EXHIBIT A.1 SCENIC CHARACTER EVALUATION

An aesthetic (visual) impact assessment ("AIA") was performed for the Kibby Expansion Project in accordance with the requirements set forth in 34-A M.R.S.A. § 3451 and 12 M.R.S.A. § 685-B(4-C). Associated facilities including new roads, collector lines and substations were also analyzed for potential aesthetic impacts. The AIA is provided in Attachment A.1.

There are four scenic resources of state or national significance located within three miles of the Project: The Arnold Trail (National Register of Historic Places), Chain of Ponds (Great Ponds), Kibby Stream (Scenic River) and Natanis Pond Overlook (Scenic Road Turnout). There are seven scenic resources of state or national significance located within three to eight miles of the Project: Additional sections of the Arnold Trail and Chain of Ponds; Arnold Pond, Crosby Pond (Great Ponds), the North Branch of the Dead River and Spencer Stream (Scenic Rivers) as well as the Sarampus Fall Rest Area (Scenic Road Turnout).

The visibility of the Kibby Expansion Project overall is relatively limited. Portions of the Project will be visible from approximately 31% of the Chain of Ponds at distances ranging from about 2.8 miles to 3.5 miles from the closest turbine. The Project will not be visible from Round Pond or from most of Natanis Pond. In addition, the Project will not be visible from Lower Pond. The Project will be visible (up to 14 turbines) from the southeastern portion of Long Pond. There would be minor visibility (1-3 turbines) of the Project from Arnold and Crosby Ponds, which are located between 6.5 and 7.5 miles from the Project.

The Project is not visible from the Natanis Pond Overlook or the Sarampus Falls Rest Area.

Views of the Kibby Expansion Project including access roads and collector lines may be visible from portions of Kibby Stream where there are openings in the forest from roads and forest management activities. These Project elements are not expected to dominate views from Kibby Stream.

The AIA demonstrates that the Kibby Expansion Project will not have an unreasonable adverse effect on the scenic values and the existing uses related to scenic character of the area, or uses of scenic resources of state or national significance.

ATTACHMENT A.1

Aesthetic Impact Assessment

KIBBY EXPANSION WIND PROJECT

AESTHETIC IMPACT ASSESSMENT

By
Jean Vissering Landscape Architecture

With

Simulations and Mapping by Judy Bartos,
Senior GIS Systems Analyst, TRC

For

TransCanada

November 30, 2009

AESTHETIC IMPACT ASSESSMENT

KIBBY EXPANSION WIND POWER PROJECT

A. Introduction and Purpose of Report

This report examines potential visual impacts on scenic resources of state and national significance surrounding TransCanada's proposed 15-turbine 45MW wind energy Project (the "Project" or Kibby Expansion") proposed by TransCanada along portions of the ridgeline of Sisk Mountain. The Project would be located in Chain of Ponds and Kibby Townships in the expedited permitting area as defined under 35-A M.R.S.A. § 3451. Supplementing this report are the following appendices:

- Appendix 1. Viewshed Analysis Map 8-Mile Radius,
- Appendix 2. Viewshed Analysis Map Detail: Chain of Ponds
- Appendix 3. Photographs Illustrating Scenic Resources in the Surrounding Area
- Appendix 4. Simulation Photographs:
    1. Chain of Ponds: Natanis Pond Southeast
    2. Chain of Ponds: The Narrows between Natanis and Long Ponds
    3. Chain of Ponds: Long Pond Northwest 1
    4. Chain of Ponds: Long Pond Northwest 2
    5. Chain of Ponds: Long Pond Southeast
    6. Chain of Ponds: Bag Pond

B. Methodology of Review

The aesthetic impact assessment follows the criteria for review defined in 35-A M.R.S.A. § 3451 and 12 M.R.S.A. § 685-B(4-C). The Kibby Expansion Project will be reviewed by the Land Use Regulation Commission (LURC) under Title 12, Chapter 206-A.

The focus of review is on designated scenic resources of state or national significance within an 8- mile radius of the proposed Project ("study area").[1] Scenic resources within 3 miles of the proposed Project are analyzed in greater detail. Associated facilities including new roads, collector lines and substations have also been analyzed for their potential aesthetic impacts. Project assessment included several field visits to the area during March and October of 2009.

Scenic resources of state or national significance within 8 miles of the proposed Project were identified in accordance with 35-A M.R.S.A. § 3451 as follows:

[1] Viewshed Analysis is based on 8 miles from the proposed turbines (Appendices 1 and 2).

A. *National natural landmark, federally designated wilderness or other comparable outstanding natural and cultural feature*.
   - None occur within the area.

B. *A property listed on the National Register of Historic Places.*
   - The Arnold Trail is listed on the National Register of Historic Places. The trail extends from Coburne Shipyard in Pittston, Maine to Quebec City, and portions within the U.S. to the Canadian border are managed by the Arnold Expedition Historical Society. Within the study area, the Trail route follows the North Branch of the Dead River and continues north through Chain of Ponds, then along Horseshoe Stream, through Horseshoe Pond to Arnold Pond. The route is adjacent to the present day Route 27. Visibility of the Project would occur along some portions of Chain of Ponds at distances ranging from about 2.7 to 4 miles away from the closes turbine. A few turbines may be visible from Arnold Pond located approximately 7 miles away.

C. *A national or state park.*
   - There are no national or state parks in the study area.

D. *A great pond designated in the Maine Wildlands Lakes Assessment (1987) as having outstanding or significant scenic quality*.
   - Chain of Ponds is identified as Management Class 2 in the *Maine Wildlands Lake* Assessment with outstanding scenic value. Chain of Ponds includes Round, Natanis, Long, Bag and Lower Ponds. While there would be no visibility from approximately 70% of Chain of Ponds, there would be visibility of the Project from portions of Natanis, Long and Bag Ponds at distances ranging from 2.7 to 4 miles away from the closest turbine.
   - Crosby Pond is identified as a Management Class 2 Pond with outstanding scenic values and is 6.5 miles away from the Project. There will be very limited visibility from this pond.
   - Arnold Pond is listed as a Management Class 4 pond (high value, developed lakes) with outstanding scenic value. It is located near the Canadian border at approximately 7 miles from the Project. Visibility would be minimal.

E. *A segment of a scenic river or stream identified as having unique or outstanding scenic attributes.*
   - Appendix G of the Maine Rivers Study lists three rivers or streams within the study area as “scenic rivers.” Kibby Stream has its headwaters near the Sisk ridge and portions are within 3 miles of the proposed Project. There may be visibility from the stream. Spencer Stream and the North Branch of the Dead River are also listed but the Project would not be visible from either one. Both are located between 3 and 8 miles from the Project.

F. *A scenic viewpoint located on state public reserved land or on a trail that is used exclusively for pedestrian use that the Department of Conservation designates by rule adopted in accordance with section 3457.*

- There are no identified scenic viewpoints within Maine Reserve Lands occurring in the area. Maine Reserve Lands are located around the northern end of Natanis Pond and along portions of the northeast shoreline of Natanis, Long, Bag and Lower Ponds.

G. *A scenic turnout constructed by the DOT on a public road designed as a scenic highway*.

- There are two scenic turnouts along the Route 27 Scenic Byway in the study area. The Sarampus Falls Rest Area overlooks a small but scenic waterfall and has picnic tables and toilet facilities. There is also a small overlook at the north end of Natanis Pond. There would be no views of the Project from either location.

H. *Scenic viewpoints located in the coastal area.*

- None occur in the Project area.

Summary of Scenic Resources of State and National Significance in the Surrounding Area

Scenic Resources of State or National Significance in the Surrounding Area	Significance State: S National: N	Visibility Yes (Y) No (N)
<u>Within 3 miles of the Project</u>		
▪ National Register of Historic Places: The Arnold Trail	N	Y
▪ Great Ponds: Chain of Ponds	S	Y
▪ Scenic River: Kibby Stream	S	Y
▪ Scenic Road Turnouts:		
▪ Natanis Pond Overlook	S	N
<u>Within 3-8 miles of the Project</u>		
▪ National Register of Historic Places: The Arnold Trail	N	Y
▪ Great Ponds:		
▪ Chain of Ponds	S	Y
▪ Arnold Pond	S	Y
▪ Crosby Pond	S	Y
▪ Scenic River:		
▪ North Branch of the Dead River	S	N
▪ Spencer Stream	S	N
▪ Scenic Road Turnouts:		
▪ Sarampus Falls Rest Area	S	N

The evaluation of aesthetic impacts is discussed as follows in 35-A M.R.S.A. § 3452:

Determination of Effect on Scenic Character and Related Existing Uses

1. Application of Standard.
In making findings regarding the effect of an expedited wind energy development on scenic character and existing uses related to scenic character pursuant to Title 12, section 685-B, subsection 4 or Title 38, section 484, subsection 3 or section

480-D, the primary siting authority shall determine, in the manner provided in subsection 3, whether the development significantly compromises views from a scenic resource of state or national significance such that the development has an unreasonable adverse effect on the scenic character or existing uses related to scenic character of the scenic resource of state or national significance. Except as otherwise provided in subsection 2, determination that a wind energy development fits harmoniously into the existing natural environment in terms of potential effects on scenic character and existing uses related to scenic character is not required for approval under either Title 12, section 685-B, subsection 4, paragraph C or Title 38, section 484, subsection 3.

3. Evaluation criteria. *In making its determination pursuant to subsection 1, and in determining whether an applicant for an expedited wind energy development must provide a visual impact assessment in accordance with subsection 4, the primary siting authority shall consider:*

A. The significance of the potentially affected scenic resource of state or national significance;
B. The existing character of the surrounding area;
C. The expectations of the typical viewer;
D. The expedited wind energy development's purpose and the context of the proposed activity;
E. The extent, nature and duration of potentially affected public uses of the scenic resource of state or national significance and the potential effect of the generating facilities' presence on the public's continued use and enjoyment of the scenic resource of state or national significance; and
F. The scope and scale of the potential effect of views of the generating facilities on the scenic resource of state or national significance, including but not limited to issues related to the number and extent of turbines visible from the scenic resource of state or national significance, the distance from the scenic resource of state or national significance and the effect of prominent features of the development on the landscape.

A finding by the primary siting authority that the development's generating facilities are a highly visible feature in the landscape is not a solely sufficient basis for determination that an expedited wind energy Project has an unreasonable adverse effect on the scenic character and existing uses related to scenic character of a scenic resource of state or national significance. In making its determination under subsection 1, the primary siting authority shall consider insignificant the effects of portions of the development's generating facilities located more than 8 miles, measured horizontally, from a scenic resource of state or national significance.

C. Project Description and Context

The Project is located near the Canadian border in northwestern Maine within the Boundary Mountains and would consist of up to fifteen 3 MW turbines along the northern portions of Sisk Mountain. The Project would be located about 1.2 miles north of the more prominent southern peak of Sisk and extend north along the Canadian border approaching near the Chain of Ponds TWP/Merrill Strip township line. The turbines would be Vesta V90s with a hub height of 295 feet (90 meters) and a height to tip of blades of 410 feet (125 meters). Access to the Project would be from Gold Brook Road along the eastern flanks of the ridge. Existing roads extend most of the way to the ridge, but approximately 3.31 miles of new access roads and 3.62 miles of new Project roads along the summit would be constructed. Collector lines would run along the access road and connect into the Kibby substation on Wahl Road. Some of the turbines would be lit at night per FAA requirements.

Route 27 is a major highway running through the Project area. It extends from Stratton to Coburn Gore on the Canadian border and runs south of the southernmost end of Sisk Mountain. The North Branch of the Dead River, Chain of Ponds, Horseshoe Stream, Horseshoe Pond and Arnold Pond are alongside the highway and were part of the Route Benedict Arnold took between the Colburne Shipyard in Pittston and Quebec City. The route is now a National Historic Site, though no associated structures exist in the study area. Chain of Ponds is also a Great Pond identified as having outstanding scenic quality, and one of the few recreation areas from which any significant visibility of the Project would occur. The visual character of Chain of Ponds is described in more detail below.

The Project site is surrounded by mountains on all sides. Mount Pisgah is to the west. Kibby Range and Kibby Mountain lie east of the Project site and are currently being developed with 44 wind turbines. Indian Stream Mountain, Bag Pond Mountain, Snow Mountain, and Round Mountain lie to the south. There are trails to the summits of Snow and Kibby Mountains but neither is a resource of state or national significance. Kibby Stream, a stream of state scenic significance runs down the east side of Sisk Mountain and passes under Gold Brook Road, a heavily used private road maintained by Plum Creek. It continues east between Kibby Mountain and Kibby Range.

D. Project Visibility and Scenic Character of Affected Areas

Project visibility would be relatively limited within the area as a whole (see Appendices 1 and 2, Viewshed Analyses). The Project's visibility and the character of areas identified as having national or state significance are described below. Factors affecting visual impacts are discussed below in Section E. Evaluation of Aesthetic Impacts.

- **Arnold Trail**

  The Arnold Trail is listed on the National Register of Historic Places and extends from Pittston, Maine to the Canadian border. Although no structures exist in the area, the trail location extends up the North Branch of the Dead River, through Chain of Ponds and up to Arnold Pond along Horseshoe Stream. Project visibility along the route of the trail would be primarily from portions of Chain of Ponds, with very limited visibility from Arnold Pond. Information about the Arnold

Trail is planned for the Natanis overlook on Route 27. There would be no project visibility from the roadside overlook.

Documentation for the nomination of the Arnold Trail to the National Register is brief and does not include any details about the Chain of Ponds area or the significance of views (see Architectural Survey Report and Findings of Effects Report). The Arnold Expedition Historical Society based in Shapleigh, Maine has developed a brochure about the Trail (included in application).

The Trail is also noted as an historic and cultural resource in the *Flagstaff Region Management Plan* (Maine Department of Conservation, Bureau of Parks and Lands, June 12, 2007). A Special Protection Area is identified within a 100-foot buffer along the historic Trail located on DOC land north of the Ponds. The visual character of the immediate shoreline is discussed but there is no guidance or discussion regarding scenic views to surrounding mountains or about development in the area. Views from Chain of Ponds and the character of the area are discussed in more detail below.

- **Chain of Ponds:**

Chain of Ponds is identified in the *Maine Wildland Lake Assessment* as a Management Class 2 lake. It is described as a Recreation and Visual Resource in the *Flagstaff Region Management Plan* (Maine Department of Conservation, Bureau of Parks and Lands, June 12, 2007; pages 91-92).

Recreational uses on the Ponds include camping, motorboating, paddling, fishing, swimming, and wildlife viewing. An ATV trail extends from the Natanis Campground to Stratton. Route 27 runs along the Ponds, sometimes immediately along the edge (Natanis and Lower Ponds) and at a greater distance along Long and Bag Ponds where it is not visible from the water or shoreline. From all locations it is audible due to heavy use by commercial trucks.

Most people are likely to view Chain of Ponds from the Route 27 overlook or the Natanis Campground from which there would be no views of the proposed Project. From the Pond itself, the Project would be primarily visible from portions of Long Pond. There would be no visibility from Round Pond. Visibility from Natanis and Bag Ponds would be extremely limited, and there would be no visibility from Lower Pond (see Appendix 2, Viewshed Analysis: Chain of Ponds).

Maine Public Reserve Lands extend from the northern end of Natanis and Round Ponds, and along the northeast shoreline between much of Natanis, Long and Bag Ponds and Route 27. Natanis Campground is located at the northern end of Natanis Pond on Reserve Land leased from the State. It accommodates up to 61 tent and RV sites and includes a camp store and recreation hall. There are two Department of Conservation (DOC) campsites along the northeastern shore which also provide access areas to the ponds and three additional sites near Upper Farm. All are accessible by vehicle and include toilets. The Kibby Expansion Project would not be visible from the shoreline campsites, but may be visible from three campsites at Upper Farm which are immediately adjacent to Route 27 (see below).

A number of private camps are concentrated at the lower end of Natanis and upper end of Long Pond. Other private camps are located at the narrows between Lower and Bag Pond and between Bag and Lower Ponds. Some of these private camps were formerly part of the Megantic Fish and Game Club.

A number of features contribute to the scenic quality of Chain of Ponds. Mount Pisgah is a distinctly shaped peak that forms a focal point in views from many vantage points (see Appendix 3, Character of the Area for photographs). The southern peak of Sisk Mountain is a secondary feature which is also relatively prominent in views (note that there would be no turbines on or near this southern peak of Sisk). Views toward the Bigelow Mountains from the northern end of Chain of Ponds create a notable focal point looking down the pond. Along Bag and Lower Ponds there are impressive cliffs visible on both sides. Most camps tend to be of modest size and relatively unobtrusive due to tree cover along the shoreline. Where terrain is steep, there is no development at all.

Detracting from the aesthetic quality is the presence of Route 27 visible from Natanis and Lower Ponds, and the sound of traffic, particularly truck traffic which is audible everywhere. During the summer and fall, camping vehicles are a relatively prominent feature at Natanis Campground and occasionally at the DOC campsites.

Portions of the Project would be visible from approximately 31% of Chain of Ponds at distances ranging from about 2.8 miles to 3.5 miles away from the closest turbine (see Appendix 2, Viewshed Analysis Map Detail: Chain of Ponds). Visibility occurs primarily along Long Pond. The Project would not be visible from Round Pond or along most of Natanis Pond with only the tops of 1-4 turbines visible along the southwesterly end. The turbines disappear from view in the narrows between Natanis and Long Ponds. Heading south on Long Pond the turbines gradually come into view south of the Chain of Ponds Camp peninsula (see Appendix 4 Simulation Photographs). Visibility increases heading southeast with up to 14 turbines visible from a small part of the southeastern portion of the pond. From Bag Pond visibility is limited to the southwest corner where up to 12 turbines could be visible. There would be no visibility of Kibby Expansion turbines from Lower Pond. A few of the Kibby Range turbines will be visible from the lower end of Lower Pond following construction in 2010. Some visibility of Project clearing and small areas of cut and fill slopes along roadways and around turbines sites is likely to occur, but is expected to be most noticeable immediately after Project site clearing and construction occurs. Dark-colored mulch matting will be installed to reduce color contrast and encourage vegetative growth in these areas. No other Project infrastructure would be visible from Chain of Ponds.

- **Visibility from Other Ponds with Scenic Resource Values**

There would be minor visibility from two additional ponds identified in the *Maine Wildlands Lake Assessment* as having outstanding or significant scenic values. Arnold and Crosby Ponds are located between 6.5 and 7.5 miles from the project. From both ponds visibility would be limited to a few turbines (1-3)

- **Rivers or Streams with Identified Scenic Attributes**

Kibby Stream has it's headwaters near the northern peak of the Sisk ridge. It crosses Gold Brook Road between Kibby Mountain and Kibby Range both of which have been or will be developed with wind turbines as part of the Kibby Wind Power Project. It continues in a valley northeast of Wahl Road, at which point views of the proposed Project would be blocked by Kibby Range. Views of Kibby Expansion Project including the access roads and collector lines may be visible from portions of Kibby Stream where tree cover is thin. The Kibby Wind Power Project may also be visible where these conditions occur.

- **Project Visibility from Other Areas of Local Interest**

As noted above, the Project would not be visible from the two scenic overlooks along Route 27 at Natanis Pond or from Sarampus Falls Rest Area. However, about 1-3 turbines would be briefly glimpsed from two areas along Route 27 near Upper Farm. The Upper Farm area is part of Maine Reserve Land. There are several DOC campsites south of the road. Two of these campsites are on Chain of Ponds (no project visibility) and another three campsites are located closer to Route 27. There may be minimal project visibility from these sites if they are located very close to Route 27 in the open area.[2] The Project would also be visible from fire towers on Snow Mountain and Kibby Mountain at distances of 6.5 and 4.5 miles, respectively. The entire Kibby Wind Project will be visible from both fire towers once it is completed in 2010. None of these areas is of state or national significance.

E. Evaluation of Aesthetic Impacts

- **Identified Resource Values**
  As noted above the Project would be visible from a limited portion of Chain of Ponds which is identified as a scenic resource of state or national significance. The ponds are noted for their outstanding scenic quality and are part of the Arnold Trail historic site. Due to it's proximity to the Project (around 3 miles) and the number of turbines

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[2] The Flagstaff Region Management Plan (Maine Department of Conservation, Bureau of Parks and Lands, (June 12, 2007) notes that these three campsites are in need of upgrading (page 95).

visible, Chain of Ponds is considered to be the most impacted of the resources identified.

Kibby Stream is the only other resource of state or national significance within 3 miles of the Project. Arnold Pond and Crosby Pond are located beyond three miles but within the 8-mile study area and are also noted in the *Wildlands Lake Assessment* as having outstanding scenic quality. Visibility by itself does not mean that unreasonable impacts will occur. To make this determination it is necessary to understand how the Project would be seen from these scenic resources including the number of turbines in the view, the extent to which they become focal points or dominate views, the duration of views, and the expectations of users of the resource (see below).

- **Dominance of the Project in Views**

  As noted above, Mount Pisgah and the southern peak of Sisk Mountain are compelling visual features on Chain of Ponds, and would also block many views of the Project. Visibility would be minimal from Natanis, Bag and Lower Ponds. From most of Long Pond, only 1-6 turbines would be visible with the highest visibility in only one small portion of the Pond. Where turbines are visible, they would appear lower in apparent elevation and further away than the prominent foreground peaks of Pisgah and Sisk (See Appendix 4, Simulation Photographs).

  There would be no visibility from Natanis Campground or from private camps[3] or public campsites along the northeastern shoreline. From the shore and docks of a few private camps on the southern shore to the north and south of the narrows between Natanis and Long Ponds up to 4 turbines would be visible. There would be no visibility from camps on the narrows itself or on Lower Pond. Visibility increases at the southern end of Long Pond and in the small southwest corner of Bag Pond. No private camps or public campsites are located in the areas of maximum visibility. Due to surrounding forest cover, views of the Project are unlikely from any of the camp structures themselves.

  Views of the Kibby Expansion Project from Arnold and Crosby Ponds would also not dominate views. Views are from limited portions of the ponds, would be seen from at least 6.5 miles away, and include only a few Project turbines (1-3).

  The Project is also not likely to dominate views from Kibby Stream. This would be the only location of state significance from which the access roads, collector lines and substation could be visible. These views would be most likely to occur at road crossings where the visual character is more likely to be dominated by the road itself. In other openings, the Kibby Wind Power Project turbines are also likely to be visible. The substation is unlikely to be visible from the stream. It will be co-located

[3] Visual assessments generally focus on views from publically accessible land. While private property cannot be accessed directly, some evaluation of the potential visibility and aesthetic impacts to private residences is usually attempted. Focus should be only on primary from use areas including living structures and commonly used outdoor spaces.

with the Kibby substation and would not result in substantial increases in visual impacts from any viewing areas.

- **Viewer Expectations and Experience**
  Due to its easy accessibility, high scenic quality, and the opportunity to paddle four miles of easy flatwater, Chain of Ponds is recommended as a pleasing paddling opportunity. Historical associations add to the experience. Fishermen and local camp owners also enjoy the Ponds. The turbines would not be prominent features since they would be set behind dominant foreground landforms. These peaks along with the surrounding cliffs and attractive shoreline will continue to be the dominant visual experience along the Ponds. Due to the visual and auditory presence of Route 27 and dominance of camping vehicles in some areas, the experience is not presently one that feels remote in character. The presence of wind turbines will alter the experience for users of Chain of Ponds to some degree, but they would not significantly diminish the aesthetic experience.

  From Kibby Stream the most likely views would occur where there are openings in the forest such as near Gold Brook Road where the landscape is currently modified by various human actions. The Kibby turbines are also part of this landscape.

  Viewer experiences from Arnold and Crosby Ponds are unlikely to be significantly altered. The project would be minimally visible from these ponds and seen at a distance of at least 6.5 miles. Arnold Pond is part of the Arnold Trail, but is noted in the *Wildlands Lake Assessment* as a “developed lake” so that changes have already occurred that have altered these landscapes. The Project would occupy a very small part of views from these ponds.

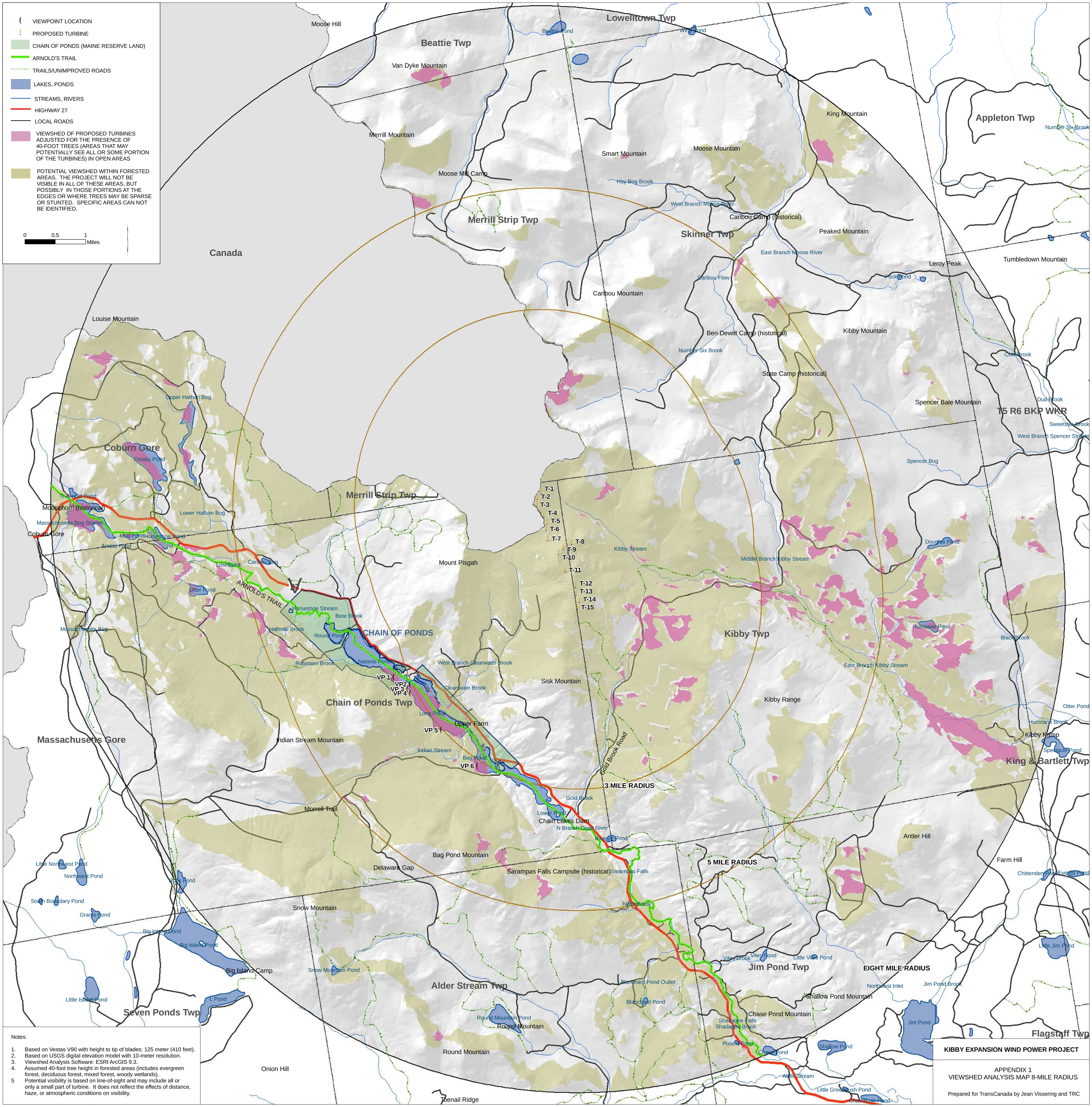
- **Duration of Views**
  From Chain of Ponds views would be a changing sequence. There would be very limited visibility from Natanis Pond, with the Project beginning to gradually emerge as one continues past the narrows into Long Pond with the maximum views at the southern end of Long Pond. Then the Project would recede from view entirely (unless one heads to the back corner of Bag Pond) with no visibility at all from Lower Pond. The maximum visibility on Long Pond (10-15 turbines) would occur along about 2000 linear feet and occupy less than 1% of the experience along Chain of Ponds.

