the most significant factors affecting the type and structure of the available habitats.

The project layout was designed to utilize existing roadways where possible and to avoid and minimize impacts to wetlands. Following are descriptions of the cover types and wildlife species that occur in the project area.

3.1. Forest Cover Types

Forests present within the project area include second and third-growth mixed native forests, early successional and regenerating forest stands, and plantations of both native and exotic tree species, including red pine (*Pinus resinosa*), Jack pine (*Pinus banksiana*), red spruce (*Picea rubens*), and hybrid larch trees (*Larix* spp.). Several recent timber management cuts that exceed 30 acres in size are scattered throughout the ridgeline area. The project area is dominated by Beech-Birch-Maple Forest and Spruce-Northern Hardwoods Forest (Gawler and Cutko 2010) types in various stages of regeneration following timber harvesting. Dominant trees present in these forested uplands include yellow birch (*Betula alleghenensis*), red spruce, American beech (*Fagus grandifolia*), and sugar maple (*Acer saccahrum*) with balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), and striped maple (*Acer pennsylvanicum*) also present. The understory ranges from sparse to densely vegetated depending upon the successional stage of the area. Species present in the sapling and shrub layer include those tree species listed above, as well as beaked hazelnut (*Corylus cornuta*), hobblebush (*Viburnum lantanoides*) and northern mountain-ash (*Sorbus decora*). Canadian bunchberry (*Cornus canadensis*), hay-scented fern (*Dennstaedtia punctilobula*), wild sarsaparilla (*Aralia nudicaulis*), and evergreen wood fern (*Dryopteris intermedia*) dominate the herbaceous layer with bracken fern (*Pteridium aquilinum*), yellow bluebead-lily (*Clintonia borealis*), maystar (*Trientalis borealis*), painted wakerobin (*Trillium undulatum*), sessile-leaf bellwort (*Uvularia sessilifolia*), red raspberry (*Rubus idaeus ssp. idaeus*), and seedlings of tree species also present.

3.2. Wetlands

Wetlands in the project area were identified and delineated between 2010 and 2013. The complete report is included as Exhibit 7A. Forested, scrub-shrub, and emergent wetlands, as well as small to moderate-sized perennial and intermittent streams, are located throughout the ridgeline areas and along the generator lead corridor. Wetlands that occur on the ridgelines and hills are located primarily in topographic low points and drainages. Larger wetlands occur in areas of relatively moderate topography such as occurs between the northern end of Johnson Mountain and Route 16, and along the eastern portion of the generator lead. The generator lead corridor, which occurs at generally lower elevation than the ridgeline areas, includes a few larger perennial streams such as Kingsbury Stream and Gales Brook.

Forested wetlands are the most common wetland type, found throughout the ridgeline portion of the project area and along the generator lead. The canopy of these forested wetlands is dominated by red spruce, green ash (*Fraxinus pennsylvanica*), yellow birch, and northern white cedar (*Thuja occidentalis*) with a smaller component of balsam fir, black ash (*Fraxinus nigra*), and red maple (*Acer rubrum*). Several of the forested wetlands along the eastern portion of the generator lead corridor are dominated by northern white cedar and are characterized by relatively dense canopies and open understories.

Scrub-shrub wetlands are common throughout the project area, although not as prevalent as forested wetland communities. Scrub-shrub communities, particularly on the ridgelines, are previously forested wetlands that were altered by timber harvesting activities. Naturally occurring scrub-shrub communities are more generally found in association with the larger watercourses along the Route 16 collector line corridor and the generator lead corridor. The scrub-shrub wetlands that represent early successional forested wetlands are typically dominated by shrub and sapling sized tree species. Speckled alder is often dominant or co-dominant with the tree species, and other shrub species such as long-beaked willow (*Salix bebbiana*), pussy willow (*Salix discolor*), and white meadowsweet (*Spiraea alba)* also are present.

Emergent wetlands are common throughout the project area and often occur in previously forested areas that recently have been altered by timber harvesting activities. These types of emergent wetlands are typically referred to as wet meadows. These wetlands are dominated by herbaceous vegetation such as fowl manna grass (*Glyceria striata*), northeastern manna grass (*Glyceria melicaria*), Canada reed grass (*Calamagrostis canadensis*), nodding sedge (*Carex gynandra*), common woolsedge (*Scirpus cyperinus*), barber-pole bulrush (*Scirpus microcarpus*), cinnamon fern (*Osmunda cinamomea*), interrupted fern (*Osmunda claytoniana*), soft rush (*Juncus effuses*), spotted touch-me-not (*Impatiens capensis*), and common wrinkle-leaved goldenrod (*Solidago rugosa*). Naturally occurring emergent wetland communities are limited within the project area. Dominant vegetation within these naturally occurring emergent communities is similar to that found in the wet meadows.

Open water wetland communities within the project area are limited to two locations along the generator lead. These open water communities are part of larger wetland complexes that include forested components, as well as other wetland types located beyond the project limits.

3.3. Streams

Stantec identified 67 MDEP-jurisdictional streams within the project area. Twenty-nine streams within the project area are mapped by the U.S. Geological Survey (USGS), and seven of these are named, including Bigelow Brook within the ridgeline area, and Bottle Brook, Bear Brook, Cook Brook, Kingsbury Stream, Carlton Stream, and Gales Stream along the generator lead. Several of these streams in Mayfield Township and Kingsbury Plantation, including Bigelow Brook and Bottle Brook, also are identified by MDIFW as valuable fisheries habitat for species, including populations of wild brook trout (*Salvelinus fontinalis*). See Exhibit 7A, Appendix C, Table C-2 for a description of streams in the project area.

4.0 Wildlife Species

Following are brief descriptions of the predominant wildlife species known or suspected to occur in the project area. The information presented here was derived from extensive ecological field surveys conducted in the project area between 2009 and 2013.

Appendix A identifies the wildlife species observed within the project area, including those documented during targeted species-specific surveys or those observed incidentally during field surveys, or those expected to occur at the project based on their known range and habitat preferences. This matrix also identifies the general habitat categories each species would commonly use, and the expected season(s) of use (e.g., breeding, wintering).

4.1. Birds

<u>Breeding Birds</u>
Birds comprise one of the most abundant and diverse wildlife communities in the region, and the project area provides habitat for a variety of species. During spring 2010 breeding bird surveys, 50 species of birds, including those documented as incidental observations, were identified within the project area. Species with the greatest numbers of individuals detected during the spring 2010 surveys were white-throated sparrow (*Zonotrichia albicollis*), ovenbird (*Seiurus aurocapillus*), chestnut-sided warbler (*Dendroica pensylvanica*), and Nashville warbler (*Vermivora ruficapilla*). Of the 50 species documented during these surveys, 9 are listed in Maine as Special Concern. These are the least flycatcher (*Empidonax minimus*), eastern wood-pewee (*Contopus virens*), veery (*Catharus fuscescens*), American redstart (*Setophaga ruticilla*), black-and-white warbler (*Mniotilta varia*), Canada warbler (*Wilsonia canadensis*), chestnut-sided warbler, yellow-warbler (*Dendroica petechia*), and white-throated sparrow. For a complete description of the breeding bird surveys, refer to Exhibit 7D. Appendix A identifies those

bird species observed within the project area, as well as other species expected to occur based upon the available habitat and known species range.

Stantec conducted aerial nest surveys for bald eagles, osprey (*Pandion haliaetus*) and heron (*Ardea herodias*) rookeries in fall 2009, spring 2010 and spring 2011. Spring 2012 aerial nest surveys surrounding the project area were conducted by others and the results of these surveys were provided by MDIFW. Spring 2012 surveys identified an active bald eagle nest approximately 4.95 miles from the nearest proposed turbine location. This nest location was not active in 2010 and 2011; however, an alternate nest location for this pair of eagles, in close proximity to this nest, was active in 2011. No osprey nest sites or great blue heron rookery sites were identified in the search areas. For a complete description of these nest surveys, refer to Exhibit 7C-3.

Migratory Birds

Stantec conducted nocturnal radar migration surveys in spring 2010, fall 2010, and fall 2011 (Table 1). Flight heights (i.e., flight altitude above the radar location) were consistent with the results of other pre-construction surveys conducted at other locations in Maine. Although passage rates in fall 2010 and fall 2011 were at the high end of the range of other pre-construction surveys conducted in Maine and in the Northeast, the percent of targets below turbine height was within the range of fall survey results from these other projects (1% at multiple projects to 40% at a project in Hillsborough, New Hampshire). Comparative results are discussed further in Section 5.2.2 of this report. For a complete description and discussion of these surveys, refer to Exhibit 7D.

Table 1: Nocturnal radar migration survey summary. Spring 2010, Fall 2010 and Fall 2011.[2]

Season	Mean Passage Rate (targets per kilometer per hour)	Mean Flight Height (m)	Percent of Targets Below Turbine Height (152 m)	Flight Direction
Spring 2010	543 ± 30	355 ± 1	21	43° ± 51°
Fall 2010	803 ± 46	378 ± 1	20	234° ± 62°
Fall 2011	952 ± 63	397 ± 1	16	244° ± 50°

Stantec conducted raptor migration surveys from 2 locations in the project area (Kingsbury Ridge and Johnson Mountain) in spring and fall 2010. A total of 11 species of raptor were documented in the vicinity of the project area during raptor migration surveys; some of these species could potentially breed in the project area. Species observed during the surveys include American kestrel (*Falco sparverius*), bald eagle, broad-winged hawk (*Buteo platypterus*), Cooper's hawk (*Accipiter cooperii*), merlin (*Falco columbarius*), northern harrier (*Circus cyaneus*), osprey, peregrine falcon (*Falco peregrinus*) red-tailed hawk (*Buteo jamaicensis*), sharp-shinned hawk (*Accipiter striatus*), and turkey vulture (*Cathartes aura*). The use of the project area by state species of Special Concern (northern harrier and bald eagle) is anticipated to be largely during migration, and therefore infrequent and for short durations. For a complete description of these surveys, refer to Exhibit 7D.

[2] At the time of radar data analysis, the proposed turbine height was 152 meters. Given that the turbine height has decreased and as currently proposed is 150 meters, the percent below turbine height was not re-calculated for the reduced turbine height; it is expected that the percent below turbine height will decrease.

4.2. Mammals

Large mammals incidentally observed in the project area during project surveys include white-tailed deer (*Odocoileus virginianus*), moose (*Alces alces*), black bear (*Ursus americanus*), coyote (*Canis latrans*), and American marten (*Martes americana*). In addition, bobcat (*Lynx rufus*), fisher (*Martes pennanti*), and red fox (*Vulpes vulpes*) were documented during a winter camera survey. Canada lynx tracks were observed approximately 1.4 miles west of the project area during winter tracking surveys. For additional details related to this Canada lynx observation, refer to Section 4.4.7 of this report.

Medium-sized mammals incidentally observed within the project area include porcupine (*Erethizon dorsatum*), snowshoe hare (*Lepus americanus*), beaver (*Castor canadensis*), and river otter (*Lontra canadensis*). Small mammals incidentally within the project area include eastern chipmunk (*Tamias striatus*) and red squirrel (*Tamiasciurus hudsonicus*). The small mammal community also likely includes masked shrew (*Sorex cinereus*), pygmy shrew (*Sorex hoyi*), northern short-tailed shrew (*Blarina brevicauda*), deer mouse (*Peromyscus maniculatus*), and southern red-backed vole (*Clethrionomys gapperi*). Stantec conducted targeted surveys within the project area for bog lemming (*Synaptomys borealis*), a state-listed Threatened species. Based upon these surveys, bog lemming activity was documented in one wetland within the project area (See Section 4.4.4).

Eight species of bat also could occur in the area based upon their normal geographical range. These include the little brown myotis (*Myotis lucifugus*), northern long-eared myotis (*Myotis septentrionalis*), eastern small-footed bat (*Myotis lebeiii*), silver-haired bat (*Lasionycteris noctivagans*), big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and tri-colored bat (*Perimyotis subflavus*).[3]

Stantec conducted acoustic surveys in spring-summer 2010 and fall 2010 to characterize bat activity in the project area. Eight bat detectors deployed in the three on-site met towers (Bessey, Crockett and Johnson met towers) and in two tree locations recorded calls of migrating or foraging bats in the vicinity of the project area. Of the calls that were identified to species guild, bats of the Genus *Myotis* were the most abundant bats documented during both the 2010 surveys. Other bat species/guilds that were documented include big brown /silver haired bat, hoary bat, and eastern red bat/tri-colored bat guilds. For a complete description of these surveys, refer to Exhibit 7D.

4.3. Amphibians and Reptiles

Amphibians and reptiles observed in the project area include spotted salamander (*Ambystoma maculatum*), dusky salamander (*Desmognathus fuscus*), northern two-lined salamander (*Eurycea wilderae*), northern spring salamander (a Special Concern species), northern redback salamander (*Plethodon cinereus*), wood frog (*Lithobates sylvatica*), bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans*), gray treefrog (*Hyla versicolor*), eastern garter snake (*Thamnophis sirtalis*), and northern redbelly snake (*Storeria occipitomaculata*). Other common species likely to occur in the project area include American toad (*Bufo americanus*) and northern redback salamander (*Plethodon cinereus*). For a list of amphibian/reptile species observed in the project area during field surveys, refer to Appendix A.

4.4. Significant Wildlife Habitat

As defined by the Maine Natural Resource Protection Act (NRPA; M.R.S.A. 38 §480-B), Significant Wildlife Habitat includes the following resources as mapped by MDIFW or located within any other protected natural resource:

- Habitat for species appearing on the official state or federal list of endangered or threatened animal species;
- High and moderate value DWAs and travel corridors;
- Seabird nesting islands;

[3] Formerly known as the eastern pipistrelle (*Pipistrellus subflavus*).

- Critical spawning and nursery areas for Atlantic salmon (*Salmo salar*) as defined by the Department of Marine Resources;
- Significant Vernal Pool (SVP) habitat;
- High and moderate value inland waterfowl and wading bird habitat (IWWH), including nesting and feeding areas; and
- Shorebird nesting, feeding and staging areas.

The following identifies Significant Wildlife Habitats known or expected to occur within the project area. Also addressed are known or expected occurrences of species listed in the state of Maine as species of Special Concern that are not addressed elsewhere in this report.

4.4.1. Deer Wintering Areas and Inland Waterfowl and Wading Bird Habitat

Two DWAs identified to the northwest and southeast of Johnson Mountain in Bingham are located outside of the current project area, and will not be impacted by the proposed project. Two IWWHs occur within the ridgeline portion of the project area, and will not be impacted by the proposed project. One IWWH occurs in association with Withee Pond (UMO-10985) in Mayfield Township and the other occurs north of Route 16 near the electrical collector along Rift Brook (UMO-10813) in Mayfield Township.

Several Significant Wildlife Habitats, including four DWAs and one IWWH, occur along the generator lead. One DWA (#080604) located in Kingsbury Plantation will be crossed by the generator lead. DWA #084029 is located in Parkman along Carlton Stream. DWA #084031 extends from Route 15 in Abbot southeast to Crow Hill Road in Parkman. This DWA also includes a mapped IWWH (IWWH #203972) that straddles the Parkman/Abbot town line. The generator lead will cross DWA #084031 approximately 650 feet south of the Parkman/Abbot town line. DWA #084033 extends from the Parkman/Abbot and Parkman/Guilford town lines south to Harlow Pond and Manhanock Pond. The generator lead will cross east through the mapped habitat before turning southeast to the CMP substation. Refer to Exhibit 7C-4 for detailed survey results and maps.

4.4.2. Significant Vernal Pool Habitat

Stantec conducted vernal pool surveys in April and May 2010, which included the majority of the ridgeline portion of the project area. In May 2011, Stantec conducted vernal pool surveys along the generator lead extending from an unnamed ridgeline in Kingsbury Plantation east and southeast to the CMP substation in Parkman. An approximately four-mile long aboveground collector corridor located along the north side of Route 16 in Mayfield Township was added to the project in the fall of 2012. Much of this corridor was located outside of the 2010 vernal pool surveys limits. Wetlands within this aboveground collector corridor were delineated in the fall of 2012, and potential vernal pools (PVPs) were identified during the course of these delineations.

The purpose of the surveys conducted in 2010 and 2011 was to evaluate PVPs within the defined project area. The data collected during the surveys were used to determine if the pools met the criteria of an SVP as defined in Chapter 335 Section 9 of the NRPA.

Stantec identified 58 vernal pools within the project area. Thirteen of these vernal pools were determined to be naturally-occurring. The remaining 45 pools, which are located in all-terrain vehicle trails, borrow pits along gravel logging roads, or ruts made by logging equipment like skidders, were characterized as man-made. Each vernal pool identified is located within a jurisdictional wetland. Of the natural vernal pools identified, four were determined to be SVPs as defined by the NRPA. For a complete description of vernal pool surveys, refer to Exhibit 7A.

4.4.3. Northern Spring Salamander

In Maine, the northern spring salamander is listed as a species of Special Concern. Using information collected during project area delineations, a subset of the streams documented during wetland delineation efforts as exhibiting suitable habitat characteristics was selected to survey for this species. Based on Stantec's past experience with this species, northern spring salamanders prefer well-oxygenated perennial streams with a moderate to swift gradient, a rock-cobble-gravel-dominated substrate with low to moderate embeddedness of larger substrate materials, and a source generally above 800 feet in elevation. Stantec conducted surveys for this species on September 27-29, 2010, and September 12-15, 2011. Survey efforts involved turning over rocks and logs of various sizes within and adjacent to the stream, targeting habitat areas for both adults and larvae throughout the section of the stream located within and immediately adjacent to (i.e., within 250 feet of) the project area limits. Once a northern spring salamander was documented within a stream reach, survey efforts in that reach were considered complete.

During the 2010 surveys, no northern spring salamanders were documented within project area streams. During the 2011 surveys, northern spring salamanders were documented in one stream within the ridgeline portion of the project area. One additional stream within the ridgeline area had habitat characteristics very similar to known locations of northern spring salamanders. Although Stantec did not document northern spring salamanders within this stream, there is a high likelihood that they are present based on the habitat characteristics of the stream and are therefore assumed to be present.

The current location of the Route 16 section of the collector line and the location of the generator lead were not selected until after the completion of these surveys. Stantec ecologists reviewed subsequently collected wetland and stream delineation data and conducted a general landscape analysis to identify potentially suitable habitat within these corridors. Twenty-three streams were identified as containing potential habitat for the northern spring salamander. For a complete description of this survey, refer to Exhibit 7C-1.

4.4.4. Northern Bog Lemming

In Maine, the northern bog lemming is listed as Threatened. Stantec conducted surveys for northern bog lemming activity in late summer 2010 and 2011 to coincide with the anticipated peak seasonal activity. Two Stantec ecologists conducted meander surveys within potentially suitable habitats to locate and document evidence of bog lemming activity such as runways and tunnels through the peat moss (*Sphagnum* spp.), browse and clippings on graminoid vegetation, and fecal pellets. Because the northern bog lemming and southern bog lemming (*Synaptomys cooperi*) can only be definitively separated based upon enamel patterns on their lower teeth or through genetic analysis, any bog lemming activity was treated as if it indicated the presence of northern bog lemming. Stantec did not conduct trapping; therefore, it was not possible to determine if the observed activity was northern bog lemming or southern bog lemming. The field surveys were conducted on September 28-29, 2010 and September 14, 2011. During the 2010 surveys, bog lemming activity was identified in one wetland within the project area, as evidenced by well-defined runways and tunnels through peat moss and sedges, browsed and clipped three-seeded sedge (*Carex trisperma*) stems, and bright green fecal pellets. Based upon overlapping ranges of the southern and northern bog lemmings at this location and the relatively low elevation of the wetland where the bog lemming activity was observed (1,370 ft), it is possible that the observed activity could be attributed to the southern bog lemming. During the 2011 surveys, bog lemming activity was not observed in the surveyed wetlands within the project area. For a complete description of the bog lemming surveys, refer to Exhibit 7C-1.

4.4.5. Roaring Brook Mayfly

Stantec conducted field surveys for the Roaring Brook mayfly on September 13, 2011. Field surveys were conducted in accordance with the *DRAFT Recommended Survey Protocol for the Roaring Brook Mayfly* (Siebenmann and Swartz, September 16, 2010 and Siebenmann and Swartz, May 25, 2011), developed by MDIFW. Field surveys were conducted during the late summer to maximize the likelihood of obtaining final instar (i.e., pre-emergent) larvae of *Epeorus* species. During the 2010 surveys, no streams within the current project area were identified as containing potentially suitable habitat for Roaring Brook mayfly. During the 2011 surveys, one stream within the project area was identified as containing potentially suitable habitat for Roaring Brook mayfly. No *Epeorus* or dorsally-compressed mayfly species were collected in samples from this stream, indicating that the stream likely lacks sufficient sustained high energy flow. For a complete description of these surveys, refer to Exhibit 7C-1.

4.4.6. Bald Eagle

The bald eagle is listed as a species of Special Concern in Maine. Stantec conducted aerial nest surveys in the fall 2009, spring 2010 and spring 2011. Biologists from MDIFW conducted aerial nest surveys surrounding the project area in spring 2012. Based on the results of these surveys, there are no bald eagle nest locations within four miles of the proposed turbines. During the 2011 surveys, 3 active bald eagle nests were identified within 10 miles of the project area. In 2012, the closest active nest to the proposed turbine locations was nest 509B/C at approximately 4.95 miles. From the three years of spring surveys, this was the nearest active nest to the proposed project. For a complete discussion of the bald eagle surveys results, refer to Exhibit 7C-3.

4.4.7. Canada Lynx

Canada lynx is federally-listed as a Threatened species. Canada lynx were historically documented in Somerset County, and the project area occurs within approximately 25 miles of the southern limits of the species' designated critical habitat. Based upon this information, Stantec conducted an assessment of potential habitat, winter track surveys, and remote camera surveys, to assess the potential occurrence of Canada lynx within the vicinity of the project area. The habitat assessment and field surveys were conducted during the 2010-2011 winter season and included a one-mile buffer around the proposed turbine strings, as well as the remainder of Mayfield Township. In 2013, a second assessment of potential habitat was completed using more recent aerial photographs that more closely reflect current landscape conditions.

Because snowshoe hare (*Lepus americanus*) is the preferred prey species for Canada lynx, Stantec reviewed aerial photographs (i.e., conducted a desktop landscape analysis) to identity and qualify potential snowshoe hare habitat in the vicinity of the project area. The 2013 desktop analysis of 1-mile turbine buffer using 2011 aerial photography revealed 29 polygons (1,439 acres) of potential high value hare habitat, 97 polygons (2,145 acres) of moderate value hare habitat, and 69 polygons (1,572 acres) of future hare habitat (i.e., regenerating forest stands). Within the portions of Mayfield Township outside the 1-mile buffer and within the generator lead corridor, another 4,433 acres of habitat were identified. These include 41 polygons (1,779 acres) of potential high value hare habitat, 56 polygons (1,960 acres) of moderate value hare habitat, and 33 polygons (694 acres) of future hare habitat.

Stantec conducted Canada lynx snow track surveys at the project area and in the surrounding forest on three separate occasions on December 9 and 10, 2010, January 31, 2011, and March 23, 2011. A single Canada lynx track was observed on March 23, 2011. The observed track crossed a logging road in the northeastern corner of Mayfield Township where the cat had apparently emerged from Kingsley Bog, crossed the road, and continued northeast. The track location was in an area mapped by Stantec's 2011 desktop analysis as potentially moderate value habitat, approximately 1.4 to 1.7 miles from the nearest components of the proposed project. A scat sample was collected for DNA analysis and sent to U.S Department of Agriculture (USDA) Forest Service Rocky Mountain Research Station, Wildlife Genetics Lab for species determination, which found that the sample was from a male Canada lynx. Because only a single track was observed during the breeding season for this species, it is believed that the observation documented a transient male and that the surveyed area does not currently support a breeding population of Canada lynx.

In addition to the habitat analysis and tracking survey, Stantec conducted remote camera surveys to document the presence or the absence of Canada lynx. Stantec deployed 5 cameras on December 9, 2010, which remained in the field through March 23, 2011. No Canada lynx were detected with this camera survey. For a complete description of the lynx habitat assessment and results, refer to Exhibit 7C-2.

4.4.8. Atlantic Salmon

The Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon is federally-listed as Endangered. Much of the project area occurs within the Piscataquis River watershed (HUC 0102000401), which is designated as critical habitat for this species. No targeted post-construction fisheries surveys were conducted within the project area, although watercourses were mapped as part of wetland delineations. Approximately half of the turbines and the entire electrical generator lead corridor occur within this designated critical habitat. Several of the streams in Mayfield Township and Kingsbury Plantation including Bigelow Brook and Bottle Brook also are identified by MDIFW as valuable fisheries habitat for species including populations of wild brook trout (*Salvelinus fontinalis*). For a description of the streams within the project area, refer to Exhibit 7A, Appendix C.

5.0 Potential Project Impacts to Habitat and Wildlife

The construction and operation of wind turbines at the project will result in direct and indirect impacts to local wildlife communities and their habitats. In general, impacts could include habitat conversion, as well as collision-related fatalities. The following discusses the potential project impacts that could affect the natural resources and wildlife groups, based on the findings of on-site field surveys.

5.1. Habitat Conversion

The project was designed to avoid wetlands to the greatest extent possible, and the proposed turbines and associated access roads will be located principally within previously disturbed upland forests. Where possible, existing access roads will be used to provide construction and operational access to the project. The project also will take advantage of existing clearings where possible for turbine locations and construction laydown areas. The project will include the direct loss of some forested uplands and wetlands, and the conversion of some forested habitats to earlier-successional habitats.

The development of the project will require the construction of turbine structures, new roads, and an electrical collector system. Each wind turbine will be located in an opening that will be graded relatively flat and, after construction, all but approximately 0.35 acres will be allowed to revegetate to herbaceous and shrub covers. The road system needed to construct the project requires that roads have a travel surface of 35 feet wide on the ridgeline for the passage of the crane needed to erect the turbines. All other roads will have a travel surface of up to 24 feet wide.

For local wildlife, the direct loss of habitat will occur from the conversion of vegetated habitats to permanent roads and turbine clearings. Potential indirect effects also may include disturbance during and following construction of the project. This could result in short-term avoidance of the area by some individual animals or species, or possible longer-term avoidance by some species. In contrast, some species may target the converted early successional habitat for use. These changes will affect local wildlife use, but in part because current wildlife populations have historically adapted to rapid habitat changes associated with timber management activities, the habitat conversion associated with the project is not expected to adversely affect local wildlife populations.

Specific impacts to identified wildlife habitats will include:

- **SVP_07AL_N significant vernal pool habitat**: Impacts associated with construction of a project access road and an aboveground portion of the collector line combined with existing clearing will result in total clearing of the SVP habitat of approximately 24.3 percent.
- **SVP_50KN_and SVP_108SK_N significant vernal pool habitat**: Clearing for the aboveground portion of the collector line combined with existing clearing will result in total clearing of the SVP habitat of approximately 23.97 percent.
- **SVP_53KN_N significant vernal pool habitat**: Clearing for the generator lead line combined with existing clearing will result in total clearing of the SVP habitat of approximately 24.94 percent.
- **Northern spring salamander stream buffers**: No direct in-stream work is proposed within the project area; however, clearing within the vegetated buffer of 24 streams with suitable northern spring salamander habitat will occur for one access road, for the aboveground portion of the electrical collector line and for the electrical generator lead corridor.
- **Northern bog lemming habitat buffer**: The proposed project will not directly impact the one habitat where bog lemming activity was observed, but a portion of the aboveground electrical collector line will be located approximately 600 feet to the south. Clearing at this location will occur at a slightly lower elevation than the habitat where bog lemming activity was observed and is not expected to impact the hydrology of this habitat. Blasting will be required but would be limited to small local charges for pole placement.
- **Atlantic salmon stream buffers:** No direct in-stream work is proposed within the project area; however, clearing within the vegetated stream buffers of 28 perennial streams will occur.

Impacts within mapped DWA and/or the 250-foot habitat zone associated with mapped IWWH are summarized in Table 2.

Table 2. Summary of Impacts within Mapped DWA and/or the 250-foot Habitat Zone Associated with Mapped IWWH.

Habitat ID	MDIFW Rating	Town or Township	Habitat Impact	Approximate Area of Clearing (acres)	Approximate Fill Associated with Generator Lead Access Roads (acres)	Comments
IWWH #10985	Moderate	Mayfield Township	No impact	0	0	IWWH associated with Withee Pond. Total IWWH area 65 acres
IWWH #10813	Moderate	Mayfield Township	Principally forested upland	0	0	IWWH associated with Rift Brook. Total IWWH area 55 acres
DWA #080604	Not available	Kingsbury Plantation	Principally forested uplands	0.93	0	Total DWA area 166 acres
DWA #084029	Not available	Parkman	Forested uplands and forested wetlands	1.26	0.12	Associated with Carlton Stream Total DWA area 21 acres
DWA #084031	Not available	Parkman	Forested uplands and forested wetlands	6.5	0.52	DWA extends from Route 15 in Abbot southeast to Crow Hill Road in Parkman. Total DWA area 445 acres
IWWH #203972	Moderate	Parkman	See DWA #084031	See DWA #084031	0	Occurs within DWA #084031. Total IWWH area 81 acres
DWA #084033	Not available	Parkman	Principally forested wetlands and forested uplands	12.84	0.14	DWA extends from the Parkman/Abbot and Parkman/Guilford town lines south to Harlow and Manhanock ponds. Total DWA area 510 acres

To the extent practicable, clearing within DWA and IWWH habitats and habitat buffers will be minimized. Section 10 of this permit application discusses the eight basic types of buffers proposed for the project and the clearing and maintenance practices that will be implemented to maintain each type of buffer.

5.2. Collision Risk

It is known that birds and bats collide with tall structures, such as buildings, communications towers and wind turbines. Because wind turbines are large, have moving parts and extend above the surrounding landscape, the potential exists for wildlife collisions to occur. However, mortality surveys conducted at operational wind projects in the U.S. have found that collision risk is generally low when compared to other sources of bird mortality and to mortality from other energy sources (i.e., fossil fuels and nuclear power). Further, a recent summary of avian mortality at communication towers suggests that, for 177 bird species for which collision and population trend data is available, there is no correlation between collision vulnerability and annual rate of population change indicating that this source of mortality has no observable effect on these populations (Arnold and Zink 2011). In fact, many of the species involved in collisions with manmade structures have increasing population trends (Arnold and Zink 2011), suggesting that collisions involve regionally abundant species. Table 3 provides a summary of estimates of known sources of bird mortality.

Table 3. Summary of Nation-Wide Bird Mortality Estimates

Structure/Cause	**Total Bird Fatalities**	**Reference**
Building and Windows	1 billion	Klem 1990
Power Lines	10,000 - 174 million	Erickson et al. 2001
Housecats	1.4 – 3.7 billion	Loss et al. 2012
Vehicles	60 - 80 million	Erickson et al. 2001
Agricultural Pesticides	67 million	Pimentel and Acquay 1992
Communication Towers	25 million	Longcore et al. 2012
Wind Generation Facilities	10,000 - 40,000	Erickson *et al.* 2001

5.2.1. Measurement of Avian Mortality and Comparability

The original concern that wind development-induced fatalities could pose biologically significant impacts to bird populations arose from a few facilities, mainly Altamont Pass and Solano County Wind Resource Areas in California [Altamont Pass; Orloff and Flannery 1992, Hunt 2002]). For example, numerous raptor fatalities, particularly of golden eagles (*Aquila chrysaetos*), were documented at the Altamont Pass site. The closely spaced early-model turbines used at Altamont Pass were on relatively short pedestals placing the blades close to the ground where golden eagles were actively hunting preferred prey species, in particular California ground squirrel (*Spermophilus beecheyii*) (Hunt 2002).

In response to potential impacts, post-construction monitoring plans are typically developed in consultation with state and federal agencies. Such plans detail field methodology in terms of timing, proportion of turbines to search, size of search areas, and search interval. Plans also specify how fatality estimates are calculated statistically, and how correction factors are incorporated. For example, plans typically include the results of searcher efficiency trials, in which the observer is tested to help assess what percent of carcasses the observer actually finds, and results of carcass persistence trials, which assess how long carcasses persist on the ground before being scavenged and are available to be discovered. Carcass persistence trials also can be used to validate the length of the study's search interval, to determine if the majority of carcasses are expected to remain on the ground between search intervals.

It is important to acknowledge that fatality estimation methods are evolving, and fatality estimates, which are generally expressed as fatalities per turbine or per MW, between sites must be compared with caution because differences in methodology, estimators, or overall survey goals occur. These types of mortality studies are designed to sample peak periods of collision risk for birds and bats at a representative sample of turbines, with the ultimate goal of estimating the level of take over the course of a study period. In this respect, these estimates are indices of the level of impact to birds and bats from individual projects. These indices can best be compared with similar field methodology used at sites with similar physical and landscape characteristics (i.e., forested ridgeline, agricultural field).

Bird and bat fatality study protocols at existing wind farms in Maine (Mars Hill, Stetson, Kibby, Rollins, and Record Hill) and New Hampshire (Lempster) have been developed in consultation with the respective state and federal agencies. Other states such as New York (NYSDEC 2009) and Pennsylvania (PGC 2007) have developed guidelines for post-construction monitoring methods for which study work plans can be developed in a uniform manner. While study protocols have been tailored to address individual project study objectives, post-construction studies in Maine and New Hampshire have included the following key elements: searches under turbines (either a subset or all turbines), searcher efficiency trials, carcass persistence trials, and statistical analysis to estimate total mortality during a study period.

These studies have generally been conducted from mid-April to mid-October (sometimes with a break in June), to cover spring migration, the summer breeding period, the late-summer bat activity period, and the fall migration period. The majority of studies in Maine and New Hampshire have used a weekly search interval where individual turbines are searched every 7 days. The advantage to a weekly search interval versus a daily search interval is the feasibility of including a larger number of turbines (depending on the size of the project) in searches. The appropriate search interval (weekly or daily) would depend on survey objectives, as well as scavenger activity at a project. Weekly searches are adequate if 1) the objective is to determine estimates, or indices, of take that can be compared to most other available studies, and 2) if a reasonable number of carcasses remain to be found within the weekly search interval (as determined by carcass persistence trials).

Turbine searches at forested ridgeline projects in Maine and New Hampshire have involved searching the areas leveled for turbine lay-down (typical plot diameter of 75 m) with linear transects established 3 to 5 m apart (depending on vegetation cover). For those wind projects in landscape settings where searching a greater area is feasible, such as agricultural landscapes in New York, search areas are typically as large as 120 square meters (m^2) (14,400 m^2) where 120 m represents the maximum rotor-swept height of most modern turbines. Some carcasses may land outside of the 75 m average diameter turbine lay-down area at projects on forested ridgelines; however, studies at sites with larger search plots have indicated that the majority of carcasses are found closer to turbine bases. For example, a study at the Maple Ridge Wind Project in New York that included search areas of 120 m by 130 m indicated that the mean distance birds and bats were found from tower bases was 39 m and 26 m, respectively (Jain et al. 2009). For those projects with exceptionally small search areas (e.g., Lempster, New Hampshire), search area correction factors based on the distribution of carcasses found within search areas may be applied to account for some of the carcasses that may have landed outside of search plots.

Vegetation cover within plots also influences the percent of carcasses that may be found by searchers. Studies may involve vegetation management to increase searcher efficiency rates. Alternatively, an emerging method of fatality estimation includes vegetation visibility class mapping within the search plots to account for variable searcher efficiency in different vegetation cover types. This method provides a gradation of “correction factors” that are applied to the actual number of carcasses found, resulting in what is presumably a more accurate (and greater) estimate of fatality than if vegetation classes are not accounted for. It should be noted, however, that the use of this method during some of the more recent studies creates another difference with older studies, making them not perfectly comparable across sites.

5.2.2. Review of Known Collision Risk

Birds

In 2004, raptor mortality estimates at Altamont Pass were 0.24 raptor fatalities per turbine per year (fatalities/turbine/year), or 1,296 raptor fatalities annually (GAO 2005). Altamont Pass and Solano County Wind Resource Areas are located along migratory ‘bottlenecks’ or sites where birds were seasonally very active. Studies conducted at those California facilities that experienced high fatality rates found significant contributing factors to the high mortality observed: the number, density, and physical characteristics of turbines (over 5,000 turbines present at Altamont Pass alone); high raptor wintering density; high prey densities within the wind resource areas; and the funneling of migrants through these areas by topographical features. Additionally, the turbines are predominantly older generation turbines that are smaller, lower to the ground, and with blades that spin faster as wind speed increases. Turbines at these sites also are spaced very close together in comparison to more modern facilities with larger turbines. Finally, most turbines are placed on lattice-type towers, which could provide perch locations in proximity to spinning blades.

Raptor mortality in the U.S., outside of California, has been documented to be very low. Mortality rates found at onshore wind developments outside of Altamont Pass have documented 0 to 0.07 raptor fatalities/turbine/year from 2000-2004 (GAO 2005). Results of roughly 30 studies at over 25 different locations throughout the U.S. (outside California) have documented approximately 50 total raptor fatalities (Appendix B Table 1). This compares with more than 100 raptor mortalities documented per year at Altamont Pass and overall estimates of thousands killed annually at that facility.

Documented flight heights of raptors migrating through a project area does not correlate to collision risk, particularly since raptors frequently exhibit avoidance behavior, probably due to their propensity to migrate during daylight hours under clear weather conditions. Studies have documented high raptor and eagle collision avoidance behaviors at modern wind facilities (Whitfield and Madders 2006, Chamberlain et al. 2006, Sharp et al. 2011, Stantec 2013). As most raptors are diurnal, raptors are able to visually, as well as acoustically detect turbines during periods of fair weather. Foraging raptors that may become distracted by prey, resident young birds that are learning to fly, or migrant raptors flying during periods of reduced visibility, may be at increased risk of collision with wind turbines.

Songbirds (e.g., warblers, vireos, thrushes, sparrows) account for up to 80 percent of known fatalities reported at wind facilities (Johnson et al. 2000, Erickson et al. 2002). Species that migrate long distances and/or migrate at night have been found to be at greater risk of collision with manmade structures than diurnal migrants or year-round resident species (Arnold and Zink 2011). While mortality of these species has included both daytime and nocturnal fatalities (Erickson et al. 2001), collisions are more likely to occur at night particularly during periods of low visibility resulting from inclement weather. Publicly available results (not accounting for search area corrections) of recent studies at 15 wind projects in the northeastern U.S. (Maine, New Hampshire, Vermont, New York) estimate fatality rates between 0.44 to 2.5 birds/turbine/year (Mars Hill, Maine; Stantec Consulting 2008) and 9.48 birds/turbine/year (Maple Ridge, New York; Jain et al. 2007) (Table 4; Appendix B Table 2).

See Table 4 for estimated fatality results for bats and birds at Maine projects.[4] Projects in Table 4 used comparable post-construction monitoring methodologies developed in consultation with USFWS and MDIFW.

[4] See Appendix B Table 2 for additional details of the fatality studies at these projects.

Table 4. Estimated fatalities for birds and bats at operational projects in Maine.

Project	Year	Estimated Bat Fatalities/Turbine/ Period (Estimated total bat fatalities)	Estimated Bird Fatalities/Turbine/Period (Estimated total bird fatalities)	Source
Mars Hill	2007	0.43 - 4.40 (12-123)	0.44 - 2.5 (27-69)	Stantec Consulting 2008
Mars Hill	2008	0.17 - 0.68 (5-19)	2.40 - 2.65 (57-74)	Stantec Consulting 2009
Stetson I*	2009	2.11 (80)	4.03 (153)	Stantec Consulting 2010
Stetson I	2011	0.43 (16)	1.77 (67)	Normandeau Associates 2010a
Stetson II	2010	2.48 (42)	2.14 (36)	Normandeau Associates 2010b
Stetson II	2012	2.06 (36)	2.83 (49)	Stantec Consulting 2012a
Rollins	2012	0.18 (7)	2.94 (118)	Stantec Consulting 2012b
Kibby	2011	0 spring; 0.37 fall (16)	0.72 spring (32); 0.29 fall (12)	Stantec Consulting 2011
Record Hill	2012	6.78 (150)	8.46 (187)	Stantec Consulting 2012c

Bats

Emerging evidence suggests that migratory bats are at a greater risk of turbine collisions than birds, particularly in certain areas of the country. This concern arose mainly from a study at the 44-turbine Mountaineer Wind Energy Facility in Tucker County, West Virginia where 475 dead bats (47.5 bats/turbine/year) were documented, the majority (92.5%) which were found between August 18 and September 30, 2003 (Kerns and Kerlinger 2004). A 2009 post-construction study at the Blue Sky Green Field project in Wisconsin documented an unprecedented, high mortality rate for the Midwest, with total estimated mortality of 40.5 bat fatalities per turbine (Gruver 2009). At a 56-turbine facility southeast of Lubbock, Texas, observers found 47 Brazilian free-tailed bats, an abundant species, from September 2006 to September 2007 (Miller 2008). At a 68-turbine facility in northwestern Oklahoma, 95 Brazilian free-tailed bats were found (Piorkowski 2006). These and similar subsequent studies have raised concerns that bat mortality associated with wind turbine collisions could adversely impact bat populations (Williams 2003; GAO 2005; Arnett et al. 2008; Kunz et al. 2007a).

As of 2008, there were 11 species of bats reported as fatalities at projects in the U.S. (Arnett et al. 2008); however, Indiana bat has since been documented as a fatality at a project in Indiana (West 2011) for a total of 12 bat species reported in the US. Mortality of eight bat species has been documented at wind energy facilities specifically in the eastern U.S. (Kunz et al. 2007b), with most fatalities occurring during what is generally considered the fall migration period of August to November (Arnett et al. 2008, Cryan 2003, Cryan and Brown 2007, Johnson et al. 2005). Species documented under turbines in the East include little brown myotis, northern myotis, tri-colored bat, Seminole (*Lasiurus seminolus*), silver-haired, hoary, red, and big brown bats. In North America, migratory tree roosting bat species represent about 75 percent of documented bat fatalities, and hoary bats specifically represent about half of all bat fatalities (Arnett et al. 2008).

Mortality estimates for bats in Maine are far lower than those documented at other projects in the East and in other regions of the U.S. Post-construction monitoring studies conducted between April and November at the 195-turbine Maple Ridge Wind Project in New York in 2007 and the 44-turbine Mountaineer Wind Project in West Virginia in 2003 estimated 15.54 to 18.53 bat fatalities/turbine/year (Jain et al. 2008) and 47.53 bat fatalities/turbine/year (Kerns and Kerlinger 2004), respectively. At Maple Ridge, 64 turbines were searched weekly, and at Mountaineer, 44 turbines were searched twice per week. In comparison, bat fatality estimates in Maine range from 0.18 bats/turbine/yr (at the Rollins Wind Project in 2012; Stantec Consulting 2012b) to 6.78 bats/turbine/yr (at the Record Hill Wind Project in 2012; Stantec 2012 c) (Appendix B Table 2). The Rollins Wind Project has 40 turbines, 20 of which (50%) were searched weekly between April 15 to October 15. The Record Hill Wind Project has 22 turbines, all of which were searched 3 times every 2 weeks from April 15 to June 7 and July 7 to October 15. Mortality estimates at the Maine projects used estimator adjustment calculations derived from searcher efficiency and scavenger trail data, which has been standard protocol for post-construction monitoring in Maine. However, differences among studies (between projects within Maine, and between Maine studies and studies in other states) such as survey period, search interval, number of turbines searched, size of search area, non-searchable area corrections, visibility within search plots, and overall study objectives must be considered when making any direct comparisons between studies.

Despite what is currently known about bat collision rates in Maine, it is important to acknowledge that little is known about the migration routes and the numbers of migratory bats in Maine and other states and the factors contributing to levels of risk. Pre- and post-construction acoustic surveys at wind facilities have documented bat activity to be positively correlated with nightly mean temperatures and negatively correlated with wind speed (Fiedler 2004, Reynolds 2006). Reynolds (2006) found that no detectable spring migratory activity occurred on nights when the mean temperature was below 10.5°C (50.9°F). Bat activity at Buffalo Mountain, West Virginia from 2000 to 2003 was most closely correlated with average nightly temperature (Fiedler 2004). Although some activity at Bingham did occur on cold nights, peak activity occurred on nights with temperatures above 10°C. Reynolds (2006) found activity of bats to be highest on nights with wind speeds of < 5.4 meters per second (m/s) during the spring migratory period at the Maple Ridge, New York wind facility. Bat activity levels at Buffalo Mountain, Tennessee also showed a negative association with average nightly wind speeds (Fiedler 2004). At Bingham, peak activity occurred on a night when mean wind speeds were 5.8 m/s.

Researchers currently have a limited understanding of the actual mechanism of bat collisions, although evidence from the timing of fatalities documented at existing wind facilities and other structures suggests that migrating bats are most at risk, whereas resident bats during the summer feeding and pup-rearing period are considered low risk (Johnson and Strickland 2004, Johnson et al. 2003, Whitaker and Hamilton 1998). Additionally, only certain species of bats appear to be at risk. Of the 45 species of bats that occur in the U.S., only approximately 12 species have been found during mortality searches (Arnett et al. 2008, West 2011). In most regions including the eastern U.S., migratory tree-roosting species such as hoary, eastern red, and silver-haired bats have higher mortality rates at wind projects than cave-dwelling species (Arnett et al. 2008). See Table 5 for the percent of total fatalities and number of migratory tree-roosting bats found during standard surveys[5] at operational projects in Maine.

[5] Standard surveys at Mars Hill included dog searches.

Table 5. Migratory tree-roosting bat fatalities at operational projects in Maine.

Project	Year	Percent (Number) of migratory tree-roosting bats	Source
Mars Hill	2007	71% (17)	Stantec Consulting 2008
Mars Hill	2008	100% (5)	Stantec Consulting 2009
Stetson I	2009	60% (3)	Stantec Consulting 2010
Stetson I	2011	100% (4)	Normandeau Associates 2010a
Stetson II	2010	79% (11)	Normandeau Associates 2010b
Stetson II	2012	100% (4)	Stantec Consulting 2012a
Rollins	2012	50% (1)	Stantec Consulting 2012b
Kibby	2011	78% (7)	Stantec Consulting 2011
Record Hill	2012	100% (44)	Stantec Consulting 2012c

5.2.3. Summary of Collision Risk at the Bingham Wind Project

Impacts to birds and bats due to the project are expected to be comparable to other projects located on forested ridgelines in the Northeast U.S. Other projects on forested ridgelines in the region share similar landscape features, as well as similar land use activities to the project (i.e., timber harvest). The proposed project will include a similar post-construction mortality monitoring study to those conducted at other projects recently in the region. However, the Curtailment Plan (Exhibit 7E-1) indicates that curtailment at half of the turbines would be incorporated into the post-construction monitoring protocol of the proposed project. Only one curtailment study has been conducted in the Northeast U.S. to-date (Sheffield, Vermont in 2012); therefore, with curtailment treatments to reduce bat fatalities, bat mortality at the proposed project would be expected to be lower than that reported at other projects in the region that have not incorporated curtailment into their study plans. Curtailment has been shown to be an effective strategy to reduce bat mortality. One recent study in Pennsylvania documented reductions in nightly fatality from 44 to 93 percent (Arnett et al. 2010).

Results of pre-construction surveys alone cannot predict level of risk at a project. These survey results when compared to similar projects in the region can illustrate regional patterns in migration activity, timing, or species composition (in the case of raptors). Understanding regional patterns may help illustrate the potential level of risk at a project. The results of site-specific pre-construction surveys conducted for this project are consistent with the results of surveys conducted at other wind projects in the East and Northeastern U.S., as summarized below and further described in the seasonal Avian and Bat Migration Survey Reports (Exhibit 7D).

Raptors

The results of raptor surveys conducted for this project are typical, and within the range of results documented at other proposed wind projects in the region. In fall 2010, 11 raptor species were documented during migration surveys conducted from two locations, Kingsbury Ridge and Johnson Ridge. Species observed were those expected to occur in this region of the Northeast during migration. The range in number of species observed in fall at other projects in the East and Northeast is 0 species (at multiple sites) to 15 species (at a project in Clinton County, New York). No state or federally-listed raptor species were observed during surveys conducted for this project. Two state species of Special Concern were observed: bald eagle (n=6) and northern harrier (n=3). Of these observations, 3 bald eagle observations (50%) and no northern harrier observations (0%) occurred within the project area. The seasonal passage rate at Kingsbury Ridge was 0.68 raptor observations per hour and at Johnson Ridge, it was 1.74 observations per hour. When compared to fall passage rates at other projects located on forested ridgelines in the East and Northeast, these passage rates are relatively low (0 raptor observations per hour at multiple sites to 12.7 raptor observations per hour at a project in Bennington County, Vermont) (Stantec unpub.). At Johnson Ridge, 34 percent of observations occurred in the project area and of those, 100 percent occurred below the proposed maximum turbine height. At Kingsbury Ridge, 23 percent of observations occurred in the project area, and of those, 85 percent occurred below turbine height. Percent below turbine height at Kingsbury Ridge falls within the range of fall results at other projects in the East and Northeast, and results at Johnson Ridge occur just at the high end of the range of results (43% at a project in Grafton County, New Hampshire to 98% at the Bull Hill wind project in Hancock County, Maine).

In spring 2010, nine raptor species were observed. Species observed were those expected to occur in this region of the Northeast during migration. Spring 2011 surveys at other projects in the East and Northeast documented 6 (at multiple sites) to 12 species (at multiple sites). No state or federally-listed raptor species were observed. One state-listed species of Special Concern was observed: bald eagle (n=6). Of these 6 observations, 4 (67%) occurred in the project area. The seasonal passage rate at Kingsbury Ridge was 0.27 raptor observations per hour and at Johnson Ridge was 1.06 observations per hour. These passage rates are at the low end of the range of spring passage rates at other projects on forested ridges in the East and Northeast (0.21 raptor observations per hour at a project in Coos County, New Hampshire to 15.4 raptor observations per hour at a project in Jefferson County, New York) (Stantec unpub.). At Johnson Ridge, 57 percent of observations occurred in the project area and of those, 95 percent occurred below the proposed maximum turbine height. At Kingsbury Ridge, 68 percent of observations occurred in the project area, and of those, 77 percent occurred below turbine height. Percent below turbine height at both ridges in the project fall within the range of spring results at other projects in the East and Northeast (25% at a project in Grafton County, New Hampshire to 100% at the Bull Hill wind project in Hancock County, Maine).

Pre-construction raptor survey results have not shown a correlation to post-construction mortality of raptors. The risk of raptor collision at facilities other than those located at migration bottlenecks or high use areas is relatively low. Because most raptors are diurnal and modern turbines have comparatively slower spinning blades, raptors can avoid the spinning turbine blades and rotor structures. The turbines at the project will consist of this modern design, lacking the features believed to present a greater risk of collision. Additionally, most raptors migrate during periods of good visibility when conditions are favorable for long-distance flight. Therefore, the risk of migrant raptors colliding with the proposed turbines is anticipated to be low. Some resident raptors engage in flight behaviors that could put them at a greater risk of collision, such as aerial courtship displays. Owls primarily forage during nocturnal and crepuscular periods. Despite these behaviors, mortality surveys at existing wind developments, outside of the California, have documented low raptor mortality. Although one raptor fatality, a barred owl (*Strix varia*), was documented in two years of study (2007 and 2008) at Mars Hill, it was thought to have possibly been a natural kill resulting from the severe 2007-2008 winter (Stantec Consulting 2008).

At Stetson I, post-construction raptor surveys occurred in conjunction with the post-construction mortality surveys. A total of 79 raptors (34 in spring; 45 in fall) were observed during 70 hours of survey during both spring and fall survey seasons (Stantec 2010). Two red-tailed hawks were found during the concurrent post-construction mortality surveys; however both mortalities resulted from contact with a riser pole of the electrical collection system that resulted in electrocution of the birds and not from collision with a turbine. Incidental observations of raptors during the mortality survey at Stetson I in 2009 included instances of raptor turbine-avoidance behaviors. Out of 47 incidental observations, 7 raptors exhibited turbine-avoidance behaviors. For these seven observations, raptors made slight changes to their flight paths as they approached spinning turbines. No raptors observed came into contact with the turbines, and no raptor fatalities were documented under turbines despite continued use of the airspace during migration or breeding periods (Stantec 2010). Raptor mortality data from other projects in the U.S. and from Stetson I and Stetson II indicated that this trend of low raptor mortality can also be expected at the project.

To the extent practicable, the project has been designed to reduce potential detrimental effects to local wildlife, including raptors. For example, all but approximately 1.7 miles of the electrical collector system will be installed underground within project roadways. The aboveground portion of the electrical collector system has been designed with consideration of the Avian Power Line Interaction Committee's (APLIC) Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006 (APLIC 2006). This manual was developed to mitigate and avoid electrocution with overhead electrical lines. The overall goal of the collection system design is, to the extent practicable, reduce risk of avian electrocution while ensuring maintaining the reliability safety of the system.

Nocturnal Migrants

In terms of timing and flight height, the results of radar surveys conducted at the project are consistent with results documented at other proposed wind projects in the region (Exhibit 7D). The seasonal spring passage rate (543 ± 30 targets per kilometer per hour [t/km/hr]) was within the range of spring passage rates at other projects on forested ridges in the East (147 t/km/hr at Stetson I in Washington County, ME to 1020 t/km/hr at a project in Grant City, West Virginia). The percent below turbine height in spring (21%) is within the range of spring results from other projects in the East (3% at a project in Barbour County, West Virginia to 38% at the Bull Hill Project in Hancock County, Maine).

In fall 2010 and fall 2011, passage rates at the project (803 ± 46 and 952 ± 63) were at the high end of the range compared to other projects in the East (91 t/km/hr at a project in Caledonia County, Vermont to 811 t/km/hr at a project in Grant County, West Virginia). However, the percent below turbine height in both fall seasons (20% and 16%) is within the range of fall results from other projects in the East (1% at multiple projects to 40% at a project in Hillsborough, New Hampshire).

The results of these and other radar studies conducted in the eastern U.S. suggest that the vast majority of nocturnal migrants fly at altitudes well above the rotor swept zone of proposed turbines. Flight heights documented during radar surveys in the project area, as well as emerging evidence from other studies indicate that flight height is more important in determining potential collision risk than factors such as passage rate or flight direction. Based upon flight height documented at the project, there appears to be limited collision risk for nocturnal migrants. There has been no documented population-level impact to an individual songbird species from a wind development project. A recent summary of avian mortality at communication towers suggests that, for 177 bird species for which collision and population trend data is available, there is no correlation between collision vulnerability and annual rate of population change indicating that this source of mortality has no observable effect on these populations (Arnold and Zink 2011). In fact, many of the species involved in collisions with manmade structures have increasing population trends (Arnold and Zink 2011), suggesting that collisions involve regionally abundant species. Also, mortality of avian species at manmade structures, including wind turbines, has involved a diverse assemblage of species rather than disproportionate impacts to a single species (Environmental Bioindicators Foundation, Inc. and Pandion Systems, Inc. 2009).

Another example of a strategy to reduce impacts to wildlife and particularly to songbirds involves minimizing lighting on the turbines and on buildings within the project area. Because nocturnal migrants, particularly songbirds, are attracted to steady burning lights, which can lead to fatalities principally through collisions with structures, lighting for the project will be minimized to the extent practicable to maintain safe operations (Longcore et al. in press 2011). The project also has been designed to use the existing road network where possible and to minimize construction of new roads, which should reduce habitat loss/conversion and species displacement. Wetland areas will be avoided to the maximum extent practicable to reduce impacts to species that use these habitats, including migratory waterbirds and waterfowl.

Breeding Birds

No state or federally-listed bird species were detected during the spring and summer 2010 breeding bird surveys conducted at the project. During the breeding bird surveys, a total of 787 individual birds representing 50 species were identified within the project area. These totals included nine state-listed species of Special Concern. Because songbirds on their breeding grounds tend to be active during the day and migration generally occurs at night, collision risk with turbines tends to be lower for breeding birds than for migrating individuals. Impacts to breeding birds at wind projects more often occur during project construction as the result of displacement or disturbance rather than from direct mortality. As no state or federally-listed breeding bird species were detected during onsite breeding bird surveys, impacts to these species are not expected.

Bats

The acoustic bat surveys conducted at the project documented results similar to other pre-construction surveys. The results of these surveys, including variability in bat activity and generally low detection rates above canopy height, are consistent with other publicly available acoustic surveys conducted at proposed wind projects in the region (Exhibit 7D). Although bats are present in the project area, the activity levels and guilds detected are similar to those documented at other sites including Mars Hill, Stetson, and Lempster (Exhibit 7D).

At this project, no bats belonging to the red bat/tri-colored bat guild (both tree-roosting bats) were recorded by met tower detectors in spring 2010, and no bats from this guild were recorded by the Bessey met tower detectors in summer and fall 2010. Mortality of migratory tree-roosting bats at this project may therefore be lower than at other projects in the Northeast (Table 5).

In addition, the Applicant has committed to curtail wind turbines during wind conditions when previous studies have shown that bats are active, and when existing Maine-based post-construction fatality data indicates that the potential for bat mortality is greatest.

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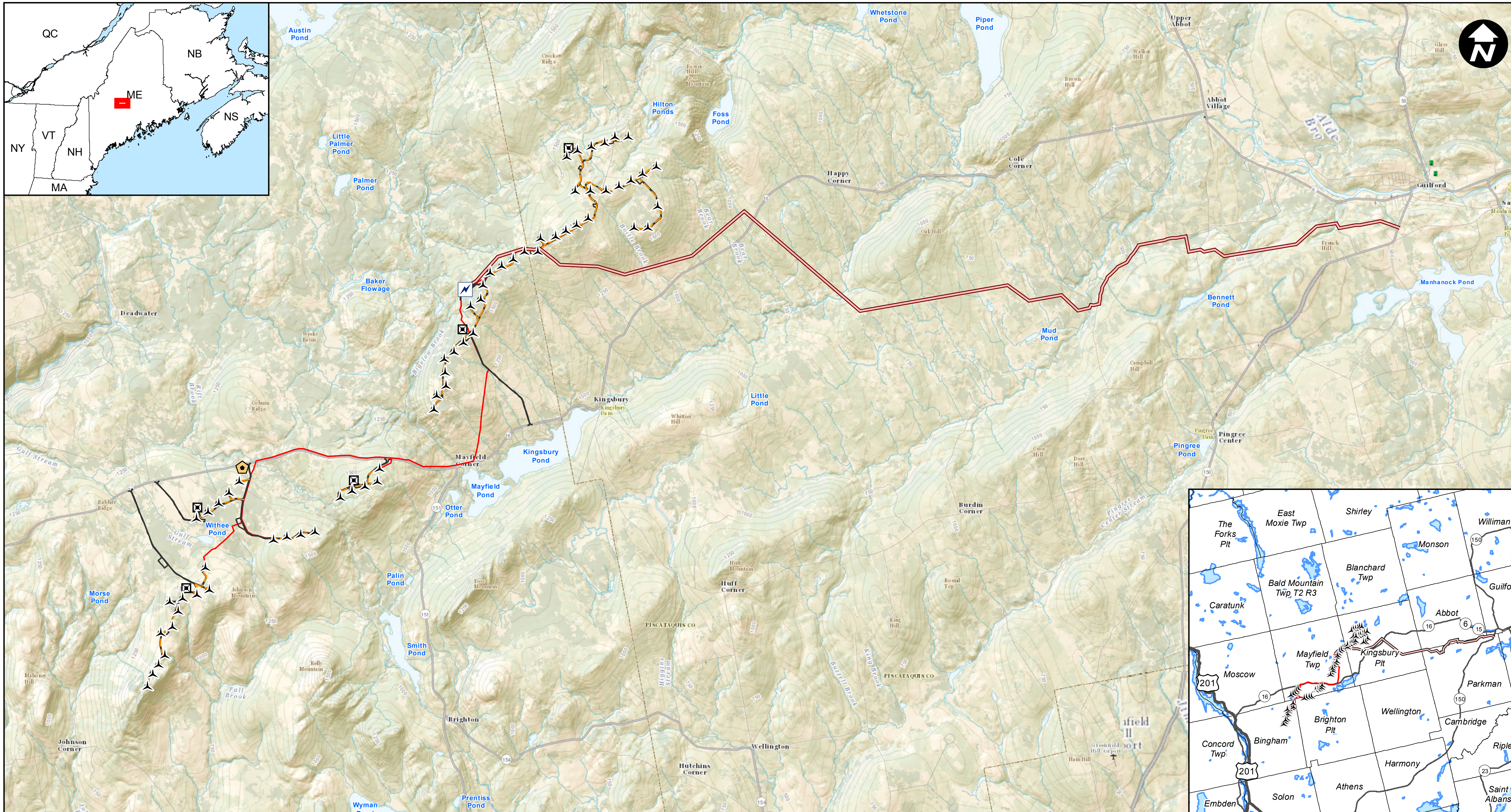
FIGURE 1



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Legend

- Turbine Location
- Permanent MET Tower
- O&M Building
- Substation
- Edge of Gravel
- Electrical Generator Lead
- Overhead Collector
- Underground Collector

0 8,000
Feet

Client/Project 195600539
Bingham Wind Project

Figure No.
1

Title
Bingham Wind Project Location

4/16/2013

Appendix A
Wildlife Observations and Wildlife Habitat Use Matrix

Common Name	Scientific Name	Special Habitat Requirements	Likely Relative Abundance in the State	Maine	Federal	Beech-Birch-Maple-Forest	Harvested Hardwood Forest	Softwood Plantations	Forested Wetlands	Forested Streams	Vernal Pools	Observed During Surveys	Observed Incidentally to Surveys	Migration Only
Amphibians														
Blue-spotted salamander	*Ambystoma laterale*	Wooded swamps, ponds or vernal pools for breeding	U	SC		Y			Y	B	B	X		
Bullfrog	*Rana catesbeiana*	Deep permanent water and emergent vegetation	C							Y	Y	X	X	
Dusky salamander	*Desmognathus fuscus*	Permanent or intermittent streams or seeps in woodlands	C			Y			Y	Y			X	
Gray treefrog	*Hyla versicolor*	Aquatic sites	U			Y	Y		B		B		X	
Green frog	*Rana clamitans*	Riparian areas, wooded swamps, ponds and vernal pools	A						Y	Y	Y	X	X	
Northern redback salamander	*Plethodon cinereus*	Wide variety of terrestrial habitats, mostly forested	C			Y				Y				
Northern two-lined salamander	*Eurycea bislineata*	Wide variety of habitats, including streams, floodplains, and swamps	C			Y				Y			X	
Northern spring salamander	*Gyrinophilus porphyriticus*	Cold streams, seeps, or springs with flat rocks or crevices	C	SC						Y		X		
Spotted salamander	*Ambystoma maculatum*	Mesic woods, semi-permanent water for breeding	U			Y	Y		B	B	B	X		
Wood frog	*Lithobates sylvaticus*	Vernal pools in woodland setting	A			Y			Y	B	B	X		
Reptiles														
Eastern garter snake	*Thamnophis sirtalis*	Ubiquitous; moist areas	A			Y	Y		Y		Y		X	
Northern redbelly snake	*Storeria occipitomaculata*	Woodland debris: bark or rotting wood	C			Y	Y		Y			X		
Wood turtle	*Clemmys insculpta*	Wooded banks of sandy-bottom streams with adjacent meadows	U	SC						Y			X	
Birds														
Alder flycatcher	*Empidonax alnorum*	Wet areas with dense, low shrubs or clearings with wet edges	C				B	B	B	B	B	X	X	
American crow	*Corvus brachyrhynchos*	Open areas for foraging	A			Y	Y	Y	Y	Y	Y	X	X	
American goldfinch	*Carduelis tristis*	Spruce and fir forest	A			Y	Y	Y	Y	Y	Y	X	X	
American kestrel	*Falco sparverius*	Open flat areas, cavity trees	C				B	B				X		
American redstart	*Setophaga ruticilla*	Early successional deciduous habitats	C	SC		B	B					X	X	
American robin	*Turdus migratorius*	Lawns, fields, agricultural areas, forest openings	A			B	B	B				X		
American woodcock	*Scolopax minor*	Fields or forest openings for courtship; brushy swales for cover; reverting farms	C				B		B	B	B		X	
Bald eagle	*Haliaeetus leucocephalus*	Large bodies of fish supporting water, large supercanopy trees for nesting	U	SC								X	X	X
Barred owl	*Strix varia*	Cool, damp lowlands, cavity trees >20" dbh	C			Y	Y		Y	Y	Y		X	
Bay-breasted warbler	*Dendroica castanea*	Second-growth boreal forests	C					B	B	B	B	X		
Belted kingfisher	*Megaceryle alcyon*	Near water, sandy sites with steep banks	C						B	B	B		X	
Black-and-white warbler	*Mniotilta varia*	Deciduous or mixed conifer-hardwood forests	C	SC		B	B		B			X	X	
Blackburnian warbler	*Dendroica fusca*	Coniferous forests, mixed woodlands	C				B	B	B			X		
Black-capped chickadee	*Poecile atricapilla*	Cavity trees >4" dbh	A			Y	Y	Y	Y	Y	Y	X	X	
Blue-headed vireo	*Vireo solitarius*	Low, shrubby vegetation or brambles	C				B	B	B	B	B	X		
Black-throated blue warbler	*Dendroica fusca*	Hardwoods with well-developed understory	C			B	B		B	B	B	X		
Black-throated green warbler	*Dendroica virens*	Coniferous forests, mixed woodlands	C			B	B		B			X		
Blue jay	*Cyanocitta cristata*	Variety of rural to urban habitats	A			Y	Y	Y	Y	Y	Y	X		
Broad-winged hawk	*Buteo platypterus*	Extensive woodlands with roads or clearings	C			B	B		B		B	X		
Brown creeper	*Certhia americana*	Standing dead trees with loose bark	C			B	B	B	B			X		
Brown-headed cowbird	*Molothrus ater*	Open fields, actively grazed pastures, mowed grassy areas	C				B	B					X	
Canada goose	*Branta canadensis*	Elevated sites in marshes for nesting	C										X	X
Canada warbler	*Dendroica tigrina*	Forest with dense understory, along streams, bogs, or swamps	C	SC		B	B		B			X	X	
Cedar waxwing	*Bombycilla cedrorum*	Wide variety of habitats. Berry- or fruit-producing trees and shrubs, forest edges and riparian areas	C			B	B		B	B	B	X		
Chestnut-sided warbler	*Dendroica pensylvanica*	Early second growth deciduous stands, regenerating clearcuts or shelterwood cuts with dense vegetation	C	SC		B	B					X		

Common Name	Scientific Name	Special Habitat Requirements	Likely Relative Abundance in the State	Maine	Federal	Beech-Birch-Maple-Forest	Harvested Hardwood Forest	Softwood Plantations	Forested Wetlands	Forested Streams	Vernal Pools	Observed During Surveys	Observed Incidentally to Surveys	Migration Only
Chimney swift	*Chaetura pelagica*	Chimneys and dead hollow large trees in wetlands	C	S C					B					
Chipping sparrow	*Spizella passerina*	Suburban residential areas, farms, orchards, clearings in forests, borders of lakes and streams	C				B		B	B			X	
Common grackle	*Quiscalus quiscala*	Wetlands, open areas and scrub shrub wetlands	A			B	B		B					
Common raven	*Corvus corax*	Cliffs and outcrops in rural areas	C			Y	Y		Y				X	
Common yellowthroat	*Geothlypis trichas*	Moist Shrublands, dense forest edges, regenerating fields and forests	C			B	B		B	B		X	X	
Cooper's hawk	*Accipiter cooperii*	Mature forests in open country, urban woodlots, tolerates forest fragmentationa and human distrubance	C			B		B	B					
Dark-eyed junco	*Junco hyemalis*	Edges and small openings in coniferous and mixed forests, logging roads, and old burns	C				B	B	B			X	X	
Double-crested cormorant	*Phalacrocorax auritus*	coastal bays, estuaries, marine islands, freshwater lakes, ponds, and rivers	A										X	X
Downy woodpecker	*Picoides pubescens*	Trees, limbs with decay column >6" dbh	C			Y	Y		Y				X	
Eastern phoebe	*Sayornis phoebe*	Exposed, streamside perches, sheltered ledges for nesting	C			B	B		B	B				
Eastern wood-pewee	*Contopus virens*	Open deciduous and mixed forests, forest edge	C	S C		B	B					X		
Hairy woodpecker	*Picoides villosus*	Trees, limbs with decay column >10" dbh	C			Y	Y		Y			X	X	
Hermit thrush	*Catharus guttatus*	Coniferous woodlands with dense understory	C			B						X	X	
House wren	*Troglodytes aedon*	Thickets and cavities for nesting	U						B				X	
Golden-crowned kinglet	*Regulus satrapa*	Conifer and mixed conifer-hardwood forests	C				Y	Y	Y			X	X	
Great-crested flycatcher	*Myiarchus crinitus*	Natural tree cavities in deciduous forest edge	C			B						X		
Least flycatcher	*Empidonax minimus*	Open mature and second-growth hardwood and mixed forest	C	S C		B			B			X		
Magnolia warbler	*Dendroica magnolia*	Young fir or spruce stands	C				B		B			X	X	
Mallard	*Anas platyrhynchos*	Shallow water for feeding	A						B					
Merlin	*Falco columbarius*	Open forests adjacent to open areas	U									X		X
Mourning dove	*Zenaida macroura*	Open land with bare ground	C				Y						X	
Mourning warbler	*Oporornis philadelphia*	Stands of dense saplings and shrubs, disturbed second growth	U			B	B					X		
Nashville warbler	*Vermivora ruficapilla*	Disturbed second growth; scattered trees interspersed with brush	C			B	B		B			X	X	
Northern flicker	*Colaptes auratus*	Open areas, trees with heart rot	C			B	B		B			X	X	
Northern harrier	*Circus cyaneus*	Open areas or wetlands with low vegetation	U	S C					B			X		
Northern mockingbird	*Mimus polyglottos*	Low, dense woody vegetation	C										X	
Northern parula	*Parula americana*	In lichen *Usnea* in moist forests	C						B	B		X		
Northern waterthrush	*Seiurus noveboracensis*	Cool, shady, wet brushy areas with open pools of water	U						B			X		
Olive-sided flycatcher	*Contopus cooperi*	Tall perches near exposed wetland areas	C	S C				B	B				X	
Osprey	*Pandion haliaetus*	Elevated nesting areas near a body of water	C						B			X		
Ovenbird	*Seiurus aurocapillus*	Deciduous or mixed conifer-hardwood forests	C			B	B					X	X	
Peregrine falcon	*Falco peregrinus*	Cliffs and outcrops	U	S C*								X		X
Pileated woodpecker	*Dryocopus pileatus*	Mature trees >20" dbh with decay	C			Y	Y					X	X	
Pine warbler	*Dendroica pinus*	Pine stands	U					B						
Purple finch	*Carpodacus purpureus*	Coniferous trees	C					B				X	X	
Red-breasted nuthatch	*Sitta canadensis*	Cavity trees in mixed or coniferous woods	C				Y	Y	Y					
Red-eyed vireo	*Vireo olivaceus*	Deciduous forests with continuous canopy	C			B	B		B			X	X	
Red-tailed hawk	*Buteo jamaicensis*	Mature forest-field ecotone	C			Y	Y		Y			X		
Rose-breasted grosbeak	*Pheucticus ludovicianus*	Forest-field ecotones, thickets, sapling stands	C			B	B		B	B		X		
Ruby-crowned kinglet	*Regulus calendula*	Coniferous forests in pure or mixed stands of spruce, tamerack, or pine	C					B	B				X	
Ruby-throated hummingbird	*Archilochus colubris*	Tubular flowers, especially red	C			B	B			B			X	

Common Name	Scientific Name	Special Habitat Requirements	Likely Relative Abundance in the State	Maine	Federal	Beech-Birch-Maple-Forest	Harvested Hardwood Forest	Softwood Plantations	Forested Wetlands	Forested Streams	Vernal Pools	Observed During Surveys	Observed Incidentally to Surveys	Migration Only
Ruffed grouse	*Bonasa umbellus*	Fallen logs amidst dense saplings	C			Y	Y		Y	Y		X	X	
Scarlet tanager	*Piranga olivacea*	Mature deciduous and mixed conifer-hardwood forests	C			B	B		B					
Sharp-shinned hawk	*Accipiter striatus*	Extensive, undisturbed open mixed woodlands	U						Y			X		
Snow bunting	*Plectrophenax nivalis*	Open areas	C				W							
Song sparrow	*Melospiza melodia*	Moist areas with brushy vegetation	C				B		B			X	X	
Spruce grouse	*Falcipennis canadensis*	Large stands of dense coniferous forest	U					Y					X	
Swainson's thrush	*Catharus ustulatus*	Coniferous or mixed forest adjacent to water, low damp areas	U				B		B			X	X	
Turkey vulture	*Cathartes aura*	Forest openings, fields, large dead tree trunks	C									X		X
Veery	*Catharus fuscescens*	Moist woodlands with understory	C	SC			B		B					
White-breasted nuthatch	*Sitta carolinensis*	Cavity trees in hardwoods or mixed woods	C			Y	Y					X		
White-throated sparrow	*Zonotrichia albicollis*	Shrublands and dense forest edges	C	SC		B	B	B	B			X	X	
White-winged crossbill	*Loxia leucoptera*	Cone-bearing mature coniferous forests	U					Y					X	
Wild turkey	*Meleagris gallopavo*	Forests with mast-producing trees, openings, and dense vegetation for roosting	C			Y	Y						X	
Winter wren	*Troglodytes troglodytes*	Conifer forests near water, often in ravines and swamps	C				B	B	B			X	X	
Yellow warbler	*Dendroica petechia*	Dense deciduous thickets with few taller trees	C	SC						B		X		
Yellow-bellied flycatcher	*Empidonax flaviventris*	Low, wet areas with coniferous forest	C						B			X		
Yellow-bellied sapsucker	*Sphyrapicus varius*	Dead or live trees with a central decay column	C			B						X	X	
Yellow-rumped warbler	*Dendroica coronata*	Coniferous trees, bayberry thickets	C				B		B			X	X	
Mammals														
American marten	*Martes americana*	Variety of forests with den sites in large hollow trees or logs	U				Y						X	
Beaver	*Castor canadensis*	Streams with an abundance of young hardwood	C						Y	Y			X	
Big brown bat	*Eptesicus fuscus*	Cold dry cave in winter	C			R	R		R	R		X		
Black bear	*Ursus americanus*	Fallen trees, hollow logs, rock ledges, slash piles, northern hardwoods, mixed forests	C			Y	Y		Y	Y			X	
Bobcat	*Lynx rufus*	Dense hardwood or softwood understories with high hare densities	U					Y				X		
Bog lemming**	*Synaptomys sp.*	Moist soils with leaf mold	U							Y		X		
Canada lynx	*Lynx canadensis*	Dense fir forest with high hare densities	R		T		W	W				X		
Coyote	*Canis latrans*	Forests, forest edges, agricultural land	U			Y	Y		Y	Y		X		
Deer mouse	*Peromyscus maniculatus*	Down logs, rotting stumps in coniferous and mixed forests	C				Y							
Eastern chipmunk	*Tamias striatus*	Forests with brushy areas	C			Y	Y	Y	Y	Y			X	
Eastern red bat	*Lasiurus borealis*	Deciduous trees on forest edges for roosting	U	SC		R	R		R	R				
Eastern tri-colored bat	*Perimyotis subflavus*	Warm, draft-free, damp sites for hibernation, open woodlands	U	SC		R	R		R	R				
Ermine	*Mustela erminea*	Dense brushy cover with high densities of small mammal prey	C				Y		Y	Y		X		
Fisher	*Martes pennanti*	Coniferous or mixed forest with dens in hollow trees, logs, or holes under boulders	C						Y			X		
Hoary Bat	*Lasiurus cinereus*	Edges of coniferous forests	U	SC		R	R		R	R				
Moose	*Alces alces*	Wetlands preferred in the summer for insect relief and aquatic vegetation	C			Y	Y		Y	Y		X		
Little brown bat	*Myotis sp.*	Dark, warm sites for maternity colonies	C	SC		R	R		R	R				
Masked shrew	*Sorex cinereus*	Damp deciduous and coniferous woodlands with leaves and rotting logs for cover	U				Y	Y	Y					
Northern flying squirrel	*Glaucomys sabrinus*	Conifers in summer, hollow trees and cavities in winter	U			Y	Y	Y						
Northern short-tailed shrew	*Blarina brevicauda*	Forested areas with low vegetation, loose leaf litter and high humidity	C			Y	Y							
Porcupine	*Erethizon dorsatum*	Mixed or coniferous forest with den sites in rock ledges or trees	C				Y						X	
Pygmy shrew	*Sorex hoyi*	Wide variety of forests with moist leafmold near water	U			Y			Y					
Red fox	*Vulpes vulpes*	Variety of habitats in suitable den sites	C			Y	Y		Y	Y		X		

Common Name	Scientific Name	Special Habitat Requirements	Likely Relative Abundance in the State	Maine	Federal	Beech-Birch-Maple-Forest	Harvested Hardwood Forest	Softwood Plantations	Forested Wetlands	Forested Streams	Vernal Pools	Observed During Surveys	Observed Incidentally to Surveys	Migration Only
Red squirrel	*Tamiasciurus hudsonicus*	Woodlands with mature trees	C				Y		Y			X		
River otter	*Lutra canadensis*	Water body, river, or stream with fish, dens, and riparian vegetation	U						Y	Y			X	
Silver-haired bat	*Lasionycteris noctivagans*	Dead trees with loose bark; streams	U	SC		R	R		R	R				
Snowshoe hare	*Lepus americanus*	Dense brushy or softwood cover	C			Y	Y	Y	Y	Y		X		
Southern red-backed vole	*Clethrionomys gapperi*	Cool, moist, deciduous or mixed forest near water sources	C						Y	Y				
White-tailed deer	*Odocoileus virginianus*	Softwood yarding cover in winter	C			Y	Y		Y	Y			X	
Woodland jumping mouse	*Napaeozapus insignis*	Moist, cool woodland, loose soils	U				Y		Y	Y				

*breeding population, only
**northern bog lemming (*Synaptomys borealis*) is state T

<u>Relative Abundance</u>
A – Abundant
C – Common
U – Uncommon
R – Rate

Status
E – Endangered
T – Threatened
SC – Special Concern

Season of Use
B – Breeding
R – Roosting (for bats)
W – Wintering
Y – Year round

Appendix B
Publicly Available Post-Construction Results

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (incidental)	Estimated BATS/turbine/ period (total)	# BIRDS found during surveys (incidental)	Estimated BIRDS/turbine /period (total)	Reference
Searsburg, Vermont	forested (11)	June 30 - Oct 18, 1997	11 total (4 per search) 2 to 6 days per month	0	n/a	0	n/a	Kerlinger, P. 2002. An Assessment of the Impacts of Green Mountain Power Corporation's Wind Power Facility on Breeding and Migrating Birds in Searsburg, Vermont. Prepared for the Vermont Department of Public Service Montpelier, Vermont. Subcontractor report for the National Renewable Energy Laboratory NREL/SR-500-28591.
Somerset County, Pennsylvania	agricultural (8)	2000 (12 months)	n/a	0	n/a	0	n/a	Kerlinger, P. 2006. Supplement to the Phase I Avian Risk Assessment and Breeding Bird Study for the Deerfield Wind Project, Bennington County, Vermont. Prepared for Deerfield Wind, LLC.
Mountaineer, West Virginia	forested ridgeline (44)	April 4 - Nov 11, 2003	2x per week	475	47.53 (2092)	69*	4.04 (178 + 33 due to substation lighting)	Kerns, J., and P. Kerlinger. 2004. A study of bird and bat collision fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia, USA: annual report for 2003. <http://www.responsiblewind.org/docs/MountaineerFinalAvianRpt3-15-04PKJK.pdf>. (Accessed 30 September 2007).
Mountaineer, West Virginia	forested ridgeline (44)	July 31- Sept 11, 2004	22 daily, 22 weekly	398 (68)	38 (1364-1980)	15 (n/a)	n/a	Arnett, E.B., W.P. Erickson, J. Kerns, and J. Horn. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. Bats and Wind Energy Cooperative.
Meyersdale, Pennsylvania	forested ridgeline (20)	Aug 2 - Sept 13, 2004	10 daily, 10 weekly	262 (37)	25 (400-660)	13 (4)	n/a	Arnett, E.B., W.P. Erickson, J. Kerns, and J. Horn. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. Bats and Wind Energy Cooperative.
Buffalo Mtn, Tennessee	reclaimed mine on ridge (18)	April - Dec 10, 2005	18 of 18 every week, every 2 weeks, or every 2-5 days	243 (14)	63.9 (1,149)	9 (2)	1.8 (112)	Fiedler, J.K., T.H. Henry, R.D. Tankersley, and C.P. Nicholson 2007. Results of Bat and Bird Mortality Monitoring at the Expanded Buffalo Mountain Windfarm, 2005 June 28, 2007. Prepared for Tennessee Valley Authority.
Maple Ridge, New York	woodland, grassland, agricultural (120)	June 17 - Nov 15, 2006	10 every 3-days, 30 7-days, 10 daily	326 (58)	11.39-20.31 (1367-2437.2)	123 (15)	3.10-9.48 (372-1138)	Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2007. Annual report for the Maple Ridge wind power project post-construction bird and bat fatality study—2006. Annual report prepared for PPM Energy and Horizon Energy. Curry and Kerlinger, Cape May Point, New Jersey, USA. http://www.wind-watch.org/documents/wp-content/uploads/maple_ridge_report_2006_final.pdf Accessed 1 December 2007.
Maple Ridge, New York	woodland, grassland, agricultural (195)	April 30 - Nov 14, 2007	64 weekly	202 (81)	15.54-18.53 (3030-3614)	64 (32)	5.67-6.31 (1106-1230)	Jain, A. P. Kerlinger, R. Curry, and L. Slobodnik. 2008. Annual report for the Maple Ridge wind power project post-construction bird and bat fatality study—2007. Annual report prepared for PPM Energy and Horizon Energy. Curry and Kerlinger, Cape May Point, New Jersey, USA.
Maple Ridge, New York	woodland, grassland, agricultural (195)	April 15 - Nov 9, 2008	64 weekly	140 (76)	8.18 - 8.92 (1595-1739)	74 (23)	3.42-3.76 (667-733)	Jain, A. P. Kerlinger, R. Curry, and L. Slobodnik. 2009. Annual report for the Maple Ridge wind power project post-construction bird and bat fatality study—2007. Annual report prepared for PPM Energy and Horizon Energy. Curry and Kerlinger, Cape May Point, New Jersey, USA.
Mars Hill, Maine	forested ridgeline (28)	April 23-June 3, July 15-Sept 23, 2007	2 of 28 daily, 28 of 28 weekly, seasonal dog searches	22 (2)	0.43-4.4 (12.1-122.5)	19 (3)	0.44-2.5 (27-69)	Stantec Consulting. 2008. Spring, Summer, and Fall Post-construction Bird and Bat Mortality Study at the Mars Hill Wind Farm, Maine. Unpublished report prepared for UPC Wind Management, LLC.
Mars Hill, Maine	forested ridgeline (28)	April 19 - June 6, July 15-Oct 8, 2008	28 of 28 weekly, seasonal dog searches	5 (0)	0.17-0.68 (5-19)	17(4)	2.4-2.65 (57-74)	Stantec Consulting. 2009. Post-construction Monitoring at the Mars Hill Wind Farm, Maine – Year 2. Unpublished report prepared for First Wind Management, LLC.
Munnsville, New York	agricultural forested uplands (23)	April 15-Nov 15, 2008	12 of 23 weekly, seasonal dog searches	9 (1)	0.70-2.90 (16-67)	7 (3)	1.71-2.22 (39-51)	Stantec Consulting. 2009. Post-construction monitoring at the Munnsville Wind Farm, New York, 2008. Prepared for E.ON Climate and Renewables.
Mount Storm, West Virginia	forested ridgeline (82)	July 18 - Oct 17, 2008	18 weekly, 9 daily	182 (27)	daily: 24.21 (1985) weekly: 7.76 (636)	29 (8)	2.41-3.81 (198-312)	Young, D.P., W.P. Erickson, K. Bay, S. Normani, W. Tidhar. 2009. Mount Storm Wind Energy Facility, Phase 1: Post-construction Avian and Bat Monitoring. Prepared for: NedPower Mount Storm, LLC.
Mount Storm, West Virginia	forested ridgeline (82)	July-October 2010	25 daily	308 (73)	22.39 (1836)	36 (11)	2.77 (227)	Young, D.P., S. Nomani, W. Tidhar, and K. Bay. 2010. Mount Storm Wind Energy Facility Post-construction Avian and Bat Monitoring, July-October 2010. Prepared for NedPower Mount Storm, LLC.
Casselman, Somerset Cty, PA	forested ridge, grassland mine ridge (23)	July 27 - October 9, 2008	22 daily	32***	24.2 (557)	N/A	N/A	Arnett, E.B., M. Schirmacher, M.P. Huso, J.P. Hayes. 2010. Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.
Casselman, Somerset Cty, PA	forested ridge, grassland mine ridge (23)	July 26 - October 8, 2009	22 daily	39***	17.4 (400)	N/A	N/A	Arnett, E.B., M. Schirmacher, M.P. Huso, J.P. Hayes. 2010. Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.
Clinton, New York	agricultural, woodland (67)	April 26 to October 13, 2008	8 daily, 8 every 3-days, 7 weekly	39 (14)	daily: 5.45 (365); 3-day: 4.81 (322); weekly: 3.76 (252)	14 (9)	daily: 1.43 (956); 3-day: 3.26 (218); weekly: 2.48 (166)	Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Histed, and J. Meacham. 2009. Annual Report for the Noble Clinton Windpark, LLC. Postconstruction Bird and Bat Fatality Study – 2008. Prepared by Curry and Kerlinger, LLC.
Clinton, New York	agricultural, woodland (67)	April 15 to November 15, 2009	8 daily, 15 weekly	36 (6)	daily: 9.72 (651); weekly: 5.16 (3.46)	16 (8)	daily: 1.50 (101); weekly: 1.76 (118)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2010. Annual Report for the Noble Clinton Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC.
Ellenburg, New York	agricultural, woodland (54)	April 28 to Oct 13, 2008	6 daily, 6 every 3-days, 6 every 7-days	34 (25)	daily: 8.17 (441); 3-day: 6.94 (375); weekly: 4.19 (226)	12 (10)	daily: 2.09 (113); 3-day: 1.37 (74); weekly: 1.18 (64)	Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, A. Fuerst, and C. Hansen. 2009. Annual Report for the Noble Ellenburg Windpark, LLC. Postconstruction Bird and Bat Fatality Study – 2008. Prepared by Curry and Kerlinger, LLC.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (incidental)	Estimated BATS/turbine/ period (total)	# BIRDS found during surveys (incidental)	Estimated BIRDS/turbine /period (total)	Reference
Ellenburg, New York	agricultural, woodland (54)	April 15 to November 15, 2009	6 daily, 12 weekly	28 (4)	daily: 8.01 (433); weekly: 3.70 (200)	19 (2)	daily: 5.69 (307); weekly: 2.29 (124)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2010. Annual Report for the Noble Ellenburg Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC.
Bliss, New York	agricultural, woodland (67)	April 21 to Nov 14, 2008	8 daily, 8 every 3-days, 7 weekly	74 (15)	daily: 7.58 (508); 3-day:14.66 (983); weekly: 13.01 (872)	20 (7)	daily: 4.30 (288); 3-day: 0.66 (44); weekly: 0.74 (50)	Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Quant, D. Pursell. 2009. Annual Report for the Noble Bliss Windpark, LLC. Postconstruction Bird and Bat Fatality Study – 2008. Prepared by Curry and Kerlinger, LLC.
Bliss, New York	agricultural, woodland (67)	April 15 to November 15, 2009	8 daily, 15 weekly	36 (0)	daily: 8.24 (552); weekly: 4.46 (299)	25 (7)	daily: 4.45 (298); weekly: 2.87 (192)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2010. Annual Report for the Noble Bliss Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC.
Altona, New York	primarily woodlots (65)	April 26 to October 15, 2010	22 weekly, 8 daily from July 18 to Sept 18	24 (7)	daily: 6.51 (423); weekly: 3.87 (252)	14 (6)	daily: 1.55 (101); weekly: 2.76 (180)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2011. Annual Report for the Noble Altona Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC.
Cohocton and Dutch Hill, NY	agricultural, woodland (50)	April 15 to Nov 15, 2009	5 daily, 12 weekly	62 (7)	daily: 40.4 (2002); weekly: 13.8 (804)	15 (3)	2.9 - 4.7 (147-235)	Stantec Consulting. 2010. Cohocton and Dutch Hill Wind FarmsYear 1 Post-Construction Monitoring Report, 2009 for the Cohocton and Dutch Hill Wind Farms In Cohocton, New York. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC.
Cohocton and Dutch Hill, NY	agricultural, woodland (50)	April 26 to October 22, 2010	17 weekly except when 12 weekly and 5 daily from July 15-Sept 17	63 (5)	daily: 25.62 (1281); weekly 1: 5.04 (252); weekly 2: 10.44 (522)	9 (1)	daily: 2.06 (103); weekly 1: 0.82 (41); weekly 2: 1.16 (58)	Stantec Consulting. 2011. Cohocton and Dutch Hill Wind FarmsYear 2 Post-Construction Monitoring Report, 2010 for the Cohocton and Dutch Hill Wind Farms In Cohocton, New York. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC.
Wethersfield, NY	agricultural, woodlots (84)	April 15 to Oct 15, 2010	28 weekly	62 (13)	24.45 (2054)	11 (7)	2.55 (214)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K., Harte, A. 2011. Annual Report for the Noble Wethersfield Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC.
Chateaugay, NY	agricultural, woodlots (71)	April 26 to Oct 15, 2010	24 weekly	22 (7)	3.66 (260)	19 (9)	2.40 (170)	Jain, A., Kerlinger, P., Slobodnik, L., Curry, R., Russel, K. 2011. Annual Report for the Noble Chateaugay Windpark, LLC Post-Construction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC.
Lempster, NH	forested ridgeline (12)	April 15-June 1; July 15-Oct 31, 2009	4 daily	10 (2)	spring: 0.58 (7); fall: 5.51 (66)	9 (4)	spring: 0.80 (10); fall: 5.95 (71)	Tidhar, D., W. Tidhar, and M. Sonnenberg. 2010. Post-Construction Fatality Surveys for Lempster Wind Project. Prepared for Lempster Wind, LLC.
Lempster, NH	forested ridgeline (12)	April 15-June 1; July 15-Oct 31, 2010	12 weekly	14 (5)	spring (0); fall 7.13 (86)	11 (0)	spring: 1.16 (14); fall: 4.12 (49)	Tidhar, D., W. Tidhar, L. McManus, and Z. Courage. 2011. 2010 Post-Construction Fatality Surveys for Lempster Wind Project. Prepared for Lempster Wind, LLC.
Stetson Mountain I, Maine	forested ridgeline (38)	April 20 to Oct 21, 2009	19 weekly	5 (0)	2.11 (80)	30 (9)	4.03 (153)	Stantec Consulting. 2010. Stetson I Mountain Wind Project, Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC.
Stetson Mountain I, Maine	forested ridgeline (38)	April 18 to October 21, 2011	19 weekly	4 (0)	0.43 (16)	7 (0)	1.77 (67)	Normandeau Associates. 2010. Year 3 Post-construction avian and bat casualty monitoring at the Stetson I Wind Farm. Prepared for First Wind, LLC.
Stetson Mountain II, Maine	forested ridgeline (17)	April 19 to Oct 15, 2010	17 weekly	14 (0)	2.48 (42.12)	11 (0)	2.14 (36.41)	Normandeau Associates. 2010. Stetson Mountain II Wind Project Year 1 Post-Construction Avian and Bat Mortality Monitoring. Prepared for First Wind, LLC.
Kibby Mountain, Maine	forested ridgeline (44)	May 2 to June 20; July 11 to October 14, 2011	22 3 times every 2 wks	6 (3)	spring: (0); fall: 0.37 (16)	17 (4)	spring: 0.72 (32); fall: 0.29 (12)	Stantec Consulting. 2011. 2011 Post-Construction Monitoring Report Kibby Wind Power Project, Franklin County, Maine. Prepared for TransCanada Hydro Northeast, Inc.
Rollins, Maine	forested ridgeline (40)	April 15 to October 15, 2012	20 weekly	2 (0)	0.18 (7.2)****	9 (7)	2.94 (118)***	Stantec Consulting. 2012. RollinsWind Project Post-Construction Monitoring Report, 2012. Prepared for First Wind, LLC.
Stetson II, Maine	forested ridgeline (17)	April 15 to October 15, 2012	17 weekly	4 (0)	2.06 (36)****	5 (0)	2.83 (49)***	Stantec Consulting. 2012. Stetson II Wind Project Post-Construction Monitoring Report, 2012. Prepared for First Wind, LLC.
Record Hill, Maine	forested ridgeline (22)	April 15 to June 7 and July 7 to October 15, 2012	22 3 times every 2 wks	44 (0)	6.78 (150)****	46 (7)	8.46 (187)****	Stantec Consulting. 2012. Record Hill Wind Project Post-Construction Monitoring Report, 2012. Prepared for Record Hill Wind, LLC.

*33 birds found on May 23, 2003 at turbines near a substation and at substation associated with sodium vapor lights
**Results of spring interim report, study period April 20 to June 1.
***Fresh bats found at curtailment treatment turbines reported only.
****Based on the Huso fatality estimator with area corrections.

Exhibit 7C-1: Rare, Threatened, and Endangered Species Report

Rare, Threatened and Endangered Non-Avian Wildlife Species Report

Bingham Wind Project

Bingham, Moscow, Mayfield Township, Kingsbury Plantation, Abbot, and Parkman
Somerset and Piscataquis Counties, Maine

April 2013

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PN 195600539

1.0 INTRODUCTION

Blue Sky West, LLC and Blue Sky West II, LLC (the Applicants) have proposed the construction of a utility-scale wind energy facility in Bingham, Moscow, Mayfield Township, Kingsbury Plantation, Abbot, and Parkman, in Somerset and Piscataquis Counties, Maine (Figure 1). As currently proposed, the Bingham Wind Project (project) includes approximately 62 turbines (63 potential turbine locations are being permitted); associated access roads; up to 5 permanent meteorological (met) towers; an Operations and Maintenance (O&M) building; electrical collector system; an electrical substation; and an approximately 17-mile generator lead extending easterly to an existing Central Maine Power Company (CMP) substation in Parkman. It is anticipated that a dynamic reactive device (DRD) such as a synchronous condenser will be required at the project collector substation to meet the interconnection requirements of ISO NE and CMP.

The project area includes several low-elevation ridgelines (i.e., below 1,800 feet in elevation) situated within a landscape managed for commercial timber products. A network of unpaved logging roads occurs throughout this portion of the project area. The forest communities present within the project area include second and third-growth mixed native forests, early successional and regenerating forest stands, and plantations of both native and exotic tree species, including red pine (*Pinus resinosa*), Jack pine (*Pinus banksiana*), red spruce (*Picea rubens*), and hybrid larch trees (*Larix* spp.). The generator lead corridor crosses through an area of generally lower elevation; dropping to approximately 750 feet in elevation in southeastern Kingsbury Plantation to an elevation typically less than 600 feet for the remainder of the corridor. The landscape is primarily forested with small areas of agriculture, timber management, and sparse residential development. Forested, scrub-shrub, and emergent wetlands, as well as small perennial and intermittent streams, are located throughout the project area. The generator lead corridor includes a few larger perennial streams such as Kingsbury Stream and Gales Brook.

In 2010 and 2011, Stantec Consulting (Stantec) completed targeted surveys to determine the presence/absence of three species of wildlife associated with the ridgeline portion of the project area: northern bog lemming (*Synaptomys borealis*), northern spring salamander (*Gyrinophilus porphyriticus*), and Roaring Brook mayfly (*Epeorus frisoni*). In Maine, northern bog lemming is listed as Threatened, Roaring Brook mayfly is listed as Endangered, and northern spring salamander is listed as Special Concern. These surveys were prompted by Stantec's preliminary natural resource investigations (e.g., vernal pool surveys and wetland and stream delineations conducted prior to these rare species surveys) and subsequent consultation with the Maine Department of Inland Fisheries and Wildlife (MDIFW). This report presents the results of these field surveys as they relate to the currently proposed project layout. Reporting limits for these surveys include those resources located within approximately 300 feet of proposed edge of gravel surfaces and those resources located within the approximately 100-foot wide electrical corridors.