  Those who hug the northern shore might never see any turbines. View direction and time spent will vary depending on the mode of travel (motorboat vs. canoe) and intent (fishing in one spot or traveling the length of the Chain). Private camp owners may use shoreline areas for longer periods of time, but, few would have views of the Project, and those who do would see only 1-4 turbines. Based on field assessment, it appears that most camps are surrounded by trees so that visibility from the camp buildings themselves should be minimal. Visibility of hazard lighting may also be of concern to camp owners, but due to the generally limited visibility from most camps, few if any lights would be visible.

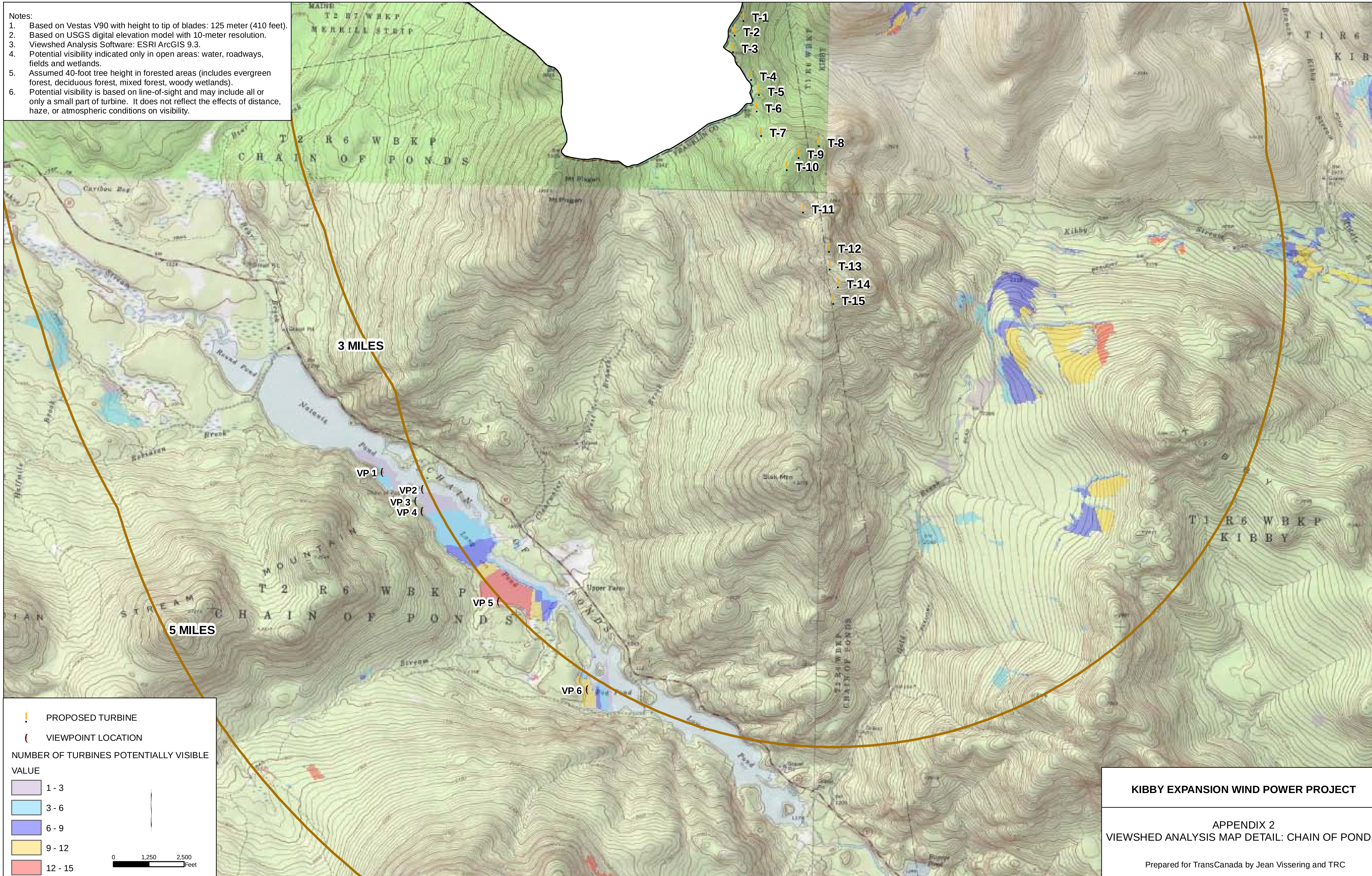
- **Extent of Project Impacts on Scenic Resources**
  The primary visual impact from the Project would occur along portions of Chain of Ponds. Some visibility is possible along Kibby Stream, but visibility is expected to be extremely minimal. There would be no visibility of the Project from the two scenic pullouts along Route 27, and minimal visibility overall along this route.

Conclusions
The proposed Kibby Expansion Project would not significantly compromise views from scenic resources of statewide or national significance, or have an unreasonable adverse effect on the scenic character of the area or uses related to this scenic character. The Project will have potential adverse effects on the scenic character of Chain of Ponds, but these adverse effects would not rise to the level of unreasonable, nor would the views of the Project from Chain of Ponds or the experience of users be significantly compromised. A summary of findings follows:

- As a Great Pond, Chain of Ponds is recognized as having state significance but not national scenic or recreational significance.
- Chain of Ponds constitutes a small part of the Arnold Trail which is on the National Register of Historic Places. There is no indication that the scenic views from Chain of Ponds are integral to the historic significance of the Trail.
- The Project would be seen behind and beyond more prominent foreground landforms.
- Where turbines would be visible, they will appear smaller (lower in elevation) than foreground landforms.
- Visibility is extremely limited from four of the five ponds making up Chain of Ponds.
- Visibility would also be very limited from all of the private camps located around the ponds.
- There would be no visibility from Natanis Campground or from the DOC campsites on Maine Reserve Land along the Ponds.
- Chain of Ponds is scenic but not remote, being adjacent to Route 27 which is visible from portions of the ponds and very audible.
- The scenic features of the ponds will remain intact and continue to form the dominant impression for users of the area. These include the views toward Pisgah, the southern peak of Sisk, the Bigelow Range, and the dramatic cliffs along the southern portions of Chain of Ponds.
- Views from Arnold and Crosby Ponds would be very limited and seen at a distance of over 6.5 miles away.
- Views from Kibby Stream are likely to occur from very limited locations, most likely in areas where other human landscape disturbance is evident.


VIEWPOINT LOCATION
PROPOSED TURBINE
CHAIN OF PONDS (MAINE RESERVE LAND)
ARNOLD'S TRAIL
TRAILS/UNIMPROVED ROADS
LAKES, PONDS
STREAMS, RIVERS
HIGHWAY 27
LOCAL ROADS
VIEWSHED OF PROPOSED TURBINES ADJUSTED FOR THE PRESENCE OF 40-FOOT TREES (AREAS THAT MAY POTENTIALLY SEE ALL OR SOME PORTION OF THE TURBINES) IN OPEN AREAS
POTENTIAL VIEWSHED WITHIN FORESTED AREAS. THE PROJECT WILL NOT BE VISIBLE IN ALL OF THESE AREAS, BUT POSSIBLY IN THOSE PORTIONS AT THE EDGES OR WHERE TREES MAY BE SPARSE OR STUNTED. SPECIFIC AREAS CAN NOT BE IDENTIFIED.
0 0.5 1 Miles
Moose Hill
Lowelltown Twp
Beattie Twp
Beattie Pond
Van Dyke Mountain
Merrill Mountain
Moose Mill Camp
Smart Mountain
Moose Mountain
King Mountain
Appleton Twp
Number Six Brook
Hay Bog Brook
West Branch Moose River
Merrill Strip Twp
Caribou Camp (historical)
Skinner Twp
Peaked Mountain
East Branch Moose River
Leroy Peak
Tumbledown Mountain
Canada
Caribou Flow
Caribou Mountain
Ben Dewitt Camp (historical)
Kibby Mountain
Number Six Brook
State Camp (historical)
Spencer Bale Mountain
T5 R6 BKP WKR
West Branch Spencer Stream
Spencer Bog
Louise Mountain
Upper Hathan Bog
Coburn Gore
Crosby Pond
Merrill Strip Twp
T-1
T-2
T-3
T-4
T-5
T-6
T-7
T-8
T-9
T-10
T-11
T-12
T-13
T-14
T-15
Moosehorn (historical)
Massachusetts Bog Stream
Coburn Gore
Lower Hathan Bog
Mud Pond
Horseshoe Pond
Arnold Pond
Lost Pond
Caribou Bog
Kibby Stream
Middle Branch Kibby Stream
Douglas Pond
Mount Pisgah
Otter Pond
ARNOLD'S TRAIL
Horseshoe Stream
Bear Brook
Massachusetts Bog
Halfmile Brook
Round Pond
CHAIN OF PONDS
Kibby Twp
Hurricane Pond
Black Brook
Robinson Brook
Natanis Pond
West Branch Clearwater Brook
East Branch Kibby Stream
VP 1
VP 2
VP 3
VP 4
Sisk Mountain
Clearwater Brook
Chain of Ponds Twp
Kibby Range
Otter Pond
Long Pond
Upper Farm
VP 5
Hurricane Brook
Kibby Kamp
Massachusetts Gore
Indian Stream Mountain
Spectacle Pond
King & Bartlett Twp
Indian Stream
Bag Pond
VP 6
Gold Brook Road
3 MILE RADIUS
Gold Brook
Morrell Trail
Lower Pond
Chain Lakes Dam
N Branch Dead River
Antler Hill
Little Northwest Pond
Northwest Pond
Bag Pond Mountain
Delaware Gap
Sarampas Falls Campsite (historical)
Sarampas Falls
5 MILE RADIUS
Farm Hill
Chittenden Pond
South Boundary Pond
Grants Pond
Snow Mountain
Big Island Pond
Big Island Camp
Snow Mountain Pond
Little Jim Pond
Viles Brook
Viles Pond
Little Viles Pond
Jim Pond Twp
EIGHT MILE RADIUS
Alder Stream Twp
Blanchard Pond Outlet
Northwest Inlet
Jim Pond Brook
Little Island Pond
Seven Ponds Twp
Blanchard Pond
Shallow Pond Mountain
Chase Pond Mountain
Round Mountain Pond
Round Mountain
Jim Pond
Shadagee Falls
Shadagee Brook
Flagstaff Twp
Poison Pond
Shallow Pond
Chase Pond
Round Mountain
Onion Hill
Alder Stream
Little Greenbush Pond
Greenbush Pond
Toenail Ridge
Notes:
1. Based on Vestas V90 with height to tip of blades: 125 meter (410 feet).
2. Based on USGS digital elevation model with 10-meter resolution.
3. Viewshed Analysis Software: ESRI ArcGIS 9.3.
4. Assumed 40-foot tree height in forested areas (includes evergreen forest, deciduous forest, mixed forest, woody wetlands).
5 Potential visibility is based on line-of-sight and may include all or only a small part of turbine. It does not reflect the effects of distance, haze, or atmospheric conditions on visibility.
KIBBY EXPANSION WIND POWER PROJECT
APPENDIX 1
VIEWSHED ANALYSIS MAP 8-MILE RADIUS
Prepared for TransCanada by Jean Vissering and TRC

Notes:
1. Based on Vestas V90 with height to tip of blades: 125 meter (410 feet).
2. Based on USGS digital elevation model with 10-meter resolution.
3. Viewshed Analysis Software: ESRI ArcGIS 9.3.
4. Potential visibility indicated only in open areas: water, roadways, fields and wetlands.
5. Assumed 40-foot tree height in forested areas (includes evergreen forest, deciduous forest, mixed forest, woody wetlands).
6. Potential visibility is based on line-of-sight and may include all or only a small part of turbine. It does not reflect the effects of distance, haze, or atmospheric conditions on visibility.



KIBBY EXPANSION WIND POWER PROJECT

APPENDIX 2
VIEWSHED ANALYSIS MAP DETAIL: CHAIN OF PONDS

Prepared for TransCanada by Jean Vissering and TRC

APPENDIX 3

KIBBY EXPANSION PROJECT

CHARACTER OF THE AREA

The following photographs illustrate views of the project ridge from Route 27 and from Chain of Ponds as well as other characteristic views. Views from Chain of Ponds are illustrated from northwest to southeast. Potential visibility is noted and Appendix 4 provides simulation photographs illustrating how the turbines will appear from a number of locations. Unless otherwise noted, photographs of Chain of Ponds were taken from the southwest shoreline where there would be maximum visibility. Visibility from the northeastern shore would be minimal.

1. Chain of Ponds Viewed from Route 27 Overlook (No Project Visibility)

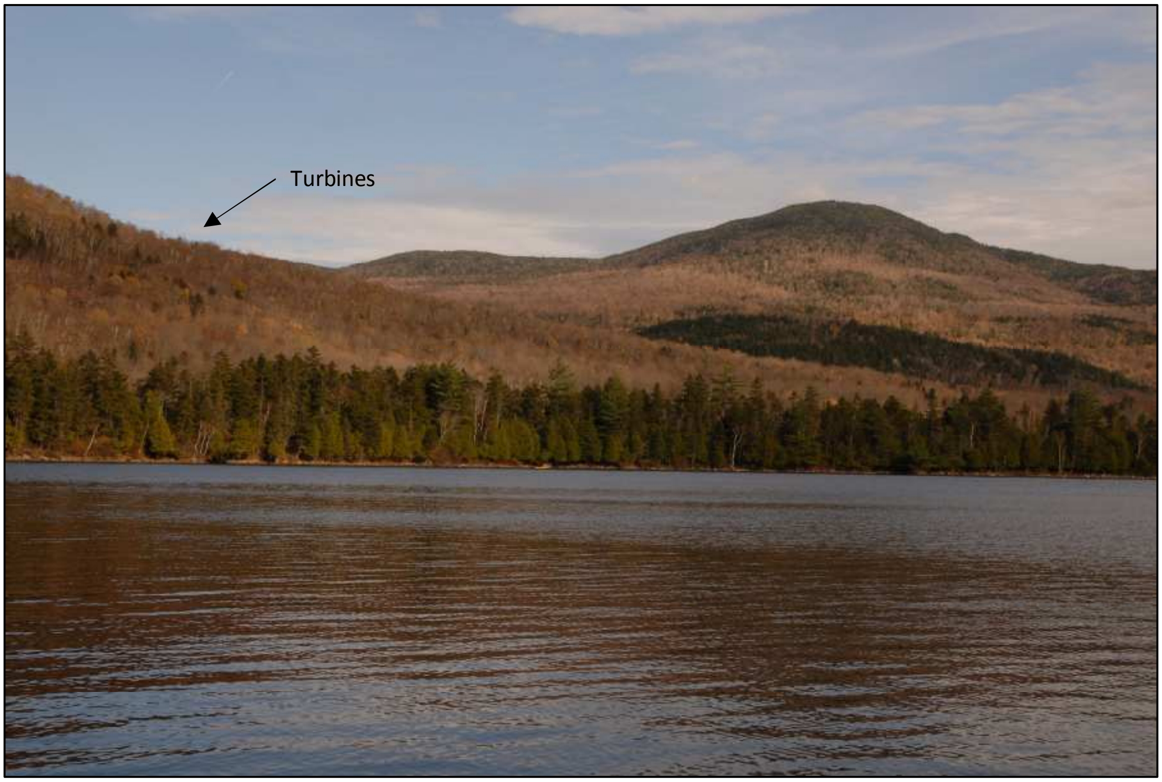
2. Natanis Pond from Natanis Campground; Bigelow Mountains in Background (No Project Visibility)

3. Southern Peak of Sisk Mountain Seen from Natanis Campground (No Project Visibility)

4. View from southern end of Natanis Pond. The tops of 4 turbines will be visible from this small portion of the Natanis Pond. On most of Natanis Pond there would be no visibility. (See Appendix 4, Viewpoint #1)

5. Sisk seen from northeastern shore between Natanis and Long Ponds near the narrows (no visibility)

6. Sisk Mountain from narrows between Natanis and Long Ponds (No Visibility, See Appendix 4 VP#2)



7. Sisk Ridge viewed from north end of Long Pond
The tops of 2 turbines would be visible ridges behind the foreground ridge (see Appendix 4, Viewpoint #3)

8. Long Pond south of point
A few turbines begin to come into view at this location (see simulation Appendix 4, Viewpoint #4)

9. Sisk Ridge viewed from southern end of Long Pond
For a short distance along the southern end of Long Pond from 12-14 of the turbines would be visible.
(See simulation, Appendix 4, Viewpoint #5)

10. Mount Pisgah is a significant focal point seen from many vantage points.

11. Pan view from the south end of Long Pond showing the prominence of Mount Pisgah (left) and the southern peak of Sisk (right) in relation to the project ridge (center). The foreground peaks dominate views while the project turbines would appear lower in elevation in relation and further away. See also a simulation in Appendix 4, Viewpoint #5 from this location.

12. View from southwest bay of Bag Pond
This photograph illustrates a small area of Bag Pond where there would be views of the Expansion Project; Most of Bag Pond would have minimal or no project views. (See Simulation, Appendix 4, Viewpoint #6)

13. Sisk Mountain from east end of Bag Pond (no visibility)

14. Pisgah from Lower Pond (No Visibility)

15. Route 27 along Lower Pond; Sisk behind (no visibility)

16. Kibby Range from south end of Lower Pond
There would be no visibility of Expansion Project; some of the Kibby Range turbines will be visible.


Photo 17. View from Arnold Pond to Pisgah (left) and Sisk (right).
A few of the turbines would be visible along the lower ridge between the two peaks at 7-8 miles away.

18. Southern Peak of Sisk Mountain Seen from Route 27 at Upper Farm
1-3 turbines may be visible from this location.

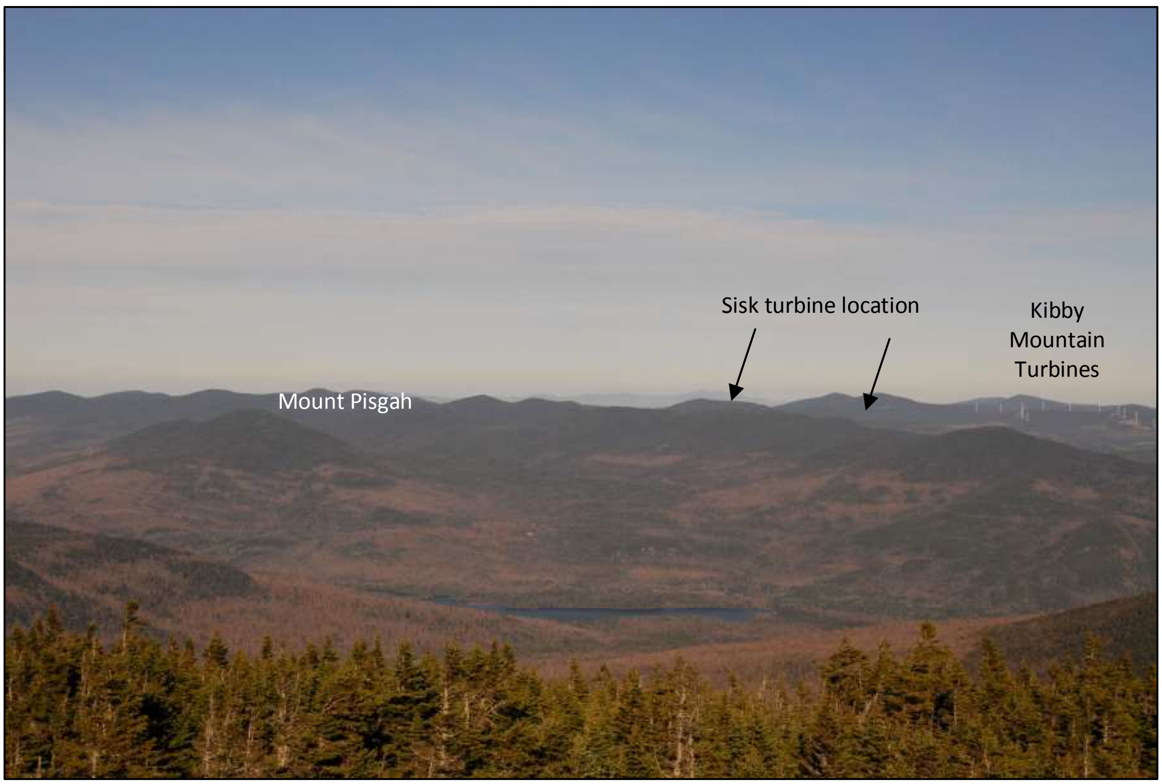
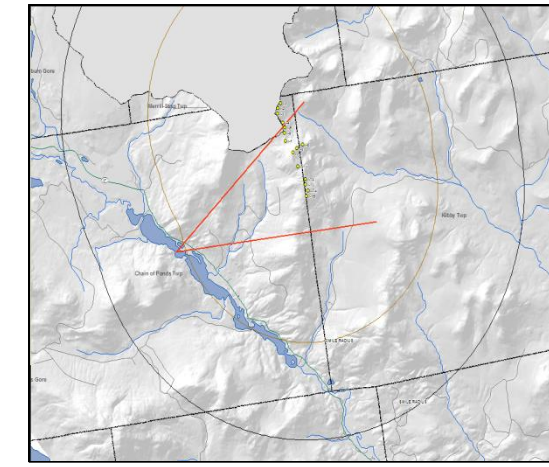


Photo 19. Looking northeast from Snow Mountain to Sisk and Kibby.
Mount Pisgah is to the left and Chain of Ponds below.

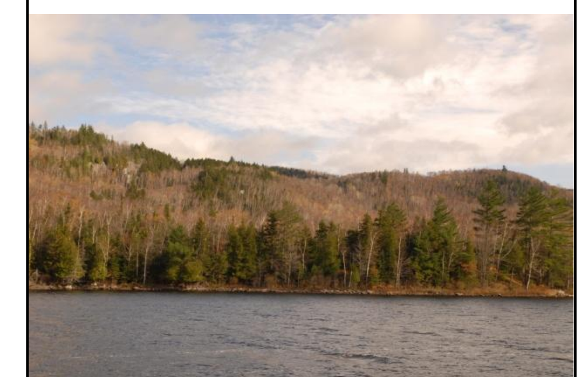
VIEWPOINT 1

Panoramic View from Natanis Pond, Southeast

VIEWPOINT LOCATION MAP



EXISTING CONDITIONS



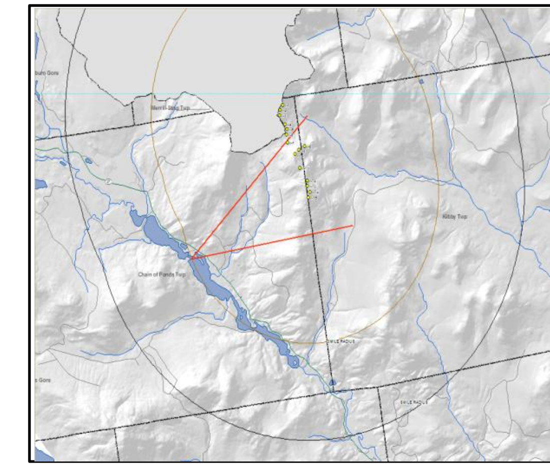
TECHNICAL INFORMATION

Turbine Model	Vestas V90 3 MW
Hub Height	80 meters
Rotor Diameter	90 meters
Viewpoint Coordinates	368016.8 E
In UTM 19	5022873.6 N
Viewpoint Location	Natanis Pond, SE
Viewer Elevation	1274 ft msl
Distance to Closet Turbine	3.2 miles
Distance to Furthest Turbine	3.3 miles
Number of Visible Turbines	4
Camera Model	Nikon D200
Lens Setting	50 mm (equivalents)
Date/Time	10.21.09/11:34 am

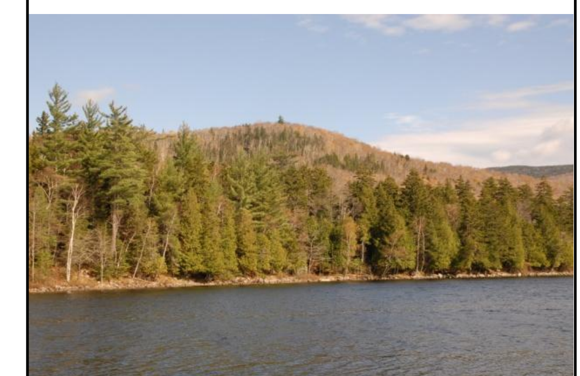
KIBBY EXPANSION WIND POWER PROJECT

Photosimulations Prepared for TransCanada by Jean Vissering and TRC

VIEWPOINT LOCATION MAP



EXISTING CONDITIONS



TECHNICAL INFORMATION

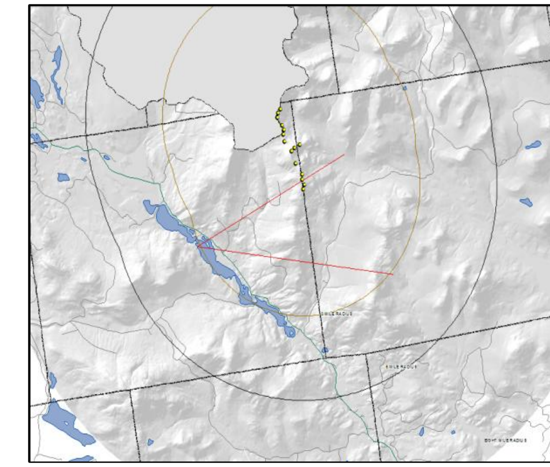
Turbine Model	Vestas V90 3 MW
Hub Height	80 meters
Rotor Diameter	90 meters
Viewpoint Coordinates	368449.4 E
In UTM 19	5022689.9 N
Viewpoint Location	The Narrows, Natanis to Long Pond
Viewer Elevation	1274 ft msl
Distance to Closet Turbine	3.0 miles
Distance to Furthest Turbine	3.1 miles
Number of Visible Turbines	0
Camera Model	Nikon D200
Lens Setting	50 mm (equivalents)
Date/Time	10.21.09/1:39 pm

KIBBY EXPANSION WIND POWER PROJECT

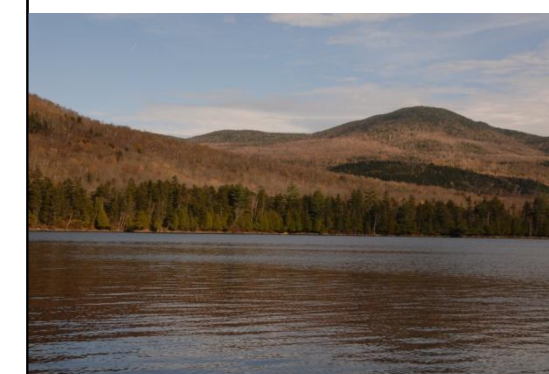
Photosimulations Prepared for TransCanada by Jean Vissering and TRC

VIEWPOINT 2

VIEWPOINT LOCATION MAP



EXISTING CONDITIONS



TECHNICAL INFORMATION

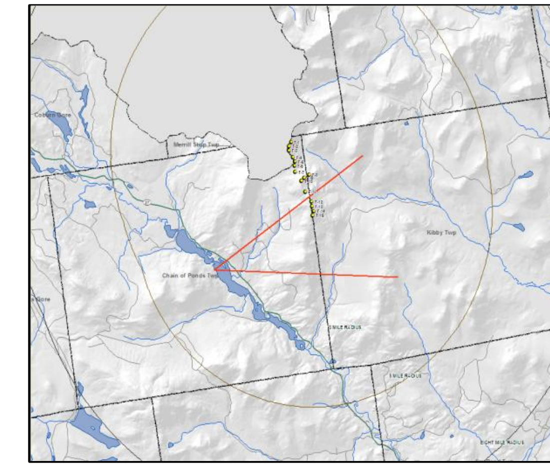
Turbine Model	Vestas V90 3 MW
Hub Height	80 meters
Rotor Diameter	90 meters
Viewpoint Coordinates	368378.2 E
In UTM 19	5022560.9 N
Viewpoint Location	Long Pond, NW 1
Viewer Elevation	1274 ft msl
Distance to Closet Turbine	3.1 miles
Distance to Furthest Turbine	3.2 miles
Number of Visible Turbines	2
Camera Model	Nikon D200
Lens Setting	50 mm (equivalents)
Date/Time	10.21.09/2:19 pm

KIBBY EXPANSION WIND POWER PROJECT

Photosimulations Prepared for TransCanada by Jean Vissering and TRC

VIEWPOINT 3

VIEWPOINT LOCATION MAP



EXISTING CONDITIONS

TECHNICAL INFORMATION

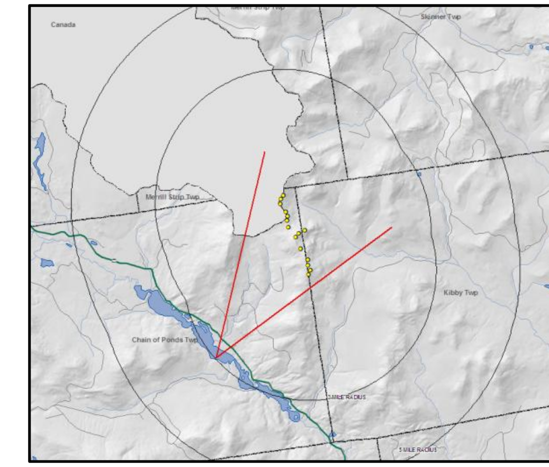
Turbine Model	Vestas V90 3 MW
Hub Height	80 meters
Rotor Diameter	90 meters
Viewpoint Coordinates	368447.4 E
In UTM 19	5022451.2 N
Viewpoint Location	Long Pond, NW 2
Viewer Elevation	1274 ft msl
Distance to Closet Turbine	3.1 miles
Distance to Furthest Turbine	3.2 miles
Number of Visible Turbines	4
Camera Model	Nikon D200
Lens Setting	50 mm (equivalents)
Date/Time	10.21.09/2:53 pm

KIBBY EXPANSION WIND POWER PROJECT

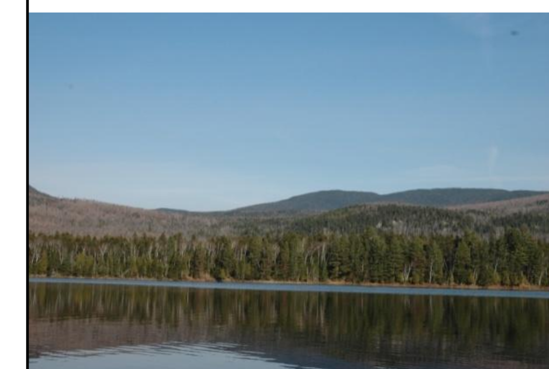
Photosimulations Prepared for TransCanada
by Jean Vissering and TRC

VIEWPOINT 4

VIEWPOINT LOCATION MAP



EXISTING CONDITIONS



TECHNICAL INFORMATION

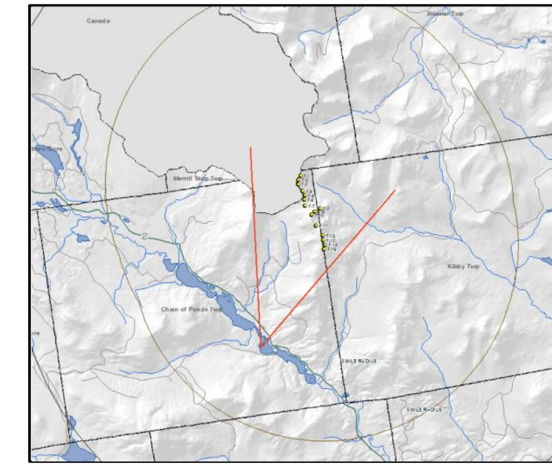
Turbine Model	Vestas V90 3 MW
Hub Height	80 meters
Rotor Diameter	90 meters
Viewpoint Coordinates	369271.3 E
In UTM 19	5021474.5 N
Viewpoint Location	Long Pond, SE
Viewer Elevation	1274 ft msl
Distance to Closet Turbine	3.0 miles
Distance to Furthest Turbine	4.25 miles
Number of Visible Turbines	14
Camera Model	Nikon D70
Lens Setting	50 mm (equivalents)
Date/Time	11.09.09/11:46 am

KIBBY EXPANSION WIND POWER PROJECT

Photosimulations Prepared for TransCanada
by Jean Vissering and TRC

VIEWPOINT 5

VIEWPOINT LOCATION MAP



EXISTING CONDITIONS

TECHNICAL INFORMATION

Turbine Model	Vestas V90 3 MW
Hub Height	80 meters
Rotor Diameter	90 meters
Viewpoint Coordinates	370228.8 E
In UTM 19	5020527.8 N
Viewpoint Location	Bag Pond
Viewer Elevation	1274 ft msl
Distance to Closet Turbine	3.5 miles
Distance to Furthest Turbine	4.6 miles
Number of Visible Turbines	10
Camera Model	Nikon D70
Lens Setting	50 mm (equivalents)
Date/Time	11.09.09/10.37 am

KIBBY EXPANSION WIND POWER PROJECT

Photosimulations Prepared for TransCanada
by Jean Vissering and TRC

VIEWPOINT 6

EXHIBIT A.2 SHADOW FLICKER EVALUATION

A.2.1 Shadow Flicker from Wind Turbines

Shadow flicker is caused by the direct rays of the sun shining through rotating WTG blades and casting alternating shadows to produce a flickering effect. Shadow flicker can be predicted using a combination of meteorology and solar angle trigonometry to model scenarios when the wind is blowing at a sufficient velocity to spin the turbine blades and when the sun is fully shining (i.e., no clouds are present). Residents and other observers in the vicinity of the WTGs may experience shadow flicker when the wind is blowing parallel to their line of sight (i.e., causing the turbine blades to rotate perpendicular to their line of sight), when the sun is shining fully (i.e., there are no clouds or fog), when the sun is low in the sky (just above the horizon), and when there are no obstacles in the line of sight between the observer and the turbine blades (i.e., buildings, topography, vegetation, etc.). Shadow flicker is a transient phenomenon that is a function of time of day, the meteorological conditions (wind speed, wind direction, and sky cover), and distance without obstruction from the turbine blades to the observer. Therefore, the shadow flicker analysis considers the orientation of the sun, WTG locations, and potential receptors taking into account the frequency of the orientation of the WTG turbine blades (based on the frequency of wind directions) and frequency of cloudiness, or conversely, amount of sunshine.

The distance between the receptor and the WTG affects intensity or how “light” or “dark” a shadow appears at a specific receptor. Shadow flicker intensity diminishes rapidly as the plane traversed by the rotating blades turns away from the line perpendicular to the line of sight from the receptor to the sun, because a smaller proportion of the sun is blocked by the passing blades. The greatest intensity observed is immediately adjacent to the WTG; however, the effect significantly diminishes with increasing shadow length. This is due to diffraction of the shadow (caused by the sun’s light radiating from a disc rather than a point source) and the addition of ambient background light to diffuse the shadow. In other words, shadow flicker intensity decreases with greater separation from the receptor to the turbine, up to a point where the change in light intensity is below what the human eye can distinguish. Shadows cast close to a turbine are more intense, distinct, and “focused” because a greater proportion of the sun is intermittently blocked by the passing blades. As separation between the receptor and the turbine increases, the proportion of the sun that is blocked decreases and the shadows become less intense and less discernible. The change in intensity from the turbines proposed for this Project is essentially imperceptible at a distance of 3,300 feet (approximately 1 km). At distances of 3,300 feet and beyond the changing light intensity is low enough that a person does not perceive the turbine rotor as “chopping” through the sun, but rather as an object with the sun behind it.

A.2.2 Modeling

If there are potential shadow flicker impacts on sensitive receptors such as residences, a determination of the magnitude of those impacts (in hours of impact per year) may be determined through application of the SHADOW module of the WindPRO 2.5 suite of modules in accordance with Maine Department of Environmental Protection (“Maine DEP”) guidance. WindPRO is a Windows-based object-oriented software suite for the design and planning of both single WTGs and multiple WTG projects. The SHADOW module incorporates the following into the flicker analysis:

- The position of the WTGs (geographical and elevation as x, y, z coordinates).
- The hub height and rotor diameter of the WTGs.
- The topography of the study area, input from U. S. Geological Survey (USGS) Digital Elevation Model (DEM) terrain data.
- The location, elevation and orientation of the receptor (typically nearest residences).
- Solar angle model to accurately calculate sunrise, sunset and solar angle of the sun during the day.
- Wind direction frequency, to determine the orientation of the WTGs.
- Monthly sunshine frequency.

The Maine DEP recommends that applicants conduct a WindPRO modeling analysis out to a distance of 1,000 feet (i.e., 300 meters) from WTGs or residences. Thus, by considering the potential for shadow flicker impacts out to a distance of 3,300 feet from a WTG or residence, this analysis assumed the potential for impacts at distances over three times the distance recommended by the Maine DEP.

Initial screening of the distance between WTGs and the nearest residences was performed. Potential receptors (i.e., either permanent or seasonal residences) that were beyond 3,300 feet of any WTG were omitted from the analysis because there would not be any perceptible effect at those receptors.

There are no seasonal or other residences located within 3,300 feet of any proposed WTG. The nearest residence (a seasonal camp) is approximately 2.5 miles (4 km) away from the proposed WTG locations. Thus, it is not expected that shadow flicker from the WTGs would be noticeable at the nearest residential location. Based on this conservative screening analysis, there are no potential receptors that would require a rigorous WindPRO modeling effort and, therefore, a WindPRO analysis was not performed for the Project.

The potential for shadow flicker was also assessed along Route 27, which has been classified as a scenic byway. This roadway is approximately 2.5 miles away from the nearest proposed WTG and, thus, shadow flicker would not be visible for passengers driving along the scenic highway.

A.2.3 Conclusion

The Kibby Expansion Project was assessed to ascertain the potential for shadow flicker at residences in the area around the fifteen WTGs associated with the Project and from Route 27, a scenic byway. There is well over 3,300 feet (1 km) of distance between the proposed WTGs, the nearest residences and the scenic byway, and all of the residences and the scenic byway are located to the south of the WTG locations. Therefore, perceptible shadow flicker effects from the Project would not occur at these sensitive receptors.

The Wind Turbine Generator Shadow Flicker Analysis is provided in Attachment A.2.

ATTACHMENT A.2

Wind Turbine Generator Shadow Flicker Analysis

TransCanada Kibby Expansion Wind Power Project
Wind Turbine Generator Shadow Flicker Analysis

Introduction

This report summarizes the assessment of potential shadow flicker effects on residents within the vicinity of the proposed TransCanada Kibby Expansion Wind Power Project ("Kibby Expansion Project") located on Sisk Mountain in the unorganized townships of Kibby and Chain of Ponds, Franklin County, Maine. The Kibby Expansion Project is a 45-megawatt grid-scale wind energy project. All of the wind turbine generators ("WTGs") would be located within the LURC Expedited Wind Power Project Permitting Area. The Project is immediately adjacent to the recently permitted Kibby Wind Power Project, which is currently under construction. The major elements of the Kibby Expansion Project consist of fifteen (15) Vestas V90 -3.0 Megawatt ("MW") WTGs, 34.5 kilovolt ("kV") electric power collector lines, access roads to and along the Sisk Mountain ridge line, and a new substation. This report addresses the potential for shadow flicker effects associated with the fifteen proposed WTGs that are part of the Kibby Expansion Project.

Pursuant to 12 M.R.S.A. § 685-B(4-B), an applicant for a grid-scale wind energy development must demonstrate that the project will be designed and sited to avoid undue adverse shadow flicker effects. Wind turbines, like other tall structures, will cast a shadow on the neighboring area when the sun is visible. For a resident living close to a wind turbine, the changing light intensity as the sun casts a shadow through the rotating blades may be noticeable as the rotor blades pass through the sunlight, causing a flickering (blinking) effect while the rotor is in motion. The change in intensity diminishes quickly with distance and, as determined from currently accepted computer modeling techniques, shadow flicker from a WTG with the hub and blade height of the Vestas V90 becomes imperceptible at 3,300 feet (1 kilometer ("km")) from the WTG.

Shadow Flicker from Wind Turbines

Shadow flicker is caused by the direct rays of the sun shining through rotating WTG blades and casting alternating shadows to produce a flickering effect. Shadow flicker can be predicted using a combination of meteorology and solar angle trigonometry to model scenarios when the wind is blowing at a sufficient velocity to spin the turbine blades and when the sun is fully shining (i.e., no clouds are present). Residents and other observers in the vicinity of the WTGs may experience shadow flicker when the wind is blowing parallel to their line of sight (i.e., causing the turbine blades to rotate perpendicular to their line of sight), when the sun is shining fully (i.e., there are no clouds or fog), when the sun is low in the sky (just above the horizon), and when there are no obstacles in the line of sight between the observer and the turbine blades (i.e., buildings, topography, vegetation, etc.). Shadow flicker is a transient phenomenon that is a function of time of day, the meteorological conditions (wind speed, wind direction, and sky cover), and distance without obstruction from the turbine blades to the observer. Therefore, the shadow flicker analysis considers the orientation of the sun, WTG locations, and potential receptors taking into account the frequency of the orientation of the WTG turbine blades (based on the frequency of wind directions) and frequency of cloudiness, or conversely, amount of sunshine.

The distance between the receptor and the WTG affects intensity or how "light" or "dark" a shadow appears at a specific receptor. Shadow flicker intensity diminishes rapidly as the plane traversed by the rotating blades turns away from the line perpendicular to the line of sight from the receptor to the sun, because a smaller proportion of the sun is blocked by the passing blades. The greatest intensity observed is immediately adjacent to the WTG; however, the effect significantly diminishes with increasing shadow length. This is due to diffraction of the shadow (caused by the sun's light radiating from a disc rather than a point source) and the addition of ambient background light to diffuse the shadow. In other words, shadow flicker intensity decreases with greater separation from the receptor to the turbine, up to a point where the change in light intensity is below what the human eye can distinguish. Shadows cast close to a turbine are more intense, distinct, and "focused" because a greater proportion of the sun is intermittently blocked by the passing blades. As separation between the receptor and the turbine increases, the proportion of the sun that is blocked decreases and the shadows become less intense and less discernible. The change in intensity from the turbines proposed for this Project is essentially imperceptible at a distance of 3,300 feet (approximately 1 km). At distances of 3,300 feet and beyond the changing light intensity is low enough that a person does not perceive the turbine rotor as "chopping" through the sun, but rather as an object with the sun behind it.

Figure 1 was prepared by Osten and Pahlke for the Article "Shadow Impact on the Surrounding of Wind Turbines – August 1998." and represents the worst-case area around a wind turbine where an observer would be affected by shadows, with each spot representing the shadow of the highest point of the wind turbine (100 meters for the Osten and Pahlke case). The two parabolic edges of the shadow area represent the data from the summer and winter seasons. As the figure shows, the most significant impact is north of the turbine and within an area of approximately three times the top of a turbine blade. The impact then decreases as the observer moves further east and west of the turbine blades.

Modeling

If there are potential shadow flicker impacts on sensitive receptors such as residences, a determination of the magnitude of those impacts (in hours of impact per year) may be determined through application of the SHADOW module of the WindPRO 2.5 suite of modules in accordance with Maine Department of Environmental Protection ("Maine DEP") guidance. WindPRO is a Windows-based object-oriented software suite for the design and planning of both single WTGs and multiple WTG projects. The SHADOW module incorporates the following into the flicker analysis:

- The position of the WTGs (geographical and elevation as x, y, z coordinates).
- The hub height and rotor diameter of the WTGs.
- The topography of the study area, input from U. S. Geological Survey (USGS) Digital Elevation Model (DEM) terrain data.
- The location, elevation and orientation of the receptor (typically nearest residences).
- Solar angle model to accurately calculate sunrise, sunset and solar angle of the sun during the day.
- Wind direction frequency, to determine the orientation of the WTGs.
- Monthly sunshine frequency.

The Maine DEP recommends that applicants conduct a WindPRO modeling analysis out to a distance of 1,000 feet (i.e., 300 meters) from WTGs or residences. Thus, by considering the potential for shadow flicker impacts out to a distance of 3,300 feet from a WTG or residence, this analysis assumed the potential for impacts at distances over three times the distance recommended by the Maine DEP.

Initial screening of the distance between WTGs and the nearest residences was performed. Potential receptors (i.e., either permanent or seasonal residences) that were beyond 3,300 feet of any WTG were omitted from the analysis because there would not be any perceptible effect at those receptors. The following table provides the geographical coordinates (UTM Zone 19) for the fifteen WTGs and the nearest residence (seasonal or year-round) to these locations.

ID	UTM Easting	UTM Northing
WTG T-1	371,919	5,027,783
WTG T-2	371,824	5,027,626
WTG T-3	371,804	5,027,446
WTG T-4	372,002	5,027,146
WTG T-5	372,085	5,026,984
WTG T-6	372,062	5,026,803
WTG T-7	372,106	5,026,542
WTG T-8	372,733	5,026,432
WTG T-9	372,513	5,026,305
WTG T-10	372,387	5,026,170
WTG T-11	372,562	5,025,714
WTG T-12	372,845	5,025,291
WTG T-13	372,849	5,025,100
WTG T-14	372,938	5,024,905
WTG T-15	372,886	5,024,727
Residence	370,182	5,022,066

The results of this screening analysis are illustrated on Figure 2. As reflected in Figure 2, there are no seasonal or other residences located within 3,300 feet of any proposed WTG. The nearest residence (a seasonal camp) is approximately 2.5 miles (4 km) away from the proposed WTG locations. Thus, it is not expected that shadow flicker from the WTGs would be noticeable at the nearest residential location. Based on this conservative screening analysis, there are no potential receptors that would require a rigorous WindPRO modeling effort and, therefore, a WindPRO analysis was not performed for the Project.

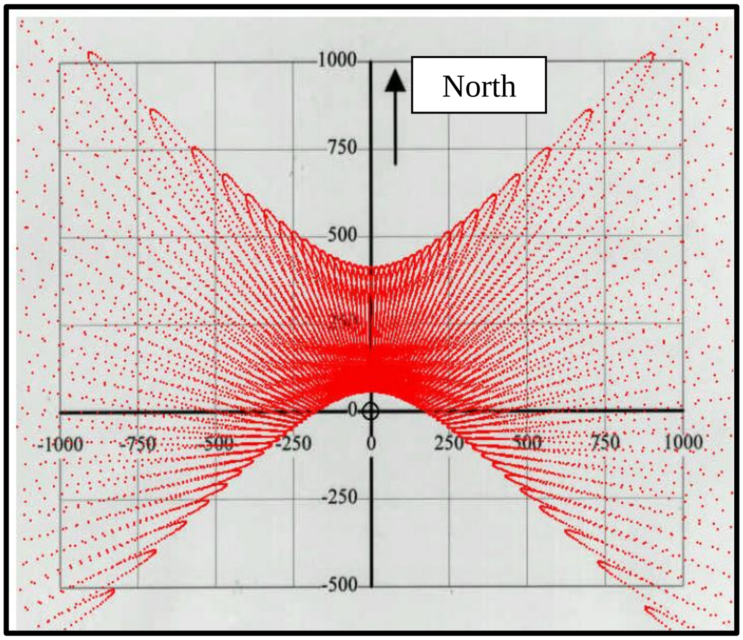
The potential for shadow flicker was also assessed along Route 27, which has been classified as a scenic byway. This roadway is approximately 2.5 miles away from the nearest proposed WTG and, thus, shadow flicker would not be visible for passengers driving along the scenic highway.

Conclusion

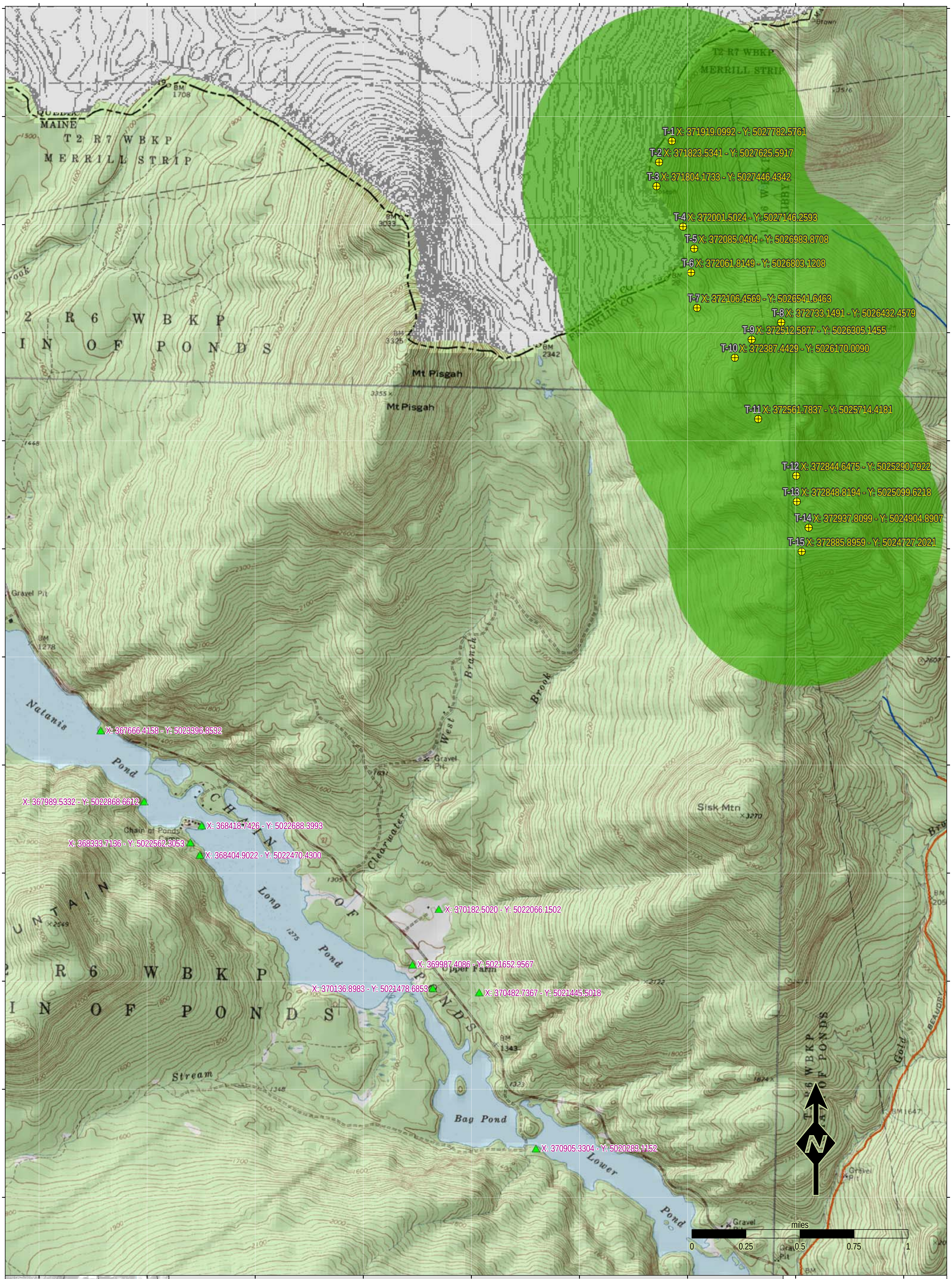
The Kibby Expansion Project was assessed to ascertain the potential for shadow flicker at residences in the area around the fifteen WTGs associated with the Project and from Route 27, a scenic byway. There is well over 3,300 feet (1 km) of distance between the proposed WTGs, the nearest residences and the scenic byway, and all of the residences and the scenic byway are located to the south of the WTG locations. Therefore, perceptible shadow flicker effects from the Project would not occur at these sensitive receptors.