2.0 METHODOLOGY

Appropriate survey methodology was developed for each target species through prior consultation with the MDIFW. The field surveys were conducted by two Stantec ecologists, including a Certified Ecologist, working in proximity to each other.

Prior to initiating the field surveys within the ridgeline areas, Stantec wetland scientists completed wetland and stream delineations throughout the project area to identify, characterize, and locate wetland and stream resources. These wetland and stream delineations allowed the RTE species field surveys to be targeted in potentially suitable habitats based on preliminary habitat characterization data collected during the wetland and stream delineations. At the time of the RTE species surveys, the current location for the proposed generator lead and the portion of the electrical collector along Route 16 had not been selected, and wetland and stream delineations had not been completed. Following completion of delineations of the electrical collector in late 2012 and the generator lead corridor in early 2013, information collected during those delineations and a general landscape analysis was used to identify potential habitat for the northern spring salamander, northern bog lemming, and Roaring Brook mayfly.

2.1 Northern Spring Salamander Survey Methodology

Prior to conducting field surveys within the ridgeline portion of the project area, Stantec reviewed stream data and photographs compiled during project-specific stream delineations to identify potentially suitable stream habitats for northern spring salamanders. Based on Stantec's past experience with this species, northern spring salamanders prefer well-oxygenated perennial streams with a moderate to swift gradient, a rock-cobble-gravel-dominated substrate with low to moderate embeddedness of larger substrate materials, and generally with a source above 800 feet in elevation. A list of streams containing potentially suitable northern spring salamander habitat was generated to perform targeted field surveys. As previously noted, the current location of the generator lead was not selected until after completion of initial RTE surveys. For the generator lead corridor, Stantec ecologists reviewed subsequently collected delineation data and conducted a general landscape analysis to identify potentially suitable habitat for this species.

Seasonally-appropriate field surveys were conducted on September 27-28, 2010, and September 13-15, 2011. During the surveys, Stantec visited each stream that was identified as providing potentially suitable habitat. If the stream contained apparently suitable habitat, the stream was surveyed for northern spring salamanders. This effort included turning over rocks and logs of various sizes within and adjacent to the stream, targeting habitat areas for both adults and larvae throughout the section of the stream located within and immediately adjacent to (i.e., within 250 feet of) the project area limits. Captured individuals were promptly identified, photographed, and returned to the stream at the capture location. Once a northern spring salamander was documented within a stream reach, survey efforts in that reach were considered complete.

2.2 Northern Bog Lemming Survey Methodology

Limited information is available about the specific habitat requirements of northern bog lemming. The MDIFW reports that the species is known to occur in moist, wet meadows or boggy areas often in alpine settings or spruce-fir forests. The species is reportedly found in association with springs or lush, mossy logs and rocks. In Maine, it is reported to occur in moist peat moss (*Sphagnum* spp.) boggy areas in both low and high elevation settings (MDIFW 2003). Several potentially suitable habitats for the northern bog lemming were identified based upon project area delineations. In general, these areas were characterized as woodland wetlands dominated by scattered trees and shrubs of red spruce, balsam fir (*Abies balsamea*), and northern white cedar (*Thuja occidentalis*). The understory contained a thick layer of peat moss (*Sphagnum* spp.) and three-seeded sedge (*Carex trisperma*) over deep, mucky organic soils.

Seasonally appropriate field surveys for the northern bog lemming were conducted late summer 2010 and 2011 to coincide with the anticipated seasonal peak activity. Field surveys consisted of two Stantec ecologists conducting meander surveys within potentially suitable habitats to locate and document evidence of bog lemming activity. Such evidence included visual observations of bog lemmings, as well as indirect observations of bog lemming activity such as runways and tunnels through the peat moss (*Sphagnum* spp.), browse and clippings on graminoid vegetation, and fecal pellets. According to Kurta (1995), bright green fecal pellets and evenly clipped stems of grasses and sedges along well-defined runways are indicative of bog lemming activity. However, visual observations and presence of these indicators is not conclusive evidence of the presence of the northern bog lemming because the northern bog lemming and southern bog lemming (*Synaptomys cooperi*) can only be definitively separated based upon enamel patterns on their lower teeth or through genetic analysis. Stantec did not trap within suitable habitats to positively identify northern bog lemmings. Rather, these field efforts were conducted to assess the presence of bog lemming activity. For the purposes of this project, any bog lemming activity will be treated as if it were evidence of the northern bog lemming.

The locations of bog lemming activity were recorded with a Garmin® eTrex Global Positioning System (GPS) receiver. Representative photos were taken as appropriate.

2.3 ROARING BROOK MAYFLY SURVEY METHODOLOGY

Prior to conducting field surveys, Stantec reviewed stream data and photographs compiled during project stream delineations to identify potentially suitable stream habitats for Roaring Brook mayfly. A review of relevant literature and previous direct consultation with the MDIFW on Roaring Brook mayfly indicated that the species prefers cold, undisturbed perennial streams in mid- to high-elevation habitats (i.e., above 1,000 feet in elevation) that contain high flows (Swartz et al. 2004, Burian et al. 2008). Furthermore, suitable stream habitats typically occur in undisturbed mixed forested stands with a semi-open to closed canopy. Once streams were selected for surveys, Scientific Collection Permits (permit # 2010-286 and # 2011-286) were obtained from the MDIFW.

Roaring Brook mayfly field surveys were conducted in accordance with guidelines presented by the MDIFW in the *DRAFT Recommended Survey Protocol for the Roaring Brook Mayfly* (*Epeorus frisoni*) (Siebenmann and Swartz, September 16, 2010, and Siebenmann and Swartz, May 25, 2011). Field surveys were conducted during the late summer to maximize the likelihood of obtaining final instar (i.e., pre-emergent) larvae of *Epeorus* species, which are needed for positive species identification. In summary, Stantec ecologists collected macroinvertebrate samples from various suitable microhabitats throughout each stream reach within approximately 250 feet of the project area limits using D-frame dip nets with a 500-microgram mesh bag. In-stream sampling involved placing the dip net firmly on the substrate. Using a jarring and kicking motion, the substrate directly upstream of the dip net was agitated to dislodge macroinvertebrates into the dip net. In addition, larger rocks upstream of the dip net were scrubbed by hand to wash any attached macroinvertebrates into the dip net. Samples were taken from numerous microhabitat types throughout each targeted stream reach, including sites at the base of riffles and runs, pools, leaf packs and snags, and the middle of riffles and runs. Samples were not collected from stream segments that were impounded from beaver (*Castor canadensis*) or other stream segments with a silt or clay substrate and slow flow. Samples were placed into sorting trays, and species of *Epeorus* and similar looking species were collected and placed into ethanol for preservation. At the request of the MDIFW, preserved *Epeorus* specimens were sent to Dr. Steven Burian at Southern Connecticut State University for identification. In-stream sampling of each targeted reach was considered complete once suitable microhabitats within the project area had been thoroughly and effectively sampled for *Epeorus* species.

3.0 RESULTS AND DISCUSSION

The following sections present the results of the field surveys. It is important to note that Hurricane Irene impacted the project area with several inches of rain in late August 2011. As a consequence, water levels within the streams were substantially higher than normal low-flow conditions as the field surveys were taking place. Representative photographs are included in Appendix A. Completed rare animal field forms are included in Appendix B.

3.1 NORTHERN SPRING SALAMANDER RESULTS

Based upon the review of available site-specific information for the ridgeline portion of the project area (i.e., stream delineation data), five streams were identified as having habitat potentially suitable for the northern spring salamander (Figures 2-6). Targeted field surveys were conducted between September 27-29, 2010, and September 12-15, 2011.

Northern spring salamanders were documented in one stream. One additional stream, stream S041, had habitat characteristics very similar to known locations of northern spring salamanders. Although northern spring salamanders were not documented within stream S041 during Stantec's field survey, there is a high likelihood that they are present based on the habitat characteristics of the stream and are therefore assumed to be present (Figure 6). Similarly, northern spring salamanders were not documented within stream S027, although a portion of this stream has good potential northern spring salamander habitat. Table 1 summarizes the results of the stream surveys.

Table 1. Summary of Northern Spring Salamander Surveys

Stream ID	Date Surveyed	Northern Spring Salamander Documented?	Figure	Comments
S007	9/27/2010	N	2	Small perennial stream with alder-dominated associated wetland; stream is impounded by beavers upstream and approximately 500 feet downstream of Rt. 16 crossing; downstream of Rt. 16 stream is very silted; poor suitability for spring salamanders
S021	9/15/2011	Y	3	Small perennial stream with a low to moderate gradient; rock-cobble-gravel-sand substrate; bankfull width to 5 feet
S027	9/28/2010	N (Likely Present)	4	Small perennial stream flowing along road; cobble-gravel-sand-rock substrate; two-lined and dusky salamanders present. Surveyed portion of the stream (upstream of access road) is marginally suitable habitat for spring salamander. Portion downstream of access road that was delineated in 2012 is better potential habitat.
S037	9/14/2011	N	5	Very small stream segment approximately 80 feet in total length; likely intermittent as terrestrial vegetation present in channel; not spring salamander habitat
S041	9/13/2011	N (Likely Present)	6	Moderate- to high-gradient perennial stream with rock-cobble-gravel-sand substrate; bankfull to 12 feet; good spring salamander habitat and are likely present

An adult northern spring salamander was located in stream S021 on September 15, 2011 (Figure 5). The stream is a small perennial stream with a low to moderate-gradient and a rock-cobble-gravel-sand substrate. At the time of the field survey, the wetted width of the stream ranged between three and four feet with a bankfull width to five feet. The flow was approximately five to six inches per second with a depth averaging between three and six inches.

The delineated limits of stream S027 were extended in 2012 after RTE surveys had been conducted. As described in Table 1, no northern spring salamanders were documented within the portion of the stream that was surveyed. The more recently delineated segment of stream S027 demonstrates better potential habitat for northern spring salamanders and as such has been treated as if the species is present.

Stream S041 is a moderate to high-gradient perennial stream with a rock-cobble-gravel-sand substrate (Figure 6). At the time of the field survey, the wetted width of the stream ranged between 5 and 6 feet with a bankfull width up to 12 feet. The flow was approximately 6 to 10 inches per second with small riffles. Although no northern spring salamanders were observed, the stream contains habitat suitable for the species and are therefore assumed to be present. The stream contained and supports both dusky and two-lined salamanders.

Based upon stream delineation data and a general landscape analysis, 23 streams along the proposed Route 16 electrical collector corridor and the generator lead corridor may provide suitable habitat for northern spring salamander. Table 2 provides a summary of these streams. These streams are characterized by perennial hydrology, coarse substrates, and moderate to fast gradients (i.e., habitat characteristics similar to known northern spring salamander locations). For the purposes of this analysis, northern spring salamanders should be assumed to be present in these streams pending targeted field surveys and evaluations.

Table 2. Streams Containing Potentially Suitable Spring Salamander Habitat within the Proposed Route 16 Electrical Collector Corridor and the Generator Lead Corridor.

Stream ID	Figure	Channel Substrate	Average Bank Full Width (Ft.)	Average Depth (In.)	Gradient	Mesohabitat	Additional Notes
S009	7	muck, sand, gravel, cobble	5.5	10.5	low to moderate	run-riffle habitat	Perennial stream
S014	8	sand, gravel, cobble	6.5	8	low	shallow run-riffle habitat with small plunges	Perennial stream
S022	9	cobble, boulder	7.5	5	low	small plunges	Small shallow perennial stream. Appears to be marginal habitat.
S023	10	sand, gravel, cobble, boulder, large flat pieces of slate	40	7.5	gradual	run-riffle-glide habitat	Northern spring salamanders observed ~3,500 feet upstream. Appears to be suitable habitat. Perennial stream. Bigelow Brook, brook trout present.
S024	10	gravel, cobble	8	3	low	shallow run-riffle habitat	Small shallow perennial stream. Appears to be marginal habitat.
S025	11	woody debris, gravel, cobble, boulders	6.5	7.5	moderate	small plunges and cascades	Small perennial stream. Tributary of Kingsbury Pond, brook trout present.
S043	12	gravel, cobble, boulder	4.5	3.5	moderate	shallow run-riffle-plunge habitat	Small perennial stream. Appears to be marginal habitat.
S045	13	gravel, cobble, boulder	17.5	9	moderate	run-riffle-glide habitat	Bottle Brook. Large perennial stream.
S046	13	sand, gravel, cobble, boulder	3	3.5	low	shallow plunge-glide habitat	Small perennial stream. Appears to be marginal habitat.
S047	14	gravel, cobble, boulder	2	13.5	low	shallow glides and small plunges	Small perennial stream. Appears to be marginal habitat.

Stream ID	Figure	Channel Substrate	Average Bank Full Width (Ft.)	Average Depth (In.)	Gradient	Mesohabitat	Additional Notes
S048	14	woody debris, gravel, cobble, boulder	6	6	low	run-riffle habitat	Perennial stream. Appears to be marginal habitat.
S049	15	gravel, cobble, boulder	6.5	13	moderate	run-riffle-glide habitat	Bear Brook. Perennial stream. Appears to be suitable habitat.
S050	15	woody debris, gravel, cobble, boulder	20	13.5	moderate	run-riffle habitat	Large perennial stream. Appears to be suitable habitat.
S051	16	gravel	4	21	low	slow glide habitat	Perennial stream. Appears to be marginal habitat.
S052	17	gravel, cobble, boulder	40	18	gradual	run-riffle-glide habitat	Kingsbury Stream. Large perennial stream with good brook trout fishery. Abundance of fish expected to limit potential for spring salamander.
S057	18	muck, sand, gravel, cobble	4	10	low	slow glide habitat	Perennial stream. Appears to be potentially suitable habitat.
S058	18	gravel, cobble, boulder	7.5	6.5	moderate	run-riffle-glide habitat	Perennial stream. Appears to be suitable habitat.
S062	19	cobble, boulder	37.5	48	gradual	run-riffle-glide-pool habitat	Perennial stream. Carlton Stream, abundance of fish expected to limit potential for spring salamander.
S063	19	gravel, cobble, boulder	11	18	moderate	riffle-run-glide habitat with small plunges	Perennial
S065	19	cobble, boulder	7	4	moderate	run-riffle-glide habitat	Perennial
S066	20	cobble, boulder	8.5	2.5	moderate	riffle habitat with small plunges	Perennial
S070	21	gravel, cobble	5	2	low to moderate	shallow run-riffle habitat	Small perennial stream

Stream ID	Figure	Channel Substrate	Average Bank Full Width (Ft.)	Average Depth (In.)	Gradient	Mesohabitat	Additional Notes
S071	22	gravel, cobble, boulder, bedrock, some large flat slate pieces	11	4	moderate	run-glide habitat with small cascades and plunges	Perennial stream

3.2 NORTHERN BOG LEMMING RESULTS

Based on the wetland delineations conducted in 2010 and 2011, seven wetlands within the project area were identified as having potentially suitable habitat for the northern bog lemming (Figures 23-27). As discussed above, preferred bog lemming habitat is characterized as a partially forested wetland with scattered red spruce, balsam fir, and northern white cedar trees with a thick carpet of peat moss (*Sphagnum* spp.) and typically three-seeded sedge in the understory over mucky organic soils.

The field surveys were conducted on September 28-29, 2010, and September 14, 2011. Bog lemming activity was observed in only one wetland, MAY_W137 (Figure 25, Photo 30). Indirect evidence of bog lemming activity included well-defined runways and tunnels through peat moss and sedges, browsed and clipped three-seeded sedge stems, and bright green fecal pellets (Photo 31). As Stantec did not conduct trapping, it is not possible to determine if the observed activity was northern bog lemming or southern bog lemming.

Bog lemming activity was not observed in the remaining wetlands that were surveyed. Many of the surveyed wetlands have been substantially impacted by previous and ongoing timber harvesting and lack the typical habitat characteristics of known bog lemming locations in the region. Table 3 presents a summary of the wetlands that were surveyed for northern bog lemming.

Based upon wetland delineation data and a general landscape analysis, no wetlands along the proposed Route 16 electrical collector corridor and the generator lead corridor provide potentially suitable habitat for northern bog lemming.

Table 3. Summary of Northern Bog Lemming Surveys

Wetland ID	Date Surveyed	Bog Lemming Activity Documented?	Figure	Comments
BING_W001	9/29/2010	N	23	Red spruce woodland wetland with balsam fir, alder, mountain holly, cinnamon fern, 3-seeded sedge, and *Sphagnum*; deep, mucky soils, recent forests harvests adjacent to wetland; no bog lemming or other rodent sign observed
BING_W005	9/29/2010	N	24	Northern white cedar-spruce-balsam fir woodland wetland with cinnamon fern, alder, mountain holly, 3-seeded sedge, bunchberry, *Sphagnum*; recent forest harvests along edge of wetland; no bog lemming or other rodent sign observed

Wetland ID	Date Surveyed	Bog Lemming Activity Documented?	Figure	Comments
BING_W013	9/29/2010	N	24	Red spruce woodland wetland with balsam fir, mountain holly, cotton-grass, and 3-seeded sedge; recent forest harvests along edge of wetland; observed 1 rodent runway through *Sphagnum*, but no conclusive bog lemming evidence
BING_W011	9/29/2010	N	24	Red spruce woodland wetland with alder, balsam fir, yellow birch, 3-seeded sedge, wool-grass, marsh fern, and *Sphagnum*; recent forest harvests along edge of wetland; rodent sign limited to runways and brown fecal pellets, but no conclusive bog lemming evidence
MAY_W137	9/28/2010	Y	25	Forested woodland with approximately 40% canopy cover; dominated by balsam fir, alder, cinnamon fern, 3-seeded sedge, and *Sphagnum*; observed runways, tunnels, green fecal pellets, and brown fecal pellets
KING_W297	9/14/2011	N	26	Large, very disturbed seepage wetland; wetland is very saturated with numerous skid trails; poor bog lemming habitat, wetland lacks dense *Sphagnum* layer characteristic of other known bog lemming locations
KING_W303	9/14/2011	N	27	Large disturbed woodland wetland; wetland hydrology altered from timber harvests throughout wetland; wetland is very wet and inundated in portions from skidder ruts; most of wetland is likely too wet and disturbed for bog lemming; small intact portion in SW portion of wetland contains marginal bog lemming habitat, no rodent sign observed

3.3 Roaring Brook Mayfly Results

Concurrent with the northern spring salamander surveys, each stream identified as potentially suitable for northern spring salamander also was evaluated for habitat suitability for Roaring Brook mayfly. Streams identified as potentially suitable Roaring Brook mayfly habitat are characterized as coldwater perennial streams above 1,000 feet in elevation with good water clarity and well-oxygenated habitat conditions as a result of swift flows, and are located in relatively intact watersheds with minimal disturbance from recent timber harvests or stream crossings.

As a result of the field surveys, one stream within the project area, stream S041, was selected to sample for Roaring Brook mayfly based on elevation, high-gradient flows, perennial hydrology, and relatively intact watersheds. No *Epeorus* or dorsally compressed mayfly species were collected in samples from this stream, indicating that the stream likely lacks sufficient sustained high energy flow. Based upon this survey, stream S041 represents low potential as Roaring Brook mayfly habitat.

The remaining streams, including those identified in Table 1, do not contain suitable Roaring Brook mayfly habitat. These remaining streams lack the high-energy and steep-gradient flows that are characteristic of Roaring Brook mayfly habitat. In addition to the low-gradient flows, many of the other streams in the project area have been affected by beaver activity and include impounded areas and a greater concentration of silt and sand in the stream substrate. Of those streams identified in Table 2 as potential habitat for the northern spring salamander, three streams (S014, S023, and S049) could potentially provide habitat for the Roaring Brook mayfly. These perennial streams are located above 1,000 feet in elevation and have sustained moderate and high-energy flows that could support dorsally-compressed mayfly species. However, based upon the absence of this species in the sampled stream, surveys provide evidence that the species is not present in these streams.

4.0 SUMMARY

Northern spring salamanders were documented in one of the surveyed streams, S021. Two other streams, S041 and S027, include potentially suitable habitat. Twenty-three streams that were identified during winter 2012-2013 along the proposed Route 16 electrical collector and generator lead corridors contain habitat potentially suitable for northern spring salamanders. These streams were not surveyed for northern spring salamanders as they were delineated subsequent to the RTE field surveys, but habitat characteristics are similar to those of known locations. The majority of the streams within the project area are too shallow, slow flowing, or silt-dominated to support northern spring salamander.

Bog lemming activity was documented in one of the surveyed wetlands: Wetland MAY_W137. As trapping was not conducted to confirm species identification, it is not known whether this occurrence is of northern bog lemming or southern bog lemming. For the purposes of this project, it is assumed to be a northern bog lemming.

Roaring Brook mayfly was not documented within the stream identified as potentially suitable habitat. However, three additional streams located along the proposed electrical collector and generator lead corridors provide potentially suitable habitat for Roaring Brook mayfly. These streams were not surveyed as they were identified in winter 2012-2013, subsequent to the RTE field surveys.

5.0 RECOMMENDATIONS

In regard to those streams known to or suspected to support the northern spring salamander, management recommendations would involve employing Best Management Practices (BMP) when working in the immediate watershed of these resources or if stream crossings are unavoidable. Use of BMPs will help reduce both indirect and direct impacts to these resources. The maintenance of existing wooded buffers or the re-establishment of wooded buffers on these streams would help reduce potential sedimentation and maintain cool water temperatures. For overhead utility crossings, vegetation clearing should be minimized to the greatest extent practicable, and poles should be placed as far from these resources as design allows. More specific details on BMPs can be determined through consultation with Stantec and MDIFW biologists.

For the wetland identified as having bog lemming activity, direct impacts should be avoided and wooded buffers should be maintained where practicable. It is also recommended that efforts be employed to avoid inadvertently altering the hydrology of this wetland. This can be accomplished by such methods as bridging streams within the immediate watershed of these wetlands to avoid redirecting the natural flow of water or otherwise changing the hydro-period of these wetlands. More specific management recommendations (i.e., buffer widths) should be determined through consultation with Stantec and MDIFW biologists.

For the streams identified as containing potentially suitable habitat for northern spring salamander and Roaring Brook mayfly that were located in winter 2012-2013 along the electrical collector and generator lead corridors, it is recommended that the presence of these species be assumed and the appropriate BMPs implemented if seasonally appropriate field surveys cannot be completed to verify presence of these species prior to project construction.

Additional evaluations and surveys are recommended if project expansions or re-alignments occur substantially outside of the project limits depicted in the figures. Furthermore, the final project layout will utilize this survey information to minimize impacts to the streams systems that appear to support northern spring salamander, northern bog lemming, and roaring brook mayfly populations.

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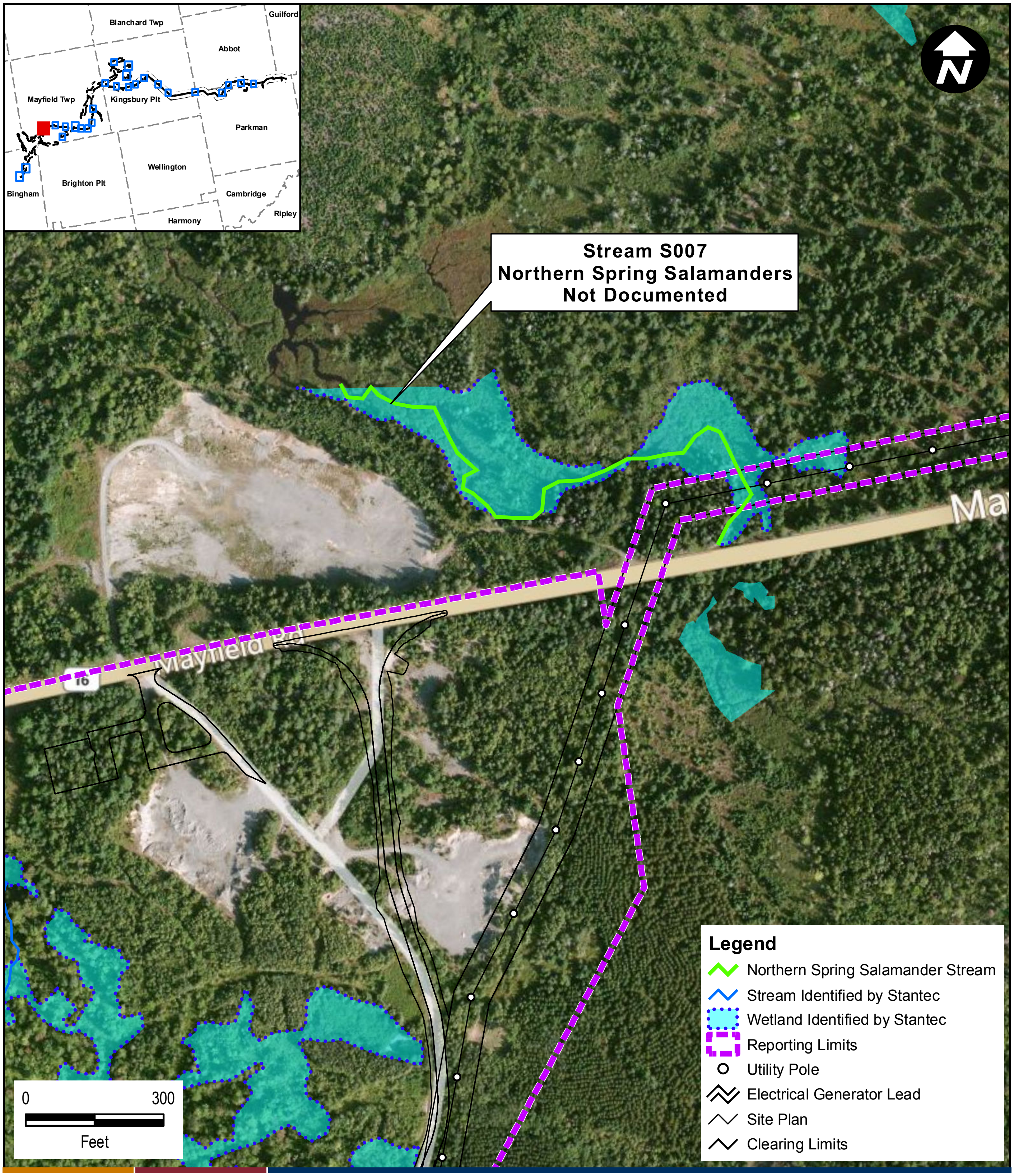
FIGURES



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00539_000_NorthernSpringSalamander_MapBook

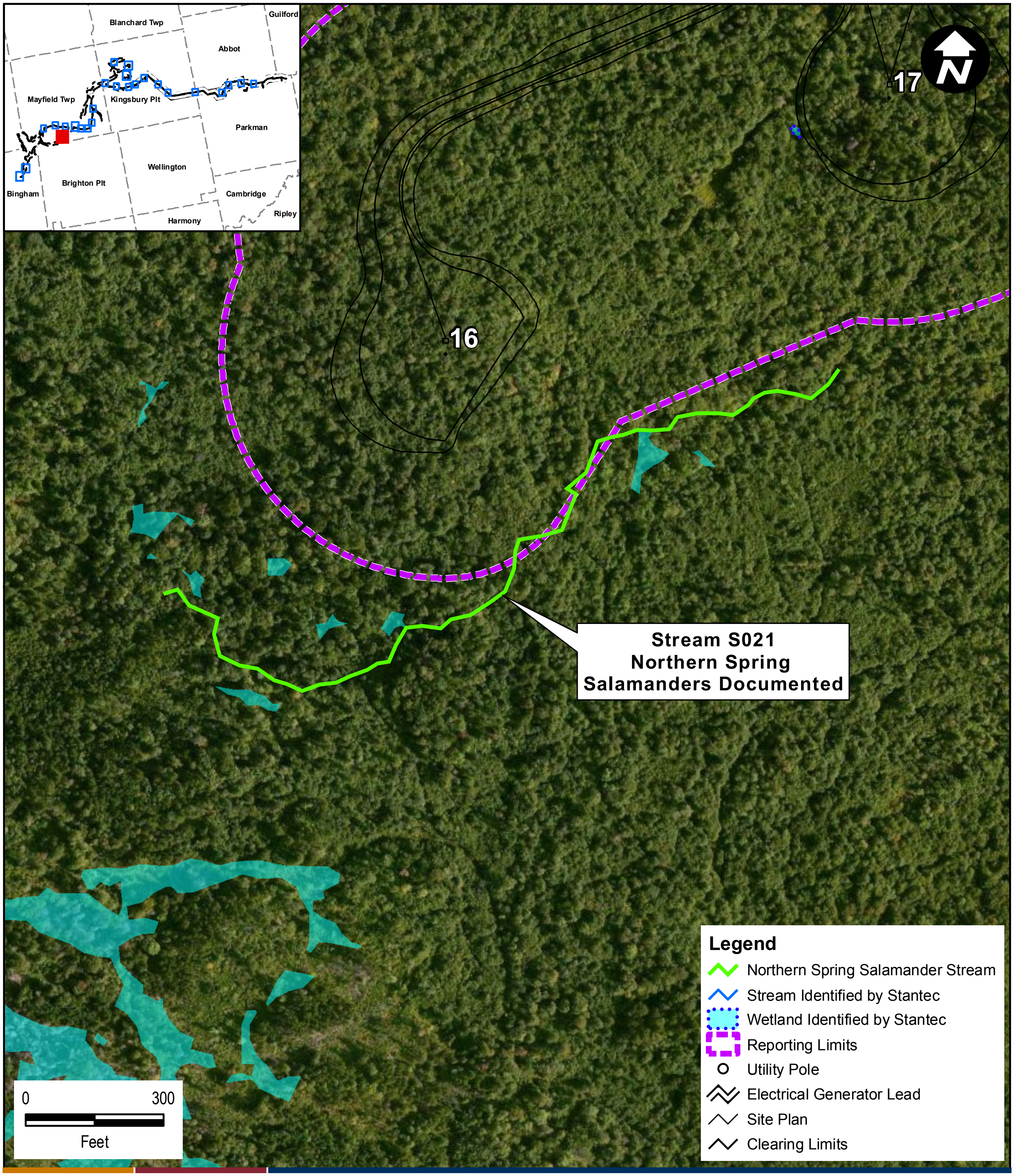
Note:
1. Not all items appear in all maps.
2. Aerial imagery provided by Bing Maps aerial imagery web service ((c) 2010 Microsoft Corporation and its data suppliers.)

Client/Project
Bingham Wind Project

Figure No.
2

Title
Northern Spring Salamander Survey Location

4/9/2013



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00539_000_NorthernSpringSalamander_MapBook

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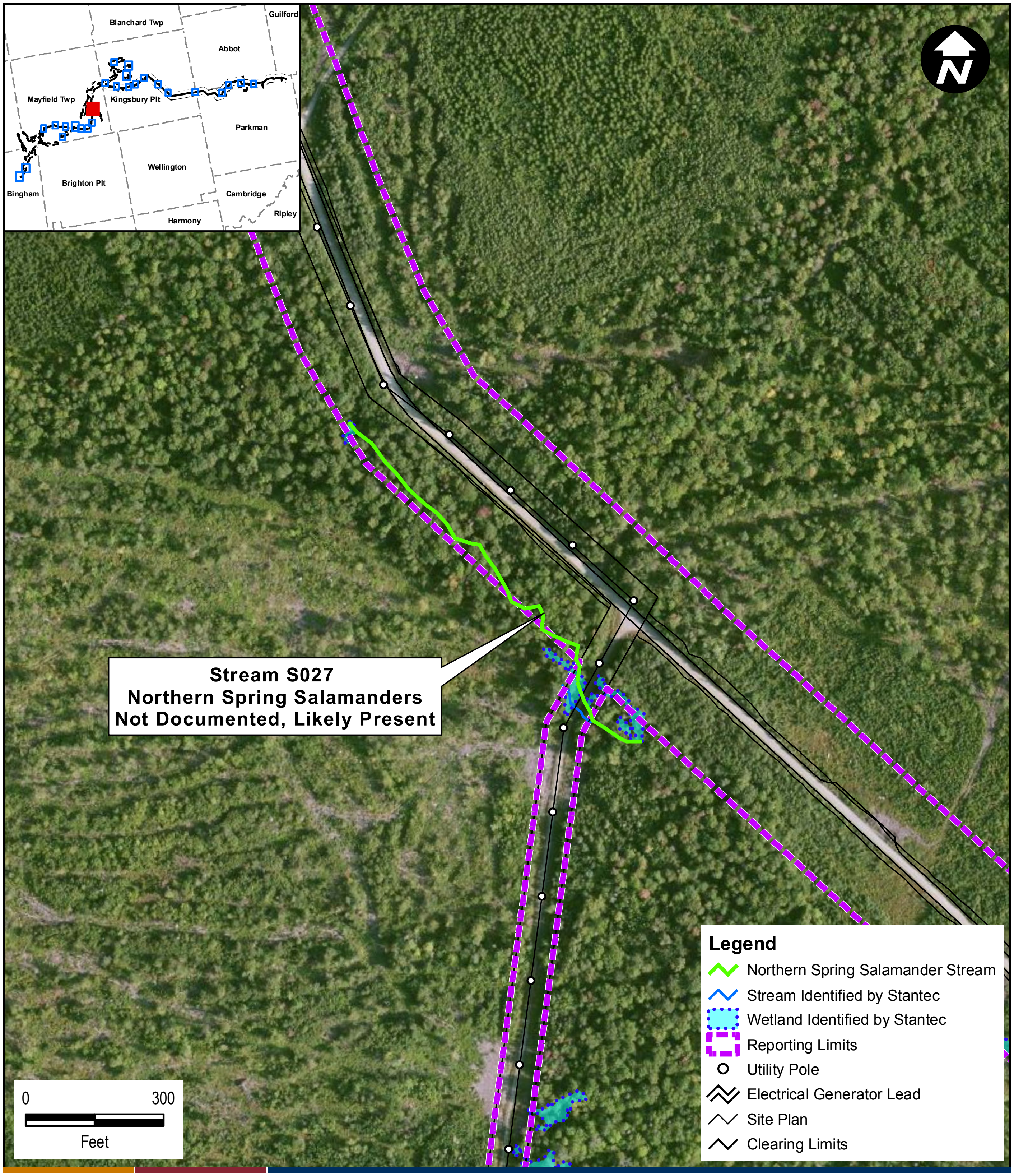
Figure No.
3

Title
Northern Spring Salamander Survey Location

4/9/2013



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Client/Project
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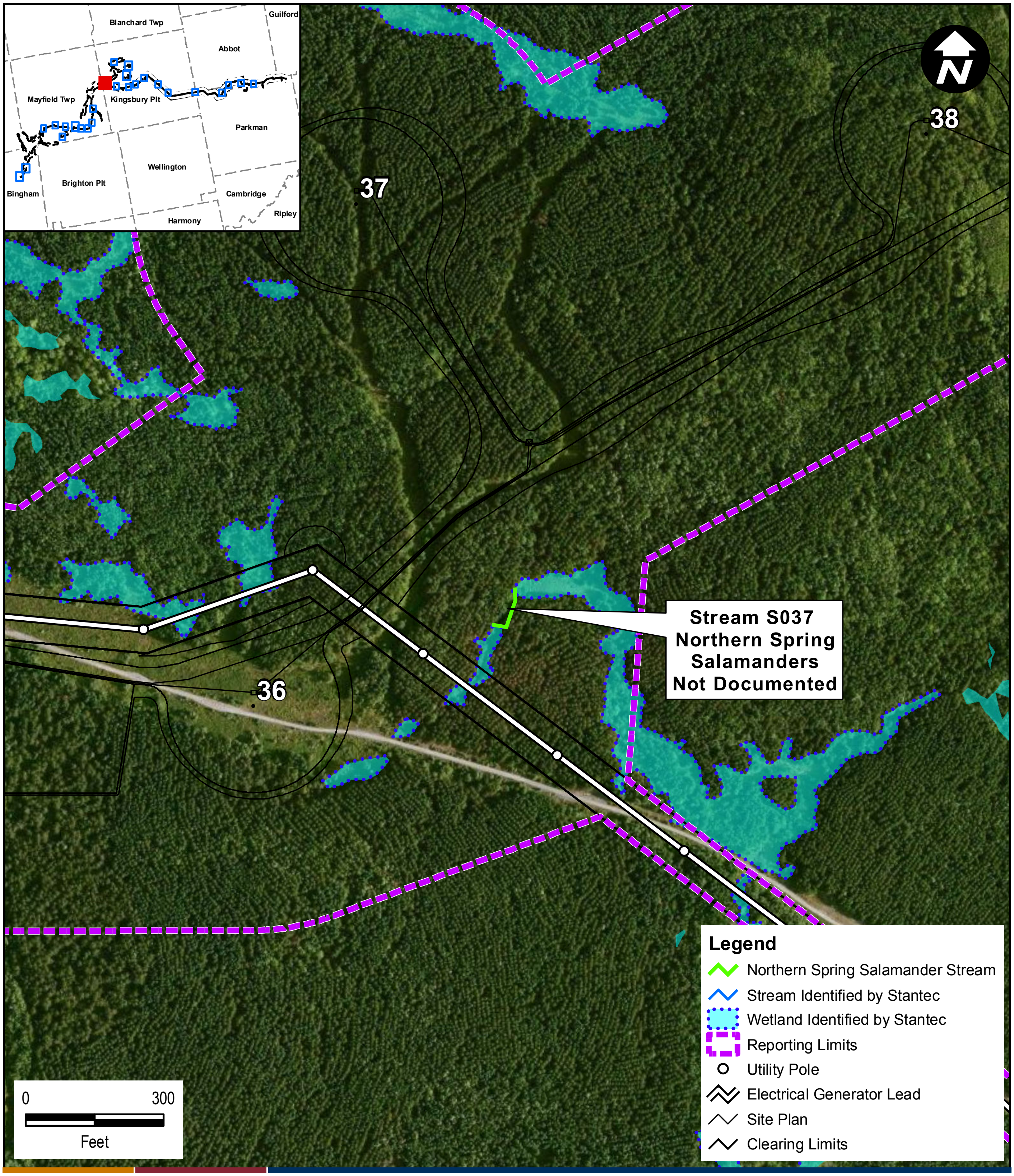
Figure No.
4

Title
Northern Spring Salamander Survey Location

4/9/2013



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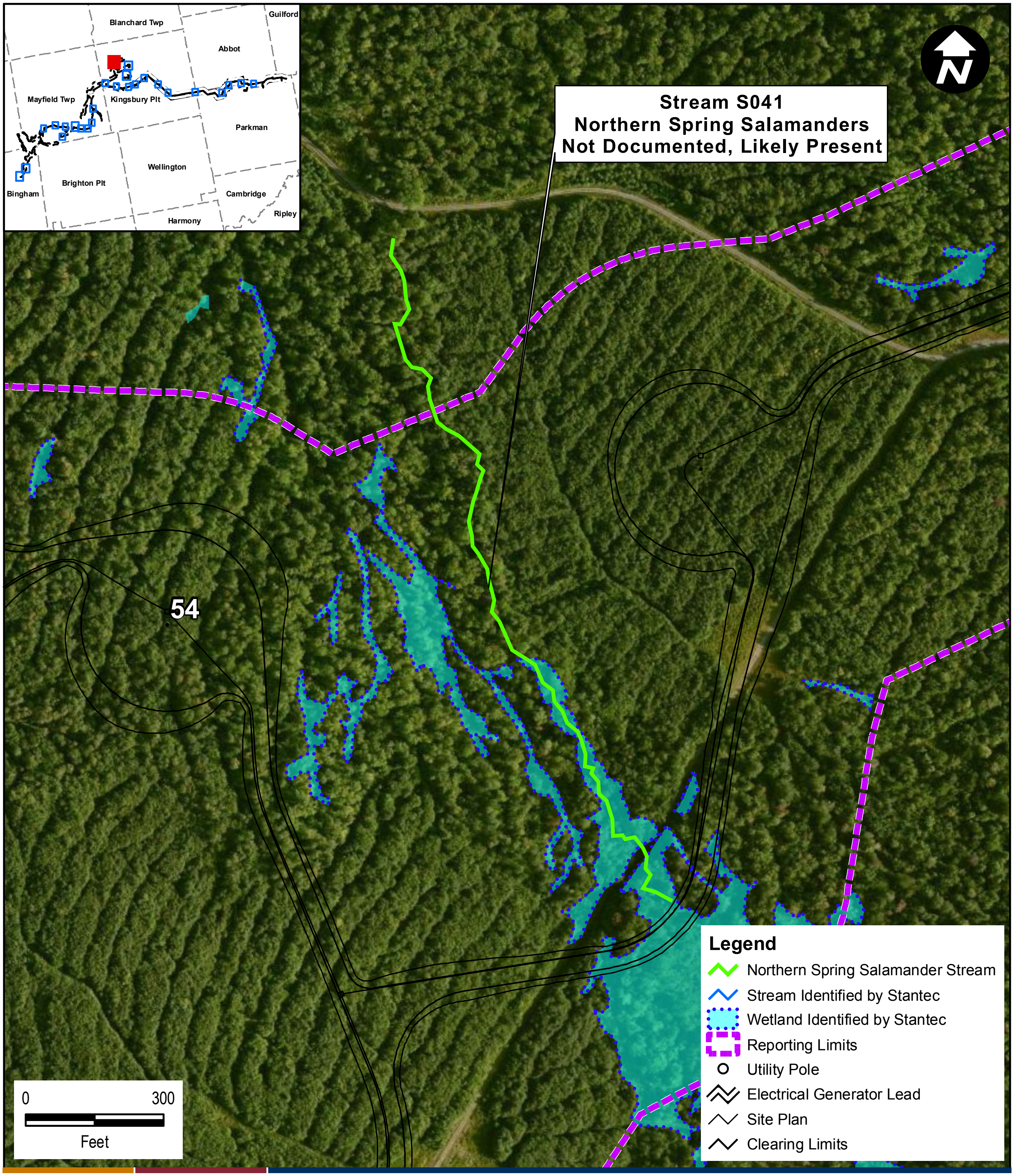
Bingham Wind Project

Figure No.
5

Title
Northern Spring Salamander Survey Location

4/9/2013



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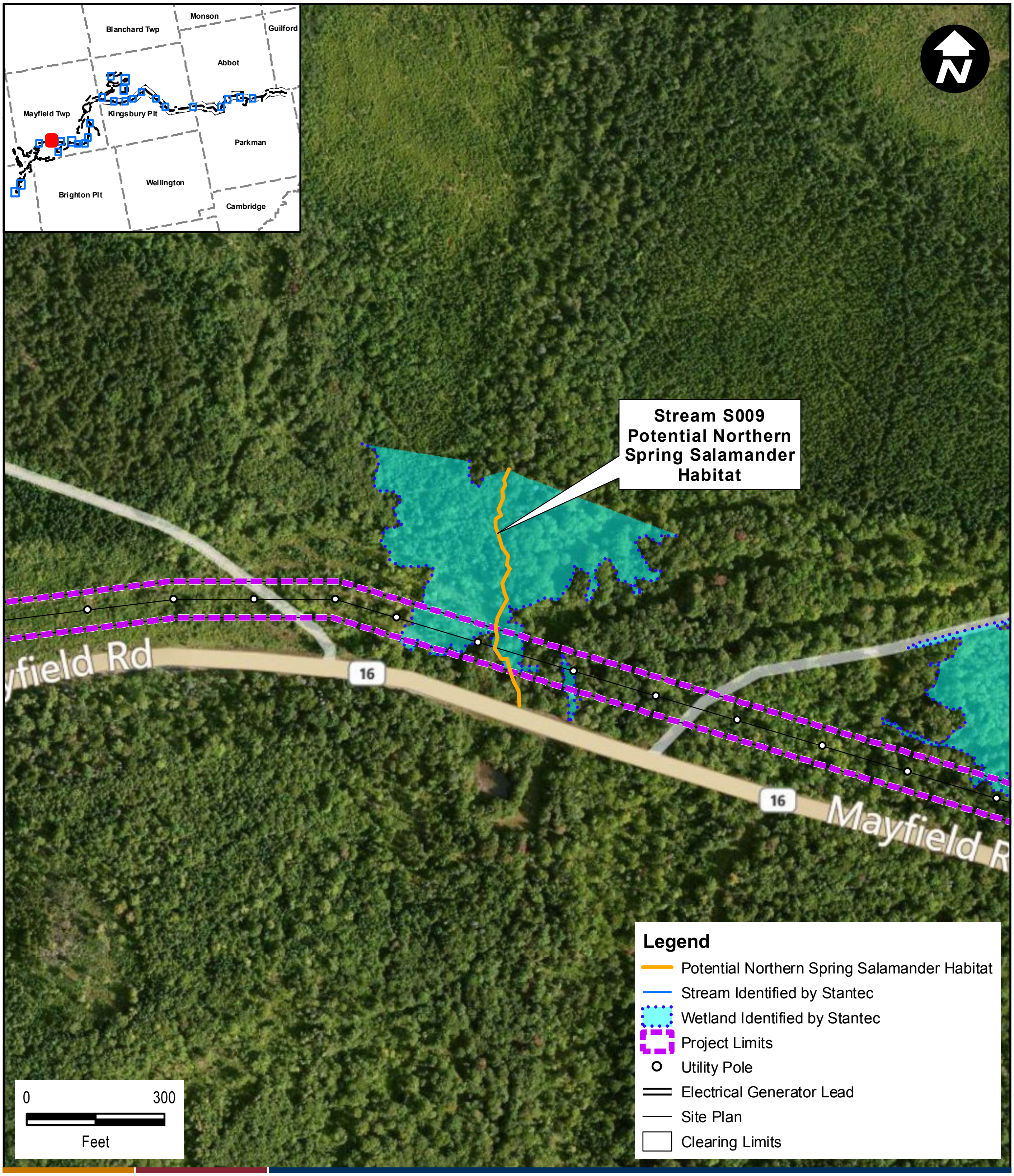
Bingham Wind Project

Figure No.
6

Title
Northern Spring Salamander Survey Location

4/9/2013



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Client/Project
Bingham Wind Project

Figure No.
7

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd

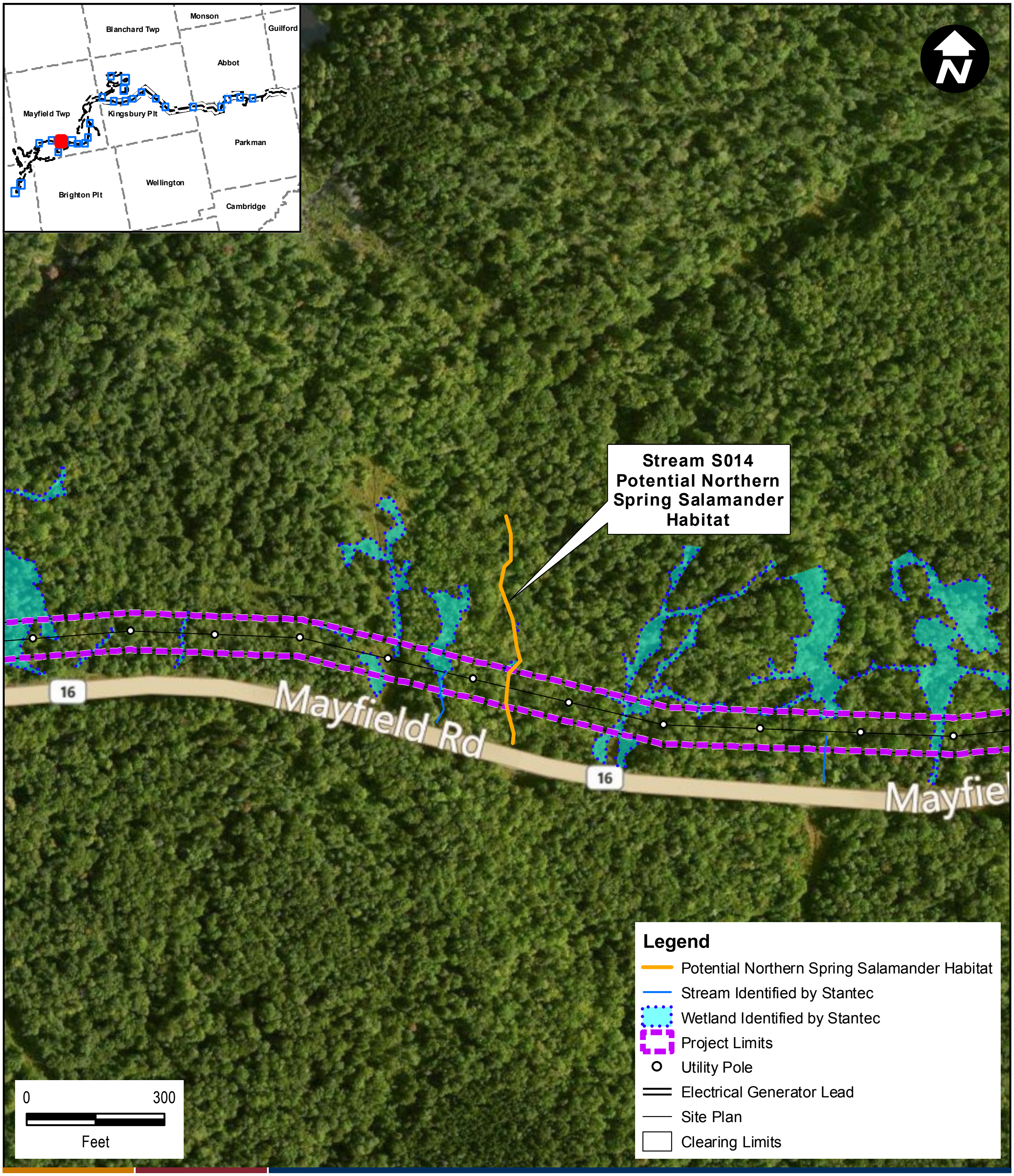

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Figure No.
8

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd

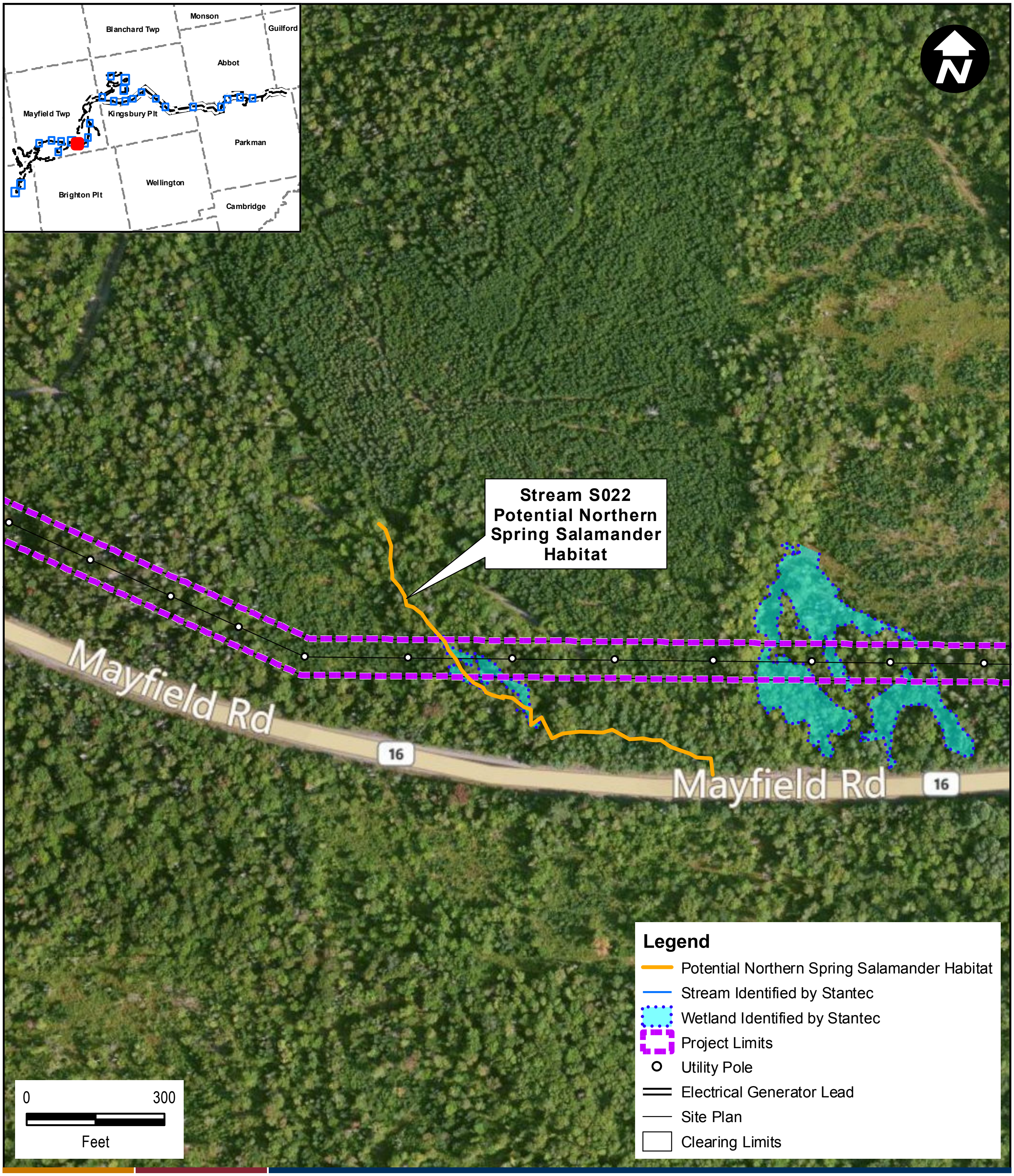

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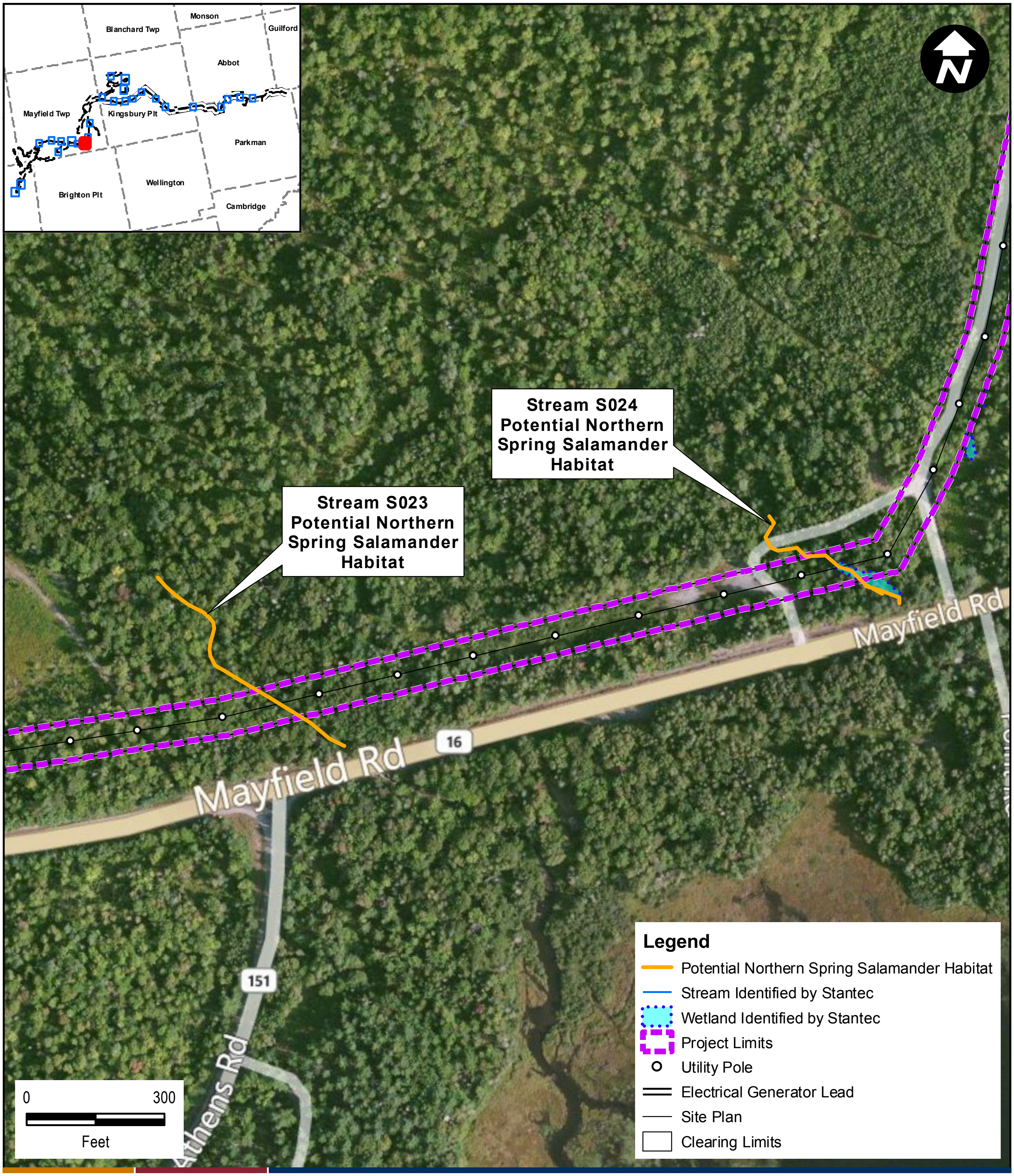
Figure No.
9

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd



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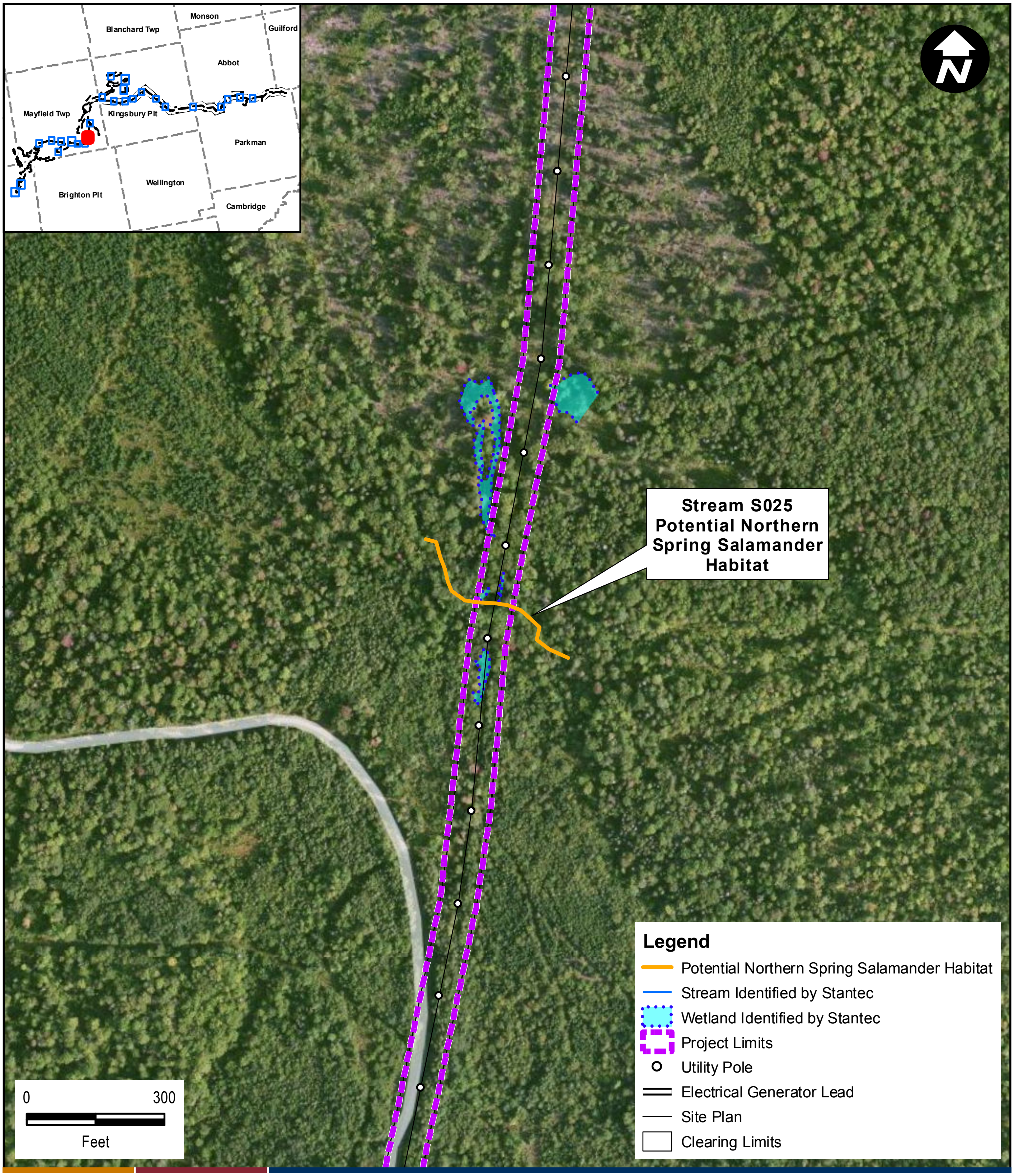
Bingham Wind Project

Figure No.
10

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd



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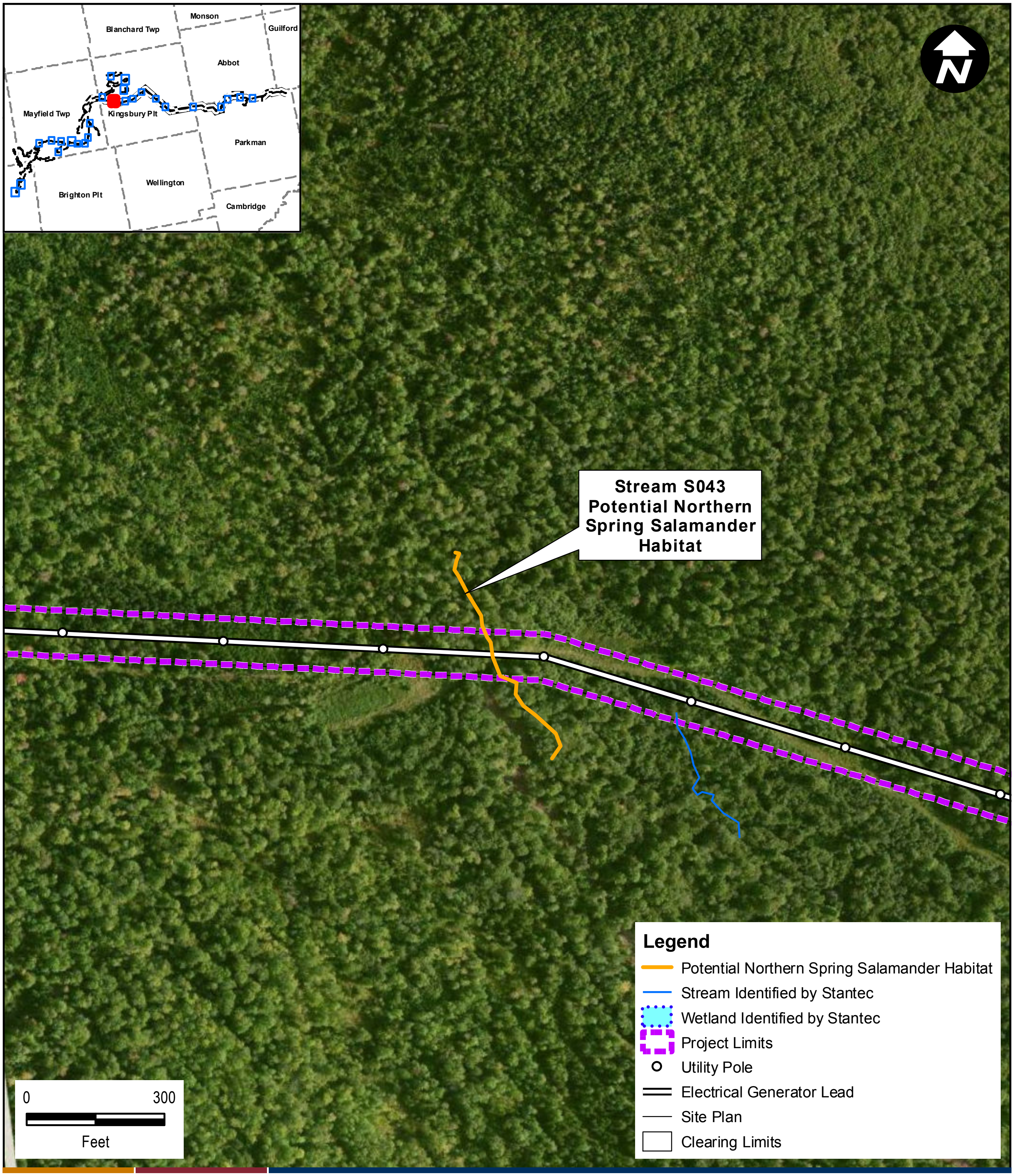
Client/Project
Bingham Wind Project

Figure No.
11

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd



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Bingham Wind Project

Figure No.
12

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd

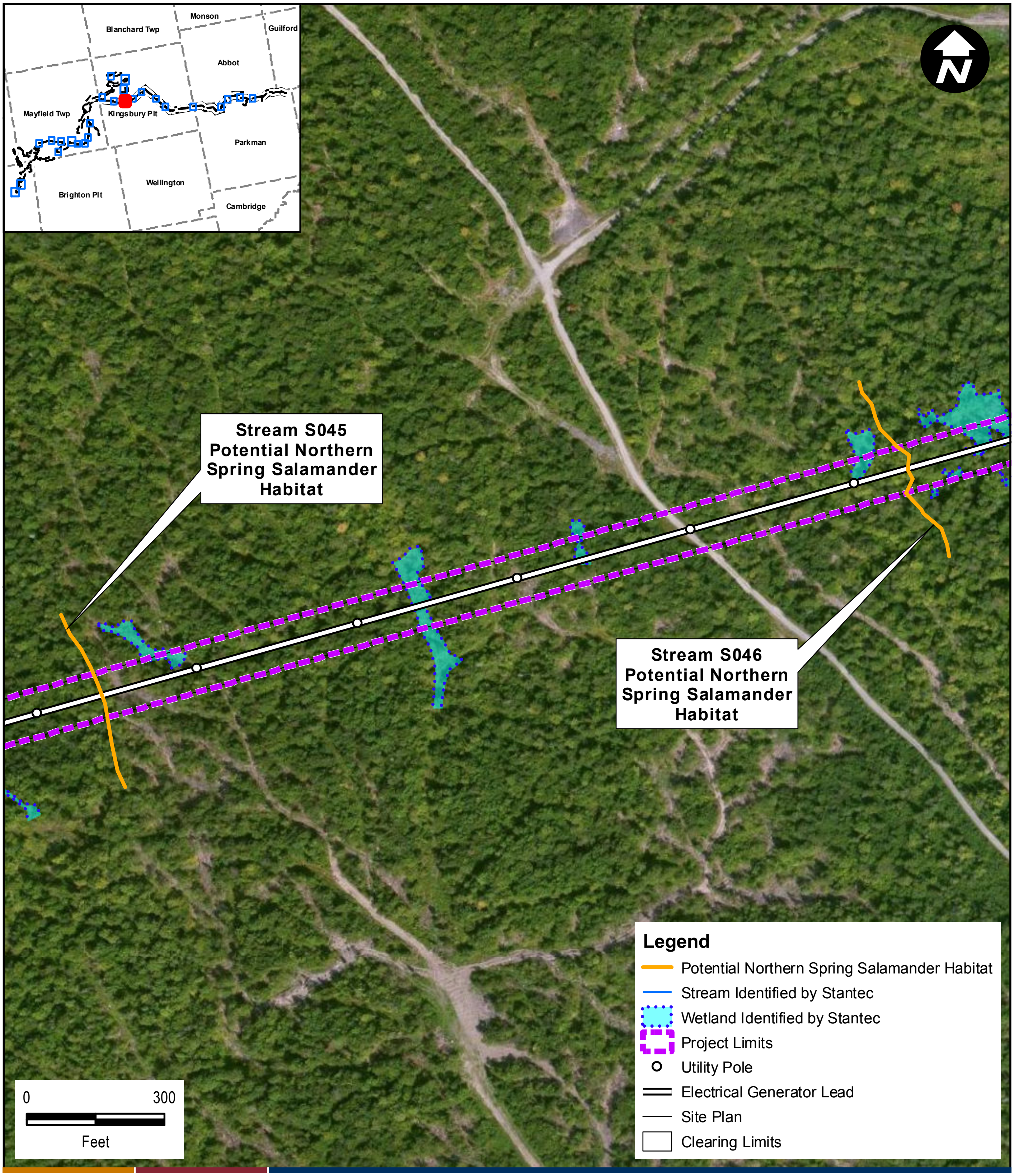

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Figure No.
13

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd

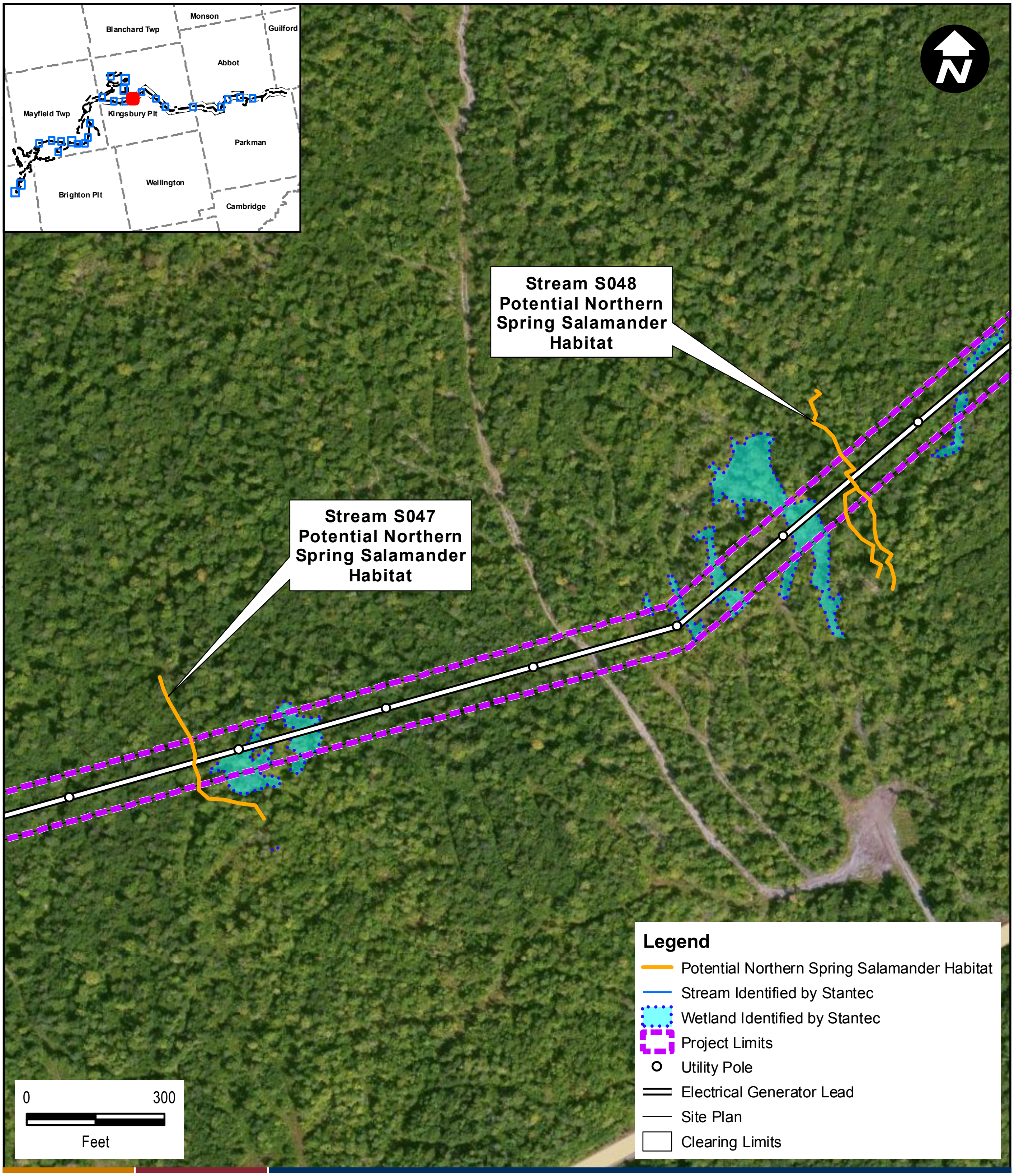

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Figure No.
14

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd

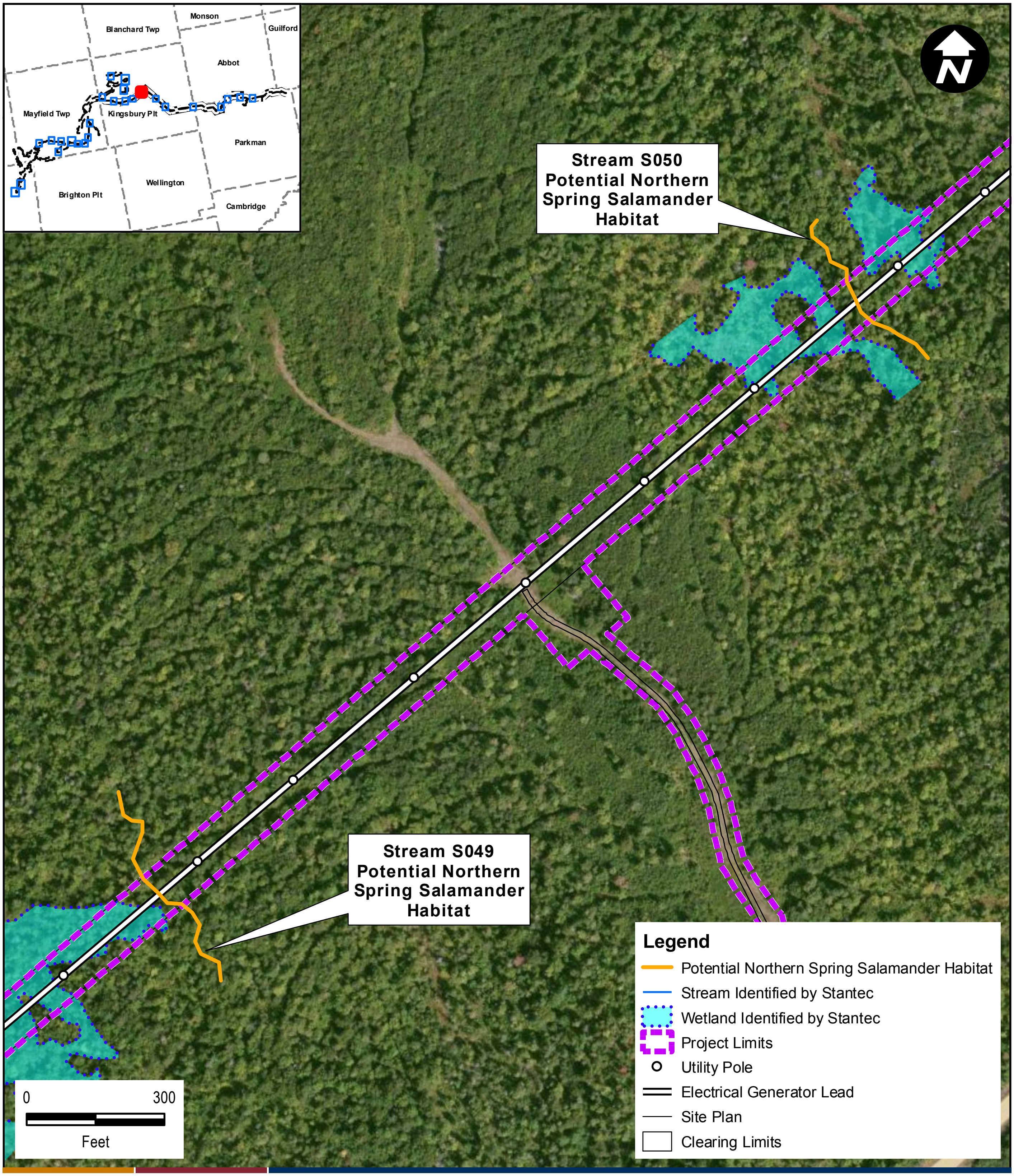

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Figure No.
15

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd

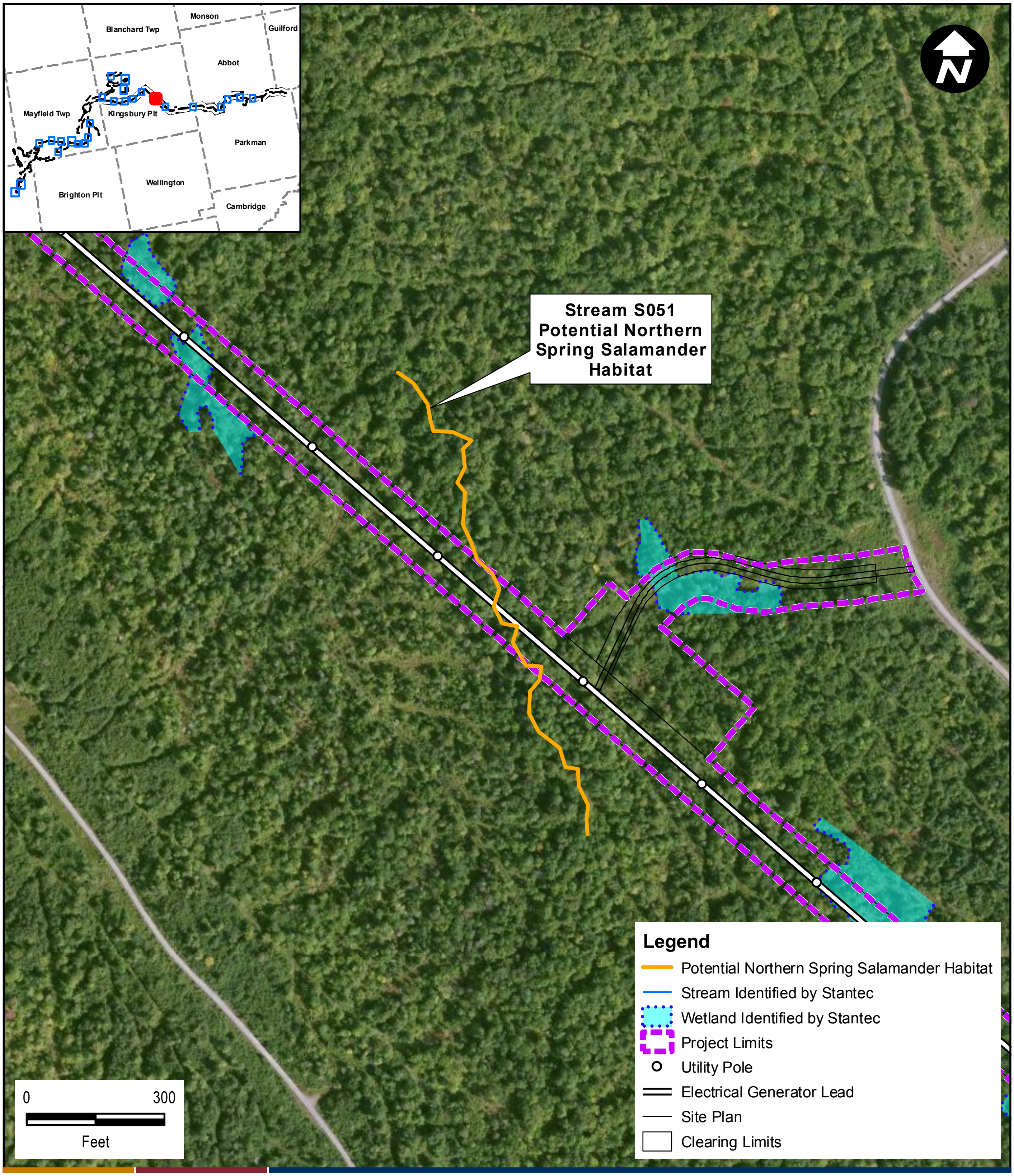

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Figure No.
16

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd

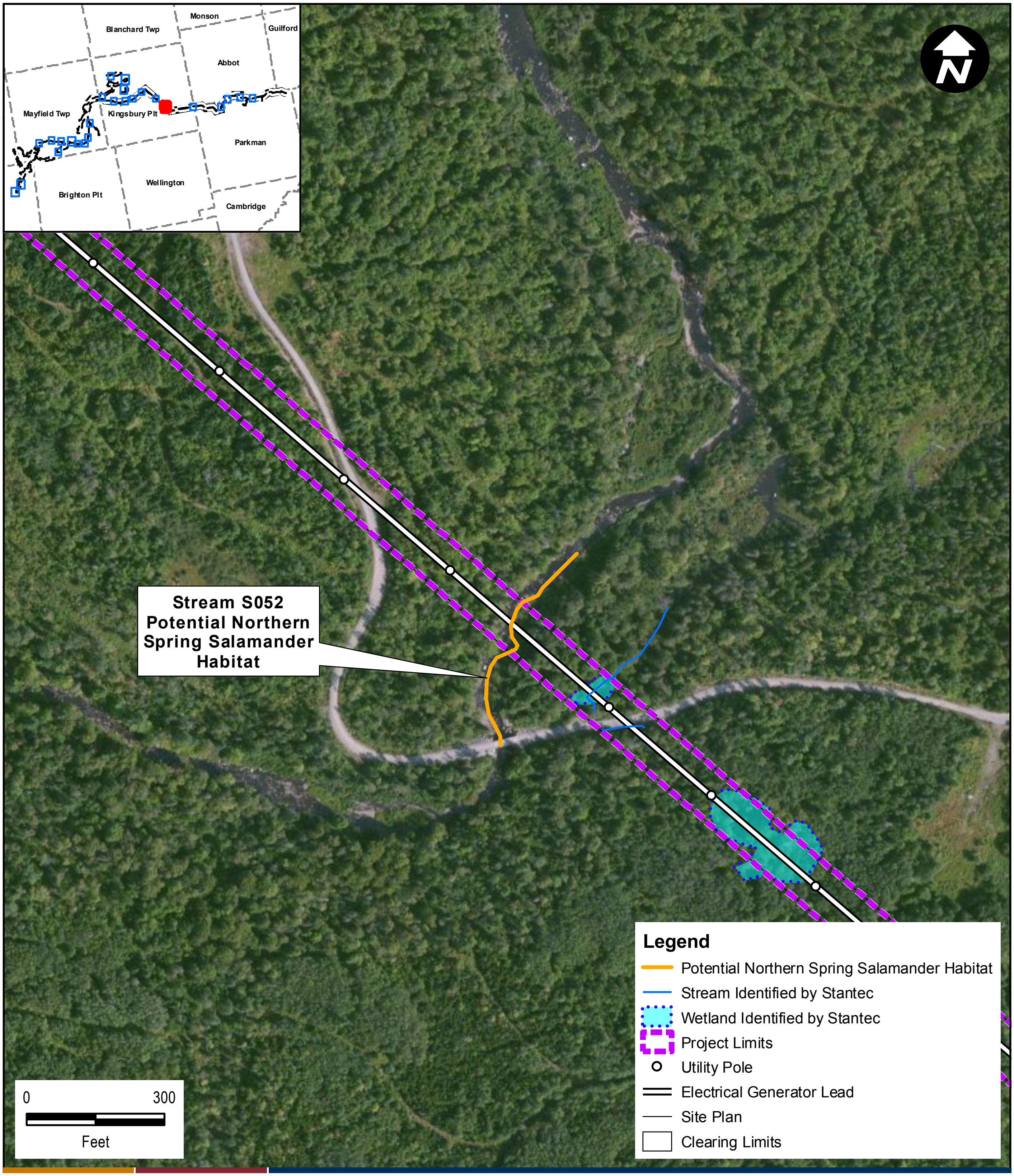

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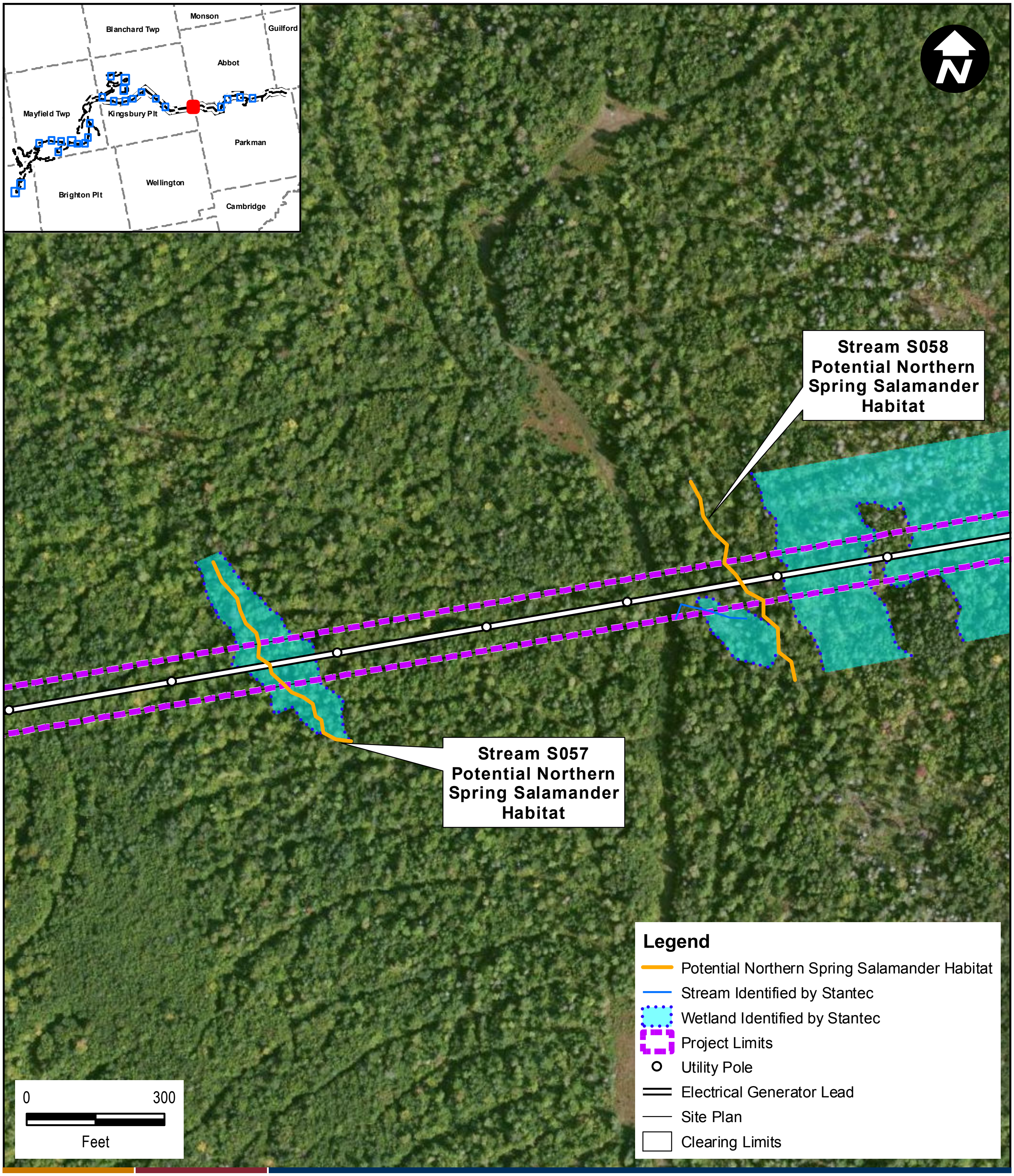
Figure No.
17

Title
Potential Northern Spring Salamander Habitat Location

4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd



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Bingham Wind Project

Figure No.
18

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd

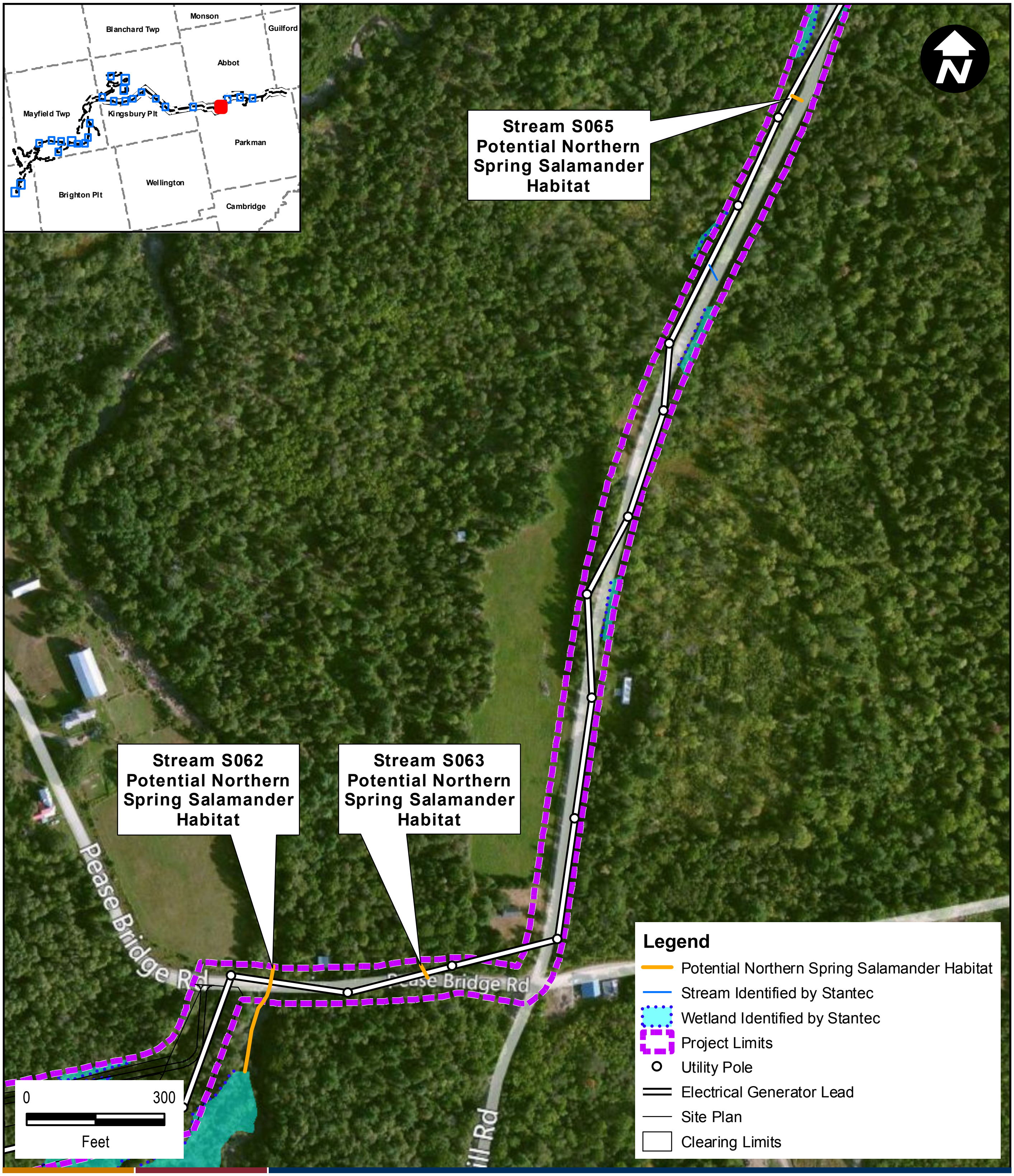

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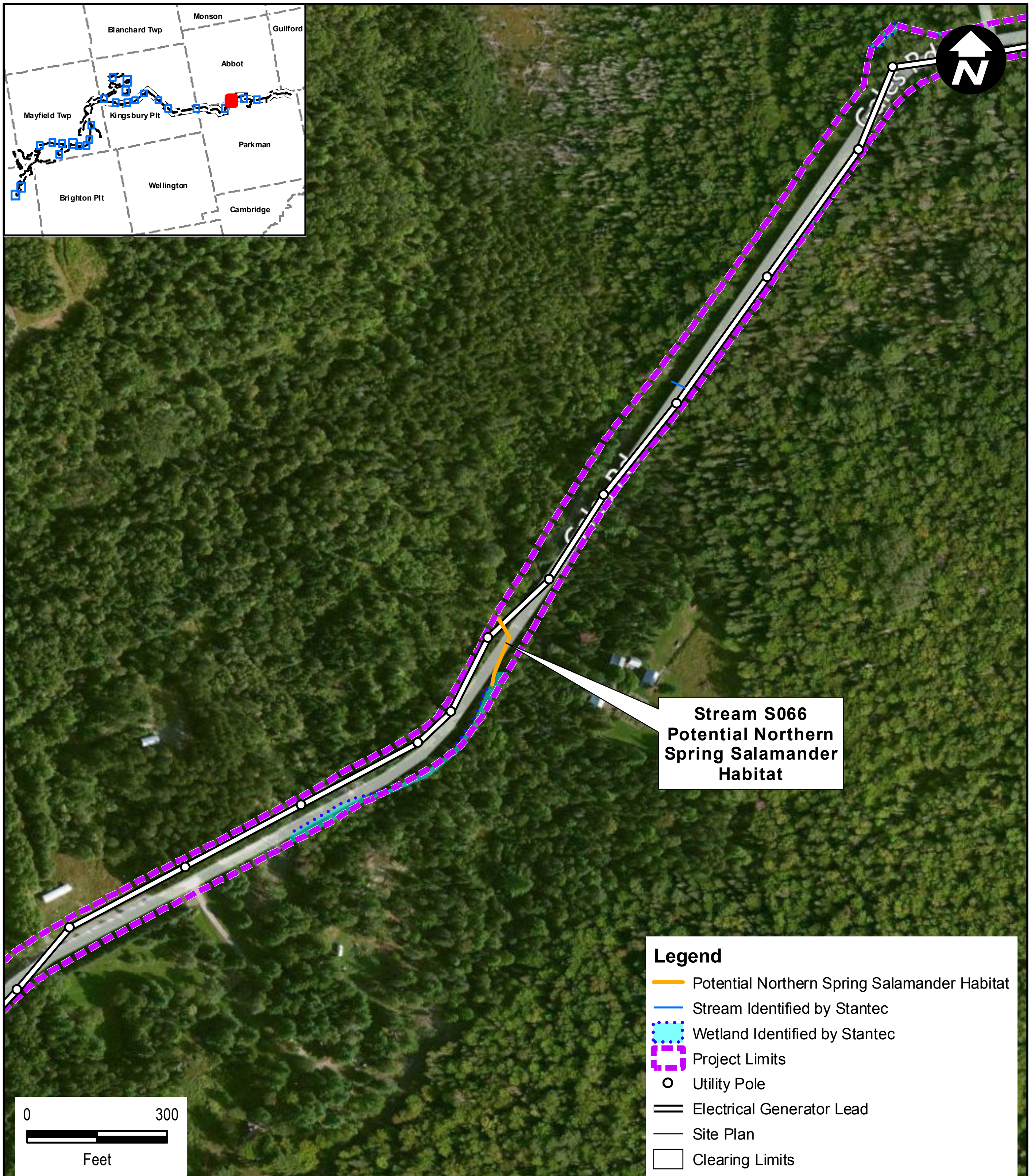
Figure No.
19