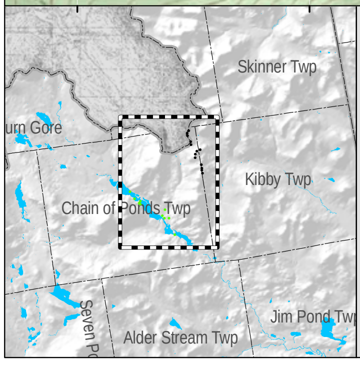
Figures

Figure 1: Hypothetical shadow impact from a wind turbine generator



Source: Osten and Pahlke, "Shadow Impact on the Surrounding of Wind Turbines," August 1998





Epedited Area 15 Turbine Layout Locations

Known Dwellings

1km Buffer Around Proposed Turbine Locations

Note: Turbine layout and camp location coordinates are NAD 1983 UTM Zone 19 North meters. Camp locations are approximate. Map grid: 0.5 mile.

Kibby Expansion Wind Power Project

Figure 2

Shadow Flicker Screening Assessment

TRC

14 Gabriel Drive
Augusta, ME 04330

Created: 11/3/2009

EXHIBIT A.3 AVIAN AND BAT MONITORING

A.3.1 Preconstruction Monitoring Plan

TransCanada met with the Maine Department of Inland Fisheries and Wildlife ("MDIFW") and US Fish and Wildlife Service ("USFWS") prior to starting any preconstruction monitoring work for avian and bat use of the Project area. It was agreed between the agencies that protocols and studies performed in support of the Kibby Project set the standard to follow for preconstruction surveys. The agencies approved of utilizing these same study protocols as a basis for surveys to be conducted in the Kibby Expansion Project area. Studies that have been performed include rare raptor nesting surveys, spring and fall daytime migrant surveys, spring and fall nighttime migrant surveys (radar, bat monitoring with detectors, ceilometer and night vision survey), and breeding bird surveys (with an emphasis on detecting Bicknell's thrush).

A.3.2 Rare Raptor Nesting Surveys

Rare raptor (bald eagle, golden eagle, peregrine falcon) nest surveys have been performed in potential breeding areas for the Kibby Project during 2005, 2006, 2007, and 2008. These surveys were conducted by observing potential and historic golden eagle nest sites from the ground and air (via helicopter) in March, April and May. The raptor nest survey protocol is provided in Attachment A.3-1. These are the same areas of concern for the Kibby Expansion Project, and include great ponds, wide rivers, and cliff sites within 10 miles of the proposed project. Aerial surveys have been performed by helicopter during several of these years, including 2009, and have included biologists from MDIFW. Surveys from the ground have also been done at the cliff sites several years, including 2009. Waterbodies surveyed include Tea Pond, Jim Pond, Chain of Ponds, and the South and North Branches of the Dead River. Cliff sites (historic golden eagle nest sites) that have been surveyed include Indian Stream Mountain, Sisk Mountain, and Moosehorn (adjacent to Arnold Pond). Nesting at these sites was last documented around 1970. To date, no breeding activity by rare raptors has been observed at or adjacent to any of these sites.

During 2009, additional surveys from the ground were performed at several different locations in Chain of Ponds TWP at the suggestion of USFWS, in order to survey large expanses of the surrounding terrain for eagle activity in the area.

In the spring of 2009, a total of 42.5 hours of ground survey was performed between March 16 and April 14 at these sites. One golden eagle and several bald eagles were observed during these surveys, however no breeding or territorial behavior was observed and most of these birds were likely migrating north through the area. No nests were observed at the historic golden eagle nest sites, either from the ground surveys of the areas or from the helicopter. No nests were observed at any of the waterbodies surveyed. Therefore, there are no known breeding eagles in the vicinity of the project.

Additional discussion of rare raptors can be found in Exhibit B.15.

Additional details are provided in the Rare Raptor Nesting Survey Memorandum located in Attachment A.3-1.

A.3.3 Daytime Migrant Surveys

Based on recommendations from MDIFW and USFWS, TransCanada performed surveys for diurnally migrating raptors in the Sisk Mountain vicinity in spring and fall 2009. The daytime raptor migration survey protocol is provided in Attachment A.3-2.

The spring, 2009 daytime raptor survey effort at Sisk Mountain consisted of 107 total hours of observation across 13 dates between April 15 and May 15. During this effort, a total of 43 individual raptors, representing seven species were identified within the immediate vicinity of the proposed Kibby Expansion Project. The vast majority of these were red-tailed hawks, which comprised 53 percent (n=23) of all observations. The next most abundant species observed was broad-winged hawk, which represented 14 (n=6) percent of all observations.

The fall 2009 daytime raptor survey effort at Sisk Mountain consisted of 227 total hours of observation across 21 dates between September 1 and October 15. During this effort, a total of 83 individual raptors, representing 11 species were identified. Buteo species were most frequently observed, with broad-winged hawks, red-tailed hawks and unidentified buteo species collectively representing 60 percent of all observations.

In spring, the overall passage rate (total birds/total hours of effort for entire season) was 0.40 birds per hour of effort (43/107=.40); the average daily passage rate (average of calculated daily passage rates) for spring 2009 was 0.38 birds per unit effort. In fall, the overall passage rate was 0.37 birds per hour of effort (83/227=0.37); the average daily passage rate was 0.39 birds per unit effort.

Spring and fall 2009 daily passage totals and daily passage rates at Sisk Mountain were compared to data for the same dates from several northeastern hawk count sites. For both seasons, daily totals and daily passage rates were dramatically lower at Sisk Mountain than any of the comparison locations. Other hawk watch sites appear to have observed pulses or peaks in migratory activity in mid- to late April for spring surveys and in mid- September for fall surveys; no such pulses were observed at Sisk Mountain.

Approximately 33 percent (n=14) of birds recorded during the spring survey used the ridge area of Sisk Mountain at some point during their observed flight path. The remaining individuals (n=29) used slope and valley areas associated with the Sisk Mountain formation. Approximately 39 percent (n=32) of the birds observed over the course of the fall survey used the ridge area at some point during their observed flight path. Approximately 51 percent (n=42) used slope and valley areas associated with the Sisk Mountain formation. The remaining individuals (n=9) were observed over other area formations (such as Kibby Range) and were not associated with the Sisk Mountain formation, its slopes or its immediate valleys.

Flight height was estimated only for individuals that used the ridge area and extreme upper slopes of Sisk Mountain, as these are the areas where potential development has been considered or proposed over the course of project planning. Flight height estimates were grouped into 3 categories: 0-50 feet above the ground, 50-500 feet above the ground, and 500+ feet above the ground. The portion of the migrating raptor population which passes near Sisk Mountain, and may be exposed to proposed wind turbine structures there, is best represented by those recorded within the 50’-500’ category. In spring 2009, this category included 7 individuals (or 16 percent of all birds recorded in spring 2009). In fall 2009, this category included 22 individuals (or 27 percent of all birds recorded in fall 2009).

When spring flight directions (excluding variable entries) are plotted, a north and south trend of travel direction is apparent; however, the number of birds traveling in south/southwest directions was comparable to the number of birds traveling in north/northwest directions. When fall flight directions (excluding variable entries) are plotted, a south/southwest trend of travel direction is apparent.

A.3.3.1 RTE Species

Three listed or formerly listed state or federal Rare, Threatened or Endangered raptor species were identified during spring and fall migration surveys at Sisk Mountain: bald eagle, golden eagle, and peregrine falcon. In spring, 2009, two listed species were observed: one bald eagle and one golden eagle. Both birds flew over the ridge of Sisk Mountain. The bald eagle flew through a saddle, at treetop level; the golden eagle flew over the north end of the ridge within the 50-500-foot flight height category.

In fall, 2009, one bald eagle, two golden eagles, one unidentified eagle spp. and one peregrine falcon were recorded. The bald eagle was seen flying over the Chain of Ponds and did not approach Sisk Mountain. One adult golden eagle was observed flying southward over Kibby Range; it did not approach Sisk Mountain. A second golden eagle was observed over the lower slope of Kibby Range and the Gold Brook Valley; it did not approach Sisk Mountain. One unidentified eagle species was observed to cross perpendicular to the ridge of Sisk Mountain near the north end of the ridge, within the 50-500-foot flight height category. The peregrine falcon flew southward along the eastern lower slope of Sisk Mountain and did not approach the ridge area.

A.3.3.2 Conclusion

Spring and fall diurnal raptor migration passage rates at Sisk Mountain were very low, both in general and when compared to contemporary and recent regional data. No pulses of migratory activity were detected. These findings indicate that Sisk Mountain is not located within a significant spring or fall migration corridor for raptors. This finding is consistent with the results of migration data collected at Kibby Mountain in fall 2005 and spring 2006.

Because of very low passage rates, the overall sample size for assessment of other parameters is very small. This should be considered when interpreting assessment of flight characteristics.

This study found high variability in flight direction in spring; however, with the "variable" flight category removed, a north and south trend was detected. Flights toward the south were essentially as frequent as flight toward the north, indicating that the north/south trend has more to do with the physical orientation of Sisk Mountain's ridge than migratory trajectories. In fall, a southward trend in flight direction was detected.

In general, low passage rates and low usage of the area of potential development suggest low overall risk to raptor species from wind development at this location.

Additional details are provided in the Daytime Raptor Migration Survey Report located in Attachment A.3-2.

A.3.4 Radar Surveys

A.3.4.1 Spring

The spring 2009 field survey occurred on 20 nights between April 29 and May 26, 2009.

Marine surveillance radar, similar to that described by Cooper *et al.* in *An improved marine radar system for studies of bird migration* (1991), was used during field data collection. The Furuno radar systems utilized have a peak power output of 12 kilowatts (kW) and have the ability to track small animals, including birds, bats, and even insects, based on settings selected for the radar functions. It cannot, however, readily distinguish between birds and bats but can distinguish between birds/bats and insects. Consequently, all birds/bats observed on the radar screen are identified as "targets." During each survey night, the radar sampled from sunset to sunrise; each hour of sampling included the recording of radar video files during horizontal and vertical operation. The radar site was located within the saddle near the middle of the Sisk

Mountain ridge. At this location, the radar had good visibility and provided coverage of the large saddle on the southern half of the ridge, as well as the upper reaches of the north ridge and south summits. The radar was capable of detecting targets within nearly all of its detection range.

Radar surveys are intended to document several variables determinant of nocturnal migration and biological activity within the Project area that can be related to other similar studies in the region for assessing potential risk from the proposed project. These variables include passage rates [targets/kilometer/hour (t/km/hr)], flight heights (meters), and flight direction (0-360 degrees).

The survey documented an overall passage rate for the entire survey period of 207 t/km/hr, which is at the lower end of the range of passage rates observed during other similar studies. Passage rates varied greatly between nights throughout the season, indicating migration occurred in pulses, with rates of migration likely influenced by weather patterns and conditions from night to night. Flight heights, however, remained fairly consistent throughout the survey period. The seasonal average flight height was 293 ± 9 meters (m) (or 961 feet (ft)). Flight heights, when compared to the anticipated 125 m (410 ft) height of the proposed turbines with blades, indicate that the percentage of targets flying below turbine height (using the adjusted flight heights) ranged from 7 to 49 percent with a seasonal average of 18 percent.

Flight direction (± 1 circular standard deviation) were summarized using software designed specifically to analyze directional data (Oriana2© Kovach Computing Services). The flight mean flight direction in spring 2009 in the Project area was 27.9°± 79.1. This mostly northeasterly direction is expected during spring migration and is comparable to most publicly available radar survey results in the northeast.

Spring radar surveys documented patterns in nocturnal migration similar to those documented at most recent radar surveys. These include highly variable passage rates between nights, a generally northward flight direction in spring, and flight heights primarily occurring between 200 and 600 m above ground. Within nights, migration activity was generally greatest four to five hours after sunset and declined steadily through the end of the night. While comparisons between radar studies are vague at best due to the variability of site circumstances, studies performed in similar regions, habitats, and at equivalent levels of effort to those at the Kibby Expansion Project do show a consistency in range of migratory activity. The preconstruction radar studies conducted during the spring 2006 migration period at the Kibby Project, which was recently permitted and is currently under construction, showed similar results as the spring 2009 study conducted at Sisk Mountain. The Project is approximately 2.6 miles west of Kibby Range, or the B-Series ridge of the Kibby Project. Although the season mean passage rate at Kibby Range (512 t/km/hr) was twice as high as Sisk Mountain (207 t/km/hr), flight heights and flight directions were very similar. The overall mean flight height at Kibby Range was 378 m with an overall percentage of targets below 125 m (the height of the proposed wind turbines) of 25 percent. At Sisk Mountain, the season mean flight height was 293 m with 18 percent flying below 125 meters. Flight directions were only 7 degrees different between Kibby Range (86 degrees) and Sisk Mountain (79 degrees).

A.3.4.2 Fall

The fall 2009 radar survey occurred on 20 nights between August 31 and October 10, 2009. X-band Marine surveillance radar was used during field data collection. During each survey night, the radar sampled from sunset to sunrise; each hour of sampling included the recording of radar video files during horizontal and vertical operation. The radar site was located within the saddle near the middle of the Sisk Mountain Summit. At this location, the radar had good visibility and provided coverage of the large saddle in the middle of the summit, as well as the upper reaches of the north and south summits. The radar was capable of detecting targets within nearly all of its detection range. Radar surveys are intended to document several variables determinant of nocturnal migration and biological activity within the Project area that can be related to other similar studies in the region for assessing potential risk from the proposed project. These variables include passage rates [targets/kilometer/hour (t/km/hr)], flight heights (meters), and flight direction (0-360 degrees). The survey documented an overall passage rate for the entire survey period of 458 t/km/hr, which is typical of other similar studies conducted on forested ridges in the northeast. Passage rates varied greatly between nights throughout the season, indicating migration occurred in pulses, with rates of migration likely influenced by weather patterns and conditions from night to night. Flight heights remained fairly consistent throughout the survey period. The seasonal average flight height was 287 meters (m) (or 940 feet (ft)). Flight heights, when compared to the anticipated 125 m (410 ft) height of the proposed turbines with blades, indicate that the percentage of targets flying below turbine height (using the adjusted flight heights) ranged from 11 to 49 percent with a seasonal average of 23 percent.

Flight direction (± 1 circular standard deviation) were summarized using software designed specifically to analyze directional data (Oriana2© Kovach Computing Services). Mean flight direction in spring 2009 in the Project area was 206°. This mostly southwesterly direction is expected during fall migration and is comparable to most publicly available radar survey results in the northeast.

Fall radar surveys documented patterns in nocturnal migration similar to those documented at most recent radar surveys. These include highly variable passage rates between nights, a generally southern flight direction, and flight heights primarily occurring between 200 and 600 m above the ground. Within nights, migration activity was generally greatest two to three hours after sunset and declined steadily through the end of the night. While comparisons between radar studies are vague at best due to the variability of site circumstances, studies performed in similar regions, habitats, and at equivalent levels of effort to those at the Kibby Expansion Project do show a consistency in range of migratory activity. The preconstruction radar studies conducted during the fall 2005 migration period at the Kibby Project, which was recently permitted and is currently under construction, showed similar results as the fall 2009 study conducted at the Kibby Expansion Project.

A.3.5 Bat Detector Surveys

A bat detector survey was conducted during the fall season of 2009 during 66 nights between August 12 and October 15, 2009. Anabat survey equipment (Titley Electronics Pty Ltd.) was used for the duration of the fall 2009 acoustic bat survey. Anabat detectors were selected based upon their widespread use for this type of survey, their ability to be deployed for long periods of time, and their ability to detect a broad frequency range, which allows detection of all species of bats that could occur in the Project area. Three bat detectors were deployed in three locations in the Project area for the majority of the survey period and one bat detector was deployed starting in late September. Two detectors (North Tower and South Tower) were mounted on the top of portable towers, which positioned the detectors at a height of approximately 20 meters above ground level, or about 5 meters above the top of the surrounding forest canopy. A third detector (Radar Tree) was deployed at a height of approximately 1.5 m along the edge of the clearing in which Stantec's radar monitoring equipment was located. The fourth detector (Met High) was deployed in late September, soon after installation of a met tower.

Acoustic bat surveys are intended to document several variables which provide information on seasonal and nightly activity patterns and species composition of resident and migratory bats within the Project area. These variables include detection rate, number of recorded sequences, and guild composition.

During the survey, detectors operated properly on all but four detector nights, resulting in 204 detector-nights of data. The detectors documented a total of 94 bat call sequences, resulting in an overall detection rate of 0.5 call sequences per detector night. Activity levels were similar between the three detectors deployed in August, with 32 sequences recorded at the North Tower, 40 at the Radar Tree, and 22 at the South Tower. No call sequences were recorded at the Met High detector, which was not deployed until late September.

At all three detectors where bat activity was documented, activity levels were highest in August, declined in September, and either remained level or declined further in October. Nightly activity levels ranged from 0-7 call sequences per night, with no more than 7 call sequences detected at any site during the survey. Peak bat activity was typically recorded between 3 and 4 hours past sunset.

Of the 94 recorded call sequences, 62 (66.0%) were classified as unknown, 15 (16.0%) were classified as belonging to the big-browned silver-haired guild, 13 (13.8%) were classified as myotis, and 4 (4.3%) were classified as hoary bat. Species composition of recorded bat calls was similar between detectors, with unknown calls comprising the majority at all three detectors that recorded bat activity (Attachment 3). Surveys documented relatively low levels of bat activity and activity levels were similar between three detectors distributed in different areas of the Project ridge.

Survey reports including protocols and more detailed summaries of the Spring and Fall 2009 Radar Survey Results are included in Attachment A.3-3.

A.3.6 Breeding Bird Surveys

Breeding bird surveys were performed during June and July of 2009 on Sisk Mountain. A survey protocol similar to that used for breeding bird survey on Kibby Project, which is based on the Vermont Center for Ecostudies (VCE), formerly Vermont Institute of Natural Science (VINS) Mountain Birdwatch program and Bird Studies Canada's High Elevation Landbird Program protocols. This protocol has been developed in consultation with MDIFW and includes a spot mapping methodology to help identify areas that are used most by Bicknell's thrush. The breeding bird survey protocol is provided in Attachment A.3-4. Three kilometer long survey transects were established on the ridge from near the southern peak of the mountain extending north beyond the northern peak. Survey points were located every 250 meters along the transect, for a total of 15 survey points. Surveys were augmented to identify the presence of Bicknell's thrush through use of playback.

Bicknell's thrush were identified at the six northern most survey points during the first round of breeding bird surveys. More intensive survey consisting of spot mapping Bicknell's thrush use within 10 hectare plots around each of these six points demonstrated a higher use within four of these plots. Two distinct "core" habitat areas were identified based on the observations made during the spot mapping surveys

A.3.7 Post-construction Monitoring Plan

TransCanada has worked closely with MDIFW and USFWS to develop and implement study protocols for pre-construction monitoring for both the Kibby Wind Power Project and the Kibby Expansion Project that provided a robust indication of the range of species and species use throughout the Project areas. In order to further understand the impact of wind power on avian and bat species and to confirm that this Project will not result in significant avian and bat mortality, TransCanada has continued to work with MDIFW and USFWS in developing a meaningful post-construction monitoring program. In determining an appropriate study program for post-construction efforts, TransCanada reviewed precedents established by other wind energy facilities in Maine, and industry information available through wind energy trade organizations. The protocol developed for the Kibby Project as a result of this effort was presented to MDIFW and USFWS for review at a meeting on March 27, 2008, and revisions were incorporated to respond to agency comments. These protocols for the Kibby Wind Power Project serve as a model for use at the Kibby Expansion Project. Currently, however, the MDIFW has determined that it is more prudent at this time for the agency to re-examine the proposed post-construction monitoring based on results of monitoring being done at existing operational wind power projects in Maine. MDIFW has a keen interest in developing consistent recommendations for Maine wind power projects, and their goal is to use data collected to date at existing facilities to focus future monitoring efforts. As a result, the post-construction monitoring plan will be finalized when ongoing discussions with MDIFW have concluded. TransCanada will provide the final post-construction monitoring program to LURC for review prior to implementation.

ATTACHMENT A.3-1

Rare Raptor Nesting Protocol
Rare Raptor Nesting Survey Memorandum

Rare, Threatened, and Endangered Raptor Nest Survey Protocol for the Kibby Expansion Wind Power Project

Prepared for:

TransCanada Maine Wind Development Inc.

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Toronto, Ontario M5E IJ4

Prepared by:

TRC

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Augusta, ME 04330

April 2009

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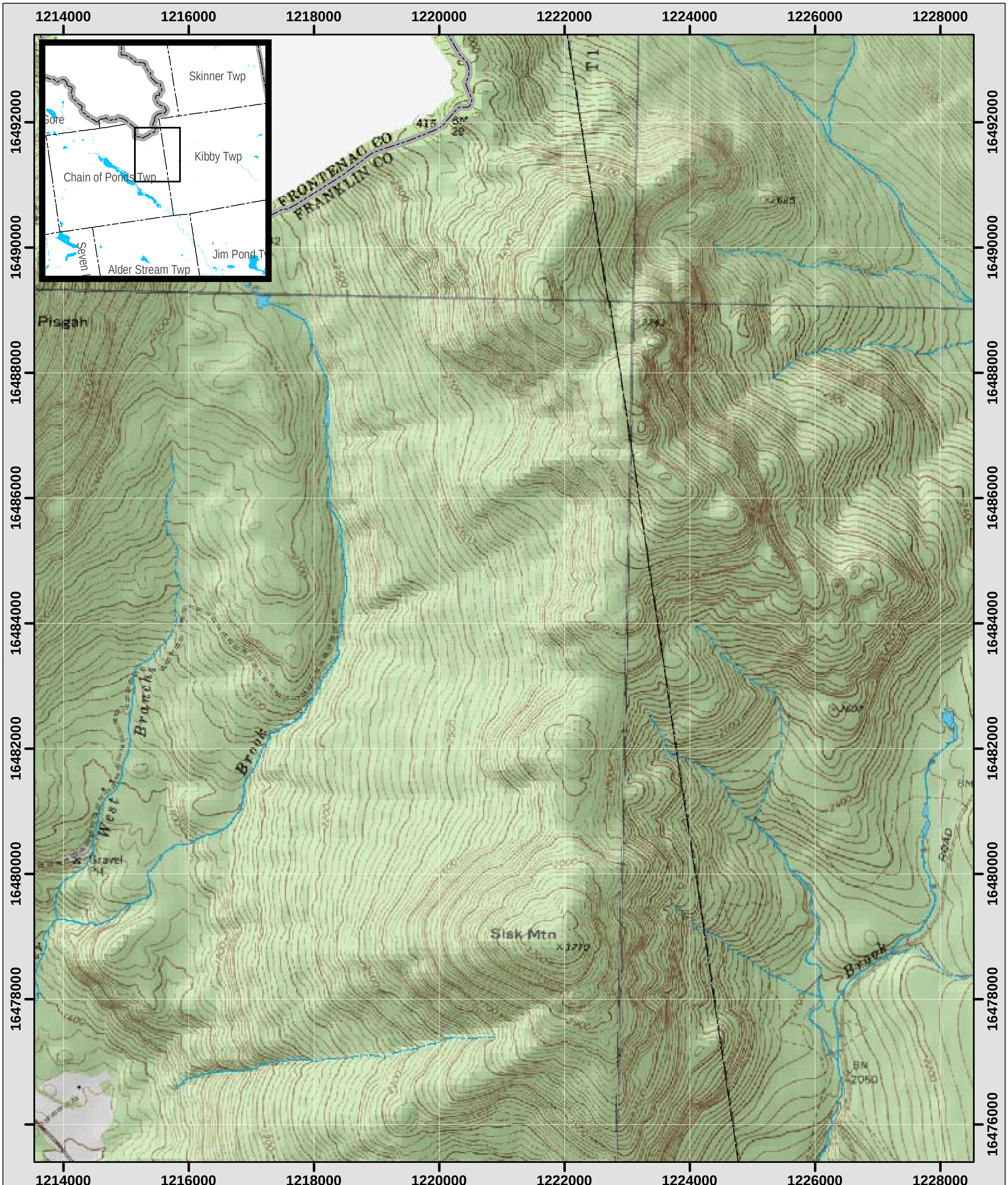
1.0 INTRODUCTION

1.1 Project Description

TransCanada Maine Wind Development (TransCanada) is assessing the development of a wind power generating facility in the Boundary Mountains of Western Maine known as the Kibby Expansion Wind Power Project (Kibby Expansion Project). The proposed Kibby Expansion Project is located in the unincorporated townships of Kibby and Chain of Ponds in Franklin County, Maine. The general project area is located along the ridgeline of Sisk Mountain, as shown in Figure 1. The surrounding area is currently actively managed for forest products.