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd



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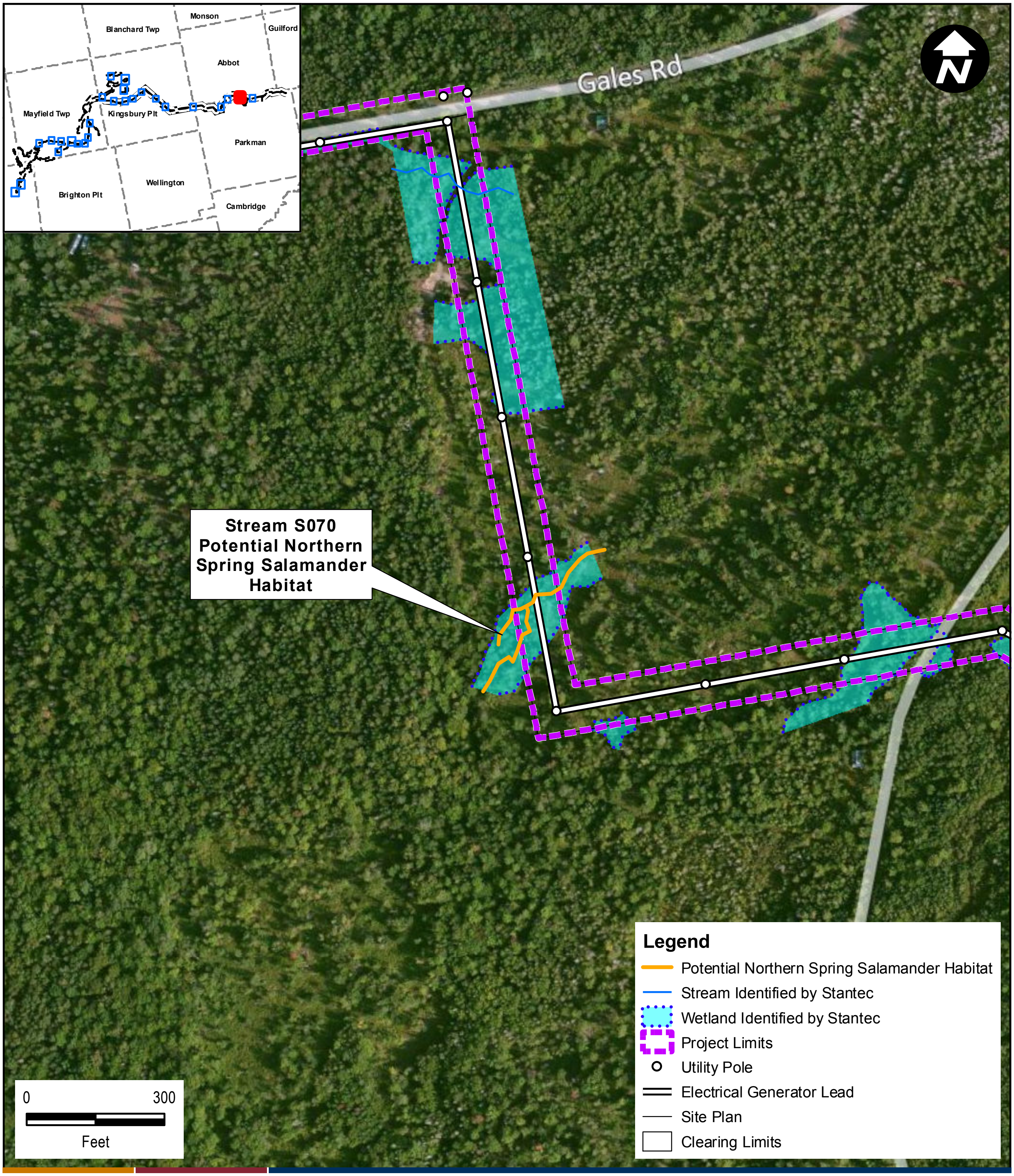
Bingham Wind Project

Figure No.
20

Title
Potential Northern Spring Salamander Habitat Location

4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd



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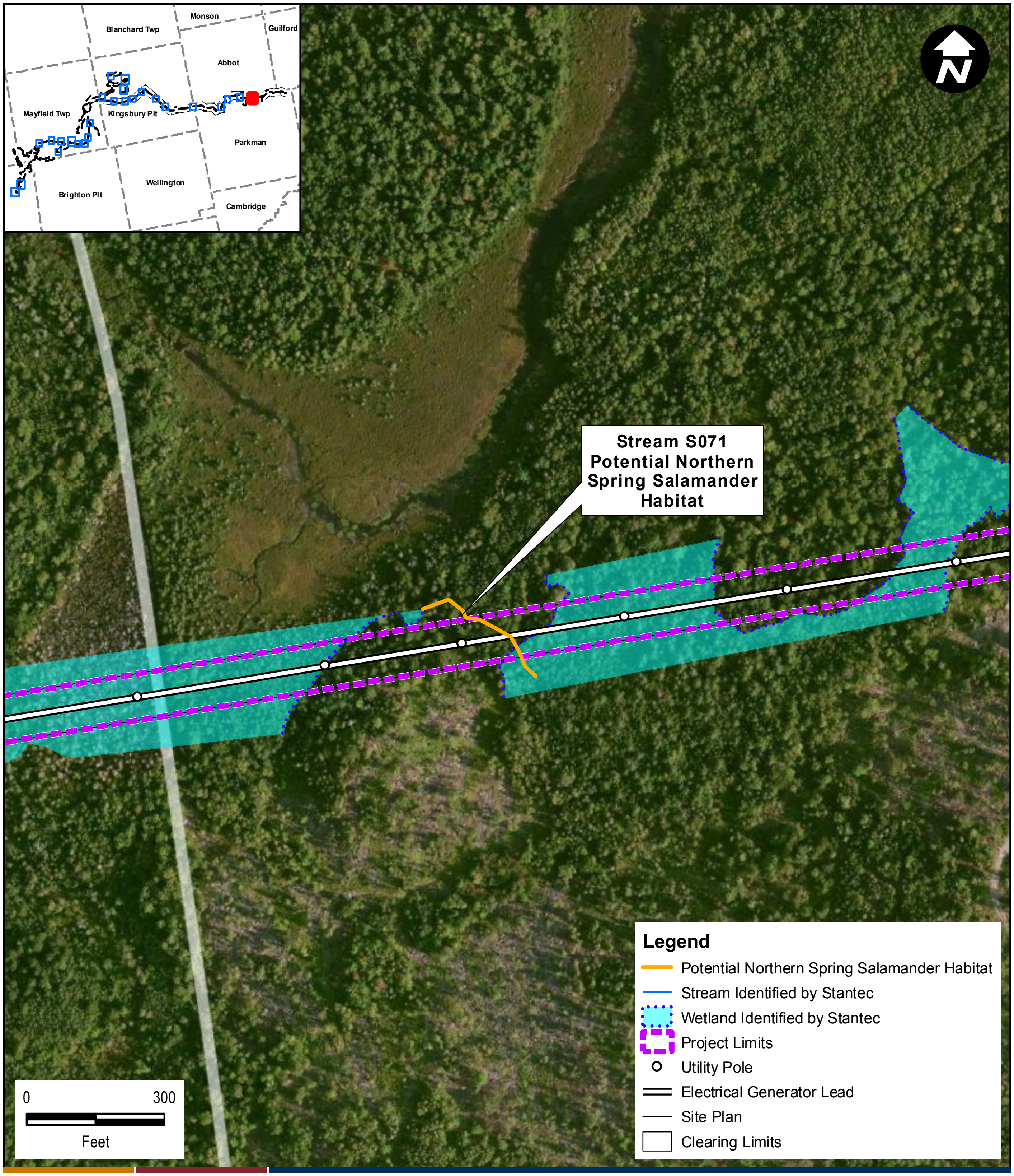
Bingham Wind Project

Figure No.
21

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd



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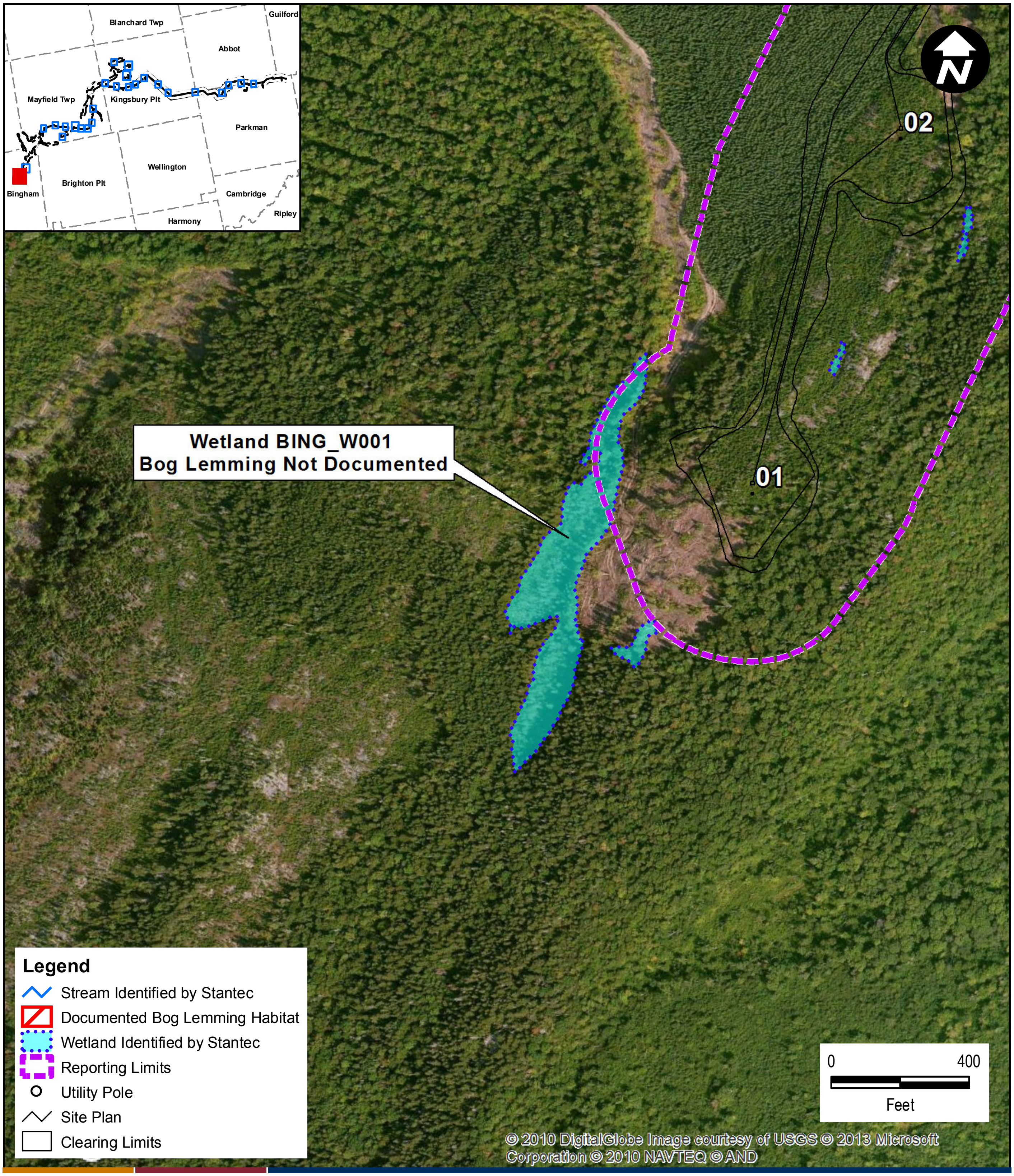
Bingham Wind Project

Figure No.
22

Title
Potential Northern Spring Salamander Habitat Location
4/3/2013

00539_000_PotentialNorthernSpringSalamander.mxd



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00539_000_Northern_Bog_Lemming_MapBook

Note:
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Bingham Wind Project

Figure No.
23

Title
Northern Bog Lemming Survey Location

4/10/2013

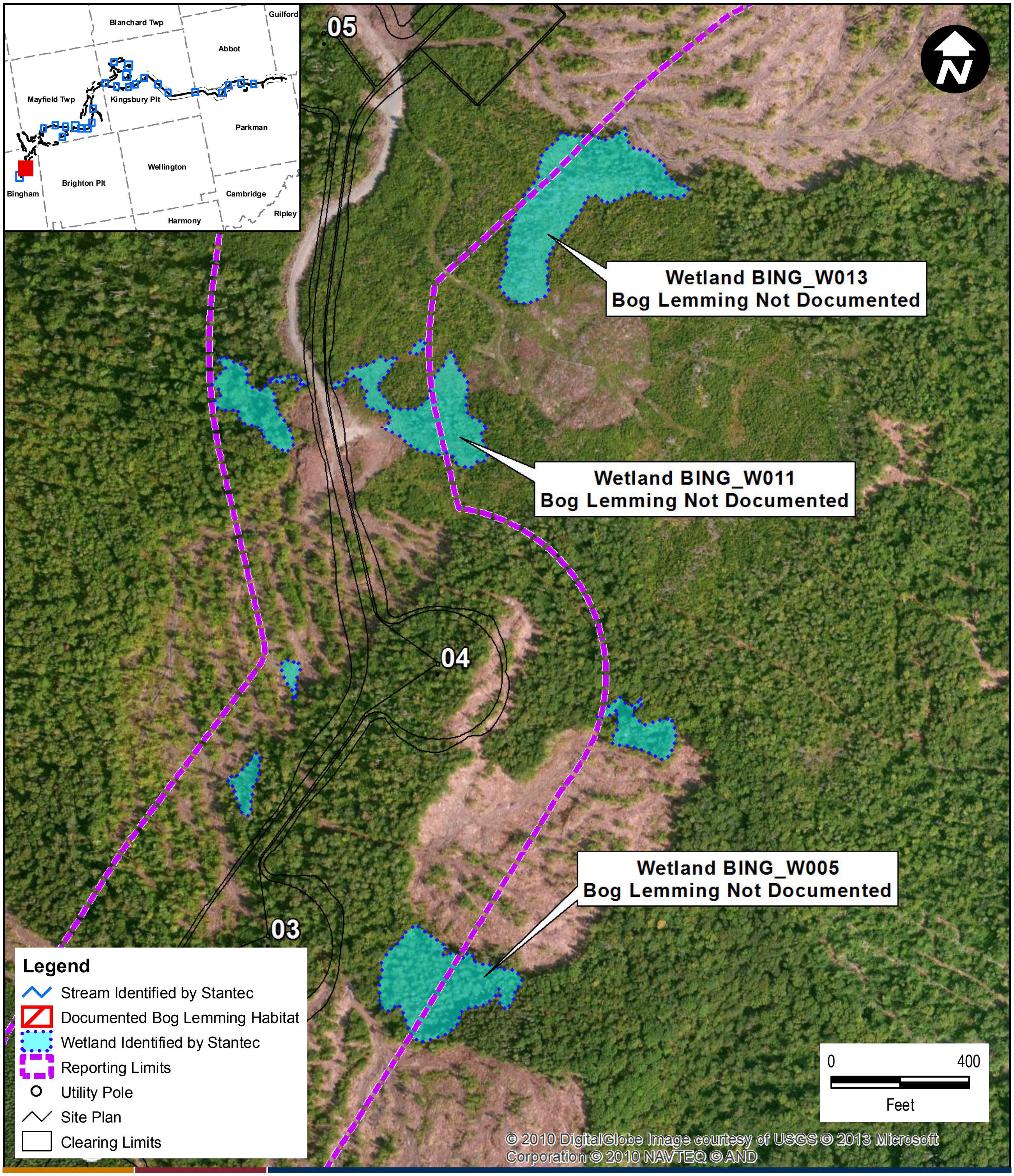

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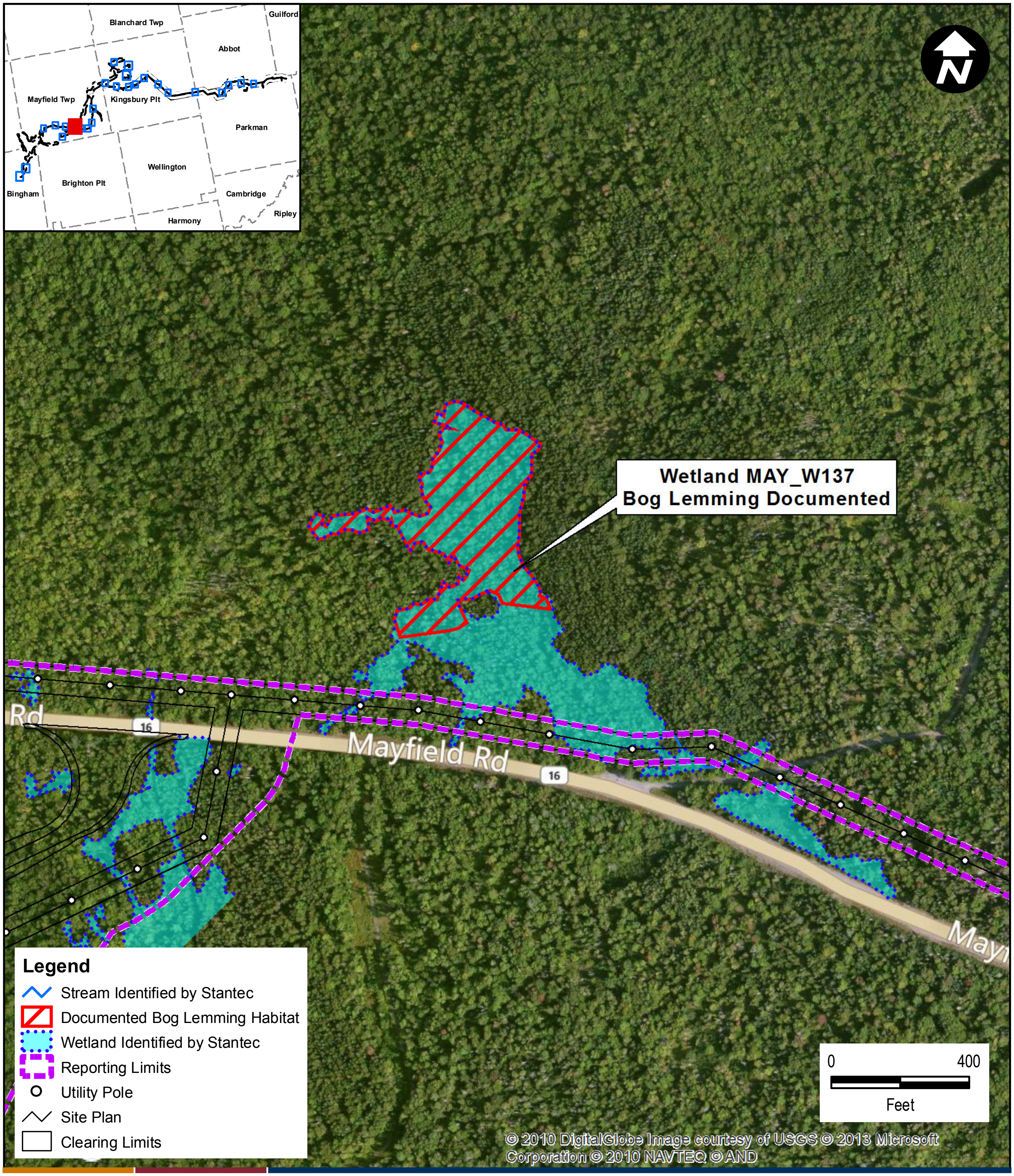
Figure No.
24

Title
Northern Bog Lemming Survey Location

4/10/2013

00539_000_Northern_Bog_Lemming_MapBook



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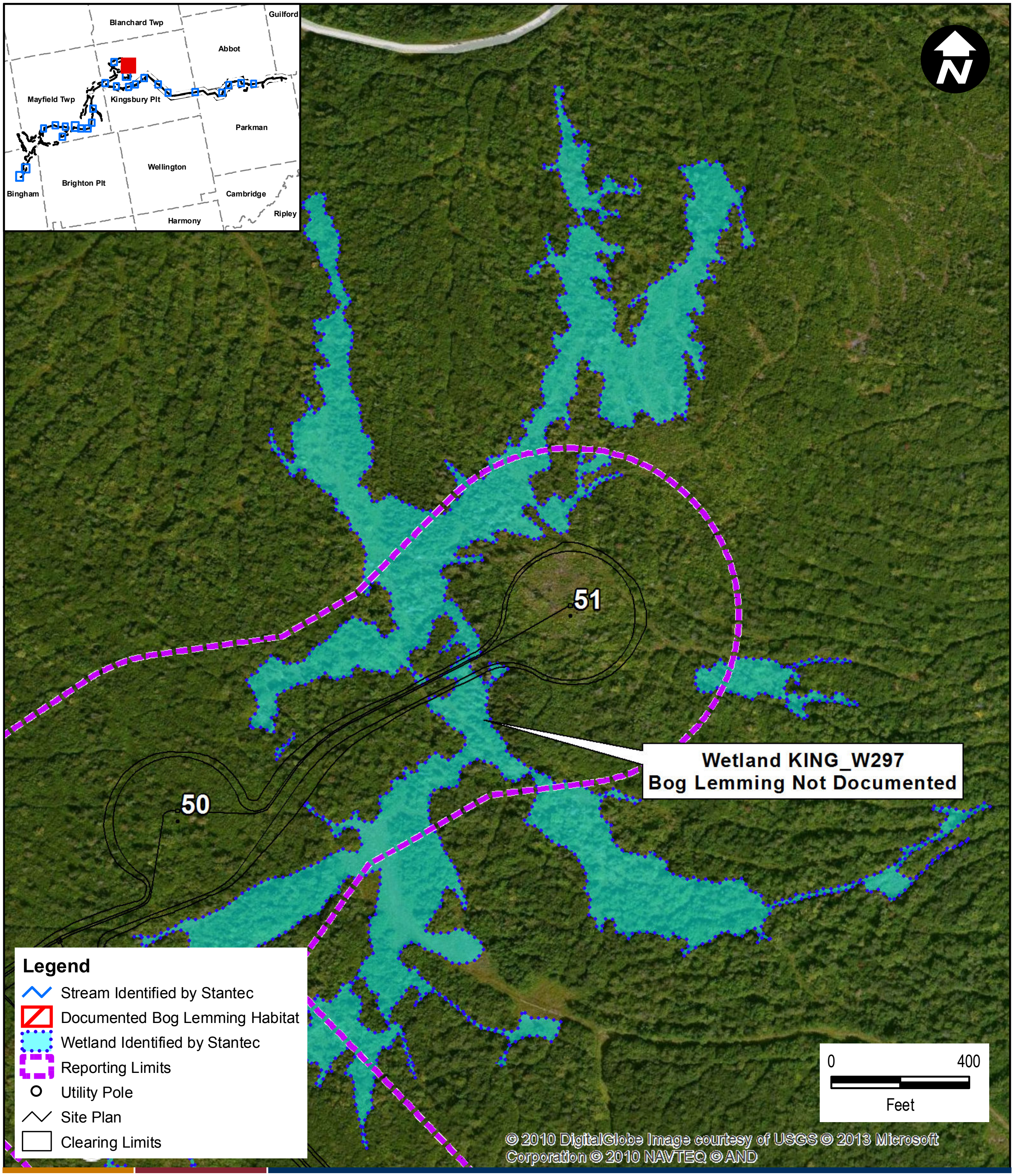
Client/Project
Bingham Wind Project

Figure No.
25

Title
Northern Bog Lemming Survey Location

4/10/2013

00539_000_Northern_Bog_Lemming_MapBook



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00539_000_Northern_Bog_Lemming_MapBook

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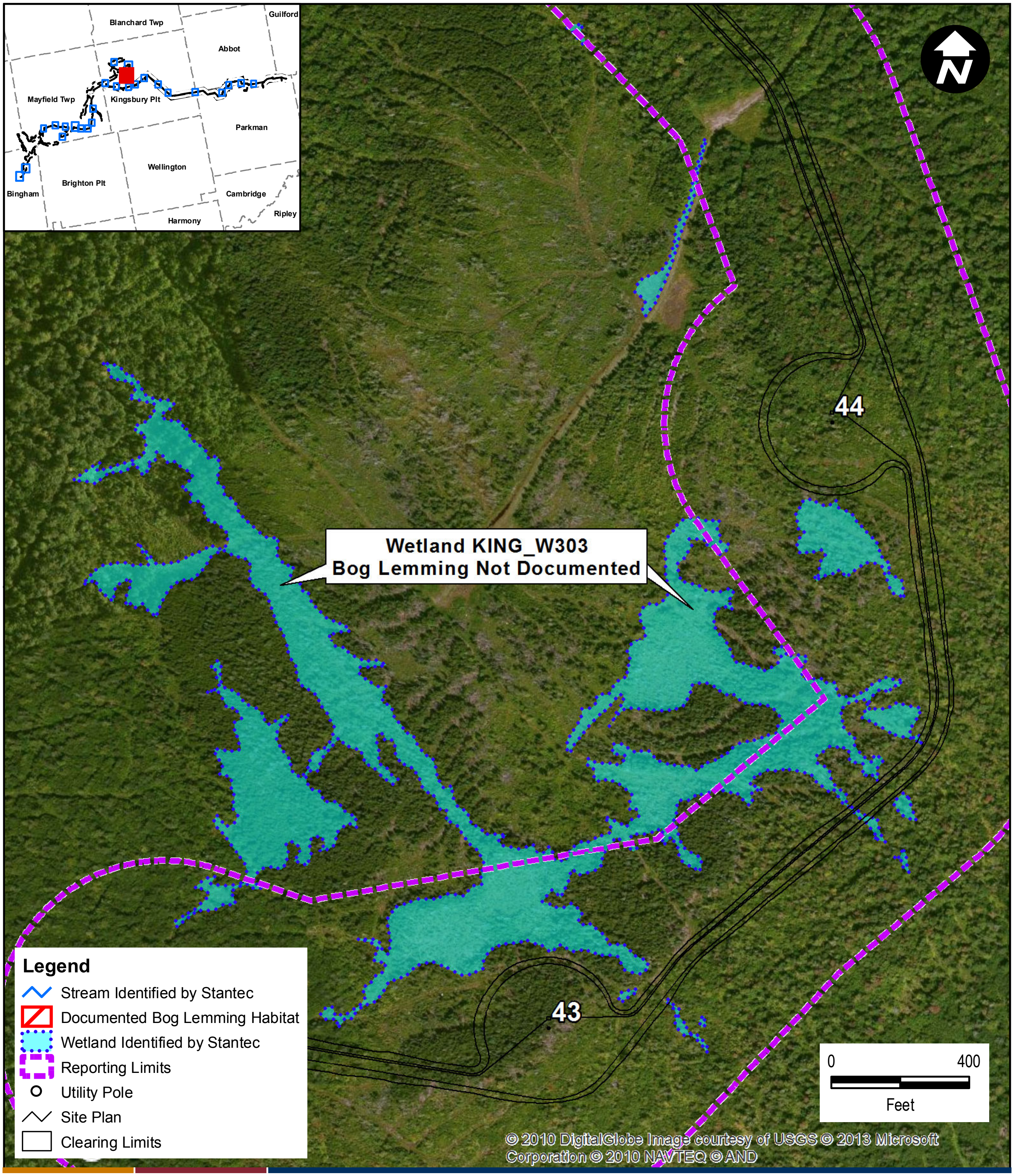
Client/Project
Bingham Wind Project

Figure No.
26

Title
Northern Bog Lemming Survey Location

4/10/2013



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00539_000_Northern_Bog_Lemming_MapBook

Note:
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Client/Project
Bingham Wind Project

Figure No.
27

Title
Northern Bog Lemming Survey Location

4/10/2013

APPENDIX A

REPRESENTATIVE PHOTOGRAPHS

Photo 1: Stream S007 surveyed habitat. No northern spring salamanders documented. Stantec Consulting, September 27, 2010.

Photo 2: Stream S027 surveyed habitat. No northern spring salamanders documented. Stantec Consulting, September 28, 2010.

Photo 3: Stream S027 potential northern spring salamander habitat. No targeted species specific surveys conducted in this portion of stream, which was delineated after RTE surveys were completed. Stantec Consulting, October 3, 2012.

Photo 4: Stream S041 surveyed habitat. Good potential habitat, but no northern spring salamanders documented. Stantec Consulting, September 13, 2011.

Photo 5:Stream S037 habitat. No northern spring salamanders documented. Stantec Consulting, September 13, 2011.

Photo 6: Stream S021 habitat. Northern spring salamanders documented. Stantec Consulting, September 15, 2011.

Photo 7: Stream S009 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, October 1, 2012.

Photo 8: Stream S014 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, October 2, 2012.

Photo 9: Stream S022 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, October 3, 2012.

Photo 10: Stream S023 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, October 4, 2012.

Photo 11: Stream S024 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, October 4, 2012.

Photo 12: Stream S025 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, October 3, 2012.

Photo 13: Stream S043 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, November 10, 2010.

Photo 14: Stream S045 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, November 10, 2010.

Photo 15: Stream S046 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, November 10, 2010.

Photo 16: Stream S047 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, November 10, 2010.

Photo 17: Stream S048 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, November 11, 2010.

Photo 18: Stream S049 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, November 11, 2010.

Photo 19: Stream S50 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, November 11, 2010.

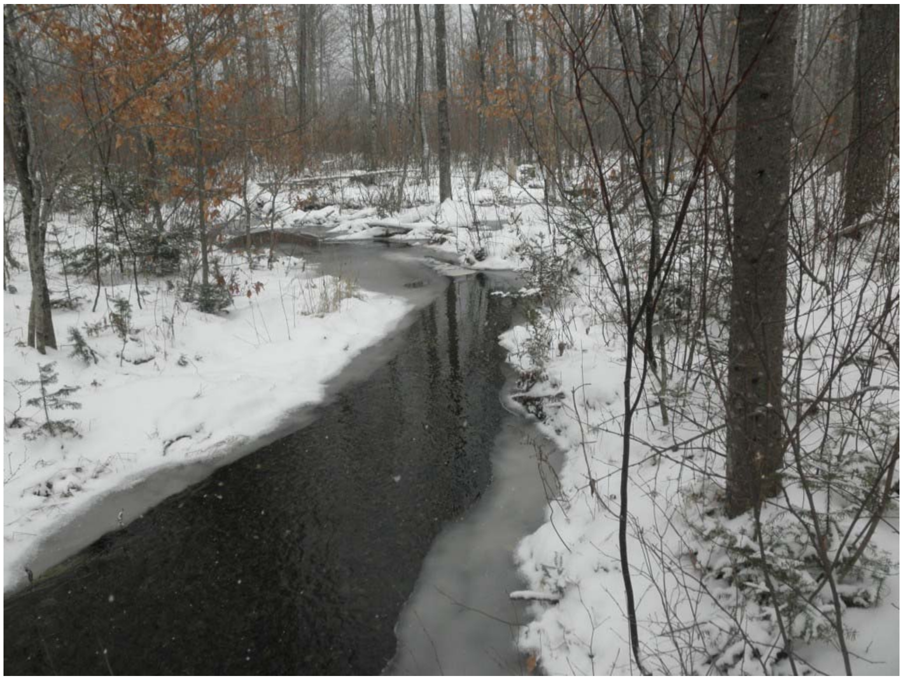


Photo 20: Stream S051 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, December 6, 2010.

Photo 21: Stream S052, Kingsbury Stream, potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, May 19, 2010.

Photo 22: Stream S057 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, December 9, 2010.

Photo 23: Stream S058 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, December 17, 2010.

Photo 24: Stream S062, Carlton Stream, potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, January 31, 2013.

Photo 25: Stream S063 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, January 31, 2013.

Photo 26: Stream S065 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, January 30, 2013.

Photo 27: Stream S066 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, January 30, 2013.

Photo 28: Stream S70 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, December 12, 2012.

Photo 29: Stream S071 potential northern spring salamander habitat. No targeted species specific surveys conducted in this stream. Stantec Consulting, December 12, 2012.

Photo 30: Wetland MAY_W137 bog lemming habitat with documented bog lemming activity. Stantec Consulting, September 28, 2010.

Photo 31: Bog lemming fecal pellets in Wetland May_W137.
Stantec Consulting, September 28, 2010.

Photo 32: Wetland BING_W001 surveyed potential bog lemming habitat. No bog lemming activity documented. Stantec Consulting, September 29, 2010.

Photo 33: Wetland BING_W005 surveyed potential bog lemming habitat. No bog lemming activity documented. Stantec Consulting, September 29, 2010.

Photo 34: Wetland BING_W013 surveyed potential bog lemming habitat. No bog lemming activity documented. Stantec Consulting, September 29, 2010.

Photo 35: Wetland BING_W011 surveyed potential bog lemming habitat. No bog lemming activity documented. Stantec Consulting, September 29, 2010.

Photo 36: Wetland KING_W303 surveyed potential bog lemming habitat. No bog lemming activity documented. Stantec Consulting, September 14, 2011.

Photo 37: Wetland KING_W297 surveyed potential bog lemming habitat. No bog lemming activity documented. Stantec Consulting, September 14, 2011.

APPENDIX B

Rare Animal Data Forms

INSTRUCTIONS: Complete 1 form per visit. **Grayed sections are for Heritage office use only**. rev. 02/06/2008

RARE ANIMAL SURVEY FORM

MDIFW
650 State St.
Bangor, ME
04401

Completed By: Matt Arsenault **Date**: 11/15/11 Review by (MDIFW): Date:

SURVEYSITE: unnamed stream, Johnson Mtn	**TOWNSHIP**: Mayfield Township
NEW EO (check): / UPDATE (check): / (EO NUM:)	**DELORME PAGE & GRID (e.g. 04B2):** **31C1**

ELEMENT INFORMATION

Common Name: Northern spring salamander **Scientific Name**: Gyrinophilus porphyriticus

SURVEYOR INFORMATION

Survey date (2011 – 09 – 15): Time from: 9:00 to: 9:30 **am** Sourcecode: F

Surveyors (principal surveyor first, include first & last name and contact information): Matt Arsenault, Michael Johnson – Stantec Consulting, 30 Park Drive Topsham, ME 04086 (207) 729-1199, matt.arsenault@stantec.com

IDENTIFICATION

Photograph/slide taken? Yes__ No X Notes & repository:

Specimen collected? Yes__ No X Specimen # and repository:

Identification problems? Yes__ No X Explain:

ELEMENT OCCURRENCE INFORMATION

1. Type of Observation: sight X vocalization__ handled__ collected__ other (explain):
2. Observed Abundance (incl. age and sex): 1 adult, sex not determined
3. Estimated Abundance (and basis for estimate): unknown
4. Evidence of Reproduction and/or Other Behaviors:
5. Misc. Notes:

HABITAT DESCRIPTION

Describe the specific habitat or micro-habitats where this animal occurs. Convey a mental image of the habitat and its features including: land forms, aquatic features, vegetation, slope, aspect, soils, associated plant and animal species, natural disturbances.

The stream is a small, sparsely vegetated, flashy perennial stream with a low- to moderate-gradient and a rock-cobble-gravel-sand substrate. At the time of the field survey, the wetted width of the stream ranged between 3 and 4 feet wide with a bankfull width to 5 feet. The flow was approximately 5 to 6 inches per second with a depth averaging between 3 and 6 inches.

EO located under partially exposed rock along side of stream

THREATS AND/OR MANAGEMENT CONCERNS:

DIRECTIONS

Provide detailed directions to this element occurrence (versus the survey site) using a readily locatable and relatively permanent landmark as a starting point. Refer to nearby landmarks, roads and villages. Include distances, compass directions (North, South etc.).

Use aerial photos to navigate. From intersection of Route 16 and 151 in Mayfield, head west on Rt. 16 up large hill. Continue shortly after top of hill and look for an obvious, grassy winter logging road on the left (south) side of the road. Road is passable with ATV but not a vehicle. Park on Rt. 16 and walk up road. At approximately 0.5 miles, head right at the fork down a well-vegetated skid road. Continue south on trail to the end, walk southerly through woods for approximately 500 feet to stream drainage. EO was located downstream in steeper portion of stream

OWNER: (If known, indicate name of owner(s), address and phone number):

LOCATION of OBSERVATION

Source 1: _____0442575_______________ UTM-E _____4993770_______________ UTM-N **NAD** 83

Source 2: _________________________ UTM-E / Lat _________________________ UTM-N / Long **NAD** 83 **/** 27 (circle one)

Coordinates / polygon provide location of:

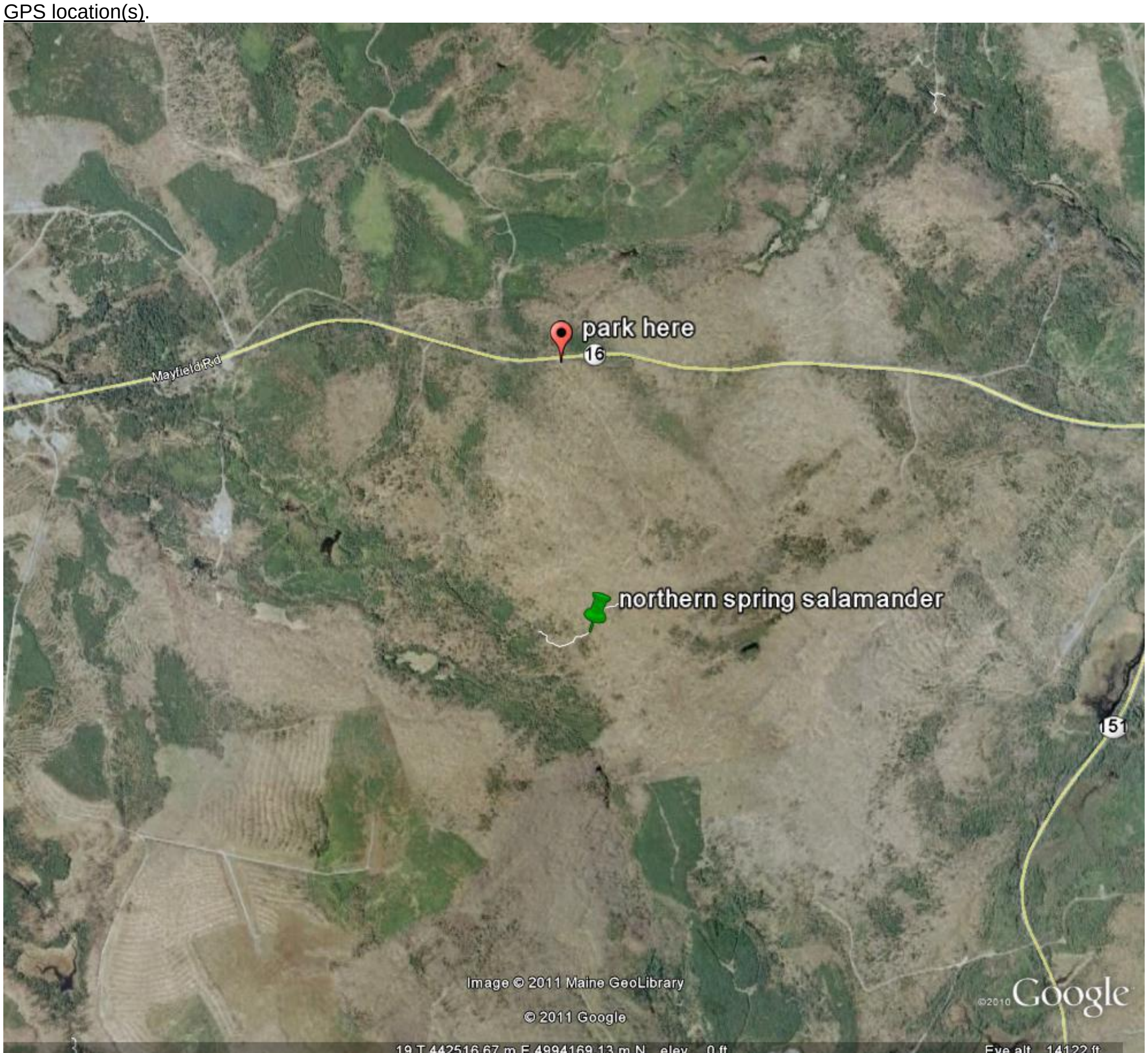
X Animal/habitat feature(s) **OR** ☐ Observer--DISTANCE / DIRECTION to animal/habitat feature: ______ meters / feet at _______°

GPS Unit Information

☐ Differentially corrected X Unit accuracy for location: ±___10______m ☐ # of Satellites = ________ ☐ 2D / 3D

Unit Model ______Garmin eTrex Legend____

LOCATION SKETCH (or attach aerial photograph/photocopied topo) Sketch fine details of an overhead view of this observation that may not be apparent on a topo map. Indicate landmarks, important features, route taken, animal/habitat observed, disturbances & threats, scale, and north. Include GPS location(s).



DIGITIZED IN GIS

Scale digitized at = 1:________________

☐ 1:24,000 topographic maps

☐ Orthophoto (pixel size = _______ m / ft), date = ___________

☐ Other: _________________________

HAND-DRAWN

Scale drawn at = 1:________________

☐ Topographic map (scale = 1:_________)

☐ Aerial imagery ☐ Other: __________________

scale = 1: ___________

date = ______________

OVERALL LOCATION ACCURACY: including uncertainty about where the animal/habitat feature was and mapping accuracy related to the GPS unit used, resolution of reference information like topographic maps or aerial photos used, etc.:

± ___1_________ meters

Exhibit 7C-2: Lynx Habitat Assessment Report

Canada Lynx Habitat Assessment and Winter Track and Camera Surveys

Bingham Wind Project

Bingham, Moscow, Mayfield Township, Kingsbury Plantation, Abbot, and Parkman

Somerset and Piscataquis Counties, Maine

Prepared for

Blue Sky West, LLC
and Blue Sky West II, LLC
129 Middle Street
3rd Floor
Portland, ME 04101

Prepared by

Stantec Consulting
30 Park Drive
Topsham, ME 04086

March 2013

Executive Summary

In advance of permitting activities for the proposed Bingham Wind Project (project, Figure 1) in Somerset and Piscataquis Counties, Maine, Blue Sky West, LLC and Blue Sky West II, LLC (Blue Sky) contracted Stantec Consulting (Stantec) to assess Canada lynx (*Lynx canadensis*; lynx) habitat within and near the project area and to conduct field surveys during the winter of 2010-2011 to determine the potential presence of lynx in those areas. The methods used for the survey included remote sensing habitat mapping and field verification, snow track surveys, and camera surveys. The scope of work and methodology described in this report were developed and discussed with the Maine Department of Inland Fisheries and Wildlife (MDIFW) and U.S. Fish and Wildlife (USFWS), and followed MDIFW's *Western Mountains Eco-Regional Lynx Track Protocol.*

Habitat Assessment

A desktop landscape analysis of potential snowshoe hare habitat (*Lepus americanus*) (i.e., the primary prey for lynx) was conducted to determine the extent of potential snowshoe hare habitat around the project, with the assumption that these areas could also provide potential lynx foraging habitat if hare are abundant. Habitat mapping was conducted with particular focus on habitats suitable for high snowshoe hare densities. Mapping and assessments were completed using available digital aerial photography. For the purposes of hare habitat assessment, a one-mile buffer was initially established around the proposed turbine string. During agency consultation, USFWS requested habitat mapping within all of Mayfield Township in addition to the one-mile turbine string buffer. Habitat mapping was also completed within a 2,000-foot wide corridor centered on the proposed 17-mile 115-kilovolt generator lead in Kingsbury Plantation, Abbot, and Parkman that connects the turbines to an existing Central Maine Power Company (CMP) substation in Parkman, Maine. In all, the remote sensing habitat assessment area totaled approximately 43,086 acres (67 square miles).

Desktop analysis of the 1-mile turbine buffer[1] using 2011 aerial photography revealed 29 polygons (1,439 acres) of potential high value hare habitat, 97 polygons (2,145 acres) of moderate value hare habitat, and 69 polygons (1,572 acres) of future hare habitat (i.e., regenerating forest stands). Within portions of Mayfield Township outside the 1-mile buffer and within the proposed generator lead corridor, the desktop analysis identified another 41 polygons (1,779 acres) of potential high value hare habitat, 56 polygons (1,960 acres) of moderate value hare habitat, and 33 polygons (694 acres) of future hare habitat.

In the winter of 2010-2011, mapped high value hare habitats were ground-truthed by Stantec during snow track surveys and any additional potential habitats observed were mapped. Due to limited winter access to all mapped habitats, only those habitats adjacent to or within sight of snow track survey routes were ground-truthed. Ground-truthing efforts of 48 potential high-value hare habitat areas revealed that 7 areas had been mechanically thinned since the 2009 aerial photos from which mapping data were collected. Twenty-six potential moderate value hare habitat polygons were assessed, and none appeared to have been harvested since 2009. Of 21 potential future hare habitat areas assessed, 3 appeared to have been mechanically thinned since 2009. On-going timber operations are evident throughout the project area and are

[1] Conducted in 2011 using 2009-2010 aerial imagery, and updated in 2013 using 2011 imagery.

expected to result in continued changes to the vegetative cover and the potential habitat values for hare and lynx.

Snow Track Survey

Stantec conducted lynx snow track surveys at the project area and in the surrounding forest on three separate occasions between December 2010 and March 2011 following MDIFW's Western Mountains Eco-Regional Lynx Track Protocol. The three visits occurred on December 9 and 10, 2010, January 31, 2011, and March 23, 2011. Prior to field surveys, Stantec, First Wind, and USFWS visited the site on November 18, 2010, to evaluate potential lynx habitat and areas to target for winter tracking surveys. Survey days were planned to occur 24 to 72 hours after a significant snowfall event, defined as enough snow to allow for accurate species identification by tracks, followed by calm winds and no precipitation.

Twelve distinct species tracks were documented, including snowshoe hare, red squirrel (*Tamiasciurus hudsonicus*), moose (*Alces alces*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), fisher (*Martes pennanti*), marten (*Martes americana*), ermine (*Mustela erminea*), red fox (*Vulpes vulpes*), ruffed grouse (*Bonasa umbellus*), river otter (*Lontra canadensis*), and Canada lynx. The most frequent track occurrences were of snowshoe hare, red squirrel, coyote, and moose.

A single Canada lynx track was observed on March 23, 2011. The observed track crossed a logging road in the northeastern corner of Mayfield Township where the lynx had apparently emerged from Kingsley Bog, crossed the road, and continued northeast. The track was from a single animal and appeared to be less than 24 hours old. It was located in an area mapped as potential moderate value habitat. As recommended by USFWS and MDIFW, the lynx track was back tracked and forward tracked for 0.25 mile in each direction in an attempt to find and collect a scat sample. A scat sample was collected for DNA analysis and sent to the U.S. Department of Agriculture Forest Service Rocky Mountain Research Station, Wildlife Genetics Lab for species determination. Results were received from the lab on June 14, 2011. The lab performed an analysis of mitochondrial DNA in the scat sample and determined the sample was from a lynx (Appendix B). Further analysis revealed that the lynx was a male (Appendix C).

Camera Survey

In addition to the habitat analysis and tracking survey, Stantec conducted remote camera surveys to supplement the tracking efforts and to attempt to document the presence or the absence of Canada lynx in the Project area. Five cameras were deployed on December 9, 2010, and remained in the field through March 23, 2011. A total of 463 camera days (1 day equals a 24 hour period) were conducted between December 9, 2010, and March 23, 2011, resulting in an overall detection rate of 0.48 pictures per camera night. This rate is calculated based on the detection of any wildlife species within the camera and is not capable of distinguishing between individual animals. During the course of the camera surveys, no Canada lynx were photographed. Snowshoe hare was the most commonly observed species (n=157), followed by red squirrel (n=27), moose (n=17), and ermine (n=7).

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EXECUTIVE SUMMARY 1

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PN196000539[1]

[1] *This report was prepared by Stantec Consulting Services Inc. for Blue Sky West, LLC and Blue Sky West II, LLC. The material in it reflects Stantec's judgment in light of the information available to Stantec 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

In advance of permitting activities for the proposed Bingham Wind Project (project, Figure 1) in Somerset and Piscataquis Counties, Maine, Blue Sky West, LLC and Blue Sky West II, LLC (Blue Sky) contracted Stantec Consulting (Stantec) to assess Canada lynx (*Lynx canadensis*; lynx) habitat in the project area and conduct field surveys during the winter of 2010-2011 to determine the potential presence of lynx. This report describes the methods and results of the lynx habitat mapping and verification, snow track surveys, and camera surveys.

Survey methods and work plans were developed based on past experience at other wind energy projects in Maine and through consultation with the Maine Department of Inland Fisheries and Wildlife (MDIFW) and U.S. Fish and Wildlife (USFWS) staff at a meeting in Augusta, Maine on March 5, 2010. In 2009, Stantec conducted initial desktop habitat mapping within a one-mile buffer around the proposed turbine strings for discussions with the agencies. The results of the initial mapping showed potential suitable snowshoe hare (*Lepus americanus*) (i.e., the primary prey of lynx) habitat to occur in the vicinity of the Project area. Although the project is not located within the USFWS-designated Canada Lynx Critical Habitat, USFWS requested additional habitat mapping of Mayfield Township and winter tracking surveys at the project area due to the proximity of the Project to designated Critical Habitat, as well as recent documentation of lynx occurrence in nearby townships by MDIFW. As recommended by the USFWS, Stantec extended the initial habitat mapping north and west of the project area to cover the majority of Mayfield Township where suitable lynx habitat was suspected to occur. The purpose of the additional habitat mapping was to determine the extent of lynx habitat available within the Township relative to the project area and to provide information to assess the potential impacts to habitat as a result of project construction.

The purpose of the field surveys was to investigate the project area for signs of Canada lynx use by documenting snow tracks, taking field camera pictures, and collecting scat or hair samples.

1.2 PROJECT AREA DESCRIPTION

The project area (Figure 1) is located within the Central and Western Mountains Ecoregion as defined in *Maine's Comprehensive Wildlife Conservation Strategy* (MDIFW 2005). This ecoregion is a consolidation of the Western Mountains and Central Mountains biophysical regions originally described by McMahon (1990). The Central and Western Mountains Ecoregion extends from the New Hampshire border south to the White Mountains National Forest, north to Aroostook County, and east to the western foothills. The average elevation within the western portion of the ecoregion (former Western Mountain Biophysical Region) is between approximately 305 meters (m) to 610 m (1,000 feet ['] to 2,000') with several peaks exceeding 823 m (2,700'). The northern portion of this ecoregion includes some of the highest peaks in Maine and has elevations that range from 183 m to 1,603 m (600' to 5,258'). The climate of this ecoregion is characterized by relatively low annual precipitation and cool temperatures. Heavy snowfall prolongs the winter resulting in a relatively short growing season (McMahon 1990). In general, ridge tops within this ecoregion are dominated by red spruce

(*Picea rubens*) and balsam fir (*Abies balsamea*) with lower elevations supporting deciduous species such as sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*).

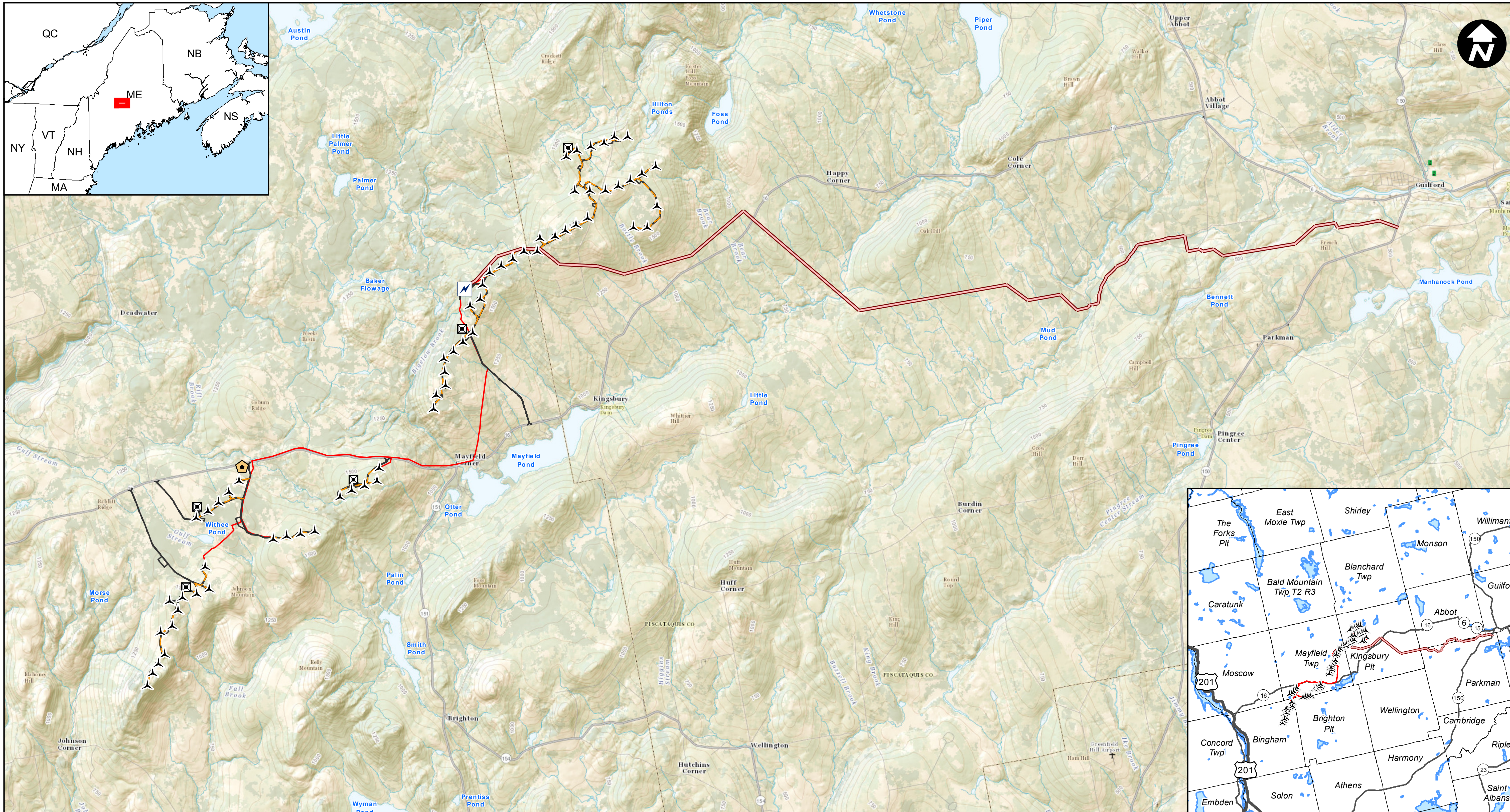
The turbine string portion of the project area is located on a series of ridgelines that do not exceed 494 m (1,620') in elevation (Figure 2). An unnamed mountain in Kingsbury reaches approximately 268 m (879') in elevation, and Johnson Mountain I Bingham reaches roughly 241 m (792') in elevation. The generator lead traverses Kingsbury Plantation and Parkman in flatter terrain at lower elevations.

Historically and presently, the summits of the ridgelines and the land surrounding the project area have been used for commercial timber management. This is evident by the recent and past cuts, as well as the presence of the network of haul roads that extend through the project area. Due to timber harvesting activities, much of the forest stands within the project area are in various stages of regeneration. Additionally, softwood plantations are present and scattered along the ridgelines.

1.3 SPECIES BACKGROUND

Canada lynx are listed as a threatened species under the U.S. Endangered Species Act of 1973 (7 U.S.C. § 136, 16 U.S.C. § 1531 et seq.). Lynx are a boreal forest species known to occur in northern Maine but are considered to be at the southern end of their geographic range within the project area. In the State of Maine, lynx are more abundant in the northern part of the state where spruce budworm epidemics of the 1980s and previous large clear cutting practices left behind large tracts of dense regenerating spruce and fir. Though very little is known about the size and distribution of the lynx population throughout Maine, the USFWS has designated Critical Habitat for this species. The Critical Habitat generally encompasses the northern half of Maine, west of the Interstate-95 and U.S. Route 1 corridors, and beginning at the southern end of Moosehead Lake and extending north. The project area is located approximately twelve miles south of the southern boundary of designated Critical Habitat.

Lynx rely almost exclusively on snowshoe hare (*Lepus americanus*) as their primary prey and show a strong preference for dense conifer re-growth, particularly within large clear-cuts or partial-cuts 12 to 30 years post-harvesting. However, recent research has also documented the importance of open areas within stands of dense regenerating conifer, which puts snowshoe hare at greater risk to predation while allowing for easier chase by lynx, ultimately resulting in a higher lynx foraging success rate (Fuller 2010).



Stantec

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Legend

- Turbine Location
- Permanent MET Tower
- O&M Building
- Substation
- Edge of Gravel
- Generator Lead Transmission Line
- Overhead Summit Collector
- Underground Summit Collector

0 8,000
Feet

195600539

Client/Project
Bingham Wind Project

Figure No.
1

Title
Bingham Wind Project Location

3/22/2013

00539_1-1_Location.mxd

1.4 METHODS

1.4.1 Habitat Assessment

Stantec conducted a desktop landscape analysis of the area within a one-mile buffer around the turbine string portion of the project, as well as the remainder of Mayfield Township, as requested by USFWS, to identify and map suitable snowshoe hare habitat types. Similarly Stantec also assessed areas within approximately 305 m (1,000’) of the proposed generator lead corridor. This mapping was done with the assumption that hare habitats could also provide potential lynx foraging habitat if hare are abundant (Robinson 2006, Scott 2009, Simons 2009). The total area evaluated within the one-mile turbine buffer, Mayfield Township, and the generator lead buffer, was 43,086 acres (67 square miles). The purpose of the habitat assessment was to evaluate the potential for lynx presence and to provide information to assess the potential impact to habitat as a result of project construction.

To identify potential lynx habitat, Stantec first reviewed existing digital orthophotos comprised of true color, medium resolution aerial imagery available from the Maine Office of GIS. This digital imagery, dated May 19, 2003, was viewed on-screen in 2-D using AutoCAD® and ArcMap® software. Polygons of suitable hare habitats observed on the 2003 imagery were digitized on screen and were later updated using summer 2009 and 2011 National Agriculture Imagery Program (NAIP) photos to adjust for habitat changes that occurred between 2003 and 2011. Only those habitat types that appeared to provide conditions suitable for snowshoe hare were mapped.

During the on-screen analysis of the aerial photography, snowshoe hare habitat polygons were subjectively divided into three categories based generally on the scientific literature, and representing high-value, moderate-value, and future habitats. Polygons depicting the three categories were color-coded for mapping and assessment purposes. The habitat-value designations were based on variations in the habitat parameters observed on the aerial photography, primarily in regard to stand type, stand age, and stand density. Stand size also was considered in some cases, given that some stands may provide suitable conditions for hare but their small size may not effectively support or sustain a viable population. The habitat-value designations for this analysis are as follows.

- High-value - these polygons included the habitat types typically preferred by snowshoe hare, which are characterized by dense stands of early-successional regenerating coniferous forest approximately 10 to 35 years old that can provide this species with optimal conditions for food and cover. High-value areas also included dense deciduous and mixed regenerating stands if the density and age class appeared to provide suitable food and cover, as these types may provide optimal conditions during certain times of the year.

- Moderate-value – these polygons included habitat types that appear to provide suitable hare habitat but where the stand density, age, and/or species composition do not provide optimal conditions for food and cover. Moderate-value habitats include those where the stand age is approaching the upper limit (e.g., >30 years old), the stand has not yet reached the optimal age or density, or the stand generally does not exhibit a consistency in the quality of habitat throughout.

- Future – these polygons represent areas that may become suitable hare habitat as the vegetation matures and becomes more dense (i.e., regeneration fills in the openings). Mapped future habitats included recent clearcuts or thinned stands with obvious signs of young but relatively dense coniferous or mixed regeneration. In general, future habitats included those that would be expected to provide suitable hare habitat in 5 to 15 years (from the date of aerial photos). Stands that have not been recently harvested were not considered future habitats.

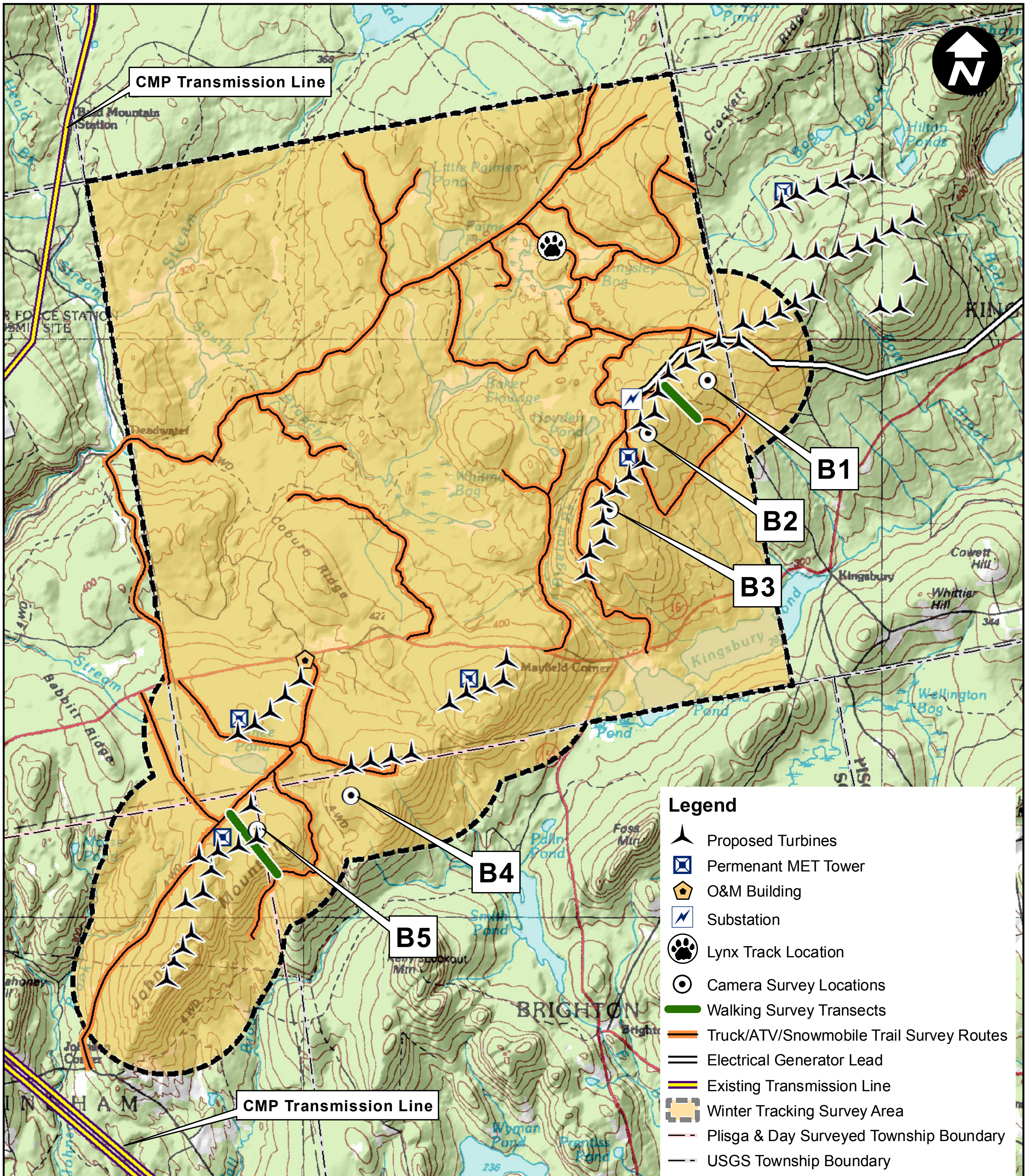
At the time of the habitat assessment, orthophotos used to map potential hare habitat were two years old, and given the intensity of recent timber harvest activities within the project area, many of the forest blocks mapped by the 2009 aerial photos had changed. Therefore, during on-site winter snow track surveys, Stantec biologists ground-truthed habitats identified in the desktop assessment. Winter tracking surveyors were provided with mapped habitat data from the desktop analysis indicating areas of high, moderate and future hare habitat for confirmation in the field. Using the MDIFW habitat data code system outlined in the *Western Mountains Eco-regional Lynx Track Survey* protocol, surveyors took detailed notes on each mapped habitat encountered during snow track surveys; including signs of recent timber harvest activity. Observed changes from 2009 mapped polygons were incorporated into the habitat maps and are reflected in Figure 3.

1.4.2 Snow Track Survey

Stantec conducted lynx snow track surveys in the turbine string portion of the project area and surrounding forest between December 2010 and March 2011 (Figure 2). Surveyors followed MDIFW's *Western Mountains Eco-Regional Lynx Track Survey Protocol*. Based on MDIFW's recommendations and the established protocol, three separate visits for tracking surveys were planned based on snow conditions. The three visits occurred on December 9 and 10, 2010, January 31, 2011, and March 23, 2011. Prior to field surveys, Stantec, First Wind, and USFWS visited the site on November 18, 2010, to evaluate potential lynx habitat and areas to target for winter tracking surveys. During each visit, areas that contained high value hare habitat and areas along an established series of logging and snowmobile trails in the project area and Mayfield Township were searched for tracks. Additionally, two 1-kilometer (km) walking transects were surveyed during each track survey, crossing high value ridgeline hare habitat in the northern and southern portion of the turbine string project area (Figure 2). In total, nearly 100 km of snowmobile trail, skid trails, and logging roads were surveyed in the project area and Mayfield Township during each track survey.

Survey days were planned to occur 24 to 72 hours after a significant snowfall event, defined as enough snow to allow for accurate species identification by tracks, followed by calm winds and no precipitation. The latency between storm event and survey day theoretically allows for movement of lynx through their home range, increasing the likelihood of bisecting a lynx track crossing a survey route. After 72 hours, tracks may become too aged by sun or wind, making positive identification difficult and possibly increasing the likelihood of misidentification. Weather conditions were monitored via weather forecasting and reports and through conversations with local Bingham business owners.

The survey routes were divided between two observers for each visit. Snow track surveys began between 7:30 and 8:30 am and continued until all possible survey routes had been ridden by all-terrain vehicle (ATV), snowmobile, or truck or until sunset precluded reliable track identification.



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Miles

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Client/Project
Bingham Wind Project

Figure No.
2

Title
Winter Lynx Tracking and Camera Survey Locations

4/16/2013

When surveyors did not have sufficient time to finish all transects in one day, the remaining survey routes were completed the following day. While on ATV, snowmobile or vehicle, surveyors traveled at a slow enough speed to allow for accurate detection of tracks. Once tracks were detected, the surveyors stopped to record information about the tracks and identify the species.

Following the MDIFW's *Western Mountains Eco-Regional Lynx Track Survey Protocol*, if a potential track of Canada lynx was intersected, surveyors back-tracked and forward-tracked the animal in attempt to find scat for DNA analysis. During lynx track surveys, evidence of incidental species (non-target species) was noted; however, track counts and locations of these other species were not recorded. If a lynx track was observed, surveyors documented habitats and suspected behavior through field notes, photos, and track measurements. When possible, track measurements were taken in a section of trail where the animal showed a direct register walk with an even, unhurried pace. Measurements included trail width (straddle), trail length (stride), track width, track length, sinking depth, direction of travel, and an STQ rating, which indicates the track quality. To account for variation in an individual animal's gait, three sets of track measurements were taken in areas of similar gait. Beyond observational and track measurement data, observers searched for hair or scat from the target animal for collection and genetic processing for species verification. If scat was discovered, a Global Positioning System (GPS) point and photos were taken of the scat alongside a measurement device, and the sample was collected using a sterile container. The sample was labeled with the date, GPS location, and suspected species of origin and was frozen until it was sent to U.S. Department of Agriculture (USDA) Forest Service Rocky Mountain Research Station, Wildlife Genetics Lab for genetic processing.

1.4.3 Camera Surveys

To supplement winter tracking surveys, Stantec conducted remote trail camera surveys to document the potential presence or absence of Canada lynx in the project area. The camera surveys targeted the time of year when cats may be especially susceptible to novel smells in their territories. Cameras were deployed on December 9, 2010, the day of the first tracking survey, and remained in the field through March 23, 2011, the end of lynx breeding season. Although camera surveys are not guaranteed to document every animal within an area and will therefore not capture every animal present in the project area, it is a commonly used, low-cost survey method for determining presence or probable absence of target species, and in this case, supplemented the snow tracking surveys.

Five Moultrie™ Gamespy 6.0 megapixel cameras were deployed within the project area at five locations along the two main ridgelines of the project area and were maintained for the duration of the study. The camera sites (refer to Figures 2 and 3) were chosen and positioned to provide adequate sampling of suitable habitat within the project area. The cameras were set to trigger when a subject interrupted an infrared beam, resulting in a series of 3 digital photos, which were stored on a 4GB SD™ photo card capable of storing over 800 photos at the highest resolution. Each digital photo was numerically identified and included the date, time, temperature, and moon phase. The camera delay was set to record a series of 3 photos with a 30-second delay between each series of photos. The cameras were equipped with infrared flash that illuminates up to 45 feet during both low light and dark conditions. Stantec checked the cameras during each tracking survey to download pictures and to refresh lures and batteries.

Cameras were dispersed across the project area and located in forested areas near gravel roads or four-wheeler trails. To avoid camera theft and photos of ATVs and vehicles traveling on roads, cameras were deployed adjacent to roadways and trails in natural clearings with appropriate cover and potential foraging opportunities. The locations of each camera were recorded with GPS and are depicted on Figures 2 and 3.

Each camera station included a tuft of wool dosed in a petroleum jelly-based catnip lure (personal communications with Mark McCullough, USFWS). The scented wool patch was wired to a tree approximately two feet above the ground, perpendicular to the game camera at sniffing height of lynx. Cameras were aimed directly at the scent station using the laser pointer feature. Additionally, a skunk-based lure was smeared eight feet high above the wool patch to act as a more powerful broadcasting lure with the intention of drawing in lynx from further away than the more localized scent from the wool dosed with catnip lure. Low-lying vegetation was cleared from the camera field view to create an unobstructed view of animals triggering the camera beam and to minimize photographs triggered by moving vegetation during windy conditions.

Photos gathered during the camera survey were visually inspected to identify any animals present and labeled with species detected as well as date and time of detection. A second observer examined the photos to check for accuracy and confirm identifications. Once triggered, cameras typically recorded a series of three images often resulting in multiple images of the same individual. To prevent over-representing the number of individuals detected by the cameras, an individual animal, or group of animals present in a series of photos taken within the same timeframe was counted as one “capture.” When definitive species identification could not be made due to poor image quality or only part of the animal in the frame of view, the animal was labeled as unknown to species group when possible. Due to the low sample size, results were reported as total number of individuals per 100 nights of survey period, similar to the method used by Nielson and McCollough (2009) and Crowley et al (2005).

Camera Location Descriptions

The B1 Camera (elevation 453 m [1,487’]) was the northern-most camera, deployed along the eastern edge of Mayfield Township. The camera was placed between two parcels labeled as potential high value hare habitat, in a natural clearing along an old skid trail surrounded by areas of dense mid-aged to mature spruce and fir regrowth including a smaller component of mature hardwood with a relatively open understory. Evidence of snowshoe hare was abundant. The camera was secured three feet above the ground and was focused on the lure station approximately eight feet away in an adjacent tree (Photograph 1).

Photograph 1. B1 Camera survey site (December 9, 2010)

The B2 Camera (elevation 457 m [1,500']) was located approximately 1.3 km south of the B1 camera and deployed along the head of a spruce bog drainage in the eastern section of Mayfield Township. The camera was deployed in a stand mapped as potential high value hare habitat, dominated by dense young spruce. The drainage created a corridor from the logging road approximately 110 m to the southwest. Abundant hare sign was apparent at the camera site. (Photograph 2)

Photograph 2. B2 Camera survey site (December 9, 2010)

The B3 Camera (elevation 415 m [1,362']) was 1 km southwest from the B2 camera. The camera was deployed approximately 152 m (500') off trail from the meteorological tower access trail. The camera was placed in a parcel identified as moderate value hare habitat, in a cleared area with abundant snowshoe hare sign and dominated by dense spruce fir growth with evidence of recent mechanical thinning (Photograph 3).

Photograph 3. B3 Camera survey site (December 9, 2010)

The B4 Camera (elevation 459 m [1,505']) was located 6 km southwest of the B3 camera, at the end of a spur road in an area mapped as potential moderate value hare habitat. The camera was located in a patch of thick spruce and fir that had been mechanically thinned. The edges of the stand were dominated with sparse patches of hardwood growth dominated by young birch and alder. The site had abundant hare sign. (Photograph 4).

Photograph 4. B4 Camera survey site (December 9, 2010)

The B5 Camera (elevation 476 m [1,563']) was deployed 2.6 km southwest of the B4 camera, in a parcel labeled as potential high value hare habitat, in a section of dense spruce growth along a mechanically thinned corridor. The survey site was approximately 200 m from an old log landing where a slash pile remained. (Photograph 5).

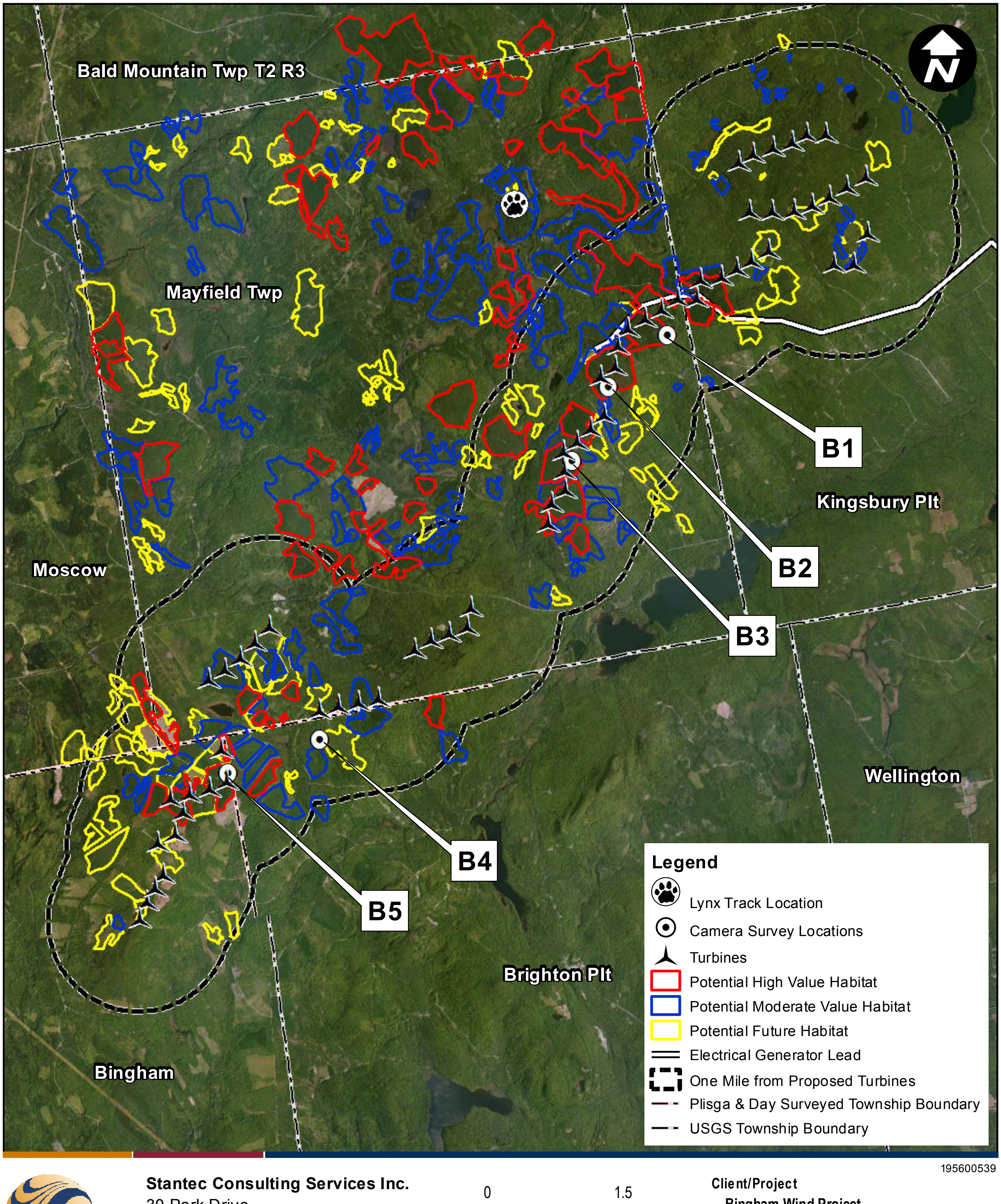
Photograph 5. B5 Camera survey site (December 9, 2010)

2.0 Results

2.1 HABITAT ASSESSMENTS

Aerial images of the project area from 2003, 2009, 2010, and 2011 revealed abundant potential snowshoe hare habitat throughout the project area and surrounding Mayfield Township (Figures 3 and 4). The photo interpretation indicates that potential hare habitats may exist within the generator lead buffer, though these areas do not appear to exhibit the same forest type and silvicultural characteristics as the habitats on the higher ridges. A total of approximately 5,156 acres of potential hare habitat were mapped within the 1-mile buffer surrounding the proposed turbine string. The potential hare habitats within the 1-mile buffer included 29 polygons (1,439 acres) of potential high value hare habitat, 97 polygons (2,145 acres) of moderate value hare habitat, and 69 polygons (1,572 acres) of future hare habitat (i.e., regenerating forest stands).

Within the portions of Mayfield Township outside the 1-mile buffer and within the generator lead corridor, another 4,433 acres of habitat were identified. These include 41 polygons (1,779 acres) of potential high value hare habitat, 56 polygons (1,960 acres) of moderate value hare habitat, and 33 polygons (694 acres) of future hare habitat. There were no high value polygons identified in the generator lead corridor.



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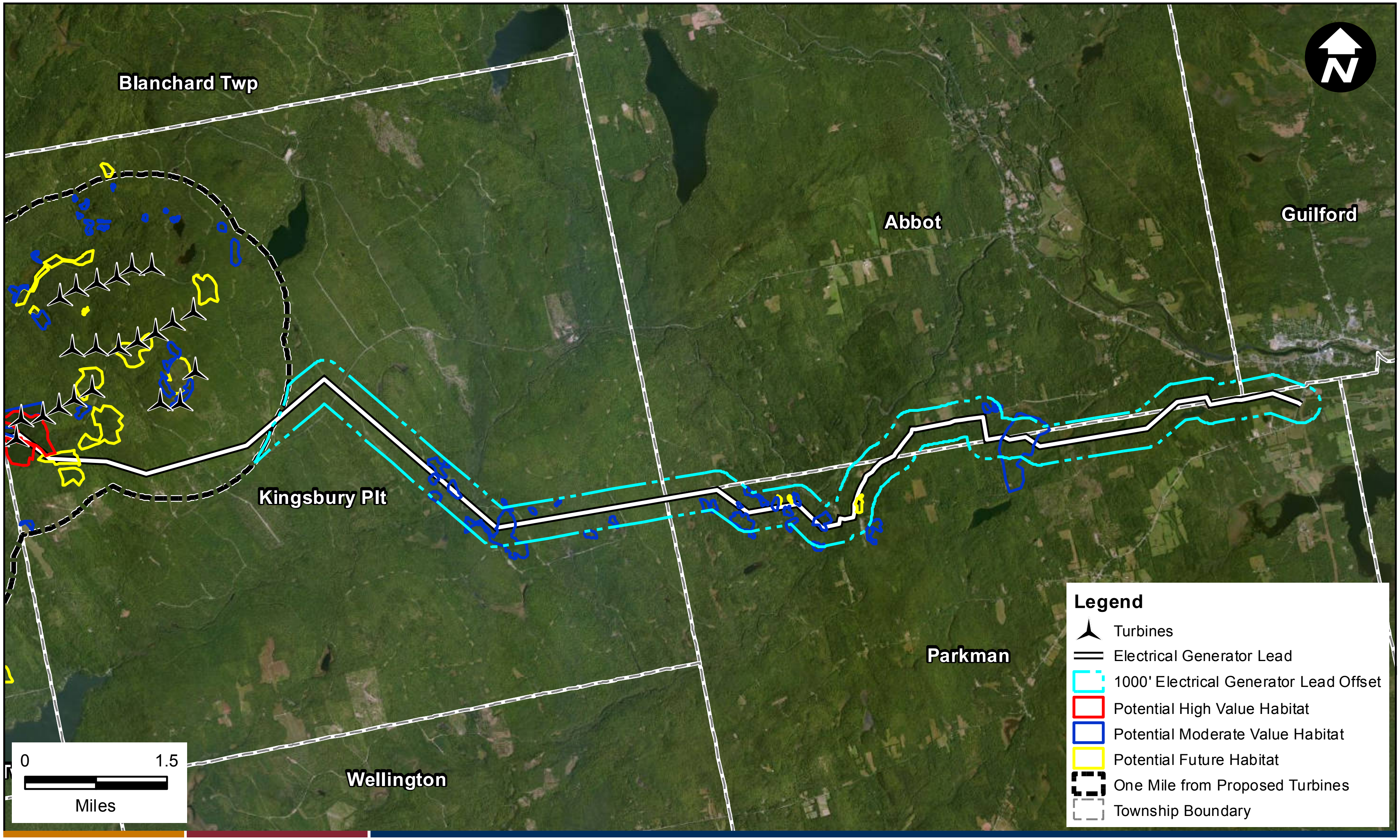
00539_003_Canada_Lynx_Showshoe_Hare_Habitat_Map_Summit.mxd

Client/Project
Bingham Wind Project

Figure No.
3

Title
Canada Lynx/Snowshoe Hare Habitat Map - Turbine Area

3/27/2013



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Client/Project

Bingham Wind Project

Figure No.
4

Title

Canada Lynx/Snowshoe Hare Habitat Map - Generator Lead Transmission Line

3/27/2013

During the March 9 and 23, 2011 visits and snow track survey, mapped hare habitats were ground-truthed, and any additional previously-unmapped potential habitats that were observed were recorded during on-site winter tracking field survey efforts. Due to limited winter access to the Project area, only those habitats adjacent to or within sight of snow track survey routes were ground-truthed. Ground-truthing efforts of 48 potential high-value hare habitat areas revealed that 7 areas had been mechanically thinned since the aerial image mapping data from 2009 was collected. Twenty-six potential moderate value hare habitat polygons were assessed, and none appeared to have been harvested since 2009. Of 21 potential future hare habitat areas assessed, 3 appeared to have been mechanically thinned since 2009.

Results from field verification of mapped hare habitats revealed that the desktop landscape analysis was a relatively accurate predictor of available potential snowshoe hare habitat within Mayfield Township and the one mile buffer surrounding the proposed turbine string. The field surveys indicated that, as expected in a working forest, that the stands and habitat types are dynamic landscape features subject to change from year to year.

2.2 SNOW TRACK SURVEY

Two biologists conducted snow track surveys in the project area and in the surrounding forest on December 9 and 10, 2010, January 31, 2011, and March 23, 2011 (Figure 2). Biologists spent an additional day (March 9, 2011) in the project area ground-truthing mapped habitat because snow conditions were not ideal for a track survey. During snow track survey days, snow conditions ranged from 2 to 4 inches of fallen snow in the previous 24 to 48 hours. Two 1-km walking transects were surveyed during each track survey, crossing high value ridgeline hare habitat in the northern and southern portion of the project area. Nearly 100 km of snowmobile trail, skid trails, and logging roads were surveyed in the project area and surrounding forest during each track survey.

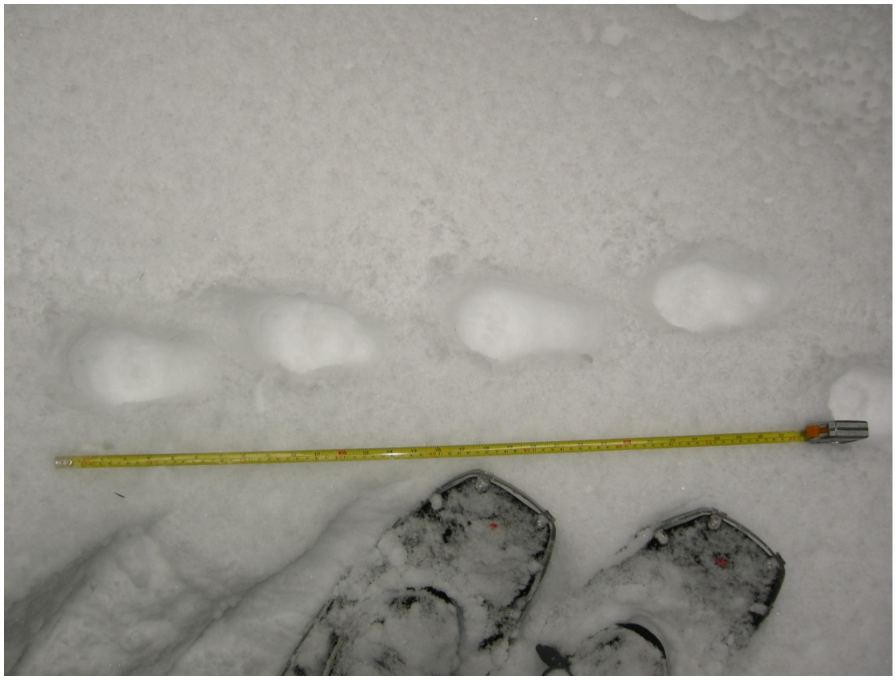
Twelve distinct species tracks were documented, including snowshoe hare, red squirrel (*Tamiasciurus hudsonicus*), moose (*Alces alces*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), fisher (*Martes pennanti*), marten (*Martes americana*), ermine (*Mustela erminea*), red fox (*Vulpes vulpes*), ruffed grouse (*Bonasa umbellus*), river otter (*Lontra canadensis*), and Canada lynx. The most frequent track occurrences were of snowshoe hare, red squirrel, coyote, and moose.

The initial survey on December 9 and 10, 2010, was conducted using ATVs due to shallow snow cover. Snow conditions were a mix of powder and wind-blown snow in open spaces. The survey was conducted from 7:00 am to 4:30 pm. Most of the 100 km of survey roads consisted of unplowed snowmobile trails; however, 24 km of survey roads had been plowed and maintained for active logging operations. A second day of snow track surveys was required to complete the entire mapped route. No significant weather event occurred on or between the two survey days. Species observed during the first round of track surveys on December 9 and 10, 2010, included bobcat , snowshoe hare, moose, coyote, red fox, and river otter.

A second round of track surveys occurred on January 31, 2011. Surveys were conducted from snowmobiles between 8:00 am and 4:30 pm. Eleven of the 100 km of survey roads were recently plowed and maintained for timber harvest operations. Snow conditions were a mix of powder and wind-blown snow over a sugary base, which resulted in deep sinking depths for tracks encountered in open areas. Species observed during this round of track surveys included coyote, moose, bobcat, fisher, snowshoe hare, ermine, and grouse.

The final round of track surveys occurred on March 23, 2011, from 7:30 am to 5:30 pm. The area of plowed roads remained unchanged from the second round of surveys (11 km of the total 100 km of survey roads). Snow conditions ranged from one inch of new powder over plowed road to three inches of blown snow over a thick ice crust. Species observed included Canada lynx, coyote, moose, bobcat, fox, otter, red squirrel, snowshoe hare, marten, and ermine.

The single lynx track was observed crossing a logging road approximately 1.5 miles north of the developed project area where it had apparently emerged from the Kingsley Bog, crossed the road, and continued northeast (Figures 2 and 3, Photograph 6, Appendix A). The track was from a single animal and appeared to be less than 24 hours old. It was located in an area mapped as potential moderate value hare habitat. As recommended by USFWS and MDIFW, the observed lynx track was back-tracked and forward-tracked 0.25 mile in each direction in an attempt to find and collect a scat sample. The track was followed through forested wetland and dense patches of regenerating spruce/fir, where it occasionally followed snowshoe hare runs through the dense growth. However, no sign of chase or characteristic sit downs were observed. The track appeared cat-like with an overall asymmetric appearance; however, in many of the prints, there were significant nail marks that may have been a result of a thick icy crust directly beneath the two to three inches of soft snow. Toe nail marks were particularly evident in areas with steep topography or where the animal appeared to be increasing its velocity. A fresh scat was recovered along the cat's trail and sent for genetic processing and species determination at the USDA Forest Service Rocky Mountain Research Station, Wildlife Genetics Lab. Results of the species and sex determination were received from the lab on June 14, 2011, and August 3, 2011, respectively (Appendices B and C). To determine species, the lab analyzed mitochondrial DNA in the scat sample and determined the sample was from a lynx. Further analysis showed that the scat was from a pure lynx and not a lynx-bobcat hybrid, and that the lynx was a male.



Photograph 6. Canada lynx tracks

2.3 CAMERA SURVEY

Images of 223 individual animals were captured during 463 camera nights between December 9, 2010, and March 23, 2011. Due to the low sample size, results were reported as total number of individuals per 100 nights of survey, similar to the method used by Nielson and McCollough (2009) and Crowley et al (2005). For the entire survey period, the overall detection rate was 48 individuals per 100 camera nights (Table 1).

Table 1. Bingham Camera Survey Effort, December 9, 2010 to March 23, 2011

Camera	# Camera Nights	Total # Photos	# Individual Wildlife	Species Observed
B1	90	88	5	Hare, Moose
B2	88	54	8	Moose, Hare
B3	90	124	16	Hare, Moose, Bobcat
B4	105	569	121	Hare, Ermine, Moose, Bobcat, Coyote
B5	90	370	73	Hare, Red Squirrel, Coyote, Red Fox, Moose, Fisher, Grouse
Total	**463**	**1205**	**223**	--

No Canada lynx were captured by the cameras. Snowshoe hare was the most commonly observed species (n=157), followed by red squirrel (n=27), moose (n=17), and ermine (n=7) (Figure 5).

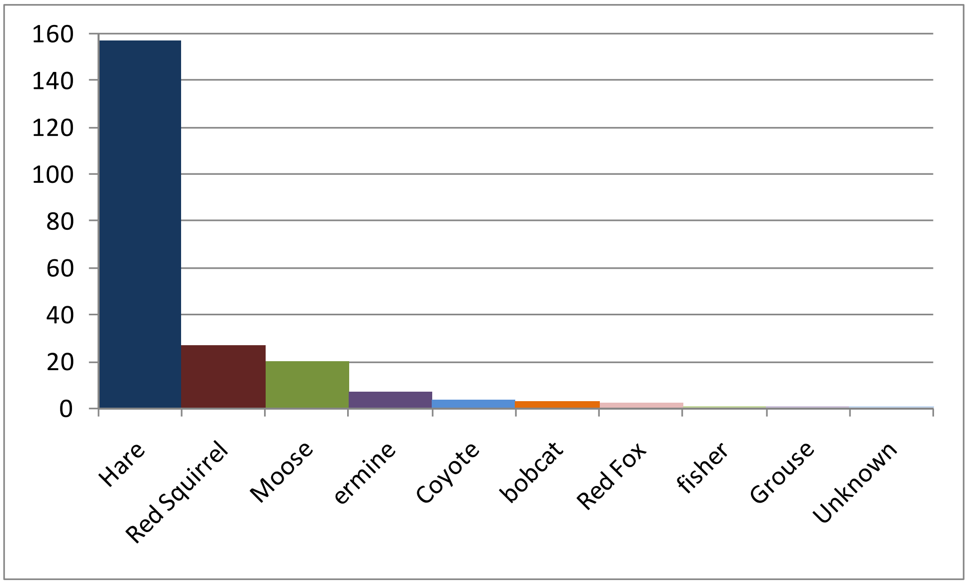


Figure 5. Species distribution from camera captures, December 9, 2010 to March 23, 2011.

2.3.1 B1 Camera

Ninety nights of survey effort were recorded at the B1 camera site, resulting in five images of individual wildlife of two species. The overall detection rate of the B1 camera was 5.5 individual wildlife images per 100 camera nights. Three of the five photos were snowshoe hare, and two were of moose (Figure 6).

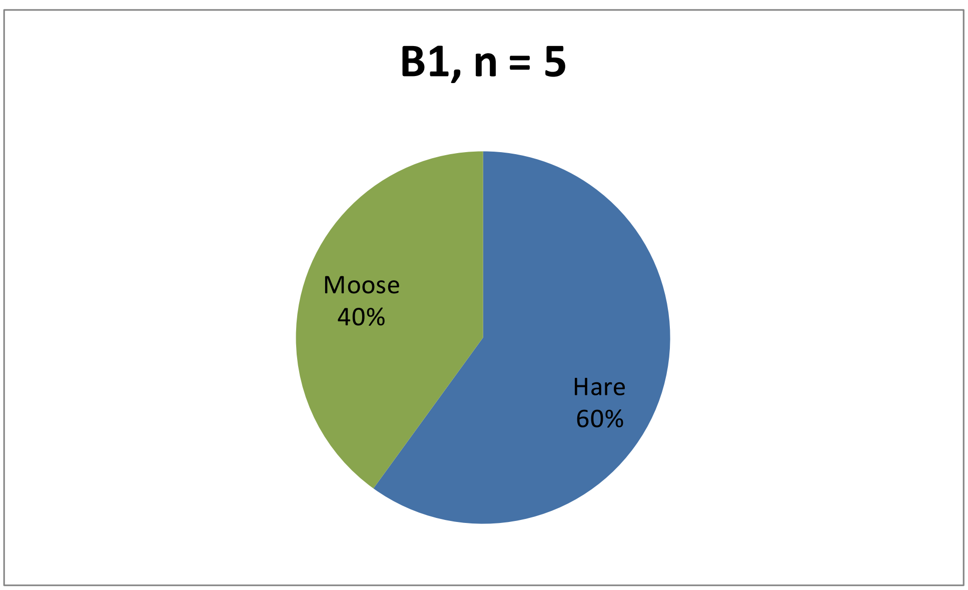


Figure 6. B1 Camera captures, December 9, 2010 to March 9, 2011

2.3.2 B2 Camera

Fifty-four photos were taken during the 88 camera nights of 8 individuals representing 2 species, resulting in an overall detection rate of 9 wildlife images per 100 camera nights. Moose (n=7) and snowshoe hare (n=1) were the species recorded at the B2 camera site (Figure 7).

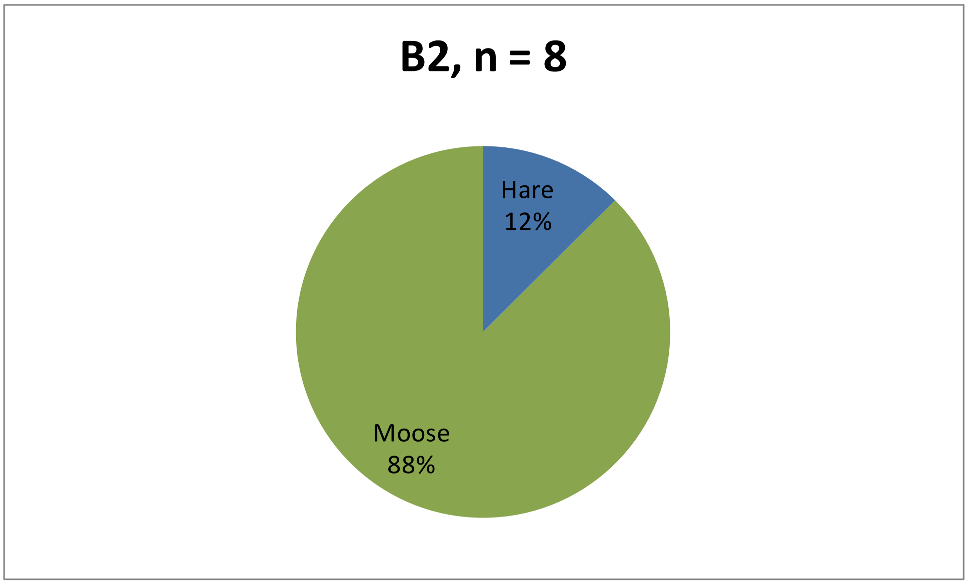


Figure 7. B2 Camera captures, December 11, 2010 to March 9, 2011.

2.3.3 B3 Camera

Fifteen photos were taken during 90 camera nights, representing 16 individual wildlife images, resulting in an overall detection rate of 18 wildlife images per 100 camera nights. One large bobcat was recorded (Photograph 3), and the most frequently recorded species included snowshoe hare (n=10) and moose (n=5) (Figure 8).

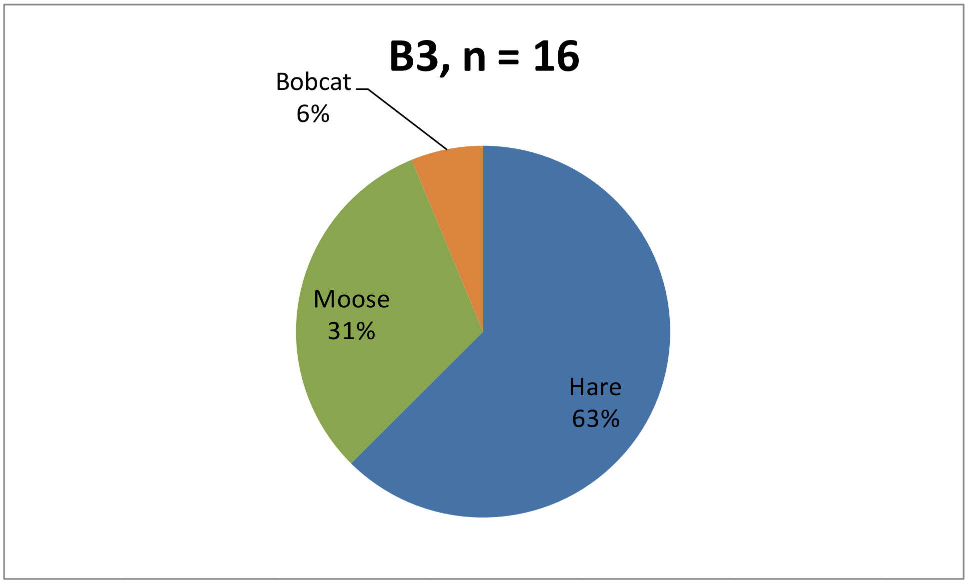


Figure 8. B3 Camera captures, December 9, 2010 to March 9, 2011.

2.3.4 B4 Camera

The B4 camera operated for 105 camera nights, recording 121 individual wildlife images representing five species, with in an overall detection rate of 115 wildlife images per 100 camera nights. Two bobcat were photographed and the most frequently recorded species were snowshoe hare (n=106), followed by ermine (n=7), moose (n=5), and coyote (Figure 9).

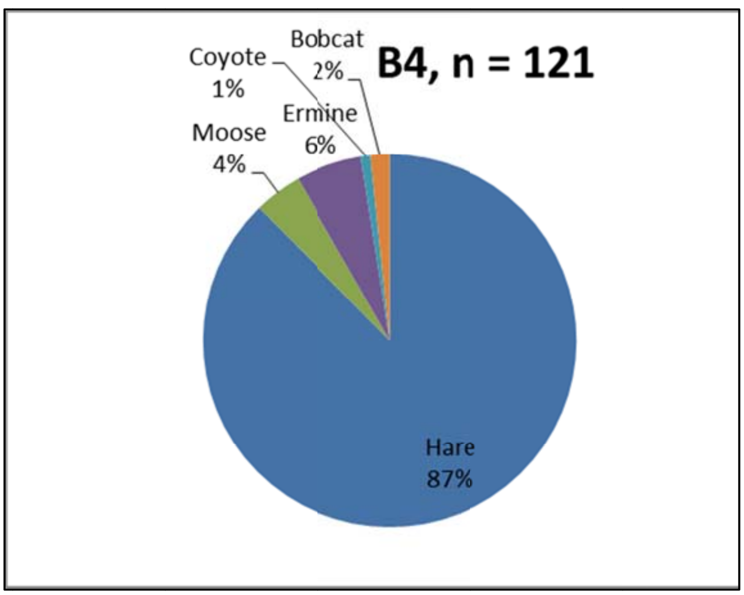


Figure 9. B4 Camera captures, December 9, 2010 to March 23, 2011

2.3.5 B5 Camera

The B5 camera operated for 90 camera nights and recorded 73 individuals representing 7 species, resulting in an overall detection rate of 81 individual wildlife images per 100 camera nights. More than half of the photos taken by the B5 camera were of snowshoe hare (n=37), followed by red squirrel (n=27), coyote (n=3), red fox (n=2), and one fisher (Figure 10).

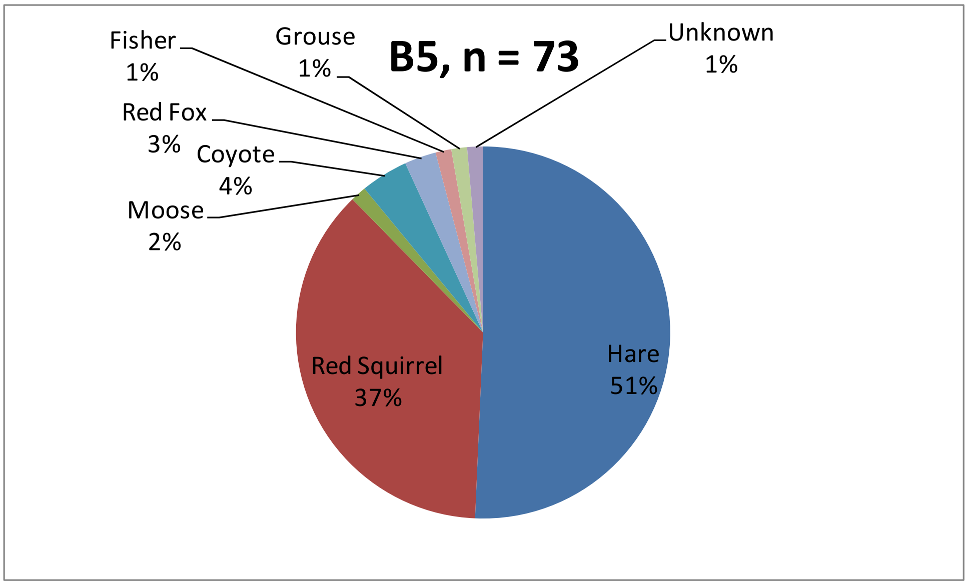


Figure 10. B5 Camera captures, December 9, 2010 to March 9, 2011.

Upon request, digital copies of camera photos containing animals can be provided on a CD.

3.0 Discussion

Aerial mapping of potential snowshoe hare and lynx habitat confirmed abundant suitable habitat within the project area and in Mayfield Township. Of the 48 potential high value hare habitat polygons visited in 2011, 7 appeared to have been mechanically thinned since the 2009 aerial imaging. Recent research in northern Maine has documented a reduction in snowshoe hare abundance of 45 to 54 percent in 2-year-old thinned regenerating forest stands versus un-thinned stands (Homyack 2003). However, regenerating stands with thinning appear to support higher hare densities than mature forest stands and mixed conifer-deciduous forest stands (Homyack 2003). During both habitat assessment and lynx snow track surveys in 2011, mechanical thinning was being conducted by the landowners throughout the project area. In early winter that year, harvesting was widespread throughout the project area, as evidenced by extensive plowed logging roads. As snow depths deepened later in the winter, harvesting within the project area diminished and was restricted to areas adjacent to Route 16.

Three rounds of snow track surveys indicated abundant snowshoe hare sign throughout the project area. Red squirrel sign was observed in highest abundance during the final round of snow track surveys on March 23, 2011. During early to mid-winter, snowmobile trails showed sign of heavy coyote travel. Later in the season, coyote sign diminished as the spring snowpack condensed, allowing coyotes to travel within forest stands. Bobcat tracks were also commonly observed traveling snowmobile trails throughout the project area. Although less common than those of other predators, fisher tracks were documented in the northern and southern portions of the project area.

The final round of snow track surveys yielded a solitary lynx track, north of the Kingsbury Bog area in the northeast quadrant of Mayfield Township. Scat collected along the lynx trail was sent to the USDA Forest Service Rocky Mountain Research Station, Wildlife Genetics Lab who determined the sample to be from a male lynx. The lynx trail was discovered in an area dominated by moderate value hare habitat with abundant snowshoe hare sign, as well as fisher and bobcat sign. Historical lynx occurrence records (1833-2000) from MDIFW indicate lynx presence near the Kingsbury Bog area.

Camera sites were selected to target ridgeline habitats in regions of the project area that may be directly impacted by turbine clearing. The five camera sites were deployed adjacent to or within areas identified as high to moderate habitat. No lynx were documented by the cameras during the survey period. Bobcats were recorded in both the northern and southern portions of the project area on three separate nights.

Lynx and snowshoe hare habitat is dynamic and constantly changing as a result of forest management and succession. Past forestry practices within the project area and the surrounding region have created favorable conditions through the regeneration of softwood-dominated stands in several locations. It is also reported that lynx will use a variety of stand types in the landscape for denning provided that there is dense cover such as abundant blowdowns and understory regeneration (Organ et al. 2008). Due to the forest practices at the site, suitable denning habitat is presumably available throughout the area.

Winter 2011 survey efforts, namely the snow track survey, documented the presence of lynx north of the project area. The track and scat were found on March 23, 2011, which corresponds with the known breeding period for lynx of March to early April (Kurta 1995, Quinn and Parker 1987 as cited in DeGraaf and Yamasaki). Because no other tracks were observed, no photos of lynx were captured during the camera survey, the single track was observed during the breeding period, and the scat analysis determined the lynx was male, Stantec suspects that the lynx was a transient male and that the project area likely does not support a breeding population of lynx.

Potential hare and lynx habitats were identified on aerial photographs in the vicinity of the proposed generator lead in the towns of Kingsbury Plantation, Parkman, and Abbot, though overall these areas appear to exhibit different cover types and forest management practices than the turbine areas. No ground truthing or track surveys were conducted to verify the accuracy of the aerial photo interpretation and mapping of habitats along the generator lead, but the aerial photographs suggest that these areas are not as intensively managed as the turbine-area ridges, and the potential hare habitat polygons seem to be smaller, less common, and separated from each other by more distance.

4.0 Literature Cited

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Appendix A
Lynx Track and Scat Photographs

Photograph 1. Canada lynx track (Stantec March, 23, 2011).

Photograph 2. Canada lynx scat (Stantec March, 23, 2011).

Photograph 3. Canada lynx track (Stantec March, 23, 2011).

Photograph 4. Canada lynx track (Stantec March, 23, 2011).

Photograph 5. Canada lynx track (Stantec March, 23, 2011).

Photograph 6. Canada lynx track (Stantec March, 23, 2011).

Photograph 7. Canada lynx track (Stantec March, 23, 2011).

Appendix B

USFS Rocky Mountain Research Station June 14, 2011 Species Determination Report

REPORT

Project: Scat sample from Mayfield Township, Maine

Date Issued: June 14, 2011

Recipient: **Sarah Boyden, Wildlife Biologist**
Project Scientist
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REPORT

On May 31, 2011 we received a scat sample collected on March 24, 2011 from Mayfield Township, Maine. This scat was submitted to our laboratory by you, and DNA analysis was requested to determine species.

DNA was extracted from this scat sample and species identification was performed using analysis of mitochondrial DNA. This scat sample is from a lynx (*Lynx canadensis*).

Please contact us if you have any questions. We look forward to working with you in the future.

Appendix C

USFS Rocky Mountain Research Station August 3, 2011 Sex Determination Report

REPORT

Project: Scat sample from Mayfield Township, Maine

Date Issued: August 3, 2011

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REPORT

On May 31, 2011 we received a scat sample collected on March 24, 2011 from Mayfield Township, Maine. This scat was determined previously by our laboratory to be from a lynx (*Lynx canadensis*; see report issued 6/14/11).

The scat was further tested for lynx-bobcat hybridization (see Schwartz et al. 2004) and gender (see Pilgrim et al. 2005). This scat is from a pure lynx (not a hybrid) and is from a male.

Please contact us if you have any questions. We look forward to working with you in the future.

Exhibit 7C-3: Eagle Survey Summary Report

Memo

To:	Josh Bagnato and Bob Roy	From:	Bryan Emerson
	First Wind		Stantec Consulting
File:	195600539	Date:	March 27, 2013

Reference: Aerial Bald Eagle Nest Survey Summary
Proposed Bingham Wind Project

Stantec Consulting (Stantec) has completed three years of aerial surveys for bald eagle (*Haliaeetus leucocephalus*) nests in the vicinity of the proposed Bingham Wind Project (project). The proposed project consists of 62 turbines located in Bingham, Kingsbury, and Mayfield, Maine. The proposed turbines are located on several small ridges and hills in the vicinity of Route 16, including Johnson Mountain and unnamed hills north and northeast of Johnson Mountain, and an unnamed ridge north of Route 16 (Figure 1).

This memo summarizes the results of the aerial surveys conducted by Stantec in 2009, 2010, and 2011, along with bald eagle nest data obtained from the Maine Department of Inland Fisheries and Wildlife (MDIFW) for 2012. Stantec's aerial surveys included inspections of known nest locations and searches of waterbodies within 10 miles or less of the proposed project area. Prior to the surveys, Stantec reviewed information provided by MDIFW regarding known active and historic bald eagle nest locations in the vicinity of the Project area. Following protocol previously established by the U.S. Fish and Wildlife Service (USFWS),[1] Stantec 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. During the aerial surveys conducted by Stantec, incidental observations of osprey (*Pandion haliaetus*) nests and great blue heron (*Ardea herodias*) rookeries were also recorded.

In October 2009, Stantec conducted the aerial survey in accordance with the 2007 National Bald Eagle Management Guidelines. Based on consultation with MDIFW and USFWS, a 5-mile radius from the potential project area was chosen for this survey. In November 2009, the Maine Field Office of USFWS issued the Guidelines for Building and Operating Wind Energy Facilities in Maine Compatible with Federal Fish and Wildlife Regulations.[2] In this document, a four mile radius from a proposed project was recommended as the distance to survey to identify eagle nesting areas. This document was released after Stantec's fall 2009 aerial survey; however, Stantec's 2010 spring survey was conducted according to these 2009 guidelines. In January 2011, USFWS issued the Draft Eagle Conservation Plan Guidance[3] to assist parties in avoiding and minimizing adverse effects on bald eagles. In this document, USFWS recommends that surveys to determine the locations of occupied bald eagle nests should be conducted within the project footprint and within 10 miles of the footprint. Stantec's survey protocol in 2011 was adjusted to adhere to this recommendation.

[1] U.S. Fish and Wildlife Service, 2007. *National Bald Eagle Management Guidelines*. U.S. Fish and Wildlife Service, Washington, DC.
[2] U.S. Fish and Wildlife Service. 2009. *Guidelines for Building and Operating Wind Energy Facilities in Maine Compatible with Federal Fish and Wildlife Regulations*. Maine Field Office, U.S. Fish and Wildlife Service, Orono, ME.
[3] U.S. Fish and Wildlife Service, 2011. *Draft Eagle Conservation Plan Guidance*. U.S. Fish and Wildlife Service, Washington, DC.

Survey Methods

Stantec conducted aerial surveys during three separate years in 2009, 2010, and 2011. MDIFW provided data from aerial surveys performed in 2012. Each aerial survey conducted by Stantec consisted of low altitude passes in a Cessna 172 aircraft, approximately 500 feet above ground level, along the shoreline of waterbodies within the survey area. Based on consultation with MDIFW, the aerial surveys were conducted in accordance with MDIFW and USFWS aerial survey protocols regarding methods and approximate time of year for surveys.

In 2009, Stantec performed a fall survey for bald eagle nests within an approximately 5-mile radius of the proposed turbine locations for the project, in accordance with existing protocol at the time. Note that this survey was performed outside of the breeding period for bald eagles; therefore, information regarding breeding activity at any nests was not recorded. The survey was performed in order to identify possible active nest locations that would require a monitoring visit during the spring 2010 breeding period.

In 2010, Stantec conducted the first aerial survey flight of the year on May 12. The purpose of the flight was to identify new nests and to assess eagle nesting activity at known nest locations. In 2010, the survey was performed within 4 miles of the project area, consistent with protocol described in the 2009 Guidelines for Building and Operating Wind Energy Facilities in Maine. 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 18, 2010, to check the status of active nests in the project 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.

In 2011, Stantec conducted the first aerial survey flight on May 2. Stantec performed the survey using a 10-mile radius from the proposed turbines in 2011, in accordance with protocol described in the 2011 Draft Eagle Conservation Plan Guidance. Stantec did not survey mapped nests along the Kennebec River in 2011, as these nests were checked by another surveyor just prior to the planned timing of Stantec's flight. In order to avoid disturbance to the nesting bald eagles, MDIFW recommended that Stantec avoid surveying these mapped nests and use the data obtained by MDIFW. Stantec did not conduct a second flight in 2011. Based on correspondence with MDIFW, the active nests within the survey area were again checked by another surveyor just prior to the planned timing of Stantec's second flight. In order to avoid disturbance, MDIFW again recommended that Stantec skip the second flight and use the data obtained by MDIFW. Therefore, all data from 2011 on known bald eagle nests along the Kennebec River and located within 10 miles of the project area were obtained from MDIFW.

Stantec did not perform aerial surveys around the project area in 2012. Data from 2012 provided in Table 1 below were obtained from MDIFW in January 2013, and are the results of aerial surveys and fledgling banding performed by NextEra Energy and Biodiversity Research Institute.

Survey Results

As shown on Table 1 and Figure 1, three active bald eagle nests have been identified within the vicinity of the proposed project. In 2010, Stantec surveyed within 4-miles of proposed turbine locations and did not identify any active bald eagle nests within this area. Nest #380B on the Kennebec River in Concord Township was found to be active during the survey, but was more than 4 miles from the nearest turbine location. Nest #509B in Bingham on the Kennebec River was also located in 2010, but it was found to be empty and inactive. Nest #509A was not located in 2010. In 2011, three active nests were identified within or immediately outside of 10 miles from the proposed turbines: nests #380B, #509A, and #301C on the Kennebec River in Carrying Place Township. Nest #509B was lot located in 2011 and nest #301C was greater than 10 miles from the proposed turbine locations. In 2012, nests #380B and #301C were also documented as active. According to MDIFW, nests #509A and #509B were inactive in 2012; however, a new nest in very close proximity to the #509B location was occupied and determined to be active. This nest was assigned #509C. For the purposes of measuring the distance to the nearest turbine, nests #509B and #509C were assumed to be in the same location. Note that occupancy has switched between the “A”, “B”, and “C” location at #509 over the past 3 years. Despite this switching, this is assumed to be the same pair of nesting eagles.

The closest active nest to the proposed project turbines in all years was #509B/C on the Kennebec River in Bingham at a distance of approximately 4.95 miles from the nearest proposed turbine location. No active bald eagle nests have been identified within 4 miles of the proposed turbine locations, the distance that the Maine Field Office of the USFWS has recommended for additional bald eagle surveys in Maine.[4] Two active bald eagle nests have been identified within 10 miles of the proposed turbine locations, the distance that the USFWS Draft Eagle Conservation Plan guidance recommends for bald eagle surveys nationwide.

In 2011, Stantec attempted to locate historic nest locations #301A, #301B, #112A, #380A, and #415A. These nests were not located during the 2011 surveys and have since been removed from MDIFW’s database of bald eagle nests due to several years without activity or a nest being located.

Table 1. Historic Activity at Active and Historic Bald Eagle Nest Locations Surrounding the Bingham Wind Project

Waterbody	MDIFW Nest #	Distance to Nearest Turbine (mi)	2012 Status	2011 Status	2010 Status	Fall 2009 Status
Kennebec River	301C	12.17	Active – 1 eaglet	Active – 1 eaglet	Not Surveyed	Not surveyed
Kennebec River	509B/C	4.95	Active – 2 eaglets	Empty	Empty	Not located
Kennebec River	509A	n/a	Not located	Active – 1 eaglet	Not located	Not located
Kennebec River	380B	6.29	Active – 1 eaglet	Active – 1 eaglet	Active – 2 eaglets	Nest in good condition
Kennebec River	112A	n/a	Removed from IFW database	Not located – assumed down	Not surveyed	Not surveyed
Kennebec River	380A	n/a	Removed from IFW database	Not located – assumed down	Not located	Not located
Kennebec River	415A	n/a	Removed from IFW database	Not located – assumed down	Not surveyed	Not surveyed

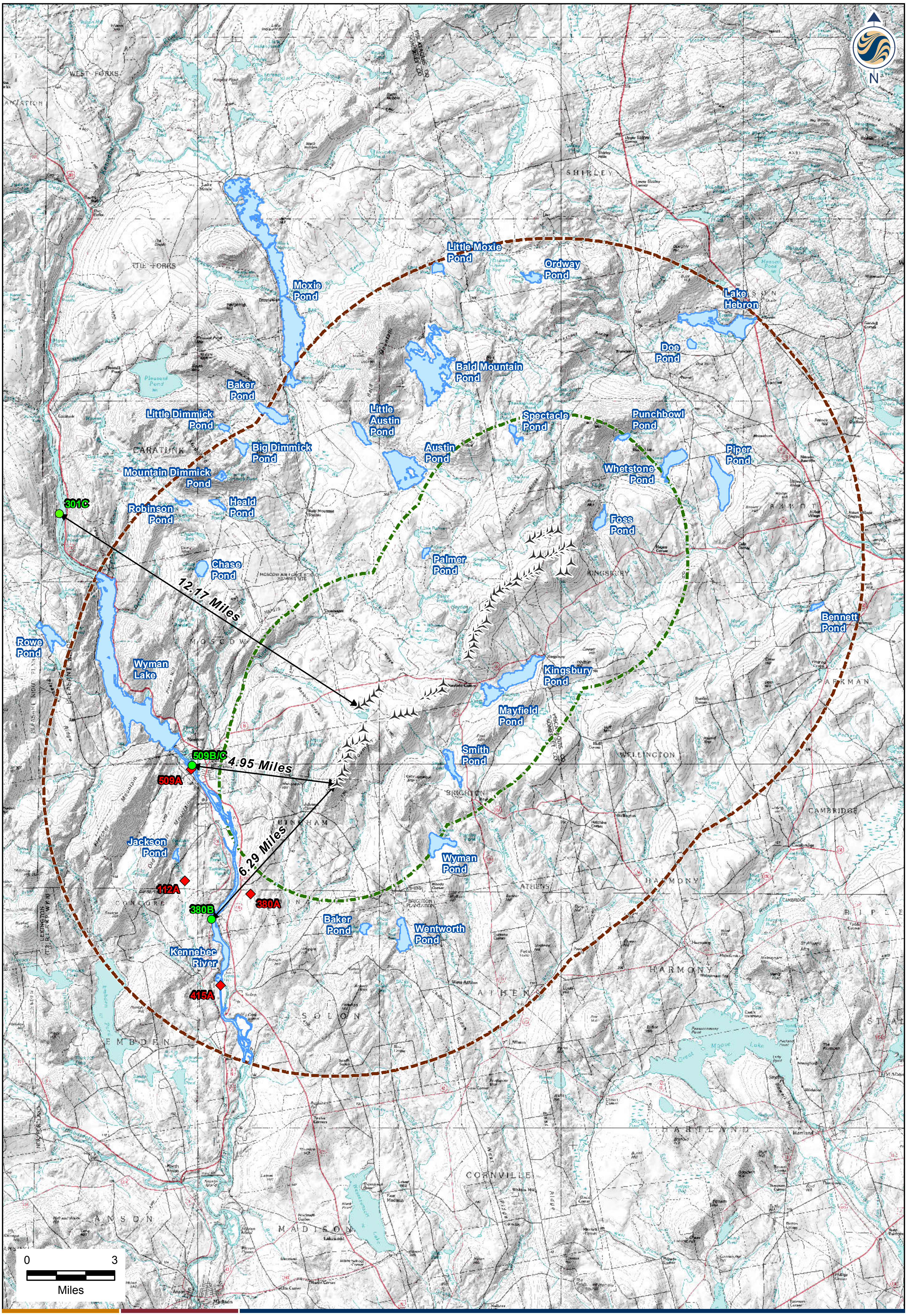
[4] U.S. Fish and Wildlife Service, March, 2012. *Guidelines for Building and Operating Wind Energy Facilities in Maine Compatible with Federal Fish and Wildlife Regulations*. U.S. Fish and Wildlife Service, Maine Field Office, Orono, ME.

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
Project Manager

cc: Dale Knapp, Stantec
Adam Gravel, Stantec



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00539_01_EagleMemo.mxd

Legend

- Active Bald Eagle Nest
- Historic/Inactive Bald Eagle Nest Location
- Proposed Turbine (1/16/2013)
- Surveyed Waterbody
- 4 Miles from Turbines
- 10 Miles from Turbines

195600539

Client/Project
Blue Sky West, LLC
Bingham Wind Project
Bingham, Maine

Figure No.
1

Title
Active Bald Eagle Nests

3/12/2013

Exhibit 7C-4: Deer Wintering Area Habitat Assessment Report

2013 Deer Wintering Area Habitat Assessment Report

Bingham Wind Project
Somerset and Piscataquis Counties, Maine

Prepared for:

Blue Sky West II, LLC

129 Middle Street, 3rd Floor
Portland, ME 04101

Prepared by:

Stantec Consulting

30 Park Drive
Topsham, ME 04086

March 2013

Stantec

1.0 INTRODUCTION AND PROJECT BACKGROUND

Blue Sky West II, LLC proposes to construct an approximately 17-mile generator lead extending from the Bingham Wind Power Project (project) in Bingham, Mayfield Township, and Kingsbury Plantation, Maine to a substation in Parkman. The generator lead will extend east through Kingsbury Plantation into Parkman. In Parkman, the proposed generator lead will continue northeasterly along Gales Road, into Abbot, turn south from Gales Road back into Parkman, then continue east crossing into Abbot again and then back into Parkman before tying into a Central Maine Power Company substation along Route 150 in Parkman. Along this route, the proposed generator lead will intersect portions of four mapped Deer Wintering Areas (DWAs). These include DWAs identified from two sources: areas mapped by the Maine Department of Inland Fisheries and Wildlife (MDIFW) under the Natural Resources Protection Act (NRPA) and areas zoned as P-FW Subdistricts by the Maine Land Use Planning Commission (LUPC) (Figure 1). These include the following locations:

- Kingsbury Plantation, LUPC P-FW #080604 (Figure 2);
- Parkman, MDIFW DWA #084029 (Figure 3);
- Parkman/Abbott, MDIFW DWA #084031/#084054 (Figure 4); and
- Parkman, MDIFW DWA #084033 (Figure 5);

The MDIFW identifies and regulates DWAs throughout Maine. DWAs provide important refuge for white-tailed deer (*Odocoileus virginianus*) during the winter months in northern climates (Moen 1968, Moen 1978, MDIFW 1990, Lavigne 1999). DWAs are typically characterized by an extensive forest stand of mature softwood species with a dense forest canopy. In Maine, such areas typically include stands of eastern hemlock (*Tsuga canadensis*), eastern white pine (*Pinus strobus*), or red spruce (*Picea rubens*), as well as forested wetlands dominated by northern white cedar (*Thuja occidentalis*) or black spruce (*Picea mariana*). During the cold winter months (i.e., average daily temperatures below 32 degrees Fahrenheit) and deep snow conditions (i.e., greater than 12 inches), deer will congregate or "yard-up" within these areas. DWAs provide shallower snow depths allowing for more efficient travel for foraging and avoiding predators, as well as provide thermal protection from wind chill.

2.0 SURVEY METHODOLOGY

In March 2013, Stantec conducted habitat assessments within portions of the four DWAs in Kingsbury Plantation, Abbot, and Parkman that are intersected by the proposed generator lead. Prior to these assessments, a survey plan was prepared and reviewed with MDIFW (Appendix A). Through consultation with MDIFW Region E biologists, transects were largely established along the proposed centerline of the generator lead, as well as within a 0.25-mile zone on either side of the proposed corridor. Transects within the 0.25-mile zone were oriented to provide sufficient coverage to accurately characterize the existing canopy cover and deer use within that zone. Field surveys were conducted during appropriate deer wintering conditions as outlined in the MDIFW DWA and Travel Corridor guidance document (December 22, 1993). Snow depth and weather conditions were recorded at each DWA. Along each transect, data were collected on forest stand type, deer use, and general landscape characteristics along 2-chain (i.e., 132 feet) intervals using the standard MDIFW DWA data collection form. Plot location points were loaded onto a Garmin eTrex handheld Global Positioning System (GPS) receiver to allow for accurate navigation.

3.0 SURVEY RESULTS AND DISCUSSION

Stantec completed surveys from March 12 through March 14, 2013. Representative photographs are included in Appendix B. Completed data forms for each transect are included in Appendix C. The following sections, including Table 1, provide the results of the field surveys and present a characterization of the existing forest conditions within each DWA in the vicinity of the proposed generator lead.

Snow conditions were similar for each DWA. Snow depth averaged from 17 to 24 inches in open, hardwood areas and 6 to 10 inches in areas with a closed canopy. Sinking depth ranged from 0 to 8 inches from the surface of the snow. When snow depth exceeds 12 inches, deer will typically leave hardwood areas and seek shelter in the closed canopy and decreased snow depth found in closed canopies. Deer will concentrate in the areas of best shelter within the DWAs and utilize established trails when sinking depth exceeds 18 inches. The recorded snow depth indicates that deer are likely to be present in the DWAs during the time of the survey. The relatively low sinking depth indicates that deer will likely be utilizing the entire DWA and will not be confined to the areas of best shelter within the DWAs.

3.1 Kingsbury Plantation DWA (#080604)

On March 12, 2013, Stantec completed surveys within the DWA in Kingsbury Plantation. The DWA is not mapped by MDIFW, but is within LUPC P-FW Subdistricts. Four transects and 33 plots were established within a 0.25-mile zone in the vicinity of the proposed generator lead within the DWA (#080604) south of Kingsbury Stream and west of 2500 Road (Figure 2). Field survey results indicate that 7 of the plots (21%) contained conforming DWA canopy cover (e.g., stands with tree heights 35 feet or taller and canopy closures of more than 50%). None of the plots along the proposed generator lead contained evidence of deer use. The two western-most transects contained the highest proportion of suitable DWA forest cover. Portions of the transects in the vicinity of the proposed generator lead, and near 2500 Road, have been affected from past timber harvests and are presently characterized by an open canopy forest with very dense regeneration of balsam fir (*Abies balsamea*), striped maple (*Acer pennsylvanicum*), and quaking aspen (*Populus tremuloides*) shrubs and saplings within the forest understory.

Within the proposed generator lead corridor (Transect 1), none of the four plots surveyed presently contain suitable softwood forest cover, and no plots contained evidence of deer use. The proposed corridor will create a permanently treeless corridor along the eastern tip of the DWA. Because the proposed generator lead will be located along the eastern periphery of the DWA and avoids the interior habitat that contains a higher proportion of softwood forest cover, habitat fragmentation and impacts to deer winter cover and travel corridors will be minimized, and suitable softwood forest cover will not be removed.

3.2 Parkman West DWA (#084029)

On March 12, 2013, Stantec completed surveys within the Parkman West MDIFW-mapped DWA (#084029). The proposed generator lead crosses the northwestern corner of this DWA, which is bordered by Pease Bridge Road to the north and Crow Hill Road to the east. Carlton Stream flows south to north and bisects the DWA (Figure 3). Stantec surveyed 2 transects with 18 plots along the western edge of the DWA and within the proposed generator lead corridor. Seven of the survey plots (39%) contained conforming DWA cover. No plots contained evidence of deer use. The transects included forested wetlands and open canopy upland woods. These mixed hardwood and softwood communities are dominated by red spruce and yellow birch (*Betula alleghaniensis*). Past timber harvests have occurred in portions of the forested wetlands. Landowner permission was not obtained for the portion of the DWA that is located to the east of Carlton Stream. However, based on a review of the available aerial photographs and views from Pease Bridge Road, this portion of the DWA is dominated by forests similar to those on the west side of Carlton Stream.

Within the proposed generator lead corridor (Transect 1, plot 3 and transect 2, plots 1 and 2), 1 of 3 plots surveyed presently contain suitable softwood forest cover, and no plots contained evidence of deer use. The proposed generator lead will create a permanently treeless corridor along the northwestern corner of the DWA. Although the proposed generator lead will remove suitable softwood forest cover, habitat fragmentation impacts to deer travel corridors will be minimized because impacts will be located only along the periphery of the DWA.

3.3 Parkman/Abbot DWA (#084031/#084054)

On March 13, 2013, Stantec completed surveys within the Parkman/Abbot MDIFW-mapped DWA (#084031/#084054), which is located south of Gales Road and adjacent to Gales Brook near the Parkman and Abbot town line (Figure 4). Six transects and 97 plots were established within a 0.25-mile zone in the vicinity of the proposed generator lead crossing of this DWA. Forty-three of the plots (44%) contained conforming DWA canopy cover. The two northern-most transects (Transects 1 and 2), which follow the east and west sides of Gales Brook, contained the highest proportion of suitable DWA forest cover. Portions of forested communities in the vicinity of the proposed generator lead have been affected by past timber harvests and beaver (*Castor canadensis*) activity. Overall, upland forests along the transects are presently primarily closed canopy and dominated by balsam fir and red spruce. Wetland communities along the transects are closed canopy and dominated by northern white cedar.

Within the proposed generator lead corridor (Transect 4), 11 of the 17 plots surveyed presently contain suitable softwood forest cover, with 16 plots containing evidence of deer use. The proposed generator lead will create a permanently treeless corridor through the center of the DWA. Because the generator lead will cross through the center of the DWA and will remove suitable softwood forest cover, it may impact deer winter cover and travel corridors, potentially fragmenting this existing habitat.

3.4 Parkman East DWA (#084033)

On March 14, 2013, Stantec completed surveys with the Parkman East MDIFW-mapped DWA (#084033), which is located south of Route 6 and north of Route 150 (Figure 5). Eight transects and 161 plots were established within a 0.25-mile zone in the vicinity of the proposed generator lead crossing of the DWA. Sixty-three of the plots (39%) contained conforming DWA canopy cover. Western portions of the transects in the vicinity of the proposed generator lead have been affected by past timber harvests and development associated with Davis Road. These areas are presently characterized by primarily closed canopy hardwood and softwood forests dominated by balsam fir, red spruce, and red maple (*Acer rubrum*) and disturbed, open canopy wetlands dominated by black ash (*Fraxinus nigra*), red maple, and balsam fir. The eastern portions of transects 1, 3, and 5, located east of Davis Road contained the highest proportion of suitable DWA forest cover. These areas are less disturbed by past timber harvests and are presently characterized by closed canopy forested wetlands dominated by northern white cedar.

Within the proposed generator lead corridor (Transect 1), 22 of the 61 plots surveyed presently contain suitable softwood forest cover, and 60 plots contained evidence of deer use. The proposed generator lead will create a permanently treeless corridor through the center of the DWA. Because the proposed generator lead crosses through the center of the DWA and will remove suitable softwood forest cover, it may fragment the existing habitat and impact deer winter cover and travel corridors.

4.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The DWAs surveyed and evaluated by Stantec in March 2013 appear to vary in their function as DWAs. The Kingsbury Plantation DWA (#080604) and Parkman West DWA (#084029) are not presently functioning as DWAs. Past and ongoing timber management activities have removed suitable softwood stands and fragmented travel corridors with logging roads and skidder trails, thereby substantially affecting the ability of these areas to provide effective winter cover. The proposed generator lead crossing of these DWAs will be located along the periphery of the habitats, which should minimize habitat fragmentation and allow for continued movement of deer through the interior of the habitats.

The Parkman/Abbot DWA (#084031/#084054) and Parkman East DWA (#084033) have a greater proportion of suitable DWA cover in the vicinity of the proposed generator lead. The establishment of a permanent treeless corridor through these areas has the potential to fragment travel corridors and reduce the presently available softwood cover unless measures are implemented to mitigate these impacts. These efforts could include utilizing taller poles and narrower clearing limits to allow for the retention of forested cover within the corridor, which may in turn provide better conditions for movement of deer across the corridor during winter.

The following Table 1 summarizes the results of the field surveys.

Table 1: DWA Survey Summary

DWA Name	Proportion of Suitable Softwood DWA Shelter within Proposed Corridor	Evidence of Deer Use within the Proposed Corridor	Comments
Kingsbury Plantation (#080604)	0 of 4 (0%)	0 plots	Proposed corridor is located along eastern edge of DWA, which minimizes impacts to interior of DWA.
Parkman West (#084029)	1 of 3 plots (33%)	0 plot	Proposed corridor is located along the northwestern corner of DWA, which minimizes impacts to interior of DWA.
Parkman/Abbot (#084031/#084054)	11 of 17 plots (65%)	16 plots	Proposed corridor has potential to fragment travel corridors; avoidance and minimization efforts, including taller poles and longer spans, will mitigate.
Parkman East (#084033)	22 of 61 plots (36%)	60 plots	Proposed corridor has potential to fragment travel corridors; avoidance and minimization efforts, including taller poles and longer spans, will mitigate.

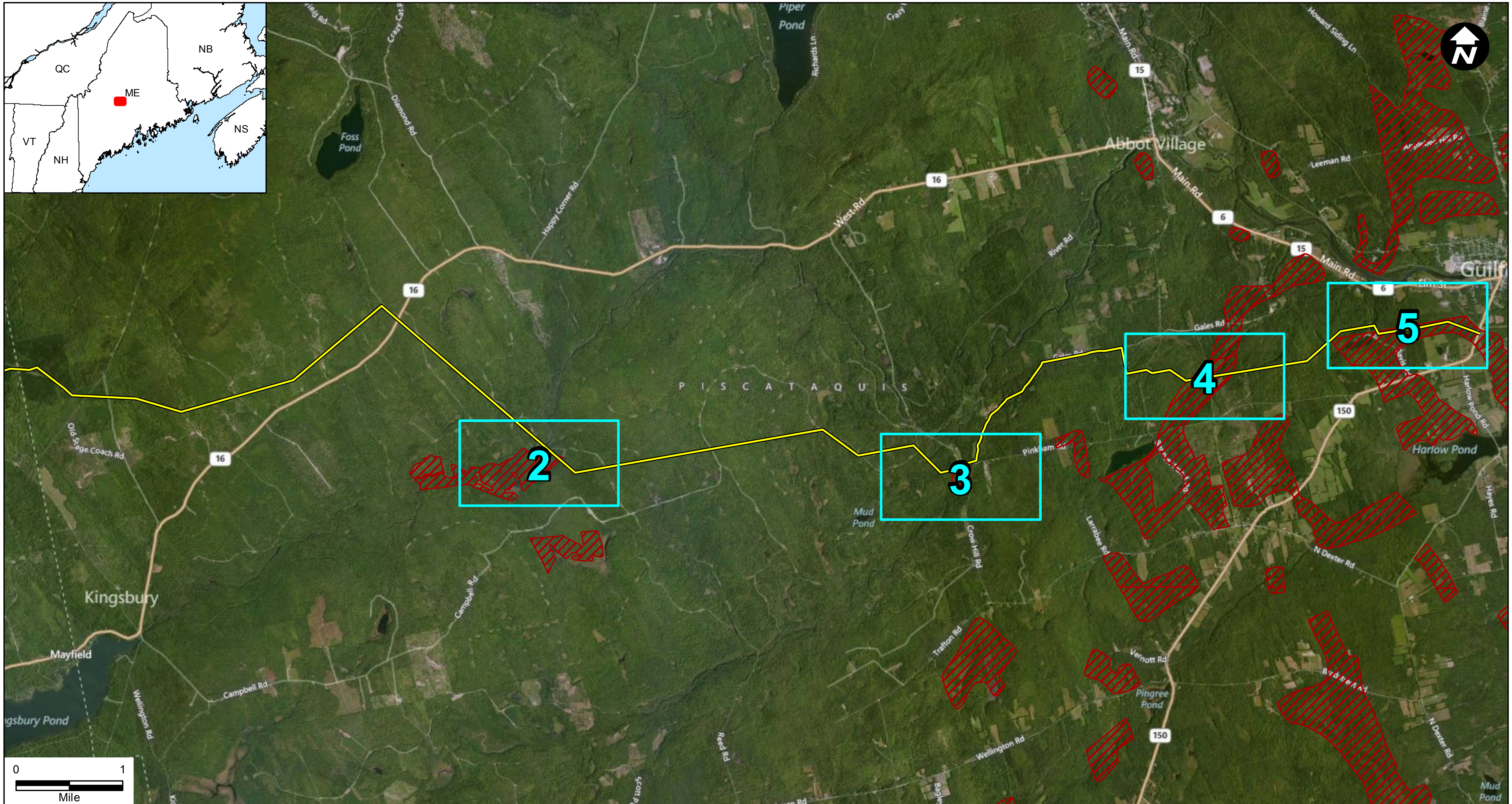
5.0 LITERATURE CITED

Lavigne, G.R. 1999. White-tailed deer assessment and strategic plan 1997. Maine Department of Inland Fisheries and Wildlife, Augusta, ME. 134 pp.

Maine Department of Inland Fisheries and Wildlife. 1990. Deer habitat management system and database. Maine Department of Inland Fisheries and Wildlife, Augusta, ME. 67 pp.

Moen, A.N. 1968. Energy exchange of white-tailed deer, western Minnesota. Ecology. 49: 676-682.
Moen, A.N. 1976. Energy conservation by white-tailed deer in the winter. Ecology. 57:192-198.

Figures



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00539_01_DWA_Survey.mxd

Legend
- Electrical Generator Lead
- Clearing Limits
- Deer Wintering Area
- Map Extent

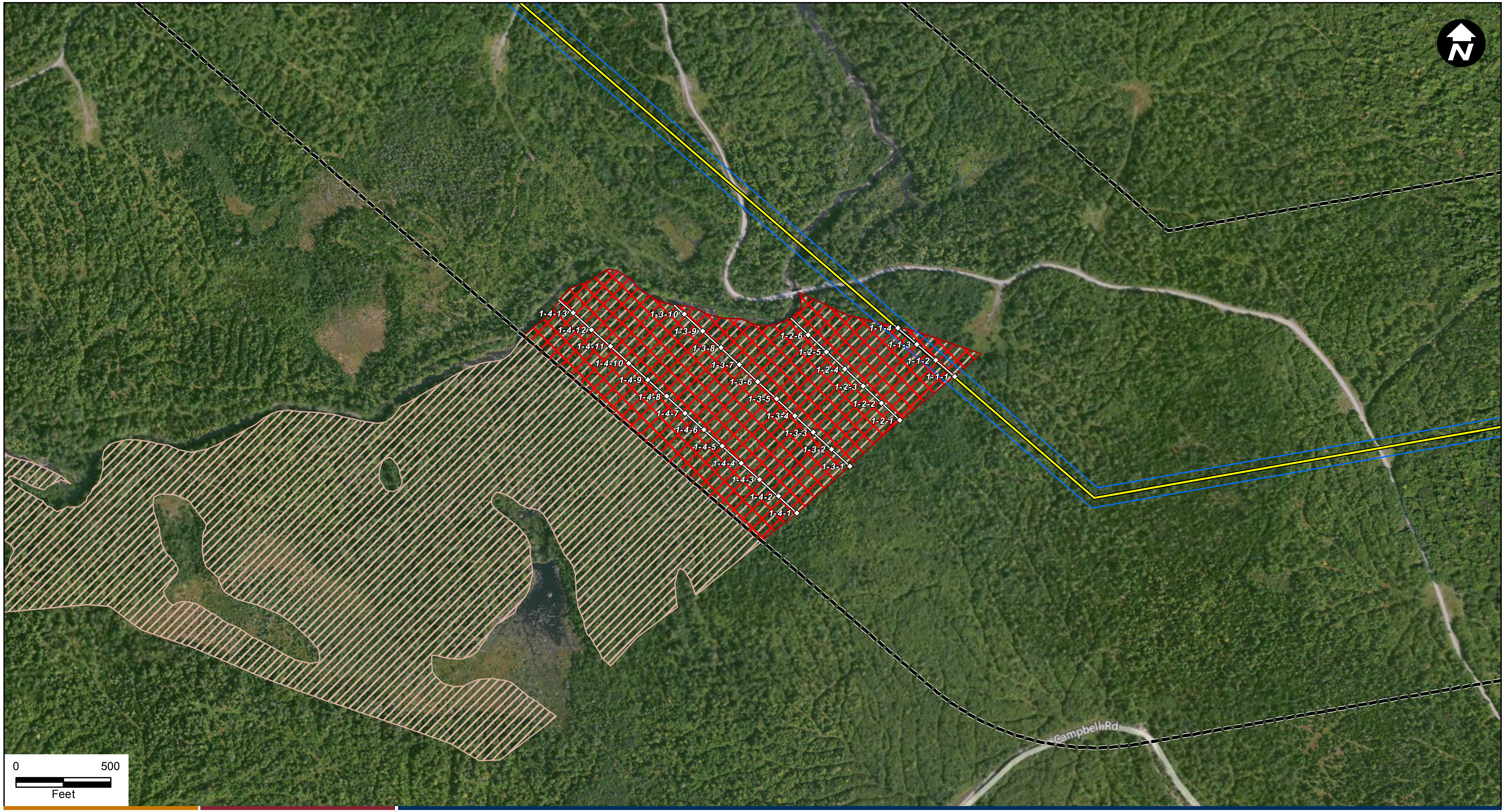
Notes
Aerial imagery provided by Bing Maps aerial imagery web mapping service ((c) 2010 Microsoft Corporation and its data suppliers).

Client/Project
Bingham Wind Project

195600539

Figure No.
1

Title
Deer Wintering Area Survey Map
3/27/2013



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00539_02_DWA_Survey.mxd

Legend

- DWA Survey Point
- 2013 DWA Transects
- Electrical Generator Lead
- Clearing Limits
- Southern Option Gales Road Quarter Mile Buffer
- 2013 DWA Survey Area
- Deer Wintering Area

Notes

Aerial imagery provided by Bing Maps aerial imagery web mapping service ((c) 2010 Microsoft Corporation and its data suppliers).

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Client/Project
Bingham Wind Project

Figure No.
2

Title
Deer Wintering Area Survey Map
LUPC P-FW# 080604

3/27/2013

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00539_03_DWA_Survey.mxd

Legend
- DWA Survey Point
- 2013 DWA Transects
- Electrical Generator Lead
- Clearing Limits
- Southern Option Gales Road Quarter Mile Buffer
- 2013 DWA Survey Area
- Deer Wintering Area

Notes
Aerial imagery provided by Bing Maps aerial imagery web mapping service ((c) 2010 Microsoft Corporation and its data suppliers).

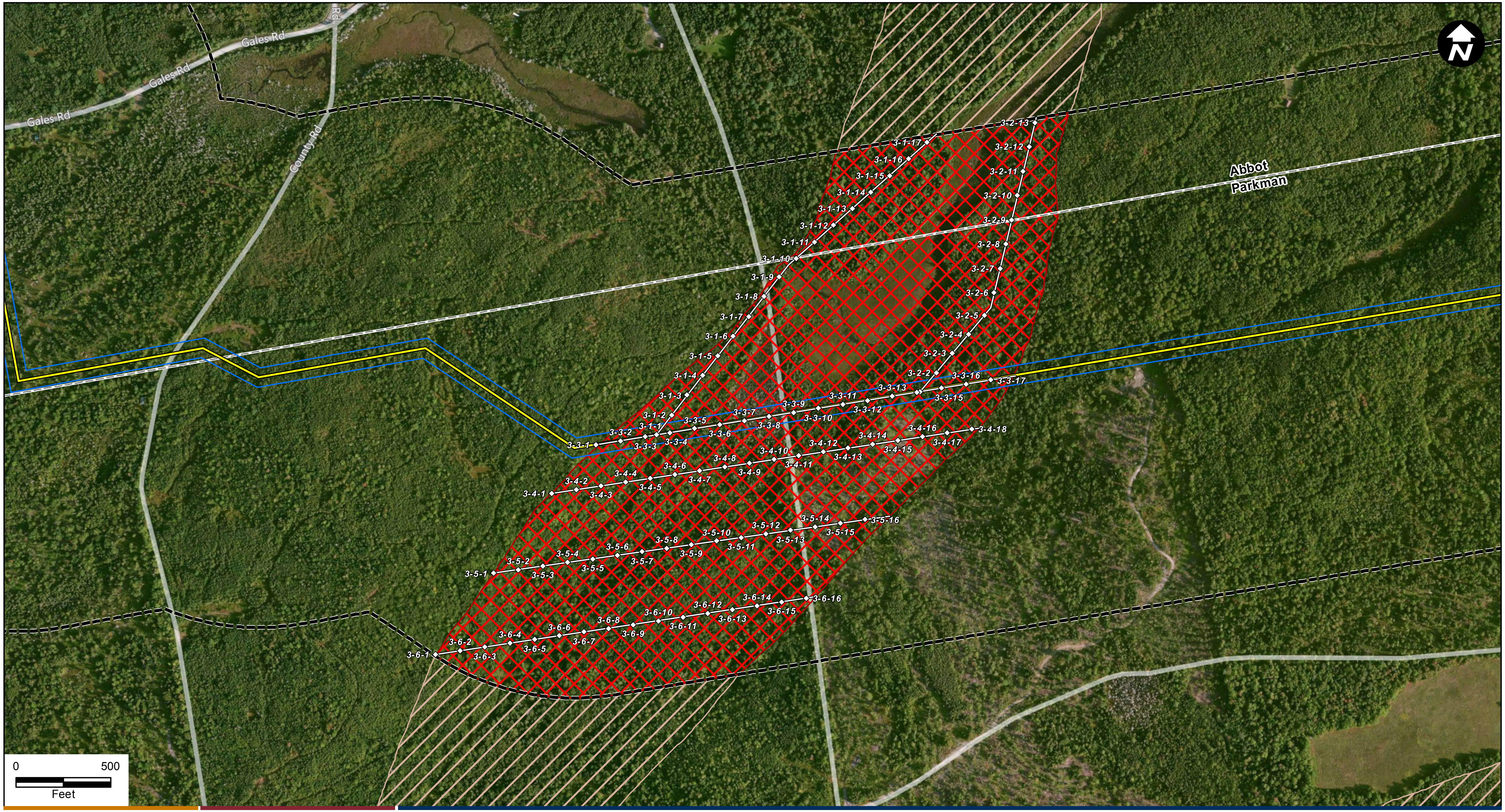
Client/Project
Bingham Wind Project

195600539

Figure No.
3

Title
Deer Wintering Area Survey Map
MDIFW DWA# 084029

3/27/2013



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00539_04_DWA_Survey.mxd

Legend
- DWA Survey Point
- 2013 DWA Transects
- Electrical Generator Lead
- Clearing Limits
- Southern Option Gales Road Quarter Mile Buffer
- 2013 DWA Survey Area
- Deer Wintering Area

Notes
Aerial imagery provided by Bing Maps aerial imagery web mapping service ((c) 2010 Microsoft Corporation and its data suppliers).

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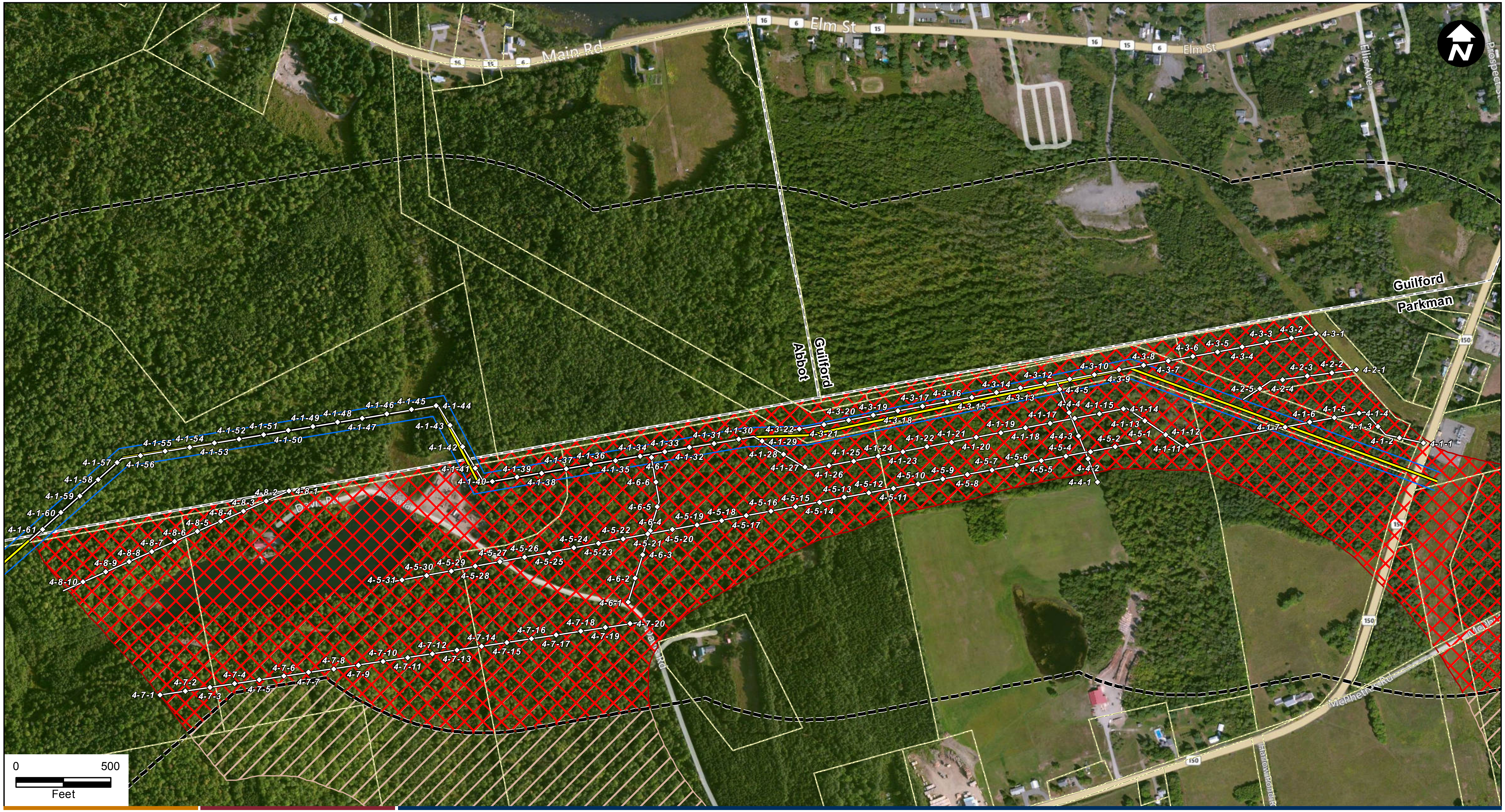
Client/Project
Bingham Wind Project

Figure No.
4

Title
Deer Wintering Area Survey Map
MDIFW DWA# 084031 and 084054

3/27/2013



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00539_05_DWA_Survey.mxd

Legend

- DWA Survey Point
- 2013 DWA Transects
- Electrical Generator Lead
- Clearing Limits
- Southern Option Gales Road Quarter Mile Buffer
- 2013 DWA Survey Area
- Deer Wintering Area
- Town Boundary
- Parcels

Notes

Aerial imagery provided by Bing Maps aerial imagery web mapping service ((c) 2010 Microsoft Corporation and its data suppliers).

195600539

Client/Project

Bingham Wind Project

Figure No.

5

Title

Deer Wintering Area Survey Map
MDIFW DWA# 084033

3/27/2013

Appendix A Study Plan

March 7, 2013

Doug Kane
Maine Department of Inland Fisheries and Wildlife
P.O. Box 551
Greenville, ME 04441

Subject: Proposed Deer Wintering Area Study Plan
Proposed Blue Sky West II, LLC Electrical Generator Lead,
Piscataquis County, Maine

Dear Doug:

Thank you for the opportunity to discuss the proposed Bingham Wind Project electrical generator lead (transmission line) and the potential impacts relative to Deer Wintering Areas (DWAs). This letter outlines the proposed study plan that Stantec Consulting (Stantec) will implement to survey and characterize the DWAs that are located within the proposed transmission line project area. We are providing this study plan to the Maine Department of Inland Fisheries and Wildlife (MDIFW) Region E biologists for your information.

Project Overview
Blue Sky West II, LLC proposes to construct an approximately 17-mile transmission line extending from a summit generation area in Mayfield Township and Kingsbury Plantation, Maine to a substation in Parkman (Overview Map). The transmission line will extend westerly through Kingsbury Plantation then follow the boundary between Parkman and Abbot to the substation located just outside of Guilford. Along its route, the proposed transmission line will intersect portions of four DWAs. These include DWAs as mapped by the MDIFW under the Natural Resources Protection Act, and areas zoned as P-FW Subdistricts by the Maine Land Use Planning Commission (LUPC). These include the following areas:

- Kingsbury Plantation DWA #080604 (Figure 1)
- Parkman DWA #084029 (Figure 2)
- Abbot DWA #084054/Parkman DWA #084031 (Figure 3)
- Parkman DWA #084033 (Figure 4)

In many instances, the proposed transmission line has been located to minimize fragmentation within the DWA in accordance with the MDIFW Guidelines for Wildlife: Managing Deer Wintering Areas in Northern, Western and Eastern Maine. This has been accomplished by locating portions of the transmission line near existing agriculture fields and areas of development or locating the proposed transmission line along the edges of the DWA. The proposed transmission line will intersect interior portions of two DWAs – Parkman DWA #084031 and Parkman DWA #084033.

DWA Survey Methodology
Through consultation with MDIFW Regional biologists on previous DWA survey projects, proposed survey efforts include establishing transects within a 0.25-mile area associated with the proposed transmission line. Transects are largely established along the proposed centerline of the transmission line corridor, as well as within a 0.25-mile zone on either side of the proposed corridor. Transects within the 0.25-mile zone are oriented to provide sufficient coverage in order to characterize the existing canopy cover and deer use within that zone. Transects are conducted during appropriate deer wintering conditions as outlined in the DWA and Travel Corridor MDIFW guidance document (December 22, 1993). Along each transect, data is collected on forest stand type, white-tailed deer (deer; *Odocoileus virginianus*) use, and general landscape characteristics along 2-chain (i.e., 132 feet) intervals using the standard MDIFW DWA data collection form. The attached figures show the locations of proposed transects to be surveyed within each DWA in 2013.

Stantec will prepare a detailed report of the field methodologies and the results of the surveys. These results and the completed DWA data forms and representative site photographs will be provided to the MDIFW.

Kingsbury Plantation LUPC P-FW DWA #080604
The proposed transmission line will intersect the eastern tip of the LUPC P-FW DWA #080604 in Kingsbury Plantation (Figure 1). Stantec will establish and conduct field surveys along four transects within a 0.25-mile zone to the west of the proposed transmission line, as well as along the centerline of the proposed transmission line, to characterize forest cover and deer use within the vicinity of the proposed transmission line.

Parkman DWA #084029
The proposed transmission line will cross a narrow portion of DWA #084029 along the northern edge of the DWA crossing Carlton Stream in the town of Parkman (Figure 3). Stantec will establish and conduct field surveys along three transects within a 0.25-mile zone south of the proposed transmission line to characterize forest cover and deer use within the vicinity of the proposed transmission line.

Abbot DWA #084054/Parkman DWA #084031
The proposed transmission line is located south of the southern boundary of the Abbot DWA #084054 along the Parkman town line (Figure 3). Although the boundary of this DWA likely follows the Parkman town line and continues to the south as the Parkman DWA #084031, a portion of this DWA is within the 0.25-mile inclusion zone. As such, Stantec has established and extended two transects from where the proposed transmission line crosses the Parkman DWA #084031, northeast into the Abbot DWA #084054, one on each side of Gales Brook.

The proposed transmission line crosses Parkman DWA #084031 south of the Abbot town line (Figure 3). In order to provide assessments of habitat connectivity and travel corridors within the vicinity of the proposed transmission line, Stantec will conduct surveys along six transects including the centerline of the proposed transmission line. Three transects cross the DWA at the same bearing as the proposed transmission line at recommended intervals to the south, while the final two transects extend through forest cover on either side of Gales Brook, northeast of the proposed crossing and continue into the Abbot DWA #084054.

Parkman DWA #084033
Portions of the Parkman DWA #084033 abut the existing CMP Parkman substation while the proposed transmission line crosses the interior of the northern section of the DWA paralleling the Guilford and Abbot town lines (Figure 4). In order to provide assessments of habitat connectivity and travel corridors within the vicinity of the proposed transmission line, Stantec will conduct surveys along eight transects, including the centerline of the proposed transmission line where it is within the mapped DWA. Five

transects roughly parallel the line while two cross or extend from it in a perpendicular fashion. Perpendicular transects were added to cover proposed access roads.

Stantec anticipates conducting field surveys in March 2013 during appropriate snow and temperature conditions. We respectfully request that any comments that MDIFW may have regarding this DWA study plan be submitted to us by March 11, 2013.

Sincerely,
STANTEC CONSULTING

Dale F. Knapp
Director, Water Resources Division

PN 195600539

Stantec

Exhibit 7D-1: Spring 2010 Pre-Construction Avian and Bat Survey Report

Spring 2010
Avian and Bat Survey Report
for the Bingham Wind Project
In Bingham, Mayfield, and Kingsbury, Maine

Prepared for

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Rev. February 2012

Executive Summary

In advance of permitting activities for the proposed Bingham Wind Project (Project) in Somerset and Piscataquis Counties, Maine, Blue Sky West, LLC (Blue Sky) contracted Stantec Consulting Services Inc. (Stantec) to perform bird and bat surveys in 2010. The purpose of the field surveys was to evaluate bird and bat species presence and use of the Project area. Survey methods and work plans were developed based on past experience at other wind energy projects in the state. The work described in this report as well as the ongoing field surveys at the project were developed and discussed with the Maine Department of Inland Fisheries and Wildlife (MDIFW) and United States Fish and Wildlife (USFWS) staff at a meeting in Augusta, ME on March 5, 2010. This first season of wildlife field surveys for the Project included nocturnal marine radar surveys, bat detector surveys, raptor migration field surveys, breeding bird surveys, and aerial eagle nest surveys.[*] Summer/fall surveys are currently ongoing and the results of those studies will be presented in a separate report.

The Project is in the early stages of planning; however, current biological investigations include a series of four ridgelines extending approximately 15 miles northeast through the organized towns of Bingham, and unorganized townships of Mayfield and Kingsbury Plantation. The proposed turbines have a maximum height of 152 meters (m; 499 feet [']).

Nocturnal Radar Survey

Radar surveys were conducted during 20 nights in spring 2010 (between April 19 and May 26) to characterize nocturnal migration activity in the Project area. Surveys were conducted using X-band marine 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 an unnamed ridge just south of Route 16 in the town of Mayfield, located within the Project area. The radar location provided nearly unobstructed views of the surrounding airspace within the radar's range in all directions.

The overall mean passage rate for the entire spring survey period was 543 ± 30 targets per kilometer per hour (t/km/hr), and nightly passage rates varied from 51 ± 7 on April 29 to 1231 ± 202 t/km/hr on May 1. Mean flight direction through the Project area for the season was 43 ± 51°. The seasonal mean flight height of targets was 355 ± 1 m (1164') above the radar site, and nightly flight heights ranged from 156 ± 49 m (511') to 497± 96 m (1631'). The percent of targets observed flying below 152 m (499') was 21 percent for the entire season and varied by night, from 7 to 65 percent.

[*] The results of the aerial eagle survey were included in a Bald Eagle Nest Survey memo report dated June 30, 2010 and are not summarized in this report.

Bat Survey

The 2010 bat acoustic surveys were initiated in spring 2010 and the detectors will continue to operate through the fall 2010. This report presents the results of the spring surveys only, from April 13 through June 8. Eight acoustic detectors were deployed at five ridge top locations across the Project area. Three survey locations utilized meteorological (met) towers to elevate detectors at or above tree canopy height. Two additional locations did not have met towers, and therefore detectors were deployed at or below tree canopy height at these sites. At the recommendation of MDIFW, the majority of detectors were deployed at or below tree canopy height, however to document activity of long-distance migratory tree roosting species, those documented as most susceptible to collision with wind turbines, two detectors were deployed up high in two of the met towers to provide activity information above tree canopy height.

A total of 250 call sequences were recorded during the spring survey. Activity increased with decreasing detector height. Detectors deployed above tree canopy in met towers (n=2) had a combined detection rate of 0.16 call files recorded per detector-night (files/detector-night); detectors deployed at tree canopy height in met towers (n=3) had a combined detection rate of 0.31 files/detector-night; detectors deployed at or below tree canopy height (n=3) had a combined detection rate of 1.2 files/detector-night. Activity also increased over time during the spring survey period. The maximum activity recorded in a single night by all detectors occurred on May 28 (27 total calls for all detectors combined).

Of those calls that could be identified to species or guild, the Myotis guild (MYSP) contained the highest number of call sequences (n = 92) identified to a taxonomic level. Tree detectors recorded calls from all five guilds (MYSP, Unknown, eastern red bat/tri-colored bat (RBTB), big brown bat, silver-haired bat and hoary bat), while met tower detectors recorded call sequences from all guilds except the RBTB guild.

Diurnal Raptor Survey

Spring 2010 raptor migration surveys were conducted on 10 days from mid-March (March 19) through late-May (May 21). Five of those survey days were conducted at the two observation locations simultaneously (April 30, May 5, May 13, May 18, and May 21), for a total of 15 observation days (5 days at Johnson Ridge and 10 days at Kingsbury Ridge). A total of 105 hours were surveyed (70 hours at Kingsbury Ridge and 35 hours at Johnson Ridge).

Over the course of the survey period a total of 56 observations of raptors were made from both observation locations combined;19 observations from Kingsbury and 37 observations from Johnson. Two of these observations,1 turkey vulture (*Cathartes aura*) on May 5, and 2 turkey vultures on May 21, were thought to be simultaneous observations between the observers at Kingsbury and Johnson Ridges based on their flight directions and behavior. The seasonal passage rate for Kingsbury Ridge was 0.27 raptor observations per hour (raptors/hr); the seasonal passage rate for Johnson Ridge was 1.06 raptors/hr. Based on flight direction and behavior, the majority of birds observed were suspected to be seasonally local birds.

Of the 56 total raptor observations made within the study area at both observation locations combined, 34 (61%) observations occurred specifically within the Project area. In particular, 21 raptor observations occurred over Johnson Ridge and 13 observations occurred over Kingsbury Ridge. All other observations occurred either over hills, peaks, or valleys outside of the Project area.

At Johnson Ridge, 21 observations (57%) occurred within the Project area in topographical positions where the turbines are to be sited. Of these birds, 20 (95% of the 21 in the Project area) occurred at flight heights below the proposed maximum rotor height of 152 m. At Kingsbury Ridge, 13 observations (68%) occurred within the Project area in positions where the turbines are to be sited. Of these birds, 10 birds (77% of the 13 in the Project area) occurred at flight heights below the proposed maximum rotor height.

The most commonly observed species at both survey locations were turkey vultures. No endangered or threatened species were observed. Six observations of bald eagle (*Haliaeetus leucocephalus)*, a state-listed species of special concern, were made in the study area, four of which were made on May 25. Four of the six bald eagle observations occurred within the Project area. Of these, two adult bald eagles were observed near (at 150 m) and above 152 meters above the ground, one sub-adult bald eagle was observed flying between 50 and 100 meters, and another sub adult was observed flying over 500 meters above the ridge.

Breeding Bird Survey

In order to assess the assemblage of species of breeding birds within the Project area, a breeding bird survey (BBS) was conducted in late spring and summer 2010. Stantec biologists conducted breeding bird point-count surveys during three separate visits to the Project area. The first visit was completed during late May, the second visit in early June, and third visit in late June 2010.

The BBS surveys consisted of 25, 10-minute point count surveys positioned at locations along the ridgelines of the Project area. Survey points were positioned in various habitats within the Project area including coniferous forest, hardwood forest, equally mixed hardwood-coniferous forest, coniferous-dominated mixed forest, and hardwood-dominated mixed forest. Much of the Project area has been harvested either recently or historically or has been otherwise managed. As a result of this land use, many survey points occurred in forest stands in various stages of regeneration or within tree plantations.

A total of 787 individuals were documented among all survey points, including birds observed beyond 100 m from the observer and birds observed as flyovers. The species with the greatest numbers of individuals detected were white-throated sparrow (*Zonotrichia albicollis*; n=89), ovenbird (*Seiurus aurocapillus*; n=62), chestnut-sided warbler (*Dendroica pensylvanica*; n=53), and Nashville warbler (*Vermivora ruficapilla*; n=52).

There were a total of 673 individuals observed within 100 m of the observer and excluding flyovers. Excluding birds more than 100 m from the observer and flyovers, point-count data were analyzed to determine species richness, relative abundance, and community diversity for all survey points combined and for each habitat type present within the Project area. For all survey points and for birds within 100 m and non-flyovers, the relative abundance was 8.97, the species richness was 44, and the Shannon Diversity Index was 3.19.

Hardwood-dominated mixed forest habitat had the greatest number of total birds observed (n=179), the highest species richness (32), as well as the highest Shannon Diversity Index (3.04). Coniferous-dominated mixed forest had the highest relative abundance (10.89).

There were no endangered or threatened species observed; however, there were nine state special concern species documented either during surveys or incidentally: least flycatcher (*Empidonax minimus*), eastern wood-pewee (*Contopus virens*), veery (*Catharus fuscescens*), American redstart (*Setophaga ruticilla*), black-and-white warbler (*Mniotilta varia*), Canada warbler (*Wilsonia canadensis*), chestnut-sided warbler, yellow-warbler (*Dendroica petechia*), and white-throated sparrow.

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Appendix B	Bat Survey Data Tables
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PN195600539[†]

[†] *This report was prepared by Stantec Consulting Services Inc. for the Bingham Wind Project for Blue Sky West, 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

In advance of permitting activities for the proposed Bingham Wind Project (Project) in Somerset and Piscataquis Counties, Maine, Blue Sky West, LLC (Blue Sky) contracted Stantec Consulting Services Inc. (Stantec) to perform bird and bat surveys in 2010. The purpose of the field surveys was to evaluate bird and bat species presence and use of the Project area. Survey methods and work plans were developed based on past experience at other wind energy projects in the state. The work described in this report as well as the ongoing field surveys at the project were developed and discussed with the Maine Department of Inland Fisheries and Wildlife (MDIFW) and United States Fish and Wildlife (USFWS) staff at a meeting in Augusta, ME on March 5, 2010. This first season of wildlife field surveys for the Project included nocturnal marine radar surveys, bat detector surveys, raptor migration field surveys, breeding bird surveys, and aerial eagle nest surveys.[3] Summer/fall surveys are currently ongoing and the results of those studies will be presented in a separate report.

The Project is in the early stages of planning; however, current biological investigations include a series of four ridgelines extending approximately 15 miles northeast through the organized towns of Bingham, and unorganized townships of Mayfield and Kingsbury Plantation. The proposed turbines have a maximum height of 152 meters (m; 499 feet [']).

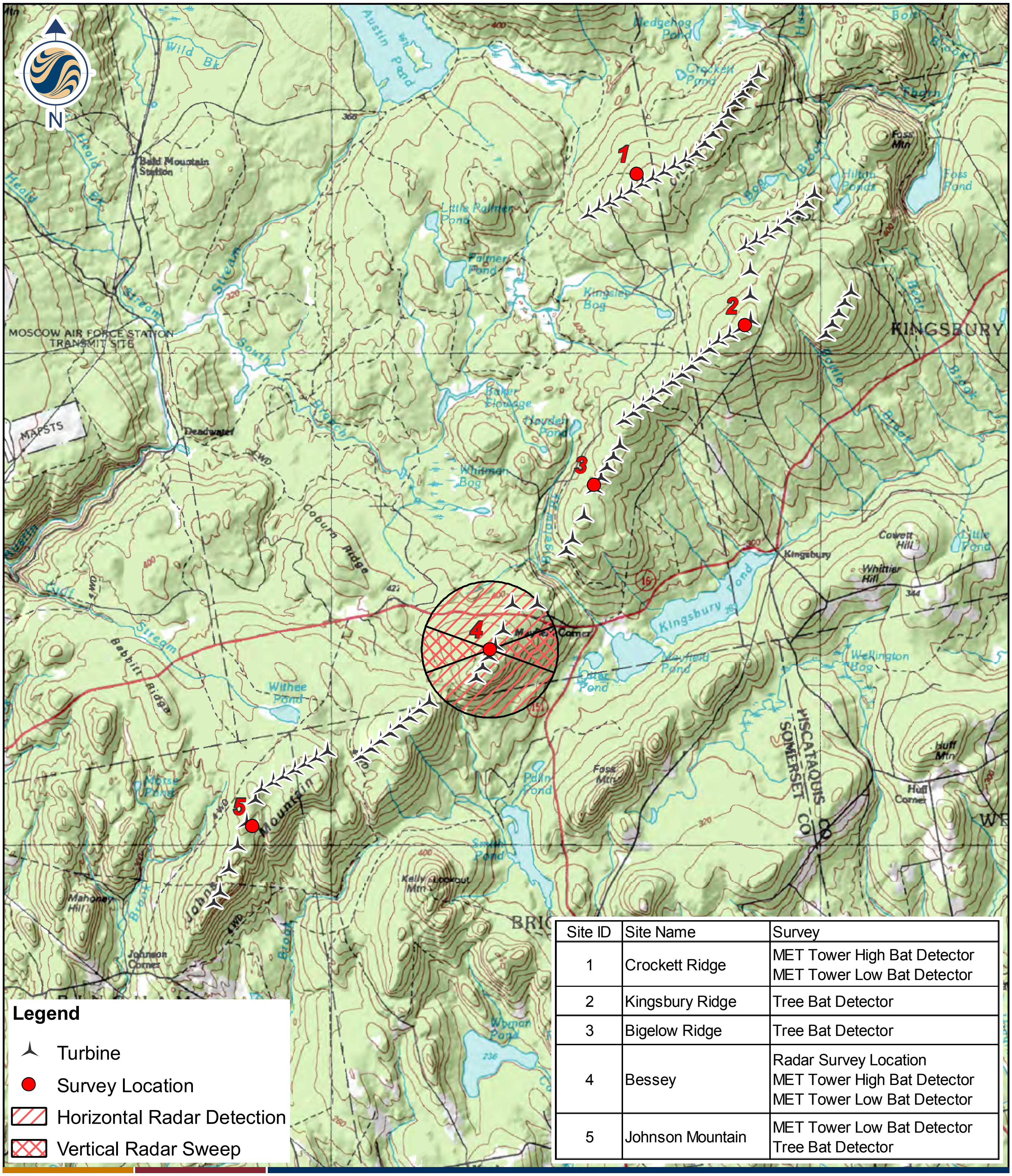
1.2 PROJECT AREA DESCRIPTION

The Project area is located within the Central and Western Mountains Ecoregion as defined in *Maine's Comprehensive Wildlife Conservation Strategy* (MDIFW 2005). This ecoregion is a consolidation of the Western Mountains and Central Mountains biophysical regions originally described by McMahon (1990). The Central and Western Mountains Ecoregion extends from the New Hampshire border south the White Mountains National Forest, north to Aroostook County and east to the western foothills. The average elevation within the western portion of the ecoregion (former Western Mountain Biophysical Region) is between approximately 305 m to 610 m (1,000' to 2,000') with several peaks exceeding 823 m (2,700'). The northern portion of this ecoregion includes some of the highest peaks in the state and has elevations that range from 183 m to 1,603 m (600' to 5,258'). The climate of this ecoregion is characterized by relatively low annual precipitation and cool temperatures. Heavy snow fall prolongs the winter resulting in a relatively short growing season (McMahon 1990). In general, ridge tops within this ecoregion are dominated by red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*) with lower elevations supporting deciduous species such as sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*) and American beech (*Fagus grandifolia*).

[3] The results of the aerial eagle survey were included in a Bald Eagle Nest Survey memo report dated June 30, 2010 and are not summarized in this report.

The Project area is located on a series of ridgelines that do not exceed 494 m (1620') in elevation. These include Johnson and Crockett ridges and an unnamed mountain in Kingsbury. The unnamed mountain and Crockett ridgelines are separated by Bog Brook and Kingsley Bog. Crockett Mountain has the highest elevation reaching up to 494 m. The unnamed mountain is the next highest in elevation reaching nearly 268 m; and Johnson Mountain reaches 241 m.

Historically and presently, the land within and surrounding the Project area, including the summits of the ridgelines, have been used for commercial timber management. This is evident by the recent and past cuts as well as the presence of the network of haul roads that extend through the Project area. Due to timber harvesting activities much of the forest stands within the Project area are in various stages of regeneration. Additionally, softwood plantations are present along some of the ridgelines.



Site ID	Site Name	Survey
1	Crockett Ridge	MET Tower High Bat Detector MET Tower Low Bat Detector
2	Kingsbury Ridge	Tree Bat Detector
3	Bigelow Ridge	Tree Bat Detector
4	Bessey	Radar Survey Location MET Tower High Bat Detector MET Tower Low Bat Detector
5	Johnson Mountain	MET Tower Low Bat Detector Tree Bat Detector

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Client/Project
Bingham Wind Project
Bingham, Maine

Figure No.
1-1

Title
Project Area and Spring 2010 Radar and Bat Acoustic Survey Locations Map

00539-F11-BatRadar.mxd

August 20, 2010

2.0 Nocturnal Radar Survey

2.1 INTRODUCTION

Nocturnal radar surveys were conducted in the Project area to characterize nocturnal migration patterns in spring 2010. The goal of the surveys was to document nocturnal migration in the Project area, including the number of migrants, nightly and seasonal passage rates, the flight direction of migrants, and flight altitude of migrants.

2.2 DATA COLLECTION METHODS

The radar site was located within the met tower clearing just south of Route 16 in Mayfield. This location was selected due to its nearly central location within the Project area. The site's topography and surrounding tree height allowed for relatively unobstructed views of the airspace surrounding the radar. Radar surveys were conducted during 20 nights between April 19 and May 26, 2010

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. Insects can be identified and removed from the migration calculations based on flight speed; however, it cannot readily distinguish between different types of animals being detected. Consequently, all animals observed on the radar screen (not including insects) were identified as "targets." The radar has an "echo trail" function which captures past echoes of flight trails, enabling determination of flight speed and 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 7.3 m (24') above ground. The antenna has a vertical beam width of 20° (10° above and below horizontal).

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).

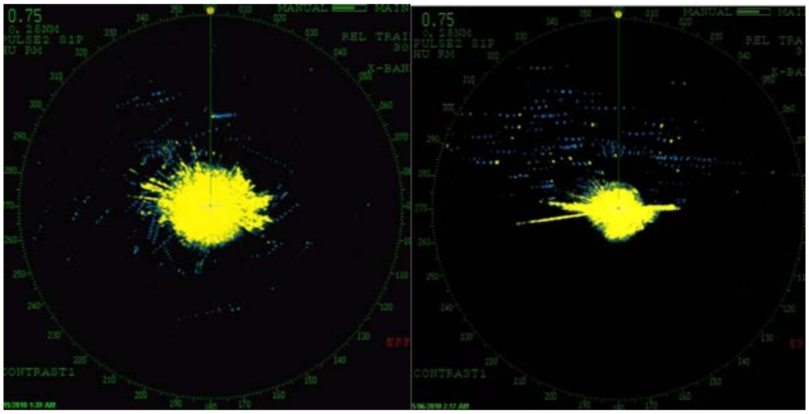

Figure 2-1. Screenshots from actual radar video files for the Bingham Wind Project showing ground clutter in horizontal mode (left) and vertical mode (right). Although the radar records three-dimensional space, it is translated by the radar screen into a two dimensional representation. For this reason ground clutter if not minimized with proper site configuration 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. 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.

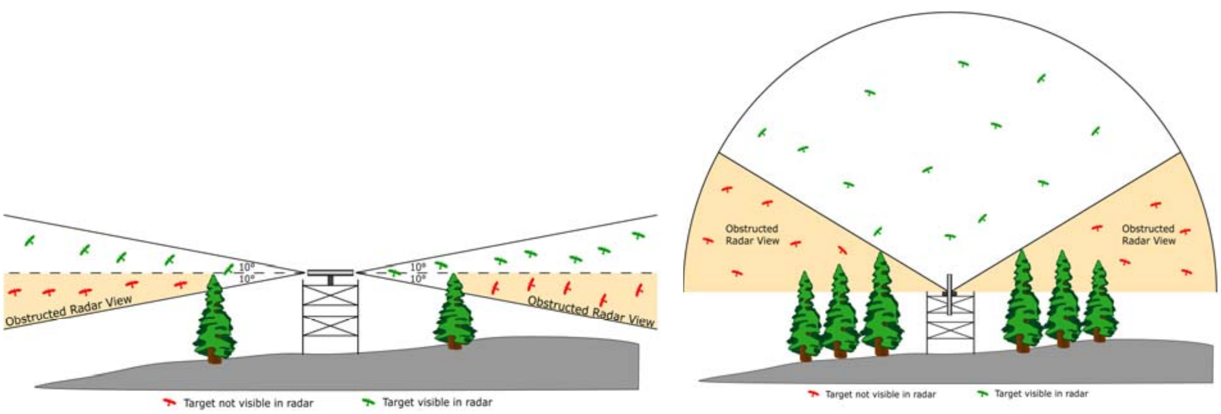

Figure 2-2. An example of ground clutter "hiding" a section of the radar beam, allowing adequate detection of targets (left). The effect of ground clutter on target detection in vertical mode is also shown (right).

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.

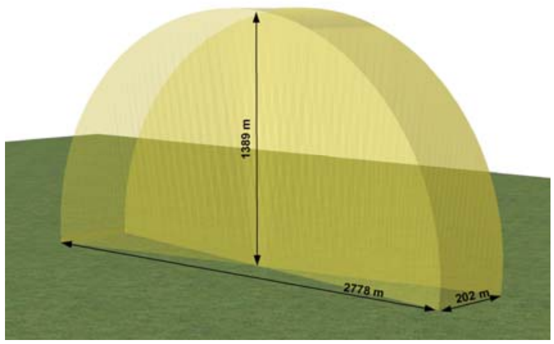

Figure 2-3. Detection range of the radar in vertical mode

The radar was operated at a range of 1.4 km (0.75 nautical miles [4,500']) to ensure detection of small targets. When radar is operated at greater ranges, 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.

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.

2.2.1 Weather Data

Temperature, wind speed and direction were recorded by the on-site met tower on Bessey Ridge. 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 period.

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 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 152 m (499'), 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. 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.

2.4 RESULTS

Radar surveys were conducted during 20 nights between April 19 and May 26, 2010 (Appendix A Table 1) resulting in 184 total hours surveyed. The radar location provided nearly unobstructed views of the airspace within the range of the radar in all directions.

2.4.1 Passage Rates

The overall passage rate for the entire survey period was 543 ± 30 t/km/hr. Nightly passage rates varied from 51 ± 7 targets per kilometer per hour (t/km/hr) on April 29 to 1231 ± 202 t/km/h on May 1, (Figure 2-4, Appendix A Table 1). Individual hourly passage rates varied between and within nights and throughout the season, and ranged from 0 t/km/hr on the 10^{th} hour of May 6 to 2193 t/km/hr on the 7^{th} hour of May 1 (Appendix A Table 2). For the entire season, passage rates were typically highest during the third hour after sunset, and then steadily declined until sunrise (Figure 2-5).

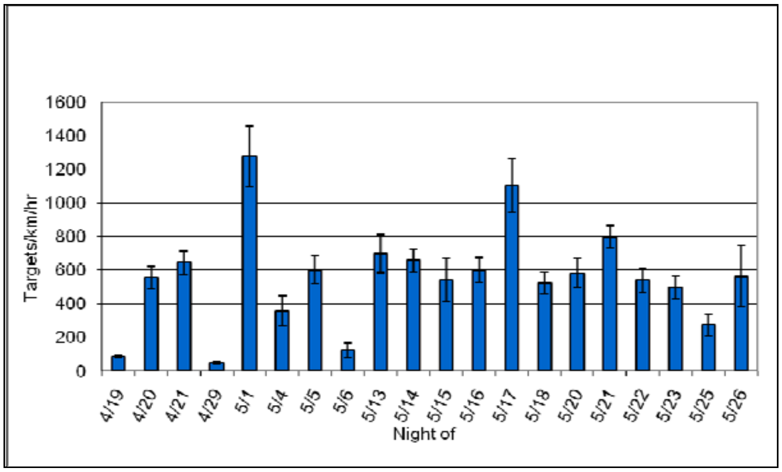

Figure 2-4. Nightly passage rates observed (error bars ± 1 SE) during Spring 2010 at the Bingham Wind Project.

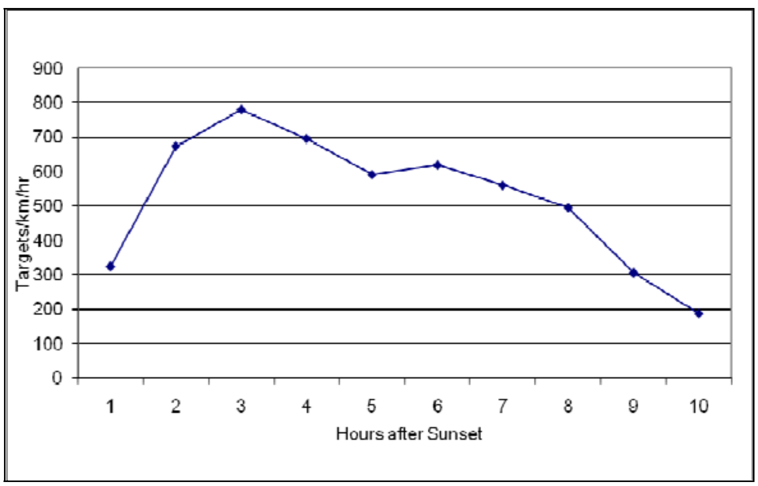

Figure 2-5. Hourly passage rates for entire season during Spring 2010 at the Bingham Wind Project

2.4.2 Flight Direction

Mean flight direction through the Project area was 43 ± 51°(Figure 2-6). Overall, the mean flight direction was to the northeast, but varied between nights (Appendix A Table 3).

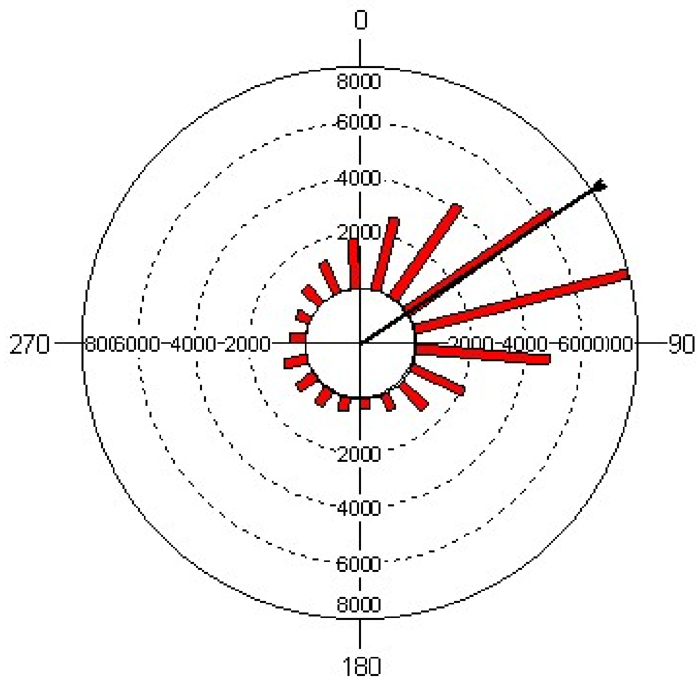

Figure 2-6. Mean flight direction for the entire season during Spring 2010 at the Bingham Wind Project (the bracket along the margin of the histogram is the 95% confidence interval)

2.4.3 Flight Altitude

The seasonal average mean flight height of all targets was 355 ± 1 m 1164) above the radar site. The average nightly flight height ranged from 156 ± 49 m (511') on May 15 to 497 ± 96 m (1631') on April 21 (Figure 2-7, Appendix A Table 4). The percent of targets observed flying below 152 m was 21 percent for the season and varied nightly from 7 percent on May 5 to 65 percent on May 15 (Figure 2-8).

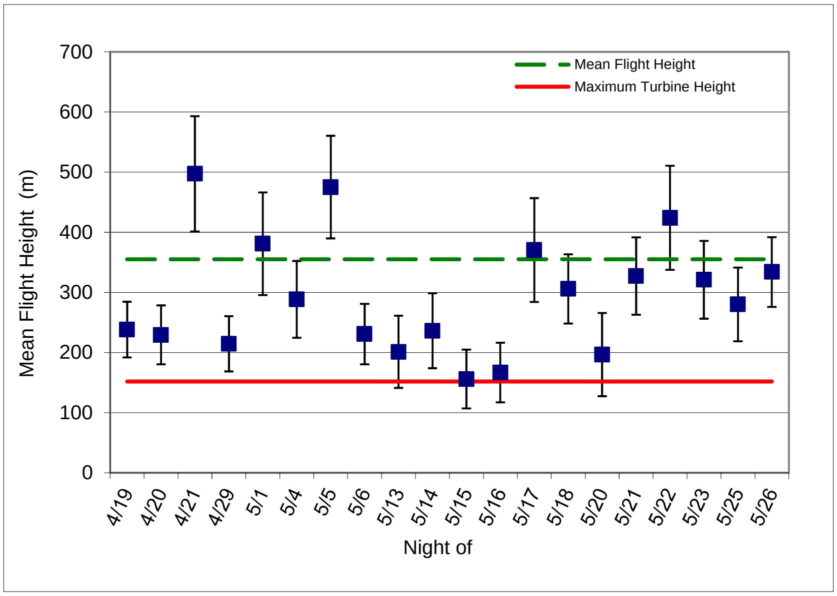

Figure 2-7. Mean nightly flight height of targets during Spring 2010 at the Bingham Wind Project (error bars ± 1 SE)

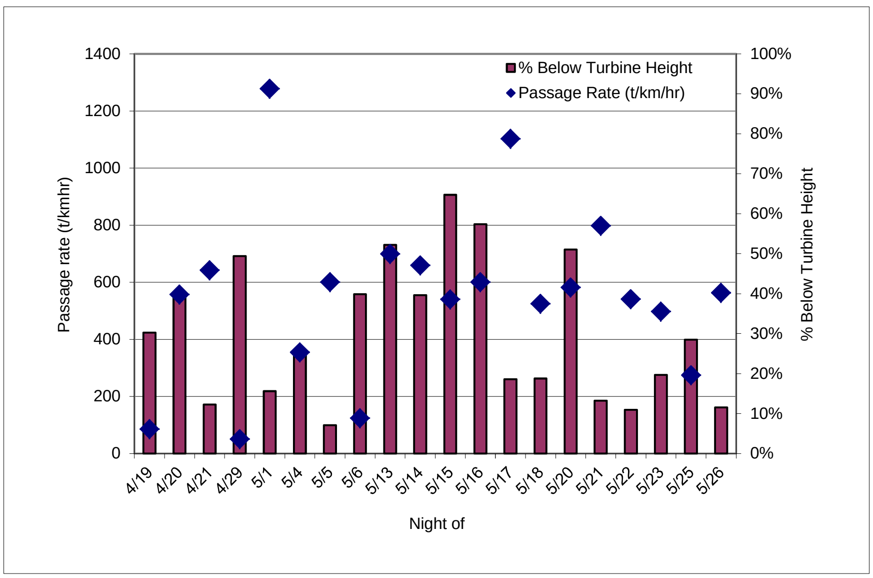

Figure 2-8. Percent of targets observed flying below a height of 152 m (499') during Spring 2010 at the Bingham Wind Project

Figure 2-9 below displays the range in nightly flight heights to graphically show the distribution of individual flight heights of all targets recorded each survey night relative to the proposed turbine height. The "blocks" seen on Figure 2-9 depict the middle 50 percent of targets. The error bars depict the statistical outliers, or 25 percent of targets above and below the middle 50% of targets. The horizontal line within each box represents the median flight height value for that night.

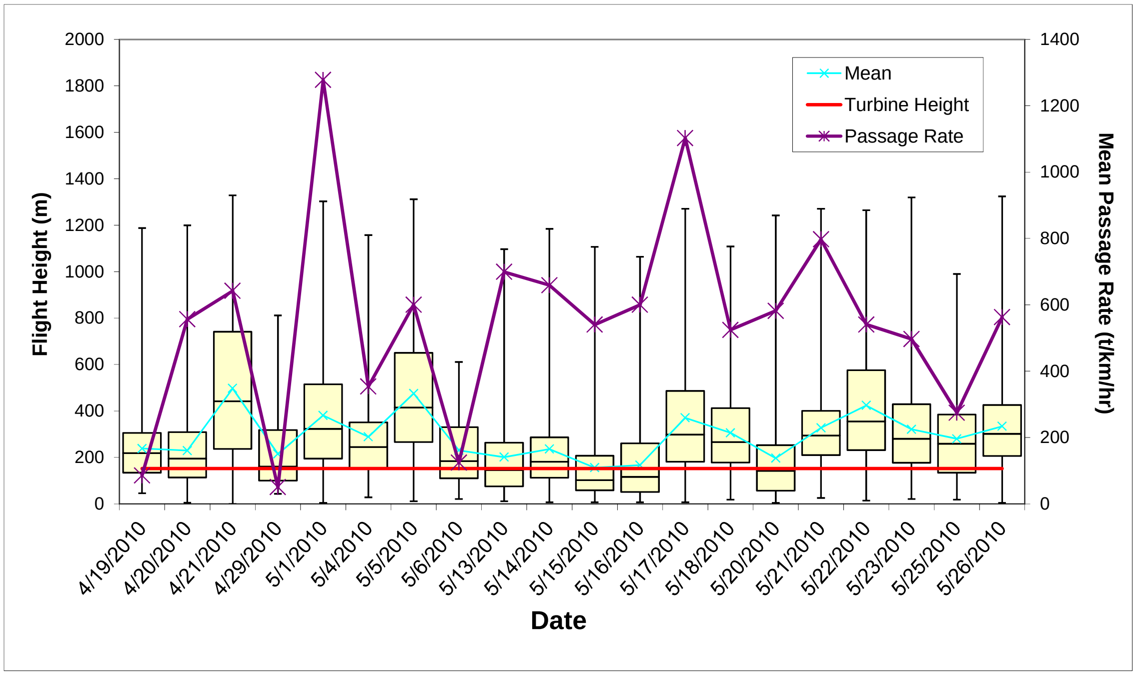

Figure 2-9. Flight height Whisker plot depicting the vertical distribution of targets for each survey night during Spring 2010 at the Bingham Wind Project

For the entire season, the mean hourly flight heights were typically highest during the second hour after sunset, with a second spike in the tenth hour (Figure 2-10).

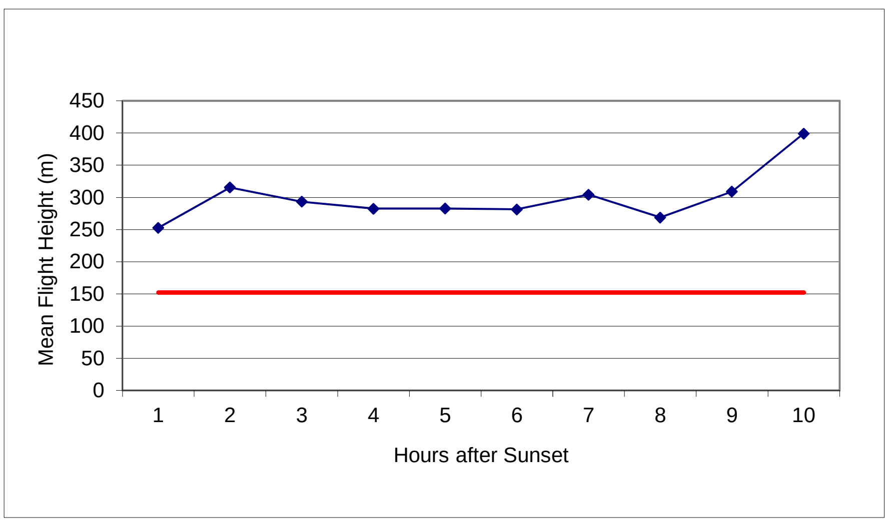

Figure 2-10. Hourly target flight height distribution during Spring 2010 at the Bingham Wind Project

2.4.4 Weather Data

During the survey period, mean nightly wind speeds in the Project area varied between 2.7 meters per second (m/s) on May 17 and 12.9 m/s on May 6, with an overall mean of 7.0 m/s.

Mean nightly temperatures varied between 4.8 °C on April 19 and 15.5 °C on May 1, with an overall mean of 10.0°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.

2.5 DISCUSSION

Spring radar surveys in the Project area documented similar nocturnal migration patterns to those observed during other recent 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.

The increasingly emerging number of publicly available studies characterizing nocturnal migration movements shows a relatively consistent pattern in flight altitude, with most targets appearing to fly at altitudes of several hundred meters or more above the ground (Appendix A Table 5). Flight heights are typically highest during the third to fifth hours after sunset, and then decreased until sunrise for other surveys conducted in the eastern US. Flight heights between hours within and among nights at the Project showed a slight increase between the first and second hours, remained consistent between the second and ninth hours, and appeared to increase during the tenth hour after sunset. The increase in flight heights in the tenth hour after sunset is fairly unusual when compared to flight height trends within and among nights at other projects; however, this may be due to the fact that no data were available for flight height during the tenth hour of 13 out of 20 nights due to too few samples in that hour as a result of increased daytime hours as the season progressed.

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 radar location was nearly centrally located within the Project area. Consequently, the radar site had good visibility and was capable of detecting targets within nearly all of its detection range. The average passage rate at the Project (543 ± 30 t/km/hr) is within the range of results of other radar studies conducted in Maine and the northeast (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 in large part to differences in radar view between sites, and not necessarily the amount of migration above a radar site.