The Kibby Expansion Project is immediately adjacent to the recently permitted Kibby Wind Power Project (Kibby Project). TransCanada intends to conduct baseline studies in addition to the existing information from the Kibby Project licensing effort to determine the level of potential impact associated with the proposed project.

The Maine Department of Inland Fisheries and Wildlife (MDIFW) and the United States Fish and Wildlife Service (USFWS) have recommended that TransCanada perform surveys for rare, threatened and endangered raptors in the project vicinity. Surveys for these species have been previously performed for the Kibby Project in 1992, 1993, 2005, 2006, 2007, and 2008. Due to the immediate juxtaposition of the Kibby Expansion Project to the Kibby Project area, much of the U.S. Windpower and Kibby Project data are applicable to the Kibby Expansion Project.



0.5

Kilometers

2,000

Feet

Sisk Mountain

Chain of Ponds Twp, ME

Figure 1: Location Map

Created by: TRC 1/17/2009

Base map: 24k USGS Topographic Map. Elevation shading derived from MEDEM10 courtesy of Maine OGIS. Coordinate Grid: NAD83 UTM Zone 19N, U.S Survey Feet

1.2 Raptor Protection Status

There are three raptor species listed under the Maine Endangered Species Act (Maine ESA), 12 M.R.S.A Ch. 713 subchapter 5, which is administered by the Maine Department of Inland Fisheries and Wildlife (MDIFW). These species include bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), and peregrine falcon (*Falco peregrinus*) as of the spring of 2009. Note however that the bald eagle is likely to come off of the Maine list in the fall of 2009. None of these species are currently listed under the federal Endangered Species Act (ESA). In addition to the regulatory protections of state listing status, eagles and their nests are also protected by the Bald and Golden Eagle Protection Act, 16 U.S.C. §§ 668-668d, which is administered by the United States Fish and Wildlife Service (USFWS). The specific legal status of and protections afforded to each of these species are discussed in detail, below.

1.2.1 Legal Status of the Bald Eagle in Maine

The bald eagle, which has historically been a listed species under the Federal ESA, was reclassified from endangered to threatened on July 12, 1995. As a result of it's successful comeback, this species was de-listed from the ESA on June 28, 2007. The bald eagle, however, remains state listed as "threatened" under the Maine ESA, though it will likely be coming off the list in the fall of 2009. In addition to the regulatory protections of state listing status, the eagles and their nests are also protected by the federal Bald and Golden Eagle Protection Act.

Because of continued management interest by both federal and state agencies in the management of bald eagles, consultation with both the USFWS and MDIFW for any project that has the potential to affect bald eagles is advisable. The designation of "Essential Habitat" protects their habitat in Maine. Specifically, pursuant to state law, significant wildlife habitat (e.g., Essential Habitat) in Maine is protected under the Natural Resources Protection Act (NRPA), 38 M.R.S.A. § 480-A, et seq. The NRPA is administered by the Maine Department of Environmental Protection (MDEP). In Maine, the MDIFW designates Essential Habitats as “those areas that currently or historically provide physical or biological features essential to the conservation of an endangered or threatened species and which may require special management considerations.” Essential Habitats are identified and mapped by the MDIFW.

Bald eagle Essential Habitat areas consist of a mapped habitat circle with a radius of 1,320 feet originating at a center located at a nest site. Bald eagle Essential Habitat areas are described on MDIFW Essential Habitat maps by an alpha-numeric designation and are available digitally. These habitat areas are also elements of a geographic information system (GIS) database that is searched by MDIFW for potential project impacts. Typically, nests are located near larger bodies of water. State records of about 1,200 different nest sites locations accumulated over the last 40 years indicate that bald eagle nests are not found more than 1.1 miles from a large waterbody of open water (ponds greater than 35 acres and rivers at least 200 yards wide) (personal communication with Charlie Todd, March 14, 2006).

Projects in Maine requiring a permit or license from a state agency or municipal government partly or wholly within a bald eagle nest site designated as Essential Habitat shall not be permitted, licensed, funded, or carried out unless “the Commissioner determines that the activity will not significantly alter or unreasonably harm the Essential Habitat.” Several factors are considered in determining if a project significantly alters or unreasonably harms essential nesting habitat. These factors are as follows:

- Magnitude and time of year that noise and human activity is generated by the project;
- Physical alteration to the landscape;
- Destruction of or alteration to key habitat components such as perch trees, roost trees or forage areas;
- Reduction in the seclusion of the nest site and adjacent shoreline area;
- Demonstrated tolerance of the particular eagles to human activity or disturbance; and

- Reduction in the future suitability of the nest site to the eagles.

1.2.2 Legal Status of the Golden Eagle in Maine

The golden eagle is not federally listed, but is state-listed as endangered under the Maine ESA. In addition to the regulatory protections of listing status, the eagles and their nests are also protected by the federal Bald and Golden Eagle Protection Act.

Currently, there are no known active golden eagle nests in Maine, though there are known historical sites. These sites are found in the mountainous western and northwestern part of the state, and include nests in both cliff and tree sites (MDIFW 2003). Nesting season for golden eagles begins in February or March, and nesting pairs may occupy a home rage up to 600 square miles in size in forested areas such as in the northeast (personal communication with Charlie Todd, December 1, 2006). As the historic nest sites are no longer occupied by golden eagles, MDIFW has not designated Essential Habitat for golden eagles. The golden eagle in the east is found in eastern Quebec and Labrador, and this population may be increasing. MDIFW policy is to protect historical nest sites by cooperative, voluntary agreements with land owners. Therefore, any project that has the potential to affect these historical sites will be of interest to MDIFW, and prior to development or timber harvest in these areas, MDIFW biologists should be consulted (MDIFW 2003). In addition, MDIFW recommends that historical nest site locations should be investigated and documented for inactivity.

1.2.3 Legal Status of the Peregrine Falcon in Maine

The peregrine falcon was historically listed under the federal Endangered Species Act; however, it was removed from the list in 1999. The breeding population found in Maine remains listed as endangered on the Maine ESA list. Peregrine falcons nest on cliffs, often near large waterbodies. They utilize cliffs for nesting and perching and also require a large prey base of small to medium-sized birds. The nests themselves are on ledges that are inaccessible to mammalian predators and are protected against the elements (MDIFW 2003).

Currently, the nesting population of peregrine falcons in Maine is low and widely scattered in various cliff locations around the state. Essential Habitat has not been designated for peregrine falcons in Maine. MDIFW policy is to protect nest sites by cooperative, voluntary agreements with land owners, as well as conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitats. Therefore, land development projects that have the potential to affect these nest sites should undertake consultation with MDIFW biologists to assist with project planning (MDIFW 2003).

1.3 Previous Studies within the Project Area

Numerous studies which collected observations of raptor movements in the Boundary Mountains have been performed in the past two decades. Most recently, RTE raptor nest surveys and daytime migration studies were performed for the Kibby Wind Power Project in 2005, 2006, 2007, and 2008. In 1992 and 1993, similar surveys were performed by U.S. Wind Power when they sought a permit for a wind facility in the same location as the Kibby Project. RTE raptor nest surveys were performed at the same locations for these studies as are relevant to Sisk, thereby providing historic information which is directly relevant to this project. Daytime migrant studies for the earlier projects focused on ridges near Sisk and can provide background knowledge of RTE raptor use in the area during migration. Furthermore, incidental observations from the previous studies provide a snapshot of RTE raptor presence in the area during the summer (breeding) season.

1.3.1 U.S. Wind Power Surveys (1992-1994)

In 1992 and 1993, U.S. Wind Power performed surveys to document summer use by raptors by surveying logged areas, overlooks with good visibility, and cliff faces within or near the project area. No RTE raptors were observed during these surveys, or incidentally during other summer surveys. U.S. Wind Power also conducted raptor migration surveys in the Kibby vicinity. Their work consisted of day-long surveillance during peak migration and identified numbers and species of raptors crossing the project area. The goals were to identify raptor species' relative abundance, composition, and flight characteristics (flight height, direction, and consistency of use) in the project area.

1.3.2 Kibby Wind Power Project Studies

On behalf of TransCanada, TRC conducted RTE nest surveys in several locations where historic golden eagle nesting was known or suspected. Survey locations were determined based on U.S. Windpower project files and consultation with MDIFW. Sites were observed in April, in 2005 and 2006. Each of the sites was scanned multiple times, using binoculars and spotting scopes, over the course of 5-6 hours. These sites were also observed during April and May in 2007 and 2008 by ground and helicopter aerial surveys.

In addition, TRC conducted raptor migration surveys in fall 2005 and spring 2006. Similar to U.S. Windpower's previous studies, this effort consisted of day-long surveillance during peak migration and identified numbers and species of raptors crossing the project area. The goals were to identify raptor species' relative abundance, composition, and flight characteristics (flight height, direction, and consistency of use) in the project area.

1.4 Existing Knowledge of RTE Raptor use in the Project Area

1.4.1 Bald Eagles

Breeding bald eagles are present in northwestern Maine, and there are known recent nest sites on nearby Flagstaff and Spencer Lakes (personal communication with Charlie Todd, March 14, 2006: see Appendix B). Though the project area is possibly within these nesting eagles' home range, they typically focus their time around larger waterbodies and it is questionable whether they would frequent the ridges within the project area (personal communication with Charlie Todd, March 14, 2006).

Based on data from MDIFW and USFWS, at the time of U.S. Windpower's studies (1992-1993), there was no evidence of any active or historic bald eagle nest sites in Kibby, Skinner, or Merrill Strip Townships. During U.S. Windpower studies, one bald eagle was observed in the Kibby Project area in September 1993. (NEWES 1993; U.S. Windpower 1994). Three bald eagles were observed in the Kibby Project area by TRC staff during fall 2005 daytime migration surveys. No bald eagles were observed during spring 2006 daytime migration surveys. Bald eagles have not been observed by TRC staff in the Kibby Project area during the breeding season.

1.4.2 Golden Eagles

Golden eagles are not known to currently breed in Maine, but MDIFW has identified three historic nest sites within roughly a ten-mile radius (and within potential foraging range) of the proposed project (personal communication with Charlie Todd, March 14, 2006 and March 11, 2009). Charlie Todd, MDIFW, reports that golden eagles have also nested in trees in Maine, and cliff sites are not the only suitable habitat for nests (personal communication with Charlie Todd, August 16, 2005).

Based on data from MDIFW and USFWS, at the time of U.S. Windpower's studies, there was no evidence of any active nest sites for golden eagles in the project vicinity. The historic golden eagle nest locations were surveyed by TRC staff in spring of 2005 and 2006; no stick nests were visible at any of the sites, and no eagles were observed. Ravens, however, were observed to spend a significant amount of time at two of the sites. Presence of ravens is considered a strong indication that golden eagles are not present at a given location (Mark McCollough, USFWS, personal communication, February 23, 2006; Tom Hodgman, MDIFW, personal communication, February 23, 2006). This is because golden eagles are typically dominant birds at preferred nest sites; if present, they have been known to displace ravens (Marquiss et al. 1978).

During the course of U.S. Windpower studies, two golden eagles (paired) were observed incidental to the migration surveys in September 1993 (U.S. Windpower 1994). In the fall of 2005, two golden eagles were observed passing through the Kibby Project area by TRC staff during daytime migration surveys. No golden eagles were observed during spring 2006 daytime migration surveys. Golden eagles have not been observed by TRC staff in the Kibby Project area during the breeding season, however, several golden eagles have been observed in the area during migration seasons during 2007.

1.4.3 Peregrine Falcons

Peregrine falcons have nested on at least two cliff sites in northwestern Maine; however these sites are greater than ten miles from the project location. The historic golden eagle sites in the project vicinity can be considered generally suitable for peregrine falcon nesting, though peregrine falcons have not been documented using these sites.

During the course of U.S. Windpower studies, one peregrine falcon was observed in September 1992, and three peregrine falcons were observed in September 1993 (NEWES 1993; U.S. Windpower 1994). TRC staff observed three peregrine falcons passing through the Kibby Project area during fall 2005 daytime migration surveys. No peregrine falcons were observed during spring 2006 raptor migration surveys. Peregrine falcons have not been observed by TRC staff in the Kibby Project area during the breeding season.

1.5 Purpose and Objectives

The purpose of 2009 eagle and falcon nest surveys is to monitor the Sisk Mountain area and surrounding vicinity for bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), and peregrine falcon (*Falco peregrinus*) nesting activity. Study objectives include:

- Confirm presence or absence of bald eagle nesting activity at any known nest sites or suitable habitat within roughly a 10-mile radius of Sisk Mountain;
- Confirm presence or absence of golden eagle nesting activity at any known historic nest sites within roughly a 10-mile radius of Sisk Mountain area;
- Confirm presence or absence of peregrine falcon nesting activity at suitable habitat within roughly a 10-mile radius of Sisk Mountain area;
- Monitor the Sisk Mountain vicinity for bald eagle, golden eagle, or peregrine falcon activity that may indicate nesting at previously undocumented sites through incidental observations during other field surveys; and
- Map (if found) bald eagle, golden eagle, or peregrine nest site locations within the Sisk Mountain vicinity.

2.0 METHODS

2.1 Background Research/Consultation

Both state and federal biologists were consulted in order to develop and refine the survey protocols utilized. Prior to implementing the field program, the draft protocol was distributed for agency review on March 28, 2006. Comments were received and incorporated through April, 2006. The protocol was redistributed on April 8, 2009, and agency comments were again invited for incorporation. Agency personnel were consulted, including a meeting on March 11, 2009, with Mark McCollough, USFWS, and Charlie Todd, MDIFW, to specifically discuss rare raptor issues and surveys. Agency staff have also been invited to participate throughout the survey efforts.

MDIFW currently has an annual program to locate active bald eagle nests consisting primarily of observation from fixed-wing aircraft. Data collected from the annual surveys are then mapped and incorporated into an MDIFW GIS project. During the consultation process for the Kibby Wind Power Project, TRC obtained these data and overlaid nest site locations on project maps. Historic information on golden eagle and peregrine falcon nest sites was also overlaid on project maps. These maps will be used to facilitate the eagle and falcon nesting surveys for Sisk Mountain in spring 2009. The locations of these protected species nest sites are not provided in this document due to the sensitive nature of this information.

2.2 Survey Protocol

2.2.1 General Breeding Eagle and Falcon Surveys

Based on suggestions made by Charlie Todd and Tom Hodgman of MDIFW, and Mark McCollough of the USFWS, a general survey for breeding eagles and falcons will entail visual searches from good vantage points on the ground during the months of March, April and May. During such surveys, biologists will watch for and document eagle and falcon behavior that is indicative of nesting activities. Such behaviors include observation of paired birds, habitual observations in the same general area, observation of eagles or falcons flying with food items, and observed territorial interactions with other birds.

In addition to formal observations during daytime migration surveys, any eagle and falcon activity observed in the Kibby vicinity will be documented as incidental observations whenever biologists are in the area.

If observations indicate suspected eagle or falcon nesting, MDIFW and USFWS biologists will be notified as soon as possible.

2.2.2 Ground-Based Golden Eagle and Peregrine Falcon Nest Surveys

Ground-based golden eagle and peregrine falcon nest surveys will be performed in early April, before leaf-out, as this timeframe provides optimal seasonal conditions for documentation of active nest use. Nest surveys will focus on three known historic golden eagle nest sites. Though peregrine falcons have not been documented at these sites, they are generally suitable habitat for falcon nesting (personal communication with Charlie Todd, March 14, 2006). As noted above, work performed for the Kibby Wind Power Project concluded that, as of 2006, there were no golden eagle nests evident at any of the three sites. Peregrine falcons were also not observed at that time.

Surveys will be conducted at a suitable distance from the sites from or adjacent to existing roads by scanning each cliff face multiple times (10 to 60 times) with binoculars and spotting scopes. Surveyors will be looking for any sign of potential nest sites or activity. Perches or nest sites often have large “white-washed” areas below them from raptor liquid droppings, and the location of such perches will be documented. TRC personnel performing this work will be in close communication with MDIFW and USFWS throughout survey efforts. If any evidence of nesting is discovered, MDIFW and USFWS personnel will be informed immediately.

2.2.3 Aerial Eagle Surveys

An aerial eagle nest survey will be conducted using a helicopter, flying as low and slow as safety and practicality will allow. A single aerial survey will be conducted prior to leaf-on conditions, and to correspond to the period typically used by MDIFW for surveying Maine nesting pairs of eagles. The area surveyed will include Jim Pond, Chain of Ponds, Arnold Pond, and the cliff sites along Chain of Ponds, Indian Stream Mountain, and at Moosehorn (adjacent to Arnold Pond).

Flights will only be conducted when conditions are conducive to the survey, including skies with at least one-mile visibility and winds less than 15 mph. The location of any new nests or other pertinent information observed will be recorded. Information recorded will include areas surveyed, location of any nests observed, and status of nests (active/inactive). Active participation by regional MDIFW and USFWS biologists who are familiar with the area will be sought.

2.2.4 Surveyor Preparedness

Personnel performing breeding eagle surveys and ground-based golden eagle nest surveys will be experienced in bird identification and familiar with the logistics involved with work in remote settings. Personnel performing aerial nest surveys will be experienced in bird identification and experienced conducting wildlife observations from the air.

2.2.5 Data Collection

Breeding eagle observations will be recorded among field notes collected during spring daytime migration surveys. Observations from ground-based golden eagle nest surveys and from aerial eagle nest surveys will be recorded into field notebooks, which will be translated into electronic format upon return to the office from the field.

3.0 REFERENCES

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Subject: Rare Raptor Surveys Spring 2009 **Date:** November 18, 2009

From: Dana Valleau **Ext.:** 620-3834

To: Christine Cinnamon

On February 24, 2009, we met with agency representatives from the Army Corps of Engineers, LURC, and Maine Department of Inland Fisheries and Wildlife to discuss the proposed wind power project being planned for Sisk Mountain. Among discussion items was the appropriate level of study and protocols to be used for those studies. It was agreed that surveys and protocols used for Kibby Wind Power Project would be appropriate.

On March 11, 2009, we met with Mark McCollough (USFWS) and Charlie Todd (MDIFW) to discuss the proposed project and study protocol. Both agreed that the level of survey completed for the Kibby Project would be adequate for the most part; the only additional request was to include an effort to identify eagle use of the general region by surveying from good vantage points nearby. It was agreed that several locations in Chain of Ponds and Coburn Gore would provide suitable vantage points for these surveys. It was agreed that this additional effort would occur during early spring when eagles are typically setting up territories and would be more visible. It was also agreed that this effort would be conducted as part of the ground survey for nesting rare raptors.

Ultimately, both ground and aerial surveys were performed during 2009. A summary of each effort follows.

Ground Surveys

Ground surveys in Chain of Ponds TWP were performed at 3 different sites along the Chain of Ponds and Route 27, between March 26, 2009, and April 14, 2009. Similar surveys were performed in Coburn Gore at Moosehorn, between March 16, 2009 and March 26, 2009. A single survey of the Indian Stream Mountain cliffs was done on May 4, 2009.

A total of nine adult and one immature bald eagle and one adult golden eagle were observed during these surveys. All of these observations were either at Moosehorn or at the Natanis Pond DOT overlook. No eagles or nests were observed at Indian Stream Mountain. No breeding or territorial behavior was observed among any of the eagles recorded. Most of the birds observed

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were flapping, gliding, circling and soaring; generally, they were moving through and out of the field of view of the observer.

Based on behaviors observed during these observations, we believe that most of the birds were migrating or moving through the area. This assumption is supported by the lack of regularity in which most of these birds were observed. For example, seven of the bald eagles and the one golden eagle were observed during the first two days of survey at one site, Moosehorn; subsequent surveys at that location recorded no eagles. The other three observations of bald eagles were isolated events. The assumption that the eagles observed were migrating or transient is additionally supported by the lack of nesting found during later aerial survey of suitable nesting habitat in the vicinity.

Aerial Survey

On April 29, 2007, Mike Lychwala and myself (TRC), accompanied by Charlie Todd (MDIFW), performed a rare raptor nest survey via helicopter. We were in the area for part of a much larger survey and were able to survey all areas of interest in the vicinity of Sisk Mountain. Areas surveyed included the North Branch Dead River, Jim Pond, Northwest Inlet, Tea Pond, Chain of Ponds, Sisk Mountain, Indian Stream Mountain, Arnold Pond, and Moosehorn. All suitable cliff sites in the area and suitable trees adjacent to the waterbodies were investigated. No rare raptors or evidence of nesting were observed during this survey.

ATTACHMENT A.3-2

Daytime Raptor Migration Survey Protocol
Daytime Raptor Migration Survey Report

Daytime Avian Migration Survey Protocol for the Kibby Expansion Wind Power Project

Prepared for:
TransCanada Maine Wind Development Inc.
8th Floor, 55 Yonge Street
Toronto, Ontario M5E IJ4

Prepared by:
TRC Environmental Corporation
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Augusta, Maine 04330

April 2009

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APPENDIX

1.0 INTRODUCTION

1.1 Project Description

TransCanada Maine Wind Development (TransCanada) is assessing the development of a wind power generating facility in the Boundary Mountains of Western Maine known as the Kibby Expansion Wind Power Project (Kibby Expansion Project). The proposed Kibby Expansion Project is located in the unincorporated townships of Kibby and Chain of Ponds in Franklin County, Maine. The general project area is located along the ridgeline of Sisk Mountain, as shown in Figure 1. The surrounding area is currently actively managed for forest products.

The Sisk Project is immediately adjacent to the recently permitted Kibby Wind Power Project (Kibby Project). TransCanada intends to conduct baseline studies in addition to the existing information from the Kibby Project licensing effort to determine the level of potential impact associated with the proposed project.

The Maine Department of Inland Fisheries and Wildlife (MDIFW) and the United States Fish and Wildlife Service (USFWS) have recommended that TransCanada perform surveys for daytime avian migrants in the Sisk Project vicinity. Daytime avian migration surveys have been previously performed in the Kibby Project area in 1992, 1993, 2005 and 2006. Due to the immediate juxtaposition of the Kibby Expansion Project to the Kibby Project area, much of the U.S. Windpower and Kibby Project data are applicable to the Sisk Project.

1.2 Previous Studies

Numerous studies which collected observations of avian migration in the Boundary Mountains have been performed in the past two decades. Most recently, daytime migration studies were performed for the Kibby Project in 2005 and 2006. In 1992 and 1993, similar surveys were performed by U.S. Wind Power when they sought a permit for a wind facility in the same location as the Kibby Project. Daytime migrant studies for the earlier projects focused on ridges near Sisk and can provide background knowledge of avian use in the area during migration. Furthermore, other objectives and incidental observations from the previous studies provide a snapshot of avian presence and use in the area during the both migration and summer (breeding) season.

1.2.1 U.S. Wind Power Surveys (1992-1994)

In 1992 and 1993, U.S. Wind Power conducted raptor migration surveys in the Kibby vicinity. Their work consisted of day-long surveillance during peak migration and identified numbers and species of raptors moving through the area. The goals were to identify raptor species’ relative abundance, composition, and flight characteristics (flight height, direction, and consistency of use) in the Kibby vicinity.

1.2.2 Kibby Wind Power Project Studies

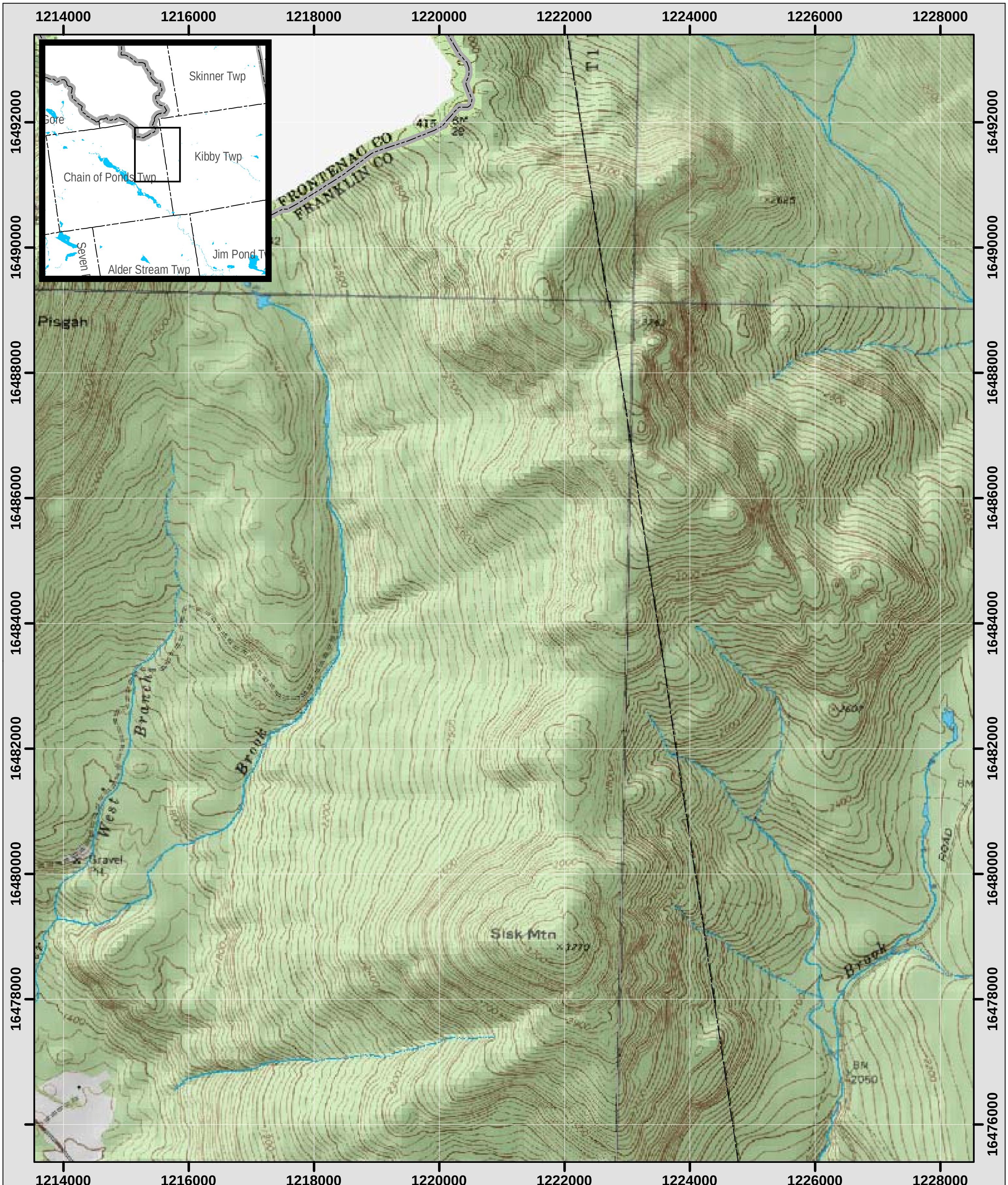
On behalf of TransCanada, TRC conducted daytime avian migration surveys in fall 2005 and spring 2006. Similar to U.S. Windpower's previous studies, this effort consisted of day-long surveillance during peak migration and identified numbers and species of daytime avian migrants crossing the Kibby Project area. The goals were to identify raptor species' relative abundance, composition, and flight characteristics (flight height, direction, and consistency of use) in the Kibby Project area.

1.3 Purpose and Objectives

The specific purpose of daytime avian migration surveys is to observe the approximate numbers, species, and patterns of use by spring and fall daytime migrants in the Kibby Expansion Wind Power Project (Kibby Expansion Project) vicinity. Data will be used to develop a qualitative assessment of general patterns of use by migrating birds in the vicinity of the proposed Kibby Expansion Project. Data from these efforts at Sisk Mountain will be compared with data collected during prior studies of the Kibby Wind Power Project (Kibby Project) area.

The main objectives of daytime avian migration surveys are to:

- Obtain a quantitative assessment of species composition, relative abundance, distribution, and spatial patterns of use by birds migrating during daytime hours in and around the Sisk Mountain area;
- Identify route(s) used by daytime migrating birds passing through/near Sisk Mountain area; and
- Evaluate potential for collisions at proposed turbine sites.



0.5
Kilometers
2,000
Feet

Sisk Mountain

Chain of Ponds Twp, ME

Figure 1: Location Map

Created by: TRC 1/17/2009

Base map: 24k USGS Topographic Map. Elevation shading derived from MEDEM10 courtesy of Maine OGIS. Coordinate Grid: NAD83 UTM Zone 19N, U.S Survey Feet

2.0 STUDY PROTOCOL

2.1 Survey Site Selection

Daytime avian migrant observation sites will be selected based on vantage, and range of visibility. Optimal sites will provide an obtuse view of Sisk Mountain and significant portions associated valleys. Views from survey locations should provide an opportunity to detect avian migrants as they approach the Kibby Expansion Project area, and should allow subjects to be tracked as the pass over or near the ridge of Sisk Mountain.

2.2 Survey Protocol

The protocol for daytime avian migration surveys at the Sisk Project is similar to protocol used during previous U.S. Windpower and TransCanada studies for the Kibby Project area. These protocols are largely based on standards set forth by the Hawk Migration Association of North America (HMANA), and by HawkWatch International (Hoffman and Smith 2003).

2.2.1 Number and Timing of Surveys

Surveys will be performed in the spring and fall of 2009. Spring surveys will occur between April 1 and May 31, and fall surveys will occur between September 1 and October 15. Seasonal surveys will consist of multiple survey days at each survey site.

Sampling will be performed based upon favorable weather for migration, timed to start the morning after the passage of a cold front. Surveys will be done for three consecutive days following this weather event. Surveys will not be conducted during precipitation, in fog, on days that are overcast with low cloud cover, or during any other circumstances that hamper visibility.

2.2.2 Surveyor Preparedness

Surveyors will be familiarized with the topography of the area, including the elevation of the survey site, surrounding ridge elevations and distances from the sampling site, and tree height, prior to starting surveys. Knowledge of these parameters will be useful in estimating flight height. Each surveyor will be trained in the methodology, and will calibrate themselves to the survey site prior to commencing survey activity. Surveyors will also be experienced in bird identification.

2.2.3 Data Collection

Detailed weather and migratory bird observation data will be collected during each survey. All data will be entered onto data sheets. Data will be collected on forms that have been developed based on those utilized by HMANA, using their suggested codes and guidelines. These data sheets are the same as those utilized during Kibby Project studies. An example data sheet is provided in Appendix A.

2.2.3.1 Weather Observations

Weather conditions will be noted at the beginning of each survey and hourly thereafter. Data will be collected based on codes and protocol by HMANA, and will be recorded directly onto observation data sheets. Parameters that will be recorded are:

- Wind speed (recorded based on HMANA codes and descriptions)
- Wind direction (compass direction from which the wind is coming, or “variable”)
- Temperature (degrees Celsius)
- Humidity (percent relative)
- Barometric pressure
- Percent cloud cover
- Visibility (approximate distance)
- Precipitation

2.2.3.2 Individual Bird Observations

Migratory bird observations will be recorded continuously throughout each survey period. When collecting data on migrating birds, surveyors will perform continuous scanning with the naked eye and with binoculars. Spotting scopes will be used as necessary to aid in identification. Several hours of consecutive data will be collected at each plot. The following data will be recorded for each bird observed:

- Species (if possible)
- Sex (if possible)
- Age class (if possible)
- Altitude at first observation, with noted variations over duration of presence within the survey area (using codes denoting below, within, or above rotor swept area)
- Distance from observation point at first observation, and variations over duration of presence within the survey radius
- Behavior (such as soaring, flapping, circling, gliding, perching, hunting, or other)
- General compass bearing flight direction (S, SSW, NE, etc.)

In the event a bird cannot be identified to the species level, it will be described to the greatest extent possible. For example, unknown raptors may be further described as “buteo” versus “accipiter”, or “large” versus “small”.

2.2.3.3 Flock Observations

Flock observations will be treated in the same way as individual bird observations, with counts or estimates of the number of birds comprising the flock.

2.2.3.4 Field Quality Assurance and Quality Control

Data sheets will be reviewed for completeness, accuracy, and legibility prior to leaving the survey site. Incidental observation data sheets will be inspected at the end of each survey day. Any problems noted will be rectified at that time; changes to the data sheets will be initialed by the person making the change.

Data will be analyzed concurrently with on-going field work to determine if project objectives are being met or will be met with the types of data and method of data being collected. Since similar protocols have been successfully utilized in other areas, only minor, if any, modifications should be needed during the course of the study, but since every project area is biologically and physically different, data will be frequently evaluated relative to the objectives. Any proposed changes to the protocols will be discussed with Maine Department of Inland Fisheries and Wildlife (MDIFW) prior to implementation.

2.3 Data Entry and Analysis

2.3.1 Data Entry

Data as recorded onto data sheets in the field will be entered into and stored in a numerical database or spreadsheet format. All entered data will be checked against original field notes and any errors detected will be corrected using the field data sheets and/or by consulting with the observer.

2.3.2 Data Analysis

The following summaries and statistics will be generated to address the objectives and goals of this study.

- Species lists by season;
- Indices of bird relative abundance;
- Avian migration patterns by species, season, and habitat type;
- Flight paths and heights, by species and season;
- Number and proportion of observations, by species and season, within the rotor-swept area of the proposed turbines; and

Standard statistical parameters (e.g., means, standard deviations) will be computed, where appropriate.

3.0 REFERENCES

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APPENDIX A

Data Form and Instructions

Daytime Migrant Survey Data Sheet

Observers:	Date:	Time Start:	Time End:

Weather (see reverse for instructions)		Location:
wind speed:	bar. press:	
wind direction:	cloud cover:	
temp (C):	visibility:	
humidity:	precipitation:	

ID	Species	#	Age (J,A,U)	Gender (M,F,U)	Time of first Observation	Behavior (So,Fl,Ci,Gl,Pe,Hu)	Flight Direction	Flight Height (0-4)	Time of last Observation	Notes
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

GENERAL INSTRUCTIONS:

For weather, enter for the first hour of observation, for following hours only if data changes, if there are no changes, draw a line from the recorded data through the hours in which no change occurred; do not use ditto marks or dashes. For hawks, enter only the number seen (no zeros). Write notes, comments, etc. below. Send completed form to appropriate **Regional Editor** - or to - **HMANA, P.O. Box 822, Boonton,NJ 07005-0822**.

Weather and Observation Codes

Wind Speed: Enter code: 0-less than 1 km/h, (calm, smoke rises vertically); 1 - 1-5 km/h, (smoke drift shows wind direction); 2 - 6-11 km/h, (leaves rustle, wind felt on face); 3 - 12-19 km/h, (leaves, small twigs in constant motion; light flag extended); 4 - 20-28 km/h (raises dust, leaves, loose paper; small branches in motion); 5 - 29-38 km/h (small trees in leaf sway); 6 - 39-49 km/h (larger branches in motion; whistling heard in wires); 7 - 50-61 km/h (whole trees in motion; resistance felt walking against the wind); 8 - 62-74 km/h (twigs small branches broken off trees; walking generally impeded); 9 - Greater than 75 km/h.
Wind Direction: Enter compass direction from which the wind is coming, i.e., N, NNE, SE, etc. If variable, enter VAR.
Temperature: Record temperature in degrees Celsius.
Humidity: Record the percent relative humidity.
Barometric Pressure: Record barometric pressure in inches.
Cloud Cover: Record percent of sky with background cloud cover.
Visibility: Judge from your longest view and enter distance in kilometers. To convert miles to kilometers multiply by 1.61.
Precipitation: Enter code: 0 for none, 1 for Haze or Fog, 2 for Drizzle, 3 for Rain, 4 for Thunderstorm, 5 for Snow, 6 for wind driven dust, sand or snow.
Flight Direction: Enter compass direction migrants are heading, i.e., S, SSW, etc.
Height of Flight: Height of Flight. Enter code: 0 - Below rotor sweep; 1 -within rotor sweep; 2 - above rotor sweep; 3 - outside of turbine array area 4 - No predominant height

Observers: Number of observers **CONTRIBUTING** to the count for the hour noted.
Duration of Observation: Specify time in minutes.

COMMENTS

Daytime Raptor Migration Survey Report for the Kibby Expansion Wind Power Project

Spring and Fall 2009

Prepared for:
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Toronto, Ontario M5E IJ4

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November 2009

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APPENDIX

1.0 INTRODUCTION

1.1 Project Description

TransCanada Maine Wind Development Inc. (TransCanada) is assessing the development of a wind power generating facility in the Boundary Mountains of Western Maine known as the Kibby Expansion Wind Power Project (Kibby Expansion Project or the Project). The proposed Kibby Expansion Project is located in the unincorporated townships of Kibby and Chain of Ponds in Franklin County, Maine, and is associated with Sisk Mountain. The Sisk Mountain region and the proposed project area are illustrated in Figure 1. The surrounding area is currently actively managed for forest products.

The Kibby Expansion Project is immediately adjacent to the recently permitted Kibby Wind Power Project (Kibby Project). TransCanada has conducted baseline studies in addition to the existing information from the Kibby Wind Power Project licensing effort to determine the level of potential impact associated with the proposed project.

The Maine Department of Inland Fisheries and Wildlife (MDIFW) and the United States Fish and Wildlife Service (USFWS) have recommended that TransCanada perform surveys for diurnally migrating raptors in the Kibby Expansion Project vicinity. Daytime avian migration surveys have been previously performed in the Kibby Project area in 1992, 1993, 2005 and 2006. Due to the immediate juxtaposition of the Kibby Expansion Project to the Kibby Project area, much of the U.S. Windpower and Kibby Project data are applicable to the Kibby Expansion Project.

1.2 Previous Studies

Numerous studies which collected observations of avian migration in the Boundary Mountains have been performed in the past two decades. Most recently, daytime migration studies were performed for the Kibby Project in 2005 and 2006. In 1992 and 1993, similar surveys were performed by U.S. Wind Power when they sought a permit for a wind facility in the same location as the Kibby Project. Daytime migrant studies for the earlier projects focused on ridges near Sisk and can provide background knowledge of avian use in the area during migration. Furthermore, other objectives and incidental observations from the previous studies provide a snapshot of avian presence and use in the area during the both migration and summer (breeding) season.

1.2.1 U.S. Wind Power Surveys (1992-1994)

In 1992 and 1993, U.S. Wind Power conducted raptor migration surveys in the Kibby vicinity. Their work consisted of day-long surveillance during peak migration and identified numbers and species of raptors moving through the area. The goals were to identify raptor species' relative abundance, composition, and flight characteristics (flight height, direction, and consistency of use) in the Kibby vicinity.

1.2.2 Kibby Wind Power Project Studies

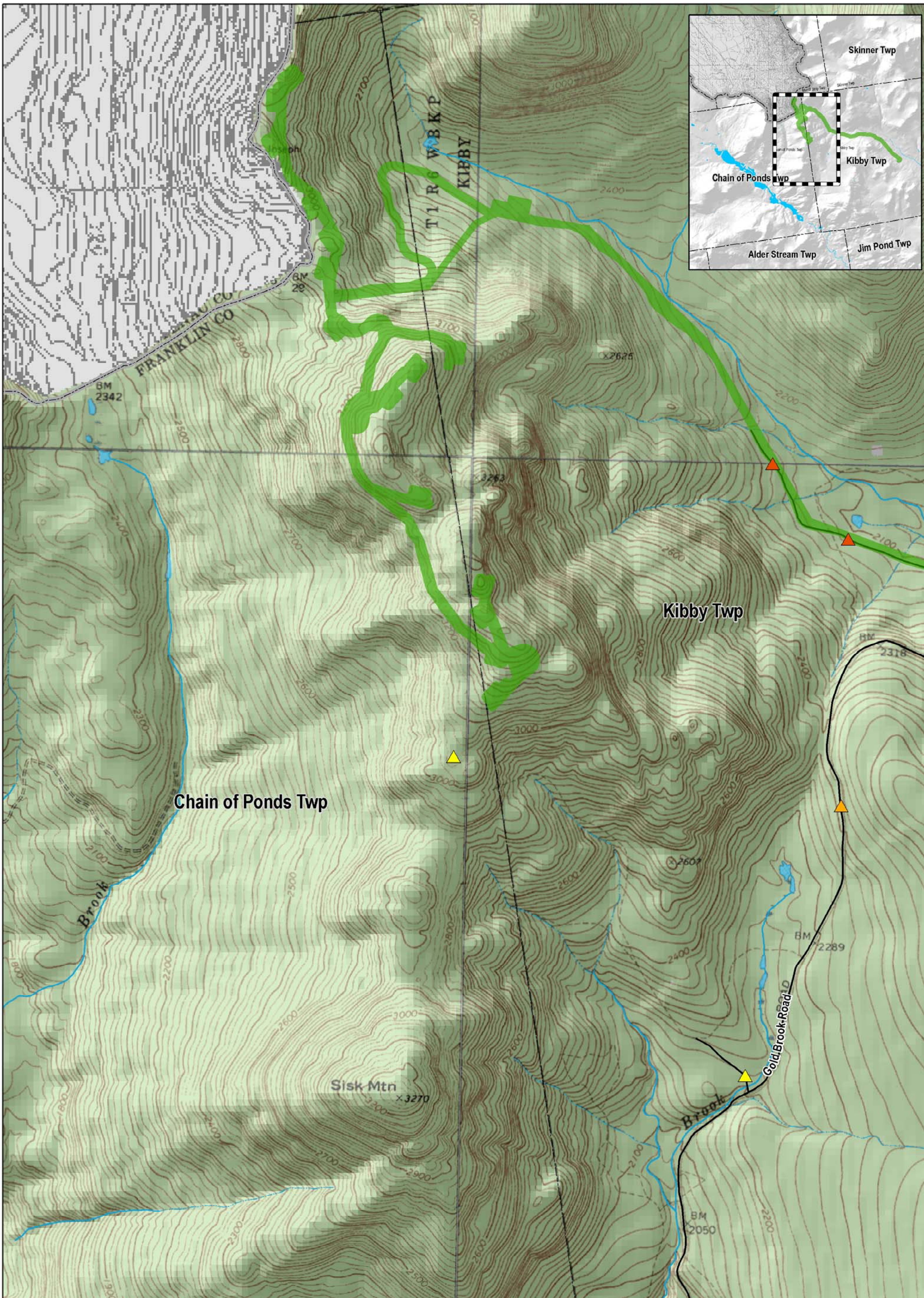
On behalf of TransCanada, TRC conducted daytime avian migration surveys in fall 2005 and spring 2006. Similar to U.S. Windpower's previous studies, this effort consisted of day-long surveillance during peak migration and identified numbers and species of daytime avian migrants crossing the Kibby Project area. The goals were to identify raptor species' relative abundance, composition, and flight characteristics (flight height, direction, and consistency of use) in the Kibby Project area.

1.3 Purpose and Objectives

The specific purpose of this daytime raptor migration survey effort was to observe the approximate numbers, species, and patterns of use by diurnally migrating raptors in the Kibby Expansion Wind Power Project (Kibby Expansion Project) vicinity during spring and fall migration seasons. Data have been used to develop a qualitative assessment of general patterns of use by migrating birds in the vicinity of the proposed Kibby Expansion Project. Data from these efforts have also been compared with data collected during prior studies of the Kibby Wind Power Project (Kibby Project) area as well as other regional data, where available.

The main objectives of daytime raptor migration surveys were to:

- Obtain a quantitative assessment of species composition, relative abundance, distribution, and spatial patterns of use by raptors migrating during daytime hours in and around the Kibby Expansion Project area;
- Identify route(s) used by diurnally migrating raptors passing through/near the Kibby Expansion Project area; and
- Evaluate potential for collisions at proposed turbine sites.



N

Miles

0 0.25

Raptor Observation Location (spring only)

Raptor Observation Location (spring & fall)

Raptor Observation Location (fall only)

Project Layout

Kibby Expansion Wind Power Project

Project Location and 2009 Raptor Migration Observation Locations

TRC

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2.0 STUDY PROTOCOL

The following study protocol was developed in consultation with the Maine Department of Inland Fisheries and Wildlife (MDIFW) and the United States Fish and Wildlife Service (USFWS) and was applied during daytime raptor migration studies at Sisk Mountain in spring and fall, 2009.

2.1 Survey Site Selection

Observation sites were selected based on vantage, and range of visibility. Sites were sought which provided an obtuse view of Sisk Mountain and significant portions of associated valleys. Survey sites were favored where views provided an opportunity to detect avian migrants as they approached the Kibby Expansion Project area, and allowed subjects to be tracked as they passed over or near the ridge of Sisk Mountain.

2.2 Survey Protocol

The protocol for daytime raptor migration surveys at the Kibby Expansion Project was similar to protocol used during previous U.S. Windpower and TransCanada studies for the Kibby Project area. These protocols are largely based on standards set forth by the Hawk Migration Association of North America (HMANA), and by HawkWatch International (Hoffman and Smith 2003).

2.2.1 Number and Timing of Surveys

Surveys were performed in the spring and fall of 2009. Spring surveys occured between April 1 and May 31, and fall surveys occured between September 1 and October 15. Seasonal surveys consisted of multiple survey days at each survey site.

Sampling was performed based upon favorable weather for migration, timed to start the morning after the passage of a cold front. Surveys were done for three consecutive days following such weather events. Surveys were not conducted during precipitation, in fog, on days that are overcast with low cloud cover, or during any other circumstances that hampered visibility.

2.2.2 Surveyor Preparedness

Surveyors were familiarized with the topography of the area, including the elevation of the survey site, surrounding ridge elevations and distances from the sampling site, and tree height, prior to starting surveys. Knowledge of these parameters is useful in estimating flight height. Each surveyor was trained in the methodology, and was expected to calibrate themselves to the survey site prior to commencing survey activity. Surveyors were experienced in bird identification.

2.2.3 Data Collection

Detailed weather and migratory bird observation data was collected during each survey. All data was entered onto data sheets. Data was collected on forms that were developed based on those utilized by HMANA, using their suggested codes and guidelines. These data sheets are the same as those utilized during Kibby Project studies. An example data sheet is provided in Appendix A.

2.2.3.1 Weather Observations

Weather conditions were noted at the beginning of each survey and hourly thereafter. Data was collected based on codes and protocol by HMANA, and was recorded directly onto observation data sheets. Parameters that were recorded include:

- Wind speed (recorded based on HMANA codes and descriptions)
- Wind direction (compass direction from which the wind is coming, or “variable”)
- Temperature (degrees Celsius)
- Humidity (percent relative)
- Barometric pressure
- Percent cloud cover
- Visibility (approximate distance)
- Precipitation

2.2.3.2 Individual Bird Observations

Observations were recorded continuously throughout each survey period. When collecting data on migrating birds, surveyors performed continuous scanning with the naked eye and with binoculars. Spotting scopes were used as necessary to aid in scanning and identification. Several hours of consecutive data were collected at each session. The following data were recorded for each bird observed:

- Species (if possible)
- Sex (if possible)
- Age class (if possible)
- Altitude at first observation, with noted variations over duration of presence within the survey area (using codes denoting below, within, or above rotor swept area)
- Distance from observation point at first observation, and variations over duration of presence within the survey radius
- Behavior (such as soaring, flapping, circling, gliding, perching, hunting, or other)
- General compass bearing flight direction (S, SSW, NE, etc.)

In the event a bird could not be identified to the species level, it was described to the greatest extent possible. For example, unknown raptors may have been further described as “buteo” versus “accipiter”, or “large” versus “small”.

2.2.3.3 Flock Observations

Flock observations were treated in the same way as individual bird observations, with counts or estimates of the number of birds comprising the group.

2.2.3.4 Field Quality Assurance and Quality Control

Data sheets were reviewed for completeness, accuracy, and legibility prior to leaving the survey site. Incidental observation data sheets were inspected at the end of each survey day. Any problems noted were rectified at that time; changes to the data sheets were initialed by the person making the change.

Data were analyzed concurrently with on-going field work to determine if project objectives were being met with the types and method of data being collected. Data were frequently evaluated relative to the objectives. Any proposed changes to the protocols would have been discussed with Maine Department of Inland Fisheries and Wildlife (MDIFW) prior to implementation. No changes were deemed necessary over the course of survey.

2.3 Data Entry and Analysis

2.3.1 Data Entry

Data as recorded onto data sheets in the field was entered into and stored in a spreadsheet format. All entered data was checked against original field notes and any errors detected were corrected using the field data sheets and/or by consulting with the observer.

2.3.2 Data Analysis

The following summaries and statistics have been generated to address the objectives and goals of this study.

- Species lists by season;
- Indices of relative abundance;
- Migration patterns by species, season, and habitat type;
- Flight paths and heights, by species and season;
- Number and proportion of observations, by species and season, within the rotor-swept area of the proposed turbines; and

Standard statistical parameters (e.g., means, standard deviations) have been computed, where appropriate.

3.0 RESULTS AND DISCUSSION

The spring, 2009 daytime raptor survey effort for the Kibby Expansion Project at Sisk Mountain consisted of 107 total hours of observation across 13 dates between April 15 and May 15. Two primary survey locations were used; one on the ridge of Sisk Mountain and one in the valley on a gravel road which originates at Mile 2.5 of the Gold Brook Road. A third location, at mile 3.5 on the Gold Brook Road was used on one occasion.

The fall 2009 daytime raptor survey effort for the Kibby Expansion Project at Sisk Mountain consisted of 227 total hours of observation across 21 dates between September 1 and October 15. Three primary survey locations were used. These included the ridge location and the mile-2.5 road location that were used in the spring; a third location along a gravel road which originates at mile 5 of the Gold Brook Road was also used for several surveys. The mile-5 road offers several excellent vantages of the north end of Sisk Range and the specific location of survey varied by observer and by date.

All survey locations are illustrated on Figure 1 (Project Location Map).

3.1 Species Identified and Relative Abundance

In the spring of 2009, a total of 43 individual raptors[1], representing seven species were identified within the immediate vicinity of the proposed Kibby Expansion Wind Power Project. The vast majority of individuals observed were red-tailed hawks, which comprised 53 percent (n=23) of all observations. The next most abundant species observed was broad-winged hawk, which represented 14 percent (n=6) of all observations.

In the fall of 2009, a total of 83 individual raptors, representing 11 species were identified. Most of these were within the immediate vicinity of the proposed Kibby Expansion Wind Power Project; some were observed over other area ranges. Buteo species were most frequently observed, with broad-winged hawks, red-tailed hawks and Buteo spp. collectively representing 60 percent of all observations (or 14 percent, 22 percent and 24 percent, respectively).

A species list and summary of relative abundance, by season, is provided in Table 1. Table 1 also defines the 4-letter Bird Banding Laboratory code for each species, as used for data presentation hereinafter.

Three listed Rare, Threatened or Endangered raptor species were identified during spring and fall migration surveys for the Kibby Expansion Project. In spring, one bald eagle and one golden eagle were recorded. In fall, one bald eagle, two golden eagles, one eagle spp. and one peregrine falcon were recorded. The details of project area use by these individuals are presented in Section 3.4: Listed Species Flight Details.

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[1] For the purpose of this study, the term "raptors" refers to all members of Order Falconiformes; this order currently includes the family Cathartidae (New World vultures).

Table 1: Species List and Relative Abundance

Common Name	Binomial Nomenclature	Bird Banding Laboratory (BBL) Code	Season Observed (*s / f*)	SPRING		FALL		Overall Relative Abundance
				Total Individuals Observed	Relative Abundance	Total Individuals Observed	Relative Abundance	
Accipiter spp. (small)	(n/a)	(n/a)	*s, f*	3	7%	1	1%	3%
Bald eagle	*Haliaeetus leucocephelus*	BAEA	*s, f*	1	2%	1	1%	2%
Broad-winged hawk	*Buteo platypterus*	BWHA	*s, f*	6	14%	12	14%	14%
Buteo spp.	(n/a)	(n/a)	*s, f*	3	7%	20	24%	18%
Cooper's hawk	*Accipiter cooperii*	COHA	*s, f*	2	5%	7	8%	7%
Eagle spp.	(n/a)	(n/a)	*f*	0	0%	1	1%	1%
Falcon spp.	(n/a)	(n/a)	*f*	0	0%	1	1%	1%
Golden eagle	*Aquila chrysaetos*	GOEA	*s, f*	1	2%	2	2%	2%
Northern Goshawk	*Accipiter gentilis*	NOGO	*f*	0	0%	1	1%	1%
Northern Harrier	*Circus cyaneus*	NOHA	*f*	0	0%	2	2%	2%
Osprey	*Pandion haliaetus*	OSPY	*f*	0	0%	1	1%	1%
Peregrine Falcon	*Falco peregrinus*	PEFA	*f*	0	0%	1	1%	1%
Raptor spp.	(n/a)	(n/a)	*f*	0	0%	4	5%	3%
Red-tailed hawk	*Buteo jamaicensis*	RTHA	*s, f*	23	53%	18	22%	33%
Sharp-shinned hawk	*Accipiter striatus*	SSHA	*s, f*	2	5%	9	11%	9%
Turkey vulture	*Cathartes aura*	TUVU	*s, f*	2	5%	2	2%	3%
			TOTAL	***43***		***83***		

3.2 Passage Rate

Spring, fall and overall passage rates (total individuals / total hours of effort) for each species observed is listed in Table 2.