Nightly variation in the magnitude and flight characteristics of nocturnal migrants is not uncommon and is often attributed to weather patterns, such as cold fronts and winds aloft (Hassler *et al.* 1963, Gauthreaux and Able 1970, Richardson 1972, Able 1973, Bingman *et al.* 1982, Gauthreaux 1991). For the 2010 spring radar surveys, high pressure systems were either present or had passed through the region just prior to nights of relatively high passage rates (May 1, May 13 and May 17). The sharp difference between passage rates on April 29 and May

1, the nights with the lowest and highest average passage rates, respectively, is likely due to the passage of a high pressure system. A low pressure system had stalled over the area for several days at the end of April causing heavy cloud cover, precipitation and northwest winds. Once a high pressure system moved through the area, allowing a break in weather, migration conditions improved as was reflected in the high passage rate on the night of May 1. Winds were generally light and from the southwest or southeast during the two nights with the highest passage rates (1231 t/km/hr on May 1 and 1103 t/km/hr on May 17). The average temperatures for these nights were also higher than on nights prior to or following these peaks.

The average flight height (355 ± 1 m) is within the range of average flight heights recorded at other radar studies conducted in the east (210 m to 552 m), and the overall percent below turbine height (21%) for all targets falls within the range of other results (4% to 26%). No nights experienced average flight heights below 152 m, the maximum height of the proposed turbines. Additionally all targets within the 50th percentile for each night were above the proposed turbine height (Figure 2-9).

For the 2010 spring Project surveys, flight heights were generally highest on nights with relatively high passage rates (349 ± 31 m on May 1 and 357 ± 33 m on May 17), indicating that birds tend to fly higher on nights more suitable for migration. On April 29, both average passage rate (51 ± 7 t/km/hr) and flight height (214 ± 46 m) were relatively low, most likely due to the inclement weather on that night which may have limited migration activity and “pushed” birds closer to the ground.

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

3.0 Acoustic Bat Survey

3.1 INTRODUCTION

Bats use high frequency echolocation to maneuver through the landscape during migration or in search of food and water. Although the echolocation sounds produced by bats are above the human range of hearing, electronic equipment can be used to record these high frequency sounds. Acoustic sampling of bat activity has become a standard element of pre-construction surveys for proposed wind-energy developments. Acoustic sampling allows for simultaneous data collection at varying heights at or below canopy tree height and across long time periods (Kunz *et al.* 2007); as a result, these surveys can provide insight into altitudinal and seasonal patterns of bat activity. While this type of data collection cannot determine the number of individuals found in the area, and is associated with several major assumptions (Hayes 2000), it can be used to examine activity trends for certain species or species groups, and may be useful in predicting potential post-construction mortality patterns.

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*) (BCI 2001). Of these, all but the big brown bat is listed as a species of special concern in the state.

The objective of acoustic surveys at Bingham were (1) to document bat activity patterns from April to October in airspace near the rotor zone of the proposed turbines, at an intermediate height, and near the at or below tree canopy height; and (2) to document bat activity patterns in relation to weather factors including wind speed, temperature, and relative humidity. Information in this report covers the 2010 spring migratory period from the beginning of the survey in mid-April through early June. Subsequent reports will cover the summer maternity season and fall migration period.

3.2 METHODS

3.2.1 Data Collection

Anabat SDI detectors (Titley Electronics Pty Ltd.) were selected for data collection 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 which could occur in the Project area. Anabat detectors are frequency division detectors, dividing the frequency of echolocation sounds made by bats by a factor of 16, and then recording these sounds onto removable compact flash cards for subsequent analysis. Detectors were programmed to begin monitoring at 19:00 hours each night and end monitoring at 08:00 hours each morning, and were visited approximately every two weeks to check the condition of the detectors and to download recorded data. 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 curved plastic joint was used to funnel sound into the downward-facing microphone, allowing the microphone to record the airspace horizontally surrounding the detector.

3.2.2 Site Selection

Acoustic survey sites at Bingham were chosen based on professional opinion of how bats might move across the Project area. Currently, pre-construction acoustic methods emphasize monitoring a vertical array of airspace to document species flying at all altitudes (Arnett *et al.* 2006, Kunz *et al*. 2007, Reynolds 2006). Fatalities occur when individuals collide with turbines (Horn *et al.* 2008) or come in close proximity to spinning blades, which can result in rapid decompression that leads to death as a result of barotrauma (Baerwald *et al*. 2008). Detectors placed at or near rotor-swept height assess flight activity at heights relevant to assessing risk of fatality. Also, detectors deployed above canopy height more readily survey long-distance migrants; these species generally fly and forage at high altitudes, and are species that experience the highest turbine collision rates (Arnett *et al.* 2008). At or below tree canopy height detectors are deployed because (1) resident bat species generally forage close to, or below, the tree canopy, (2) activity is often greater at or below tree canopy height, so these detectors assist with species presence and activity patterns, and (3) bats present at or below tree canopy height could potentially become attracted to the height of rotating blades (Cryan and Barclay 2009, Kunz *et al.* 2007). Detectors deployed at intermediate heights are used to fill in the vertical array to get a complete picture of species composition and airspace use within the Project area.

Eight acoustic detectors were deployed at five ridge top locations across the proposed Project area (Figure 1-1). Three survey locations utilized meteorological (met) towers to elevate detectors above tree canopy height. Two additional locations did not have met towers, and therefore detectors were deployed in trees at or below tree canopy height at these sites.

Two acoustic bat detectors were placed in the Bessey Met Tower on April 13, 2010 (Figure 3-1). The high detector was raised to an approximate height of 40 m and the low detector was raised to approximately 20 m. The met tower clearing is located approximately a half mile south of Route 16 in Mayfield. The elevation at the tower is 474 m (1,555'). The forest composition surrounding the met clearing is made up of sapling to pole size mixed hardwoods with scattered log sized spruce.

Figure 3-1 Bessey Met Detectors (High and Low).

One acoustic bat detector was placed in a spruce tree on April 14, 2010 at an approximate height of 5 m on Bigelow Ridge (Figure 3-2). This location is on the south end of the ridgeline which runs parallel to Old Hayden Pond Road and Bigelow Brook. The elevation at the site is 466 m (1,529'). The tree detector was placed in a small opening at the end of an old skid trail. The forest surrounding the area is spruce plantation with an approximate tree height of 3 to 5 m.

Figure 3-2 Bigelow Ridge Tree Detector.

Two acoustic bat detectors were placed in the met tower located on the ridgeline just south of Crockett Mountain (Figure 3-3). The elevation at the tower is 459 m (1,504'). The high detector was raised to an approximate height of 40 m and the low detector was raised to an approximate height of 20 m. The met tower clearing is about 300 m in diameter and is surrounded by dense regenerating spruce-fir as well as sapling to mature sized hardwoods. The tree height in the area varies from approximately 5 m to 15 m.

Figure 3-3 Crockett Met Detectors (High and Low).

One acoustic bat detector was placed in a spruce tree on the northern edge of the met tower clearing on Johnson Ridge on April 14, 2010 (Figure 3-4). The elevation at the tower is elevation 439 m (1,440’). The detector was deployed at an approximate height of 5 m. This tree is located adjacent to a small forested wetland and regenerating spruce-fir growth at the edge of the met clearing. The surrounding forest is mixed with sapling to mature hardwoods as well as seedling to mature softwood scattered with dead snags and areas of dense regeneration.

Figure 3-4 Johnson Met Tree Detector.

One acoustic bat detector was placed in the met tower on Johnson Ridge on April 14, 2010 (Figure 3-5). It was raised to an approximate height of 20 m. The elevation at the tower is elevation 439 m (1,440'). The met tower clearing is surrounded by regenerating softwood and shrubs.

Figure 3-5 Johnson Met Low Detector.

One acoustic bat detector was placed in a dead birch tree on Kingsbury Ridge, located approximately a quarter mile west of Old Mountain Road, on April 15, 2010 (Figure 3-6). The elevation at this site is elevation 540 m (1,772'). The detector was raised to an approximate height of 2.5 m. This tree is located in the middle of an old clearcut where most of the surrounding tree growth is regenerating mixed hardwoods, as well as sapling to pole size spruce and fir.

Figure 3-6 Kingsbury Ridge Tree Detector.

3.2.3 Data Analysis

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 bats in the Northeast. 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 have 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[4] 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. For this area, HFUN most likely represents eastern red bats, tri-colored bats and *Myotis* species since these species typically produce ultrasound sequences of more than 30 kHz. Big brown, silver-haired and hoary bats would be the species in this area typically producing ultrasound sequences of less than 30 kHz.

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

- **Eastern red bat/tri-colored bat[5] (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 bat/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.

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

The sunset time was subtracted from the time of recording in order to determine the number of hours after sunset each file was recorded.

3.2.4 Weather Data

Temperature (degrees Celsius [°C]) and wind speed (meters per second [m/s]) were recorded at 10-minute intervals by the Bessey met tower just South of Route 16 in Mayfield. 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. Data through June 1 was available for this report.

3.3 RESULTS

3.3.1 Timing of Activity

Although the 2010 acoustic surveys are continuous, starting in the spring and operating through the fall, results presented here represent the spring migratory period. Deployment end dates for the purposes of this report coincide with biweekly maintenance visits to detectors in early June. The range of dates that each detector was deployed is summarized in Table 3-1.

Table 3-1. Summary of bat detector field survey effort and results during Spring 2010 at the Bingham Wind Project.

Location	Dates Deployed	Calendar Nights	Detector-Nights*	Recorded Sequences	Detection Rate **	Maximum Sequences recorded ***
Bessey Met High	4/13 - 6/8	57	57	10	0.2	2
Bessey Met Low	4/13 - 6/8	57	57	18	0.3	4
Bigelow Ridge Tree	4/14 - 6/2	50	50	89	1.8	18
Crockett Met High	4/14 - 6/8	56	56	8	0.1	2
Crockett Met Low	4/14 - 6/8	56	56	15	0.3	2
Johnson Met Low	4/14 - 6/2	50	50	17	0.3	5
Johnson Met Tree	4/14 - 6/2	50	50	61	1.2	4
Kingsbury Ridge Tree	4/15 - 6/2	49	49	32	0.7	32
Overall Results		***425***	***425***	***250***	***0.6***	--

* 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 250 call sequences were recorded during the spring survey (Table 3-1). Activity increased with decreasing detector height. Detectors deployed above tree canopy in met towers ("Met High" detectors) had a combined detection rate of 0.16 call files recorded per detector night (18 files recorded by 2 detectors over 113 detector-nights). Detectors deployed at tree canopy height in met towers ("Met Low" detectors) had a combined detection rate of 0.31 call files recorded per detector night (50 files recorded by 3 detectors over 163 detector-nights). Detectors deployed at or below tree canopy height had a combined detection rate of 1.20 call sequences per detector night (182 files recorded by 3 detectors over 149 detector-nights). Activity increased over time during the spring survey period (Figure 3-7). Activity was first recorded on April 20, but was not recorded consistently (on more than two nights in a row) until April 28. The maximum activity recorded in a single night by all detectors occurred on May 28 (27 calls for all detectors combined) (Figure 3-7).

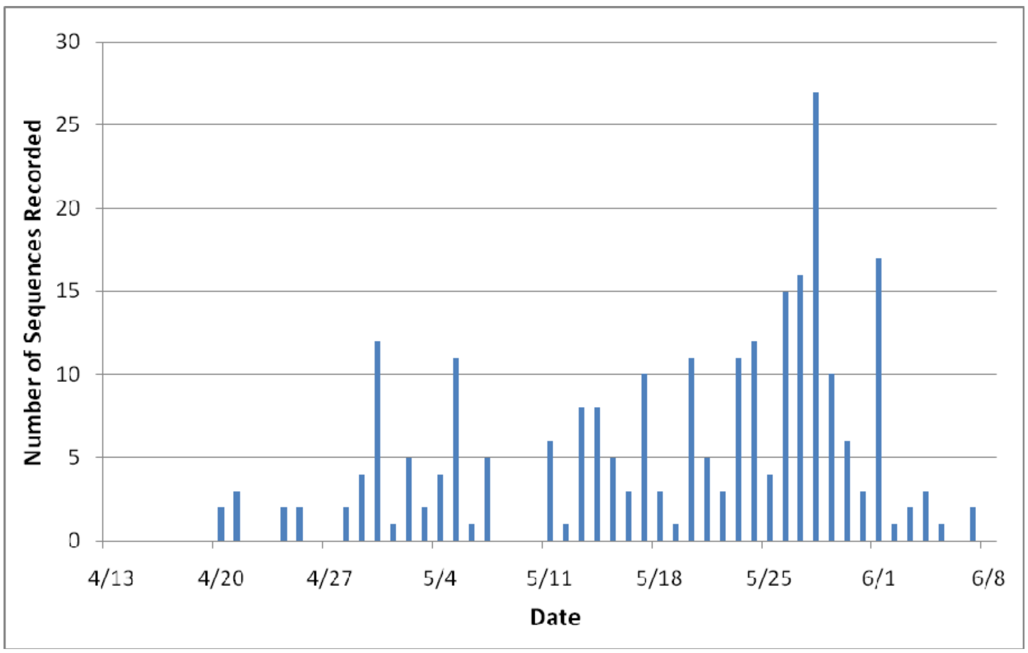


Figure 3-7. Total nightly bat call sequence detections recorded by eight detectors at Bingham, between mid-April and early June 2010.

There was a sharp spike in activity 3 hours after sunset at tree detectors (Figure 3-8). Trends were less clear at Met High and Met Low detectors due to low recorded activity rates. However, there were two slight peaks evident at 1 hour and 4 hours after sunset at Met Low detectors, and at 1 hour and 6 hours after sunset at Met High detectors (Figure 3-8).

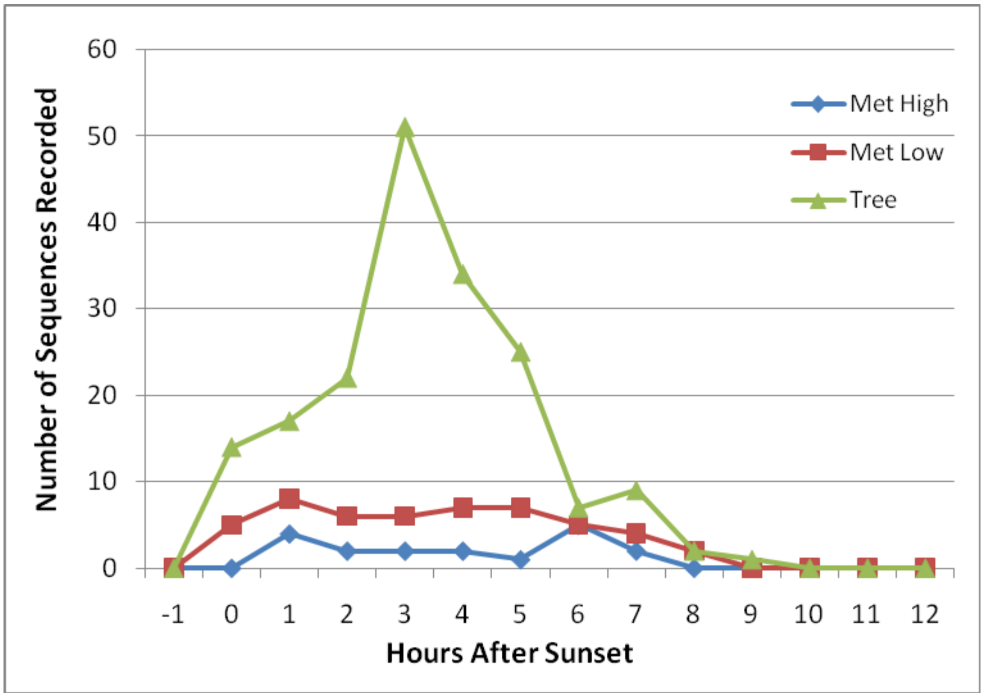


Figure 3-8. The number of call sequences recorded during each hour of the night at Met High, Met Low, and Tree detectors during Spring 2010 at the Bingham Wind Project.

3.3.2 Species Composition

The largest proportion of calls was assigned to the unknown (UNKN) guild (Table 3-2). The *Myotis* guild (MYSP) contained the highest number of call sequences (n = 92) identified to a taxonomic level. At or below tree canopy level detectors combined recorded calls from all five guilds, while met tower detectors recorded call sequences from all guilds except the red bat/tri-colored bat (RBTB) guild (Table 3-2).

Table 3-2. Distribution of detections by guild during Spring 2010 at the Bingham Wind Project.

Detector	Guild					Total
	BBSH	**HB**	**MYSP**	**RBTB**	**UNKN**	
Bessey Met High	4	0	5	0	1	10
Bessey Met Low	3	3	1	0	11	18
Bigelow Ridge Tree	3	0	41	0	45	89
Crockett Met High	1	0	1	0	6	8
Crockett Met Low	2	2	5	0	6	15
Johnson Met Low	4	2	3	0	8	17
Johnson Met Tree	12	4	23	1	21	61
Kingsbury Ridge Tree	0	0	13	0	19	32
Total	**29**	**11**	**92**	**1**	**117**	**250**
Total Guild Composition %	**11.6%**	**4.4%**	**36.8%**	**0.4%**	**46.8%**	
Met Total	**14**	**7**	**15**	**0**	**32**	**68**
Met Guild Composition %	**20.6%**	**10.3%**	**22.1%**	**0.0%**	**47.1%**	
Tree Total	**15**	**4**	**77**	**1**	**85**	**182**
Tree Guild Composition %	**8.2%**	**2.2%**	**42.3%**	**0.5%**	**46.7%**	

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 8 provide information on the number of call sequences, by guild and suspected species, recorded at each detector and the weather conditions for that night. Analook files for all 250 recorded call sequences can be made available upon request.

3.3.3 Activity and Weather

Weather data from April 15 through June 1 was available for this report. Mean nightly wind speeds in the Project area varied between 2.09 and 11.67 m/s (Figure 3-9), and mean nightly temperatures varied between $^{-}$0.6 °C and 26.1 °C (Figure 3-10). Although activity was highly variable over the course of the survey, there were weak associations between the number of call sequences recorded and the weather conditions on that night. Activity was highest when mean nightly wind speeds were between 6 and 8 m/s (Figure 3-9), and increased as temperature increased (Figure 3-10). On May 28, when the maximum number of call sequences was recorded in a single night, the mean nightly wind speed was 6 m/s and the mean nightly temperature was 16 °C.

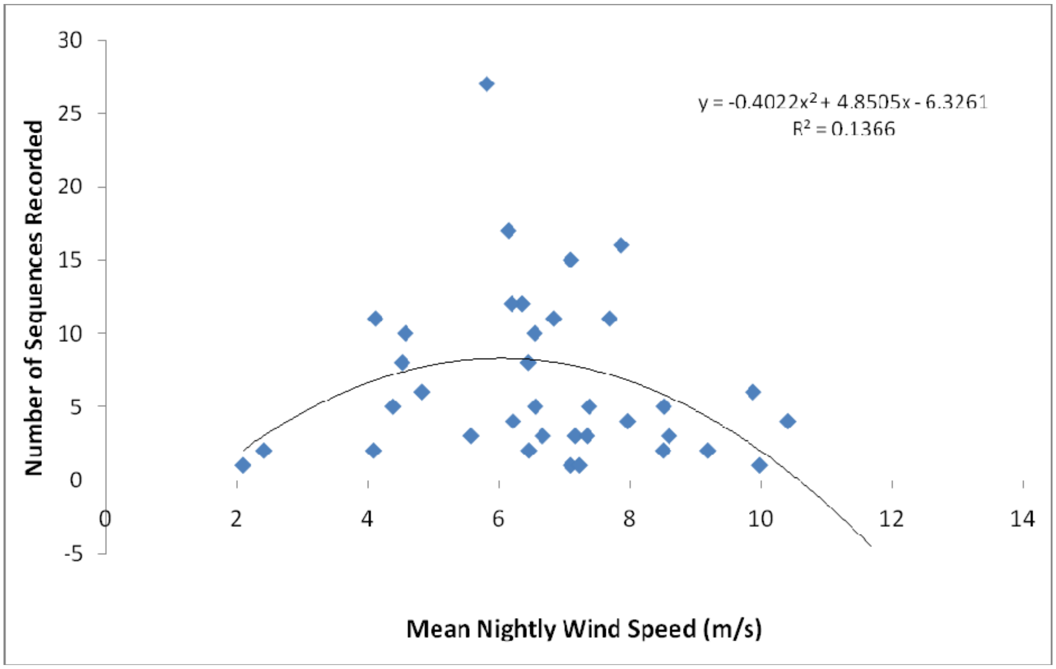


Figure 3-9. Nightly mean wind speed (m/s) and number of call sequences recorded during Spring 2010 at the Bingham Wind Project.

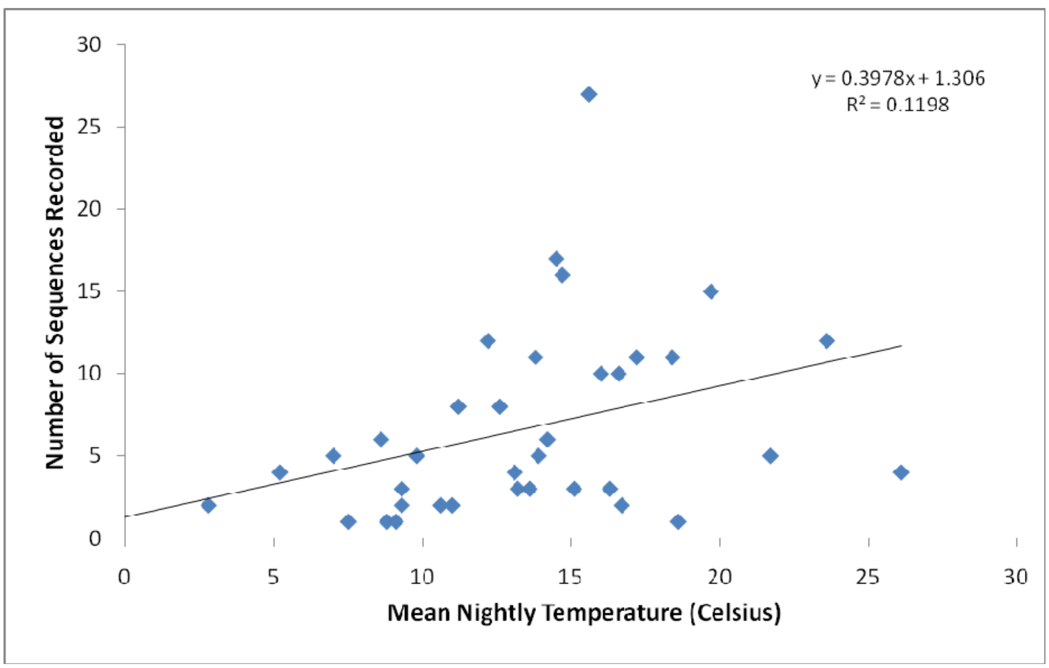


Figure 3-10. Nightly mean temperature (Celsius) and number of call sequences recorded during Spring 2010 at the Bingham Wind Project.

3.4 DISCUSSION

The 2010 acoustic survey was initiated in the spring and the detectors will continue to operate through the fall. The results of the summer and fall acoustic surveys will be presented in a separate report following completion of the surveys. The data included in this report are representative of trends often observed during spring acoustic surveys, and during the spring migratory period. Overall activity was low throughout the survey, with detection rates at individual detectors ranging from 0.1 to 1.8 call sequences recorded per detector-night. Activity increased over time, likely due to a corresponding increase in mean nightly temperatures across the spring season, as well as an increase in the local bat population as individuals arrived for the summer maternity season. Activity was higher at the three tree detectors (1.2 sequences/detector-night) than five met detectors (0.2 sequences/detector-night), and species composition varied between the two detector types, with *Myotis* species more prominently recorded at tree detectors and guilds containing long-distance migrant species (BBSH and HB guilds) more prominently recorded at the met detectors.

These data are similar to trends observed at other proposed wind facilities. Pre- and post-construction acoustic monitoring of bat activity has documented a negative relationship with average nightly wind speed (Fiedler 2004, Reynolds 2006). Reynolds (2006) found activity of bats to be highest on nights with wind speeds of < 5.4 m/s during the spring migratory period at the Maple Ridge, New York wind facility. Bat activity levels at Buffalo Mountain, Tennessee also showed a negative association with average nightly wind speeds (Fiedler 2004). At Bingham, peak activity occurred on a night when mean wind speeds were 5.8 m/s.

Pre- and post-construction acoustic surveys at wind facilities have also documented bat activity to be positively correlated with nightly mean temperatures (Fiedler 2004, Reynolds 2006). Reynolds (2006) found that no detectable spring migratory activity occurred on nights when the mean temperature was below 10.5°C (50.9°F). Bat activity at Buffalo Mountain, West Virginia from 2000 to 2003 was most closely correlated with average nightly temperature (Fiedler 2004). Although some activity at Bingham did occur on cold nights, peak activity occurred on nights with temperatures above 10°C.

Bat calls were identified to guild within this report, although calls were provisionally categorized by species when possible during analysis. Tree detectors recorded more *Myotis* activity (42%) than met detectors (22%). Since bats belonging to this guild are resident species that forage primarily at or below tree canopy height it would be expected that they would most often be recorded by tree detectors. Only one call sequence was assigned to the RBTB guild, although poor-quality calls from these two species are likely included in low numbers in the Unknown guild. Twelve percent of calls were of the BBSH guild, with the most recorded at the Johnson Met Tree detector. Hoary bat calls only made up 4 percent of all calls recorded, and were identified at all three Met low detectors, as well as the Johnson Met Tree detector. Of the 250 total sequences recorded, 47 percent were classified as UNKN due to their short duration or poor quality.

When considering the level of activity documented at Bingham, 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 there is currently little data aiding in the interpretation of the number of calls per detector nights. Results cannot be used to determine the number of bats inhabiting an area or quantitatively determine a post-construction fatality rate. 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

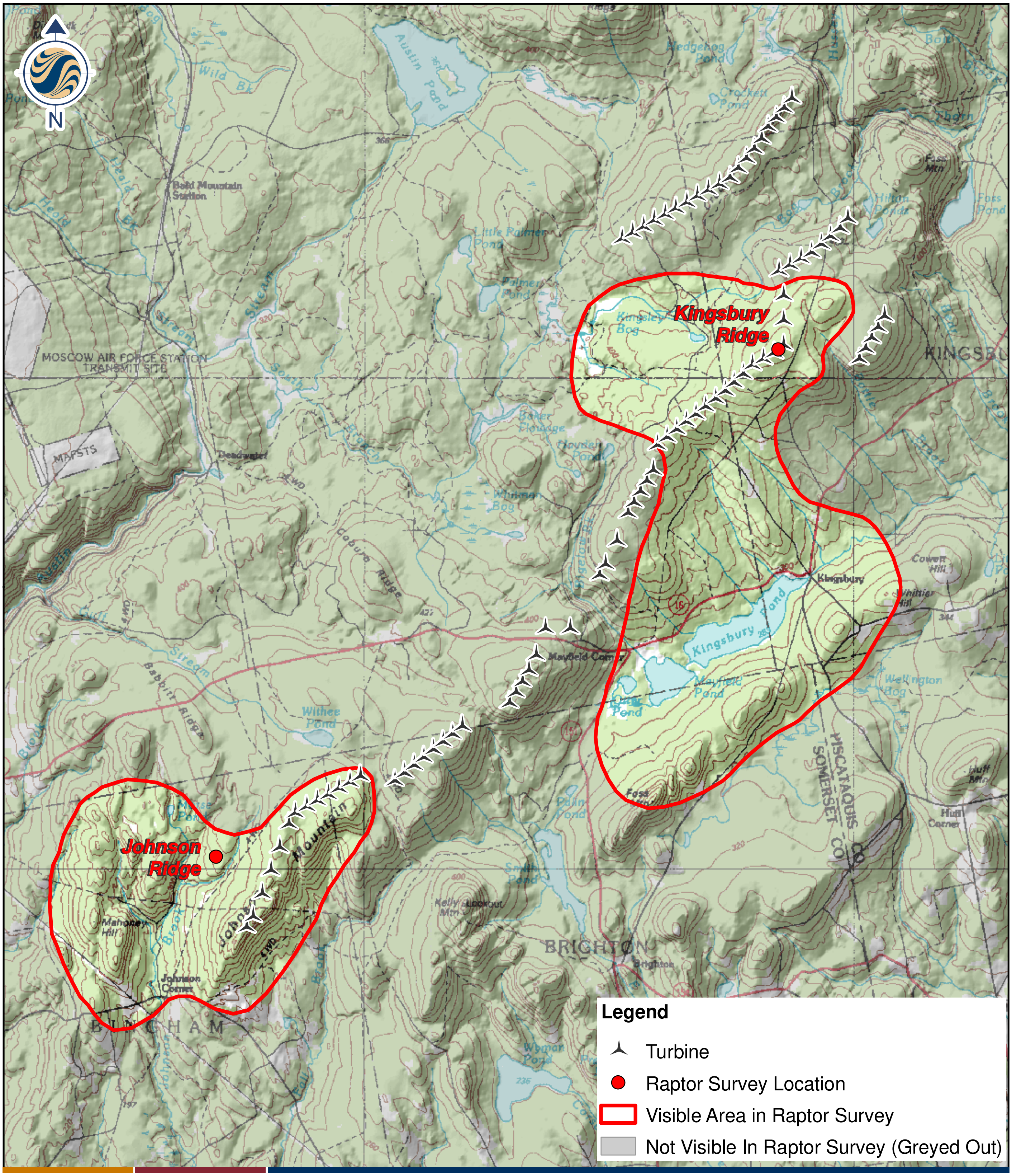
4.1 INTRODUCTION

Spring 2010 raptor surveys were conducted at the Project consistent with methods and level of effort at pre-construction surveys at other proposed wind energy Project's in the state. The purpose of the raptor surveys were to sample migration activity at central and prominent locations within the Project area, to document the species that occur in the vicinity of the Project, with particular effort focused on documenting bald eagle activity. It was also the purpose of the study to record the approximate flight heights, flight path locations, and other flight behaviors of all raptor species observed. The results of the surveys provide baseline species composition and behavioral data for migrants and seasonally local raptors which occur in the area.

4.1.1 Study Area Description

Two observation locations, one on Kingsbury Ridge and one on Johnson Ridge, were used during the spring 2010 surveys (Figure 4-1). The Kingsbury Ridge observation site was located approximately a quarter mile west of Old Mountain Road in Kingsbury. The observation location was in an old clear cut. The site provided a good view to the south over Kingsbury and Mayfield Ponds and west over the valley. Due to the topography and surrounding trees, the views in other directions were limited to the airspace above the surrounding trees. The Johnson Ridge observation site was located approximately 0.75 miles west of the Johnson Ridge met tower. This site was located along a dirt road surrounded by a spruce plantation and a recent clearcut. From this site, the met tower located on Johnson Ridge could clearly be seen as well as the profile of the Johnson ridgeline. There also were decent views of the valleys and surrounding landscape to the south, southwest west, and northwest. Crockett ridge was not in view from either survey location.

For the purposes of this report, the 'study area' is considered the observable airspace above the surrounding topography as seen from these observation locations (Figure 4-1). The 'Project area' includes only those locations within the study area where turbines are proposed. The Project area includes three separate ridgelines: Johnson Ridge, Kingsbury Ridge (north and south of Route 16), and Crockett Ridge.



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Client/Project
Bingham Wind Project
Bingham, Maine

Figure No.
4-1

Title
Raptor Survey Study Area and Viewshed Map

8/6/2010

4.2 RAPTOR DATA COLLECTION METHODS

4.2.1 Field Surveys

Surveys in spring 2010 were performed on 10 days during the spring migration period; on five of these days, surveys were performed simultaneously by two observers, yielding a total of 15 total survey days. The level of effort included 5 simultaneous days of survey from two observation locations, yielding 10 total survey days. The spring 2010 raptor surveys utilized standard methodologies to monitor diurnal raptor migration activity. Raptor migration surveys methods were based on methods used by the Hawk Migration Association of North America (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 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 that had been observed at some other point during the survey day. Therefore, daily count totals include all observations, or passes, of birds observed throughout a survey day[6]. Detailed information for each observation was recorded on standardized data sheets, including:

- Observation date and time;
- Species[7], number of individuals, and age (if possible);
- The location of each bird depicted on a topographical map;
- The flight height[8] and behaviors observed in each of the topographical positions where birds occurred[9];
- 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 and recorded by the observer as incidentals; however, this data was not collected uniformly or systematically.

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)

[6] 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.

[7] 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.

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

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

flight path over upper slope of ridge, C) flight path over lower slope of ridge, and D) flight path over a valley (see Figure 4-2 below). As individual birds traveled through or in the vicinity of the Project, all position categories in which a bird occurred were recorded.

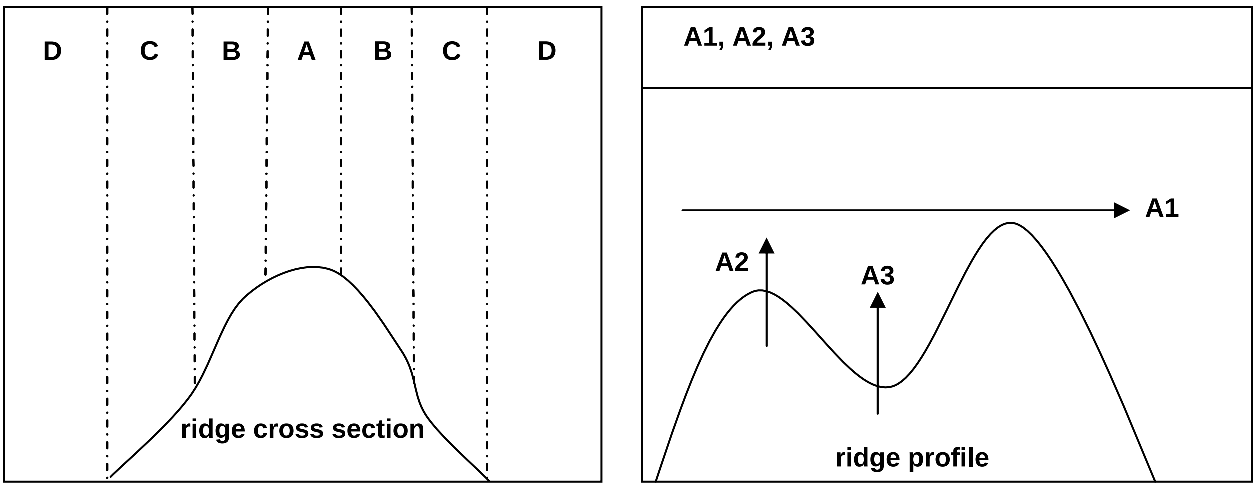


Figure 4-2. Raptor flight position categories in relation to the topography of the study area (codes apply to locations within and outside of Project area). A1) parallel to ridge, A2) perpendicular to ridge, A3) over saddle, B) flight path over upper slope of ridge, C) flight path over lower slope of 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 hourly weather conditions including wind speed and direction, temperature, sky condition, percent cloud cover, cloud type, and relative cloud height.

Specific seasonal weather conditions influence 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.

4.2.3 Raptor Data Analysis Methods

Raptor observation data were summarized by survey day and for the entire survey period. As there were two observation locations, data was analyzed separately (where applicable) for each observation location. 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 152 m (499').

The results of the spring 2010 surveys were compared to the results of the closest available HMANA raptor migration surveys conducted in the region. HMANA 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.

4.3 RESULTS

The spring surveys were conducted on 10 days from mid-March (March 19) through late-May (May 21). Surveys were conducted simultaneously from the two observation locations on five of those survey days (April 30, May 5, May 13, May 18, and May 21), yielding a total of 15 survey days (5 days at Johnson Ridge and 10 days at Kingsbury Ridge). A total of 105 hours were surveyed (70 hours at Kingsbury Ridge and 35 hours at Johnson Ridge). Table 4-1 summarizes the spring 2010 survey effort and results.

Table 4-1. A summary of the spring 2010 survey effort and results at two observation locations at the Bingham Wind Project

Range of survey dates	**3/19/2010-5/21/2010**
No. survey days	**10 (10 at Kingsbury Ridge, 5 simultaneous at Johnson Ridge)**
No. survey hours	**105 (70 at Kingsbury Ridge, 35 at Johnson Ridge)**
No. raptor species observed	**9**
Raptor species observed (common name)	**Scientific name**
American kestrel	*Falco sparverius*
bald eagle	*Haliaeetus leucocephalus*
broad-winged hawk	*Buteo platypterus*
Cooper's hawk	*Accipiter cooperii*
merlin	*Falco columbarius*
osprey	*Pandion haliaetus*
red-tailed hawk	*Buteo jamaicensis*
sharp-shinned hawk	*Accipiter striatus*
turkey vulture	*Cathartes aura*
unknown raptor	*n/a*
Total no. observations of raptors	**56 (19 at Kingsbury Ridge, 37 at Johnson Ridge - 2 simultaneous)**
Seasonal passage rate (raptor observations/hour)	**Kingsbury Ridge: 0.27; Johnson Ridge: 1.06**
Total no. observations of raptors within Project area (percent of total observations)	**Kingsbury Ridge: 13 (68%); Johnson Ridge: 21 (57%)**
Total no. of observations of raptors in the Project area and below max rotor height (percent of total observations)	**Kingsbury Ridge: 10 (77%); Johnson Ridge: 20 (95%)**

4.3.1 Weather Summary

Among survey days, the average hourly temperature was 14° C (58° F). Temperatures ranged from 4° C to 27° C (40 to 80° F). Sky conditions were generally clear to partly cloudy. Wind direction was generally from the northwest, north and west. Observers recorded wind speed codes of 3 (9-12 mph) or below on 6 of the 10 survey days (Table 4-2).

Analysis of regional surface weather maps indicated the timing of approaching low pressure systems, when raptor movements tend to be accentuated. Table 4-2 shows the wind direction and pressure system pattern on each survey date during the spring surveys.

Table 4-2. Wind direction and pressure systems during spring 2010 surveys			
Date	**Wind direction**	**Wind speed code (s)**	**Daytime Pressure System (high or low)**
		1 = 1-3 mph; 2 = 4-7 mph; 3 = 9-12 mph; 4 = 13-18 mph; 5 = 19-24 mph	
3/19/2010	SE	1, 2, 3	not available
3/25/2010	W	1	low 2 days before survey date
4/2/2010	SW	3, 4, 5	low then high 2 days before survey date
4/15/2010	NW	3, 4	high pressure 1 day before, low on survey date
4/20/2010	NW	4, 5	survey date one day before low system moved in for a few days
4/30/2010	NW	5	survey date one day before low system moved in for a few days
5/5/2010	WNW	2	low starting 3 days before survey date
5/13/2010	NW	2	low one day before survey date
5/18/2010	SW	1	survey date one day before low system moved in for a few days
5/21/2010	NW	1	low 2 days before survey date

4.3.2 Raptor Data

Over the course of the survey period a total of 56 observations of raptors were made from both observation locations combined (19 observations from Kingsbury and 37 observations from Johnson). Based upon timing, flight direction and flight paths, two of these observations (1 turkey vulture on May 5, and 2 turkey vultures on May 21) were thought to be simultaneous observations between the observers at Kingsbury and Johnson Ridges. The seasonal passage rate for Kingsbury Ridge was 0.27 raptor observations per hour (raptors/hr); the seasonal passage rate for Johnson Ridge was 1.06 raptors/hr. Figure 4-3a and b and Appendix C Tables 1a and b show the daily totals of raptor species for the spring season at the two observation sites.

At Kingsbury Ridge, daily passage rates ranged from 0.0 raptors/hr (March 19, April 15, 20, and 30) to 0.57 raptors/hr (April 2 and May 5). Daily passage rates at Johnson Ridge ranged from 0.29 raptors/hr (April 30) to 2.0 (May 13) raptors/hr. The day with the highest passage rate at either site, May 13 at Johnson Ridge, was characterized by moderate northwest winds and a low pressure system which had passed through the region the day before. May 5 also experienced a relatively high raptor passage rate, particularly at Johnson Ridge (1.14 raptors/hr). This survey day was characterized by moderate west-northwest winds and a low pressure system which had settled into the region three days prior to the survey date.

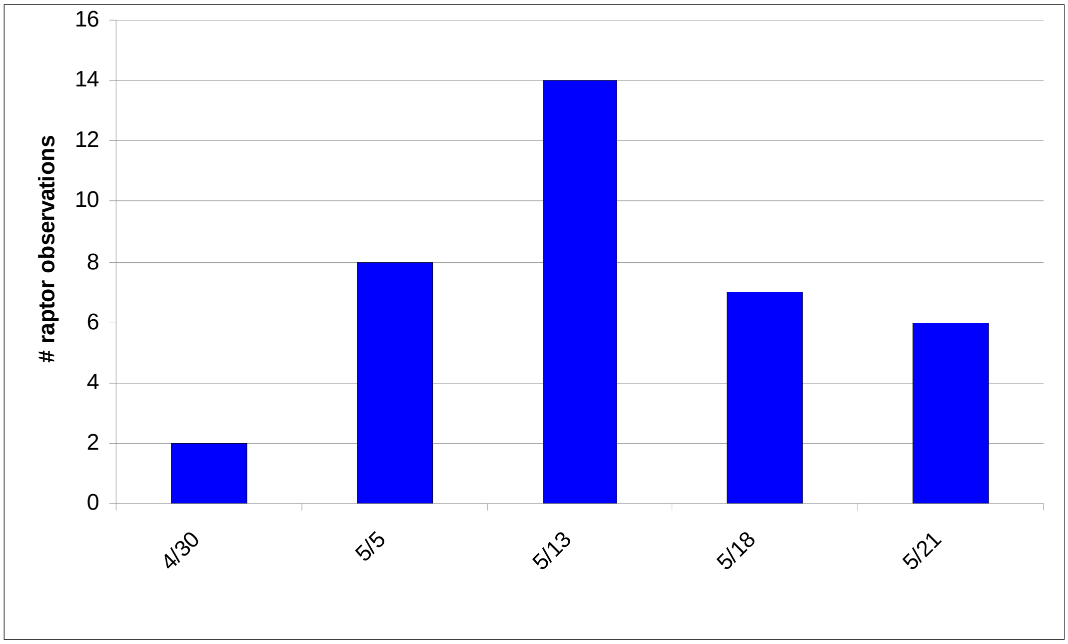


Figure 4-3a. Survey day totals of raptor observations from Johnson Ridge during Spring 2010 surveys at the Bingham Wind Project.

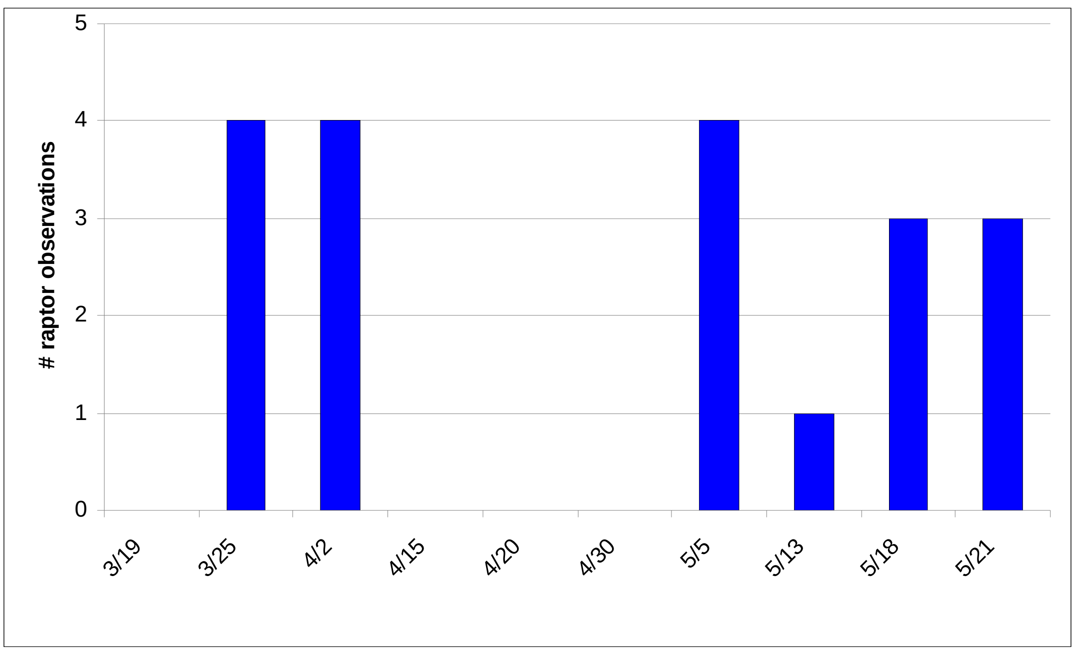


Figure 4-3b. Survey day totals of raptor observations from Kingsbury Ridge during Spring 2010 surveys at the Bingham Wind Project.

There were nine species of raptors observed (not including one unidentified raptor) at both observation locations combined (Figures 4-4a and b, Appendix C Table 1a and b).

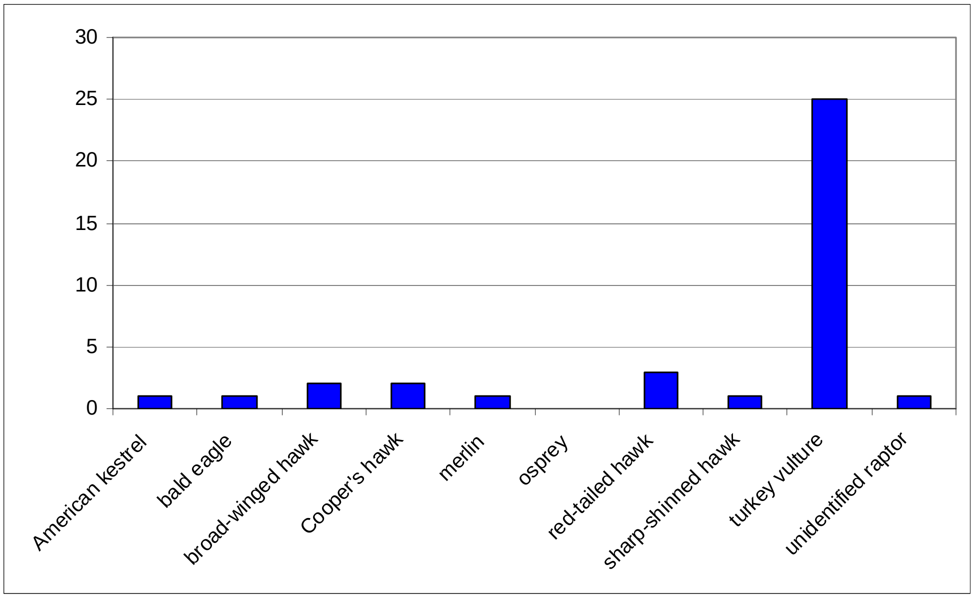


Figure 4-4a. Number of observations of raptor species observed from Johnson Ridge during Spring 2010 surveys at the Bingham Wind Project.

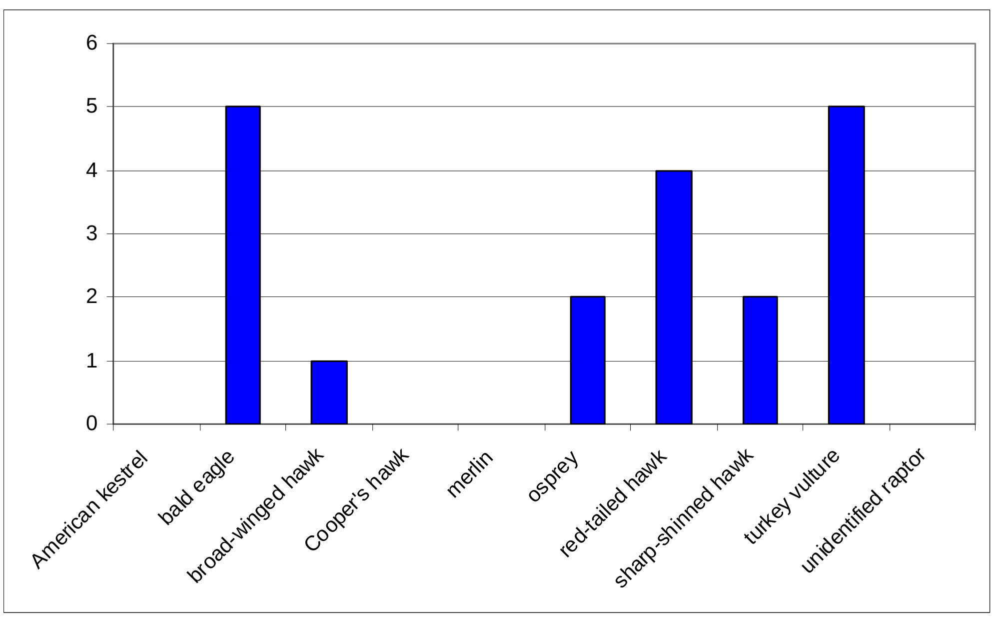


Figure 4-4b. Number of observations of raptor species observed from Kingsbury Ridge during Spring 2010 surveys at the Bingham Wind Project.

At Johnson Ridge, turkey vultures were the most commonly observed species (n=25, 68%), followed by red-tailed hawk (n=3, 8%). At Kingsbury Ridge, bald eagle (n=5, 26%) and turkey vulture (n=5, 26%) were the most commonly observed species followed by red-tailed hawk (n=4, 21%). Four of the five bald eagle observations were made on March 25, 2010. Based on the time between observations it is likely that one adult eagle was counted twice.

4.3.3 Hourly observations

Throughout the survey season, at both observation sites the majority of observations peaked between 10 and 11 am. At Johnson Ridge a second peak occurred between noon and 1 pm, while a second peak occurred between 2 and 3 pm at Kingsbury Ridge (Figure 4-5a and b, Appendix C Table 2).

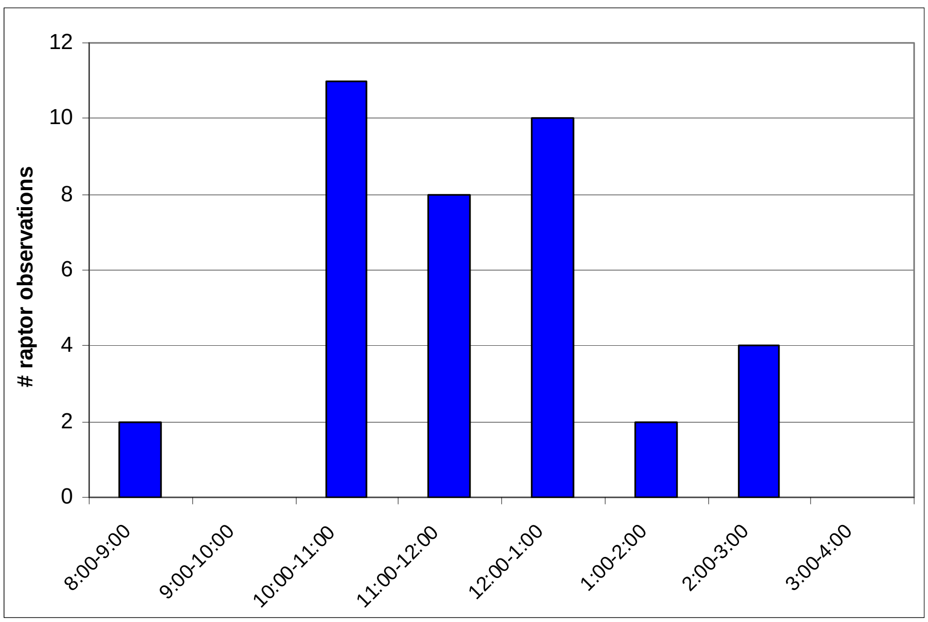


Figure 4-5a. Number of observations of raptors per survey hour from Johnson Ridge during Spring 2010 surveys at the Bingham Wind Project.

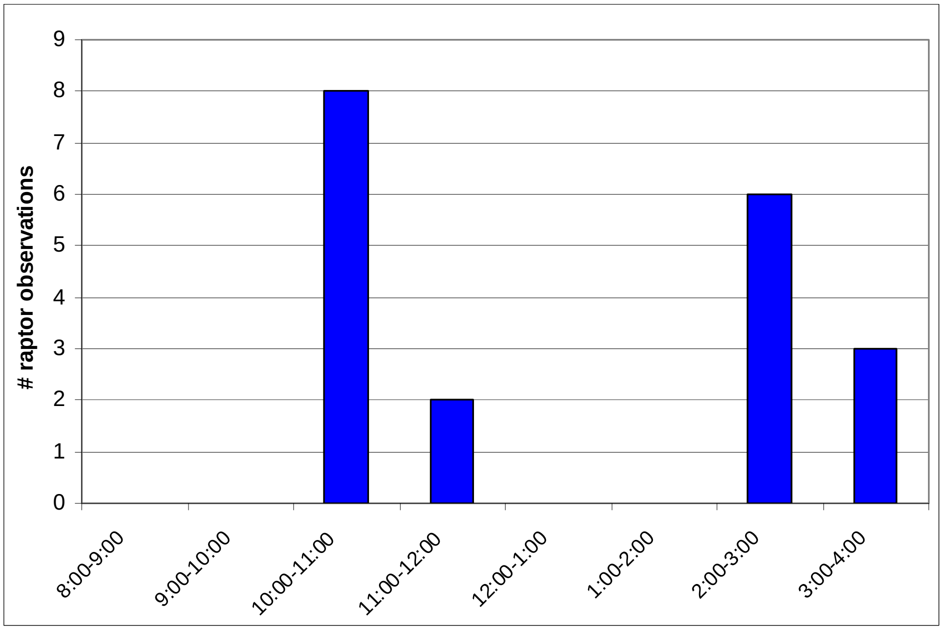


Figure 4-5b. Number of observations of raptors per survey hour from Kingsbury Ridge during Spring 2010 surveys at the Bingham Wind Project.

4.3.4 Raptor Locations

Of the 56 total raptor observations made within the study area at both observation locations combined, 34 (61%) observations occurred within the Project area (Figure 4-6, Appendix C Table 3). Specifically, 21 raptor observations occurred over Johnson Ridge and 13 observations occurred over Kingsbury Ridge. All other observations occurred either over hills, peaks, or valleys outside of the Project area.

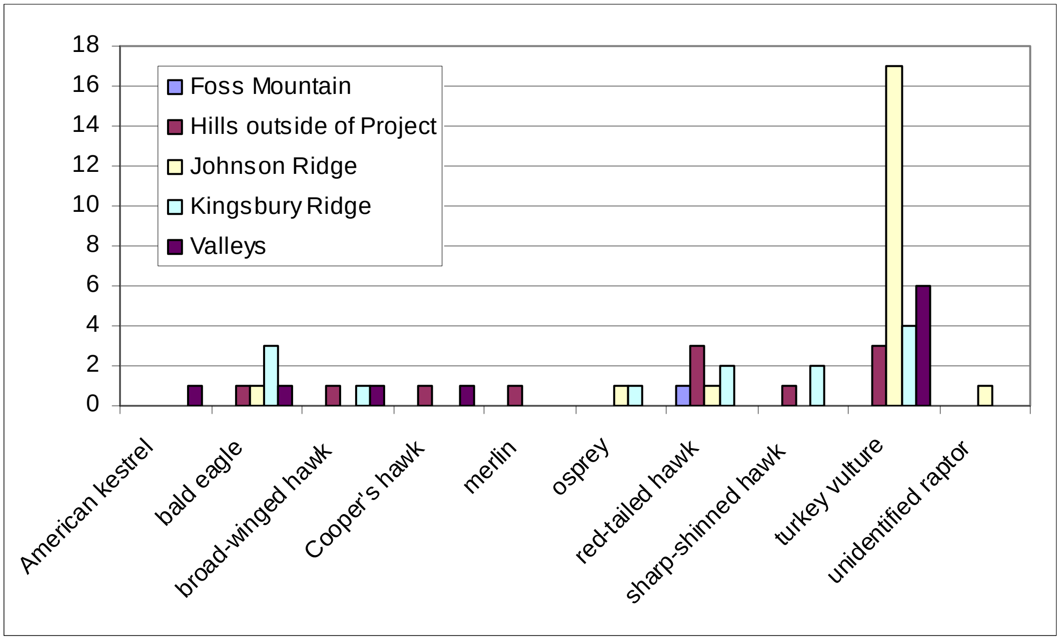
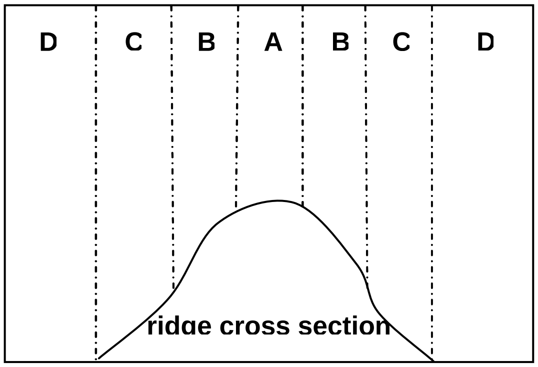


Figure 4-6. Number of observations of raptors within different study area locations observed from Johnson and Kingsbury Ridges combined during Spring 2010 surveys at the Bingham Wind Project.

4.3.5 Raptor Behaviors

Raptor behaviors observed in the topographical positions of the study area locations are summarized in Table 4-3. 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.



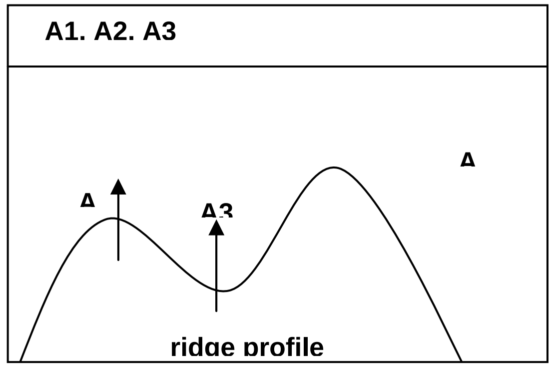


Table 4-3. Raptor behaviors summarized by location in study area and flight position as seen from Johnson and Kingsbury Ridge combined, Bingham Wind Project, Spring 2010

Location in Study Area	soaring, gliding						powered flight						foraging behaviors						territorial or courtship behavior						perched					
	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
Foss Mountain	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Hills outside of Project	2	3	0	6	4	2	0	2	0	2	1	0	0	0	0	0	3	1	0	0	0	2	2	0	0	0	0	0	1	0
Johnson Ridge	13	4	0	4	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Kingsbury Ridge	9	1	0	6	3	2	1	1	0	5	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Valleys	0	0	0	0	0	9	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total behaviors observed at both observation sites combined = 98																														

Within visible Project area locations (Johnson and Kingsbury Ridges), the majority of birds observed were soaring or gliding over the upper slopes of the ridges, or parallel to the ridges (Table 4-3). There were no territorial or courtship behaviors or perched birds observed within areas of the Project; however, one bird (a red-tailed hawk) demonstrated foraging behaviors within the Project area as it was seen hovering over a lower slope of Johnson Ridge.

Based on their flight behaviors, raptors suspected to be actively migrating or not actively migrating are summarized in Table 4-4a and b. Raptors were considered actively migrating if their flight path was generally direct and in a northerly direction. Raptors would be characterized as 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. At Johnson Ridge, 8 percent (n=3) were suspected to be actively migrating. At Kingsbury Ridge, 32 percent (n=6) were suspected to be actively migrating. All turkey vultures, the most commonly observed raptor during the surveys, were believed to be seasonally local birds.

Table 4-4a. Observations of raptors suspected to be actively migrating at Johnson Ridge, Bingham Wind Project, Spring 2010

Species	Not Actively Migrating	Actively Migrating	Total
American kestrel	1		1
bald eagle	1		1
broad-winged hawk	2		2
Cooper's hawk		2	2
merlin		1	1
osprey			
red-tailed hawk	3		3
sharp-shinned hawk	1		1
turkey vulture	25		25
unidentified raptor	1		1
Total	**34**	**3**	**37**

Table 4-4b. Observations of raptors suspected to be actively migrating at Kingsbury Ridge, Bingham Wind Project, Spring 2010

Species	Not Actively Migrating	Actively Migrating	Unknown	Total
American kestrel				
bald eagle		1	4	5
broad-winged hawk	1			1
Cooper's hawk				
merlin				
osprey		2		2
red-tailed hawk	2	2		4
sharp-shinned hawk	1	1		2
turkey vulture	5			5
unidentified raptor				
Total	**9**	**6**	**4**	**19**

4.3.6 Flight Heights

The average minimum flight heights of birds observed in the different topographical positions of the study area are summarized in Table 4-5a and b below. These summaries include birds observed both within and outside of the Project area.

Table 4-5a. Number of observations and average flight heights for each position category for birds observed from Johnson Ridge, Bingham Wind Project, Spring 2010

	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=49)	14	7	0	12	7	9
Average minimum flight height (m)	70	107	N/A	74	104	67

Table 4-5b. Number of observations and average flight heights for each position category for birds observed from Kingsbury Ridge, Bingham Wind Project, Spring 2010

	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=38)	11	1	0	12	6	8
Average minimum flight height (m)	111	30	N/A	141	170	225

At Johnson Ridge, 21 observations (57%) occurred within the Project area in topographical positions on ridgelines where the proposed turbines are to be sited (positions A, B, and C). Of these birds, 20 (95%) occurred at flight heights below the proposed maximum rotor height of 152 m (Figure 4-7a, Appendix C Table 4a). At Kingsbury Ridge, 13 observations (68%) occurred within the Project area in positions on ridgelines where the proposed turbines are to be sited. Of these, 10 observations (77% of the 13 in the Project area) occurred at flight heights below the proposed maximum rotor height (Figure 4-7b, Appendix C Table 4b).

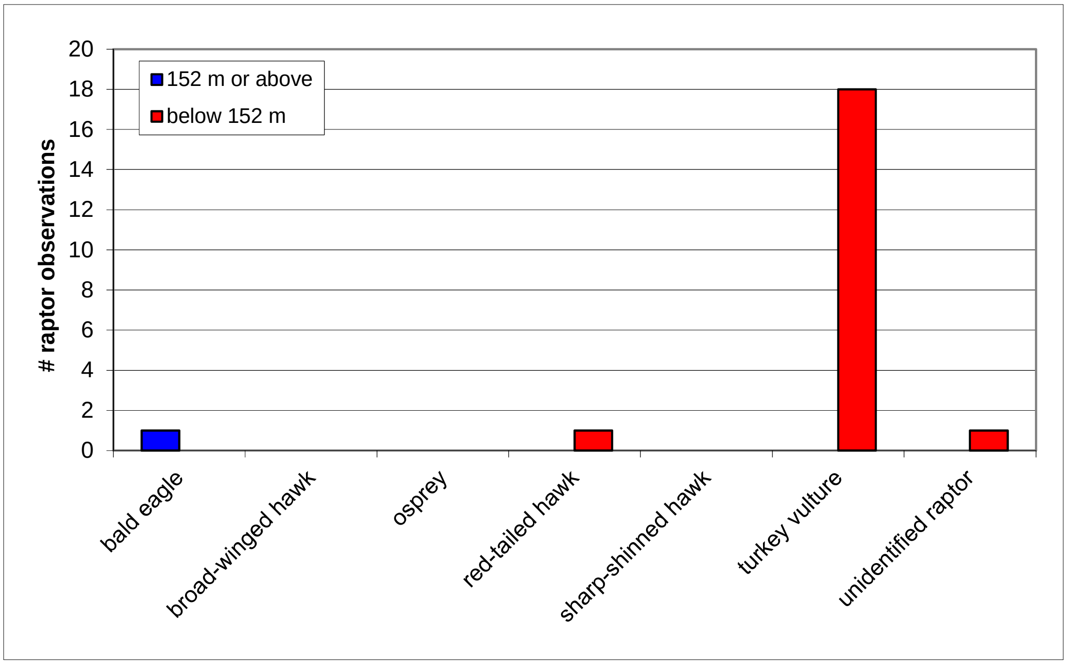


Figure 4-7a. Number of observations of raptor species observed within proposed turbine areas (positions A, B, C within Project area) at heights above and below 152 m from Johnson Ridge during Spring 2010 surveys at the Bingham Wind Project.

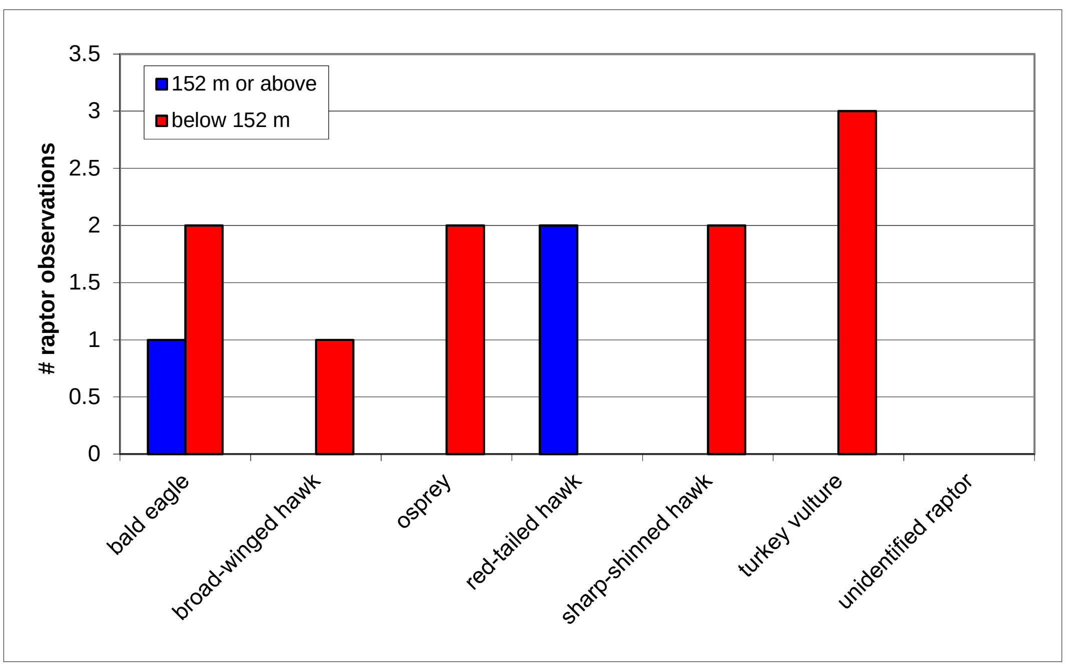


Figure 4-7b. Number of observations of raptor species observed within proposed turbine areas (positions A, B, C within Project area) at heights above and below 152 m from Kingsbury Ridge during Spring 2010 surveys at the Bingham Wind Project.

4.3.7 Rare, Threatened and Endangered Species

No state or federally-listed endangered or threatened raptor species were observed during spring 2010 surveys. One state-listed species of special concern, bald eagle, was observed.

Six observations of bald eagles occurred in the study area, four of which were within the Project area. Two adult bald eagles crossed Kingsbury Ridge on March 25 at heights equal to and above 152 m. An observation of an adult was made on March 25; the bird was seen over a valley outside of the Project area. An observation of a sub-adult was made on March 25; it flew at 50 to 100 m as it crossed Kingsbury Ridge. A sub-adult bald eagle was observed on May 5 outside of the Project area. A third sub-adult observation was made on May 21 flying at over 500 m over Johnson Ridge.

4.3.8 Incidental Non-raptor Observations

There were 38 non-raptor avian species observed incidentally to the spring 2010 raptor surveys (Table 4-6). Among these species, three are state-listed as species of special concern: black-and-white warbler (*Mniotitla varia*), chestnut-sided warbler (*Dendroica pensylvanica*) , and white-throated sparrow (*Zonotrichia albicollis*) .

Table 4-6. Non-raptor avian species observed incidentally during raptor surveys from Johnson and Kingsbury Ridges, Bingham Wind Project, Spring 2010

Common name	Scientific name	Status
American crow	*Corvus brachyrhynchos*	
American goldfinch	*Carduelis tristis*	
American robin	*Turdus migratorius*	
barred owl	*Strix varia*	
black-and-white warbler	*Mniotilta varia*	special concern
black-capped chickadee	*Poecile atricapilla*	
belted kingfisher	*Megaceryle alcyon*	
brown-headed cowbird	*Molothrus ater*	
blue jay	*Cyanocitta cristata*	
brown creeper	*Certhia americana*	
black-throated green warbler	*Dendroica virens*	
chipping sparrow	*Spizella passerina*	
common raven	*Corvus corax*	
common yellowthroat	*Geothlypis trichas*	
chestnut-sided warbler	*Dendroica pensylvanica*	special concern
double-crested cormorant	*Phalacrocorax auritus)*	
dark-eyed junco	*Junco hyemalis*	
golden-crowned kinglet	*Regulus satrapa*	
hairy woodpecker	*Picoides villosus*	
hermit thrush	*Catharus guttatus*	
house wren	*Troglodytes aedon*	
magnolia warbler	*Dendroica magnolia*	
mourning dove	*Zenaida macroura*	
Nashville warbler	*Vermivora ruficapilla*	
northern flicker	*Colaptes auratus*	
northern mockingbird	*Mimus polyglottos*	
ovenbird	*Seiurus aurocapillus*	
pileated woodpecker	*Dryocopus pileatus*	
purple finch	*Carpodacus purpureus*	
ruby-crowned kinglet	*Regulus calendula*	
ruffed grouse	*Bonasa umbellus*	
song sparrow	*Melospiza melodia*	
Swainson's thrush	*Catharus ustulatus*	
winter wren	*Troglodytes troglodytes*	
white-throated sparrow	*Zonotrichia albicollis*	special concern
white-winged crossbill	*Loxia leucoptera*	
yellow-bellied sapsucker	*Empidonax flaviventris*	
yellow-rumped warbler	*Dendroica coronata*	

4.4 DISCUSSION

Of the 56 raptor observations made in the study area (from both observation locations combined) during the spring 2010 surveys, 61 percent of observations occurred within the Project area. It should be noted that the locations where raptors were observed in the study area are subject to observer bias. Birds in closer proximity to the observation locations would be more likely to be seen than birds occurring at greater distances from the observer. Also birds that traveled outside of the observer's view shed 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 rates at Johnson and Kingsbury Ridges are comparable to the rates reported at regional HMANA locations in Maine, New Hampshire, and Massachusetts; however, when comparing the Bingham results to HMANA survey results, it should be considered that HMANA surveys typically do not count birds that are not actively migrating. The overall passage rate for migrants at the Project was 0.09 raptors/hr; this passage rate 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. The two survey days which experienced the highest raptor counts (May 13 and May 5) were characterized by moderate north winds; however, low pressure systems had recently passed or settled into the region on those dates. Seasonal timing and weather both likely influenced the daily activity rates. 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).

Although the occurrence of some raptors below maximum turbine height increases the potential for migrating raptors to come into the vicinity of the turbines, raptor mortality in the United States, outside of California, has been documented to be relatively low. For example, mortality rates found at wind developments, outside of Altamont Pass in California, have documented 0 to 0.07 fatalities/turbine/year from 2000-2004 (GAO 2005). Several recent studies, conducted in the U.S., have documented low raptor mortality with few more than 20 raptor fatalities reported at more than a dozen sites combined (Osborn *et al*. 2000, Johnson *et al*. 2002, Kerlinger 2002, Young *et al*. 2003, Erickson *et al*. 2000, Kerlinger 2006, Erickson *et al*. 2002, Johnson *et al*. 2003, Kerns and Kerlinger 2004, Arnett 2005, Koford *et al*. 2005, Fiedler *et al*. 2007, Jain *et al*. 2007, Jain *et al.* 2008, Stantec 2008, Stantec 2009a and b, Stantec 2010a and b).

Of the nine species of raptor observed during the spring 2010 surveys, one state-listed species of special concern, bald eagle, was observed. The species composition and flight behaviors documented during the spring 2010 raptor surveys at the Project are typical among the results of regional raptor migration studies, while the overall passage rates at the two observation locations were 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. 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 fatalities that have been documented during post-construction mortality studies.

Studies have documented high raptor collision avoidance behaviors at modern wind facilities (Whitfield and Madders 2006, Chamberlain *et al.* 2006). As most raptors are diurnal, raptors may be able to visually, as well as acoustically detect turbines during periods of fair weather. Foraging raptors that may become distracted by prey, or migrant raptors flying during periods of reduced visibility, may be at increased risk of collision with wind turbines.

5.0 Breeding Bird Survey

5.1 INTRODUCTION

Stantec conducted a breeding bird survey at the Project during the spring and summer of 2010. The goals of the surveys were to determine the species composition, abundance, diversity, and distribution of breeding birds in the Project area. The surveys focused effort on documenting the occurrence of endangered, threatened, or species of special concern; however, the surveys documented of all species detected either acoustically or visually during the surveys. Survey methods were modeled after the United States Geological Survey (USGS) Breeding Bird Survey methodology (Sauer *et al*. 2003).

The breeding bird survey methods were designed to be repeatable in order to compare data to other sites, as well as to compare to future data collected on-site if necessary. The 2010 survey provides baseline data of the species present in the Project area, their abundance, as well as the community structures among the different habitats present on-site.

5.2 METHODS

5.2.1 Breeding Bird Survey Point Counts

Stantec biologists conducted breeding bird point-count surveys during three separate visits to the Project area. The first visit was completed during late May, the second visit in early June, and third visit in late June 2010.

Twenty-five point-count locations were established within the proposed Project area using Global Positioning System (GPS) equipment (Figure 5-1). These locations were positioned to sample representative habitats that occur in the Project area and in proximity to the proposed turbine locations. Surveys were timed to begin approximately 15 minutes before sunrise and end six (+/-) hours after sunrise on days with suitably clear weather, mild temperatures, and when rain or wind would not inhibit the detection of birds. GPS location, time, weather, habitat, species, number of individuals, and other behavioral notes were recorded during each survey point.

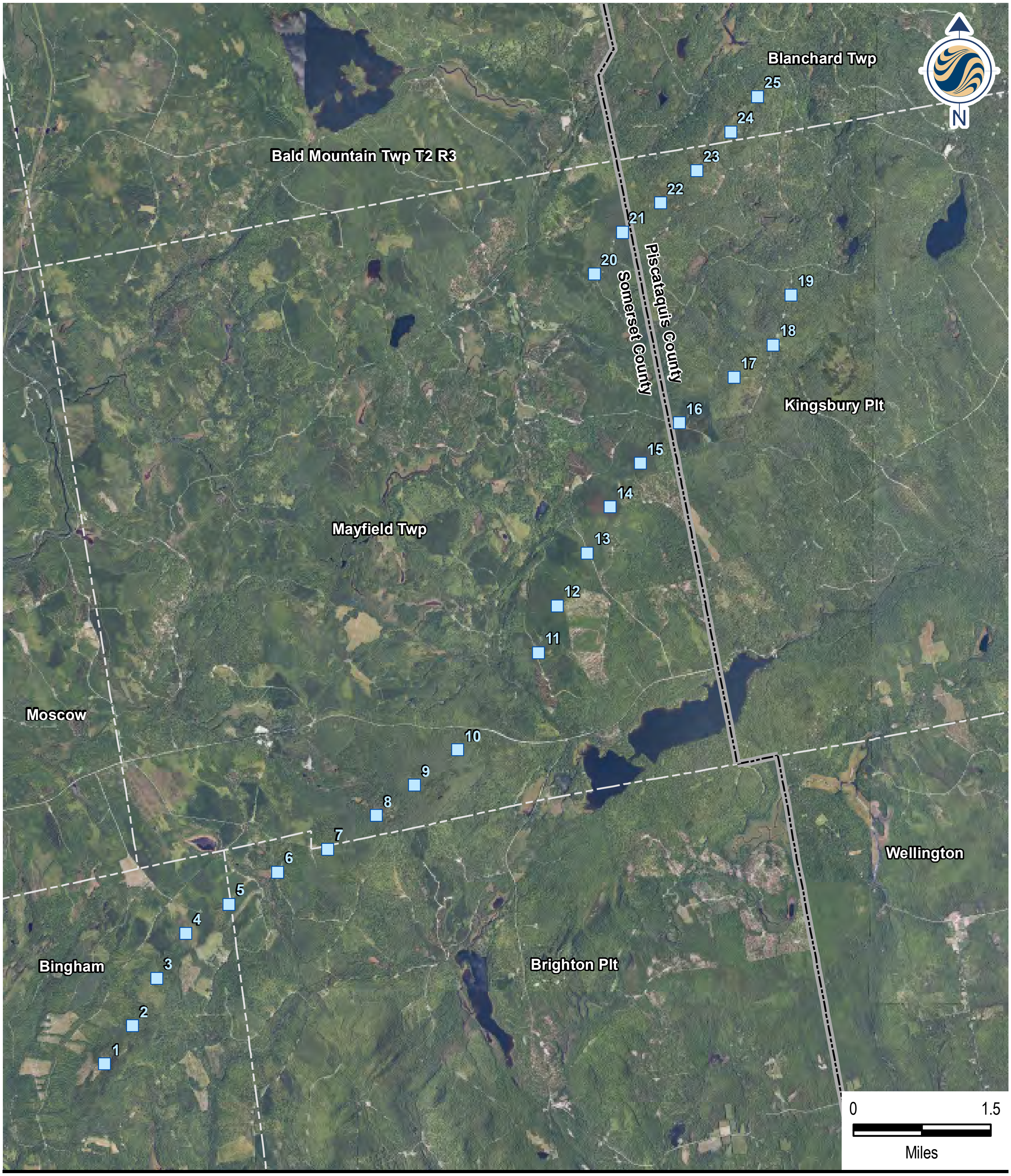
During surveys, observers orientated themselves to the north and recorded the general locations of birds within the directional quadrants of a count circle. Point-count sample periods were broken into three periods: the first three minutes, the following two minutes, and the final five minutes. For the duration of the 10 minute count surveys, the number of individuals by species was recorded on data sheets as occurring at distances of 0-50 m, 50-100 m, or greater than 100 m from the observer, or flying overhead depending upon when the bird was first seen or heard. During each consecutive time period, observers determined the location of previously recorded birds and tracked any movements within the count circle in order to avoid recounting birds. Other notes related to breeding behavior, weather conditions, and habitat descriptions were recorded. When possible, observers made digital recordings of rare or unusual birds. Only adult birds were counted when juveniles were present. Observations of birds made before and after the point-count timeframes were recorded separately as incidental observations.

5.2.2 Data Summary and Analysis

The habitats within the Project area were separated into five general community types based on the dominant vegetation cover present at each survey point: coniferous forest, deciduous forest, mixed coniferous and deciduous forest, coniferous-dominated mixed forest, and deciduous-dominated mixed forest. Habitats with similar characteristics were grouped wherever possible for simplicity of statistical analysis; however, habitat types varied to a small degree within these classifications. For example, some of the hardwood stands, although predominately hardwoods, included conifer species such as red spruce, eastern hemlock (*Tsuga canadensis*) and eastern white pine (*Pinus strobus*), and/or openings with boulder outcrops. Additionally, due to recent and past timber harvesting activities much of the forest communities are in various stages of regeneration.

Quantitative data collected during point counts were used to calculate the species richness, relative abundance, community diversity, and frequency of breeding birds within the available habitats of the Project area.

- Species richness (SR) is the total number of species that are detected at a specific point, within a habitat classification, or across the Project area.
- Relative abundance (RA) measures the number of individuals of a species within a habitat classification or across the Project area, and takes into account the number of times each point is surveyed and the number of points per habitat, or per Project area.
- Frequency (Fr) of occurrence, expressed as a percentage, measures the number of points within a habitat type, or across the Project area, where a particular species is detected.
- The Shannon Diversity Index (SDI) is a measure of species diversity in a community or habitat. SDI can provide more information about community composition than species richness alone because it takes into account relative abundance and evenness of species. It indicates not only the number of species, but also how abundance is distributed among all the species in the community or habitat.



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Legend

- Breeding Bird Survey Location
- County Boundary
- Town Boundary

Client/Project
Bingham Wind Project
Bingham, Maine

Figure No.
5-1

Title
Breeding Bird Survey Location Map

August 20, 2010

Species recorded as beyond 100 m from the observer, as flyovers, or birds detected incidentally were not included in the statistical analysis for relative abundance, species frequency, or community diversity because of the low probability that they were breeding in the vicinity of the point-count location. These data were used to determine overall species richness and the total number of birds observed.

5.3 RESULTS

The first of breeding bird surveys was conducted in late May (May 25, 26, and 27), the second in early June (June 9 and 10), and the final round was conducted in late June (June 22 and 25). Surveys were conducted when wind or rain conditions did not adversely affect bird detection. Wind conditions generally ranged from <1 mph to approximately 7 mph (2 to 12 kph). Weather conditions ranged from clear to overcast skies with periods of light drizzle on one day (June 10). Temperatures during the surveys ranged from 0º to 29º C (32º to 85º F).

5.3.1 Breeding Bird Survey Point Counts

Each of the 25 point count locations was surveyed during the three separate site visits. The majority of individuals were observed were within 50 m of the observer (n=312, 40%) and between 50 and 100 m of the observer (n=361, 46%). Thirteen percent (n=99) of individuals were detected at more than 100 m from the observer and 2 percent (n=15) were recorded as flyovers (Appendix D Table 1).

Including birds observed beyond 100 m from the observer and birds observed as flyovers, a total of 49 species (and one unidentified warbler) were observed within the Project area during point-count surveys (Appendix D Table 1). One additional species, veery (*Catharus fuscensces*), was observed incidentally between survey points, for a total of 50 species (Appendix D Table 2).

Including birds observed beyond 100 m from the observer and birds observed as flyovers, a total of 787 individuals were documented. The species with the greatest numbers of individuals detected were white-throated sparrow (n=89), ovenbird (*Seiurus aurocapillus*; n=62), chestnut-sided warbler (n=53), and Nashville warbler (*Vermivora ruficapilla*; n=52) (Appendix D Table 1). There were no endangered or threatened species observed; however, there were nine state-listed species of special concern documented either during surveys or incidentally: least flycatcher (*Empidonax minimus*), eastern wood-pewee (*Contopus virens*), veery, American redstart (*Setophaga ruticilla*), black-and-white warbler, Canada warbler (*Wilsonia canadensis*), chestnut-sided warbler, yellow-warbler (*Dendroica petechia*), and white-throated sparrow.

There were a total of 673 individuals observed within 100 m of the observer, excluding birds seen as flyovers (Appendix D Table 1). For birds within 100 m of the observer, excluding flyovers, point-count data were analyzed to determine SR, RA, and community diversity for all survey points combined and for each habitat type present within the Project area (Table 5-1).

For all survey points and for birds within 100 m and non-flyovers, the RA was 8.97, the SR was 44, and the SDI was 3.19 (Table 5-1).

Table 5-1. Summary of Project area breeding bird point-count results by habitat type, excluding observations of birds >100 m from the observer and flyovers

Habitat Type	# BBS Points	Total Birds Observed	Relative Abundance	Species Richness	Shannon Diversity Index
coniferous forest	3	70	7.78	20	2.72
hardwood forest	6	158	8.78	27	2.92
mixed coniferous-hardwood forest	6	168	9.33	29	3.01
coniferous-dominated mixed forest	3	98	10.89	25	2.84
hardwood-dominated mixed forest	7	179	8.52	32	3.04
All points	**25**	**673**	**8.97**	**44**	**3.19**

Hardwood-dominated mixed forest habitat had the greatest number of total birds observed (n=179), the highest SR (32), as well as the highest SDI (3.04). Coniferous-dominated mixed forest had the highest RA (10.89).

5.3.2 Species relative abundances and frequencies among habitats

The following are the values of relative abundances and frequencies for the most relatively abundant species in the five habitat types surveyed within the Project area (reference Appendix D Tables 2, 3, and 4).

5.3.2.1 Coniferous Forest

The species with the greatest RA within coniferous forest habitats were dark-eyed junco (*Junco hyemalis*; RA=1.22, Fr=100%) and yellow-rumped warbler (*Dendroica coronata*; RA=0.89, Fr=100%).

5.3.2.2 Hardwood Forest

The species with the greatest RA within hardwood forest habitats were black-throated blue warbler (RA=1.06, Fr=83%) and chestnut-sided warbler (RA=1.17, Fr=100%).

5.3.2.3 Coniferous-dominated Mixed Forest

The species with the greatest RA within coniferous-dominated mixed forest habitats were white-throated sparrow (RA=1.78, Fr=100%), Nashville warbler (RA=1.33, Fr=100%), and dark-eyed junco (RA=0.89, Fr=100%).

5.3.2.4 Hardwood-dominated Mixed Forest

The species with the greatest RA within hardwood-dominated mixed forest habitats were ovenbird (RA=0.90, Fr=100%), black-throated blue warbler (RA=0.86, Fr=86%), and chestnut-sided warbler (RA=0.76, Fr=100%).

5.3.2.5 Mixed Coniferous-hardwood Forest

The species with the greatest RA within mixed forest habitats were white-throated sparrow (RA=1.22, Fr=100%), Nashville warbler (RA=0.89, Fr=100%), and common yellowthroat (RA=0.78, Fr=83%).

5.4 DISCUSSION

The intent of the 2010 surveys was to document the occurrence of species of conservation concern as well as to provide baseline data of all species breeding within the Project area. The surveys were conducted during the peak nesting period, and were initiated in early morning when birds are typically the most vocal. In addition, these surveys targeted optimal weather conditions that would allow for maximum detection of vocalizing birds. Certain species of bird vocalize less frequently and are, therefore, often under-represented during breeding bird surveys (Farnsworth *et al.* 2002). However, the 2010 surveys used standard methods that are comparable to other breeding bird surveys conducted in the region; therefore, the results of the surveys provide a suitable reflection of the baseline breeding bird community in the Project area.

Among the habitats sampled, hardwood dominated mixed forest had the greatest number of detected individuals, the highest diversity of species, and the most even distribution of species across points sampled within this habitat. However, coniferous-dominated mixed forest had the greatest relative abundance of birds.

Of the 50 species documented on-site during the 2010 surveys, all are generally common and regionally abundant, and are representative of the habitats in which they were detected. There were no endangered or threatened species; however, there were nine special concern species observed on-site.

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Appendix A

Radar survey results

Date	Sunset	Sunrise	Passage Rate	Flight Direction	Flight Height (m)	% Below 152 m	Temperature (C)	Wind Speed (m/s)	Wind Direction (degrees)
4/19	19:29	5:46	85	117	238	30%	5	8	332
4/20	19:30	5:45	556	72	229	39%	7	6	320
4/21	19:31	5:43	642	350	497	12%	7	4	144
4/29	19:41	5:30	51	88	214	49%	6	12	312
5/1	19:44	5:27	1231	35	381	16%	15	6	236
5/4	19:47	5:23	353	107	289	24%	10	8	319
5/5	19:49	5:22	594	23	475	7%	13	8	212
5/6	19:50	5:20	124	84	231	40%	7	13	304
5/13	19:58	5:11	699	56	201	52%	9	5	311
5/14	19:59	5:10	659	42	236	40%	10	6	271
5/15	20:01	5:09	540	54	156	65%	7	7	310
5/16	20:02	5:08	600	70	167	57%	10	9	340
5/17	20:03	5:07	1103	31	371	19%	12	3	106
5/18	20:04	5:06	524	39	306	19%	9	6	184
5/20	20:06	5:04	582	72	197	51%	11	7	258
5/21	20:07	5:03	797	21	327	13%	11	8	197
5/22	20:08	5:02	540	33	424	11%	13	7	215
5/23	20:10	5:01	497	46	321	20%	15	7	258
5/25	20:12	5:00	275	75	280	29%	13	4	173
5/26	20:13	4:59	563	22	334	12%	10	6	214
Entire Season			**543**	**43**	**355**	**21%**	**10**	**7**	**251**

Appendix A Table 1. Survey dates, results, level of effort, and weather - Bingham Wind Project, Spring 2010

Appendix A Table 2. Summary of passage rates by hour, night, and for entire season - Bingham Wind Project, Spring 2010														
Night of	Passage Rate (targets/km/hr) by hour after sunset										Entire Night			
	1	2	3	4	5	6	7	8	9	10	Mean	Median	Stdev	SE
4/19	64	57	82	75	96	96	93	79	68	143	85	80	24	8
4/20	364	646	796	718	686	750	525	593	325	161	556	620	210	66
4/21	539	571	864	836	536	796	704	896	464	211	642	638	217	69
4/29	21	89	71	57	64	43	54	50	32	25	51	52	21	7
5/1	1032	561	889	Rain	1082	1675	2193	1529	1779	343	1231	1082	605	202
5/4	375	721	625	839	136	164	321	204	132	11	353	263	283	89
5/5	523	1014	1068	489	414	479	496	625	707	129	594	510	279	88
5/6	21	418	261	207	179	64	39	17	32	0	124	52	138	44
5/13	461	1093	1286	843	743	707	564	375	221	N/A	699	707	341	114
5/14	229	718	839	811	861	611	489	718	657	N/A	659	718	200	67
5/15	43	971	1079	921	564	525	421	232	104	N/A	540	525	382	127
5/16	282	757	743	661	807	764	596	571	218	N/A	600	661	214	71
5/17	443	829	1286	1661	1454	1636	1207	1039	371	N/A	1103	1207	476	159
5/18	379	736	789	614	539	568	564	329	200	N/A	524	564	191	64
5/20	346	764	811	839	725	579	386	204	N/A	N/A	582	652	242	86
5/21	411	736	804	979	843	1007	843	757	N/A	N/A	797	823	184	65
5/22	325	621	668	711	704	671	611	532	21	N/A	540	621	228	76
5/23	350	686	779	586	618	557	379	432	86	N/A	497	557	209	70
5/25	21	264	268	375	236	368	Rain	596	68	N/A	275	266	182	64
5/26	257	1200	1560	975	511	296	139	104	21	N/A	563	296	550	183
Entire Season	**324**	**673**	**778**	**695**	**590**	**618**	**559**	**494**	**306**	**128**	**543**	**538**	**403**	**30**
	0 indicates no targets counted for that hour							N/A indicates no data for that hour						

Appendix A Table 3. Mean Nightly Flight Direction- Bingham Wind Project, Spring 2010		
Night of	**Mean Flight Direction**	**Circular Stdev**
4/19	117	62
4/20	72	47
4/21	350	62
4/29	88	52
5/1	35	45
5/4	107	64
5/5	23	38
5/6	84	38
5/13	56	33
5/14	42	33
5/15	54	39
5/16	70	39
5/17	31	53
5/18	39	40
5/20	72	44
5/21	21	30
5/22	33	45
5/23	46	42
5/25	75	37
5/26	22	54
Entire Season	**43**	**51**

Appendix A Table 4. Summary of mean flight heights by hour, night, and for entire season - Bingham Wind Project, Spring 2010																
Night of	Mean Flight Height (m) by hour after sunset										Entire Night				# of targets below 152 meters	% of targets below 152 meters
	1	2	3	4	5	6	7	8	9	10	Mean	Median	STDV	SE		
4/19	117	231	226	252	238	272	241	200	228	260	238	219	147	46	66	30%
4/20	229	246	235	233	223	211	247	228	202	222	229	195	155	49	551	39%
4/21	309	431	495	538	564	500	468	426	511	639	497	442	303	96	534	12%
4/29	136	287	167	148	237	177	303	189	123	287	214	161	145	46	44	49%
5/1	181	279	Rain	Rain	468	388	396	334	377	367	381	323	242	85	1040	16%
5/4	257	275	304	343	223	284	248	234	260	68	289	245	202	64	201	24%
5/5	356	427	450	507	508	517	503	449	439	505	475	415	270	85	240	7%
5/6	280	270	180	180	221	288	390	43	217	N/A	231	184	151	50	69	40%
5/13	198	187	181	170	133	232	245	263	289	N/A	201	146	180	60	600	52%
5/14	218	245	328	245	210	179	252	200	171	N/A	236	181	187	62	726	40%
5/15	223	166	156	140	170	117	137	149	172	N/A	156	102	147	49	609	65%
5/16	163	184	166	137	170	170	199	148	112	N/A	167	116	149	50	525	57%
5/17	320	551	502	358	267	288	304	295	324	N/A	371	298	259	86	717	19%
5/18	269	345	326	308	261	282	272	265	317	N/A	306	266	173	58	466	19%
5/20	202	259	147	155	137	184	379	315	N/A	N/A	197	142	196	69	323	51%
5/21	298	389	297	304	282	315	358	361	N/A	N/A	327	295	182	64	676	13%
5/22	281	492	499	442	400	369	334	392	356	N/A	424	355	260	87	370	11%
5/23	321	415	327	305	260	261	244	297	416	N/A	321	280	194	65	185	20%
5/25	283	285	273	275	335	298	Rain	238	230	N/A	280	259	173	61	138	29%
5/26	415	347	316	328	351	298	264	349	820	N/A	334	302	174	58	132	12%
Entire Season	**253**	**316**	**293**	**283**	**283**	**281**	**304**	**269**	**309**	**335**	**355**	**291**	**247**	**1**	**8212**	**21%**
-- 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 Services Inc.