The spring raptor migration survey effort at Sisk Mountain for the Kibby Expansion Project involved 107 total hours of observation. A total of 43 individual raptors were recorded during the spring effort, for an overall spring passage rate of approximately 0.40 birds per hour of effort (43/107=0.40); see Table 2. The average daily passage rate for spring 2009 was 0.38 birds per unit effort (see Table 3, Section 3.2.1). The fall survey effort involved 227 hours of observation. A total of 83 raptors were recorded during the fall effort, which constitutes an overall fall passage rate of approximately 0.37 birds per hour of effort (83/227=0.37); see Table 2. The average daily passage rate was 0.39 birds per unit effort (see Table 3, Section 3.2.1).

Section 3.2.1 provides a discussion of how passage rates at Sisk Mountain in 2009 compare to other contemporary and recent regional data.

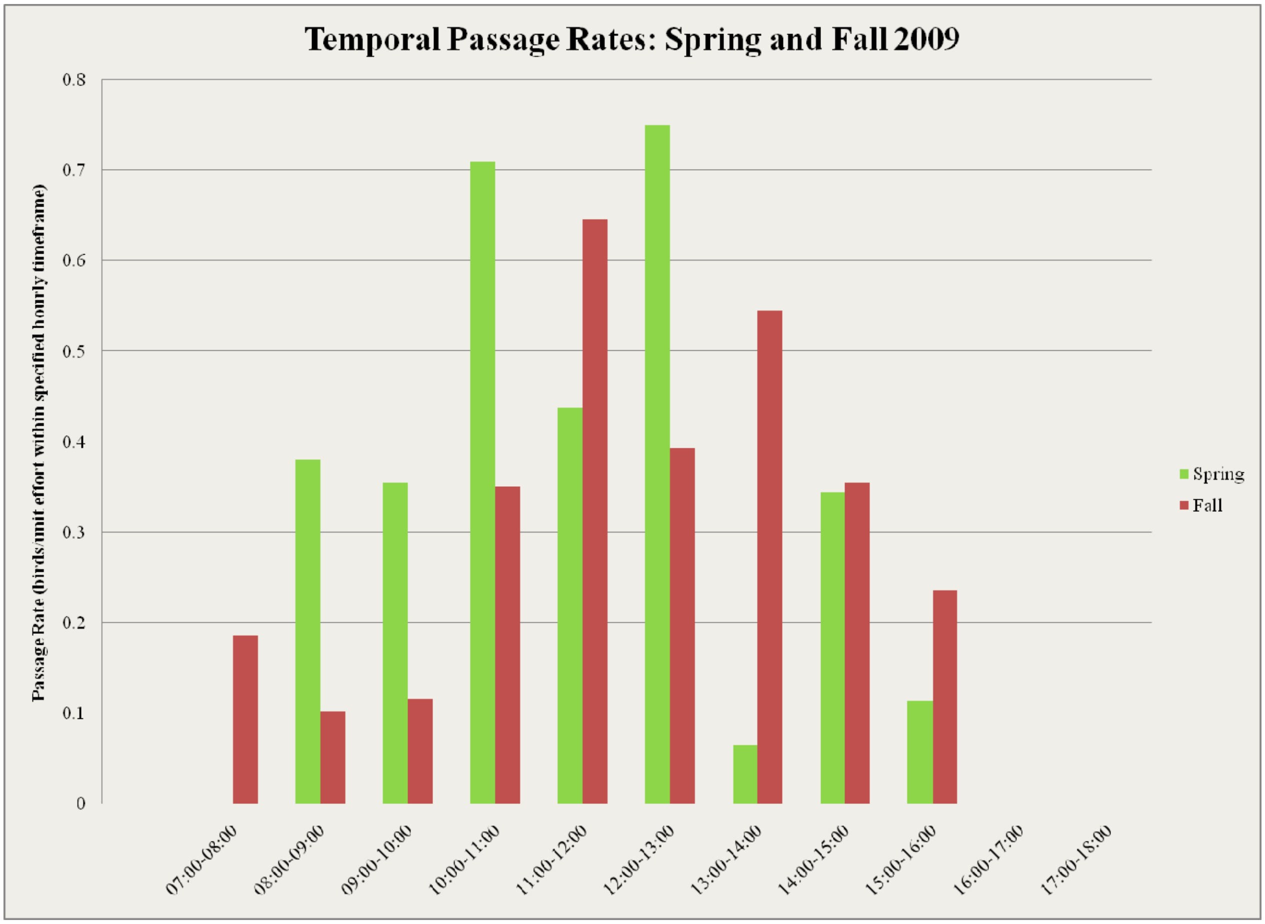
Table 2: Spring, Fall and Overall Passage Rate, by Species

Species	SPRING		FALL	
	Total Individuals Observed	Spring Passage Rate	Total Individuals Observed	Fall Passage Rate
Accipiter spp. (small)	3	0.028	1	0.004
BAEA	1	0.009	1	0.004
Buteo spp.	3	0.028	20	0.088
BWHA	6	0.056	12	0.053
COHA	2	0.019	7	0.031
Eagle spp.	0	0.000	1	0.004
Falcon spp.	0	0.000	1	0.004
GOEA	1	0.009	2	0.009
NOGO	0	0.000	1	0.004
NOHA	0	0.000	2	0.009
OSPY	0	0.000	1	0.004
PEFA	0	0.000	1	0.004
Raptor spp.	0	0.000	4	0.018
RTHA	23	0.215	18	0.079
SSHA	2	0.019	9	0.040
TUVU	2	0.019	2	0.009
Total Individuals	**43**		**83**	
Overall Passage*		**0.40**		**0.37**

*Overall passage = (total individuals / total hours of effort) per season

A temporal trend in daily observations was observed (see Chart 1). In spring, passage rates tended to peak between the hours of 10:00 AM and 1:00 PM. In fall, passage rates tended to peak between the hours of 11:00 AM and 2:00 PM.

Chart 2: Spring and Fall Temporal Passage Rates



3.2.1 Comparison Passage Rates for other Regional Hawk Watches

Spring and fall 2009 raptor passage rates for the Kibby Expansion Project at Sisk Mountain are compared, below, with numerous other contemporary and recent spring data sets from several New England locations. Variations in count efficiency may occur between sites due to differences in topography, weather, climate, range of view, observer efficiency and etc. Also, some hawk counts do not enumerate individuals that are believed to be residents; at Sisk Mountain in 2009, *all* raptors observed (including probable residents) were recorded, providing a higher estimate of passage. Such variables should be considered when interpreting these data.

2009 Data Comparison

Spring and fall 2009 daily passage totals and daily passage rates for the Kibby Expansion Project at Sisk Mountain were compared to data for the same dates from several northeastern hawk count sites: Bradbury Mountain, in Maine (spring only); Barre Falls, in Massachusetts; Pack Monadnock, in New Hampshire (fall only); and Allegheny Front, Tussey Mountain (spring only) and Hawk Mountain in Pennsylvania. Daily raptor migration survey data for these sites were obtained from the HMNA website at hawkcount.org, and are summarized in Table 3.

In spring of 2009, daily totals and daily passage rates were dramatically lower at Sisk Mountain than any of the comparison locations. The average passage rate recorded at Sisk Mountain in spring 2009 was 0.38 birds per unit effort. The average passage rates for other locations among the same dates as recorded at Sisk ranged from 4.49 raptors per hour of effort (at Hawk Mountain, Pennsylvania) to 19.14 raptors per hour of effort (at Allegheny Front, Pennsylvania). Other hawk watch sites appear to have observed pulses or peaks in migratory activity in mid- to late April; no such pulse was observed at Sisk Mountain.

Similarly, in fall, daily totals and daily passage rates were dramatically lower at Sisk Mountain than any of the comparison locations. The average passage rate recorded at Sisk Mountain in fall 2009 was 0.39 birds per unit effort. The average passage rates for other locations among the same dates as recorded at Sisk ranged from 15.76 raptors per hour of effort (at Allegheny Front, Pennsylvania) to 28.98 raptors per hour of effort (at Pack Monadnock, new Hampshire). Other hawk watch sites appear to have observed pulses or peaks in migratory activity in mid-September; no such pulse was observed at Sisk Mountain.

Table 3: Daily Total Raptors and Passage Rates for Regional Hawk Watch Sites, 2009

Date	DAILY TOTALS													
	Sisk Mt., ME		Bradbury Mt., ME		Barre Falls, MA		Allegheny Front, PA		Tussey Mt., PA		Hawk Mt., PA		Pack Monadnock, NH	
	Total Raptors	Passage Rate	Total Raptors	Passage Rate	Total Raptors	Passage Rate	Total Raptors	Passage Rate	Total Raptors	Passage Rate	Total Raptors	Passage Rate	Total Raptors	Passage Rate
SPRING														
4/15/2009	6	1.20	35	4.38										
4/17/2009	3	0.46	33	4.13	76	11.69	38	4.75	81	8.53	14	2.55		
4/24/2009	1	0.15	380	42.22	61	12.84	735	81.67	301	27.36	78	9.18		
4/25/2009	1	0.19	699	73.58	41	8.20	49	5.30	59	9.44	52	7.70		
4/28/2009	6	0.62	685	85.63			16	2.13			9	1.57		
4/29/2009	4	0.31	12	1.50			13	1.86			8	1.45		
5/3/2009	2	0.25	25	3.13	2	0.50								
5/4/2009	2	0.24	19	2.38										
5/11/2009	0	0.00	46	5.58										
5/12/2009	2	0.28	43	5.38										
5/13/2009	14	1.00	33	4.13										
5/14/2009	1	0.13	16	2.29										
5/15/2009	1	0.13	12	1.50										
Average Passage		***0.38****		***18.14***		***8.31***		***19.14***		***15.11***		***4.49***		
FALL														
9/1/2009	3	0.61					21	2.63			48	4.27	28	3.73
9/2/2009	1	0.10					38	4.47			54	5.40	15	1.88
9/7/2009	2	0.33			0	0.00	0	0.00			42	4.67	65	8.13
9/8/2009	1	0.15					0	0.00			54	5.68	12	1.50
9/9/2009	4	0.44			32	5.33	141	15.67			76	7.60	173	21.63
9/10/2009	1	0.07			38	7.60	651	108.50			568	54.10	50	6.25
9/11/2009	3	0.57					38	6.91			0	0.00	0	0.00
9/14/2009	4	0.64			205	29.29	36	4.50			104	9.67	315	42.00
9/15/2009	2	0.26			1324	155.76	27	3.38			375	34.09	334	41.75
9/16/2009	3	1.01					457	48.11			1383	134.93	2129	266.13
9/19/2009	4	0.37			332	39.06	474	45.14			363	31.57	241	25.37
9/20/2009	0	0.00			99	15.23	148	14.80			610	61.00	86	11.86
9/21/2009	3	1.00			508	101.60	67	8.93			694	73.05	715	89.38
9/22/2009	2	0.50			9	2.25	5	0.83			16	1.64	14	1.93
9/24/2009	3	1.50			132	17.03	9	1.00			379	32.26	314	38.06
9/25/2009	3	0.38			106	15.70	242	28.47			254	22.58	79	10.53
9/26/2009	1	0.19			26	4.33					242	24.82	105	14.00
9/29/2009	2	0.13			12	2.82	3	0.55			38	4.11	20	2.96
9/30/2009	0	0.00			44	9.78	4	0.73			242	21.04	58	7.73
10/8/2009	0	0.00			170	23.45	43	4.78			596	54.18	114	13.41
10/9/2009	0	0.00									0	0.00	1	0.31
Average Passage		***0.39****				***28.62***		***15.76***				***27.94***		***28.98***

*Average passage rates differ by Overall passage rates by mode of calculation. Average passage rates are the average of calculated passage rates (observations / hour of effort) for each individual date of survey; Overall passage rate is calculated by directly dividing the overall total birds observed by the overall total hours of observation.

Note: No count data available for shaded cells

Source: HMNA at hawkcount.org

Regional Data from Previous Years

Spring

Daytime raptor migration studies performed at Kibby Mountain in spring of 2006 found very similar results as spring 2009 studies for the Kibby Expansion Project at Sisk Mountain. An overall passage rate of 0.39 raptors per hour were recorded at Kibby Mountain in spring, 2006 (TRC 2006a); at Bradbury Mountain, an overall passage rate of 12.93 raptors per unit effort were recorded during the same general time period (hawkcount.org).

In Spring 2006, raptor migration studies were performed for the Mars Hill Wind Farm in Mars Hill, Maine (Woodlot 2006); the average passage rate was 1.1 birds per unit effort. In spring, 2008, diurnal raptor migration studies were performed for the Record Hill Wind Project in Roxbury, Maine (Stantec 2008a); the average passage rate was 1.15 birds per unit effort. Stantec, 2008, compared this passage rate to 14 other spring migration survey data sets from numerous wind sites in several New England states from several years. Average passage rates in this set ranged from 0.9 birds per hour (in Deerfield, Vermont in 2005) to 25.6 birds per hour (in Westfiled, New York in 2003). Record Hill was described as "among the lower passage rates observed in the region in recent years" (Stantec 2008a). The overall passage rate, in spring 2009, of 0.40 birds per hour of observation for the Kibby Expansion Project at Sisk Mountain is lower than any entry in the referenced set.

Fall

Daytime raptor migration studies performed at Kibby Mountain in fall of 2005 recorded an average passage rate of 3.34 raptors per hour of effort during surveys performed in September (TRC 2006b). This passage rate is slightly higher than that observed for the Kibby Expansion Project at Sisk Mountain in fall 2009. During the fall 2005 effort at Kibby Mountain, most birds were observed to funnel down the Gold Brook Valley, east of Sisk Mountain. Surveys at Sisk Mountain would not have captured migration movements in this valley, which may explain the small discrepancy in findings. In general, however, passage rates at Kibby Mountain in fall 2005 and at Sisk Mountain in 2009 are both considered to be low.

During the fall of 2007, Stantec (2008b) recorded an overall passage rate of 1.12 raptors per hour of observation at Record Hill Wind Project in Roxbury Maine. This study compared its data to numerous concurrent regional data. Stantec (2008b) reported that, according to HMANA hawk watch data from September through October, daily raptor passage rates at other sites in the region ranged from approximately 8.95 to 40.04 birds per hour. Stantec (2008b) concluded that "the Record Hill passage rate was among the lowest passage rates reported in the East." The overall passage rate at Sisk Mountain in fall 2009, at 0.37 raptors per hour of observation (and the fall 2005 rate of 3.34 raptors per hour at Kibby Mountain), is lower than any entry in the referenced set.

3.3 Flight Characteristics

3.3.1 Flight Position

Mapped data from field observations at Sisk Mountain were interpreted to assign flight position codes to each individual bird observed. Flight paths over the ridge area were listed under codes A1 (parallel to ridge), A2 (perpendicular to ridge) or A3 (within a saddle); flights over the upper slope, lower slope and valley were listed as B, C, and D, respectively (Stantec 2008a, 2008b). Birds that were observed over other area formations (but not near Sisk Mountain) were listed under flight code E. In instances where individuals used multiple code areas, the code for the area closest to the ridge and/or the proposed project area was applied.

Spring

Of 43 total birds observed over the course of the spring survey, 14 individuals (approximately 33 percent) used the ridge area (flight codes A1, A2 and A3) at some point during their flight near Sisk Mountain. The remaining 29 individuals (approximately 67 percent) used slope and valley areas associated with the Sisk Mountain formation. Horizontal flight positions observed during the spring 2009 survey are presented, by species, in Chart 2.

Fall

Of 83 total birds observed over the course of the fall survey, 32 individuals (approximately 39 percent) used the ridge area (flight codes A1, A2 and A3) at some point during their flight near Sisk Mountain. A total of 42 individuals (approximately 51 percent) used slope and valley areas associated with the Sisk Mountain formation. The remaining 9 individuals were observed over other area formations (such as Kibby Range) and were not associated with the Sisk Mountain formation, its slopes or its immediate valleys. Horizontal flight positions observed during the fall 2009 survey are presented, by species, in Chart 3.

Chart 2: Spring Flight Positions

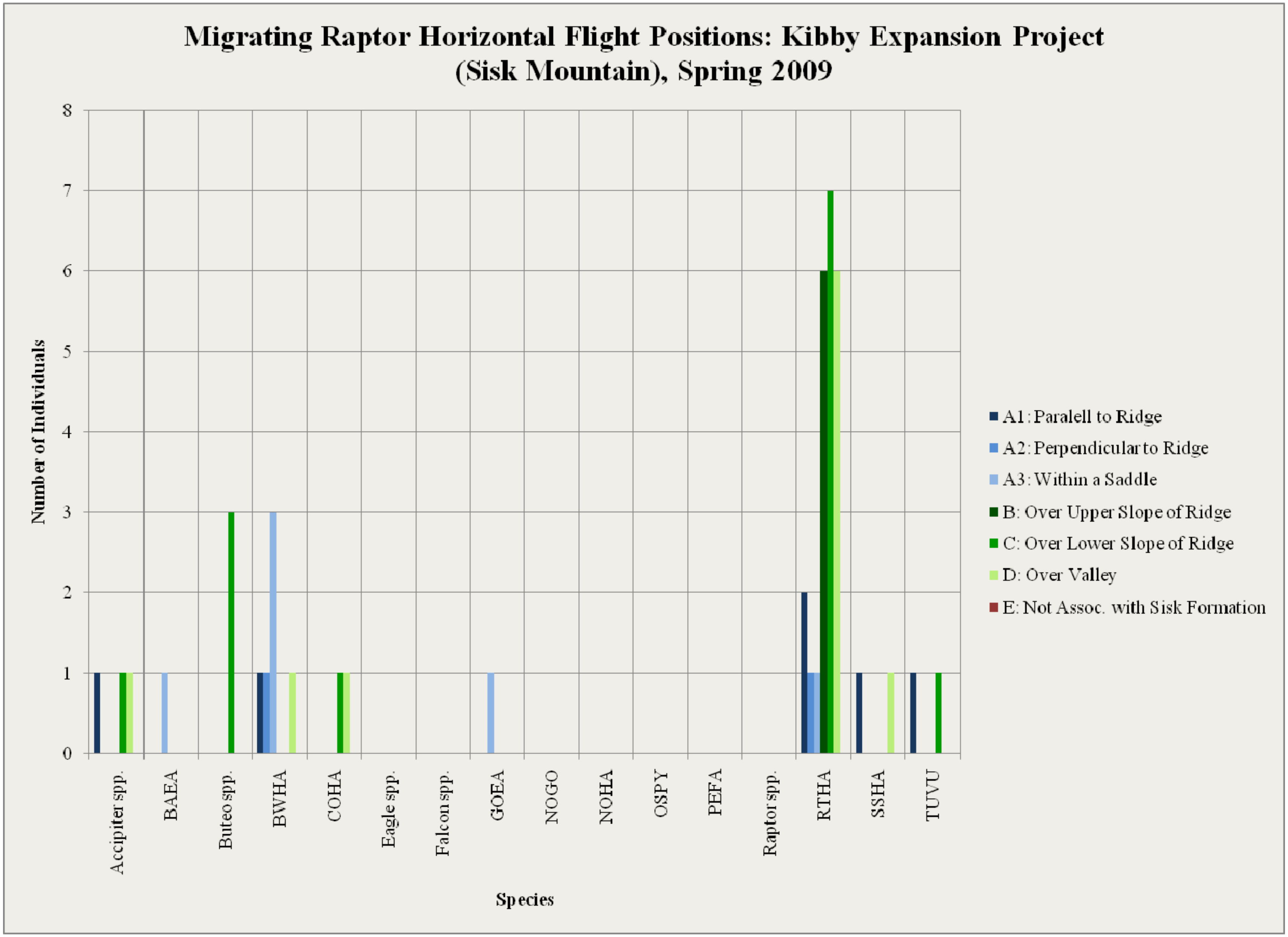
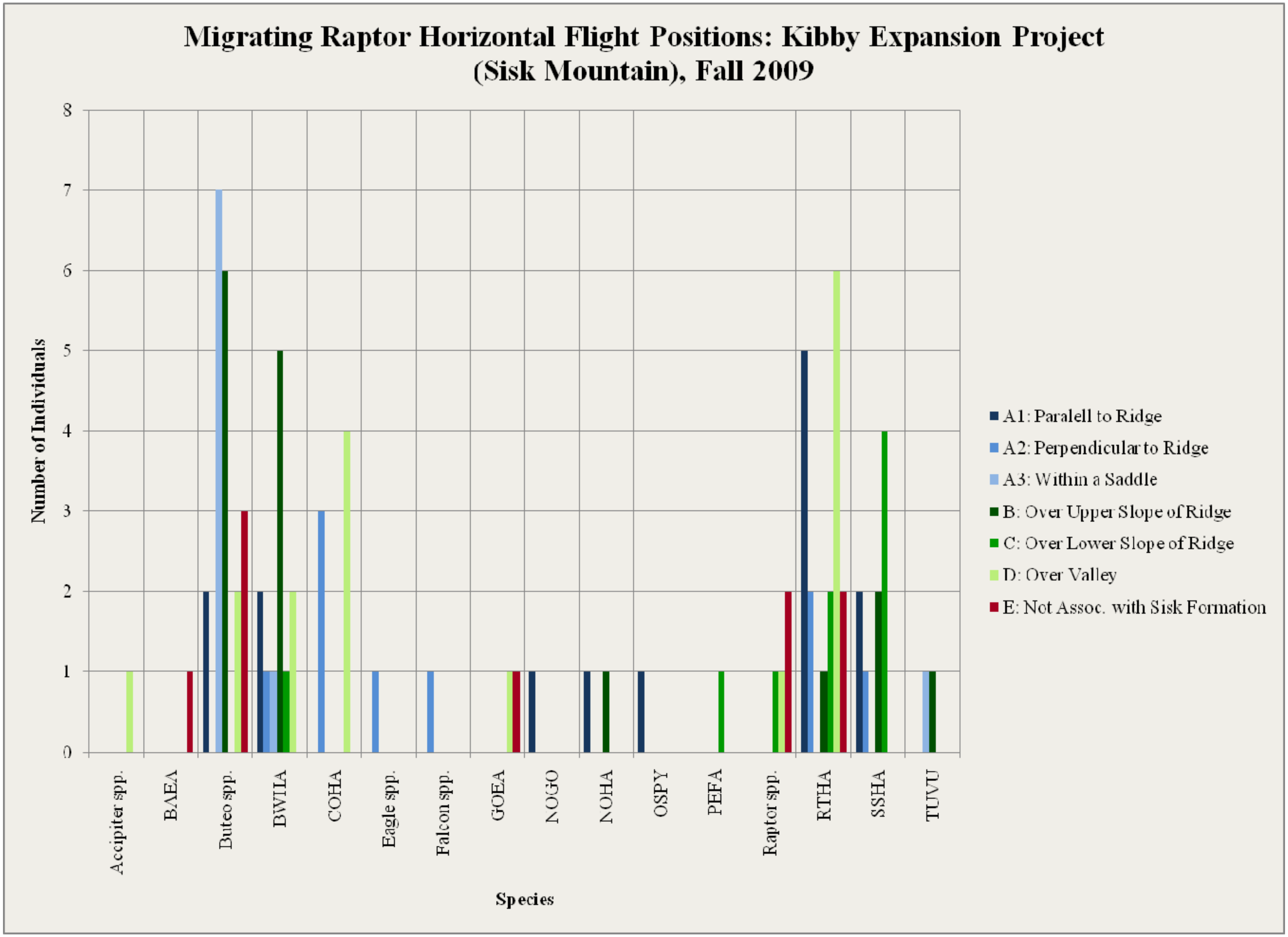


Chart 3: Fall Flight Positions



3.3.2 Flight Height

Flight height was estimated only for individuals that used the ridge area and extreme upper slopes of Sisk Mountain, as these are the areas where potential development has been considered or proposed for the Kibby Expansion Project over the course of project planning. Flight height estimates were grouped into 3 categories: 0-50 feet above the ground, 50-500 feet above the ground, and 500+ feet above the ground. Estimation of raptor elevation can be influenced by perspective, distance, topography and observer and etc.; for this reason, flight height categories were designed conservatively. In order to produce the most conservative possible estimate of risk, these categories were also judged conservatively in the field, erring toward the 50-500-foot category. Table 5 lists the flight height categories for each species recorded.

The portion of the migrating raptor population which passes near the proposed Kibby Expansion Project at Sisk Mountain, and may be exposed to proposed wind turbine structures there, is best represented by those recorded within the 50'-500' category. In spring 2009, this category included 7 individuals (or 16 percent of all birds recorded in spring 2009). In fall 2009, this category included 22 individuals (or 27 percent of all birds recorded in fall 2009).