Appendix B

Bat survey results

Stantec

Appendix B Table 1. Summary of acoustic bat data and weather during each survey night at the Bessey Met High detector – Spring 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)**
04/13/09	1												**0**		
04/14/09	1												**0**		
04/15/09	1												**0**	5.9	3.3
04/16/09	1												**0**	5.0	2.6
04/17/09	1												**0**		-0.6
04/18/09	1												**0**	4.4	0.9
04/19/09	1												**0**	8.4	6.2
04/20/09	1												**0**	6.5	10.6
04/21/09	1												**0**	6.7	9.3
04/22/09	1												**0**	2.2	9.9
04/23/09	1												**0**	9.2	5.4
04/24/09	1												**0**	4.1	11.0
04/25/09	1												**0**	2.4	9.3
04/26/09	1												**0**	4.9	12.1
04/27/09	1												**0**	5.8	3.4
04/28/09	1												**0**	8.5	2.8
04/29/09	1					1							**1**	10.4	5.2
04/30/09	1					1							**1**	6.4	12.2
05/01/09	1												**0**	2.1	18.6
05/02/09	1												**0**	7.4	21.7
05/03/09	1												**0**	9.2	16.7
05/04/09	1												**0**	8.0	13.1
05/05/09	1												**0**	4.1	13.8
05/06/09	1												**0**	10.0	8.8
05/07/09	1												**0**	8.5	7.0
05/08/09	1												**0**	3.6	4.6
05/09/09	1												**0**	11.7	2.3
05/10/09	1												**0**	9.0	-0.3
05/11/09	1												**0**	4.8	8.6
05/12/09	1												**0**	7.1	7.5
05/13/09	1												**0**	6.4	11.2
05/14/09	1												**0**	4.5	12.6
05/15/09	1												**0**	6.6	9.8
05/16/09	1					1							**1**	8.6	13.2
05/17/09	1					1							**1**	4.6	16.6
05/18/09	1												**0**	7.2	13.6
05/19/09	1												**0**	7.2	9.1
05/20/09	1	1											**1**	6.8	18.4
05/21/09	1												**0**	4.4	13.9
05/22/09	1												**0**	5.6	15.1
05/23/09	1												**0**	7.7	17.2
05/24/09	1												**0**	6.2	23.6
05/25/09	1												**0**	6.2	26.1
05/26/09	1												**0**	7.1	19.7
05/27/09	1					1							**1**	7.9	14.7
05/28/09	1												**0**	5.8	15.6
05/29/09	1												**0**	6.5	16.0
05/30/09	1	1											**1**	9.9	14.2
05/31/09	1												**0**	7.3	16.3
06/01/09	1										1		**1**	6.1	14.5
06/02/09	1												**0**		
06/03/09	1												**0**		
06/04/09	1	1		1									**2**		
06/05/09	1												**0**		
06/06/09	1												**0**		
06/07/09	1												**0**		
06/08/09	1												**0**		
By Species		**3**	**0**	**1**	**0**	**5**	**0**	**0**	**0**	**0**	**1**	**0**	**10**		
By Guild			**4**		**0**	**5**		**0**			**1**				
			BBSH		**HB**	**MYSP**		**RBTB**			**UNKN**		**Total**		

Appendix B Table 2. Summary of acoustic bat data and weather during each survey night at the Bessey Met Low detector – Spring 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)
04/13/09	1												0		
04/14/09	1												0		
04/15/09	1												0	6	3
04/16/09	1												0	5	3
04/17/09	1												0		-1
04/18/09	1												0	4	1
04/19/09	1												0	8	6
04/20/09	1												0	6	11
04/21/09	1												0	7	9
04/22/09	1												0	2	10
04/23/09	1												0	9	5
04/24/09	1					1							1	4	11
04/25/09	1												0	2	9
04/26/09	1												0	5	12
04/27/09	1												0	6	3
04/28/09	1												0	9	3
04/29/09	1									1			1	10	5
04/30/09	1												0	6	12
05/01/09	1												0	2	19
05/02/09	1												0	7	22
05/03/09	1												0	9	17
05/04/09	1												0	8	13
05/05/09	1	1											1	4	14
05/06/09	1									1			1	10	9
05/07/09	1												0	9	7
05/08/09	1												0	4	5
05/09/09	1												0	12	2
05/10/09	1												0	9	0
05/11/09	1									1			1	5	9
05/12/09	1												0	7	8
05/13/09	1												0	6	11
05/14/09	1												0	5	13
05/15/09	1												0	7	10
05/16/09	1									1			1	9	13
05/17/09	1												0	5	17
05/18/09	1												0	7	14
05/19/09	1												0	7	9
05/20/09	1												0	7	18
05/21/09	1												0	4	14
05/22/09	1												0	6	15
05/23/09	1	1			1								2	8	17
05/24/09	1									4			4	6	24
05/25/09	1									1			1	6	26
05/26/09	1												0	7	20
05/27/09	1												0	8	15
05/28/09	1												0	6	16
05/29/09	1												0	7	16
05/30/09	1												0	10	14
05/31/09	1				1								1	7	16
06/01/09	1												0	6	15
06/02/09	1												0		
06/03/09	1	1											1		
06/04/09	1										1		1		
06/05/09	1				1								1		
06/06/09	1												0		
06/07/09	1									1			1		
06/08/09	1												0		
By Species		**3**	**0**	**0**	**3**	**1**	**0**	**0**	**0**	**10**	**1**	**0**	**18**		
By Guild		**3**			**3**	**1**	**0**			**11**					
		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 3. Summary of acoustic bat data and weather during each survey night at the Bigelow Ridge Tree detector – Spring 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)
04/14/09	1												**0**		
04/15/09	1												**0**		
04/16/09	1												**0**	6	3
04/17/09	1												**0**	5	3
04/18/09	1												**0**		-1
04/19/09	1												**0**	4	1
04/20/09	1												**0**	8	6
04/21/09	1												**0**	6	11
04/22/09	1												**0**	7	9
04/23/09	1												**0**	2	10
04/24/09	1												**0**	9	5
04/25/09	1												**0**	4	11
04/26/09	1												**0**	2	9
04/27/09	1												**0**	5	12
04/28/09	1												**0**	6	3
04/29/09	1												**0**	9	3
04/30/09	1									2			**2**	10	5
05/01/09	1												**0**	6	12
05/02/09	1												**0**	2	19
05/03/09	1												**0**	7	22
05/04/09	1					1							**1**	9	17
05/05/09	1	2				1				2			**5**	8	13
05/06/09	1												**0**	4	14
05/07/09	1					1							**1**	10	9
05/08/09	1												**0**	9	7
05/09/09	1												**0**	4	5
05/10/09	1												**0**	12	2
05/11/09	1					1				1			**2**	9	0
05/12/09	1												**0**	5	9
05/13/09	1					3							**3**	7	8
05/14/09	1					1				2			**3**	6	11
05/15/09	1									1			**1**	5	13
05/16/09	1												**0**	7	10
05/17/09	1									3			**3**	9	13
05/18/09	1												**0**	5	17
05/19/09	1												**0**	7	14
05/20/09	1									5			**5**	7	9
05/21/09	1					2							**2**	7	18
05/22/09	1												**0**	4	14
05/23/09	1					2				1			**3**	6	15
05/24/09	1									1			**1**	8	17
05/25/09	1									1			**1**	6	24
05/26/09	1									7			**7**	6	26
05/27/09	1					10							**10**	7	20
05/28/09	1					9				9			**18**	8	15
05/29/09	1					5				3			**8**	6	16
05/30/09	1					1							**1**	7	16
05/31/09	1					1							**1**	10	14
06/01/09	1	1				3				7			**11**	7	16
06/02/09	1												**0**	6	15
By Species		**3**	**0**	**0**	**0**	**41**	**0**	**0**	**0**	**45**	**0**	**0**	**89**		
By Guild		**3**			**0**	**41**	**0**			**45**					
		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 Crocket Met High detector – Spring 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)
04/14/09	1												**0**		
04/15/09	1												**0**		
04/16/09	1												**0**	6	3
04/17/09	1												**0**	5	3
04/18/09	1												**0**		-1
04/19/09	1												**0**	4	1
04/20/09	1												**0**	8	6
04/21/09	1												**0**	6	11
04/22/09	1												**0**	7	9
04/23/09	1												**0**	2	10
04/24/09	1												**0**	9	5
04/25/09	1												**0**	4	11
04/26/09	1												**0**	2	9
04/27/09	1												**0**	5	12
04/28/09	1												**0**	6	3
04/29/09	1												**0**	9	3
04/30/09	1												**0**	10	5
05/01/09	1												**0**	6	12
05/02/09	1												**0**	2	19
05/03/09	1									1			**1**	7	22
05/04/09	1												**0**	9	17
05/05/09	1		1										**1**	8	13
05/06/09	1												**0**	4	14
05/07/09	1									1			**1**	10	9
05/08/09	1												**0**	9	7
05/09/09	1												**0**	4	5
05/10/09	1												**0**	12	2
05/11/09	1												**0**	9	0
05/12/09	1												**0**	5	9
05/13/09	1									1			**1**	7	8
05/14/09	1												**0**	6	11
05/15/09	1												**0**	5	13
05/16/09	1												**0**	7	10
05/17/09	1												**0**	9	13
05/18/09	1												**0**	5	17
05/19/09	1												**0**	7	14
05/20/09	1												**0**	7	9
05/21/09	1												**0**	7	18
05/22/09	1												**0**	4	14
05/23/09	1												**0**	6	15
05/24/09	1										1		**1**	8	17
05/25/09	1												**0**	6	24
05/26/09	1									1			**1**	6	26
05/27/09	1					1				1			**2**	7	20
05/28/09	1												**0**	8	15
05/29/09	1												**0**	6	16
05/30/09	1												**0**	7	16
05/31/09	1												**0**	10	14
06/01/09	1												**0**	7	16
06/02/09	1												**0**	6	15
06/03/09	1												**0**		
06/04/09	1												**0**		
06/05/09	1												**0**		
06/06/09	1												**0**		
06/07/09	1												**0**		
06/08/09	1												**0**		
By Species		**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**5**	**1**	**0**	**8**		
By Guild		**1**			**0**	**1**	**0**			**6**					
		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 5. Summary of acoustic bat data and weather during each survey night at the Crocket Met Low detector – Spring 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)
04/14/09	1												**0**		
04/15/09	1												**0**		
04/16/09	1												**0**	6	3
04/17/09	1												**0**	5	3
04/18/09	1												**0**		-1
04/19/09	1												**0**	4	1
04/20/09	1												**0**	8	6
04/21/09	1												**0**	6	11
04/22/09	1												**0**	7	9
04/23/09	1												**0**	2	10
04/24/09	1					1							**1**	9	5
04/25/09	1												**0**	4	11
04/26/09	1												**0**	2	9
04/27/09	1												**0**	5	12
04/28/09	1												**0**	6	3
04/29/09	1					1							**1**	9	3
04/30/09	1					1							**1**	10	5
05/01/09	1												**0**	6	12
05/02/09	1												**0**	2	19
05/03/09	1												**0**	7	22
05/04/09	1	1								1			**2**	9	17
05/05/09	1												**0**	8	13
05/06/09	1												**0**	4	14
05/07/09	1												**0**	10	9
05/08/09	1												**0**	9	7
05/09/09	1												**0**	4	5
05/10/09	1												**0**	12	2
05/11/09	1												**0**	9	0
05/12/09	1												**0**	5	9
05/13/09	1												**0**	7	8
05/14/09	1					1							**1**	6	11
05/15/09	1												**0**	5	13
05/16/09	1									1			**1**	7	10
05/17/09	1												**0**	9	13
05/18/09	1												**0**	5	17
05/19/09	1												**0**	7	14
05/20/09	1					1				1			**2**	7	9
05/21/09	1												**0**	7	18
05/22/09	1												**0**	4	14
05/23/09	1												**0**	6	15
05/24/09	1	1											**1**	8	17
05/25/09	1												**0**	6	24
05/26/09	1									1	1		**2**	6	26
05/27/09	1												**0**	7	20
05/28/09	1												**0**	8	15
05/29/09	1												**0**	6	16
05/30/09	1												**0**	7	16
05/31/09	1												**0**	10	14
06/01/09	1										1		**1**	7	16
06/02/09	1												**0**	6	15
06/03/09	1				1								**1**		
06/04/09	1												**0**		
06/05/09	1												**0**		
06/06/09	1												**0**		
06/07/09	1				1								**1**		
06/08/09	1												**0**		
By Species		**2**	**0**	**0**	**2**	**5**	**0**	**0**	**0**	**4**	**2**	**0**	**15**		
By Guild		**2**			**2**	**5**	**0**			**6**					
		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 Johnson Met Low detector – Spring 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)
04/14/09	1												0		
04/15/09	1												0		
04/16/09	1												0	5.9	3.3
04/17/09	1												0	5.0	2.6
04/18/09	1												0		-0.6
04/19/09	1												0	4.4	0.9
04/20/09	1												0	8.4	6.2
04/21/09	1												0	6.5	10.6
04/22/09	1												0	6.7	9.3
04/23/09	1												0	2.2	9.9
04/24/09	1												0	9.2	5.4
04/25/09	1												0	4.1	11.0
04/26/09	1												0	2.4	9.3
04/27/09	1												0	4.9	12.1
04/28/09	1									1			1	5.8	3.4
04/29/09	1												0	8.5	2.8
04/30/09	1					1							1	10.4	5.2
05/01/09	1												0	6.4	12.2
05/02/09	1												0	2.1	18.6
05/03/09	1												0	7.4	21.7
05/04/09	1					1							1	9.2	16.7
05/05/09	1										1		1	8.0	13.1
05/06/09	1												0	4.1	13.8
05/07/09	1												0	10.0	8.8
05/08/09	1												0	8.5	7.0
05/09/09	1												0	3.6	4.6
05/10/09	1												0	11.7	2.3
05/11/09	1												0	9.0	-0.3
05/12/09	1												0	4.8	8.6
05/13/09	1												0	7.1	7.5
05/14/09	1												0	6.4	11.2
05/15/09	1												0	4.5	12.6
05/16/09	1												0	6.6	9.8
05/17/09	1			1									1	8.6	13.2
05/18/09	1												0	4.6	16.6
05/19/09	1												0	7.2	13.6
05/20/09	1									1			1	7.2	9.1
05/21/09	1										1		1	6.8	18.4
05/22/09	1												0	4.4	13.9
05/23/09	1												0	5.6	15.1
05/24/09	1				1	1							2	7.7	17.2
05/25/09	1												0	6.2	23.6
05/26/09	1			1									1	6.2	26.1
05/27/09	1												0	7.1	19.7
05/28/09	1			2							3		5	7.9	14.7
05/29/09	1												0	5.8	15.6
05/30/09	1				1						1		2	6.5	16.0
05/31/09	1												0	9.9	14.2
06/01/09	1												0	7.3	16.3
06/02/09	1												0	6.1	14.5
By Species		**0**	**0**	**4**	**2**	**3**	**0**	**0**	**0**	**2**	**6**	**0**	**17**		
By Guild		**4**			**2**	**3**	**0**			**8**					
		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 7. Summary of acoustic bat data and weather during each survey night at the Johnson Met Tree detector – Spring 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)
04/14/09	1												**0**		
04/15/09	1												**0**		
04/16/09	1												**0**	6	3
04/17/09	1												**0**	5	3
04/18/09	1												**0**		-1
04/19/09	1												**0**	4	1
04/20/09	1						1			1			**2**	8	6
04/21/09	1												**0**	6	11
04/22/09	1												**0**	7	9
04/23/09	1												**0**	2	10
04/24/09	1												**0**	9	5
04/25/09	1					1							**1**	4	11
04/26/09	1												**0**	2	9
04/27/09	1												**0**	5	12
04/28/09	1									1			**1**	6	3
04/29/09	1												**0**	9	3
04/30/09	1	1				3							**4**	10	5
05/01/09	1					1							**1**	6	12
05/02/09	1	1		1		1							**3**	2	19
05/03/09	1										1		**1**	7	22
05/04/09	1												**0**	9	17
05/05/09	1		1								2		**3**	8	13
05/06/09	1												**0**	4	14
05/07/09	1					1							**1**	10	9
05/08/09	1												**0**	9	7
05/09/09	1												**0**	4	5
05/10/09	1												**0**	12	2
05/11/09	1					1							**1**	9	0
05/12/09	1												**0**	5	9
05/13/09	1												**0**	7	8
05/14/09	1				1	2				1			**4**	6	11
05/15/09	1	1				2				1			**4**	5	13
05/16/09	1												**0**	7	10
05/17/09	1					1				1			**2**	9	13
05/18/09	1					1				1			**2**	5	17
05/19/09	1												**0**	7	14
05/20/09	1									2			**2**	7	9
05/21/09	1									2			**2**	7	18
05/22/09	1					1				1			**2**	4	14
05/23/09	1					1				1	1		**3**	6	15
05/24/09	1					3							**3**	8	17
05/25/09	1												**0**	6	24
05/26/09	1		1			1				1	1		**4**	6	26
05/27/09	1	1				1							**2**	7	20
05/28/09	1	3								1			**4**	8	15
05/29/09	1					1							**1**	6	16
05/30/09	1				2								**2**	7	16
05/31/09	1	1											**1**	10	14
06/01/09	1	1			1	1				1			**4**	7	16
06/02/09	1										1		**1**	6	15
By Species		**9**	**2**	**1**	**4**	**23**	**1**	**0**	**0**	**15**	**6**	**0**	**61**		
By Guild		**12**			**4**	**23**	**1**			**21**					
		BBSH			**HB**	**MYSP**	**RBTB**			**UNKN**			**Total**		

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

Stantec

Appendix B Table 8. Summary of acoustic bat data and weather during each survey night at the Kingsbury Ridge Tree detector – Spring 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)
04/15/09	1												**0**		
04/16/09	1												**0**		
04/17/09	1												**0**	6	3
04/18/09	1												**0**	5	3
04/19/09	1												**0**		-1
04/20/09	1												**0**	4	1
04/21/09	1					2				1			**3**	8	6
04/22/09	1												**0**	6	11
04/23/09	1												**0**	7	9
04/24/09	1												**0**	2	10
04/25/09	1					1							**1**	9	5
04/26/09	1												**0**	4	11
04/27/09	1												**0**	2	9
04/28/09	1												**0**	5	12
04/29/09	1									1			**1**	6	3
04/30/09	1					1				2			**3**	9	3
05/01/09	1												**0**	10	5
05/02/09	1					2							**2**	6	12
05/03/09	1												**0**	2	19
05/04/09	1												**0**	7	22
05/05/09	1												**0**	9	17
05/06/09	1												**0**	8	13
05/07/09	1									2			**2**	4	14
05/08/09	1												**0**	10	9
05/09/09	1												**0**	9	7
05/10/09	1												**0**	4	5
05/11/09	1					1				1			**2**	12	2
05/12/09	1									1			**1**	9	0
05/13/09	1					1				3			**4**	5	9
05/14/09	1												**0**	7	8
05/15/09	1												**0**	6	11
05/16/09	1												**0**	5	13
05/17/09	1					1				2			**3**	7	10
05/18/09	1									1			**1**	9	13
05/19/09	1									1			**1**	5	17
05/20/09	1												**0**	7	14
05/21/09	1												**0**	7	9
05/22/09	1					1							**1**	7	18
05/23/09	1					2				1			**3**	4	14
05/24/09	1												**0**	6	15
05/25/09	1									2			**2**	8	17
05/26/09	1												**0**	6	24
05/27/09	1					1							**1**	6	26
05/28/09	1												**0**	7	20
05/29/09	1									1			**1**	8	15
05/30/09	1												**0**	6	16
05/31/09	1												**0**	7	16
06/01/09	1												**0**	10	14
06/02/09	1												**0**	7	16
By Species		**0**	**0**	**0**	**0**	**13**	**0**	**0**	**0**	**19**	**0**	**0**	**32**		
By Guild		**0**			**0**	**13**	**0**			**19**					
		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 survey results

Appendix C Table 1a. Daily total observations of raptor species at Johnson Ridge, Bingham

Species	4/30/2010	5/5/2010	5/13/2010	5/18/2010	5/21/2010	Total
American kestrel					1	1
bald eagle					1	1
broad-winged hawk	1				1	2
Cooper's hawk			2			2
merlin			1			1
osprey						0
red-tailed hawk			3			3
sharp-shinned hawk	1					1
turkey vulture		8	7	7	3	25
unidentified raptor			1			1
Total	**2**	**8**	**14**	**7**	**6**	**37**

Appendix C Table 1b. Daily total observations of raptor species at Kingsbury Ridge, Bingham Wind Project, Spring 2010

Species	3/19/2010	3/25/2010	4/2/2010	4/15/2010	4/20/2010	4/30/2010	5/5/2010	5/13/2010	5/18/2010	5/21/2010	Total
American kestrel											0
bald eagle		4					1				5
broad-winged hawk							1				1
Cooper's hawk											0
merlin											0
osprey			1							1	2
red-tailed hawk			2				1	1			4
sharp-shinned hawk			1						1		2
turkey vulture							1		2	2	5
unidentified raptor											0
Total	**0**	**4**	**4**	**0**	**0**	**0**	**4**	**1**	**3**	**3**	**19**

Appendix C Table 2a. Hourly summary of raptor observations at Johnson Ridge, Bingham Wind Project, Spring 2010

Species	8:00-9:00	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				1					1
bald eagle			1						1
broad-winged hawk	1					1			2
Cooper's hawk			1		1				2
merlin					1				1
osprey									
red-tailed hawk					2		1		3
sharp-shinned hawk	1								1
turkey vulture			9	6	6	1	3		25
unidentified raptor				1					1
Total	**2**	**0**	**11**	**8**	**10**	**2**	**4**	**0**	**37**

Appendix C Table 2b. Hourly summary of raptor observations at Kingsbury Ridge, Bingham Wind Project, Spring 2010

Species	8:00-9:00	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									
bald eagle			2				2	1	5
broad-winged hawk							1		1
Cooper's hawk									
merlin									
osprey				1				1	2
red-tailed hawk			3					1	4
sharp-shinned hawk				1			1		2
turkey vulture			3				2		5
unidentified raptor									
Total	**0**	**0**	**8**	**2**	**0**	**0**	**6**	**3**	**19**

Appendix C Table 3. Total observations of raptor species at locations in the study area, Bingham Wind Project, Spring 2010

Species	Foss Mountain	Hills outside of Project	Johnson Ridge	Kingsbury Ridge	Valleys	Total
American kestrel					1	1
bald eagle		1	1	3	1	6
broad-winged hawk		1		1	1	3
Cooper's hawk		1			1	2
merlin		1				1
osprey			1	1		2
red-tailed hawk	1	3	1	2		7
sharp-shinned hawk		1		2		3
turkey vulture		3	17	4	6	30
unidentified raptor			1			1
Total	**1**	**11**	**21**	**13**	**10**	**56**

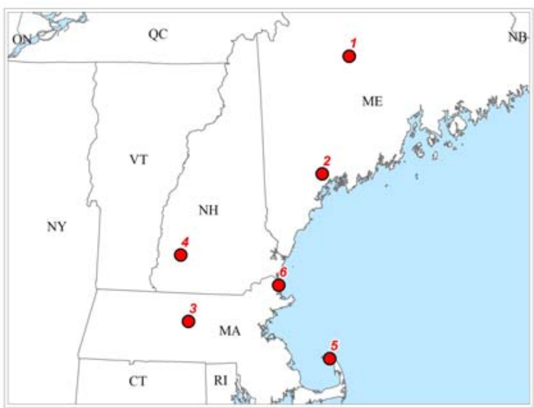
Appendix C Table 4a. Number of individuals of species observed within Project boundary in proposed turbine areas (flight positions A, B and C) above or below 152 m as seen from Johnson Ridge, Bingham Wind Project, Spring 2010

Species	152 m or above	below 152 m	Total
bald eagle	1		1
broad-winged hawk			0
osprey			0
red-tailed hawk		1	1
sharp-shinned hawk			0
turkey vulture		18	18
unidentified raptor		1	1
Total	**1**	**20**	**21**

Appendix C Table 4b. Number of individuals of species observed within Project boundary in proposed turbine areas (flight positions A, B and C) above or below 152 m as seen from Kingsbury Ridge, Bingham Wind Project, Spring 2010

Species	152 m or above	below 152 m	Total
bald eagle	1	2	3
broad-winged hawk		1	1
osprey		2	2
red-tailed hawk	2		2
sharp-shinned hawk		2	2
turkey vulture		3	3
unidentified raptor			0
Total	**3**	**10**	**13**

Site Number**	Location	Observation Hours	BV	TV	OS	BE	NH	SS	CH	NG	RS	BW	RT	RL	GE	AK	ML	PG	UA	UB	UF	UE	UR	MK	TOTAL	BIRDS/ HOUR
Appendix C Table 5. Summary of Regional Spring 2010 Migration Surveys*																										
1a	Johnson Ridge, Bingham Wind Project; ME	35	0	25	0	0	0	1	2	0	0	2	3	1	0	1	1	0	0	0	0	0	1	0	**37**	1.06
1b	Kingsbury Ridge, Bingham Wind Project; ME	70	0	5	2	5	0	2	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	**19**	0.27
2	Bradbury Mountain; Pownal, ME	432.75	1	354	500	52	106	724	97	7	67	1746	292	0	0	450	44	3	10	5	3	0	13	0	**4474**	10.34
3	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	0	**1573**	10.45
4	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	0	**117**	5.03
5	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	7	**2312**	8.26
6	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	0	**640**	5.27
* Data obtained from HMANA 2010.																										
** See map to right for site location.																										



Abbreviation Key:

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

Appendix D

Breeding bird survey results

Stantec

Appendix D Table 1. Total number of species and individuals detected and distances from observer at 25 point count locations during three survey periods - Spring 2010*

Common name	Scientific name	0-50 m	50-100 m	> 100 m	Flyover	Total
alder flycatcher	*Empidonax alnorum*	6	8	3		17
American crow	*Corvus brachyrhynchos*		1	3		4
American goldfinch	*Carduelis tristis*				6	6
American redstart	*Setophaga ruticilla*	14	8			22
American robin	*Turdus migratorius*	4	7	4		15
bay-breasted warbler	*Dendroica castanea*	3	3			6
black-and-white warbler	*Mniotilta varia*	9	5			14
blackburnian warbler	*Dendroica fusca*		1			1
black-capped chickadee	*Poecile atricapilla*	6	5			11
black-throated blue warbler	*Dendroica caerulescens*	17	22	1		40
black-throated green warbler	*Dendroica virens*	10	19	4		33
blue jay	*Cyanocitta cristata*	9	20			29
blue-headed vireo	*Vireo solitarius*	2	2	5		9
broad-winged hawk	*Buteo platypterus*				1	1
brown creeper	*Certhia americana*		1			1
Canada warbler	*Wilsonia canadensis*	3	4			7
cedar waxwing	*Bombycilla cedrorum*	3			6	9
chestnut-sided warbler	*Dendroica pensylvanica*	33	19	1		53
common yellowthroat	*Geothlypis trichas*	28	15	3		46
dark-eyed junco	*Junco hyemalis*	11	21	2		34
eastern wood-pewee	*Contopus virens*			1		1
golden-crowned kinglet	*Regulus satrapa*	10	2			12
great-crested flycatcher	*Myiarchus crinitus*			1		1
hairy woodpecker	*Picoides villosus*	1	1	1		3
hermit thrush	*Catharus guttatus*	2	30	17		49
least flycatcher	*Empidonax minimus*	2				2
magnolia warbler	*Dendroica magnolia*	18	12	1		31
mourning warbler	*Oporornis philadelphia*		1			1
Nashville warbler	*Vermivora ruficapilla*	28	24			52
northern flicker	*Colaptes auratus*		3			3
northern parula	*Parula americana*	3	1	1		5
northern waterthrush	*Seiurus noveboracensis*		2			2
ovenbird	*Seiurus aurocapillus*	11	38	13		62
pileated woodpecker	*Dryocopus pileatus*		1	1		2
purple finch	*Carpodacus purpureus*	1				1
red-eyed vireo	*Vireo olivaceus*	7	13	7		27
red-tailed hawk	*Buteo jamaicensis*				1	1
rose-breasted grosbeak	*Pheucticus ludovicianus*		1	2		3
ruby-crowned kinglet	*Regulus calendula*	2	3			5
ruffed grouse	*Bonasa umbellus*	2	2	1		5
song sparrow	*Melospiza melodia*		1			1
Swainson's thrush	*Catharus ustulatus*	1	2	2		5
unidentified warbler	*n/a*				1	1
white-breasted nuthatch	*Sitta carolinensis*	8	2			10
white-throated sparrow	*Zonotrichia albicollis*	35	32	22		89
winter wren	*Troglodytes troglodytes*	1	10	2		13
yellow warbler	*Dendroica petechia*	1				1
yellow-bellied flycatcher	*Empidonax flaviventris*	2	1			3
yellow-bellied sapsucker	*Sphyrapicus varius*	1	2	1		4
yellow-rumped warbler	*Dendroica coronata*	18	16			34
	Total	**312**	**361**	**99**	**15**	**787**

Appendix D Table 2. Total number of observations, relative abundance, and frequency of species at point count locations during three survey periods - Spring 2010

Common name	coniferous (3 points)			hardwood (6 points)		
	Total[a]	Relative abundance[b]	Frequency[c]	Total[a]	Relative abundance[b]	Frequency[c]
alder flycatcher	1	0.11	33%	2	0.11	33%
American crow	1	0.11	33%		0.00	0%
American redstart		0.00	0%	8	0.44	67%
American robin	1	0.11	33%	5	0.28	50%
bay-breasted warbler	1	0.11	33%		0.00	0%
black-and-white warbler		0.00	0%	6	0.33	67%
blackburnian warbler		0.00	0%		0.00	0%
black-capped chickadee	4	0.44	67%	4	0.22	33%
black-throated blue warbler		0.00	0%	19	1.06	83%
black-throated green warbler	4	0.44	67%	5	0.28	50%
blue-headed vireo	2	0.22	67%	8	0.44	83%
bluejay	1	0.11	33%		0.00	0%
brown creeper		0.00	0%	1	0.06	17%
Canada warbler		0.00	0%	2	0.11	17%
cedar waxwing		0.00	0%		0.00	0%
chestnut-sided warbler		0.00	0%	21	1.17	100%
common yellowthroat		0.00	0%	13	0.72	67%
dark-eyed junco	11	1.22	100%	1	0.06	17%
golden crowned kinglet	6	0.67	67%		0.00	0%
hairy woodpecker		0.00	0%		0.00	0%
hermit thrush	7	0.78	67%	6	0.33	83%
least flycatcher		0.00	0%		0.00	0%
magnolia warbler	2	0.22	33%	7	0.39	67%
mourning warbler		0.00	0%	1	0.06	17%
Nashville warbler	6	0.67	100%	4	0.22	50%
northern flicker		0.00	0%		0.00	0%
northern parula		0.00	0%	1	0.06	17%
northern waterthrush		0.00	0%		0.00	0%
ovenbird	4	0.44	100%	11	0.61	83%
pileated woodpecker		0.00	0%		0.00	0%
purple finch		0.00	0%	1	0.06	17%
red-eyed vireo		0.00	0%	6	0.33	83%
rose-breasted grosbeak		0.00	0%		0.00	0%
ruby-crowned kinglet	3	0.33	33%		0.00	0%
ruffed grouse		0.00	0%	1	0.06	17%
song sparrow		0.00	0%		0.00	0%
Swainson's thrush	1	0.11	33%		0.00	0%
white-breasted nuthatch	2	0.22	33%	2	0.11	33%
white-throated sparrow	2	0.22	33%	13	0.72	67%
winter wren		0.00	0%	2	0.11	17%
yellow warbler		0.00	0%	1	0.06	17%
yellow-bellied flycatcher	3	0.33	67%		0.00	0%
yellow-bellied sapsucker		0.00	0%		0.00	0%
yellow-rumped warbler	8	0.89	100%	7	0.39	67%
Total	**70**			**158**		
Relative abundance	**7.78**			**8.78**		
Species richness	**20**			**27**		
SDI	**2.72**			**2.92**		

a Total number of individuals detected (mainly singing males, also males and females that were visually observed).
b Mean number of birds observed.
c Percentage of survey points at which the species was observed.

Appendix D Table 3. Total number of observations, relative abundance, and frequency of species at point count locations during three survey periods - Spring 2010

Common name	coniferous-dominated mixed forest (3 points)			hardwood-dominated mixed forest (7 points)		
	Total[a]	Relative abundance[b]	Frequency[c]	Total[a]	Relative abundance[b]	Frequency[c]
alder flycatcher	7	0.78	67%	1	0.05	14%
American crow		0.00	0%		0.00	0%
American redstart	1	0.11	33%	8	0.38	71%
American robin	1	0.11	33%		0.00	0%
bay-breasted warbler		0.00	0%	3	0.14	43%
black-and-white warbler		0.00	0%	6	0.29	57%
blackburnian warbler	1	0.11	33%		0.00	0%
black-capped chickadee	1	0.11	33%	1	0.05	14%
black-throated blue warbler	1	0.11	33%	18	0.86	86%
black-throated green warbler	7	0.78	100%	7	0.33	71%
blue-headed vireo	4	0.44	100%	9	0.43	71%
bluejay		0.00	0%	1	0.05	14%
brown creeper		0.00	0%		0.00	0%
Canada warbler	2	0.22	33%	1	0.05	14%
cedar waxwing		0.00	0%		0.00	0%
chestnut-sided warbler	2	0.22	33%	16	0.76	100%
common yellowthroat	7	0.78	67%	9	0.43	57%
dark-eyed junco	8	0.89	100%	4	0.19	57%
golden crowned kinglet	3	0.33	67%	1	0.05	14%
hairy woodpecker		0.00	0%	1	0.05	14%
hermit thrush	4	0.44	100%	7	0.33	71%
least flycatcher		0.00	0%	2	0.10	29%
magnolia warbler	2	0.22	67%	11	0.52	86%
mourning warbler		0.00	0%		0.00	0%
Nashville warbler	12	1.33	100%	14	0.67	71%
northern flicker	1	0.11	33%	1	0.05	14%
northern parula	1	0.11	33%	2	0.10	29%
northern waterthrush		0.00	0%	2	0.10	14%
ovenbird	3	0.33	33%	19	0.90	100%
pileated woodpecker		0.00	0%	1	0.05	14%
purple finch		0.00	0%		0.00	0%
red-eyed vireo	1	0.11	33%	6	0.29	57%
rose-breasted grosbeak		0.00	0%	1	0.05	14%
ruby-crowned kinglet	2	0.22	33%		0.00	0%
ruffed grouse		0.00	0%	3	0.14	43%
song sparrow		0.00	0%		0.00	0%
Swainson's thrush		0.00	0%	2	0.10	14%
white-breasted nuthatch	2	0.22	67%	2	0.10	29%
white-throated sparrow	16	1.78	100%	14	0.67	100%
winter wren	2	0.22	67%	4	0.19	57%
yellow warbler		0.00	0%		0.00	0%
yellow-bellied flycatcher		0.00	0%		0.00	0%
yellow-bellied sapsucker		0.00	0%		0.00	0%
yellow-rumped warbler	7	0.78	67%	2	0.10	29%
Total	**98**			**179**		
Relative abundance	**10.89**			**8.52**		
Species richness	**25**			**32**		
SDI	**2.84**			**3.04**		

a Total number of individuals detected (mainly singing males, also males and females that were visually observed).
b Mean number of birds observed.
c Percentage of survey points at which the species was observed.

Appendix D Table 4. Total number of observations, relative abundance, and frequency of species at point count locations during three survey periods - Spring 2010			
Common name	**mixed forest (6 points)**		
	Total[a]	**Relative abundance[b]**	**Frequency[c]**
alder flycatcher	3	0.17	17%
American crow		0.00	0%
American redstart	5	0.28	67%
American robin	4	0.22	50%
bay-breasted warbler	2	0.11	17%
black-and-white warbler	2	0.11	33%
blackburnian warbler		0.00	0%
black-capped chickadee	1	0.06	17%
black-throated blue warbler	1	0.06	17%
black-throated green warbler	6	0.33	67%
blue-headed vireo	6	0.33	67%
bluejay	2	0.11	33%
brown creeper		0.00	0%
Canada warbler	2	0.11	17%
cedar waxwing	3	0.17	17%
chestnut-sided warbler	13	0.72	67%
common yellowthroat	14	0.78	83%
dark-eyed junco	8	0.44	50%
golden crowned kinglet	2	0.11	33%
hairy woodpecker	1	0.06	17%
hermit thrush	8	0.44	67%
least flycatcher		0.00	0%
magnolia warbler	8	0.44	67%
mourning warbler		0.00	0%
Nashville warbler	16	0.89	100%
northern flicker	1	0.06	17%
northern parula		0.00	0%
northern waterthrush		0.00	0%
ovenbird	12	0.67	83%
pileated woodpecker		0.00	0%
purple finch		0.00	0%
red-eyed vireo	7	0.39	67%
rose-breasted grosbeak		0.00	0%
ruby-crowned kinglet		0.00	0%
ruffed grouse		0.00	0%
song sparrow	1	0.06	17%
Swainson's thrush		0.00	0%
white-breasted nuthatch	2	0.11	33%
white-throated sparrow	22	1.22	100%
winter wren	3	0.17	17%
yellow warbler		0.00	0%
yellow-bellied flycatcher		0.00	0%
yellow-bellied sapsucker	3	0.17	33%
yellow-rumped warbler	10	0.56	83%
Total	**168**		
Relative abundance	**9.33**		
Species richness	**29**		
SDI	**3.01**		

a Total number of individuals detected (mainly singing males, also males and females that were visually observed).

b Mean number of birds observed.

c Percentage of survey points at which the species was observed.

Exhibit 7D-2: Fall 2010 Pre-Construction Avian and Bat Survey Report

Fall 2010
Avian and Bat Survey Report
for the Bingham Wind Project
In Bingham, Kingsbury, and Mayfield, Maine

Prepared for

Blue Sky West Wind, LLC
129 Middle Street,
3rd Floor
Portland, ME 04101

Prepared by

Stantec Consulting Services Inc.
30 Park Drive
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Stantec

Rev February 2012

Executive Summary

In advance of permitting activities for the proposed Bingham Wind Project (Project) in Somerset and Piscataquis Counties, Maine, Blue Sky West, LLC (Blue Sky) contracted Stantec Consulting Services Inc. (Stantec) to perform bird and bat surveys in the spring, summer and fall of 2010. The purpose of the field surveys was to evaluate bird and bat species presence and use of the Project area. Survey methods and work plans were developed based on past experience at other wind energy projects in Maine. The specific work described in this report was developed and discussed with the Maine Department of Inland Fisheries and Wildlife (MDIFW) and United States Fish and Wildlife (USFWS) staff at a meeting in Augusta, ME on March 5, 2010. Subsequently, a work plan was developed based on the discussions at the meeting and submitted to the agencies for review. The wildlife field surveys for the Project in 2010 included spring breeding bird surveys, spring aerial eagle nest surveys, spring and fall nocturnal radar surveys, spring, summer and fall 2010 bat acoustic surveys, and spring and fall raptor migration surveys. This report describes the methods and results for the fall 2010 radar, summer and fall bat acoustic, and fall raptor surveys. Methods and results of the spring 2010 surveys were described in a previous Spring 2010 report, and in the case of the eagle nest surveys, in a separate memo report.

The Project is in the early stages of planning; however the conceptual design for the Project during the current biological investigations included a broad area including a series of four ridgelines extending approximately 15 miles northeast through the organized town of Bingham, and the unorganized township of Mayfield and Kingsbury Plantation. The proposed turbines have an expected maximum height of 152 meters (m; 499 feet [']).

Nocturnal Radar Survey

Nocturnal radar surveys were conducted during 20 nights in fall 2010 (between September 7 and October 13) to characterize nocturnal migration activity in the Project area. These surveys were a continuation of the spring 2010 surveys, conducted on 20 nights from April 19 to May 26. Surveys were conducted using X-band marine 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 an unnamed ridge just south of Route 16 in the Town of Mayfield, centrally located within the Project area. The radar location provided nearly unobstructed views of the surrounding airspace within the radar's range in all directions.

The overall mean passage rate for the entire fall radar survey period was 803 ± 46 targets per kilometer per hour (t/km/hr). Nightly passage rates varied from 194 ± 31 on October 7 to 2,463 ± 279 t/km/hr on September 29. Mean flight direction through the Project area for the season was 234° ± 62°. The seasonal mean flight height of targets was 378 ± 1 m (1,239') above the radar site, and nightly flight heights ranged from 227 ± 2 m (745') on September 29 to 533 ± 3 m

(1,749') on October 2. The percent of targets observed flying below 152 m (499') was 20 percent for the entire season and varied by night, from 10 to 38 percent.

Bat Acoustic Survey

Fall 2010 bat acoustic surveys were a continuation of spring 2010 surveys. This report presents the results of the summer and fall 2010 surveys only, from June 3 through October 31. Eight acoustic detectors were deployed at five ridge top locations across the Project area. Three survey locations utilized meteorological (met) towers to elevate detectors at or above tree canopy height. Two additional locations did not have met towers and detectors were deployed at or below tree height at these sites. At the recommendation of MDIFW, the majority of detectors were deployed at or below tree canopy height. In order to document activity of long-distance migratory tree roosting species, the bats documented as most susceptible to collision with wind turbines, two detectors were deployed up high in two of the met towers to provide activity information above tree canopy height and near the height of the lower end of the proposed turbine rotor zone.

A total of 2,755 call sequences were recorded between June 3 and October 31, 2010 from all detectors combined. Activity increased with decreasing detector height. Detectors deployed above tree canopy in met towers (n=2) had a combined detection rate of .36 call files recorded per detector-night (files/detector-night); detectors deployed at tree canopy height in met towers (n=3) had a combined detection rate of .66 files/detector-night; detectors deployed at or below tree canopy height (n=3) had a combined detection rate of 5.3 files/detector-night. Activity also increased over time during the survey period. The maximum activity recorded in a single night by all detectors occurred on July 27 (188 total calls for all detectors combined).

Of those calls that could be identified to species or guild, the Myotis guild (MYSP) contained the highest number of call sequences (n = 1,494) identified to a taxonomic level. Seven of the eight detectors recorded calls from all five guilds (MYSP, Unknown, eastern red bat/tri-colored bat (RBTB), big brown bat, silver-haired bat and hoary bat). No calls from the red bat/tri-colored bat (RBTB) guild were recorded at the Bessey Met high or Met low detectors.

Diurnal Raptor Survey

Fall 2010 diurnal raptor migration surveys were conducted on 12 days from September 2 (Sept 2) through October 13. These surveys were a continuation of similar surveys conducted over 10 days between March 19 and May 21 in the spring of 2010. Five of those survey days were conducted at the two observation locations simultaneously, for a total of 17 observation days (5 days at Johnson Ridge and 12 days at Kingsbury Ridge). A total of 119 hours were surveyed (84 hours at Kingsbury Ridge and 35 hours at Johnson Ridge).

Over the course of the survey period, 57 observations of raptors were made from Kingsbury Ridge and 61 observations from Johnson Ridge. None of these observations were thought to be simultaneous observations between the observers at Kingsbury and Johnson Ridges. The seasonal passage rate for Kingsbury Ridge was 0.68 raptor observations per hour (raptors/hr); the seasonal passage rate for Johnson Ridge was 1.74 raptors/hr. Based on flight direction and behavior, the majority of birds observed at Johnson Ridge were suspected to be seasonally local birds while the majority of birds observed at Kingsbury Ridge were believed to be migrants. Most birds observed at Johnson Ridge were turkey vultures (*Cathartes aura*) and they were suspected to be seasonally local birds.

At Johnson Ridge, 34 percent (n=12) of the total raptor observations occurred within the Project area while at Kingsbury Ridge, 23 percent (n=13) occurred within the Project area (Figures 4-6a and 4-6b, Appendix C Tables 3a and 3b). All other observations occurred over nearby topographical features such as hills, peaks, or valleys outside of the Project area.

At Johnson Ridge, 12 observations (34%) occurred within the Project area in topographical positions where the turbines are to be sited. These birds occurred at flight heights below the proposed maximum rotor height of 152 m. At Kingsbury Ridge, 13 observations (15%) occurred within the Project area in positions where the turbines are to be sited. Of these birds, 11 birds (85% of the 13 in the Project area) occurred at flight heights below the proposed maximum rotor height.

The most commonly observed species at Kingsbury Ridge was sharp-shinned hawk (*Accipiter striatus*) and turkey vulture was the most commonly observed species at Johnson Ridge. No raptor species listed by the Endangered Species Act of 1973 (7 U.S.C. § 136, 16 U.S.C. § 1531 et seq.) as Threatened or Endangered were observed during the Fall 2010 survey period. Six observations of bald eagle (*Haliaeetus leucocephalus)*, a state-listed species of special concern, were made in the Study area. Two adult bald eagle observations occurred within the Project area and were observed below 152 meters for a period of their observed flight. Additionally three Northern Harrier (*Circus cyaneus),* a state listed species of special concern, were observed outside the Project area.

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Appendices

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Appendix B Bat Survey Data Tables
Appendix C Raptor Survey Data Tables

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* *This report was prepared by Stantec Consulting Services Inc. for the Bingham Wind Project for Blue Sky West, 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

In advance of permitting activities for the proposed Bingham Wind Project (Project) in Somerset and Piscataquis Counties, Maine, Blue Sky West, LLC (Blue Sky) contracted Stantec Consulting Services Inc. (Stantec) to perform bird and bat surveys in the spring, summer and fall of 2010. The purpose of the field surveys was to evaluate bird and bat species presence and use of the Project area. Survey methods and work plans were developed based on past experience at other wind energy projects in Maine. The specific work described in this report was developed and discussed with the Maine Department of Inland Fisheries and Wildlife (MDIFW) and United States Fish and Wildlife (USFWS) staff at a meeting in Augusta, ME on March 5, 2010. Subsequently, a work plan was developed based on the discussions at the meeting and submitted to the agencies for review. The wildlife field surveys for the Project in 2010 included spring breeding bird surveys, spring aerial eagle nest surveys, spring and fall nocturnal radar surveys, spring, summer and fall 2010 bat acoustic surveys, and spring and fall raptor migration surveys. This report describes the methods and results for the fall 2010 radar, summer and fall bat acoustic, and fall raptor surveys. Methods and results of the spring 2010 surveys were described in a previous Spring 2010 report, and in the case of the eagle nest surveys, in a separate memo report.

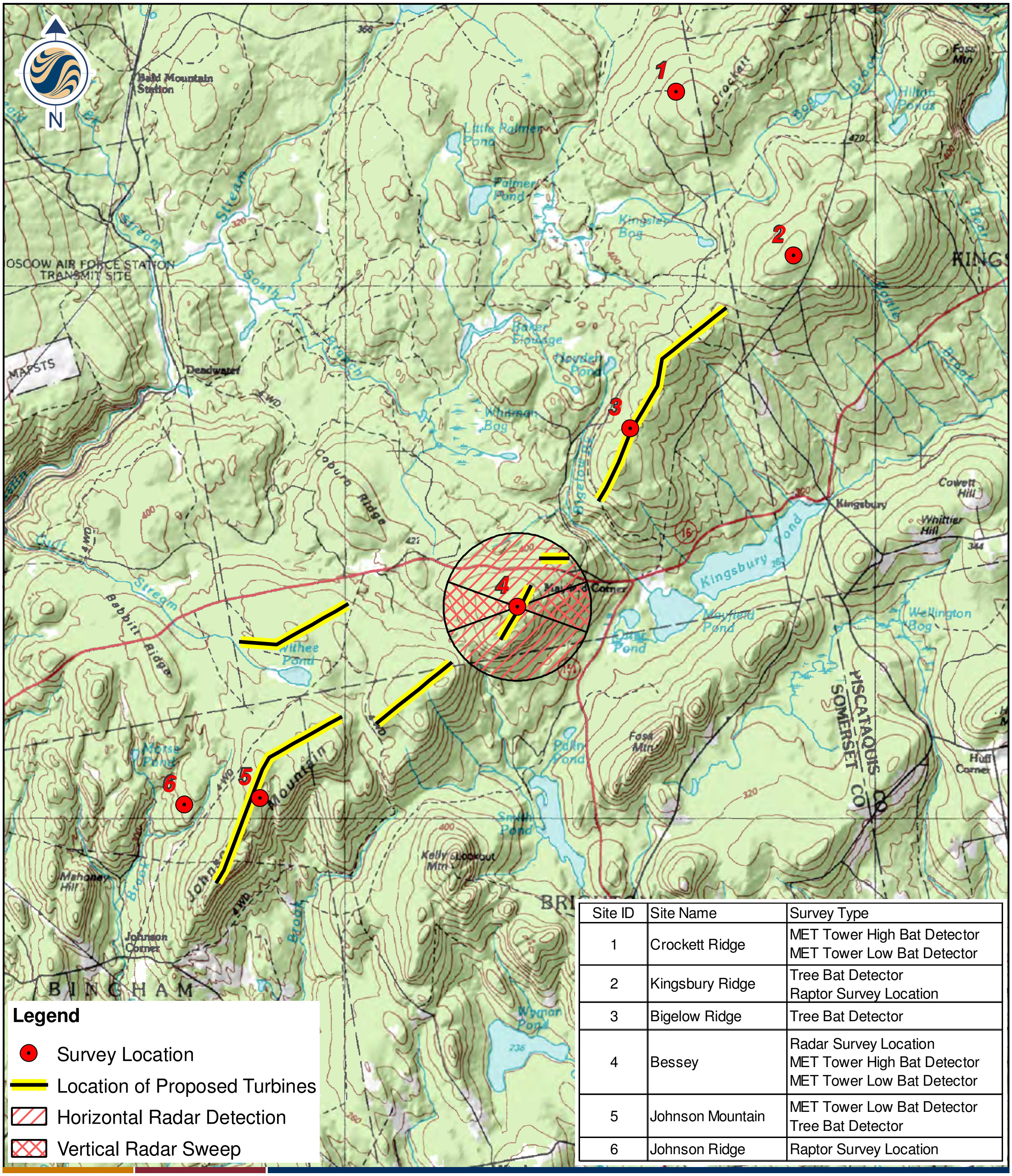
The Project is in the early stages of planning; however the conceptual design for the Project during the current biological investigations included a broad area including a series of four ridgelines extending approximately 15 miles northeast through the organized town of Bingham, and the unorganized township of Mayfield and Kingsbury Plantation. The proposed turbines have an expected maximum height of 152 meters (m; 499 feet [’]).

1.2 PROJECT AREA DESCRIPTION

The Project area is located within the Central and Western Mountains Ecoregion as defined in *Maine’s Comprehensive Wildlife Conservation Strategy* (MDIFW 2005). This ecoregion is a consolidation of the Western Mountains and Central Mountains biophysical regions originally described by McMahon (1990). The Central and Western Mountains Ecoregion extends from the New Hampshire border south to the White Mountains National Forest, north to Aroostook County and east to the western foothills. The average elevation within the western portion of the ecoregion (former Western Mountain Biophysical Region) is between approximately 305 m to 610 m (1,000' to 2,000') with several peaks exceeding 823 m (2,700'). The northern portion of this ecoregion includes some of the highest peaks in Maine and has elevations that range from 183 m to 1,603 m (600' to 5,258'). The climate of this ecoregion is characterized by relatively low annual precipitation and cool temperatures. Heavy snowfall prolongs the winter resulting in a relatively short growing season (McMahon 1990). In general, ridge tops within this ecoregion are dominated by red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*) with lower elevations supporting deciduous species such as sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*) and American beech (*Fagus grandifolia*).

The Project area is located on a series of ridgelines that do not exceed 494 m (1,620') in elevation. These include Johnson and Kingsbury Ridges. Kingsbury Mountain's elevation reaches approximately 268 m (879') and Johnson Mountain's elevation reaches roughly 241 m (792').

Historically and presently, the land within and surrounding the Project area, including the summits of the ridgelines, has been used for commercial timber management. This is evident by the recent and past cuts as well as the presence of the network of haul roads that extend through the Project area. Due to timber harvesting activities much of the forest stands within the Project area are in various stages of regeneration. Additionally, softwood plantations are present along some of the ridgelines.



Legend

- Survey Location
- Location of Proposed Turbines
- Horizontal Radar Detection
- Vertical Radar Sweep

Site ID	Site Name	Survey Type
1	Crockett Ridge	MET Tower High Bat Detector MET Tower Low Bat Detector
2	Kingsbury Ridge	Tree Bat Detector Raptor Survey Location
3	Bigelow Ridge	Tree Bat Detector
4	Bessey	Radar Survey Location MET Tower High Bat Detector MET Tower Low Bat Detector
5	Johnson Mountain	MET Tower Low Bat Detector Tree Bat Detector
6	Johnson Ridge	Raptor Survey Location

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Miles

Client/Project
Bingham Wind Project
Bingham, Maine

Figure No.
1-1

Title
Fall 2010 Raptor, Radar and Bat Acoustic Survey Locations

11/22/2010

2.0 Nocturnal Radar Survey

2.1 INTRODUCTION

Nocturnal radar surveys were conducted in the Project area to characterize nocturnal migration patterns in fall 2010. These surveys were a continuation of the spring 2010 surveys, conducted on 20 nights from April 19 to May 26. The goal of the surveys was to document nocturnal migration in the Project area, including the number of migrants, nightly and seasonal passage rates, the flight direction of migrants, and flight altitude of migrants.

2.2 DATA COLLECTION METHODS

The radar site was located within the met tower clearing just south of Route 16 in Mayfield. This location was selected due to its central location within the Project area. The site's topography and surrounding tree height allowed for relatively unobstructed views of the airspace surrounding the radar. Radar surveys were conducted during 20 nights between September 7 and October 13, 2010.

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. Insects can be identified and removed from the migration calculations based on flight speed; however, it cannot readily distinguish between different types of animals being detected. Consequently, all animals observed on the radar screen (not including insects) were identified as "targets." The radar has an "echo trail" function which captures past echoes of flight trails, enabling determination of flight speed and 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 7.3 m (24') above ground. The antenna has a vertical beam width of 20° (10° above and below horizontal).

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).

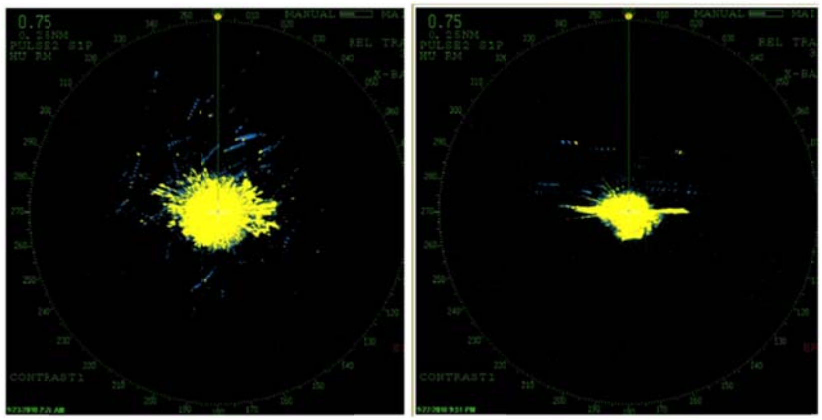


Figure 2-1. Screenshots from actual radar video files for the Bingham Wind Project showing ground clutter in horizontal mode (left) and vertical mode (right). Although the radar records three-dimensional space, it is translated by the radar screen into a two dimensional representation. For this reason ground clutter if not minimized with proper site configuration can cause targets to be obscured from view.

Vegetation and hilltops near the radar can be used to reduce or eliminate ground clutter by "hiding" clutter-causing objects from the radar (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. 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.

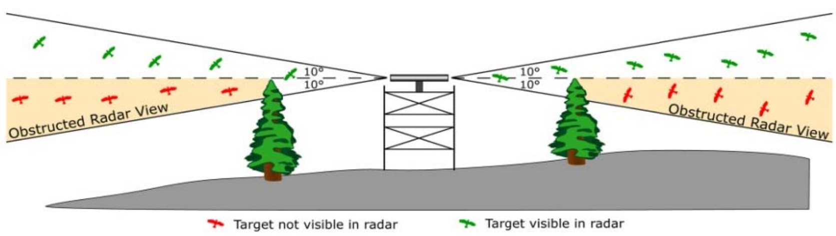


Figure 2-2. The effect of ground clutter on target detection in vertical mode is shown

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. 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 2-3). By analyzing the echo trail, the flight direction and flight speed of targets can be determined.

In vertical mode, the radar unit is tilted 90° to vertically survey the airspace above the radar (Harmata *et al.* 1999). In vertical mode, target echoes do not provide directional data, but do provide information on the altitude of targets passing through the vertical, 20° radar beam (Figure 2-3). Both modes of operation were used during each hour of sampling.

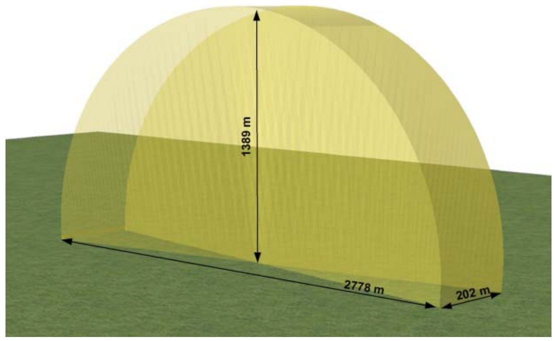


Figure 2-3. Detection range of the radar in vertical mode

The radar was operated at a range of 1.4 km (0.75 nautical miles [4,500']) to ensure detection of small targets. When radar is operated at greater ranges, 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.

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 each hour. A stratified random sample set was developed by randomly selecting six horizontal samples and six 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.

2.2.1 Weather Data

Temperature, wind speed and direction were recorded by the on-site met tower on Bessey Ridge. 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 period.

2.2.2 NEXRAD Radar Data

NEXRAD weather radar images from the National Weather Service station in Portland, Maine (selected for its proximity to the Project area and ability to provide adequate radar coverage) were examined on the dates surrounding the typical fall migration period in Maine (August 15 to October 15). NEXRAD radar provides a different type of data than the marine surveillance radar used on-site. This long-range Doppler radar produces reflectivity data on objects (and precipitation) in the sky, as well as the velocity of those objects. Because it covers such a large area, it does not track individual birds, but can be used to interpret large-scale bird migration patterns and the level of migration activity (Gauthreaux and Belser 1998).

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 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 152 m (499'), 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. 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.

2.3.3 NEXRAD Radar Data

Nightly samples of reflectivity and velocity images were obtained from the National Oceanic and Atmospheric Administration (NOAA 2007) and visually assessed to determine the overall intensity of nightly migration. Each night was qualitatively categorized as: 1) no migration (very low activity or rainy nights); 2) light migration; or 3) heavy migration. These determinations were made based on the color-coded strength of the radar reflectance data, velocity and direction, and winds aloft data. The images selected for this assessment were generally timed to be from two to four hours after sunset.

NEXRAD images were analyzed and the nights of on-site surveys in the Project area were compared with those same nights of NEXRAD data to confirm that on-site sampling took place during periods of light to heavy migration. NEXRAD data was also summarized to identify the proportion of nights with light to heavy migration activity within the entire migration season that were sampled with the on-site radar.

2.4 RESULTS

Radar surveys were conducted during 20 nights between September 7 and October 13, 2010 (Appendix A Table 1) resulting in 232 total hours surveyed. The radar was centrally located within the Project area and provided nearly unobstructed views of the airspace within the range of the radar in all directions.

2.4.1 Passage Rates

The overall passage rate for the entire survey period was 803 ± 46 targets per kilometer per hour (t/km/hr). Nightly passage rates varied from 194 ± 31 t/km/hr on October 7 to 2,463 ± 279 t/km/h on September 29 (Figure 2-4, Appendix A Table 1). Individual hourly passage rates varied between and within nights and throughout the season, and ranged from 7 t/km/hr on the 12th hour of September 15 to 3,732 t/km/hr on the 7th hour of September 29 (Appendix A Table 2). For the entire season, passage rates were typically highest during the third and fifth hour after sunset, and then steadily declined until sunrise (Figure 2-5).

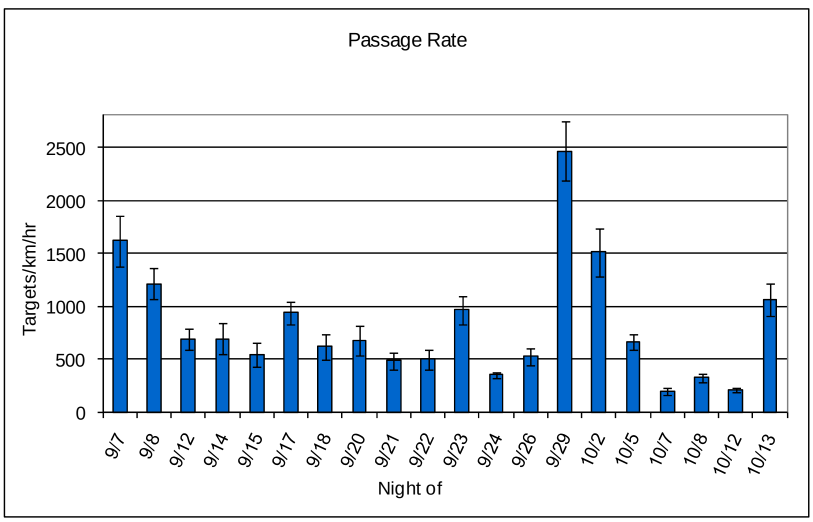


Figure 2-4. Nightly passage rates observed (error bars ± 1 SE) during Fall 2010 at the Bingham Wind Project.

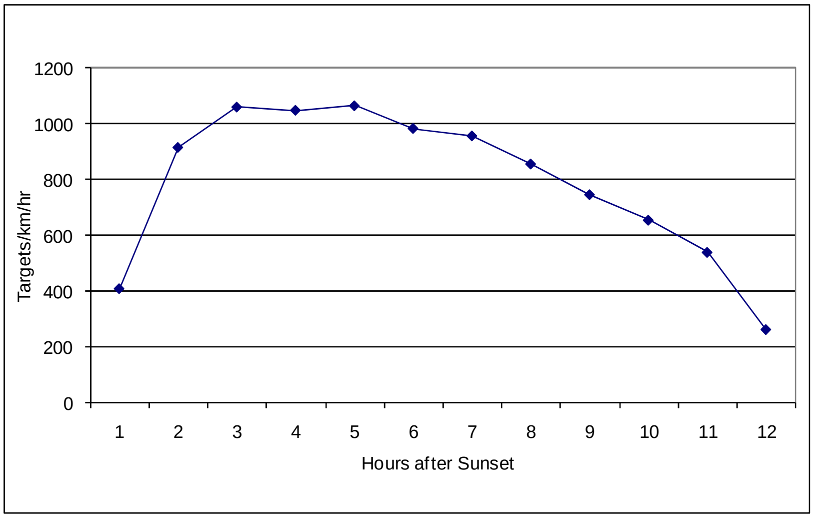


Figure 2-5. Hourly passage rates for entire season during Fall 2010 at the Bingham Wind Project

2.4.2 Flight Direction

Mean flight direction through the Project area was 234° ± 62° (Figure 2-6). Overall, the mean flight direction was to the southwest, but varied between nights (Appendix A Table 3).

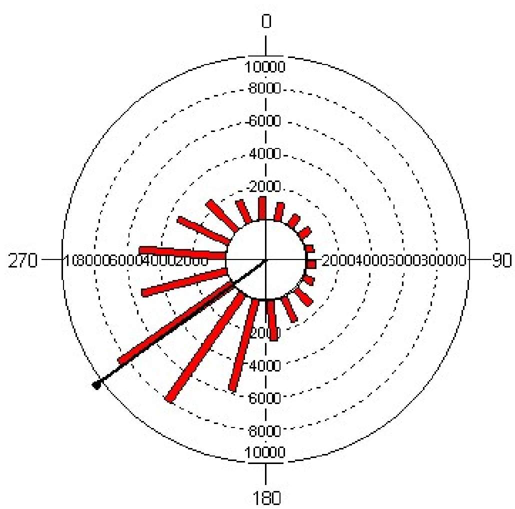


Figure 2-6. Mean flight direction for the entire season during Fall 2010 at the Bingham Wind Project (The bracket along the margin of the histogram is the 95% confidence interval.)

2.4.3 Flight Altitude

The seasonal average mean flight height of all targets was 378 ± 1 m (1239') above the radar site. The average nightly flight height ranged from 227 ± 2 m (745') on September 29 to 533 ± 3 m (1,749') on October (Figure 2-7, Appendix A Table 4). The percent of targets observed flying below 152 m was 20 percent for the season and varied nightly from 10 percent on September 17 to 38 percent on September 23 (Figure 2-8).

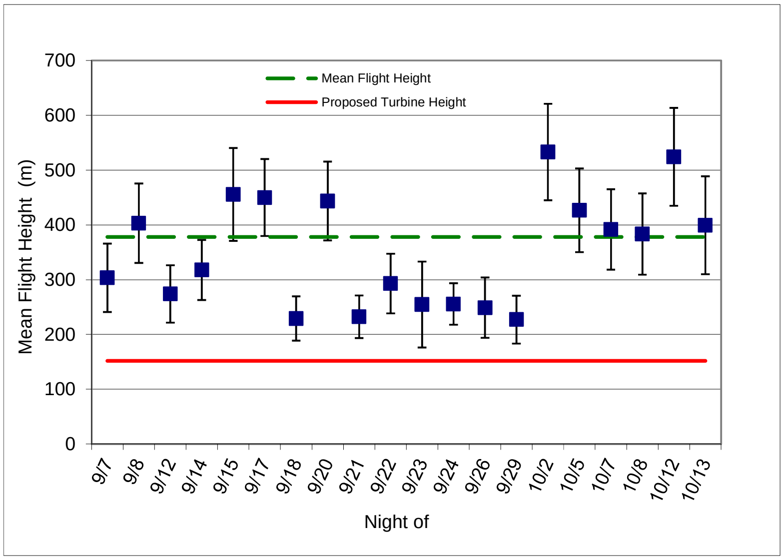


Figure 2-7. Mean nightly flight height of targets during Fall 2010 at the Bingham Wind Project (error bars ± 1 SE)

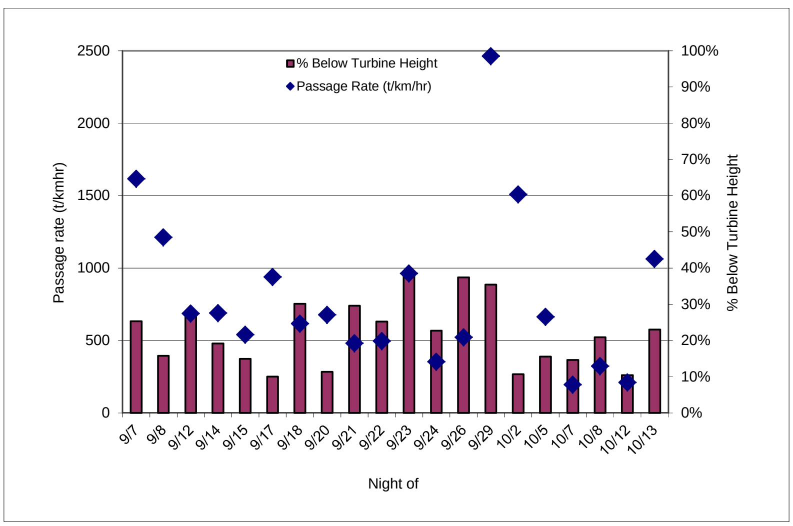


Figure 2-8. Percent of targets observed flying below a height of 152 m (499') during Fall 2010 at the Bingham Wind Project

Figure 2-9 below displays the range in nightly flight heights to graphically show the distribution of individual flight heights of all targets recorded each survey night relative to the proposed turbine height. The "blocks" seen on Figure 2-9 depict the middle 50 percent of targets. The error bars depict the statistical outliers, or 25 percent of targets above and below the middle 50 percent of targets. The horizontal line within each box represents the median flight height value for that night.

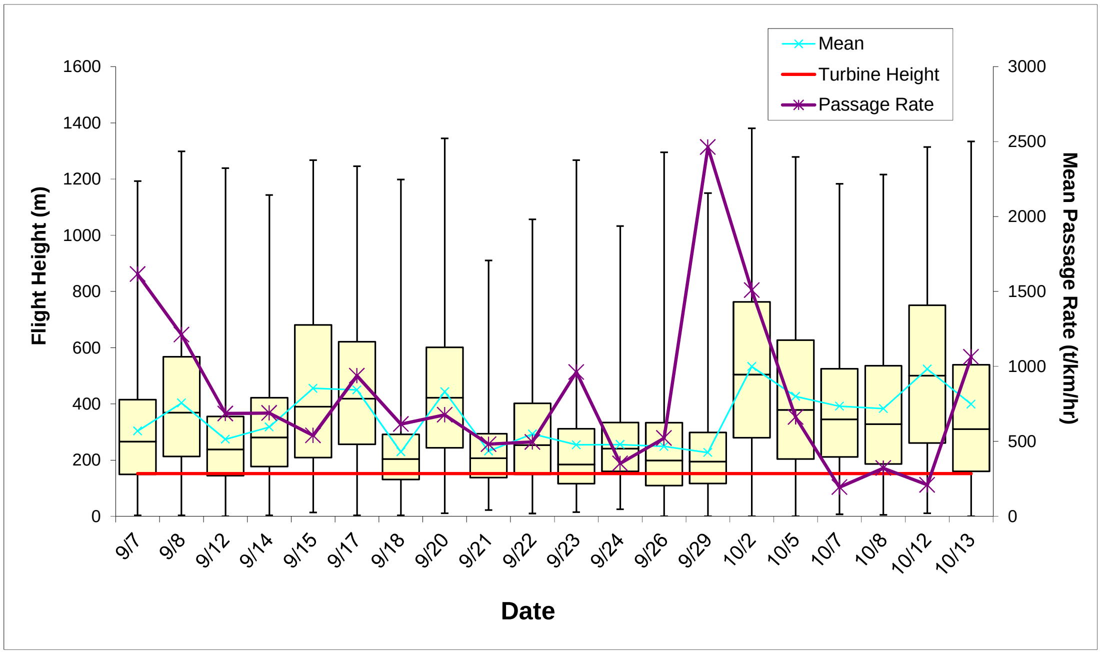


Figure 2-9. Flight height Whisker plot depicting the vertical distribution of targets for each survey night during Fall 2010 at the Bingham Wind Project

For the entire season, the mean hourly flight heights were typically highest during the fifth to sixth hour after sunset, with a second smaller spike in the ninth hour (Figure 2-10).

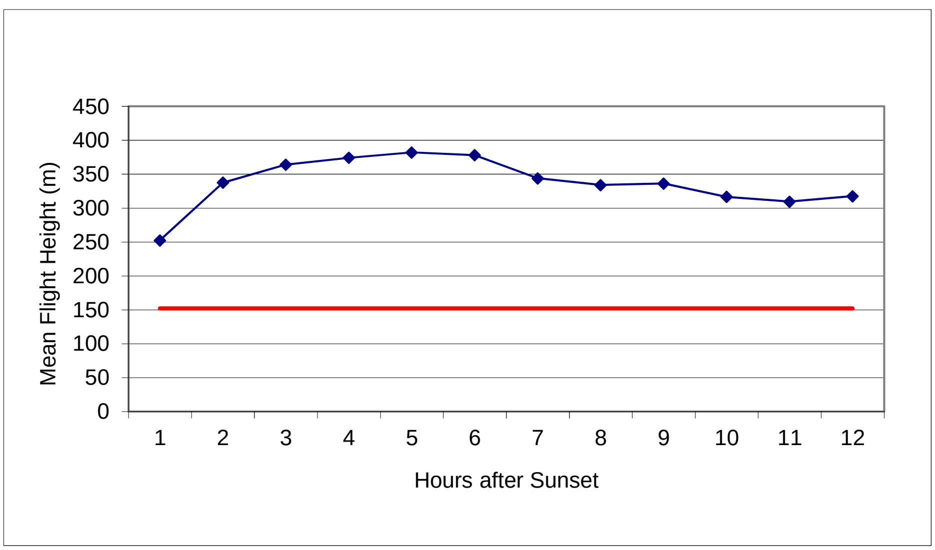


Figure 2-10. Hourly target flight height distribution during Fall 2010 at the Bingham Wind Project

2.4.4 Weather Data

During the radar survey period, mean nightly wind speeds in the Project area varied between 3.5 meters per second (m/s) on October 2 and 9.4 m/s on October 12, with an overall mean of 6.2 m/s. Mean nightly temperatures varied between 2.8 °C on October 13 and 15.7 °C on

September 7, with an overall mean of 9.2°C. The majority of nights sampled with the onsite radar (n=11) occurred when winds were from a northerly direction.

Analysis of regional surface weather maps reveals that fall 2010 surveys were conducted during periods of high atmospheric pressure and favorable conditions for migration.

High pressure weather systems passed through the region on the nights of September 13, 15, 20, 23, 26, 28 and 29. Light to very-light precipitation occurred on most days between September 8 and October 1; precipitation was considered heavy only on September 28, 30 and October 1.

2.4.5 NEXRAD Radar Data

A total of 62 nights of NEXRAD weather data were analyzed from August 15 to October 15, 2010, dates encompassing the fall migration period. Of those 62 nights, detectable migration activity occurred on only 38 nights; one night characterized as heavy migration, 19 nights as medium, and 18 nights as low. A total of 24 nights did not have migration data available due to precipitation. In general, the NEXRAD data confirmed that the nights of on-site radar sampling occurred on nights with light to moderate migration (n = 14). Of the 19 medium migration nights captured with the NEXRAD radar, eight were surveyed with the on-site radar.

Table 2-1. Summary of NEXRAD and on-site radar data collection

	High	Medium	Low	N/A	Total
Radar Survey Nights	0	8	6	6	20
Radar Survey Period	1	11	11	14	37
Fall Migration Period	1	19	18	24	62

2.5 DISCUSSION

Fall radar surveys in the Project area documented similar nocturnal migration patterns to those observed during other recent radar surveys conducted in the eastern US (Appendix A Table 5). These include highly variable passage rates between nights, a generally southward flight direction, and flight heights primarily occurring between 200 and 500 m above the ridgeline.

The increasing number of publicly available studies characterizing nocturnal migration movements shows a relatively consistent pattern in flight altitude, with most targets appearing to fly at altitudes of several hundred meters or more above the ground (Appendix A Table 5). Average flight heights at the Project peaked during the fifth and sixth hours after sunset, at an hourly average of 382 m (1253’) and 378 m (1240’) for the survey period, respectively; flight heights then declined until sunrise (Appendix A Table 4).

The radar location was centrally located within the Project area. The radar site had excellent visibility and was capable of detecting targets within nearly all of its detection range. The average passage rate at the Project (803 ± 46 t/km/hr) is higher than passage rates recorded at other radar studies conducted in the northeastern US. Average passage rates recorded in radar studies at these projects range from 64 to 732 t/km/hr (Appendix A Table 5). If the night with the highest passage rate, September 29, is removed from the data set, then passage rate drops to 713 t/km/hr. Comparison of passage rates among radar surveys at the Project and similar surveys conducted at other sites must be done with caution, as differences in passage rates are due in large part to differences in radar view among sites, and not necessarily only the amount of migration above a radar site. 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 radar view at Bingham was nearly unobstructed and ground clutter was limited to the center of the radar screen (Figure 2-1). It is also important to note that quantitative estimates of migration activity levels over an area do not translate to the level of collision fatalities post-construction based on post-construction studies in Maine.

Nightly variation in the magnitude and flight characteristics of nocturnal migrants is not uncommon and is often attributed to weather patterns, such as cold fronts and winds aloft (Hassler *et al.* 1963, Gauthreaux and Able 1970, Richardson 1972, Able 1973, Bingman *et al.* 1982, Gauthreaux 1991). During fall surveys, the highest passage rate occurred on nights with southerly winds (mainly from the southwest) of moderate speeds and moderate temperatures (Appendix A Table 1). This is generally not consistent with when you would expect high passage rates to occur during the fall migration period because migrants are travelling southwest and headwinds are not generally favorable for migration. However, flight directions on these nights were also to the southwest which is typical of heavy migration nights during the fall migration period. On the night with the highest passage rate in fall (September 29 = 2,463 t/km/hr), winds were from the southeast, and a high pressure system passed through the region on the nights before and after this event (September 28 and 29). September 29 was the only day without rain between September 27 and October 1, 2010. One possible reason for higher passage rates may be explained with the NEXRAD data collected during the 62 night migration period. The NEXRAD data collected during the fall migration period documented many rain events with approximately 39 percent of the entire 62 night migration period with no NEXRAD data available due to precipitation. This coupled with the fact that many of the higher migration nights occurred on nights with moderate headwinds suggests that the migration period may have been shortened due to inclement weather forcing migrants to travel during less favorable weather conditions for migration. This seasonal phenomenon may have resulted in fewer nights with relatively high passage rates, but higher passage rates than occur typically on those nights that were without precipitation.

The average flight height 378 ± 1 m falls within the range of average flight heights recorded at other radar studies conducted in the eastern US (233 m to 644 m), as does the percent below turbine height (20%) for all targets (percent below turbine height at projects in the eastern US range from 4% to 23%). No nights experienced average flight heights below 152 m, the maximum height of the proposed turbines. Additionally, all targets within the 50th percentile for each night were above the proposed turbine height (Figure 2-9).

In summary, results at the Project characterize a sample of migration activity over the Project during fall 2010 that can serve as baseline, quantitative information useful for assessing relative Project impact.

3.0 Acoustic Bat Survey

3.1 INTRODUCTION

Bats use high frequency echolocation to maneuver through the landscape during migration or in search of food and water. Although the echolocation sounds produced by bats are above the human range of hearing, electronic equipment can be used to record these high frequency sounds. Acoustic sampling of bat activity has become a standard element of pre-construction surveys for proposed wind-energy developments. Acoustic sampling allows for simultaneous data collection at varying heights above ground level and across long time periods (Kunz *et al.* 2007); as a result, these surveys can provide insight into altitudinal and seasonal patterns of bat activity. While this type of data collection cannot determine the number of individuals found in the area, and is associated with several major assumptions (Hayes 2000), it can be used to examine activity trends for certain species or species groups, and may be useful in predicting potential post-construction mortality patterns.

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*) (BCI 2001). Of these, all but the big brown bat is listed as a species of special concern in the state.

The objective of acoustic surveys at Bingham were (1) to document bat activity patterns from June to October in airspace within 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. Information in this report expands on work conducted during the spring migratory period in 2010, and covers the 2010 summer resident and fallmigratory period from the early June through the end of October.

3.2 METHODS

3.2.1 Data Collection

Anabat SDI detectors (Titley Electronics Pty Ltd.) were selected for data collection 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 which could occur in the Project area. Anabat detectors are frequency division detectors, dividing the frequency of echolocation sounds made by bats by a factor of 16, and then recording these sounds onto removable compact flash cards for subsequent analysis.

Detectors were programmed to begin monitoring at 19:00 hours each night and end monitoring at 08:00 hours each morning, and were visited approximately every two weeks to check the condition of the detectors and to download recorded data. 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 curved plastic joint was used to funnel sound into the downward-facing microphone, allowing the microphone to record the airspace horizontally surrounding the detector.

3.2.2 Site Selection

Acoustic survey sites at Bingham were chosen based on professional opinion of how bats might move across the Project area as well as recommendations received from MDIFW during the meeting on March 5, 2010, which were incorporated in the work plan for the Project. Currently, pre-construction acoustic methods emphasize monitoring a vertical array of airspace to document species flying at all altitudes (Arnett *et al.* 2006, Kunz *et al*. 2007, Reynolds 2006). Fatalities occur when individuals collide with turbines (Horn *et al.* 2008) or come in close proximity to spinning blades, which can result in rapid decompression that leads to death as a result of barotrauma (Baerwald *et al*. 2008). Detectors placed at or near rotor-swept height assess flight activity at heights relevant to assessing risk of fatality. Also, detectors deployed above canopy height more readily survey long-distance migrants. These species generally fly and forage at high altitudes, and long-distance migrant species experience the highest turbine collision rates (Arnett *et al.* 2008). At or below tree canopy level detectors are deployed because (1) resident bat species generally forage close to, or below, the tree canopy; (2) activity is often greater at ground level, so these detectors assist with species presence and activity patterns; and (3) bats present at ground level could potentially become attracted to the height of rotating blades (Cryan and Barclay 2009, Kunz *et al.* 2007). Detectors deployed at intermediate heights are used to fill in the vertical array to get a more complete picture of species composition and airspace use within the Project area and surrounding ridgelines.

Eight acoustic detectors were deployed at five ridge top locations across the Study area (Figure 1-1). Three survey locations utilized meteorological (met) towers to elevate detectors above tree canopy height. Two additional locations did not have met towers, and therefore detectors were deployed in trees at or below tree canopy height at these sites.

Two acoustic bat detectors were placed in the Bessey Met Tower (Figure 3-1). The high detector was raised to an approximate height of 40 m and the low detector was raised to approximately 20 m. The met tower clearing is located approximately a half mile south of Route 16 in Mayfield. The elevation at the tower is 474 m (1,555'). The forest composition surrounding the met clearing is made up of sapling to pole size mixed hardwoods with scattered log sized spruce.

Figure 3-1 Bessey Met Detectors (High and Low).

One acoustic bat detector was placed in a spruce tree at an approximate height of five m on Bigelow Ridge (Figure 3-2). This location is on the south end of the ridgeline which runs parallel to Old Hayden Pond Road and Bigelow Brook. The elevation at the site is 466 m (1,529'). The tree detector was placed in a small opening at the end of an old skid trail. The forest surrounding the area is spruce plantation with an approximate tree height of three to five m.

Figure 3-2 Bigelow Ridge Tree Detector.

Two acoustic bat detectors were placed in the met tower located on the ridgeline just south of Crockett Ridge (Figure 3-3). The elevation at the tower is 459 m (1,504'). The high detector was raised to an approximate height of 40 m and the low detector was raised to an approximate height of 20 m. The met tower clearing is about 300 m in diameter and is surrounded by dense regenerating spruce-fir as well as sapling to mature sized hardwoods. The tree height in the area varies from approximately five m to 15 m.

Figure 3-3 Crockett Ridge Met Detectors (High and Low).

One acoustic bat detector was placed in a spruce tree on the northern edge of the met tower clearing on Johnson Ridge (Figure 3-4). The elevation at the tower is elevation 439 m (1,440’). The detector was deployed at an approximate height of five m. This tree is located adjacent to a small forested wetland and regenerating spruce-fir growth at the edge of the met clearing. The surrounding forest is mixed with sapling to mature hardwoods as well as seedling to mature softwood scattered with dead snags and areas of dense regeneration.

Figure 3-4 Johnson Met Tree Detector.

One acoustic bat detector was placed in the met tower on Johnson Ridge (Figure 3-5). It was raised to an approximate height of 20 m. The elevation at the tower is elevation 439 m (1,440’). The met tower clearing is surrounded by regenerating softwood and shrubs.

Figure 3-5 Johnson Met Low Detector.

One acoustic bat detector was placed in a dead birch tree on Kingsbury Ridge, located approximately a quarter mile west of Old Mountain Road (Figure 3-6). The elevation at this site is 540 m (1,772'). The detector was raised to an approximate height of two and one-half m. This tree is located in the middle of an old clear cut where most of the surrounding tree growth is regenerating mixed hardwoods, as well as sapling to pole size spruce and fir.

Figure 3-6 Kingsbury Ridge Tree Detector.

3.2.3 Data Analysis

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 bats in the Northeast. 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 five seconds, a minimum line length of five 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 for three different detector heights 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 have required much larger sample sizes (Arnett *et al.* 2006, Hayes 1997).

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 individually marked and 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 species groups, or guilds[2] based on visual comparison to reference calls. Such categorization reflects the bat community in the region of the Project area and is as follows:

[2] 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.

- **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. For this area, HFUN most likely represents eastern red bats, tri-colored bats and *Myotis* species since these species typically produce ultrasound sequences of more than 30 kHz. Big brown, silver-haired and hoary bats would be the species in this area typically producing ultrasound sequences of less than 30 kHz.

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

- **Eastern red bat/tri-colored bat[3] (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 bat/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. The sunset time was subtracted from the time of recording in order to determine the number of hours after sunset each file was recorded.

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

3.2.4 Weather Data

Temperature (degrees Celsius [°C]) and wind speed (meters per second [m/s]) were recorded at 10-minute intervals by the Bessey met tower just South of Route 16 in Mayfield. Wind speed data was collected from a sensor located 59 m above ground level, and temperature data was collected by a sensor located two and one-half m above ground level. The mean, maximum, and minimum temperature and wind speed were calculated for each night.

3.3 RESULTS

3.3.1 Timing of Activity

Detectors were deployed during the spring season and continued to operate through the end of October. Success rates varied from detector to detector resulting in an overall success rate of 92 percent. The range of dates that each detector was deployed is summarized in Table 3-1.

Table 3-1. Summary of bat detector field survey effort and results, Bingham, Fall 2010.

Location	Dates Deployed	Calendar Nights	Detector-Nights*	Detector Success	Recorded Sequences	Detection Rate **	Maximum Sequences recorded ***
Bessey Met High	6/9 - 10/31	145	132	91%	41	0.3	5
Bessey Met Low	6/9 - 10/31	145	145	100%	91	0.6	4
Bigelow Ridge Tree	6/3 - 10/31	151	151	100%	1288	8.5	148
Crocket Met High	6/9 - 10/31	145	145	100%	59	0.4	4
Crocket Met Low	6/9 - 10/31	145	145	100%	114	0.8	7
Johnson Met Low	6/3 - 10/31	151	64	42%	34	0.5	5
Johnson Met Tree	6/3 - 10/31	151	151	100%	881	5.8	157
Kingsbury Ridge Tree	6/3 - 10/31	151	151	100%	247	1.6	11
Overall Results		***1184***	***1084***	92%	***2755***	***2.5***	--

* 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 2,755 call sequences were recorded during the fall survey (Table 3-1). Activity increased with decreasing detector height. Detectors deployed above tree canopy in the two met towers (“Met High” detectors) had a combined detection rate of 0.36 call files recorded per detector night (100 files recorded by two detectors over 277 detector-nights). Detectors deployed at tree canopy height in met towers (“Met Low” detectors) had a combined detection rate of 0.66 call files recorded per detector night (239 files recorded by three detectors over 354 detector-nights). Detectors deployed at ground level below tree canopy had a combined detection rate of 5.3 call sequences per detector night (2,416 files recorded by three detectors over 453 detector-nights). Activity increased over time during the fall survey period (Figure 3-7). The maximum activity recorded in a single night by all detectors occurred on July 27 (188 calls for all detectors combined) (Figure 3-7).

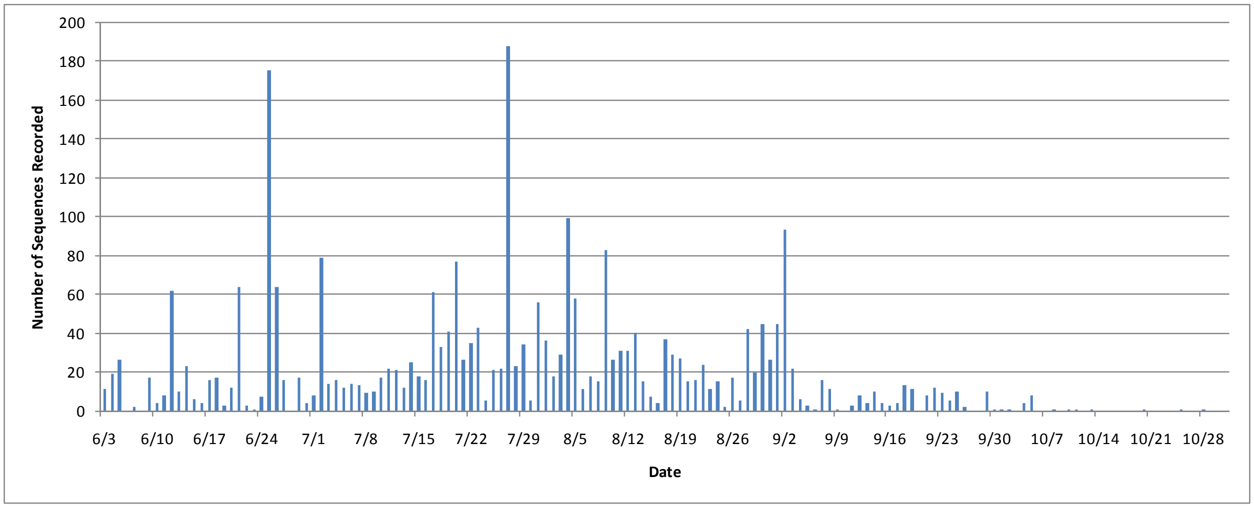


Figure 3-7. Total nightly bat call sequence detections recorded by eight detectors at Bingham between early June and the end of October, 2010.

The tree detectors recorded the highest level of bat activity during the third hour after sunset followed by a dip in activity and a second pulse in the fifth hour (Figure 3-8). Both the Met High and Met Low detectors recorded a pulse in activity during the first hour after sunset and a much smaller second pulse in the seventh hour (Figure 3-8). This trend was more pronounced at the Met Low detector which recorded twice as many calls as the Met High detector.

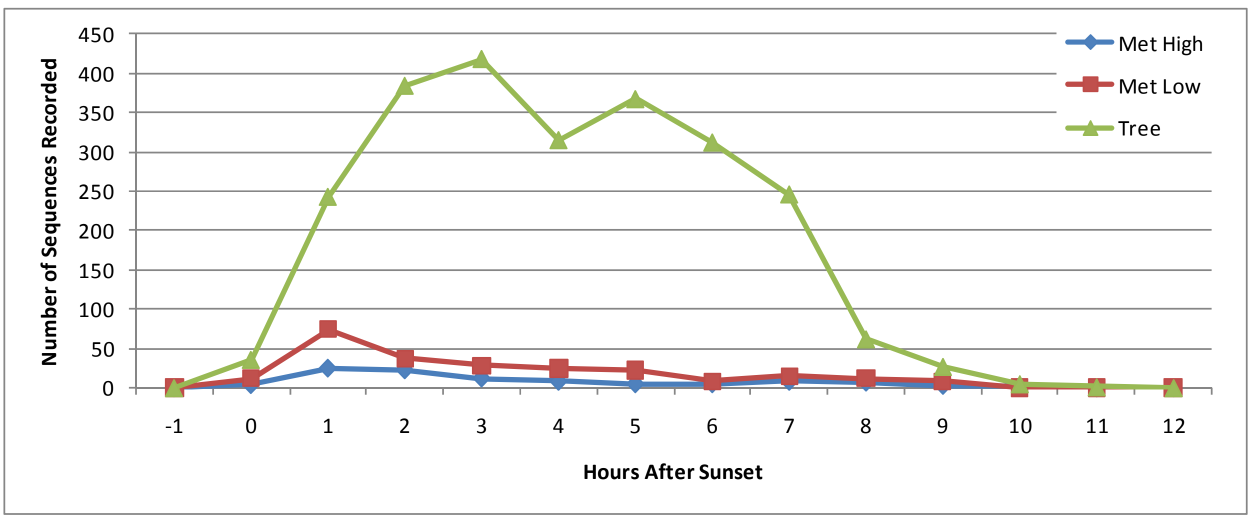


Figure 3-8. The number of call sequences recorded during each hour of the night at Met High, Met Low, and Tree detectors during Fall 2010 at the Bingham Wind Project.

3.3.2 Species Composition

The *Myotis* guild (MYSP) contained the highest number of call sequences (n = 1,494) identified to a taxonomic level (Table 3-2). A distinct gradient of bat species was recorded from the Met High detectors to the Tree detectors with MYSP generally more active at the tree detectors and long distance migratory species more active at the met high detectors. Detectors deployed 40 m above the ground recorded a larger percentage of low-frequency bat species (which include MYSP) while the detectors closest to the ground (5 m) recorded a higher percentage of high-frequency calls (long distance migratory species). The Met Low detectors (20 m) recorded balanced ratios of high and low-frequency species.

Table 3-2. Distribution of detections by guild, Bingham, Fall 2010.

Detector	Guild					Total
	BBSH	HB	MYSP	RBTB	UNKN	
Bessey Met High	5	9	7	0	20	41
Bessey Met Low	10	15	25	0	41	91
Bigelow Ridge Tree	6	1	758	3	520	1,288
Crockett Ridge Met High	3	11	6	1	38	59
Crockett Ridge Met Low	9	10	43	5	47	114
Johnson Met Low	10	4	3	2	15	34
Johnson Met Tree	38	26	527	21	269	881
Kingsbury Ridge Tree	10	3	125	8	101	247
Total	**91**	**79**	**1,494**	**40**	**1,051**	**2,755**
Total Guild Composition	**3.3%**	**2.9%**	**54.2%**	**1.5%**	**38.1%**	
Met Total	**37**	**49**	**84**	**8**	**161**	**339**
Met Guild Composition	**10.9%**	**14.5%**	**24.8%**	**2.4%**	**47.5%**	
Tree Total	**54**	**30**	**1410**	**32**	**890**	**2416**
Tree Guild Composition	**2.2%**	**1.2%**	**58.4%**	**1.3%**	**36.8%**	

Appendix B provides a series of tables with more specific information on the nightly timing, number, and species composition of recorded bat call sequences. Specifically, Appendix B Tables 1 through 8 provide information on the number of call sequences, by guild and suspected species, recorded at each detector and the weather conditions for that night. Analook files for all 2,755 recorded call sequences can be made available upon request.

3.3.3 Activity and Weather

Weather data from June 3 through October 31 was available for this report. Mean nightly wind speeds in the Project area varied between 1.9 and 13.43 m/s (Figure 3-9), and mean nightly temperatures varied between -3.0 °C and 25.4 °C (Figure 3-10). Although activity was highly variable over the course of the survey, seventy-five percent of all call sequences were recorded on nights with a mean nightly wind speed of six meters per second or less; seventy-seven percent of all calls were recorded on nights with a mean nightly temperature of 15°C or higher. The highest nightly activity rate was recorded on July 27, when mean nightly wind speed was 6 m/s and the mean nightly temperature was 20 °C.

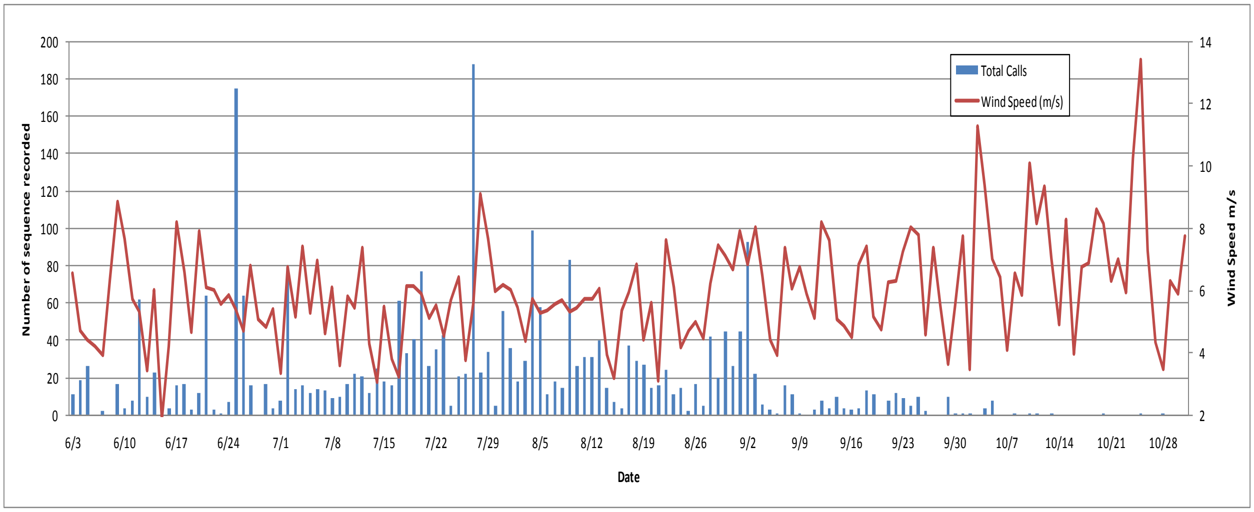


Figure 3-9. Nightly mean wind speed (m/s) and number of call sequences recorded during Fall 2010 at the Bingham Wind Project.

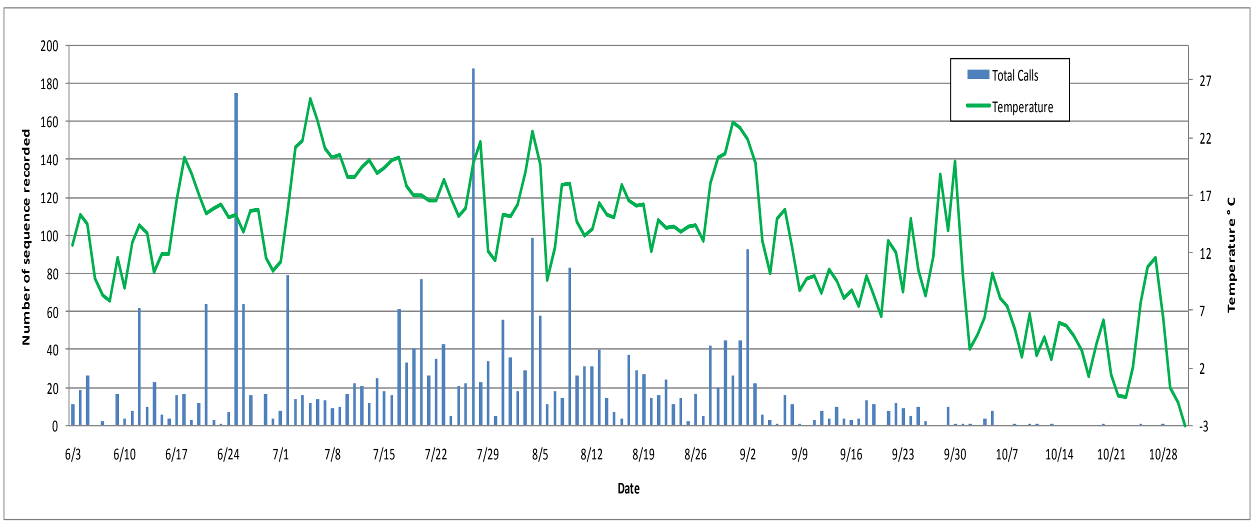


Figure 3-10. Nightly mean temperature (Celsius) and number of call sequences recorded during Fall 2010 at the Bingham Wind Project.

3.4 DISCUSSION

The summer and fall 2010 acoustic bat survey was a continuation of survey efforts in the spring. The data included in this report are representative of trends often observed during fall acoustic surveys, and during the fall migratory period. Detection rates at individual detectors ranged from 0.3 to 8.5 call sequences recorded per detector-night. Activity peaked in late July to early August, likely due to a corresponding decrease in mean nightly temperatures across the fall season. Activity was higher at the three tree detectors (5.3 sequences/detector-night) than both the two Met High detectors (0.36 sequences/detector-night) and the three Met Low detectors (0.66 sequences/detector-night). Species composition varied between detector heights, with *Myotis* species more prominently recorded at tree detectors and guilds containing long-distance migrant species (BBSH and HB guilds) more prominently recorded at the met high detectors. The Met Low detectors recorded an equal percentage of high to low-frequency species.

Pre- and post-construction acoustic monitoring of bat activity has documented a negative relationship with average nightly wind speed (Fiedler 2004, Reynolds 2006). Reynolds (2006) found activity of bats to be highest on nights with wind speeds of less than 5.4 m/s during the fall migratory period at the Maple Ridge, New York wind facility. Bat activity levels at Buffalo Mountain, Tennessee also showed a negative association with average nightly wind speeds (Fiedler 2004). At Bingham, peak activity occurred on a night when mean wind speeds were 6.0 m/s.

Pre- and post-construction acoustic surveys at wind facilities have also documented bat activity to be positively correlated with nightly mean temperatures (Fiedler 2004, Reynolds 2006). Reynolds (2006) found that no detectable fall migratory activity occurred on nights when the mean temperature was below 10.5°C (50.9°F). Bat activity at Buffalo Mountain, West Virginia from 2000 to 2003 was most closely correlated with average nightly temperature (Fiedler 2004). Although some activity at Bingham did occur on cold nights, peak activity occurred on nights with temperatures above 15°C.

Bat calls were identified to guild within this report, although calls were provisionally categorized by species when possible during analysis. Tree detectors recorded more *Myotis* activity (58%) than both the Met High detectors (13%) and the Met Low detectors (30%). Since bats belonging to this guild are resident species that forage primarily at or below tree canopy height it would be expected that they would most often be recorded by tree detectors. Only one percent of all call sequences were assigned to the RBTB guild and over half of those were LABO (n=26). Three percent of calls were of the BBSH guild, with the most recorded at the Bessey and Johnson Met Low detectors (n= 10). Hoary bat calls only made up three percent of all calls recorded, and were represented a higher percentage of bats recorded at the met tower detectors and a small percentage of bats recorded at the tree detectors.

Calls of short duration or poor quality were placed in the unknown guild and were classified as either HFUN or LFUN. Of the 2,755 total sequences recorded, 32 percent (n=892) were classified as HFUN due to sequences with a minimum frequency above 30 to 35 kHz. Eight of these calls had pulses that were characteristic of LABO species but lacked five call pulses so were labeled HFUN. Poor quality calls of less than 30 kHz were classified as LFUN and represented six percent (n=159) of all calls recorded. Eighty of these calls appeared to be LACI and two appeared to be LANO but all lacked five call pulses and were classified as LFUN. Remaining HFUN and LFUN either lacked the sufficient number of pulses or detail to be identified to species. Higher elevation detectors recorded more LFUN calls and lower elevation detectors recorded a higher ratio of HFUN calls.

When considering the level of activity documented at Bingham, 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 there is currently little data aiding in the interpretation of the number of calls per detector nights. Results cannot be used to determine the number of bats inhabiting an area or quantitatively determine a post-construction fatality rate. Although interpretations are limited, the surveys represent a sample of activity and the general species groups that occur in the Project area.

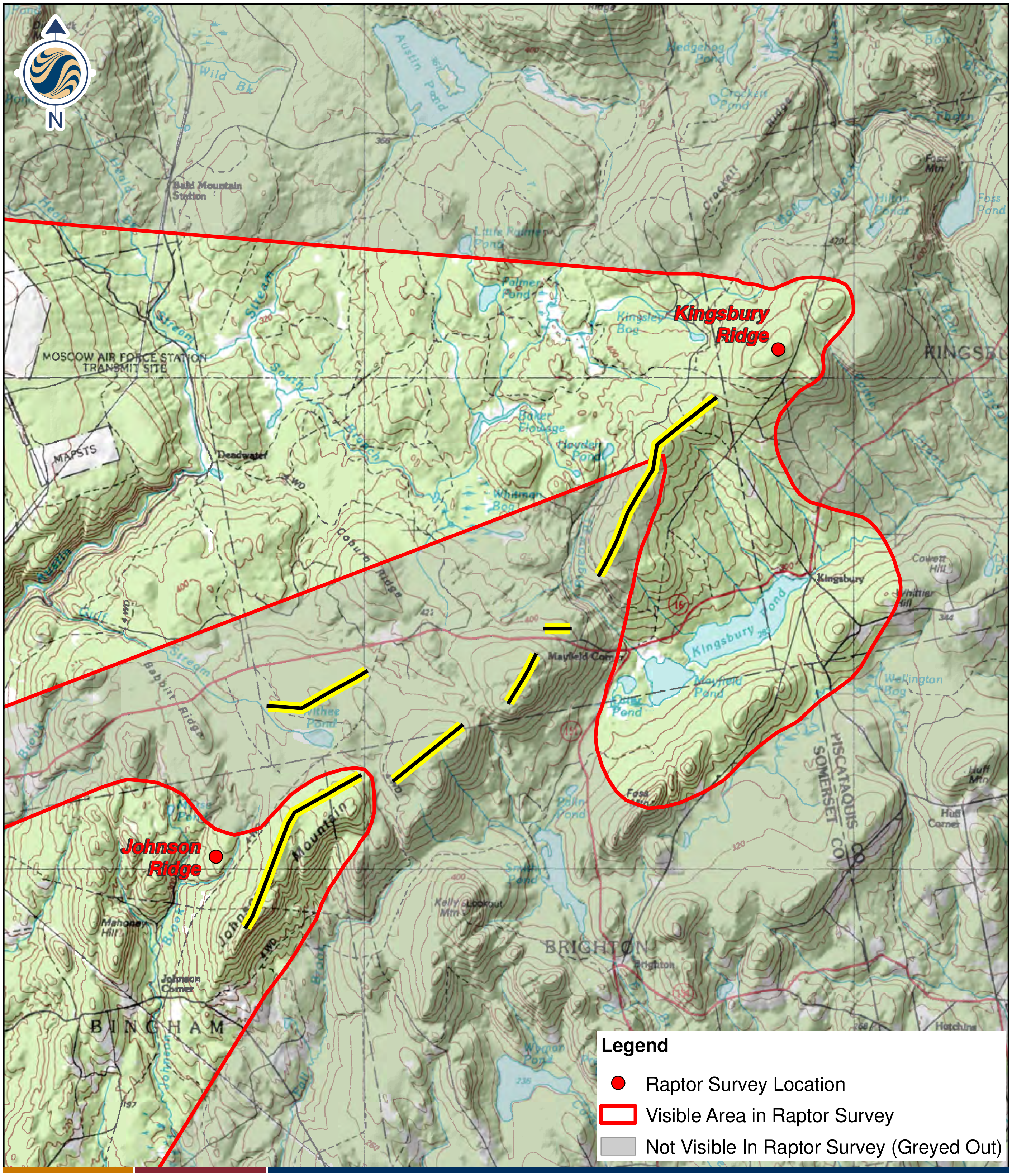
4.0 Diurnal Raptor Surveys

4.1 INTRODUCTION

Fall 2010 diurnal raptor surveys were conducted at the Project as a continuation of spring 2010 surveys conducted over 10 days between March 19 and May 21 in the spring of 2010, and consistent with methods and level of effort at pre-construction surveys at other proposed wind energy projects in Maine. The purposes of the raptor surveys were to sample migration activity at central and prominent locations within the Project area and to document the species that occur in the vicinity of the Project, with particular effort focused on documenting bald eagle activity. It was also the purpose of the study to record the approximate flight heights, flight path locations, and other flight behaviors of all raptor species observed. The results of the surveys provide baseline species composition and behavioral data for migrants and seasonally local raptors which occur in the area.

4.1.1 Study Area Description

Two observation locations, one on Kingsbury Ridge and one on Johnson Ridge, were used during the fall 2010 surveys (Figure 4-1). The Kingsbury Ridge observation site was located approximately a quarter mile west of Old Mountain Road in Kingsbury. The observation location was in an old clear cut. The site provided a good view to the south over Kingsbury and Mayfield Ponds and west over the valley. Due to the topography and surrounding trees, the views in other directions were limited to the airspace above the surrounding trees. The Johnson Ridge observation site was located approximately 0.75 miles west of the Johnson Ridge met tower. This site was located along a dirt road surrounded by a spruce plantation and a recent clear cut. From this site, the met tower located on Johnson Ridge could clearly be seen as well as the profile of the Johnson ridgeline. There also were decent views of the valleys and surrounding landscape to the south, southwest west, and northwest. For the purposes of this report, the 'Study area' is considered the observable airspace above the surrounding topography as seen from these observation locations (Figure 4-1). The 'Project area' includes only those locations within the Study area where turbines are proposed. The Project area includes two separate ridgelines: Johnson Ridge and Kingsbury Ridge (north and south of Route 16).



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Client/Project
Bingham Wind Project
Bingham, Maine

Figure No.
4-1

Title
Raptor Survey Study Area and Viewshed Map

11/22/2010

4.2 RAPTOR DATA COLLECTION METHODS

4.2.1 Field Surveys

Surveys were performed on 12 days during the fall migration period; on five of these days, surveys were performed simultaneously by two observers, yielding a total of 17 total survey days combined. The fall 2010 raptor surveys utilized methodologies to monitor daytime raptor migration activity. Surveys were conducted for seven consecutive hours between 9 am and 4 pm, during the peak hours of raptor movement and thermal development when the sun warms the earth's surface and warm air rises.

During surveys, the observer scanned the sky and surrounding landscape by eye and 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 that had been observed at some other point during the survey day. Therefore, daily count totals include all observations of birds seen throughout a survey day. Detailed information for each observation was recorded on standardized data sheets, including:

- Observation date and time;
- Species[4], number of individuals, and age (if possible);
- The location of each bird depicted on a topographical map;
- The minimum and maximum estimated flight height[5] and behaviors observed in each of the topographical positions where each bird occurred[6];
- 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 and recorded by the observer as incidentals; however, this data was not collected uniformly or systematically.

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 4-2 below). As individual birds traveled through or in the vicinity of the Project, all position categories in which a bird occurred were recorded.

[4] 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.

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

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

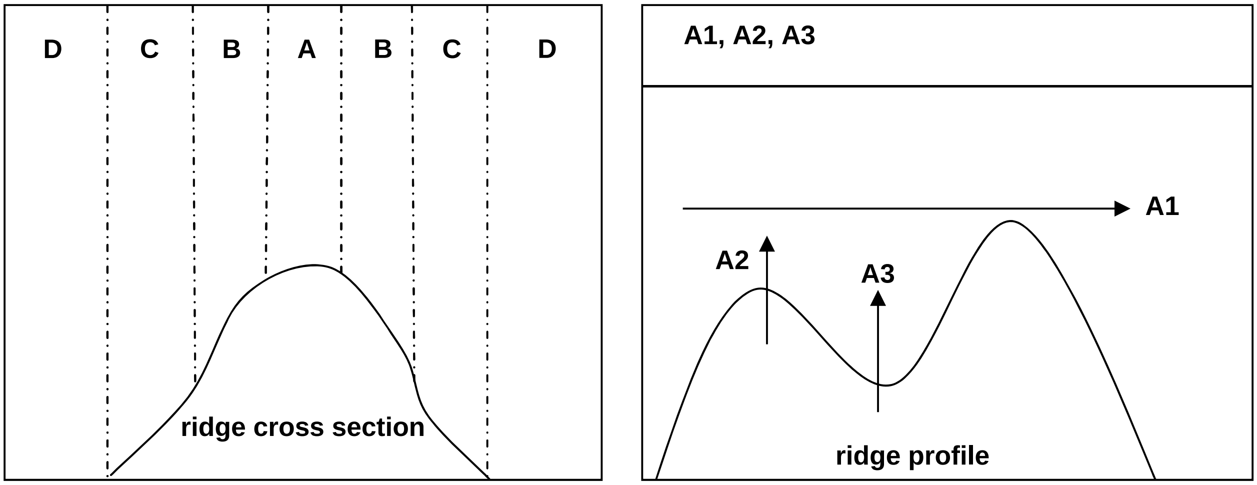


Figure 4-2. Raptor flight position categories in relation to the topography of the Study area (codes apply to locations within and outside of Project area). A1) parallel to ridge, A2) perpendicular to ridge, A3) over saddle, B) flight path over upper slope of ridge, C) flight path over lower slope of 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 hourly weather conditions including wind speed and direction, temperature, sky condition; percent cloud cover, cloud type, and relative cloud height.

Specific seasonal weather conditions influence 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 fall 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 fall 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, Eastern Standard Time (EST).

4.2.3 Raptor Data Analysis Methods

Raptor observation data were summarized by survey day and for the entire survey period. As there were two observation locations, data was analyzed separately (where applicable) for each observation location. 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 152 m (499').

The results of the fall 2010 surveys were compared to the results of publicly available data from other pre-construction raptor surveys of forested ridges in New England.

4.3 RESULTS

The fall surveys were conducted on 12 days between September 2 and October 13. Surveys were conducted simultaneously from the two observation locations on five of those survey days (September 17, 22, 23, 27 and 29), yielding a total of 17 survey days (5 days at Johnson Ridge and 12 days at Kingsbury Ridge). A total of 119 hours were surveyed (84 hours at Kingsbury Ridge and 35 hours at Johnson Ridge). Table 4-1 summarizes the fall 2010 survey effort and results.

Table 4-1. A summary of the Fall 2010 survey effort and results at the Bingham Wind Project	
Range of survey dates	**9/2 - 10/13**
No. survey days	**12 (12 at Kingsbury Ridge,5 simultaneous at Johnson Ridge)**
No. survey hours	**Kingsbury Ridge: 84; Johnson Ridge: 35**
No. raptor species observed	**11**
Raptor species observed (common name)	**Scientific name**
American kestrel	*Falco sparverius*
bald eagle	*Haliaeetus leucocephalus*
broad-winged hawk	*Buteo platypterus*
Cooper's hawk	*Accipiter cooperii*
merlin	*Falco columbarius*
northern harrier	*Circus cyaneus*
osprey	*Pandion haliaetus*
peregrine falcon	*Falco peregrinus*
red-tailed hawk	*Buteo jamaicensis*
sharp-shinned hawk	*Accipiter striatus*
turkey vulture	*Cathartes aura*
unidentified accipter	*NA*
unidentified buteo	*NA*
unidentified raptor	*NA*
Total no. observations of raptors	**Kingsbury Ridge: 57; Johnson Ridge: 61**
Seasonal passage rate (raptor observations/hour)	**Kingsbury Ridge: 0.68; Johnson Ridge: 1.74**
Total no. observations of raptors within Project area (percent of total observations)	**Kingsbury Ridge: 13 (23%); Johnson Ridge: 12 (34%)**
Total no. of observations of raptors seen in the Project area and below max rotor height (percent of total observations of birds in Project area)	**Kingsbury Ridge: 11 (85%); Johnson Ridge: 12 (100%)**

4.3.1 Weather Summary

Among survey days, the average hourly temperature was 14° C (58° F). Temperatures ranged from four ° C to 27° C (40 to 80° F). Sky conditions were generally clear to partly cloudy. Wind direction was generally from the northwest, north and west. Wind speeds ranged from calm or light on three of the surveys days to moderately strong 19-24 miles per hour (mph) (30-36 kilometers per hour [kph]) on two of the surveys days. (See Table 4-2 for wind speed codes.)

Analysis of regional surface weather maps indicated the timing of approaching low pressure systems, when raptor movements tend to be accentuated. Table 4-2 shows the wind direction, speed and pressure system pattern on each survey date during the fall surveys.

Table 4-2. Average wind speed, wind direction and pressure systems during Fall 2010 surveys			
Date	**Wind direction**	**Wind speed**	**Daytime Pressure System (high or low)**
9/2/2010	WSW	4	daytime High, coldfront approachng from the NW
9/15/2010	W	5	daytime High, low pressure over Northern ME
9/16/2010	W	1	daytime High, pushed out by approaching Low over great lakes region
9/17/2010	NW	4	AM Low, moving west, clearing out by afternoon, High building in PM
9/22/2010	WNW	3	Low to north over Quebec, cold front approaching from West
9/23/2010	NW	1	daytime High, Low developing over great lakes region
9/27/2010	SW	3	High pressure ridge to NW, Low to south bringing precip/clouds
9/29/2010	SW	4	weak Low moving off to the north, High building in behind coldfront
10/6/2010	E	4	stalled Low off cape cod brings clouds, rain by late afternoon
10/8/2010	NW	5	unsettled, scattered light precip, high pressure building by evening
10/12/2010	NW	2	variable wind speed, high pressure building throughout the day
10/13/2010	NW	4	strong daytime High, few clouds
Wind speed code (s): 1 (1-3 mph); 2 (4-7 mph); 3 (9-12 mph); 4 (3-18 mph); 5 (19-24 mph)			

4.3.2 Raptor Data

Over the course of the survey period, a total of 57 observations of raptors were made from Kingsbury Ridge, while 61 observations were made from Johnson Ridge. The seasonal passage rate for Kingsbury Ridge was 0.68 raptor observations per hour (raptors/hr); the seasonal passage rate for Johnson Ridge was 1.74 raptors/hr. Figures 4-3a and 4-3b and Appendix C Tables 1a and 1b show the daily totals of raptor species for the fall season at the two observation sites.

At Kingsbury Ridge, daily passage rates ranged from 0.14 raptors/hr (September 2) to 1.71 raptors/hr (September 29). Daily passage rates at Johnson Ridge ranged from 0.14 raptors/hr (September 27) to 2.43 raptors/hr (September 22 and 23). The days with the highest passage rate at either site, September 22 and 23 at Johnson Ridge, were characterized by light to moderate northwest winds and a low pressure system approaching from the west. A relatively high raptor passage rate occurred on September 29 at Johnson Ridge (2.14 raptors/hr) and this date had the highest passage rate for Kingsbury Ridge (1.71 raptors/hr). This survey day was characterized by moderate southwest winds and a low pressure system moving off to the east and high pressure building from the west.

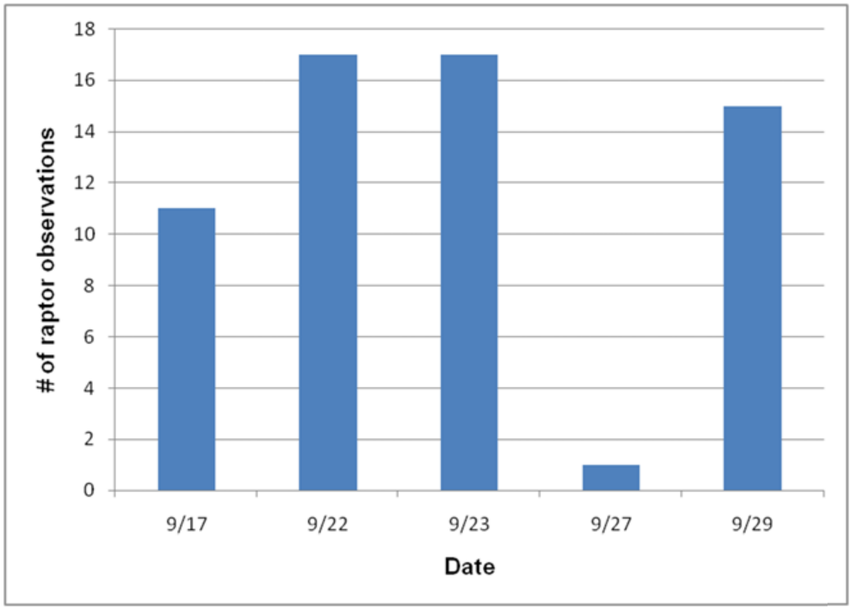


Figure 4-3a. Survey day totals of raptor observations from Johnson Ridge during Fall 2010 surveys at the Bingham Wind Project.

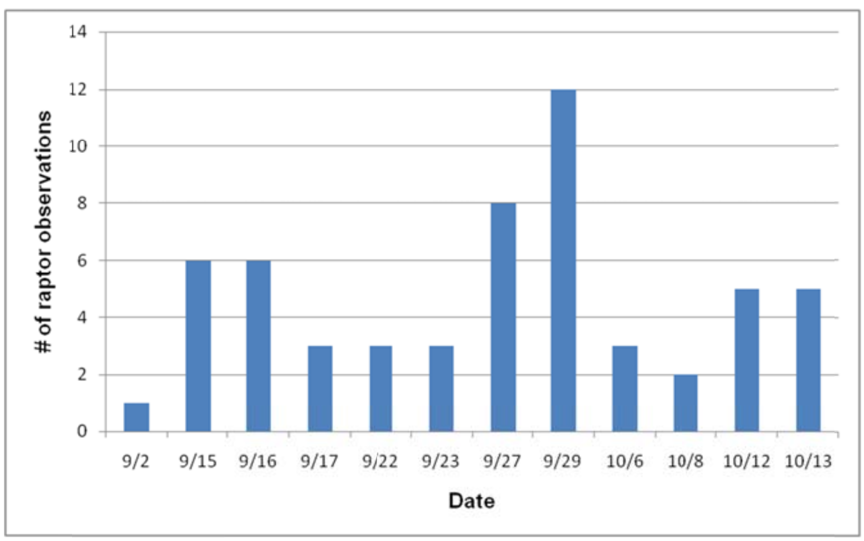


Figure 4-3b. Survey day totals of raptor observations from Kingsbury Ridge during Fall 2010 surveys at the Bingham Wind Project.

There were eleven species of raptors observed (not including unidentified accipiter, unidentified buteo, and unidentified raptor) at both observation locations combined (Figures 4-4a and 4-4b, Appendix C Tables 1a and 1b).

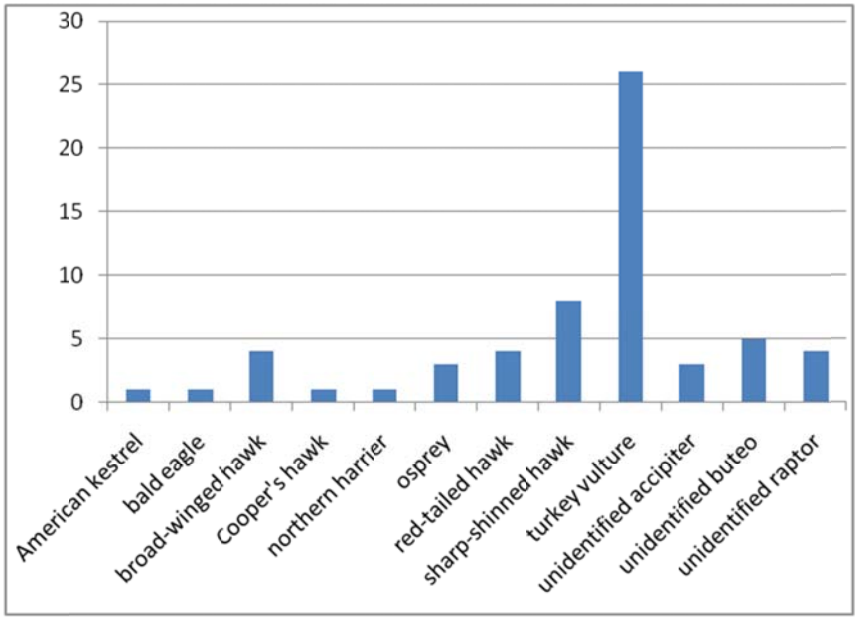


Figure 4-4a. Number of observations of raptor species observed from Johnson Ridge during Fall 2010 surveys at the Bingham Wind Project.

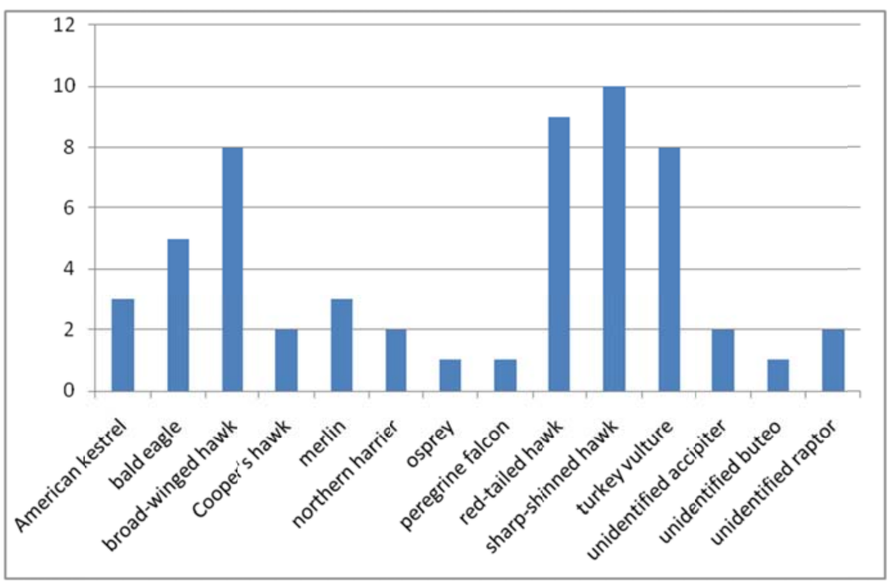


Figure 4-4b. Number of observations of raptor species observed from Kingsbury Ridge during Fall 2010 surveys at the Bingham Wind Project.

At Johnson Ridge, turkey vultures were the most commonly observed species (n=26, 43%), followed by sharp-shinned hawk (n=8, 13%). At Kingsbury Ridge, sharp-shinned hawk (n=10, 18%) were the most commonly observed species followed by red-tailed hawk (n=9, 16%).

4.3.3 Hourly observations

Throughout the survey season, at both observation sites the majority of observations peaked first between 9 am and 10 am, then again between 12 pm and 1 pm (Figures 4-5a and 4-5b, Appendix C Table 2).

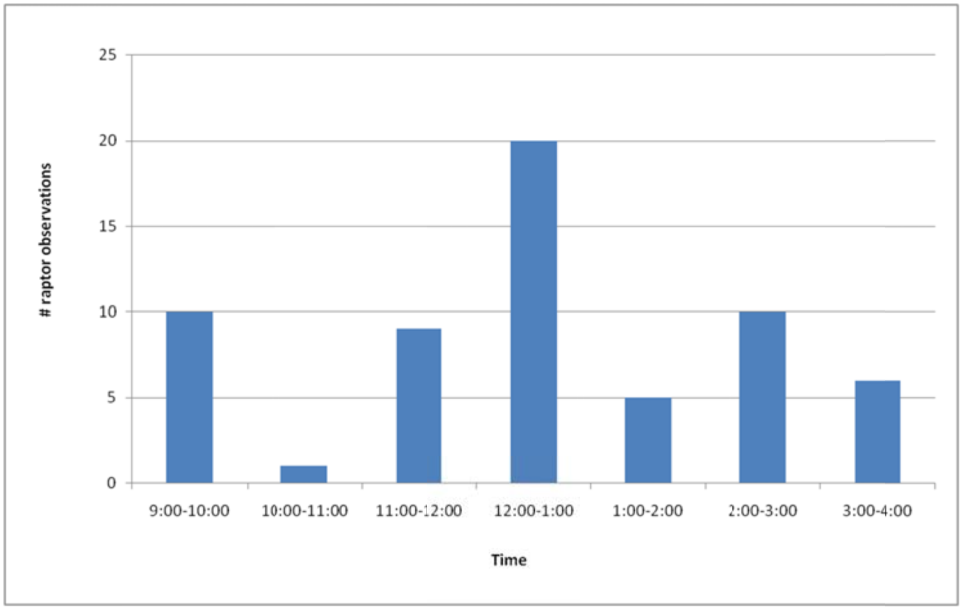
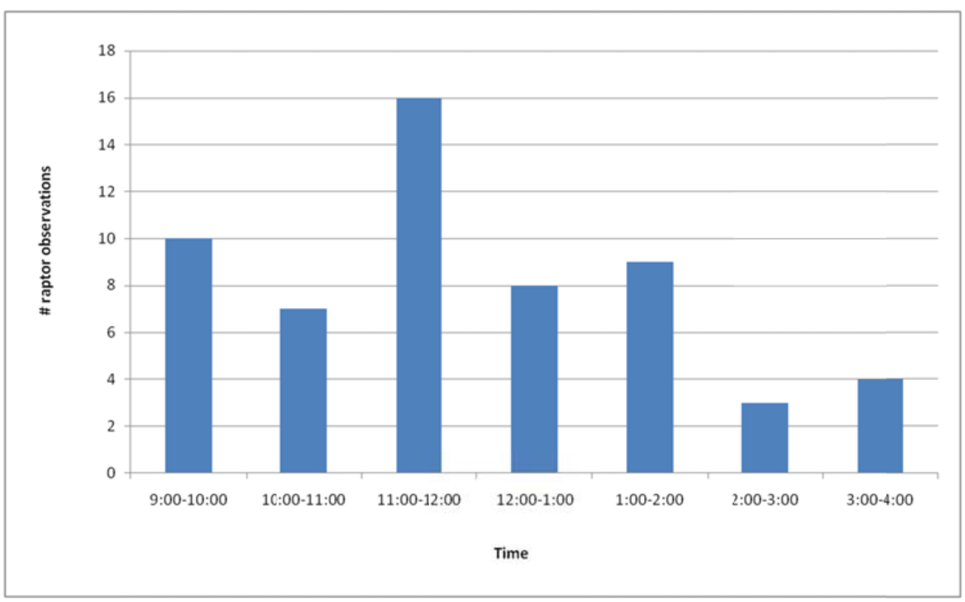


Figure 4-5a. Number of observations of raptors per survey hour from Johnson Ridge during Fall 2010 surveys at the Bingham Wind Project.



4.3.4 Figure 4-5b. Number of observations of raptors per survey hour from Kingsbury Ridge during Fall 2010 surveys at the Bingham Wind Project.Raptor Locations

At Johnson Ridge 34 percent (n=12) of 61 total raptor observations occurred within the Project area while at Kingsbury Ridge, 23 percent (n=13) of 57 total raptor observations occurred within the Project area (Figures 4-6a and 4-6b, Appendix C Tables 3a and 3b). All other observations occurred either over hills, peaks, or valleys outside of the Project area.

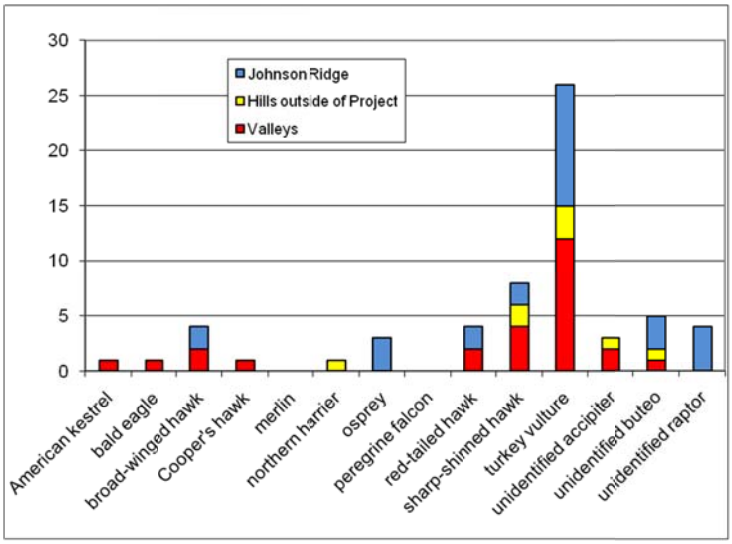


Figure 4-6a. Number of observations of raptors within different Study area locations observed from Johnson Ridge during Fall 2010 surveys at the Bingham Wind Project.

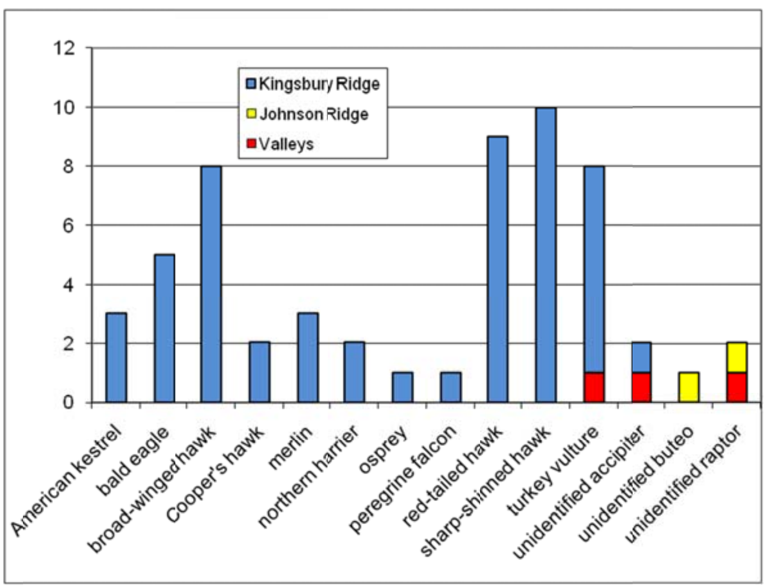
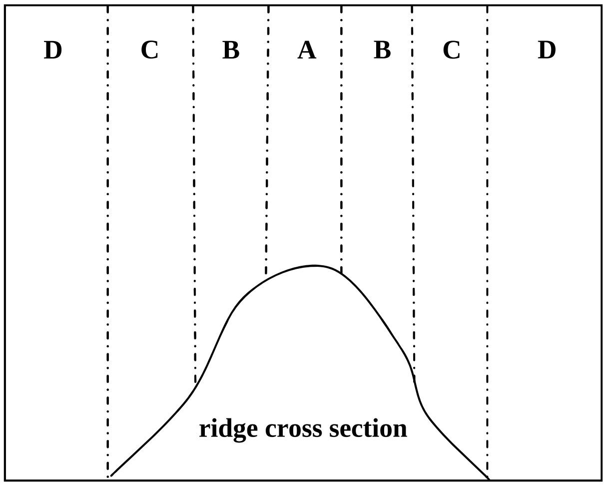


Figure 4-6b. Number of observations of raptors within different Study area locations observed from Kingsbury Ridge during Fall 2010 surveys at the Bingham Wind Project.

4.3.5 Raptor Behaviors

Raptor behaviors observed in the topographical positions of the Study area locations are summarized in Tables 4-3a and 4-3b. 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.



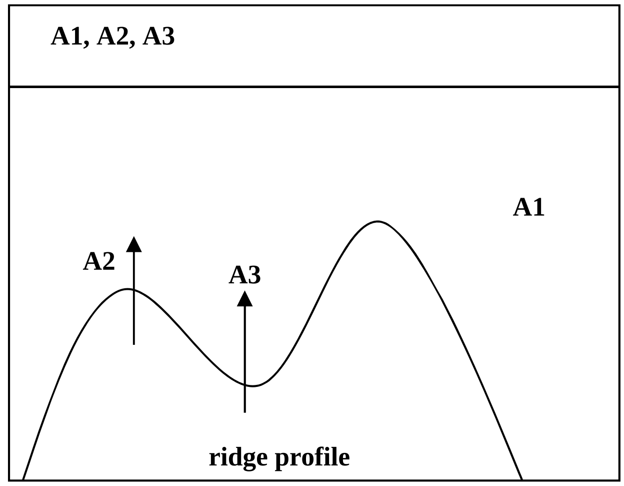


Table 4-3. Raptor behaviors summarized by location in study area and flight position as seen from Johnson and Kingsbury Ridges combined, Bingham Wind Project, Fall 2010

Location in Study Area	Soaring, Gliding						Powered Flight						Foraging Behaviors						territorial or courtship						Perched					
	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
Johnson Ridge	11	3	5	4	1	7	1	3	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Kingsbury Ridge	14	11	1	16	11	4	11	10	1	7	7	4	2	6	0	1	3	0	0	0	0	0	2	0	1	0	0	0	0	0
Valleys	3	0	1	1	4	11	0	0	0	2	1	5	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1
Hills outside Project	0	0	0	0	0	6	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total behaviors observed at both observation sites combined = 191																														

Table 4-3a. Raptor behaviors summarized by location in study area and flight position as seen from Johnson Ridge, Bingham Wind Project, Fall 2010

Location in Study Area	Soaring, Gliding						Powered Flight						Foraging Behaviors						territorial or courtship						Perched					
	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
Johnson Ridge	10	0	0	3	1	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Johnson Ridge out	1	3	5	0	0	2	0	2	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Hills outside Project	0	0	0	0	0	6	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Valley	3	0	1	1	2	10	0	0	0	2	0	5	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1
Total behaviors observed at Johnson Ridge = 73																														

Table 4-3b. Raptor behaviors summarized by location in study area and flight position as seen from Kingsbury Ridge, Bingham Wind Project, Fall 2010

Location in Study Area	Soaring, Gliding						Powered Flight						Foraging Behaviors						territorial or courtship						Perched					
	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
Kingsbury Ridge	3	7	1	7	6	1	4	4	1	2	3	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kingsbury Ridge out	11	4	0	9	5	3	7	6	0	5	4	2	2	5	0	1	3	0	0	0	0	0	2	0	1	0	0	0	0	0
Johnson Ridge out	0	0	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
Valley	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total behaviors at Kingsbury Ridge = 118																														

Within visible Project area locations (Johnson and Kingsbury Ridges), the majority of birds observed were soaring or gliding over the upper slopes of the ridges, or parallel to the ridges (Table 4-3). Two juvenile broad-winged hawks were observed interacting over the lower slope of Kingsbury Ridge; however, were not believed to be territorial or courting as they were observed in October. Ten raptor observations involved foraging behaviors within the Project area, specifically over Kingsbury Ridge.

Based on their flight behaviors, raptors suspected to be actively migrating or not actively migrating are summarized in Tables 4-4a and 4-4b. Raptors were considered actively migrating if their flight path was generally direct and in a southerly direction. Raptors would be characterized as 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. At Johnson Ridge, 44 percent (n=27) were suspected to be actively migrating. At Kingsbury Ridge, 44 percent (n=25) were suspected to be actively migrating.

Table 4-4a. Observations of raptors suspected to be actively migrating at Johnson Ridge, Bingham Wind Project, Fall 2010

Species	Not Actively Migrating	Actively Migrating	TOTAL
American kestrel	1		1
bald eagle	1		1
broad-winged hawk	1	3	4
Cooper's hawk	1		1
northern harrier		1	1
osprey		3	3
red-tailed hawk	3	1	4
sharp-shinned hawk	2	6	8
turkey vulture	15	11	26
unidentified accipiter	3		3
unidentified buteo	4	1	5
unidentified raptor	3	1	4
TOTAL	**34**	**27**	**61**

Table 4-4b. Observations of raptors suspected to be actively migrating at Kingsbury Ridge, Bingham Wind Project, Fall 2010				
Species	**not actively migrating**	**actively migrating**	**undetermined**	**TOTAL**
American kestrel	2		1	3
bald eagle		3	2	5
broad-winged hawk	1	6	1	8
Cooper's hawk			2	2
merlin	1	2		3
northern harrier		2		2
osprey	1			1
peregrine falcon		1		1
red-tailed hawk	3	3	3	9
sharp-shinned hawk	3	5	2	10
turkey vulture	3		5	8
unidentified accipiter		1	1	2
unidentified buteo		1		1
unidentified raptor	1	1		2
TOTAL	**15**	**25**	**17**	**57**

4.3.6 Flight Heights

The average minimum flight heights of birds observed in the different topographical positions of the Study area are summarized in Tables 4-5a and 4-5b below. These summaries include birds observed both within and outside of the Project area.

Table 4-5a. Number of observations and average flight heights for each position category for birds observed at Johnson Ridge, Bingham Wind Project, Fall 2010						
	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=67)	14	6	7	6	3	31
Average minimum flight height (m)	113	70	40	94	167	112

Table 4-5b. Number of observations and average flight heights for each position category for birds observed at Kingsbury Ridge, Bingham Wind Project, Fall 2010

	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=89)	19	19	2	21	20	8
Average minimum flight height (m)	65	73	200	94	134	180

At Johnson Ridge, 12 observations (34% of all observations) occurred within the Project area in topographical positions on ridgelines where the proposed turbines are to be sited (positions A, B, and C). These birds (18% of all birds observed) occurred at flight heights below the proposed maximum rotor height of 152 m (Figure 4-7a, Appendix C Table 4a). At Kingsbury Ridge, 13 observations (23% of all observations) occurred within the Project area in positions on ridgelines where the proposed turbines are to be sited. Of these, 11 observations (85% of the 13 in the Project area and 19% of all observations) occurred at flight heights below the proposed maximum rotor height (Figure 4-7b, Appendix C Table 4b).

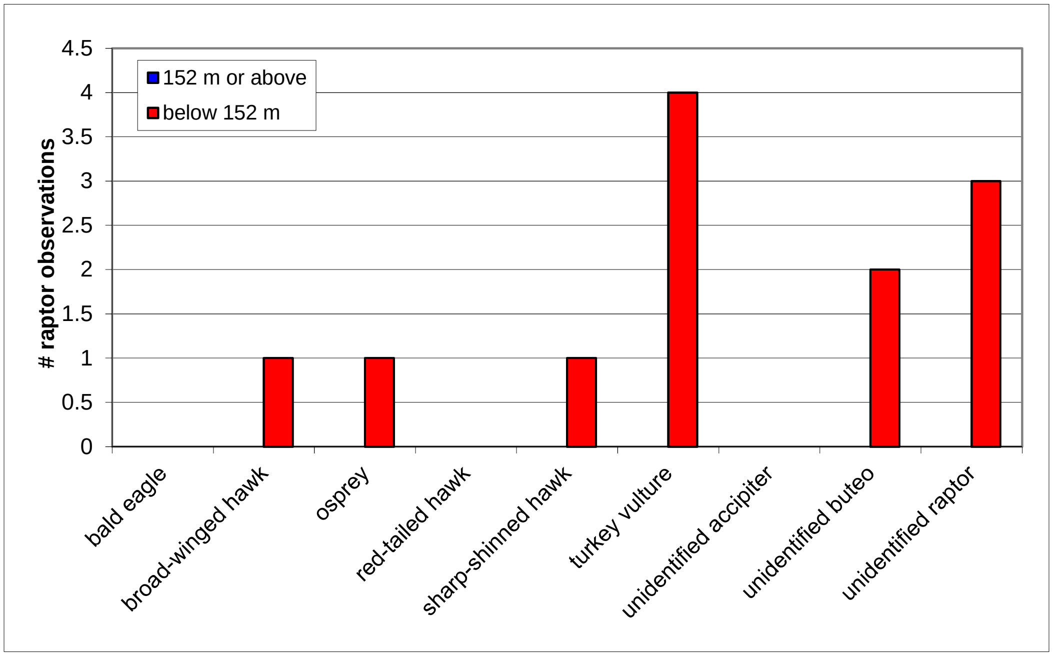


Figure 4-7a. Number of observations of raptor species observed within proposed turbine areas (positions A, B, C within Project area) at heights above and below 152 m from Johnson Ridge during Fall 2010 surveys at the Bingham Wind Project.

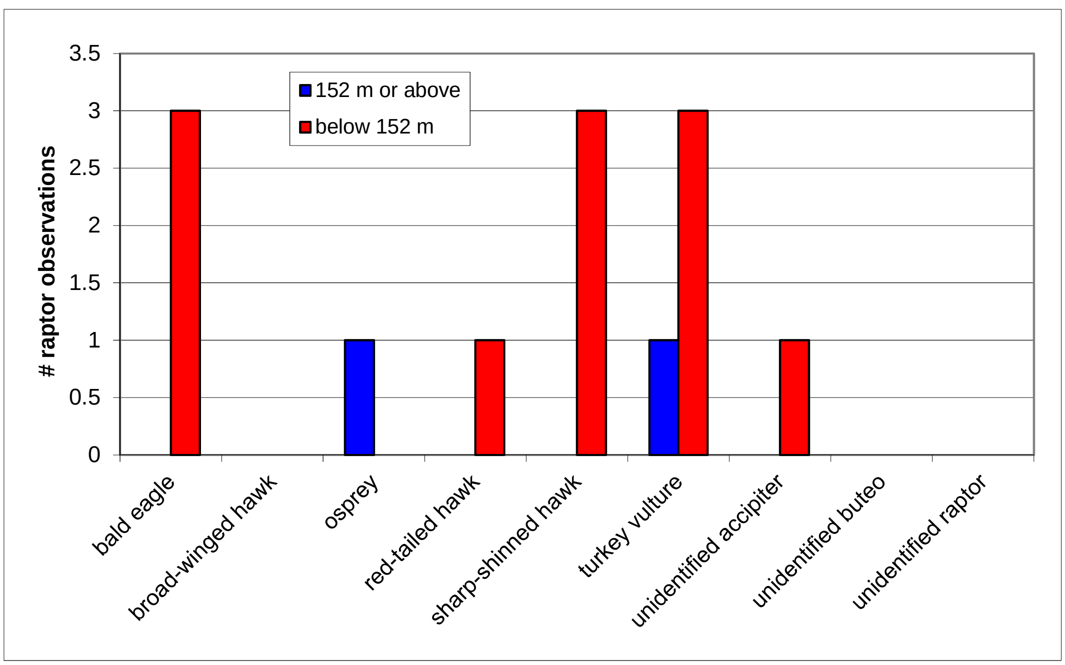


Figure 4-7b. Number of observations of raptor species observed within proposed turbine areas (positions A, B, C within Project area) at heights above and below 152 m from Kingsbury Ridge during Fall 2010 surveys at the Bingham Wind Project.

4.3.7 Rare, Threatened and Endangered Species

No raptor species listed by the Endangered Species Act of 1973 (7 U.S.C. § 136, 16 U.S.C. § 1531 et seq.) as Threatened or Endangered were observed during the fall 2010 survey period. Two state-listed species of special concern, bald eagle and northern harrier, were observed.

Six observations of bald eagles occurred in the Study area, three of which were within the Project area. Two adult bald eagles were observed soaring just west of Kingsbury Ridge on September 23 at heights between 100 m and 150 m. An observation of a sub-adult was also made on September 23 from Johnson Ridge; the bird was seen over a valley outside of the Project area. An observation of an adult was made on September 17; it flew at 100 m to 200 m as it crossed Kingsbury Ridge. A third adult bald eagle and a juvenile were observed on September 27 from outside of the Project area.

Three observations of northern harrier were made. All three were outside of the Project area, one seen from Johnson Ridge was observed flying low over Mahoney Hill, west of the Project area. The other two observations occurred on October 13 from Kingsbury Ridge. These two, a juvenile and an adult female, were observed together and believed to be hunting along the lower slope of Kingsbury Ridge.

4.3.8 Incidental Non-raptor Observations

There were 19 non-raptor avian species (not including an unidentified nuthatch and an unidentified chickadee) observed incidentally to the fall 2010 raptor surveys (Table 4-6). Among these species was a state-listed species of special concern: white-throated sparrow (*Zonotrichia albicollis*).

Table 4-6. Non-raptor avian species observed incidentally during raptor surveys from Johnson and Kingsbury Ridges, Bingham Wind Project, Fall 2010

Common name	Scientific name	Status (ME)	Johnson Ridge	Kingsbury Ridge
American crow	*Corvus brachyrhynchos*		X	X
American goldfinch	*Spinus tristis*		X	X
American robin	*Turdus migratorius*		X	X
black-capped chickadee	*Poecile atricapillus*		X	X
blue jay	*Cyanocitta cristata*		X	X
black-throated blue warbler	*Dendroica caerulescens*			X
Canada goose	*Branta canadensis*		X	X
cedar waxwing	*Bombycilla cedrorum*		X	
common raven	*Corvus corax*		X	X
dark-eyed junco	*Junco hyemalis*		X	X
downy woodpecker	*Picoides pubescens*		X	X
hairy woodpecker	*Picoides villosus*		X	X
mourning dove	*Zenaida macroura*		X	
northern flicker	*Colaptes auratus*		X	X
pileated woodpecker	*Dryocopus pileatus*			X
ruffed grouse	*Bonasa umbellus*		X	X
unidentified poecile chickadee	*Poecile (sp.)*			X
white-throated sparrow	*Zonotrichia albicollis*	special concern	X	X
yellow-rumped warbler	*Dendroica coronata*			X
yellow-shafted flicker	*Colaptes a. auratus*			X
unidentified nuthatch	*Sitta (sp.)*			X

4.4 DISCUSSION

Of the 57 total raptor observations made from Kingsbury Ridge and 61 total raptor observations made from Johnson Ridge in fall 2010, 23 percent and 34 percent, respectively, were in the Project area. It should be noted that the locations where raptors were observed in the Study area are subject to observer bias. Birds in closer proximity to the observation locations would be more likely to be seen than birds occurring at greater distances from the observer. Also, birds that traveled outside of the observer's viewshed would have gone undetected and would not have been included in total observation numbers. The seasonal passage rates of 0.68 raptors/hour at Kingsbury Ridge and 1.74 raptors/hour Johnson Ridge are at the low end of the range of passage rates documented at other wind projects in New England (0.7 to 12.7 raptors/hour; Appendix C Table 5).

The flight paths of raptors observed at the Project varied between survey dates and were influenced by varying wind direction and weather. The two survey days with the highest raptor counts (September 22 and September 29) were characterized by moderate west- northwest winds with an approaching cold front, and moderate to strong southwest winds following the passage of a cold front, respectively. Seasonal timing and weather both likely influenced the daily activity rates. 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 fall 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 lower 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).

Of the 11 species of raptor observed during the fall 2010 surveys, two state-listed species of special concern, bald eagle and northern harrier, were observed. The species composition and flight behaviors documented during the fall 2010 raptor surveys at the Project are typical of the results of regional raptor migration studies (Stantec 2008, Stantec 2009a and 2009b, Stantec 2010a and 2010b).

Studies have documented high raptor collision avoidance behaviors at modern wind facilities (Whitfield and Madders 2006, Chamberlain *et al.* 2006). As most raptors are diurnal, raptors may be able to visually, as well as acoustically detect turbines during periods of fair weather. Foraging raptors that may become distracted by prey, or migrant raptors flying during periods of reduced visibility, may be at increased risk of collision with wind turbines.

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. That is, at existing wind farms estimations of passage rates and percentages of birds below turbine height observed during pre-construction surveys have not been directly correlated to the actual number of raptors fatalities that have been documented during post-construction mortality studies.

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Appendix A

Radar Survey Results

Date	Sunset	Sunrise	Passage rate	Flight Direction	Flight Height (m)	% below 152 m	Temperature (C)	Wind Speed (m/s)	Wind Direction (degrees)
9/7	19:07	6:08	1616	287	303	25%	16	7	252
9/8	19:05	6:09	1212	209	403	16%	13	6	245
9/12	18:58	6:14	686	307	274	26%	8	8	334
9/14	18:54	6:16	689	191	318	19%	10	5	140
9/15	18:52	6:17	539	206	456	15%	8	5	189
9/17	18:48	6:20	938	213	450	10%	7	7	302
9/18	18:46	6:21	615	344	229	30%	10	7	302
9/20	18:42	6:23	677	206	443	11%	6	5	335
9/21	18:40	6:24	481	358	232	30%	13	6	224
9/22	18:39	6:26	496	205	293	25%	12	6	338
9/23	18:37	6:27	962	241	254	38%	9	7	322
9/24	18:35	6:28	353	25	256	23%	15	8	234
9/26	18:31	6:30	522	281	249	37%	8	5	206
9/29	18:25	6:34	2463	237	227	35%	14	4	144
10/2	18:20	6:38	1509	202	533	11%	4	3	217
10/5	18:14	6:42	662	246	427	16%	10	7	324
10/7	18:10	6:44	194	169	392	15%	7	4	46
10/8	18:08	6:45	322	188	383	21%	5	7	77
10/12	18:01	6:50	210	199	524	10%	5	9	304
10/13	17:59	6:52	1063	243	399	23%	3	7	295
Entire Season			**803**	**234**	**378**	**20%**	**9**	**6**	**241**

Appendix A Table 1. Survey dates, results, level of effort, and weather - Bingham Wind Project, Fall 2010

Appendix A Table 2. Summary of passage rates by hour, night, and for entire season - Bingham Wind Project, Fall 2010																
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	Mean	Median	Stdev	SE
9/7	1521	2079	1986	1843	2321	2664	1957	811	421	Rain	554	N/A	1616	1900	769	243
9/8	329	1611	1496	1786	1739	1261	996	1504	1168	943	504	N/A	1212	1261	483	146
9/12	25	1182	1171	789	889	568	404	489	554	711	764	N/A	686	711	336	101
9/14	1149	1371	1393	1143	1093	604	457	200	236	332	271	21	689	530	504	145
9/15	229	868	982	1129	886	779	525	525	246	129	168	7	539	525	382	110
9/17	468	1175	1082	1239	1021	1107	1196	1200	1154	946	646	21	938	1095	373	108
9/18	450	968	1554	1129	882	400	525	436	257	196	404	186	615	443	425	123
9/20	100	893	1511	1082	1221	1164	621	486	561	275	171	39	677	591	491	142
9/21	424	679	686	961	807	586	364	343	293	311	204	118	481	394	259	75
9/22	164	250	268	346	482	1032	939	871	693	454	271	179	496	400	311	90
9/23	300	1025	1357	1346	1279	1175	1057	504	618	Rain	Rain	Rain	962	1057	392	131
9/24	282	343	296	304	357	261	325	356	468	532	461	246	353	334	90	26
9/26	75	118	207	532	1004	879	682	689	543	589	571	379	522	557	287	83
9/29	836	2018	2418	2879	2382	2532	3732	3600	3543	2614	2314	689	2463	2475	967	279
10/2	604	2218	2757	2346	2179	1768	1564	1379	1304	1068	689	229	1509	1471	778	225
10/5	375	586	682	696	868	750	1129	929	729	661	282	261	662	689	259	75
10/7	N/A	136	196	236	346	350	271	221	161	64	36	118	194	196	104	31
10/8	193	232	236	282	361	536	593	554	325	264	168	118	322	273	159	46
10/12	100	136	189	300	343	318	286	171	164	139	239	129	210	180	84	24
10/13	121	396	707	579	811	911	1482	1829	1457	1529	1500	1439	1063	1175	543	157
Entire Season	**408**	**914**	**1059**	**1047**	**1064**	**982**	**955**	**855**	**745**	**653**	**538**	**261**	**803**	**586**	**697**	**46**
N/A indicates no data for that hour																

Appendix A Table 3. Mean Nightly Flight Direction - Bingham Wind Project, Fall 2010		
Night of	Mean Flight Direction	Circular Stdev
9/7	287	43
9/8	209	44
9/12	307	62
9/14	191	44
9/15	206	35
9/17	213	40
9/18	344	44
9/20	206	33
9/21	358	39
9/22	205	45
9/23	241	40
9/24	25	52
9/26	281	38
9/29	237	54
10/2	202	32
10/5	246	34
10/7	169	31
10/8	188	37
10/12	199	27
10/13	243	32
Entire Season	**234**	**62**

Appendix A Table 4. Summary of mean flight heights by hour, night, and for entire season - Bingham Wind Project, Fall 2010																		
Night of	Mean Flight Height (m) by hour after sunset												Entire Night				# of targets below 152 meters	% of targets below 152 meters
	1	2	3	4	5	6	7	8	9	10	11	12	Mean	Median	STDV	SE		
9/7	270	330	280	302	286	277	305	319	343	Rain	313	N/A	303	266	197	62	752	25%
9/8	313	452	441	406	407	388	395	333	364	425	393	N/A	403	369	240	72	649	16%
9/12	231	316	276	237	263	277	277	276	293	280	255	330	274	238	181	52	559	26%
9/14	301	333	337	327	298	338	320	296	314	297	272	231	318	281	190	55	619	19%
9/15	263	298	429	518	573	571	427	363	361	268	252	291	456	390	293	85	383	15%
9/17	340	548	511	522	495	453	429	368	310	289	253	319	450	419	244	70	724	10%
9/18	233	238	222	207	219	243	222	235	250	285	220	340	229	204	140	40	607	30%
9/20	238	471	508	416	426	408	449	471	504	417	403	512	443	422	249	72	464	11%
9/21	232	238	240	242	232	266	218	197	228	210	214	233	232	207	135	39	246	30%
9/22	180	244	231	282	244	250	350	352	284	283	274	284	293	253	189	55	452	25%
9/23	197	284	304	297	240	216	188	Rain	Rain	Rain	Rain	Rain	254	185	207	78	490	38%
9/24	238	289	311	270	285	266	231	224	197	201	220	279	256	241	131	38	570	23%
9/26	353	438	372	283	280	269	212	208	182	134	174	202	249	199	191	55	748	37%
9/29	250	265	265	267	224	209	193	191	193	201	220	245	227	195	151	44	2058	35%
10/2	284	413	479	526	635	624	593	558	563	521	451	388	533	504	305	88	843	11%
10/5	215	274	470	503	487	480	443	422	369	360	378	340	427	379	264	76	669	16%
10/7	N/A	346	336	382	416	453	394	339	417	348	486	429	392	345	243	73	133	15%
10/8	247	299	339	421	425	413	410	375	392	344	288	280	383	328	257	74	279	21%
10/12	198	385	504	601	594	635	483	487	486	492	451	424	524	501	309	89	105	10%
10/13	215	296	428	478	612	527	343	335	341	347	367	274	399	310	309	89	1099	23%
Entire Season	**252**	**338**	**364**	**374**	**382**	**378**	**344**	**334**	**336**	**317**	**310**	**318**	**378**	**312**	**260**	**1**	**12449**	**20%**
N/A indicates no data for that hour																		

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

Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Reference
Fall 2004									
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.
Casselman, Somerset Cty, PA	30	n/a	Forested ridge	174	n/a	n/a	436	(125 m) 7%	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
Dans Mountain, Allegany Cty, MD	34	318	Forested ridge	188	2-633	193	542	(125 m) 11%	Woodlot Alternatives, Inc. 2004. A Fall 2004 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Dan's Mountain Wind Project in Frostburg, Maryland. Prepared for US Wind Force.
Prattsburgh, Steuben Cty, NY	30	315	Agricultural plateau	193	12-474	188	516	(125 m) 3%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Windfarm Prattsburgh Project in Prattsburgh, New York. Prepared for UPC Wind Management, LLC.
Franklin, Pendleton Cty, WV	34	349	Forested ridge	229	7-926	175	583	(125 m) 8%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Liberty Gap Wind Project in Franklin, West Virginia. Prepared for US Wind Force, LLC.
Fall 2005									
Dairy Hills, Clinton Cty, NY	57	n/a	Agricultural plateau	64	n/a	180	466	(n/a) 10%	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
Perry, Wyoming Cty, NY	n/a	n/a	Agricultural plateau	64	n/a	180	466	(125 m) 10%	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
Alabama, Genesee Cty, NY	59	n/a	Agricultural plateau	67	n/a	219	489	(125 m) 11%	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
Alabama, Genesee Cty, NY	40	n/a	Agricultural plateau	111	n/a	35	413	(125 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
Churubusco, Clinton Cty, NY	38	414	Great Lakes plain/ADK foothills	152	9-429	193	438	(120 m) 5%	Woodlot Alternatives, Inc. 2005. A Fall Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Marble River Wind Project in Clinton and Ellenburg, New York. Prepared for AES Corporation.
Maple Ridge, Lewis Cty, NY	57	n/a	Agricultural plateau	158	n/a	195	415	(125 m) 8%	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
Swallow Farm, PA	58	n/a	Forested ridge	166	n/a	n/a	402	(125 m) 5%	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	36	347	Agricultural plateau	197	43-529	213	422	(120 m) 3%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Radar Survey of Bird Migration at the Proposed High Sheldon Wind Project in Sheldon, New York. Prepared for Invenergy.
Ellenberg, Clinton Cty, NY	57	n/a	Great Lakes plain/ADK foothills	197	n/a	162	333	(125 m) 12%	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
Prattsburgh-Italy, NY	41	n/a	Agricultural plateau	200	n/a	177	365	(125 m) 9%	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
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.
Fayette Cty, PA	26	n/a	Forested ridge	297	n/a	n/a	426	(125 m) 5%	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
Stamford, Delaware Cty, NY	48	418	Forested ridge	315	22-784	251	494	(110 m) 3%	Woodlot Alternatives, Inc. 2007. A Spring and Fall 2005 Radar and Acoustic Survey of Bird Migration at the Proposed Moresville Energy Center in Stamford and Roxbury, New York. Prepared for Invenergy, LLC. Rockville, MD.
Preston Cty, WV	26	n/a	Forested ridge	379	n/a	n/a	420	(125 m) 10%	Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2006 A radar and visual study of nocturnal bird and bat migration at the proposed Preston Wind Development project, Virginia, Fall 2005. Report to Highland New Wind Development, LLC.
Jordanville, Herkimer Cty, NY	38	404	Agricultural plateau	380	26-1019	208	440	(125 m) 6%	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
Highland, VA	58	n/a	Forested ridge	385	n/a	n/a	442	(125 m) 12%	Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2006 A radar and visual study of nocturnal bird and bat migration at the proposed Highland New Wind Development project, Virginia, Fall 2005. Report to Highland New Wind Development, LLC.
Clayton, Jefferson Cty, NY	37	385	Agricultural plateau	418	83-877	168	475	(150 m) 10%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Clayton Wind Project in Clayton, New York. Prepared for PPM Atlantic Renewable.
Bliss, Wyoming Cty, NY	8	n/a	Agricultural plateau	440	52-1392	n/a	411	(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
Kibby, Franklin Cty, ME (Valley)	5	13	Forested ridge	452	52-995	193	391	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Mars Hill, Aroostook Cty, ME	18	117	Forested ridge	512	60-1092	228	424	(120 m) 8%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird Migration at the Mars Hill Wind Farm in Mars Hill, Maine. Prepared for Evergreen Windpower, LLC.
Howard, Steuben Cty, NY	39	405	Agricultural plateau	481	18-1434	185	491	(125 m) 5%	Woodlot Alternatives, Inc. 20065 A Fall 2005 Survey of Bird and Bat Migration at the Proposed Howard Wind Power Project in Howard, New York. Prepared for Everpower Global.
Deerfield, Bennington Cty, VT	32	324	Forested ridge	559	3-1736	221	395	(100 m) 13%	Woodlot Alternatives, Inc. 2006. Fall 2005 Bird and Bat Migration Surveys at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy, Inc.
Kibby, Franklin Cty, ME (Mountain)	12	115	Forested ridge	565	109-1107	167	370	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Fairfield, Herkimer Cty, NY	38	423	Agricultural plateau	691	116-1351	198	516	(145 m) 6%[1]	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar Survey of Bird and Bat Migration at the Proposed Top Notch Wind Project in Fairfield, New York. Prepared for PPM Atlantic Renewable.
Munnsville, Madison Cty, NY	31	292	Agricultural plateau	732	15-1671	223	644	(118 m) 2%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Munnsville Wind Project in Munnsville, New York. Prepared for AES-EHN NY Wind, LLC.
Fall 2006									
Villenova, Chautauqua Cty, NY	36	n/a	Great Lakes plain	189	16-604	216	353	(120 m) 9%	Stantec Consulting Services Inc. 2008. A Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Ball Hill Windpark in Villenova and Hanover, New York. Prepared for Noble Environmental Power, LLC and Ecology and Environment.
Wethersfield, Wyoming Cty, NY	56	n/a	Agricultural plateau	256	31-701	208	344	(125 m) 11%	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
Centerville, Allegany Cty, NY	57	n/a	Agricultural plateau	259	12-877	208	350	(125 m) 12%	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
Somerset Cty, PA	29	n/a	Forested ridge	316	n/a	n/a	374	(125 m) 8%	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
Cape Vincent, Jefferson Cty, NY	63	508	Great Lakes plain	346	n/a	209	490	(125 m) 8%	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
Bedford Cty, PA	29	n/a	Forested ridge	438	n/a	n/a	379	(125 m) 10%	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
Stetson, Washington Cty, ME	12	77	Forested ridge	476	131-1192	227	378	(125 m) 13%	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Stetson Wind Project, Washington County, Maine. Prepared for Evergreen Wind V, LLC.
Dutch Hill, Steuben Cty, NY	21	n/a	Agricultural plateau	535	n/a	215	358	(125 m) 11%	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
Lempster, Sullivan Cty, NH	32	290	Forested ridge	620	133-1609	206	387	(125 m) 8%	Woodlot Alternatives, Inc. 2007. A Fall 2007 Survey of Nocturnal Bird Migration, Breeding Birds, and Bicknell's Thrush at the Proposed Lempster Mountain Wind Power Project Lempster, New Hampshire. Prepared for Lempster Wind, LLC.
Chateaugay, Franklin Cty, NY	35	327	Agricultural plateau	643	38-1373	212	431	(120 m) 8%	Woodlot Alternatives, Inc. 2006. Fall 2006 Radar Surveys at the Proposed Chateaugay Windpark in Chateaugay, New York. Prepared for Ecology and Environment, Inc. and Noble Power, LLC.
Fall 2007									
New Grange, Chautauqua Cty, NY	57	n/a	Great Lakes plain	112	n/a	208	458	(125 m) 10%	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	212	Forested ridge	321	76-513	209	533	(130 m) 6%	Stantec Consulting Services Inc. 2007. A Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Laurel Mountain Wind Energy Project near Elkins, West Virginia. Prepared for AES Laurel Mountain, LLC.
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.
Rollins, Lincoln, Penobscot Cty, ME	22	231	Forested ridge	368	82-953	284	343	(120 m) 13%	Woodlot Alternatives, Inc. 2008. A Fall 2007 Survey of Bird and Bat Migration at the Rollins Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
Roxbury, Oxford Cty, ME	20	220	Forested ridge	420	88-1006	227	365	(130 m) 14%	Woodlot Alternatives, Inc. 2007. A Fall 2007 Survey of Bird and Bat Migration at the Record Hill Wind Project, Roxbury, Maine. Prepared for Roxbury Hill Wind LLC.
Allegany, Cattaraugus Cty, NY	46	n/a	Forested ridge	451	n/a	230	382	(150 m) 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
New Creek, Grant Cty, WV	20	n/a	Forested ridge	811	263-1683	231	360	(130 m) 17%	Stantec Consulting Services Inc. 2008. A Fall 2007 Survey of Bird and Bat Migration at the New Creek Wind Project, West Virginia. Prepared for AES New Creek, LLC.
Wolfe Island, Ontario, Canada[2]	n/a	n/a	Great Lakes island	n/a	n/a	95	233	(125m) 23%	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									
Hounsfield, Jefferson Cty, NY	60	674	Great Lakes island	281	64-835	207	298	(125 m) 17%	Stantec Consulting Services Inc. 2008. A Fall 2008 Survey of Bird Migration at the Hounsfield Wind Project, New York. Prepared for American Consulting Professionals of New York, PLLC.
Georgia Mountain, VT	21	n/a	Forested ridge	326	56-700	230	371	(120 m) 7%	Stantec Consulting Services Inc. 2008. A Fall 2008 Survey of Bird Migration at the Georgia Mountain Wind Project, Vermont. Prepared for Georgia Mountain Community Wind.
Oakfield, Penobscot Cty, ME	20	n/a	Forested ridge	501	116-945	200	309	(125 m) 18%	Woodlot Alternatives, Inc. 2008. A Fall 2008 Survey of Bird and Bat Migration at the Oakfield Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
Tenney, Grafton Cty, NH	45	509	Forested ridge	470	94-1174	260	342	(125m) 13%	Stantec Consulting Services Inc. 2008. Fall 2008 Radar Survey Report for the Groton Wind Project. Prepared for Groton Wind, LLC.
Highland, Somerset Cty, ME	20	216	Forested ridge	549	68-1201	227	348	(130.5m) 17%	Stantec Consulting. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC
Fall 2009									
Sisk (Kibby Expansion) Franklin Cty, ME	20	210	Forested ridge	458	44-1067	206	287	(125m) 23%	Stantec Consulting Services. 2009. Fall 2009 Nocturnal Migration Survey Report. Prepared for TRC Engineers LLC.
Vermont Community Wind Farm, Orleans Cty, VT	20	227	Forested ridge	443	110-1029	215	330	(130m) 15%	Stantec Consulting Services. 2009. Fall 2009 Bird and Bat Survey Report. Nocturnal Radar, Acoustic, and Diurnal Raptor Surveys performed for the Vermont Community Wind Farm Project in Rutland County, Vermont. Prepared for Vermont Community Wind Farm, LLC.
Stetson, Washington Cty, ME	18	201	Forested ridge	457	106-1746	227	420	(119m) 2%	Stantec Consulting Services. 2010. Stetson I Mountain Wind Project Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC.
Fall 2010									
Bingham, Somerset Cty, ME	20	232	Forested ridge	803	194-2463	234	378	(152m) 20%	*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.
[2] This is a Canadian project but is being included in this table due to proximity to eastern US

Appendix B

Acoustic Bat Survey Results

Appendix B Table 1. Summary of acoustic bat data and weather during each survey night at the Bessey Met High detector – Fall, 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)
06/09/10	1												**0**	9	12
06/10/10	1												**0**	8	9
06/11/10	1												**0**	6	13
06/12/10	1				1						2		**3**	5	14
06/13/10	1												**0**	3	14
06/14/10	1			1									**1**	6	10
06/15/10	1												**0**	2	12
06/16/10	1										1		**1**	4	12
06/17/10	1												**0**	8	17
06/18/10	1												**0**	7	20
06/19/10	1												**0**	5	19
06/20/10	1					1							**1**	8	17
06/21/10	1												**0**	6	15
06/22/10	1												**0**	6	16
06/23/10	1												**0**	6	16
06/24/10	1	1											**1**	6	15
06/25/10	1												**0**	5	15
06/26/10	1												**0**	5	14
06/27/10	1												**0**	7	16
06/28/10	1												**0**	5	16
06/29/10	1												**0**	5	12
06/30/10	1												**0**	5	10
07/01/10	1												**0**	3	11
07/02/10	1												**0**	7	16
07/03/10	1				1								**1**	5	21
07/04/10	1												**0**	7	22
07/05/10	1	1											**1**	5	25
07/06/10	1												**0**	7	23
07/07/10	1												**0**	5	21
07/08/10	1												**0**	6	20
07/09/10	0												**0**	4	21
07/10/10	0												**0**	6	19
07/11/10	0												**0**	5	19
07/12/10	0												**0**	7	19
07/13/10	0												**0**	4	20
07/14/10	0												**0**	3	19
07/15/10	0												**0**	5	19
07/16/10	0												**0**	4	20
07/17/10	0												**0**	3	20
07/18/10	0												**0**	6	18
07/19/10	0												**0**	6	17
07/20/10	0												**0**	6	17
07/21/10	0										1		**1**	5	17
07/22/10	1												**0**	6	16
07/23/10	1												**0**	5	18
07/24/10	1				1								**1**	6	17
07/25/10	1					2				1	2		**5**	6	15
07/26/10	1												**0**	4	16
07/27/10	1												**0**	6	20
07/28/10	1												**0**	9	22
07/29/10	1					1					2		**3**	8	12
07/30/10	1												**0**	6	11
07/31/10	1					1							**1**	6	15
08/01/10	1									1			**1**	6	15
08/02/10	1												**0**	5	16
08/03/10	1												**0**	4	19
08/04/10	1												**0**	6	23
08/05/10	1				1								**1**	5	20
08/06/10	1												**0**	5	10
08/07/10	1												**0**	6	12
08/08/10	1												**0**	6	18
08/09/10	1												**0**	5	18
08/10/10	1					1				1			**2**	5	15
08/11/10	1												**0**	6	13
08/12/10	1				1								**1**	6	14
08/13/10	1					1							**1**	6	16
08/14/10	1												**0**	4	15
08/15/10	1												**0**	3	15
08/16/10	1												**0**	5	18
08/17/10	1												**0**	6	17
08/18/10	1			1									**1**	7	16
08/19/10	1									1	2		**3**	4	16
08/20/10	1												**0**	6	12
08/21/10	1												**0**	3	15
08/22/10	1												**0**	8	14
08/23/10	1												**0**	6	14
08/24/10	1												**0**	4	14
08/25/10	1												**0**	5	14
08/26/10	1												**0**	5	14
08/27/10	1												**0**	4	13
08/28/10	1												**0**	6	18
08/29/10	1										1		**1**	7	20
08/30/10	1												**0**	7	21
08/31/10	1												**0**	7	23
09/01/10	1				1					1			**2**	8	23
09/02/10	1				1						1		**2**	7	22
09/03/10	1												**0**	8	20
09/04/10	1												**0**	6	13
09/05/10	1												**0**	4	10
09/06/10	1												**0**	4	15
09/07/10	1				1								**1**	7	16
09/08/10	1												**0**	6	13
09/09/10	1												**0**	7	9
09/10/10	1												**0**	6	10
09/11/10	1												**0**	5	10
09/12/10	1												**0**	8	8
09/13/10	1												**0**	8	11
09/14/10	1												**0**	5	10
09/15/10	1												**0**	5	8
09/16/10	1				1								**1**	4	9
09/17/10	1												**0**	7	7
09/18/10	1										1		**1**	7	10
09/19/10	1												**0**	5	8
09/20/10	1												**0**	5	6
09/21/10	1												**0**	6	13
09/22/10	1												**0**	6	12
09/23/10	1												**0**	7	9
09/24/10	1												**0**	8	15
09/25/10	1												**0**	8	10
09/26/10	1												**0**	5	8
09/27/10	1												**0**	7	12
09/28/10	1												**0**	6	19
09/29/10	1										1		**1**	4	14
09/30/10	1												**0**	6	20
10/01/10	1												**0**	8	10
10/02/10	1												**0**	3	4
10/03/10	1												**0**	11	5
10/04/10	1												**0**	9	6
10/05/10	1												**0**	7	10
10/06/10	1												**0**	6	8
10/07/10	1												**0**	4	7
10/08/10	1												**0**	7	5
10/09/10	1												**0**	6	3
10/10/10	1												**0**	10	7
10/11/10	1												**0**	8	3
10/12/10	1												**0**	9	5
10/13/10	1			1									**1**	7	3
10/14/10	1												**0**	5	6
10/15/10	1												**0**	8	6
10/16/10	1												**0**	4	5
10/17/10	1												**0**	7	4
10/18/10	1												**0**	7	1
10/19/10	1												**0**	9	4
10/20/10	1												**0**	8	6
10/21/10	1												**0**	6	1
10/22/10	1												**0**	7	0
10/23/10	1												**0**	6	-1
10/24/10	1												**0**	10	2
10/25/10	1									1			**1**	13	8
10/26/10	1												**0**	7	11
10/27/10	1												**0**	4	12
10/28/10	1												**0**	3	6
10/29/10	1												**0**	6	0
10/30/10	1												**0**	6	-1
10/31/10	1												**0**	8	-3
By Species		**2**	**0**	**3**	**9**	**7**	**0**	**0**	**0**	**6**	**14**	**0**	**41**		
By Guild			**5**		**9**	**7**		**0**			**20**				
			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 Bessey Met Low detector – Fall, 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)
06/09/10	1					1							**1**	9	12
06/10/10	1										1		**1**	8	9
06/11/10	1				1								**1**	6	13
06/12/10	1										1		**1**	5	14
06/13/10	1				1								**1**	3	14
06/14/10	1										1		**1**	6	10
06/15/10	1										2		**2**	2	12
06/16/10	1												**0**	4	12
06/17/10	1					1							**1**	8	17
06/18/10	1				1								**1**	7	20
06/19/10	1												**0**	5	19
06/20/10	1												**0**	8	17
06/21/10	1					2							**2**	6	15
06/22/10	1												**0**	6	16
06/23/10	1												**0**	6	16
06/24/10	1										1		**1**	6	15
06/25/10	1				1								**1**	5	15
06/26/10	1					1							**1**	5	14
06/27/10	1												**0**	7	16
06/28/10	1												**0**	5	16
06/29/10	1												**0**	5	12
06/30/10	1												**0**	5	10
07/01/10	1												**0**	3	11
07/02/10	1												**0**	7	16
07/03/10	1												**0**	5	21
07/04/10	1												**0**	7	22
07/05/10	1												**0**	5	25
07/06/10	1												**0**	7	23
07/07/10	1	1											**1**	5	21
07/08/10	1												**0**	6	20
07/09/10	1												**0**	4	21
07/10/10	1									1			**1**	6	19
07/11/10	1										1		**1**	5	19
07/12/10	1				2	1					1		**4**	7	19
07/13/10	1												**0**	4	20
07/14/10	1									1			**1**	3	19
07/15/10	1									1			**1**	5	19
07/16/10	1					1				2	1		**4**	4	20
07/17/10	1					1					1		**2**	3	20
07/18/10	1												**0**	6	18
07/19/10	1					1				2			**3**	6	17
07/20/10	1					2							**2**	6	17
07/21/10	1				1						1		**2**	5	17
07/22/10	1					1							**1**	6	16
07/23/10	1												**0**	5	18
07/24/10	1												**0**	6	17
07/25/10	1												**0**	6	15
07/26/10	1					2				1			**3**	4	16
07/27/10	1					1							**1**	6	20
07/28/10	1												**0**	9	22
07/29/10	1												**0**	8	12
07/30/10	1												**0**	6	11
07/31/10	1												**0**	6	15
08/01/10	1					1							**1**	6	15
08/02/10	1												**0**	5	16
08/03/10	1												**0**	4	19
08/04/10	1	3											**3**	6	23
08/05/10	1	1			1						2		**4**	5	20
08/06/10	1					1							**1**	5	10
08/07/10	1				1								**1**	6	12
08/08/10	1					1							**1**	6	18
08/09/10	1									1			**1**	5	18
08/10/10	1												**0**	5	15
08/11/10	1					2							**2**	6	13
08/12/10	1				1					1	1		**3**	6	14
08/13/10	1										1		**1**	6	16
08/14/10	1				2						1		**3**	4	15
08/15/10	1												**0**	3	15
08/16/10	1												**0**	5	18
08/17/10	1												**0**	6	17
08/18/10	1					1							**1**	7	16
08/19/10	1					1					1		**2**	4	16
08/20/10	1					1							**1**	6	12
08/21/10	1									1			**1**	3	15
08/22/10	1										1		**1**	8	14
08/23/10	1									1			**1**	6	14
08/24/10	1												**0**	4	14
08/25/10	1												**0**	5	14
08/26/10	1	1											**1**	5	14
08/27/10	1												**0**	4	13
08/28/10	1												**0**	6	18
08/29/10	1												**0**	7	20
08/30/10	1												**0**	7	21
08/31/10	1	1											**1**	7	23
09/01/10	1				1						1		**2**	8	23
09/02/10	1	1									1		**2**	7	22
09/03/10	1												**0**	8	20
09/04/10	1												**0**	6	13
09/05/10	1									1			**1**	4	10
09/06/10	1												**0**	4	15
09/07/10	1				2								**2**	7	16
09/08/10	1												**0**	6	13
09/09/10	1												**0**	7	9
09/10/10	1												**0**	6	10
09/11/10	1												**0**	5	10
09/12/10	1									1			**1**	8	8
09/13/10	1												**0**	8	11
09/14/10	1	1											**1**	5	10
09/15/10	1					1							**1**	5	8
09/16/10	1												**0**	4	9
09/17/10	1												**0**	7	7
09/18/10	1												**0**	7	10
09/19/10	1												**0**	5	8
09/20/10	1												**0**	5	6
09/21/10	1					1							**1**	6	13
09/22/10	1		1							1	1		**3**	6	12
09/23/10	1												**0**	7	9
09/24/10	1										4		**4**	8	15
09/25/10	1												**0**	8	10
09/26/10	1												**0**	5	8
09/27/10	1												**0**	7	12
09/28/10	1												**0**	6	19
09/29/10	1										1		**1**	4	14
09/30/10	1												**0**	6	20
10/01/10	1												**0**	8	10
10/02/10	1												**0**	3	4
10/03/10	1												**0**	11	5
10/04/10	1												**0**	9	6
10/05/10	1												**0**	7	10
10/06/10	1												**0**	6	8
10/07/10	1												**0**	4	7
10/08/10	1												**0**	7	5
10/09/10	1												**0**	6	3
10/10/10	1												**0**	10	7
10/11/10	1												**0**	8	3
10/12/10	1												**0**	9	5
10/13/10	1												**0**	7	3
10/14/10	1												**0**	5	6
10/15/10	1												**0**	8	6
10/16/10	1												**0**	4	5
10/17/10	1												**0**	7	4
10/18/10	1												**0**	7	1
10/19/10	1												**0**	9	4
10/20/10	1												**0**	8	6
10/21/10	1												**0**	6	1
10/22/10	1												**0**	7	0
10/23/10	1												**0**	6	-1
10/24/10	1												**0**	10	2
10/25/10	1												**0**	13	8
10/26/10	1												**0**	7	11
10/27/10	1												**0**	4	12
10/28/10	1												**0**	3	6
10/29/10	1												**0**	6	0
10/30/10	1												**0**	6	-1
10/31/10	1												**0**	8	-3
By Species		**9**	**1**	**0**	**15**	**25**	**0**	**0**	**0**	**15**	**26**	**0**	**91**		
By Guild		**10**			**15**	**25**	**0**			**41**					
		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 3. Summary of acoustic bat data and weather during each survey night at the Bigelow Ridge detector – Fall, 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)
06/03/10	1					6				2			**8**	7	13
06/04/10	1					6				7			**13**	5	15
06/05/10	1					12				4			**16**	4	14
06/06/10	1												**0**	4	10
06/07/10	1					1				1			**2**	4	8
06/08/10	1												**0**	6	8
06/09/10	1					10				4	1		**15**	9	12
06/10/10	1					2							**2**	8	9
06/11/10	1					1					1		**2**	6	13
06/12/10	1					41				11			**52**	5	14
06/13/10	1					1				2			**3**	3	14
06/14/10	1					1							**1**	6	10
06/15/10	1									2			**2**	2	12
06/16/10	1					2							**2**	4	12
06/17/10	1					4				6			**10**	8	17
06/18/10	1					6				3			**9**	7	20
06/19/10	1					1				2			**3**	5	19
06/20/10	1					6				3			**9**	8	17
06/21/10	1		1			32				12			**45**	6	15
06/22/10	1												**0**	6	16
06/23/10	1												**0**	6	16
06/24/10	1					1							**1**	6	15
06/25/10	1					12				2			**14**	5	15
06/26/10	1					16				4			**20**	5	14
06/27/10	1					2							**2**	7	16
06/28/10	1												**0**	5	16
06/29/10	1												**0**	5	12
06/30/10	1									1			**1**	5	10
07/01/10	1					1				2			**3**	3	11
07/02/10	1					28				14	1		**43**	7	16
07/03/10	1					1				3			**4**	5	21
07/04/10	1	1				4				8			**13**	7	22
07/05/10	1					1				2			**3**	5	25
07/06/10	1					2				3			**5**	7	23
07/07/10	1									2			**2**	5	21
07/08/10	1									2			**2**	6	20
07/09/10	1									1			**1**	4	21
07/10/10	1					3				3			**6**	6	19
07/11/10	1					2				9			**11**	5	19
07/12/10	1					2				5			**7**	7	19
07/13/10	1					3				2	1		**6**	4	20
07/14/10	1					8				3			**11**	3	19
07/15/10	1					2				3			**5**	5	19
07/16/10	1									3			**3**	4	20
07/17/10	1					11				15	1		**27**	3	20
07/18/10	1					1				5			**6**	6	18
07/19/10	1					7				4			**11**	6	17
07/20/10	1					28				16			**44**	6	17
07/21/10	1					8				4			**12**	5	17
07/22/10	1					10			1	9			**20**	6	16
07/23/10	1					21				9			**30**	5	18
07/24/10	1												**0**	6	17
07/25/10	1					1				2			**3**	6	15
07/26/10	1	1	1			9				4			**15**	4	16
07/27/10	1					76			1	71			**148**	6	20
07/28/10	1												**0**	9	22
07/29/10	1					10				4			**14**	8	12
07/30/10	1					2				2			**4**	6	11
07/31/10	1					22				10			**32**	6	15
08/01/10	1					6				3			**9**	6	15
08/02/10	1					3				4			**7**	5	16
08/03/10	1					10				8			**18**	4	19
08/04/10	1					25				17	1		**43**	6	23
08/05/10	1					12				7	1		**20**	5	20
08/06/10	1					1							**1**	5	10
08/07/10	1					1				6			**7**	6	12
08/08/10	1					7							**7**	6	18
08/09/10	1					11				17			**28**	5	18
08/10/10	1					4				10			**14**	5	15
08/11/10	1					9				5			**14**	6	13
08/12/10	1					6				5			**11**	6	14
08/13/10	1					6				7			**13**	6	16
08/14/10	1					3				1			**4**	4	15
08/15/10	1					3							**3**	3	15
08/16/10	1									2			**2**	5	18
08/17/10	1					7				7			**14**	6	17
08/18/10	1					6				3			**9**	7	16
08/19/10	1					4				5			**9**	4	16
08/20/10	1					2				2	1		**5**	6	12
08/21/10	1					6				2			**8**	3	15
08/22/10	1					6				5			**11**	8	14
08/23/10	1					1				6			**7**	6	14
08/24/10	1					4				3			**7**	4	14
08/25/10	1												**0**	5	14
08/26/10	1					3				1			**4**	5	14
08/27/10	1					1				1			**2**	4	13
08/28/10	1	1				16				4			**21**	6	18
08/29/10	1					6				6			**12**	7	20
08/30/10	1					30				7			**37**	7	21
08/31/10	1					11				6			**17**	7	23
09/01/10	1					10				12			**22**	8	23
09/02/10	1					51	1			25			**77**	7	22
09/03/10	1					14				4			**18**	8	20
09/04/10	1					1							**1**	6	13
09/05/10	1												**0**	4	10
09/06/10	1												**0**	4	15
09/07/10	1					11							**11**	7	16
09/08/10	1					2				4			**6**	6	13
09/09/10	1												**0**	7	9
09/10/10	1												**0**	6	10
09/11/10	1									1			**1**	5	10
09/12/10	1												**0**	8	8
09/13/10	1					1							**1**	8	11
09/14/10	1					4				2			**6**	5	10
09/15/10	1									1			**1**	5	8
09/16/10	1					1							**1**	4	9
09/17/10	1					3							**3**	7	7
09/18/10	1												**0**	7	10
09/19/10	1				1	6							**7**	5	8
09/20/10	1												**0**	5	6
09/21/10	1												**0**	6	13
09/22/10	1					3				3			**6**	6	12
09/23/10	1					1				8			**9**	7	9
09/24/10	1												**0**	8	15
09/25/10	1					5				3			**8**	8	10
09/26/10	1					1							**1**	5	8
09/27/10	1												**0**	7	12
09/28/10	1												**0**	6	19
09/29/10	1	1				2				4			**7**	4	14
09/30/10	1									1			**1**	6	20
10/01/10	1												**0**	8	10
10/02/10	1									1			**1**	3	4
10/03/10	1												**0**	11	5
10/04/10	1					3				1			**4**	9	6
10/05/10	1					2				5			**7**	7	10
10/06/10	1												**0**	6	8
10/07/10	1												**0**	4	7
10/08/10	1									1			**1**	7	5
10/09/10	1												**0**	6	3
10/10/10	1					1							**1**	10	7
10/11/10	1												**0**	8	3
10/12/10	1												**0**	9	5
10/13/10	1												**0**	7	3
10/14/10	1												**0**	5	6
10/15/10	1												**0**	8	6
10/16/10	1												**0**	4	5
10/17/10	1												**0**	7	4
10/18/10	1												**0**	7	1
10/19/10	1												**0**	9	4
10/20/10	1												**0**	8	6
10/21/10	1												**0**	6	1
10/22/10	1												**0**	7	0
10/23/10	1												**0**	6	-1
10/24/10	1												**0**	10	2
10/25/10	1												**0**	13	8
10/26/10	1												**0**	7	11
10/27/10	1												**0**	4	12
10/28/10	1												**0**	3	6
10/29/10	1												**0**	6	0
10/30/10	1												**0**	6	-1
10/31/10	1												**0**	8	-3
By Species		**4**	**2**	**0**	**1**	**758**	**1**	**0**	**2**	**512**	**8**	**0**	**1288**		
By Guild		**6**			**1**	**758**	**3**			**520**					
		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 Crockett Ridge Met High detector – Fall, 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)
06/09/10	1												**0**	9	12
06/10/10	1												**0**	8	9
06/11/10	1												**0**	6	13
06/12/10	1									1			**1**	5	14
06/13/10	1				1								**1**	3	14
06/14/10	1										1		**1**	6	10
06/15/10	1												**0**	2	12
06/16/10	1												**0**	4	12
06/17/10	1												**0**	8	17
06/18/10	1												**0**	7	20
06/19/10	1												**0**	5	19
06/20/10	1												**0**	8	17
06/21/10	1										2		**2**	6	15
06/22/10	1												**0**	6	16
06/23/10	1												**0**	6	16
06/24/10	1												**0**	6	15
06/25/10	1												**0**	5	15
06/26/10	1												**0**	5	14
06/27/10	1										1		**1**	7	16
06/28/10	1												**0**	5	16
06/29/10	1												**0**	5	12
06/30/10	1												**0**	5	10
07/01/10	1												**0**	3	11
07/02/10	1												**0**	7	16
07/03/10	1										2		**2**	5	21
07/04/10	1										1		**1**	7	22
07/05/10	1												**0**	5	25
07/06/10	1									1	1		**2**	7	23
07/07/10	1									1			**1**	5	21
07/08/10	1												**0**	6	20
07/09/10	1												**0**	4	21
07/10/10	1										1		**1**	6	19
07/11/10	1												**0**	5	19
07/12/10	1									1			**1**	7	19
07/13/10	1									1			**1**	4	20
07/14/10	1				1					2			**3**	3	19
07/15/10	1												**0**	5	19
07/16/10	1												**0**	4	20
07/17/10	1				1						1		**2**	3	20
07/18/10	1												**0**	6	18
07/19/10	1	1			1						2		**4**	6	17
07/20/10	1												**0**	6	17
07/21/10	1				1								**1**	5	17
07/22/10	1												**0**	6	16
07/23/10	1												**0**	5	18
07/24/10	1												**0**	6	17
07/25/10	1									1			**1**	6	15
07/26/10	1												**0**	4	16
07/27/10	1												**0**	6	20
07/28/10	1				1								**1**	9	22
07/29/10	1												**0**	8	12
07/30/10	1												**0**	6	11
07/31/10	1												**0**	6	15
08/01/10	1					1							**1**	6	15
08/02/10	1										1		**1**	5	16
08/03/10	1				1								**1**	4	19
08/04/10	1									1			**1**	6	23
08/05/10	1				1						1		**2**	5	20
08/06/10	1												**0**	5	10
08/07/10	1												**0**	6	12
08/08/10	1												**0**	6	18
08/09/10	1										1		**1**	5	18
08/10/10	1												**0**	5	15
08/11/10	1					2							**2**	6	13
08/12/10	1									1			**1**	6	14
08/13/10	1						1						**1**	6	16
08/14/10	1										1		**1**	4	15
08/15/10	1												**0**	3	15
08/16/10	1												**0**	5	18
08/17/10	1												**0**	6	17
08/18/10	1				1								**1**	7	16
08/19/10	1					2					1		**3**	4	16
08/20/10	1					1							**1**	6	12
08/21/10	1										1		**1**	3	15
08/22/10	1				1						2		**3**	8	14
08/23/10	1												**0**	6	14
08/24/10	1												**0**	4	14
08/25/10	1												**0**	5	14
08/26/10	1				1								**1**	5	14
08/27/10	1												**0**	4	13
08/28/10	1									1			**1**	6	18
08/29/10	1												**0**	7	20
08/30/10	1												**0**	7	21
08/31/10	1												**0**	7	23
09/01/10	1			2						1			**3**	8	23
09/02/10	1										2		**2**	7	22
09/03/10	1												**0**	8	20
09/04/10	1												**0**	6	13
09/05/10	1												**0**	4	10
09/06/10	1												**0**	4	15
09/07/10	1												**0**	7	16
09/08/10	1									1			**1**	6	13
09/09/10	1												**0**	7	9
09/10/10	1												**0**	6	10
09/11/10	1												**0**	5	10
09/12/10	1										1		**1**	8	8
09/13/10	1												**0**	8	11
09/14/10	1												**0**	5	10
09/15/10	1												**0**	5	8
09/16/10	1												**0**	4	9
09/17/10	1												**0**	7	7
09/18/10	1										1		**1**	7	10
09/19/10	1												**0**	5	8
09/20/10	1												**0**	5	6
09/21/10	1												**0**	6	13
09/22/10	1												**0**	6	12
09/23/10	1												**0**	7	9
09/24/10	1												**0**	8	15
09/25/10	1												**0**	8	10
09/26/10	1												**0**	5	8
09/27/10	1												**0**	7	12
09/28/10	1												**0**	6	19
09/29/10	1												**0**	4	14
09/30/10	1												**0**	6	20
10/01/10	1												**0**	8	10
10/02/10	1												**0**	3	4
10/03/10	1												**0**	11	5
10/04/10	1												**0**	9	6
10/05/10	1									1			**1**	7	10
10/06/10	1												**0**	6	8
10/07/10	1												**0**	4	7
10/08/10	1												**0**	7	5
10/09/10	1												**0**	6	3
10/10/10	1												**0**	10	7
10/11/10	1												**0**	8	3
10/12/10	1												**0**	9	5
10/13/10	1												**0**	7	3
10/14/10	1												**0**	5	6
10/15/10	1												**0**	8	6
10/16/10	1												**0**	4	5
10/17/10	1												**0**	7	4
10/18/10	1												**0**	7	1
10/19/10	1												**0**	9	4
10/20/10	1												**0**	8	6
10/21/10	1												**0**	6	1
10/22/10	1												**0**	7	0
10/23/10	1												**0**	6	-1
10/24/10	1												**0**	10	2
10/25/10	1												**0**	13	8
10/26/10	1												**0**	7	11
10/27/10	1												**0**	4	12
10/28/10	1												**0**	3	6
10/29/10	1												**0**	6	0
10/30/10	1												**0**	6	-1
10/31/10	1												**0**	8	-3
By Species		**1**	**0**	**2**	**11**	**6**	**1**	**0**	**0**	**14**	**24**	**0**	**59**		
By Guild		**3**			**11**	**6**	**1**			**38**					
		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 5. Summary of acoustic bat data and weather during each survey night at the Crocket Met Low detector – Fall, 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)
06/09/10	1												**0**	9	12
06/10/10	1												**0**	8	9
06/11/10	1												**0**	6	13
06/12/10	1												**0**	5	14
06/13/10	1												**0**	3	14
06/14/10	1									1			**1**	6	10
06/15/10	1												**0**	2	12
06/16/10	1												**0**	4	12
06/17/10	1					1							**1**	8	17
06/18/10	1												**0**	7	20
06/19/10	1												**0**	5	19
06/20/10	1					1							**1**	8	17
06/21/10	1					1							**1**	6	15
06/22/10	1					2							**2**	6	16
06/23/10	1												**0**	6	16
06/24/10	1												**0**	6	15
06/25/10	1					1							**1**	5	15
06/26/10	1				1								**1**	5	14
06/27/10	1									1	2		**3**	7	16
06/28/10	1												**0**	5	16
06/29/10	1												**0**	5	12
06/30/10	1												**0**	5	10
07/01/10	1												**0**	3	11
07/02/10	1												**0**	7	16
07/03/10	1										1		**1**	5	21
07/04/10	1					1							**1**	7	22
07/05/10	1												**0**	5	25
07/06/10	1										2		**2**	7	23
07/07/10	1										1		**1**	5	21
07/08/10	1					1							**1**	6	20
07/09/10	1					1				1			**2**	4	21
07/10/10	1												**0**	6	19
07/11/10	1		1			1							**2**	5	19
07/12/10	1									1	1		**2**	7	19
07/13/10	1									1			**1**	4	20
07/14/10	1												**0**	3	19
07/15/10	1		1			1							**2**	5	19
07/16/10	1												**0**	4	20
07/17/10	1				1	1				1	1		**4**	3	20
07/18/10	1												**0**	6	18
07/19/10	1				1						1		**2**	6	17
07/20/10	1					2				1	2		**5**	6	17
07/21/10	1				1								**1**	5	17
07/22/10	1												**0**	6	16
07/23/10	1					1			1	2			**4**	5	18
07/24/10	1					1							**1**	6	17
07/25/10	1					2	1						**3**	6	15
07/26/10	1												**0**	4	16
07/27/10	1	1				1				1	1		**4**	6	20
07/28/10	1				1	1							**2**	9	22
07/29/10	1									1			**1**	8	12
07/30/10	1												**0**	6	11
07/31/10	1					2							**2**	6	15
08/01/10	1									1			**1**	6	15
08/02/10	1					1					1		**2**	5	16
08/03/10	1				1								**1**	4	19
08/04/10	1					3	1			2	1		**7**	6	23
08/05/10	1			1	1						1		**3**	5	20
08/06/10	1												**0**	5	10
08/07/10	1												**0**	6	12
08/08/10	1					2				1			**3**	6	18
08/09/10	1				1		1				1		**3**	5	18
08/10/10	1												**0**	5	15
08/11/10	1		1			1				1	1		**4**	6	13
08/12/10	1					1							**1**	6	14
08/13/10	1												**0**	6	16
08/14/10	1										1		**1**	4	15
08/15/10	1												**0**	3	15
08/16/10	1										1		**1**	5	18
08/17/10	1									1	1		**2**	6	17
08/18/10	1				1			1		1			**3**	7	16
08/19/10	1										1		**1**	4	16
08/20/10	1												**0**	6	12
08/21/10	1												**0**	3	15
08/22/10	1					1							**1**	8	14
08/23/10	1									1			**1**	6	14
08/24/10	1					2							**2**	4	14
08/25/10	1					1							**1**	5	14
08/26/10	1	2											**2**	5	14
08/27/10	1												**0**	4	13
08/28/10	1					2							**2**	6	18
08/29/10	1					1							**1**	7	20
08/30/10	1												**0**	7	21
08/31/10	1												**0**	7	23
09/01/10	1	1				2					1		**4**	8	23
09/02/10	1			1		1				1			**3**	7	22
09/03/10	1									1			**1**	8	20
09/04/10	1				1	1							**2**	6	13
09/05/10	1												**0**	4	10
09/06/10	1												**0**	4	15
09/07/10	1												**0**	7	16
09/08/10	1												**0**	6	13
09/09/10	1												**0**	7	9
09/10/10	1												**0**	6	10
09/11/10	1												**0**	5	10
09/12/10	1										1		**1**	8	8
09/13/10	1												**0**	8	11
09/14/10	1												**0**	5	10
09/15/10	1												**0**	5	8
09/16/10	1												**0**	4	9
09/17/10	1												**0**	7	7
09/18/10	1										1		**1**	7	10
09/19/10	1												**0**	5	8
09/20/10	1												**0**	5	6
09/21/10	1					2							**2**	6	13
09/22/10	1												**0**	6	12
09/23/10	1												**0**	7	9
09/24/10	1												**0**	8	15
09/25/10	1												**0**	8	10
09/26/10	1										1		**1**	5	8
09/27/10	1												**0**	7	12
09/28/10	1												**0**	6	19
09/29/10	1												**0**	4	14
09/30/10	1												**0**	6	20
10/01/10	1												**0**	8	10
10/02/10	1												**0**	3	4
10/03/10	1												**0**	11	5
10/04/10	1												**0**	9	6
10/05/10	1												**0**	7	10
10/06/10	1												**0**	6	8
10/07/10	1												**0**	4	7
10/08/10	1												**0**	7	5
10/09/10	1												**0**	6	3
10/10/10	1												**0**	10	7
10/11/10	1												**0**	8	3
10/12/10	1												**0**	9	5
10/13/10	1												**0**	7	3
10/14/10	1												**0**	5	6
10/15/10	1												**0**	8	6
10/16/10	1												**0**	4	5
10/17/10	1												**0**	7	4
10/18/10	1												**0**	7	1
10/19/10	1												**0**	9	4
10/20/10	1									1			**1**	8	6
10/21/10	1												**0**	6	1
10/22/10	1												**0**	7	0
10/23/10	1												**0**	6	-1
10/24/10	1												**0**	10	2
10/25/10	1												**0**	13	8
10/26/10	1												**0**	7	11
10/27/10	1												**0**	4	12
10/28/10	1												**0**	3	6
10/29/10	1												**0**	6	0
10/30/10	1												**0**	6	-1
10/31/10	1												**0**	8	-3
By Species		**4**	**3**	**2**	**10**	**43**	**3**	**1**	**1**	**22**	**25**	**0**	**114**		
By Guild		**9**			**10**	**43**	**5**			**47**					
		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 Johnson Met Low detector – Fall, 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)**
06/03/10	1										1		**1**	7	13
06/04/10	1			1						1			**2**	5	15
06/05/10	1										1		**1**	4	14
06/06/10	1												**0**	4	10
06/07/10	1												**0**	4	8
06/08/10	1												**0**	6	8
06/09/10	1												**0**	9	12
06/10/10	1												**0**	8	9
06/11/10	1												**0**	6	13
06/12/10	1												**0**	5	14
06/13/10	1					1							**1**	3	14
06/14/10	1												**0**	6	10
06/15/10	1												**0**	2	12
06/16/10	1									1			**1**	4	12
06/17/10	1												**0**	8	17
06/18/10	1												**0**	7	20
06/19/10	1												**0**	5	19
06/20/10	1												**0**	8	17
06/21/10	1												**0**	6	15
06/22/10	1												**0**	6	16
06/23/10	1												**0**	6	16
06/24/10	1												**0**	6	15
06/25/10	1				1								**1**	5	15
06/26/10	1												**0**	5	14
06/27/10	1				1								**1**	7	16
06/28/10	1												**0**	5	16
06/29/10	1	1											**1**	5	12
06/30/10	1												**0**	5	10
07/01/10	1												**0**	3	11
07/02/10	1												**0**	7	16
07/03/10	1										1		**1**	5	21
07/04/10	1												**0**	7	22
07/05/10	1												**0**	5	25
07/06/10	1												**0**	7	23
07/07/10	1										1		**1**	5	21
07/08/10	1												**0**	6	20
07/09/10	1	1									1		**2**	4	21
07/10/10	1		1										**1**	6	19
07/11/10	1												**0**	5	19
07/12/10	1				1	1					1		**3**	7	19
07/13/10	1												**0**	4	20
07/14/10	1												**0**	3	19
07/15/10	1		1										**1**	5	19
07/16/10	1												**0**	4	20
07/17/10	1												**0**	3	20
07/18/10	1									1			**1**	6	18
07/19/10	1		1										**1**	6	17
07/20/10	1	1	2								2		**5**	6	17
07/21/10	1												**0**	5	17
07/22/10	1		1										**1**	6	16
07/23/10	1										1		**1**	5	18
07/24/10	1												**0**	6	17
07/25/10	1												**0**	6	15
07/26/10	1												**0**	4	16
07/27/10	1												**0**	6	20
07/28/10	1					1							**1**	9	22
07/29/10	1												**0**	8	12
07/30/10	1												**0**	6	11
07/31/10	1												**0**	6	15
08/01/10	1										1		**1**	6	15
08/02/10	1				1								**1**	5	16
08/03/10	1												**0**	4	19
08/04/10	1						2						**2**	6	23
08/05/10	1												**0**	5	20
08/06/10	0												**0**	5	10
08/07/10	0										1		**1**	6	12
08/08/10	0												**0**	6	18
08/09/10	0										1		**1**	5	18
08/10/10	0												**0**	5	15
08/11/10	0												**0**	6	13
08/12/10	0												**0**	6	14
08/13/10	0												**0**	6	16
08/14/10	0												**0**	4	15
08/15/10	0												**0**	3	15
08/16/10	0												**0**	5	18
08/17/10	0												**0**	6	17
08/18/10	0												**0**	7	16
08/19/10	0												**0**	4	16
08/20/10	0												**0**	6	12
08/21/10	0												**0**	3	15
08/22/10	0												**0**	8	14
08/23/10	0												**0**	6	14
08/24/10	0												**0**	4	14
08/25/10	0												**0**	5	14
08/26/10	0												**0**	5	14
08/27/10	0												**0**	4	13
08/28/10	0												**0**	6	18
08/29/10	0												**0**	7	20
08/30/10	0												**0**	7	21
08/31/10	0												**0**	7	23
09/01/10	0												**0**	8	23
09/02/10	0												**0**	7	22
09/03/10	0												**0**	8	20
09/04/10	0												**0**	6	13
09/05/10	0												**0**	4	10
09/06/10	0												**0**	4	15
09/07/10	0												**0**	7	16
09/08/10	0												**0**	6	13
09/09/10	0												**0**	7	9
09/10/10	0												**0**	6	10
09/11/10	0												**0**	5	10
09/12/10	0												**0**	8	8
09/13/10	0												**0**	8	11
09/14/10	0												**0**	5	10
09/15/10	0												**0**	5	8
09/16/10	0												**0**	4	9
09/17/10	0												**0**	7	7
09/18/10	0												**0**	7	10
09/19/10	0												**0**	5	8
09/20/10	0												**0**	5	6
09/21/10	0												**0**	6	13
09/22/10	0												**0**	6	12
09/23/10	0												**0**	7	9
09/24/10	0												**0**	8	15
09/25/10	0												**0**	8	10
09/26/10	0												**0**	5	8
09/27/10	0												**0**	7	12
09/28/10	0												**0**	6	19
09/29/10	0												**0**	4	14
09/30/10	0												**0**	6	20
10/01/10	0												**0**	8	10
10/02/10	0												**0**	3	4
10/03/10	0												**0**	11	5
10/04/10	0												**0**	9	6
10/05/10	0												**0**	7	10
10/06/10	0												**0**	6	8
10/07/10	0												**0**	4	7
10/08/10	0												**0**	7	5
10/09/10	0												**0**	6	3
10/10/10	0												**0**	10	7
10/11/10	0												**0**	8	3
10/12/10	0												**0**	9	5
10/13/10	0												**0**	7	3
10/14/10	0												**0**	5	6
10/15/10	0												**0**	8	6
10/16/10	0												**0**	4	5
10/17/10	0												**0**	7	4
10/18/10	0												**0**	7	1
10/19/10	0												**0**	9	4
10/20/10	0												**0**	8	6
10/21/10	0												**0**	6	1
10/22/10	0												**0**	7	0
10/23/10	0												**0**	6	-1
10/24/10	0												**0**	10	2
10/25/10	0												**0**	13	8
10/26/10	0												**0**	7	11
10/27/10	0												**0**	4	12
10/28/10	0												**0**	3	6
10/29/10	0												**0**	6	0
10/30/10	0												**0**	6	-1
10/31/10	0												**0**	8	-3
By Species		**3**	**6**	**1**	**4**	**3**	**2**	**0**	**0**	**3**	**12**	**0**	**34**		
By Guild		**10**			**4**	**3**	**2**			**15**					
		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 7. Summary of acoustic bat data and weather during each survey night at the Johnson Met Tree detector – Fall, 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)
06/03/10	1				1	1							**2**	7	13
06/04/10	1	2		1		1							**4**	5	15
06/05/10	1				1	4					1		**6**	4	14
06/06/10	1												**0**	4	10
06/07/10	1												**0**	4	8
06/08/10	1												**0**	6	8
06/09/10	1									1			**1**	9	12
06/10/10	1				1								**1**	8	9
06/11/10	1					2				2			**4**	6	13
06/12/10	1			1		1					1		**3**	5	14
06/13/10	1					2				1			**3**	3	14
06/14/10	1					15				3			**18**	6	10
06/15/10	1					2							**2**	2	12
06/16/10	1												**0**	4	12
06/17/10	1				1	1							**2**	8	17
06/18/10	1					4				2			**6**	7	20
06/19/10	1												**0**	5	19
06/20/10	1					1							**1**	8	17
06/21/10	1					12				1			**13**	6	15
06/22/10	1				1								**1**	6	16
06/23/10	1				1								**1**	6	16
06/24/10	1									1			**1**	6	15
06/25/10	1					112				45			**157**	5	15
06/26/10	1					30				11			**41**	5	14
06/27/10	1					4				2	1		**7**	7	16
06/28/10	1												**0**	5	16
06/29/10	1					11				3	1		**15**	5	12
06/30/10	1									2	1		**3**	5	10
07/01/10	1					5							**5**	3	11
07/02/10	1					23				13			**36**	7	16
07/03/10	1					3	1				1		**5**	5	21
07/04/10	1									1			**1**	7	22
07/05/10	1					3							**3**	5	25
07/06/10	1	1	1			3							**5**	7	23
07/07/10	1					2				1	1		**4**	5	21
07/08/10	1		1										**1**	6	20
07/09/10	1	1		2							1		**4**	4	21
07/10/10	1					5				2			**7**	6	19
07/11/10	1					7					1		**8**	5	19
07/12/10	1				1	1							**2**	7	19
07/13/10	1					3							**3**	4	20
07/14/10	1	1			1	3				2			**7**	3	19
07/15/10	1					1				4			**5**	5	19
07/16/10	1					5				2			**7**	4	20
07/17/10	1	2				13				6			**21**	3	20
07/18/10	1				3	12				5			**20**	6	18
07/19/10	1		2			8				1	1		**12**	6	17
07/20/10	1		2	1		7				3	6		**19**	6	17
07/21/10	1					2	1			2	1		**6**	5	17
07/22/10	1		1		2	3				2			**8**	6	16
07/23/10	1					1	1			2	1		**5**	5	18
07/24/10	1					1							**1**	6	17
07/25/10	1					4				3			**7**	6	15
07/26/10	1					2	1			1			**4**	4	16
07/27/10	1	1			1	17	1			4			**24**	6	20
07/28/10	1	2			1	4				6			**13**	9	22
07/29/10	1	1				9	1			2	1		**14**	8	12
07/30/10	1					1							**1**	6	11
07/31/10	1	1				8	1			6	1		**17**	6	15
08/01/10	1					8			1	5			**14**	6	15
08/02/10	1				1	1				2			**4**	5	16
08/03/10	1					2				3			**5**	4	19
08/04/10	1	1	2	2	1	25	2	1		3	1		**38**	6	23
08/05/10	1				1	10				5	2		**18**	5	20
08/06/10	1					7							**7**	5	10
08/07/10	1					2				5			**7**	6	12
08/08/10	1												**0**	6	18
08/09/10	1	2			2	35				6			**45**	5	18
08/10/10	1					2				3			**5**	5	15
08/11/10	1					3				1			**4**	6	13
08/12/10	1				1	4				5			**10**	6	14
08/13/10	1					9				4			**13**	6	16
08/14/10	1					1				2			**3**	4	15
08/15/10	1					1				2			**3**	3	15
08/16/10	1									1			**1**	5	18
08/17/10	1					7			1	6			**14**	6	17
08/18/10	1					7			1	3			**11**	7	16
08/19/10	1					4				3			**7**	4	16
08/20/10	1					3				2			**5**	6	12
08/21/10	1					2				1	1		**4**	3	15
08/22/10	1			1	1	1					1		**4**	8	14
08/23/10	1									1			**1**	6	14
08/24/10	1					3				3			**6**	4	14
08/25/10	1					1							**1**	5	14
08/26/10	1					4				1			**5**	5	14
08/27/10	1					2							**2**	4	13
08/28/10	1				2	6				2			**10**	6	18
08/29/10	1										1		**1**	7	20
08/30/10	1					3				1			**4**	7	21
08/31/10	1	1				2				1	1		**5**	7	23
09/01/10	1	1				4							**5**	8	23
09/02/10	1					6							**6**	7	22
09/03/10	1									2			**2**	8	20
09/04/10	1									1			**1**	6	13
09/05/10	1												**0**	4	10
09/06/10	1										1		**1**	4	15
09/07/10	1									1			**1**	7	16
09/08/10	1									3			**3**	6	13
09/09/10	1												**0**	7	9
09/10/10	1												**0**	6	10
09/11/10	1												**0**	5	10
09/12/10	1	1		1						1	2		**5**	8	8
09/13/10	1										2		**2**	8	11
09/14/10	1	1					1				1		**3**	5	10
09/15/10	1						1				1		**2**	5	8
09/16/10	1												**0**	4	9
09/17/10	1												**0**	7	7
09/18/10	1				2		3			1	4		**10**	7	10
09/19/10	1						1			1			**2**	5	8
09/20/10	1												**0**	5	6
09/21/10	1						1			2	1		**4**	6	13
09/22/10	1					1				2			**3**	6	12
09/23/10	1												**0**	7	9
09/24/10	1										1		**1**	8	15
09/25/10	1					1	1						**2**	8	10
09/26/10	1												**0**	5	8
09/27/10	1												**0**	7	12
09/28/10	1												**0**	6	19
09/29/10	1					1							**1**	4	14
09/30/10	1												**0**	6	20
10/01/10	1			1									**1**	8	10
10/02/10	1												**0**	3	4
10/03/10	1												**0**	11	5
10/04/10	1												**0**	9	6
10/05/10	1												**0**	7	10
10/06/10	1												**0**	6	8
10/07/10	1												**0**	4	7
10/08/10	1												**0**	7	5
10/09/10	1												**0**	6	3
10/10/10	1												**0**	10	7
10/11/10	1									1			**1**	8	3
10/12/10	1												**0**	9	5
10/13/10	1												**0**	7	3
10/14/10	1												**0**	5	6
10/15/10	1												**0**	8	6
10/16/10	1												**0**	4	5
10/17/10	1												**0**	7	4
10/18/10	1												**0**	7	1
10/19/10	1												**0**	9	4
10/20/10	1												**0**	8	6
10/21/10	1												**0**	6	1
10/22/10	1												**0**	7	0
10/23/10	1												**0**	6	-1
10/24/10	1												**0**	10	2
10/25/10	1												**0**	13	8
10/26/10	1												**0**	7	11
10/27/10	1												**0**	4	12
10/28/10	1									1			**1**	3	6
10/29/10	1												**0**	6	0
10/30/10	1												**0**	6	-1
10/31/10	1												**0**	8	-3
By Species		**19**	**9**	**10**	**26**	**527**	**17**	**1**	**3**	**229**	**40**	**0**	**881**		
By Guild		**38**			**26**	**527**	**21**			**269**					
		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 8. Summary of acoustic bat data and weather during each survey night at the Kingsbury Ridge detector – Fall, 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)**
06/03/10	1												**0**	7	13
06/04/10	1												**0**	5	15
06/05/10	1	1								2			**3**	4	14
06/06/10	1												**0**	4	10
06/07/10	1												**0**	4	8
06/08/10	1												**0**	6	8
06/09/10	1												**0**	9	12
06/10/10	1												**0**	8	9
06/11/10	1										1		**1**	6	13
06/12/10	1	1				1							**2**	5	14
06/13/10	1				1								**1**	3	14
06/14/10	1												**0**	6	10
06/15/10	1												**0**	2	12
06/16/10	1												**0**	4	12
06/17/10	1					1					1		**2**	8	17
06/18/10	1					1							**1**	7	20
06/19/10	1												**0**	5	19
06/20/10	1												**0**	8	17
06/21/10	1									1			**1**	6	15
06/22/10	1												**0**	6	16
06/23/10	1												**0**	6	16
06/24/10	1	1			1	1							**3**	6	15
06/25/10	1									1			**1**	5	15
06/26/10	1					1							**1**	5	14
06/27/10	1					2							**2**	7	16
06/28/10	1												**0**	5	16
06/29/10	1	1											**1**	5	12
06/30/10	1												**0**	5	10
07/01/10	1												**0**	3	11
07/02/10	1												**0**	7	16
07/03/10	1												**0**	5	21
07/04/10	1												**0**	7	22
07/05/10	1					2				3			**5**	5	25
07/06/10	1												**0**	7	23
07/07/10	1					1				1	1		**3**	5	21
07/08/10	1					4				1			**5**	6	20
07/09/10	1	1											**1**	4	21
07/10/10	1									1			**1**	6	19
07/11/10	1												**0**	5	19
07/12/10	1									2			**2**	7	19
07/13/10	1					1							**1**	4	20
07/14/10	1					2				1			**3**	3	19
07/15/10	1					2				2			**4**	5	19
07/16/10	1									2			**2**	4	20
07/17/10	1					2				3			**5**	3	20
07/18/10	1					3	1			2			**6**	6	18
07/19/10	1					4				3	1		**8**	6	17
07/20/10	1					1				1			**2**	6	17
07/21/10	1					1				2			**3**	5	17
07/22/10	1					4	1						**5**	6	16
07/23/10	1					2					1		**3**	5	18
07/24/10	1					1				1			**2**	6	17
07/25/10	1					2							**2**	6	15
07/26/10	1												**0**	4	16
07/27/10	1	1				7			2	1			**11**	6	20
07/28/10	1					5				1			**6**	9	22
07/29/10	1									2			**2**	8	12
07/30/10	1												**0**	6	11
07/31/10	1					4							**4**	6	15
08/01/10	1				1	7							**8**	6	15
08/02/10	1					1				2			**3**	5	16
08/03/10	1					2				2			**4**	4	19
08/04/10	1					2				3			**5**	6	23
08/05/10	1					6				2	2		**10**	5	20
08/06/10	1									2			**2**	5	10
08/07/10	1					2							**2**	6	12
08/08/10	1					2				2			**4**	6	18
08/09/10	1									4			**4**	5	18
08/10/10	1					2				3			**5**	5	15
08/11/10	1					2				3			**5**	6	13
08/12/10	1					1			1	2			**4**	6	14
08/13/10	1					8				3			**11**	6	16
08/14/10	1									3			**3**	4	15
08/15/10	1								1				**1**	3	15
08/16/10	1												**0**	5	18
08/17/10	1					4			2	1			**7**	6	17
08/18/10	1					3							**3**	7	16
08/19/10	1					2							**2**	4	16
08/20/10	1					3							**3**	6	12
08/21/10	1					1				1			**2**	3	15
08/22/10	1					2				1	1		**4**	8	14
08/23/10	1					1							**1**	6	14
08/24/10	1												**0**	4	14
08/25/10	1												**0**	5	14
08/26/10	1					1				3			**4**	5	14
08/27/10	1									1			**1**	4	13
08/28/10	1	1				5				2			**8**	6	18
08/29/10	1					2				3			**5**	7	20
08/30/10	1					2				2			**4**	7	21
08/31/10	1					2				1			**3**	7	23
09/01/10	1	1				3				3			**7**	8	23
09/02/10	1									1			**1**	7	22
09/03/10	1									1			**1**	8	20
09/04/10	1					2							**2**	6	13
09/05/10	1									2			**2**	4	10
09/06/10	1												**0**	4	15
09/07/10	1										1		**1**	7	16
09/08/10	1									1			**1**	6	13
09/09/10	1									1			**1**	7	9
09/10/10	1												**0**	6	10
09/11/10	1	2											**2**	5	10
09/12/10	1												**0**	8	8
09/13/10	1									1			**1**	8	11
09/14/10	1												**0**	5	10
09/15/10	1												**0**	5	8
09/16/10	1									1			**1**	4	9
09/17/10	1					1							**1**	7	7
09/18/10	1												**0**	7	10
09/19/10	1									1	1		**2**	5	8
09/20/10	1												**0**	5	6
09/21/10	1					1							**1**	6	13
09/22/10	1												**0**	6	12
09/23/10	1												**0**	7	9
09/24/10	1												**0**	8	15
09/25/10	1												**0**	8	10
09/26/10	1												**0**	5	8
09/27/10	1												**0**	7	12
09/28/10	1												**0**	6	19
09/29/10	1												**0**	4	14
09/30/10	1												**0**	6	20
10/01/10	1												**0**	8	10
10/02/10	1												**0**	3	4
10/03/10	1												**0**	11	5
10/04/10	1												**0**	9	6
10/05/10	1												**0**	7	10
10/06/10	1												**0**	6	8
10/07/10	1												**0**	4	7
10/08/10	1												**0**	7	5
10/09/10	1												**0**	6	3
10/10/10	1												**0**	10	7
10/11/10	1												**0**	8	3
10/12/10	1												**0**	9	5
10/13/10	1												**0**	7	3
10/14/10	1												**0**	5	6
10/15/10	1												**0**	8	6
10/16/10	1												**0**	4	5
10/17/10	1												**0**	7	4
10/18/10	1												**0**	7	1
10/19/10	1												**0**	9	4
10/20/10	1												**0**	8	6
10/21/10	1												**0**	6	1
10/22/10	1												**0**	7	0
10/23/10	1												**0**	6	-1
10/24/10	1												**0**	10	2
10/25/10	1												**0**	13	8
10/26/10	1												**0**	7	11
10/27/10	1												**0**	4	12
10/28/10	1												**0**	3	6
10/29/10	1												**0**	6	0
10/30/10	1												**0**	6	-1
10/31/10	1												**0**	8	-3
By Species		**10**	**0**	**0**	**3**	**125**	**2**	**0**	**6**	**91**	**10**	**0**	**247**		
By Guild		**10**			**3**	**125**	**8**			**101**					
		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 Survey Results

Appendix C Table 1a. Daily total observations of raptor species at Johnson Ridge, Bingham Wind Project, Fall 2010						
Species	**9/17/2010**	**9/22/2010**	**9/23/2010**	**9/27/2010**	**9/29/2010**	**Entire Season**
American kestrel					1	1
bald eagle			1			1
broad-winged hawk	1	1	1		1	4
Cooper's hawk			1			1
northern harrier		1				1
osprey		2		1		3
red-tailed hawk		2			2	4
sharp-shinned hawk	3	1	1		3	8
turkey vulture	6	6	7		7	26
unidentified accipiter		1	2			3
unidentified buteo	1	2	1		1	5
unidentified raptor		1	3			4
Daily Totals	**11**	**17**	**17**	**1**	**15**	**61**

Appendix C Table 1b. Daily total observations of raptor species at Kingsbury Ridge, Bingham Wind Project, Fall 2010													
Species	**9/2/2010**	**9/15/2010**	**9/16/2010**	**9/17/2010**	**9/22/2010**	**9/23/2010**	**9/27/2010**	**9/29/2010**	**10/6/2010**	**10/8/2010**	**10/12/2010**	**10/13/2010**	**Entire Season**
American kestrel								1		2			3
bald eagle				1		2	2						5
broad-winged hawk		2	2				1				3		8
Cooper's hawk		1						1					2
merlin					1			2					3
northern harrier												2	2
osprey			1										1
peregrine falcon												1	1
red-tailed hawk		2	1		2		2	2					9
sharp-shinned hawk			1	1		1	1	2	3		1		10
turkey vulture	1	1	1	1			1	3					8
unidentified accipiter							1	1					2
unidentified buteo												1	1
unidentified raptor											1	1	2
Daily Totals	**1**	**6**	**6**	**3**	**3**	**3**	**8**	**12**	**3**	**2**	**5**	**5**	**57**

Appendix C Table 2a. Hourly summary of raptor observations at Johnson Ridge, Bingham Wind Project, Fall 2010

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				1				1
bald eagle				1				1
broad-winged hawk	1		1	1		1		4
Cooper's hawk		1						1
northern harrier						1		1
osprey				3				3
red-tailed hawk				2		1	1	4
sharp-shinned hawk	1		3	1	1	2		8
turkey vulture	6		3	8		4	5	26
unidentified accipter			1	1	1			3
unidentified buteo				1	3	1		5
unidentified raptor	2		1	1				4
Hourly totals	**10**	**1**	**9**	**20**	**5**	**10**	**6**	**61**

Appendix C Table 2b. Hourly summary of raptor observations at Kingsbury Ridge, Bingham Wind Project, Fall 2010

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			1		2			3
bald eagle		3	2					5
broad-winged hawk	4		1	2			1	8
Cooper's hawk	1				1			2
merlin	1		1			1		3
northern harrier			2					2
osprey							1	1
peregrine falcon					1			1
red-tailed hawk	1	1	6		1			9
sharp-shinned hawk	3		1	3	2	1		10
turkey vulture		2	1	2	2	1		8
unidentified accipter		1					1	2
unidentified buteo				1				1
unidentified raptor			1				1	2
Hourly totals	**10**	**7**	**16**	**8**	**9**	**3**	**4**	**57**

Appendix C Table 3a. Total observations from Johnson Ridge of raptor species in the study area Bingham Wind Project, Fall 2010

Species	Johnson Ridge	Hills outside of Project	Valleys	TOTAL
American kestrel			1	1
bald eagle			1	1
broad-winged hawk	2		2	4
Cooper's hawk			1	1
merlin				0
northern harrier		1		1
osprey	3			3
peregrine falcon				0
red-tailed hawk	2		2	4
sharp-shinned hawk	2	2	4	8
turkey vulture	11	3	12	26
unidentified accipiter		1	2	3
unidentified buteo	3	1	1	5
unidentified raptor	4		0	4
TOTAL	**27**	**8**	**26**	**61**

Appendix C Table 3b. Total observations from Kingsbury Ridge of raptor species in the study area Bingham Wind Project, Fall 2010

Species	Kingsbury Ridge	Johnson Ridge	Valleys	TOTAL
American kestrel	3			3
bald eagle	5			5
broad-winged hawk	8			8
Cooper's hawk	2			2
merlin	3			3
northern harrier	2			2
osprey	1			1
peregrine falcon	1			1
red-tailed hawk	9			9
sharp-shinned hawk	10			10
turkey vulture	7		1	8
unidentified accipiter	1		1	2
unidentified buteo		1		1
unidentified raptor		1	1	2
TOTAL	**52**	**2**	**3**	**57**

Appendix C Table 4a. Number of individuals of species observed within Project boundary in proposed turbine areas (flight positions A, B and C) above or below 152 m as seen from Johnson Ridge, Bingham Wind Project, Fall 2010

Species	152 m or above	below 152 m	Total
bald eagle			0
broad-winged hawk		1	1
osprey		1	1
red-tailed hawk			0
sharp-shinned hawk		1	1
turkey vulture		4	4
unidentified accipiter			0
unidentified buteo		2	2
unidentified raptor		3	3
Total	**0**	**12**	**12**

Appendix C Table 4b. Number of individuals of species observed within Project boundary in proposed turbine areas (flight positions A, B and C) above or below 150 m as seen from Kingsbury Ridge, Bingham Wind Project, Fall 2010

Species	150 m or above	below 150 m	Total
bald eagle		3	3
broad-winged hawk			0
osprey	1		1
red-tailed hawk		1	1
sharp-shinned hawk		3	3
turkey vulture	1	3	4
unidentified accipiter		1	1
unidentified buteo			0
unidentified raptor			0
Total	**2**	**11**	**13**

Appendix ATable 2. Summary of available fall raptor survey results at wind sites in the East (1996-present)

Project Site	Landscape	Survey Period	# of Survey Days	# of Survey Hours	Total # Observed	# of Species Observed	Seasonal Average 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	5.4	n/a	Kerlinger, Paul. 1996. A Study of Hawk Migration at Green Mountain Power Corporation's Searsburg, Vermont, Wind Powered 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	2.5	(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	12.7	(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%	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									
Mars Hill, Aroostook Cty, ME	Forested ridge	Sept. 9 - Oct. 13	8	42.5	115	13	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%	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	2.1	(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%	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.
Rollins, Penobscot Cty, ME	Forested ridge	Sept. 13 - Oct. 16	12	89	144	12	1.8	(120 m) 82%	Stantec Consulting. 2008. Fall 2007 Bird and Bat Migration Survey Report: Visual, Radar and Acoustic Bat Surveys for the Rollins Wind Project. Prepared for First Wind, LLC.
Fall 2007									
Roxbury, Oxford Cty, ME	Forested ridge	Sept. 3 - Oct. 15	14	86	96	12	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	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.
Fall 2008									
Highland, Somerset Cty, ME	Forested ridge	Sept 3 to Oct 31	15	135	301	10	2.2	(128m) 43%	Stantec Consulting Services. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC.
Fall 2009									
Coos County, NH	Forested ridge	Aug 27 to Oct 17	10	138	242	11	1.75	(125m) 62%	Stantec Consulting Services Inc. 2009. Summary of Fall 2009 Raptor Survey Results at the Proposed Granite Reliable Power Project. Prepared for Noble Environmental Power.
Vermont Community Wind Farm, Orleans Cty, VT	Forested ridge	Sept 3 to Oct 23	10	77	83	12	1.08	(130m) 88%	Stantec Consulting. 2009. Fall 2009 Bird and Bat Survey Report: Nocturnal Radar, Acoustic, and Diurnal Raptor Surveys performed for the Vermont Community Wind Farm Project. Prepared for Vermont Community Wind Farm, LLC
Tenney, Grafton Cty, NH	Forested ridge	Aug 24 to Oct 26	10	157	696	14	4.43	(125m) 39.1% (of those in project area)	Stantec Consulting Services Inc. 2009. 2009 Spring, Summer, and Fall Avian and Bat Surveys for the Groton Wind Project. Prepared for Groton Wind, LLC.
Stetson, Penobscot Cty, ME	Forested ridge	Sept 2 to Oct 14	8	50	45	11	0.9	(119m) 67% (combined spring and fall)	Stantec Consulting. 2009. Stetson I Mountain Wind Project Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC
Fall 2010									
Johnson Ridge, Somerset Cty, ME	Forested ridge	Sept 17 to Sept 29	5	35	61	9	1.74	(152m) 85%	Stantec Consulting. 2010. Fall 2010 Avian and Bat Survey Report for the Bingham Wind Project. Prepared for Blue Sky West Wind, LLC
Kingsbury Ridge, Somerset Cty, ME	Forested ridge	Sept 2 to Oct 13	12	84	57	11	0.68	(152m) 100%	Stantec Consulting. 2010. Fall 2010 Avian and Bat Survey Report for the Bingham Wind Project. Prepared for Blue Sky West Wind, LLC

Exhibit 7D-3: Fall 2011 Pre-Construction Radar Survey Report

Memo

To: Josh Bagnato
Bob Roy
Blue Sky West Wind, LLC
Boston, MA

From: Dale Knapp
Adam Gravel
Stantec Consulting Services Inc.
Topsham, Maine

File: Job #195600539

Date: November 1, 2011,
REV. February 23, 2012

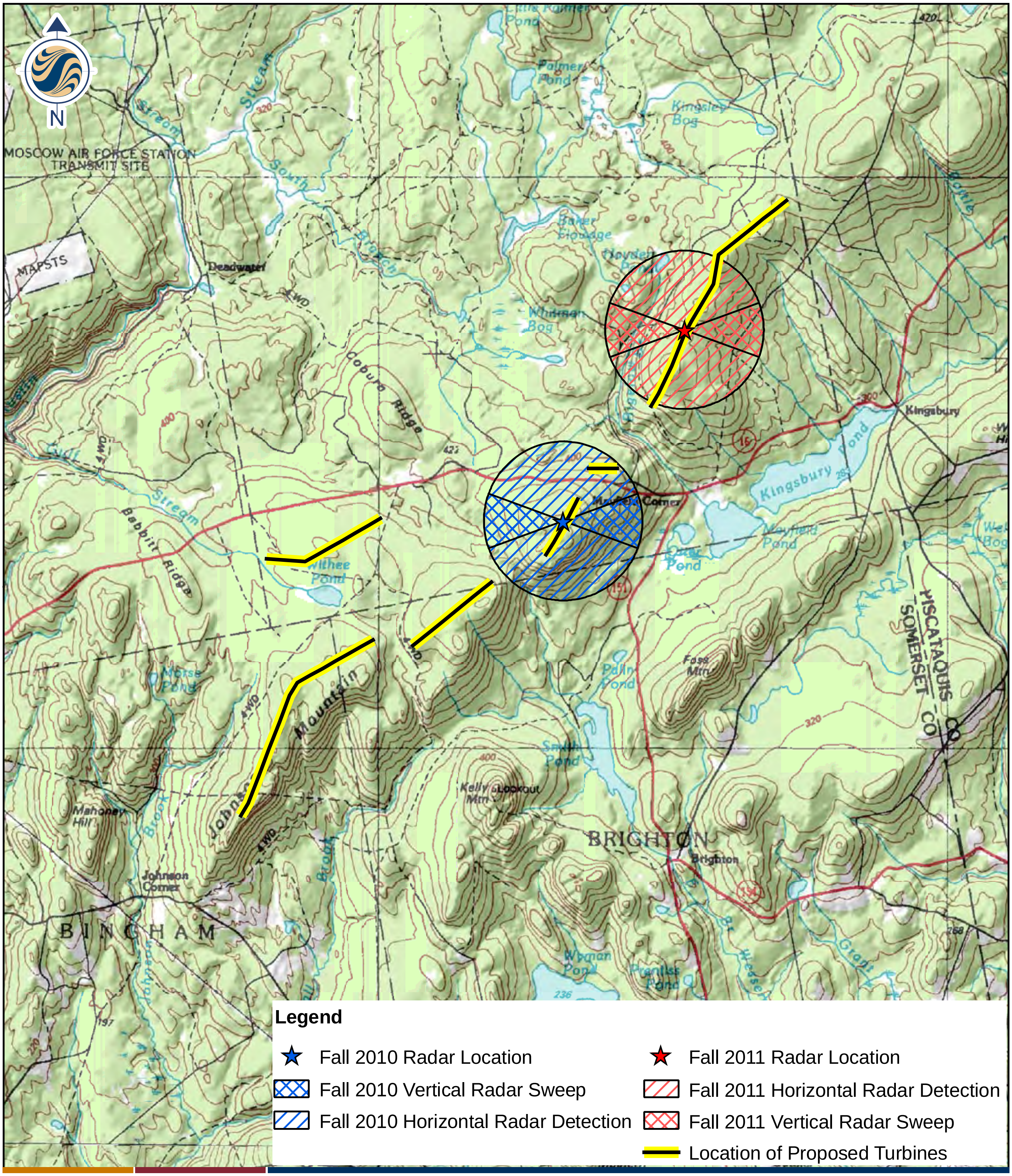
Reference: Fall 2011 Radar Survey Results and Comparison to Fall 2010 Results at the Bingham Wind Project, Bingham, Brighton, and Mayfield, Maine

Stantec conducted nocturnal radar surveys at the proposed Bingham Wind Project (Project) in Bingham, Brighton, and Mayfield, Maine, during fall 2011 to document the abundance, flight patterns, and flight altitudes of night-migrating birds and bats using X–band marine radar. Stantec previously conducted radar surveys at the Project in fall 2010; results of these surveys differed slightly from the typical survey results documented at other proposed project sites in Maine. Therefore, fall 2011 radar surveys were conducted to supplement the 2010 data. This memo report summarizes results of the fall 2011 radar surveys and attempts to compare those results to the fall 2010 results, recognizing that year to year variations in bird populations and weather events affect the timing and magnitude of migration over a particular location and how the radar survey samples that migration from year to year.

METHODS

Fall 2011 radar surveys were conducted on 12 nights between the same survey period as fall 2010 (early-September to mid-October). The fall 2011 radar survey is the third season of radar conducted at the site and the second fall season of survey. Typically, only one year of radar survey (or two seasons, spring and fall) is required at proposed wind projects in Maine. Because the fall 2011 survey is in addition to the required one year of study, survey effort was decreased to 12 nights and was focused on the peak fall migration period and nights with favorable weather conditions for migration. This survey effort was discussed with Bob Cordes of the Maine Department of Inland Fisheries and Wildlife in summer 2011 prior to the start of the fall 2011 radar survey.

The radar survey location was changed from the 2010 location to add additional coverage of the Project area. The radar in fall 2011 was centrally located within the Project area at a high point within the met tower clearing just north of Route 16 in Mayfield (Figure 1). As in fall 2010, the radar site provided good visibility and the radar was capable of detecting targets within nearly all of its theoretical detection range. Data were analyzed and summarized by hour, night and for the season, including passage rate, flight direction and flight height to remain consistent with methods of the fall 2010 surveys.



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Miles

Client/Project
Bingham Wind Project
Bingham, Maine

Figure No.
1

Title
Radar Survey Location

10/31/2011

00539_01_Radar.mxd

RESULTS

Radar surveys were conducted on 12 nights between September 2 and October 11, 2011 on nights with good to fair weather for migration (Appendix Table 1).

Passage Rates

Nightly passage rates were highly variable, and ranged from 341 ± 72 targets per kilometer per hour (t/km/hr) on September 4 to 2234 ± 304 t/km/h on September 27. The overall passage rate for the entire survey period was 952 ± 63 t/km/hr (Figure 2; Appendix Table 2). Individual hourly passage rates varied from 0 t/km/hr during the 12th hour of September 17 to 3711 t/km/hr during the 7th hour of September 27. For the entire season, passage rates were typically highest during the fifth hour past sunset (Figure 3).

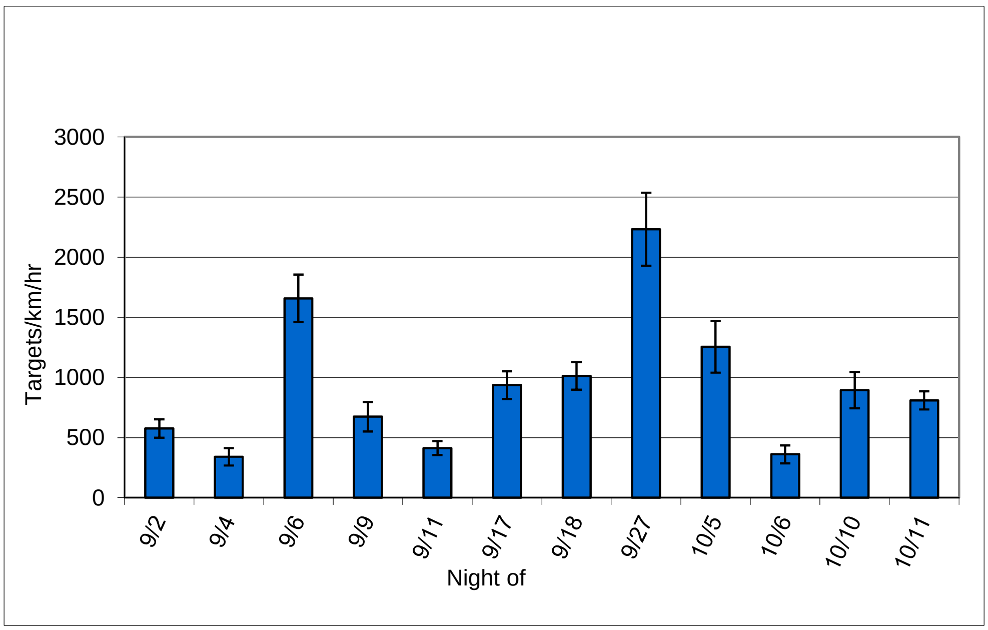


Figure 2. Nightly passage rates observed at the Bingham Wind Project, Fall 2011 (error bars ± 1 SE)

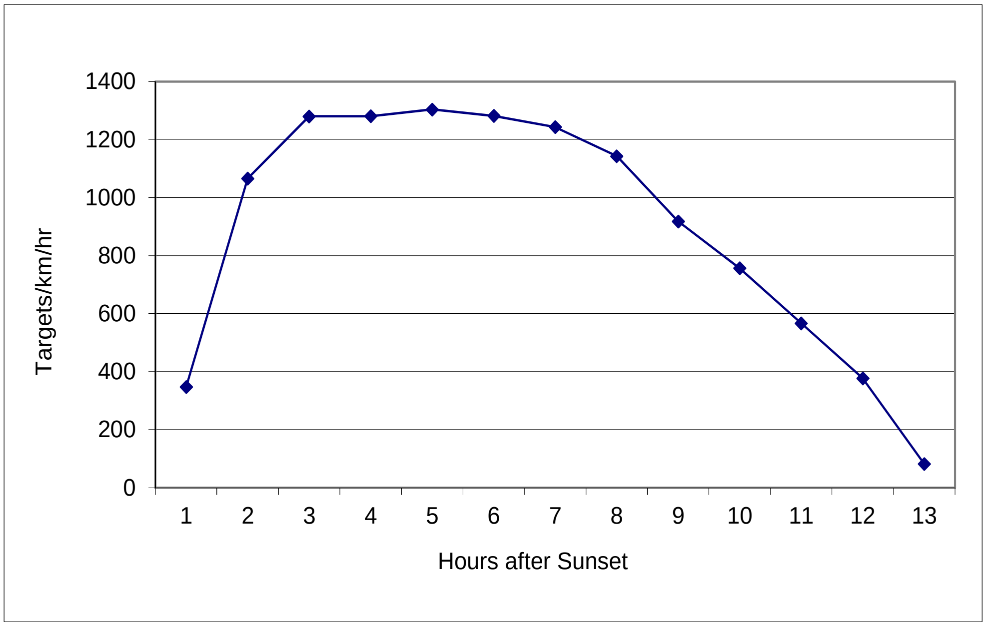


Figure 3. Hourly passage rates for entire season at the Bingham Wind Project, Fall 2011

Flight Direction

Mean flight direction through the Project area was 244° ± 50° (Figure 4; Appendix Table 3).

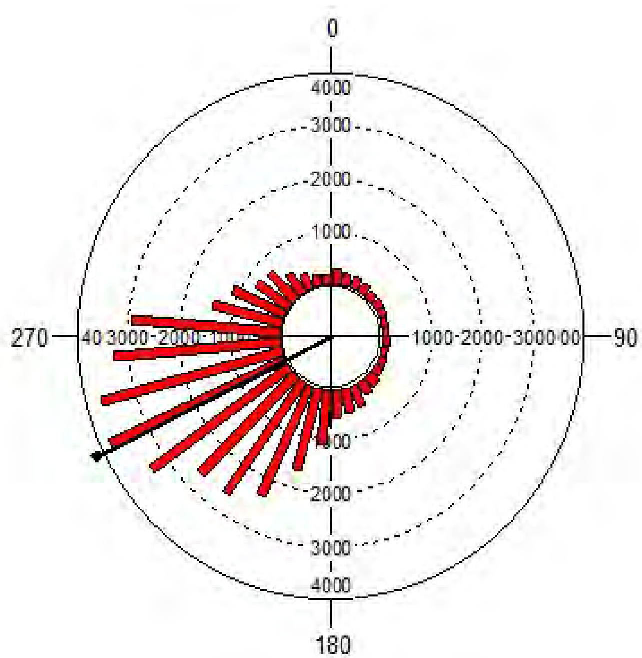


Figure 4. Mean flight direction for the entire season at the Bingham Wind Project, Fall 2011 (the bracket along the margin of the histogram is the 95% confidence interval)

Flight Altitude

The seasonal average mean flight height of all targets was 397 ± 1 meters (m; 1217 feet [']) above the radar site. The average nightly flight height ranged from 248 ± 58 m on September 2 to 501 ± 74 m on October 5 (Figure 5; Appendix Table 4). The percent of targets observed flying below 152 m, the proposed turbine height, was 16 percent for the season and varied nightly from 10 percent on October 5 to 38 percent on September 2 (Figure 6). For the entire season, the mean hourly flight heights were typically highest the 5th hour after sunset (Figure 7).

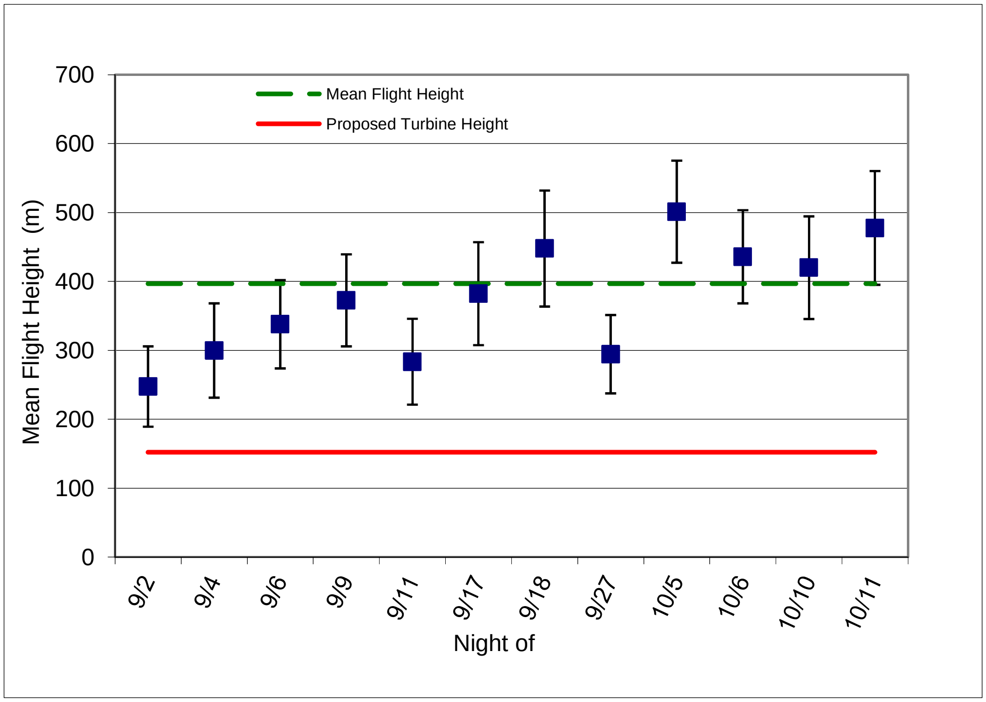


Figure 5. Mean nightly flight height of targets at the Bingham Wind Project, Fall 2011 (error bars ± 1 SE)

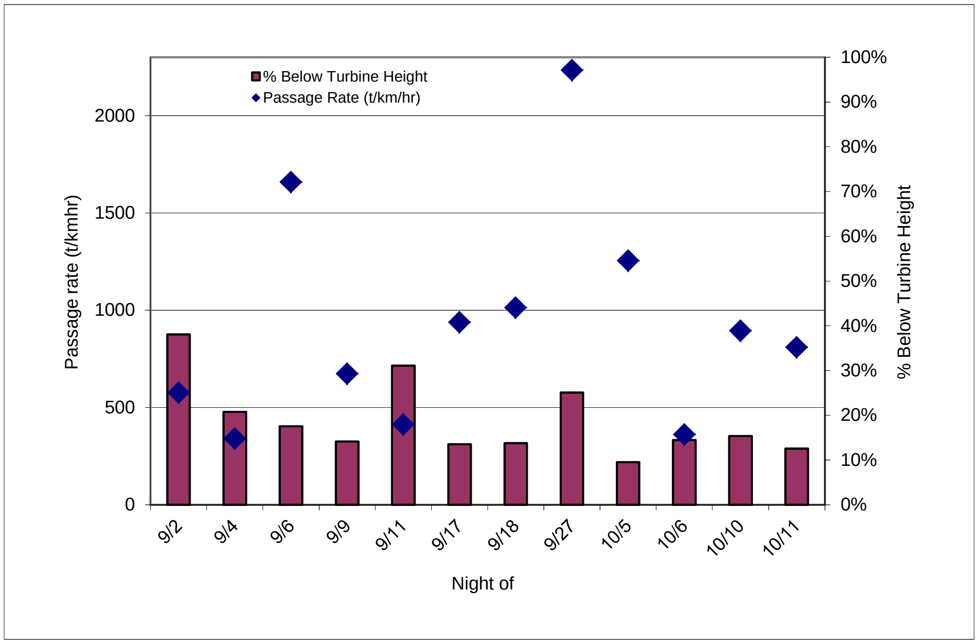


Figure 6. Percent of targets observed flying below a height of 152 m (499') at the Bingham Wind Project, Fall 2011

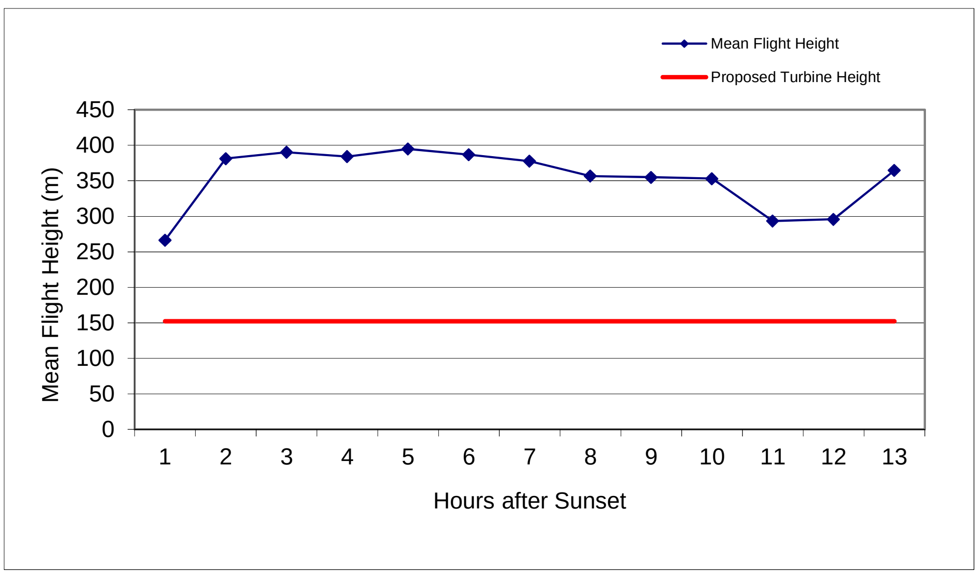
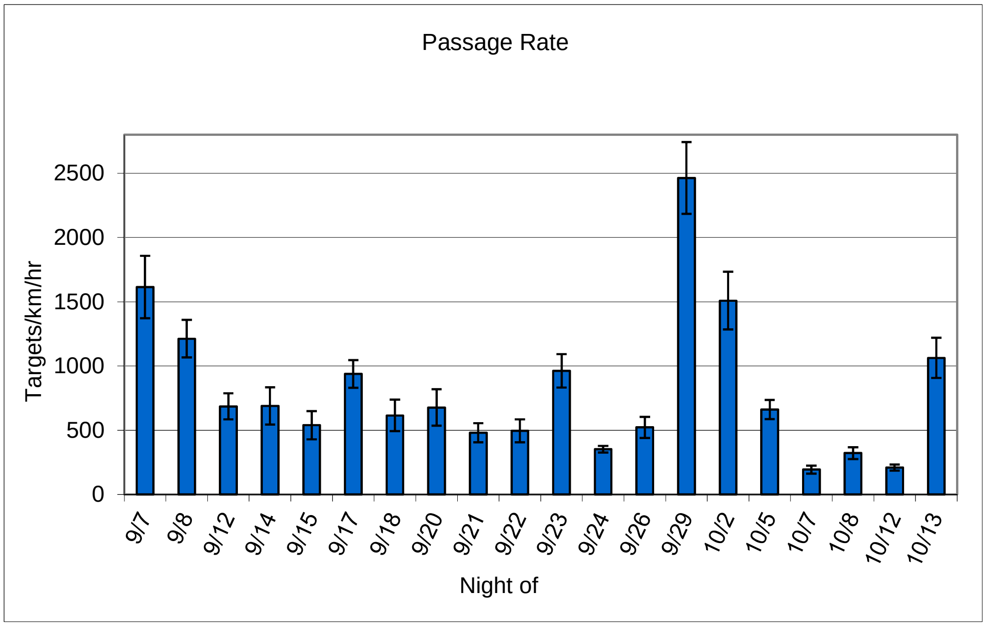


Figure 7. Hourly target flight height distribution at the Bingham Wind Project, Fall 2011

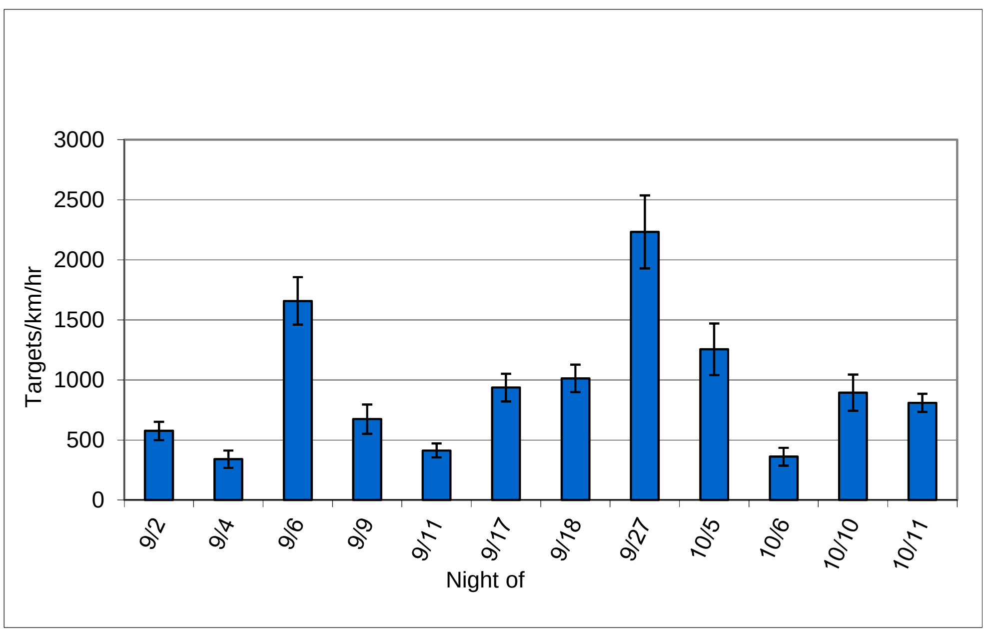
Comparison of 2010 and 2011 Radar Results

The overall passage rate in fall 2011 (952 ± 63 t/km/hr) was higher than that in 2010 (803 ± 46 t/km/hr). Year-to-year variation in magnitude of passage rates at the Project is apparent; 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). However, the timing of the highest passage rates was similar between the two years. The highest nightly passage in fall 2010 (2463 ± 279 t/km/hr) occurred on

September 29, and in fall 2011 (2234 ± 304 t/km/hr), on September 27. The overall passage rate of 952 t/km/hr is on the higher end of the range of typical fall passage rates documented at other projects in the eastern U.S. (Appendix Table 5).

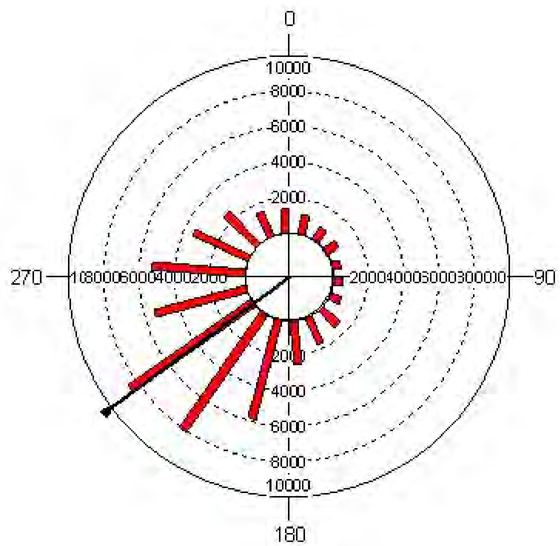


Fall 2010 Passage Rates (20 nights; error bars ± 1 SE)

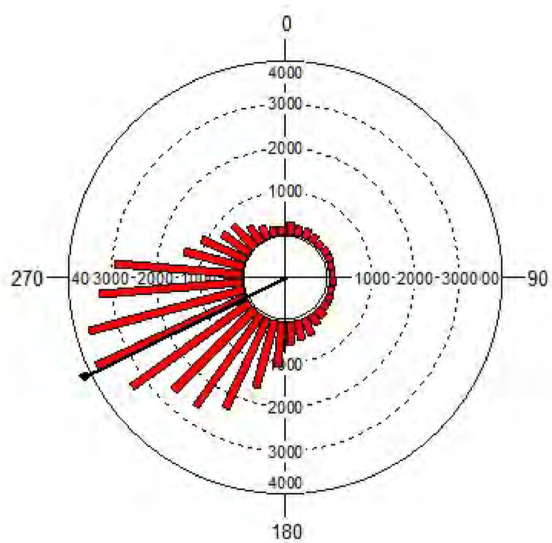


Fall 2011 Passage Rates (12 nights; error bars ± 1 SE)

The overall flight direction in fall 2010 was 234° ± 62° and in fall 2011 was 244° ± 50°, both southwestern directions. This flight direction is typical for average flight direction during fall migration based on radar results at other projects conducted on forested ridgelines in the eastern U.S. (Appendix Table 5).



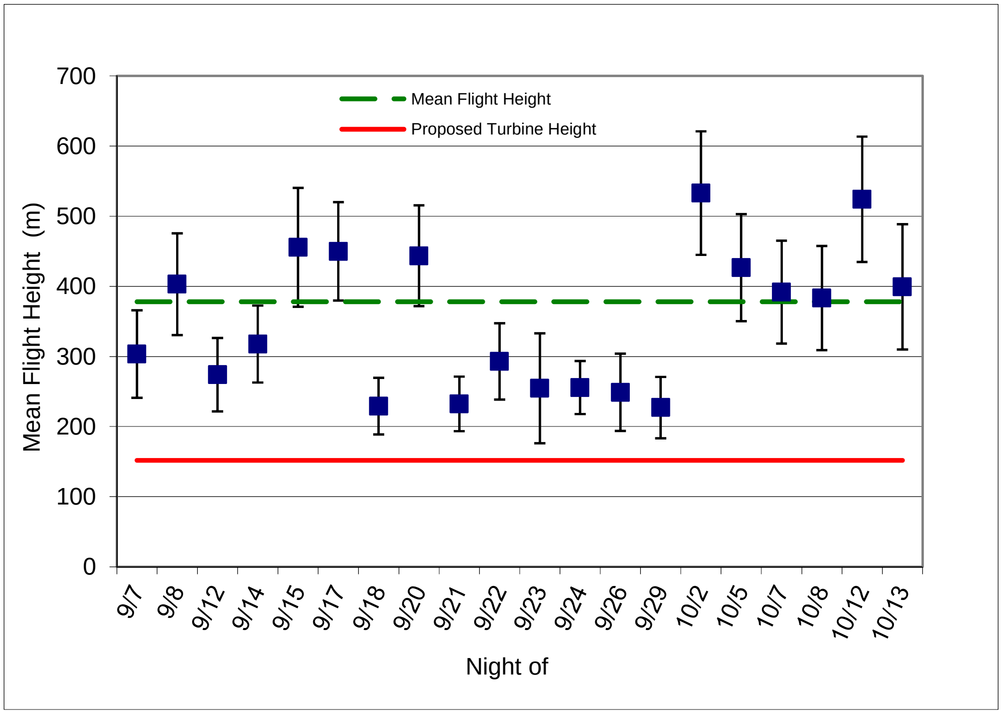
Fall 2010 Flight Direction (the bracket along the margin of the histogram is the 95% confidence interval)



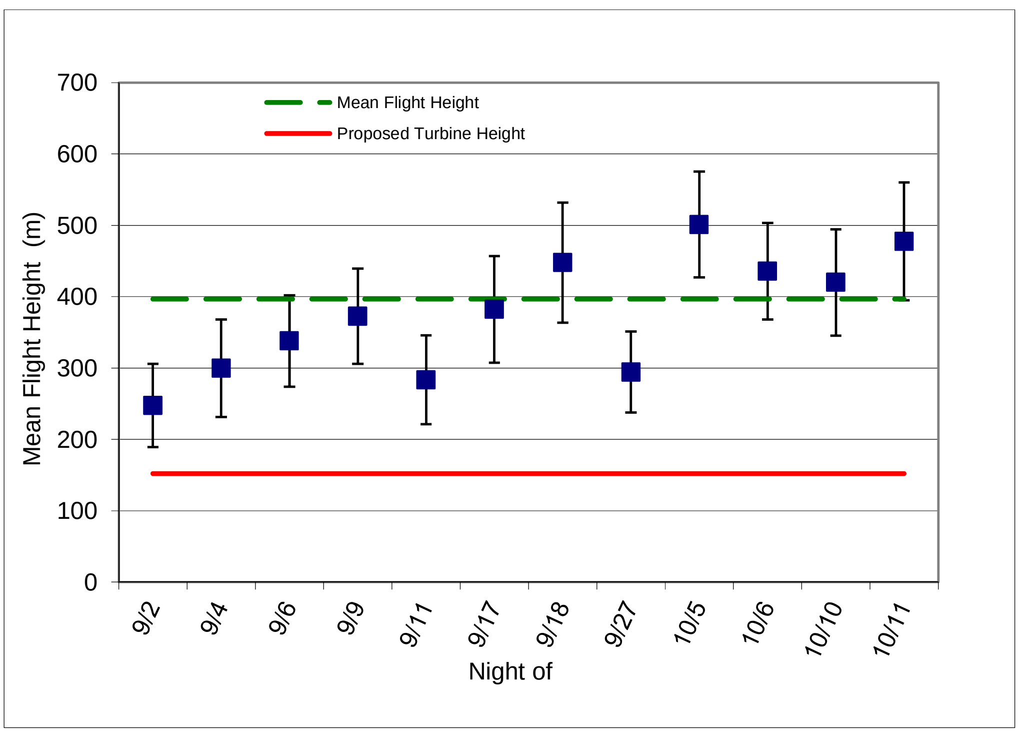
Fall 2011 Flight Direction (the bracket along the margin of the histogram is the 95% confidence interval)

Average flight height varied slightly between 2010 and 2011 at the Project. In 2010, the average flight height was 378 ± 1 m and in 2011 was 397 ± 1 m. The overall percent below turbine height in fall 2011 was 16 percent, lower than the percent below turbine height in fall 2010 (20%). The difference in flight heights between 2010 and 2011 is likely due to variations in weather patterns between years. In both 2010 and 2011, no nights had hourly or nightly mean flight heights below

152 m. Average flight height in both years is well above the proposed turbine height and within the range of results at other projects conducted on forested ridgelines in the eastern U.S. (Appendix Table 5).



Fall 2010 Flight Heights (error bars ± 1 SE)



Fall 2011 Flight Heights (error bars ± 1 SE)

In summary, results of fall 2011 surveys differed slightly from fall 2010 surveys in terms of passage rate, flight direction and flight height, which is to be expected due to year-to-year variation in migration characteristics and weather conditions which affect both the magnitude of migration and radar sampling. However, the timing of nights with the highest passage rates was similar between the two survey years.

Average flight direction and flight height are within the range of those recorded at other radar studies conducted in the eastern U.S. Passage rates at the Project in both 2010 and 2011 are higher than the range of results recorded at other radar studies conducted in the eastern U.S. It is important to note that pre-construction radar results do not directly relate to the magnitude of avian collisions post-construction; for example, at nine wind projects in the northeastern U.S. at which pre-construction radar and post-construction fatality were studied, no relationships between pre-construction passage rate results and post-construction fatality have been observed. Despite variable pre-construction passage rates across projects (Appendix Table 5), post-construction mortality rates (birds/turbine/study period) have been relatively similar (ranging from 0.44 to 6.31 birds/turbine/study period) between projects in the eastern U.S and do not appear to vary as greatly as pre-construction radar survey results (Appendix Table 6).

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Appendix – Fall 2011 Radar Summary Tables

Appendix Table 1. Survey dates, results, level of effort, and weather[1] - Bingham Wind Project, Fall 2011										
Date	**Sunset**	**Sunrise**	**# of Hours Analyzed**	**Passage rate**	**Flight Direction**	**Flight Height (m)**	**% below 152 m**	**Temperature (C)**	**Wind Speed (m/s)**	**Wind Direction (degrees)**
9/2	19:17	6:03	11	575	317	248	38%	N/A	N/A	N/A
9/4	19:13	6:05	7	341	289	300	21%	N/A	N/A	N/A
9/6	19:10	6:08	11	1658	233	338	18%	N/A	N/A	N/A
9/9	19:04	6:11	11	674	205	373	14%	N/A	N/A	N/A
9/11	19:00	6:14	11	413	342	283	31%	N/A	N/A	N/A
9/17	18:49	6:21	12	937	219	382	14%	N/A	N/A	N/A
9/18	18:47	6:22	12	1014	256	448	14%	N/A	N/A	N/A
9/27	18:30	6:33	12	2234	263	294	25%	N/A	N/A	N/A
10/5	18:15	6:43	13	1255	219	501	10%	N/A	N/A	N/A
10/6	18:13	6:44	13	361	219	436	14%	N/A	N/A	N/A
10/10	18:06	6:49	13	894	226	420	15%	N/A	N/A	N/A
10/11	18:04	6:50	13	809	275	478	13%	N/A	N/A	N/A
Entire Season			**139**	**952**	**244**	**397**	**16%**	N/A	N/A	N/A

[1] Weather Data is not yet available but can be incorporated into this report upon receipt.

Appendix A Table 2. Summary of passage rates by hour, night, and for entire season - Bingham Wind Project, Fall 2011																	
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**
9/2	554	718	1054	964	686	529	368	343	325	332	459	N/A	N/A	575	529	254	77
9/4	575	Rain	Rain	Rain	Rain	604	207	381	236	282	99	N/A	N/A	341	282	190	72
9/6	461	1675	1929	2011	2139	2207	2400	1904	1761	1239	511	N/A	N/A	1658	1904	654	197
9/9	218	539	968	1168	1486	950	582	454	346	329	371	N/A	N/A	674	539	408	123
9/11	154	729	639	543	568	521	332	243	293	279	243	N/A	N/A	413	332	192	58
9/17	393	1118	1289	1082	961	1161	1236	1343	889	1111	664	0	N/A	937	1096	400	116
9/18	564	1293	1407	1114	1189	1461	1129	1082	821	1082	1004	16	N/A	1014	1098	397	114
9/27	404	1543	2143	1943	2511	3350	3711	3529	3214	1968	1464	1029	N/A	2234	2055	1052	304
10/5	182	1586	1829	2243	2129	1979	1579	1771	1196	914	625	271	14	1255	1579	777	216
10/6	25	350	561	796	782	618	521	261	251	249	125	125	29	361	261	269	75
10/10	407	1482	1343	1336	950	1114	1793	1318	686	432	418	321	21	894	950	547	152
10/11	229	693	918	889	939	886	1061	1086	996	864	818	879	261	809	886	270	75
Entire Season	**347**	**1066**	**1280**	**1281**	**1304**	**1282**	**1243**	**1143**	**918**	**757**	**567**	**377**	**81**	**952**	**821**	**737**	**63**

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

Appendix A Table 3. Mean Nightly Flight Direction - Bingham Wind Project, Fall 2011		
Night of	**Mean Flight Direction**	**Circular Stdev**
9/2	317	67
9/4	289	79
9/6	233	38
9/9	205	49
9/11	342	69
9/17	219	44
9/18	256	61
9/27	263	25
10/5	219	26
10/6	219	39
10/10	226	37
10/11	275	36
Entire Season	**244**	**50**

Appendix A Table 4. Summary of mean flight heights by hour, night, and for entire season - Bingham Wind Project, Fall 2011																		
Night of	**Mean Flight Height (m) by hour after sunset**													**Entire Night**				**# of targets below 152 meters**	**% of targets below 152**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Mean**	**Median**	**STDV**	**SE**		
9/2	232	244	265	239	276	246	249	246	219	267	175	N/A	N/A	248	186	194	58	450	38%
9/4	210	Rain	Rain	153	Rain	278	283	340	428	363	248	N/A	N/A	300	244	193	68	89	21%
9/6	370	450	382	340	284	292	265	261	276	281	285	N/A	N/A	338	281	212	64	1094	18%
9/9	266	378	366	447	368	356	372	385	376	351	258	N/A	N/A	373	312	221	67	496	14%
9/11	193	279	298	307	327	299	304	264	267	262	257	N/A	N/A	283	216	207	62	331	31%
9/17	285	472	458	416	386	413	398	322	294	285	265	307	N/A	382	303	259	75	682	14%
9/18	325	493	524	510	472	480	498	417	381	341	306	228	N/A	448	376	292	84	443	14%
9/27	252	297	287	273	354	381	308	279	236	240	211	212	N/A	294	237	197	57	1030	25%
10/5	325	447	500	547	545	520	482	400	325	320	289	274	--	501	500	257	74	604	10%
10/6	268	396	391	481	451	478	436	416	434	415	359	336	500	436	424	244	68	295	14%
10/10	207	346	401	483	434	398	395	422	487	525	389	365	258	420	372	269	75	921	15%
10/11	262	392	421	415	447	501	542	528	538	586	481	350	337	478	416	297	82	394	13%
Entire Season	**266**	**381**	**390**	**384**	**395**	**387**	**378**	**357**	**355**	**353**	**294**	**296**	**365**	**397**	**333**	**257**	**1**	**6829**	**16%**
-- indicates no targets counted for that hour N/A indicates no or only partial data for that hour																			

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

Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Reference
Fall 2004									
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.
Casselman, Somerset Cty, PA	30	n/a	Forested ridge	174	n/a	n/a	436	(125 m) 7%	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
Dans Mountain, Allegany Cty, MD	34	318	Forested ridge	188	2-633	193	542	(125 m) 11%	Woodlot Alternatives, Inc. 2004. A Fall 2004 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Dan's Mountain Wind Project in Frostburg, Maryland. Prepared for US Wind Force.
Franklin, Pendleton Cty, WV	34	349	Forested ridge	229	7-926	175	583	(125 m) 8%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Liberty Gap Wind Project in Franklin, West Virginia. Prepared for US Wind Force, LLC.
Fall 2005									
Swallow Farm, PA	58	n/a	Forested ridge	166	n/a	n/a	402	(125 m) 5%	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
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.
Fayette Cty, PA	26	n/a	Forested ridge	297	n/a	n/a	426	(125 m) 5%	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
Stamford, Delaware Cty, NY	48	418	Forested ridge	315	22-784	251	494	(110 m) 3%	Woodlot Alternatives, Inc. 2007. A Spring and Fall 2005 Radar and Acoustic Survey of Bird Migration at the Proposed Moresville Energy Center in Stamford and Roxbury, New York. Prepared for Invenergy, LLC. Rockville, MD.
Preston Cty, WV	26	n/a	Forested ridge	379	n/a	n/a	420	(125 m) 10%	Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2006 A radar and visual study of nocturnal bird and bat migration at the proposed Preston Wind Development project, Virginia, Fall 2005. Report to Highland New Wind Development, LLC.
Highland, VA	58	n/a	Forested ridge	385	n/a	n/a	442	(125 m) 12%	Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2006 A radar and visual study of nocturnal bird and bat migration at the proposed Highland New Wind Development project, Virginia, Fall 2005. Report to Highland New Wind Development, LLC.
Kibby, Franklin Cty, ME (Valley)	5	13	Forested ridge	452	52-995	193	391	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Mars Hill, Aroostook Cty, ME	18	117	Forested ridge	512	60-1092	228	424	(120 m) 8%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird Migration at the Mars Hill Wind Farm in Mars Hill, Maine. Prepared for Evergreen Windpower, LLC.
Deerfield, Bennington Cty, VT	32	324	Forested ridge	559	3-1736	221	395	(100 m) 13%	Woodlot Alternatives, Inc. 2006. Fall 2005 Bird and Bat Migration Surveys at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy, Inc.
Kibby, Franklin Cty, ME (Mountain)	12	115	Forested ridge	565	109-1107	167	370	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
Fall 2006									
Somerset Cty, PA	29	n/a	Forested ridge	316	n/a	n/a	374	(125 m) 8%	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
Bedford Cty, PA	29	n/a	Forested ridge	438	n/a	n/a	379	(125 m) 10%	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
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.
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									
Laurel Mountain, Barbour Cty, WV	20	212	Forested ridge	321	76-513	209	533	(130 m) 6%	Stantec Consulting Services Inc. 2007. A Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Laurel Mountain Wind Energy Project near Elkins, West Virginia. Prepared for AES Laurel Mountain, LLC.
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.
Rollins, Lincoln, Penobscot Cty, ME	22	231	Forested ridge	368	82-953	284	343	(120 m) 13%	Woodlot Alternatives, Inc. 2008. A Fall 2007 Survey of Bird and Bat Migration at the Rollins Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
Roxbury, Oxford Cty, ME	20	220	Forested ridge	420	88-1006	227	365	(130 m) 14%	Woodlot Alternatives, Inc. 2007. A Fall 2007 Survey of Bird and Bat Migration at the Record Hill Wind Project, Roxbury, Maine. Prepared for Roxbury Hill Wind LLC.
Allegany, Cattaraugus Cty, NY	46	n/a	Forested ridge	451	n/a	230	382	(150 m) 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
New Creek, Grant Cty, WV	20	n/a	Forested ridge	811	263-1683	231	360	(130 m) 17%	Stantec Consulting Services Inc. 2008. A Fall 2007 Survey of Bird and Bat Migration at the New Creek Wind Project, West Virginia. Prepared for AES New Creek, LLC.
Fall 2008									
Georgia Mountain, VT	21	n/a	Forested ridge	326	56-700	230	371	(120 m) 7%	Stantec Consulting Services Inc. 2008. A Fall 2008 Survey of Bird Migration at the Georgia Mountain Wind Project, Vermont. Prepared for Georgia Mountain Community Wind.
Oakfield, Penobscot Cty, ME	20	n/a	Forested ridge	501	116-945	200	309	(125 m) 18%	Woodlot Alternatives, Inc. 2008. A Fall 2008 Survey of Bird and Bat Migration at the Oakfield Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
Tenney, Grafton Cty, NH	45	509	Forested ridge	470	94-1174	260	342	(125m) 13%	Stantec Consulting Services Inc. 2008. Fall 2008 Radar Survey Report for the Groton Wind Project. Prepared for Groton Wind, LLC.
Highland, Somerset Cty, ME	20	216	Forested ridge	549	68-1201	227	348	(130.5m) 17%	Stantec Consulting. 2009. Fall 2008 Bird and Bat Migration Survey Report: Radar and Acoustic Avian and Bat Surveys for the Highland Wind Project Highland Plantation, Maine. Prepared for Highland Wind LLC
Fall 2009									
Sisk (Kibby Expansion) Franklin Cty, ME	20	210	Forested ridge	458	44-1067	206	287	(125m) 23%	Stantec Consulting Services. 2009. Fall 2009 Nocturnal Migration Survey Report. Prepared for TRC Engineers LLC.
Vermont Community Wind Farm, Orleans Cty, VT	20	227	Forested ridge	443	110-1029	215	330	(130m) 15%	Stantec Consulting Services. 2009. Fall 2009 Bird and Bat Survey Report. Nocturnal Radar, Acoustic, and Diurnal Raptor Surveys performed for the Vermont Community Wind Farm Project in Rutland County, Vermont. Prepared for Vermont Community Wind Farm, LLC.
Stetson, Washington Cty, ME	18	201	Forested ridge	457	106-1746	227	420	(119m) 2%	Stantec Consulting Services. 2010. Stetson I Mountain Wind Project Year 1 Post-Construction Monitoring Report, 2009. Prepared for First Wind Management, LLC.
Bull Hill, Hancock Cty, ME	20	232	Forested ridge	614	188-1500	260	357	(145m) 20%	Stantec Consulting Services. 2010. Summer and Fall 2009 Avian and Bat Survey Report for the Bull Hill Project. Prepared for Blue Sky East Wind, LLC.
Bowers, Washington Cty, ME	22	249	Forested ridge	344	95-844	231	453	(119m) 14%	Stantec Consulting Services Inc. 2010. 2010 Spring Avian and Spring/Summer Bat Surveys for the Bowers Wind Project. Prepared for Champlain Wind Energy, LLC.
Fall 2010									
Bingham, Somerset Cty, ME	20	232	Forested ridge	803	194-2463	234	378	(152m) 20%	Stantec Consulting Services Inc. 2010. 2010 Spring Avian and Spring/Summer Bat Surveys for the Bowers Wind Project. Prepared for Champlain Wind Energy, LLC.
Fall 2011									
Bingham, Somerset Cty, ME	12	139	Forested ridge	952	341-2234	244	397	(152m) 16%	*this report*

Appendix Table 6. Comparison of bird and bat mortality at existing wind farms in the eastern U.S.

Site	Habitat type (# turbines)	Dates surveyed	Search interval	# BATS found during surveys (incidental)	Estimated total BAT fatalities/turbine/year (total)	# BIRDS found during surveys (incidental)	Estimated total BIRD fatalities/turbine/study period (total)	Reference
Searsburg, Vermont	forested (11)	30 June - 18 October, 1997	11 total (4 per search) 2 to 6 days per month	0	n/a	0	n/a	Kerlinger 2002
Somerset County, Pennsylvania	agricultural (8)	2000 (12 months)	n/a	0	n/a	0	n/a	Kerlinger 2006
Mountaineer, West Virginia	forested ridgeline (44)	4 April - 11 Nov, 2003	2x per week	475	47.53/t/study period (2092)	69*	4.04/t/study period (178 + 33 due to substation lighting)	Kerns and Kerlinger, 2004
Mountaineer, West Virginia	forested ridgeline (44)	31 July- 11 September, 2004	22 daily, 22 weekly	398 (68)	38/t/study period (1364-1980)	15 (n/a)	n/a	Arnett 2005
Myersdale, Pennsylvania	forested ridgeline (20)	2 August - 13 September, 2004	10 daily, 10 weekly	262 (37)	25/t/study period (400-660)	13 (4)	n/a	Arnett 2005
Buffalo Mtn, Tennessee	reclaimed mine on ridge (18)	April - December, 2005	18 of 18 every week, every 2 weeks, or every 2-5 days	243 (14)	63.9/t/study period (1,149)	9 (2)	1.8/t/study period (111.6 total)	Fiedler *et al.* 2007
Maple Ridge, New York	woodland, grassland, agricultural (120)	June 17 - November 15, 2006	10 every 3-days, 30 7-days, 10 daily	326 (58)	11.39-20.31/t/study period (1367-2437.2)	123 (15)	3.10-9.48/t/study period (372-1138 total)	Jain *et al*. 2007
Maple Ridge, New York	woodland, grassland, agricultural (195)	April 30 - November 14, 2007	64 weekly	202 (81)	15.54-18.53/t/study period (3030-3614)	64 (32)	5.67-6.31/t/study period (1106-1230)	Jain *et al.* 2008
Maple Ridge, New York	woodland, grassland, agricultural (195)	April 15 - November 9, 2008	64 weekly	140 (76)	8.18 - 8.92/t/study period (1595-1739)	74 (23)	3.42-3.76/t/study period (667-733)	Jain *et al.* 2009a
Mars Hill, Maine	forested ridgeline (28)	23 April- 3 June, 15 July-23 Sept 2007	2 of 28 daily, 28 of 28 weekly, seasonal dog searches	22 (2)	0.43/t/study period-4.4/t/study period (12.1-122.5)	19 (3)	0.44-2.5/t/study period (26.8-69.2 total)	Stantec 2008
Mars Hill, Maine	forested ridgeline (28)	19 April- 6 June, 15 July-8 Oct 2008	28 of 28 weekly, seasonal dog searches	5	0.17/t/study period-0.68/t/study period (5-19)	17(4)	2.4/t/study period-2.65/t/study period (57-74)	Stantec 2009a
Munnsville, New York	agricultural and forested uplands	April 15- November 15, 2008	12 of 23 weekly, seasonal dog searches	9 (1)	0.70-2.90/t/study period	7 (3)	1.71-2.22/t/study period (39.2-51.12)	Stantec 2009b
Stetson Mountain I, Maine	forested ridgeline (38)	April 20 to Oct 21, 2009	19 weekly	5 (0)	2.11/t/study period (80)	30 (9)	4.03/t/study period (153)	Stantec 2010a
Stetson Mountain II, Maine	forested ridgeline (17)	April 19 to Oct 15, 2010	17 weekly	14	2.48/t/study period (42.12)	11	2.14/t/study period (36.41)	Normandeau Associates, 2010 preliminary estimates, unpubl. data
Mount Storm, West Virginia	forested ridgeline (82)	July 18- October 17 2008	18 weekly, 9 daily	182 (27)	7.76-24.21/t/study period (636-1985)	29 (8)	2.41-3.81/t/study period (198-312)	Young *et al.* 2009
Clinton, New York	agricultural, woodland (67)	April 26 to October 13, 2008	8 daily, 8 every 3-days, 7 every 7-days	39 (14)	3.76-5.45/t/study period (252-365)	14 (9)	1.43-2.48 small birds/t/study period (96 - 166); 0.88 med-large birds/t/study period (59)	Jain et al. 2009b
Ellenburg, New York	agricultural, woodland (54)	April 28 to October 13, 2008	6 daily, 6 every 3-days, 6 every 7-days	34 (25)	3.37-6.59/t/study period (226-441)	12 (10)	0.92-1.10 small birds/t/study period (62-74); 0.77 med-large birds/t/study period (51)	Jain et al. 2009c
Bliss, New York	agricultural, woodland (67)	April 21 - Nov 14, 2008	8 daily, 8 every 3-days, 7 every 7-days	74 (15)	7.58-14.66/t/study period (508-983)	20 (7)	0.74-4.04 small birds/t/study period (50-271); 0.25-0.66 med-large birds/t/study period (17-44)	Jain et al. 2009d
Lempster, New Hampshire	forested ridgeline (12)	April 15-June 1; July 15-Oct 31	4 daily	10 (2)	0.58/t/spring (7); 5.51/t/fall (66)	9 (4)	0.80/t/spring (10); 5.95/t/fall (71)	Tidhar and Sonnenberg 2010
Cohocton and Dutch Hill, New York	agricultural, woodland (50)	April 15 - Nov 15, 2009	5 daily, 12 weekly	62 (7)	13.8-40.4/t/study period (804-2002)	15 (3)	2.9-4.7/t/study period (147-235)	Stantec 2010b
Cohocton and Dutch Hill, New York	agricultural, woodland (50)	April 26 - Oct 22, 2010	17 weekly; 5 daily/12 weekly from July 15 to Sept 17	58 (5)	5.04-25.62/t/study period (252-1281)**	8 (1)	0.82-2.06/t/study period (41-103)**	Stantec 2010c

*33 birds found on May 23, 2003 at turbines near a substation and at substation associated with sodium vapor lights

**Estimates based on 2010 daily searches are only representative of the period from mid-July to mid-September and are therefore not directly comparable to other sites' estimates where daily searches were conducted during the full study period.

Exhibit 7E-1: Post-Construction Monitoring Plan

Post Construction
Mortality Monitoring Plan

Bingham Wind Project
Bingham, Mayfield, and Kingsbury, Maine

Prepared for:

Blue Sky West II, LLC
129 Middle Street,
3rd Floor
Portland, ME 04101

Prepared by:

Stantec Consulting
30 Park Drive
Topsham, ME 04086

March 2013

Stantec

1.0 Post-Construction Avian and Bat Fatality Monitoring Protocol

To assess wildlife impacts due to operation of the Bingham Wind Project (project), Blue Sky West, LLC (the Applicant) will conduct post-construction monitoring during the first full year of operation. The methods in this work plan are based on standard post-construction monitoring techniques used at existing wind farms in the region, including the work plans at the operational Stetson I, Stetson II, and Rollins projects, which were developed in consultation with the Maine Department of Inland Fisheries and Wildlife (MDIFW). The effort also assumes that all 62 turbines will be curtailed, as described in Exhibit 7E-2.

Objectives of post-construction monitoring are:

- to document the species and number of individuals of bird and bat fatalities during the spring, summer, late-summer, and fall of the first year of operation of the wind farm;
- to estimate the level of take of birds and bats during the first year study period based on the results of standardized searches, searcher efficiency trials, scavenger carcass removal trials, and if necessary, a search area correction factor; and
- to determine if fatality events are uniform across the project area.

Fatality Search Methods:

Mortality monitoring during the first year of project operation will include searches at 21 turbines (33%). The turbines to be included in searches will be chosen at random from groupings of turbines classified by different landscape or project design features. Survey effort will include searches at the 21 turbines three times every two weeks (i.e., once every 5 days) between April 15 and October 15.

Monitoring during this period will result in 26 consecutive weeks of surveys. Monitoring will cover four distinct seasons:

- spring migration – April 15 to June 7;
- summer breeding – June 8 to July 14;
- late-summer – July 15 to August 31; and
- fall migration – September 1 to October 15.

The entire leveled and graded lay-down area (typical diameter of 80 m), as well as adjacent stable side slopes and adjacent road sections out to a maximum distance of 60-m from turbines will be searched. Transects will be established 4 m (13 feet [ft]) apart within search areas.

Turbine searches will be completed by 2 surveyors during approximately 5 survey days per week, typically visiting around 9 turbines per day. Searches will generally be scheduled for the same 5 days each week (Monday through Friday) to maintain consistent search intervals.

The biologists conducting turbine searches will be trained on the search protocol by the representative designated by the Applicant. During searches, all carcasses found (intact or scavenged) will be photographed and documented on standardized field forms.

The following information will be recorded for each carcass found:

- date and time;
- biologist identification;
- search plot identification;
- general weather conditions;
- ground cover conditions (e.g., vegetation type and height, wet, dry, gravel);
- distance (determined by a laser range finder) and compass direction from the turbine;
- distance and compass direction from the transect from which the carcass was detected;
- carcass condition (e.g., fresh, rigor, decomposed, intact carcass, scavenged, feather spot);
- carcass position (e.g., face-up or down, sprawled out or balled up); and
- species, age, gender, and reproductive condition (when possible).

Carcasses will be collected under appropriate state and federal permits and will be individually bagged and frozen. Carcasses will be retained in a freezer at the Operations and Maintenance building and may be used in searcher efficiency and scavenger carcass removal trials. In the event that a federally or state-listed threatened or endangered species is found, the appropriate agency will be contacted, and arrangements will be made to submit the carcass to the agency within the timeframe specified on the collection permit. If a large-scale fatality event (i.e., more than 5 carcasses at one turbine, more than 20 carcasses found across the project area in one survey day) is observed, the appropriate agency will be contacted within 24 hours. If an injured bird or bat is found, the animal will be transported to a local wildlife rehabilitator, when possible.

Maintenance personnel will be informed of the timing of standardized searches and will be trained on the collision event reporting protocol in the event that a carcass or injured animal is found. Carcasses found outside of standardized searches will be documented and collected but will be reported separately from those carcasses found during standard searches. If these carcasses are found at non-search turbines, they will not be included in estimates of take. If they are found at search turbines, but just not during a scheduled search, they will be included in estimates of take in an effort to increase the fatality dataset sample size, and ultimately increase accuracy of fatality estimates.

Vegetation conditions, including percent coverage within search areas and vegetation height, will be monitored on a weekly basis. Ground cover types will be classified into different Visibility Classes, as specified in Arnett et al. 2010. The extent of search areas at each turbine will be mapped. Additionally, nightly weather conditions will be monitored throughout the survey period. Wind speed and direction, barometric pressure, and temperature will be recorded at an on-site meteorological tower, and/or by an anemometer on a turbine nacelle. Additional weather parameters will be recorded by the survey biologist(s) from a location in proximity of the Project on nights prior to fatality searches. These parameters will include cloud type, percent cloud cover, general ceiling height, relative visibility, moon phase, precipitation, and any notable weather events (passing of storms or fronts). Additionally, during site visits the biologist(s) will document incidental wildlife observations on standardized field forms.

Searcher Efficiency Trials:
Searcher efficiency trials will be conducted throughout the study period, and the biologists will be unaware of trial dates. Carcasses will be discreetly marked and placed at turbines by the trial coordinator early in the morning prior to scheduled turbine searches. Any carcasses not found during searches will be retrieved at the end of the survey day. Trial results will be documented on standardized field forms. A target number of 50 total carcasses, or at least 10 bird and bat carcasses per ground cover Visibility Class, will be placed during trials over the course of the survey year. Carcasses will be of native species, if available; otherwise, surrogate non-native species will be selected. Trial carcasses will include both large and small bird carcasses as well as bat carcasses. Trials will be distributed across the four seasons of surveys, and carcasses will be placed in the variety of ground cover types that occur within search areas. The percent of carcasses found during trials will be used to help estimate the level of bird and bat take during the study period.

Carcass Removal Trials:
Carcass removal rate trials will be conducted during each survey season and will be completed independently of the searcher efficiency trials. A target total of 50 carcasses, or at least 10 bird and bat carcasses per ground cover Visibility Class, will be placed within all available ground cover types within search areas. Fresh bird and bat carcasses of native species will be discretely marked and monitored until they are removed by scavengers or completely decomposed. Carcasses will be checked during the first 7 days after they are placed, then again on days 10, 14, 24, 28, and on additional days if necessary. During carcass placement and during consecutive checks, efforts will be made to reduce bias associated with human scent, including minimal handling of carcasses, subtle marking of carcasses, and the use of gloves during carcass placement. Also, smaller numbers of carcasses placed during more frequent trials may more accurately represent scavenger activity at the site as opposed to placement of large numbers of carcasses during just a few trials. During the trial periods, the status of all carcasses, including all evidence of scavenging or decomposition, will be documented on standardized field forms. The carcass removal data will be used to help estimate the percent of carcasses that remain detectable in search

areas during the 7-day interval between standardized searches. Monitoring of carcasses beyond the 7-day period will also indicate the average number of days that carcasses remain in search areas.

Search area correction:
If the search area is significantly reduced by forest edge, and searching out to the maximum distance of 60 m on all sides of the tower is not possible at some search turbines, a correction factor may be applied to the number of carcasses found at these turbines. Methods to estimate the number of carcasses that may have occurred within truncated portions of search plots may be based on those proposed by Jain et al. 2009, as modified from Fiedler et al. 2007 (or the best available methods at the time of reporting).
The boundaries of searchable areas at each search turbine will be mapped. The number of bird and bat fatalities found within each 10-m annuli at each individual search turbine will be divided by the percent area searched within each annuli, within a 60 m distance from the tower on all sides. For example, if 40% of the 41-50 m annulus was searchable at a turbine, and 1 bird was found within this annulus at that turbine, then there were 1/0.40 = 2.5 adjusted bird fatalities for that annulus. As such, search area corrections will be applied to the actual number of carcasses found at each search turbine, before corrections for searcher bias and persistence bias are applied.

Analysis and Reporting:
Data collected will include the date, species, sex and age (when possible), turbine number, carcass distance and direction from tower, Visibility Class, carcass condition, and weather conditions during collision event (as possible) for bird and bat fatalities will be summarized in the annual report. Analysis will include a summary of the distribution of fatalities among turbines throughout the project area in relation to topographical and project design features (e.g., on slope, top of hill, turbine string, location within turbine string, Federal Aviation Administration lighting). The number of carcasses found during standard searches, the percent of carcasses found by the biologist as determined by the searcher efficiency trials, the percent of carcasses that are not removed by scavengers between search intervals, and if necessary, an area correction factor to account for carcasses that may have landed in unsearchable portions of 80-m diameter plots, will be used to determine an estimate of bird and bat take during the study period. This will include an estimate of the number of bird and bat fatalities per turbine and per megawatt. The formula used to estimate mortality will be one or more of the standard formulas employed by other recent mortality studies (e.g., the Huso [2012] fatality estimator), and will be based on the method or methods deemed most accurate at estimating fatality at the time of reporting.

Exhibit 7E-2: Curtailment Plan

Curtailment Plan

Bingham Wind Project
Bingham, Mayfield, and Kingsbury, Maine

Prepared for:

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March 2013

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The most recent research at operating wind farms within the eastern United States indicates that curtailment of wind turbines at low wind speeds has the potential to reduce bat mortality. Curtailment consists of altering (delaying) the operation of a wind turbine so that it begins generating energy at a wind speed greater than its normal “cut-in” wind speed (e.g., the turbine blades will begin spinning and the generator will begin producing electricity once wind speeds reach 5.0 meters per second [m/s] rather than the normal 3.0 or 3.5 m/s). Curtailment studies to date have focused on late summer/early fall, the time period when bat fatalities have been observed to be greatest. These studies have incorporated various combinations of low wind speed, temperature, and time of night (Young et al. 2011), which account for the times when bat activity is also greatest (Hayes 1997, Arnett et al. 2006, Arnett et al. 2010, Reynolds 2006, Kunz 2004, Kunz and Lumsden 2003 as cited by Young et al. 2011).

To reduce potential bat mortality due to the operation of the Bingham Wind Project (project), Blue Sky West, LLC and Blue Sky West II, LLC (Applicants) will curtail all 62 turbines, as described below. This curtailment plan is provided in response to a document received from the Maine Department of Inland Fisheries and Wildlife (MDIFW Recommendations) in an email dated December 17, 2012 for other recent projects titled, “Maine Turbine Curtailment Requirements to Decrease Bat Mortality.” The MDIFW Recommendations call for turbines to be curtailed during timeframes when all of the following criteria are met: (1) for up to 180 nights between April 20 and October 15; (2) from 0.5 hour before sunset to 0.5 hour after sunrise; and (3) when average wind speed (10-minute interval) at the hub height of a turbine is 5 m/s or below.

The Applicants believe that these curtailment parameters are above and beyond what has been determined to reliably reduce bat impacts at the project. An abundance of fatality data from sites across the eastern United States demonstrate that a very small percentage of bat fatality occurs in April, May and October; bat acoustic data indicate that far less than one percent of bat activity occurs after sunrise; and bat activity has been demonstrated to be correlated not only with wind speed but also with ambient temperature (and perhaps several other atmospheric conditions) that can be incorporated into a refined curtailment strategy that is data driven.

Regardless of the concerns described above, the Applicants will implement the curtailment parameters outlined in the MDIFW Recommendations. Given the Applicants’ commitment to curtail wind turbine operations, they believe post-construction mortality monitoring requirements at the site should include a single year of standard monitoring surveys. Since curtailment will be implemented at the start of operations, the Applicants believe that longer term monitoring is not necessary. The post-construction monitoring plan provided as Exhibit 7E-1 provides the details of the monitoring the Applicants believe most appropriate for the site, given that curtailment will be implemented according to the MDIFW Recommendations.

In addition, the Applicants should be able to reduce or eliminate this curtailment window (total time period and within the night) and/or add a temperature threshold for curtailment if agreed to in cooperation with the Maine Department of Environmental Protection, as well as existing and future research or advances in technology to reduce. For instance, if the results of MDIFW’s requested curtailment protocol for this project or any other future wind-related fatality survey data from Maine continue to demonstrate that only a small percentage of fatalities are found before June and after September, then the Applicants believe the curtailment window should be reduced accordingly. Additionally, if emerging technologies such as high-frequency audio or infra-red visual deterrents are proven to effectively reduce bat fatalities at rates that match or exceed curtailment, then a similar reduction or elimination of curtailment will be sought.

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