Table 5: Flight Height Categories

Species	Migrating Raptor Flight Heights									
	SPRING					FALL				
	Number	Ridge Flights*			Slope and Valley Flights	Number	Ridge Flights*			Slope and Valley Flights
		0'-50'	50'-500'	500'+			0'-50'	50'-500'	500'+	
Accipiter spp.	***3***	1			2	***1***				1
BAEA	***1***	1				***1***				1
Buteo spp.	***3***				3	***20***		8	6	6
BWHA	***6***	3	2		1	***12***	4	2	3	3
COHA	***2***				2	***7***	3			4
Eagle spp.	***0***					***1***		1		
Falcon spp.	***0***					***1***	1			
GOEA	***1***		1			***2***				2
NOGO	***0***					***1***		1		
NOHA	***0***					***2***		2		
OSPY	***0***					***1***		1		
PEFA	***0***					***1***				1
Raptor spp.	***0***					***4***				4
RTHA	***23***		3	1	19	***18***	2	4	2	10
SSHA	***2***	1			1	***9***	3	2		4
TUVU	***2***		1		1	***2***		1		1
TOTAL	43	6	7	1	29	83	13	22	11	37
PERCENT		14%	16%	2%	67%		16%	27%	13%	45%
*Includes some upper slope flights that occurred within or near the proposed project area										

3.3.3 Flight Direction

Spring

Of 43 individuals recorded in spring, 2009, 14 had a flight trajectory of “variable”. Twelve of these entries were red-tailed hawks. In general, “variable” flight refers to birds that were observed circling while foraging. This result may be attributable to the possible resident status of some of the raptors observed. When flight directions, excluding variable entries, are plotted, a north and south trend of travel direction is apparent (see Chart 4). It should be noted that the number of birds traveling in south/southwest directions was comparable to the number of birds traveling in north/northwest directions.

Fall

Of 83 individuals recorded in fall, 2009, 11 had a flight trajectory of “variable”. These observations were distributed among several species. In general, “variable” flight refers to birds that were observed circling while foraging. This result may be attributable to the possible resident status of some of the raptors observed. When flight directions, excluding variable entries, are plotted, a south/southwest trend of travel direction is apparent (see Chart 5).

Chart 4: Spring Flight Direction by Numbers Observed

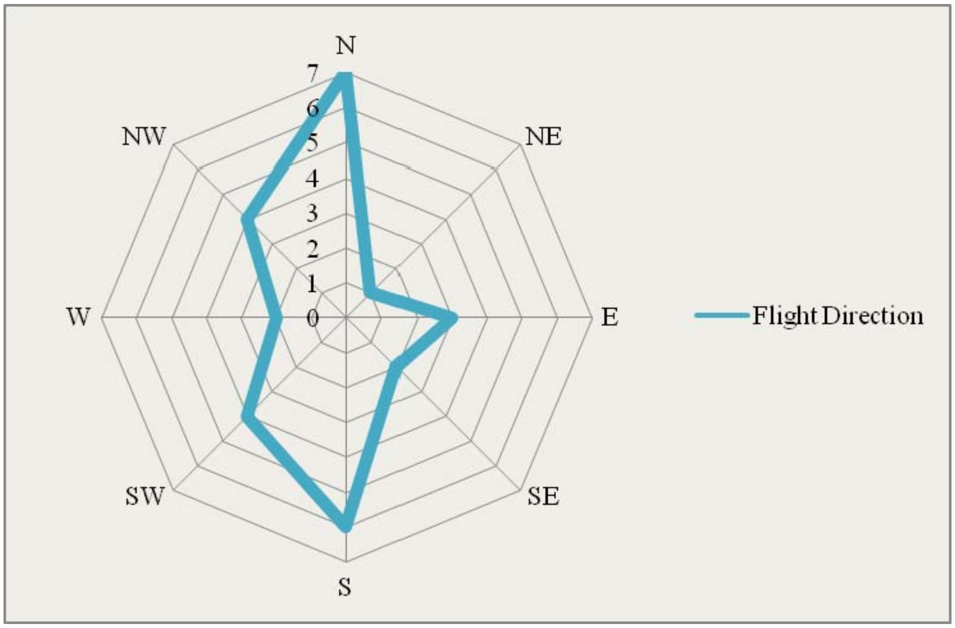
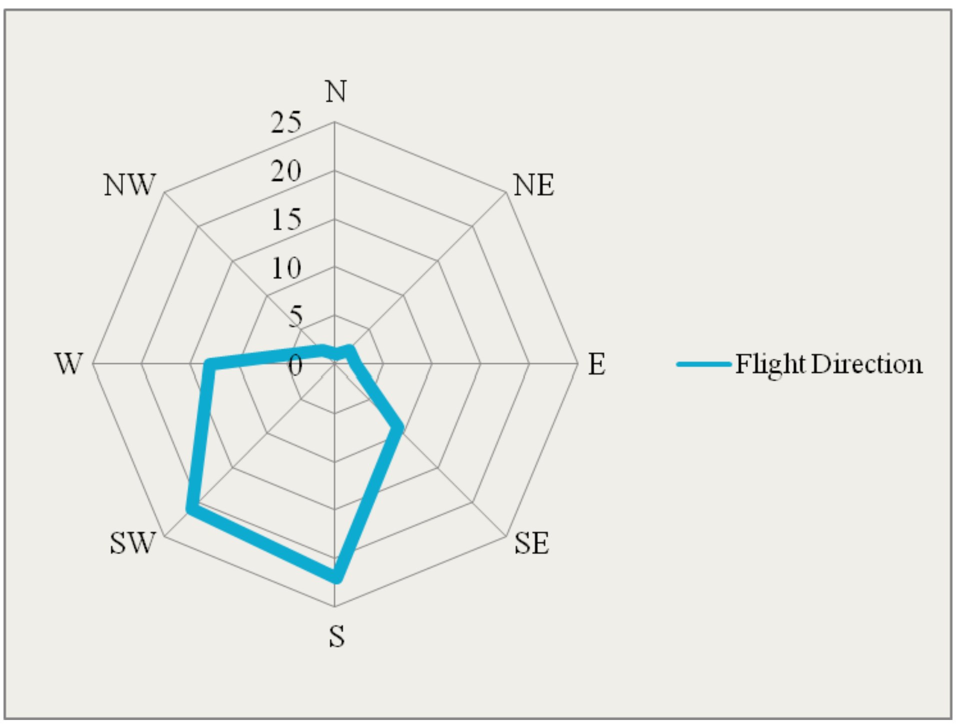


Chart 5: Fall Flight Direction by Numbers Observed



3.4 Listed Species Flight Details

State and/or federally listed rare, threatened or endangered raptor species that were identified during spring and fall migration surveys for the Kibby Expansion Project include peregrine falcon and golden eagle. Previously-listed bald eagles were also observed.

The peregrine falcon was historically listed under the federal Endangered Species Act; however, it was removed from the list in 1999. The breeding population of peregrine falcons found in Maine remains listed as endangered under the Maine ESA. The golden eagle is not federally listed, but is state-listed as endangered under the Maine ESA.

Until recently, the bald eagle was listed as an endangered species under the federal Endangered Species Act (ESA); on July 12, 1995, the bald eagle was reclassified from endangered to threatened. As a result of its successful comeback, this species was de-listed from the ESA on June 28, 2007. Similarly, the bald eagle was effectively removed from the Maine ESA on September 11, 2009.

Spring

In spring, 2009, two listed species were observed: one bald eagle and one golden eagle. The golden eagle that was observed was a juvenile. This bird was first observed near Mount Pisgah; it flew generally northeast and crossed Sisk Mountain near the north end of the ridge. It crossed perpendicular to the ridge in the 50-500-foot flight height category. The bald eagle was also an adult. It appeared at treetop level over the upper slope on the east side of Sisk Mountain and crossed, perpendicular to the ridge, between the trees in a saddle just north of the mountain's southernmost cone.

Fall

In fall, 2009, one bald eagle, two golden eagles, one eagle spp. and one peregrine falcon were recorded. The bald eagle was an adult; it was seen flying over Chain of Ponds and did not approach Sisk Mountain. One adult golden eagle was observed flying southward over Kibby Range; it did not approach Sisk Mountain. A second golden eagle (a juvenile) was observed over the lower slope of Kibby Range and the Gold Brook Valley; it did not approach Sisk Mountain. One unidentified eagle species was observed to cross the ridge of Sisk Mountain (perpendicular crossing) near the north end of the ridge, within the 50-500-foot flight height category. The peregrine falcon flew southward along the eastern lower slope of Sisk Mountain; it did not approach the area of proposed development.

3.5 Conclusions

Spring and fall diurnal raptor migration passage rates at Sisk Mountain were very low, both in general and when compared to contemporary and recent regional data. No pulses of migratory activity were detected. These findings indicate that Sisk Mountain is not in within a significant spring or fall migration corridor for raptors. This finding is consistent with the results of migration data collected at Kibby Mountain in fall 2005 and spring 2006.

Because of very low passage rates, the overall sample size for assessment of other parameters is very small. This should be considered when interpreting assessment of flight characteristics.

This study found high variability in flight direction in spring; however, with the "variable" flight category removed, a north and south trend was detected. Flights toward the south were essentially as frequent as flight toward the north, indicating that the north/south trend has more to do with the physical orientation of Sisk Mountain's ridge than migratory trajectories. In fall, a southward trend in flight direction was detected.

In general, low passage rates and low usage of the area of potential development for the Kibby Expansion Project suggest low overall risk to raptor species from wind development at this location.

4.0 REFERENCES

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APPENDIX A

Data Form and Instructions

Daytime Migrant Survey Data Sheet

Observers:	Date:	Time Start:	Time End:

Weather (see reverse for instructions)		**Location:**
wind speed:	bar. press:	
wind direction:	cloud cover:	
temp (C):	visibility:	
humidity:	precipitation:	

ID	Species	#	Age (J,A,U)	Gender (M,F,U)	Time of first Observation	Behavior (So,Fl,Ci,Gl,Pe,Hu)	Flight Direction	Flight Height (0-4)	Time of last Observation	Notes
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

GENERAL INSTRUCTIONS:

For weather, enter for the first hour of observation, for following hours only if data changes, if there are no changes, draw a line from the recorded data through the hours in which no change occurred; do not use ditto marks or dashes. For hawks, enter only the number seen (no zeros). Write notes, comments, etc. below. Send completed form to appropriate **Regional Editor** - or to - **HMANA, P.O. Box 822, Boonton,NJ 07005-0822**.

Weather and Observation Codes

Wind Speed: Enter code: 0-less than 1 km/h, (calm, smoke rises vertically); 1 - 1-5 km/h, (smoke drift shows wind direction); 2 - 6-11 km/h, (leaves rustle, wind felt on face); 3 - 12-19 km/h, (leaves, small twigs in constant motion; light flag extended); 4 - 20-28 km/h (raises dust, leaves, loose paper; small branches in motion); 5 - 29-38 km/h (small trees in leaf sway); 6 - 39-49 km/h (larger branches in motion; whistling heard in wires); 7 - 50-61 km/h (whole trees in motion; resistance felt walking against the wind); 8 - 62-74 km/h (twigs small branches broken off trees; walking generally impeded); 9 - Greater than 75 km/h.
Wind Direction: Enter compass direction from which the wind is coming, i.e., N, NNE, SE, etc. If variable, enter VAR.
Temperature: Record temperature in degrees Celsius.
Humidity: Record the percent relative humidity.
Barometric Pressure: Record barometric pressure in inches.
Cloud Cover: Record percent of sky with background cloud cover.
Visibility: Judge from your longest view and enter distance in kilometers. To convert miles to kilometers multiply by 1.61.
Precipitation: Enter code: 0 for none, 1 for Haze or Fog, 2 for Drizzle, 3 for Rain, 4 for Thunderstorm, 5 for Snow, 6 for wind driven dust, sand or snow.
Flight Direction: Enter compass direction migrants are heading, i.e., S, SSW, etc.
Height of Flight: Height of Flight. Enter code: 0 - Below rotor sweep; 1 -within rotor sweep; 2 - above rotor sweep; 3 - outside of turbine array area 4 - No predominant height

Observers: Number of observers **CONTRIBUTING** to the count for the hour noted.
Duration of Observation: Specify time in minutes.

COMMENTS

ATTACHMENT A.3-3

Spring 2009 Nocturnal Migration Survey Report
Fall 2009 Nocturnal Migration Survey Report

Spring 2009 Nocturnal Migration Survey Report

for the Kibby Expansion Wind Project
In Kibby and Chain of Ponds Township, Maine

Prepared for

TRC Engineers LLC
14 Gabriel Drive
Augusta, ME 04330

Prepared by

Stantec Consulting
30 Park Drive
Topsham, ME 04086

Final

November 2009

Executive Summary

During spring 2009, Stantec Consulting (Stantec), formerly Woodlot Alternatives, Inc.[1], conducted field radar surveys of nocturnal migration activity at the proposed Kibby Expansion Wind Project (Project) in Kibby and Chain of Ponds Township, Maine. The surveys are part of the planning process by TransCanada Maine Wind Development, Inc. (TransCanada) for a proposed wind project, which will include the erection of up to 15 wind turbines (45 megawatts) to be located on Sisk Mountain. These surveys represented the first season of investigation undertaken at this site.

The results of the field surveys provide useful information about site-specific nocturnal migration activity and patterns in the vicinity of the project area. These findings are especially relevant when considered along with the previous studies conducted near this location as part of the pre-construction survey effort for the currently operational Kibby Mountain wind project.

Nocturnal Radar Survey

The spring field survey included 21 nights of sampling from April 29 and May 26, 2009. Surveys were conducted using X-band radar, sampling from sunset to sunrise. Each hour of sampling included the recording of radar video files during horizontal and vertical operation. The radar was located on the summit of the Sisk Mountain ridgeline, in the saddle south of the northern summit, and provided good views of both the southern and northern portions of the project area.

The overall passage rate for the entire survey period was 207 targets per kilometer per hour (t/km/hr), and nightly passage rates varied from 50 to 452 t/km/hr. Mean flight direction through the project area was 28º. The mean flight height of targets was 293 m (962') above the radar site, and nightly flight heights ranged from 167 m (547') to 494 m (1621'). The percent of targets observed flying below 125 m (410') was 18 percent for the entire season and varied by night, from 7 to 49 percent.

Spring radar surveys at the Project area documented patterns in nocturnal migration similar to that documented at recent radar surveys in Maine, including at nearby Kibby Mountain, and throughout the northeast. These patterns include highly variable passage rages between nights, a generally northeastern flight direction, and flight heights between 200 and 500 m. Within nights, migration activity was generally greatest 3-7 hours after sunset and declined steadily through the end of the night. Additionally, the flight height of targets indicates that the vast majority of nocturnal migration in the area occurs well above the height of the proposed wind turbines.

[1] All field work and any reporting and permitting activities performed prior to October 1, 2007, were conducted as Woodlot Alternatives, Inc. and will be herein referenced as work done by Woodlot. On October 1, 2007, Woodlot Alternatives, Inc. was acquired by Stantec Consulting Services, Inc. Work conducted on or after October 1, 2007 is herein referenced as work done by Stantec.

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PN1956482[†]

1.0 Introduction

TransCanada Maine Wind Development, Inc. (TransCanada) is considering construction of an expansion to the existing Kibby Wind Project to be located on Sisk Mountain in Kibby and Chain of Ponds Township, Maine (Figure 1). The project, Kibby Expansion Wind Project (the Project), is still in the preliminary stages of design; but, it is expected to consist of 15 turbines and will likely be 3.0 megawatt (mw) machines mounted on tubular steel towers with an approximate hub height of 80 meters and a maximum height of 125 meters (m) (410 feet [']).

In advance of permitting activities for the Project, TRC Engineers contracted Stantec Consulting, (Stantec) to conduct pre-construction radar surveys to characterize nocturnal migration in the Project area. The scope of surveys was based on a combination of standard methods that are developing within the wind power industry for pre-construction surveys and is consistent with several other studies conducted recently in Maine and throughout the Northeast region of the United States. Prior to conducting the studies, TRC had several meetings and discussions with appropriate regulatory agencies regarding the scope and methods for the pre-construction nocturnal radar migration surveys. These included discussions with Maine Department of Inland Fisheries and Wildlife (MDIFW) on February 24, 2009 and MDIFW and the United States Fish and Wildlife Service (USFWS) on March 10, 2009. Protocols for the pre-construction radar surveys were subsequently circulated to all interested agency staff for comments on April 7, 2009. The outcome of these meetings was that the Kibby Expansion project should follow methodology used during the pre-construction surveys conducted at the existing Kibby Wind Project in 2006. Site visits were also attended by Army Corps of Engineers (ACOE), USFWS, and MDIFW on August 26, 2009 and September 1, 2009.

This report has been prepared to document and discuss passage rates for nocturnal migration in the vicinity of the Project area, including the number of migrants, their flight direction, and their flight altitude;

Following is a brief description of the project; a review of the methods used to conduct scientific surveys, the results of those surveys, and a discussion of those results.

1.1 PROJECT AREA DESCRIPTION

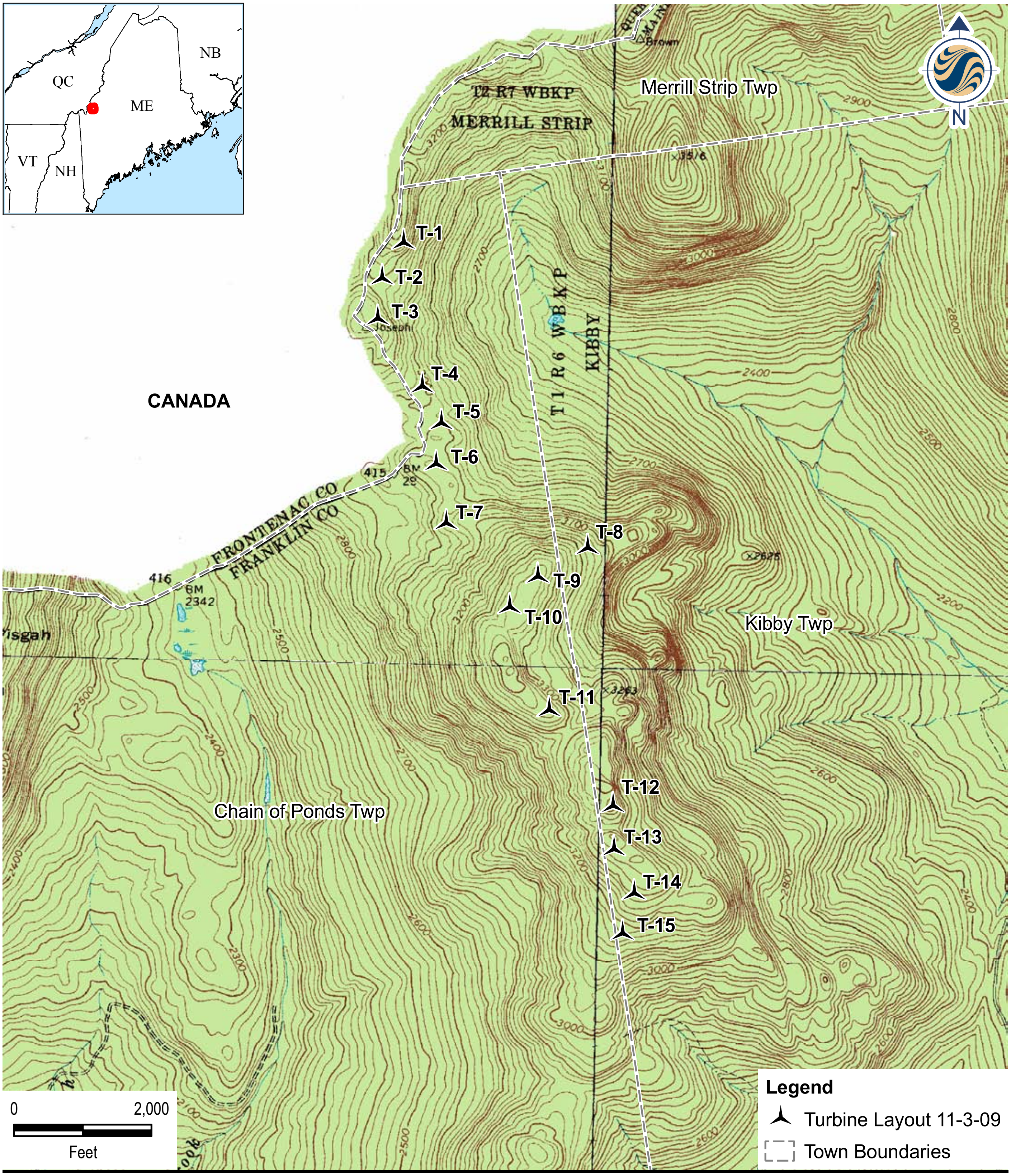
The project area is located in the Boundary Mountains of western Maine, in Franklin County. It is within the Western Mountains Biophysical Region of Maine, which borders northern New Hampshire and Quebec, Canada.

The Western Mountains Biophysical Region is best characterized by its rugged topography, cool climate, low annual precipitation, and high snowfall. The average maximum temperature in July is approximately 24ºC (75ºF), which is lower than any other part of the state except the Eastern Coastal Region. The average minimum temperature in January is -18ºC (-1ºF), comparable to that of northern Maine. The average annual precipitation in this region is low, at approximately

15 centimeters (cm) (39 inches [in]) although this varies with elevation and aspect. Due to the rain shadow effect that mountains and mountain ranges produce, windward slopes may receive up to 20 cm (50 in) of annual precipitation while leeward slopes may receive less than 14 cm (35 in) (McMahon 1990).

The project area is located on Sisk Mountain (Figure 1). Elevations in the project area range from 853 meters (2800') to approximately 1036 meters (3400'). The summit is dominated by dense, stunted, balsam fir with mixed spruce/fir and maple/birch/beech in the saddles and side slopes. The project area has evidence of some past and recent timber harvesting activities at the lower elevations but is minimal along the summit. All 15 turbines will be located on private lands owned by Plum Creek Timber and Kennebec West Forest.

Soils within this region of Maine are generally cool, shallow, and well drained at elevations above 762 m (2,500 ft). The ridge tops are typically made up of shallow Saddleback soils while deeper Enchanted soils occur on upper slopes. Both of these soils are cryic and are characterized by a mean annual soil temperature between 0ºC and 8ºC (32ºF and 47ºF). Balsam fir (*Abies balsamea*) and red spruce (*Picea rubens*) are the dominant tree species along ridge tops above 762 m (2,500 ft) and sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*) are the dominant tree species on the side slopes of the ridgelines. Within the maple/birch/beech forests of the lower elevations, hobblebush (*Viburnum lantanoides*) is the most common woody shrub species.



195600482

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30 Park Drive
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Phone (207) 729-1199
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www.stantec.com

Client/Project

Sisk Mountain Wind Project
Chain of Ponds Township, Maine

Figure No.
1-1

Title
Location Map
November 3, 2009

00482-F001-Locus.mxd

2.0 Nocturnal Radar Survey

2.1 INTRODUCTION

Nocturnal radar surveys were conducted in the Project area to characterize spring 2009 nocturnal migration patterns. The majority of North American passerines (songbirds) migrate at night and the strategy of migrating at night may have evolved to take advantage of more stable atmospheric conditions for their flapping flight (Kerlinger 1995). Additionally, migration during the night, with cooler nighttime temperatures, may provide a more efficient medium to regulate body temperature during more active, flapping flight and reduce predation risk while in flight (Alerstam 1990, Kerlinger 1995). Documenting the patterns of nocturnal migrants requires the use of radar or other non-visual technologies. The goal of the surveys was to document the overall passage rates for nocturnal migration in the vicinity of the Project area, including the number of migrants, their flight direction, and their flight altitude.

2.2 SURVEY DESIGN

Radar surveys were conducted from sunset to sunrise on 21 nights between April 26 and May 26. The radar was deployed at the summit of Sisk Mountain (Figures 1 and 2-1), at an elevation of 925 m (3035'). This location provided a good view in most directions, including all of the saddle between southern and northern summits. Although view was partially obscured in some areas of the radar detection range, targets could be tracked as they moved in and out of those areas (Figure 2-3).

Figure 2-1. Radar deployed on the summit of Sisk Mountain.

2.3 DATA COLLECTION METHODS

2.3.1 Radar Data

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

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

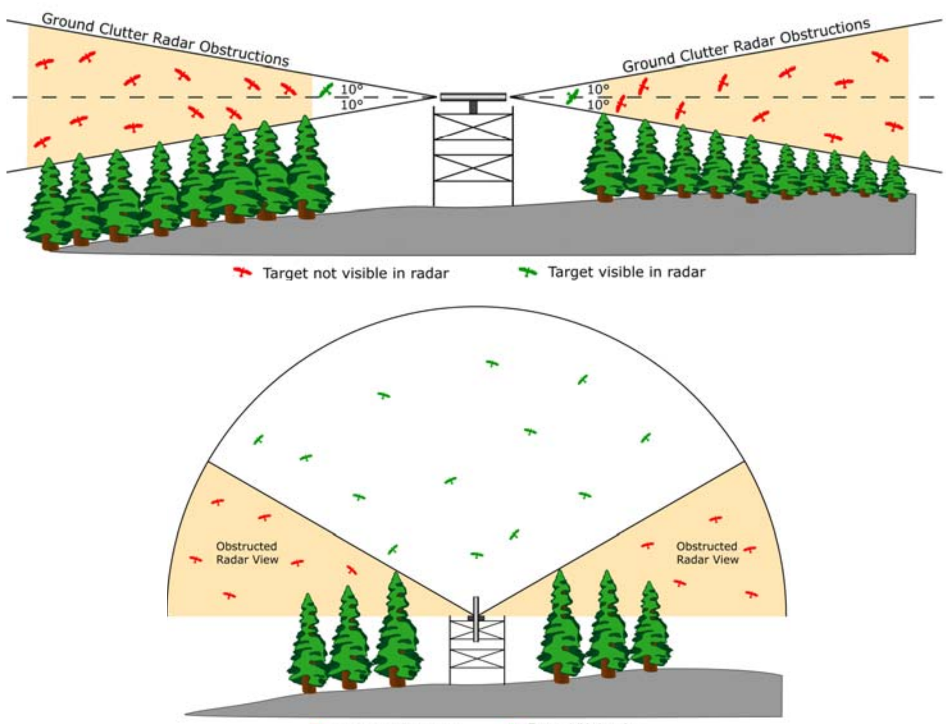

Figure 2-2. An example of ground clutter causing objects in horizontal mode (top) and vertical mode (bottom). Although the radar records three-dimensional space, it is translated by the radar screen into a two dimensional representation, which can cause targets to be obscured from view.

However, vegetation and hilltops near the radar can be used to reduce or eliminate ground clutter by “hiding” clutter-causing objects from the radar. These nearby features also cause ground clutter, but their proximity to the radar antenna generally limits the ground clutter to the center of the radar screen – targets are indistinguishable from the “clutter” as represented on the radar screen (Figure 2-3). 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.

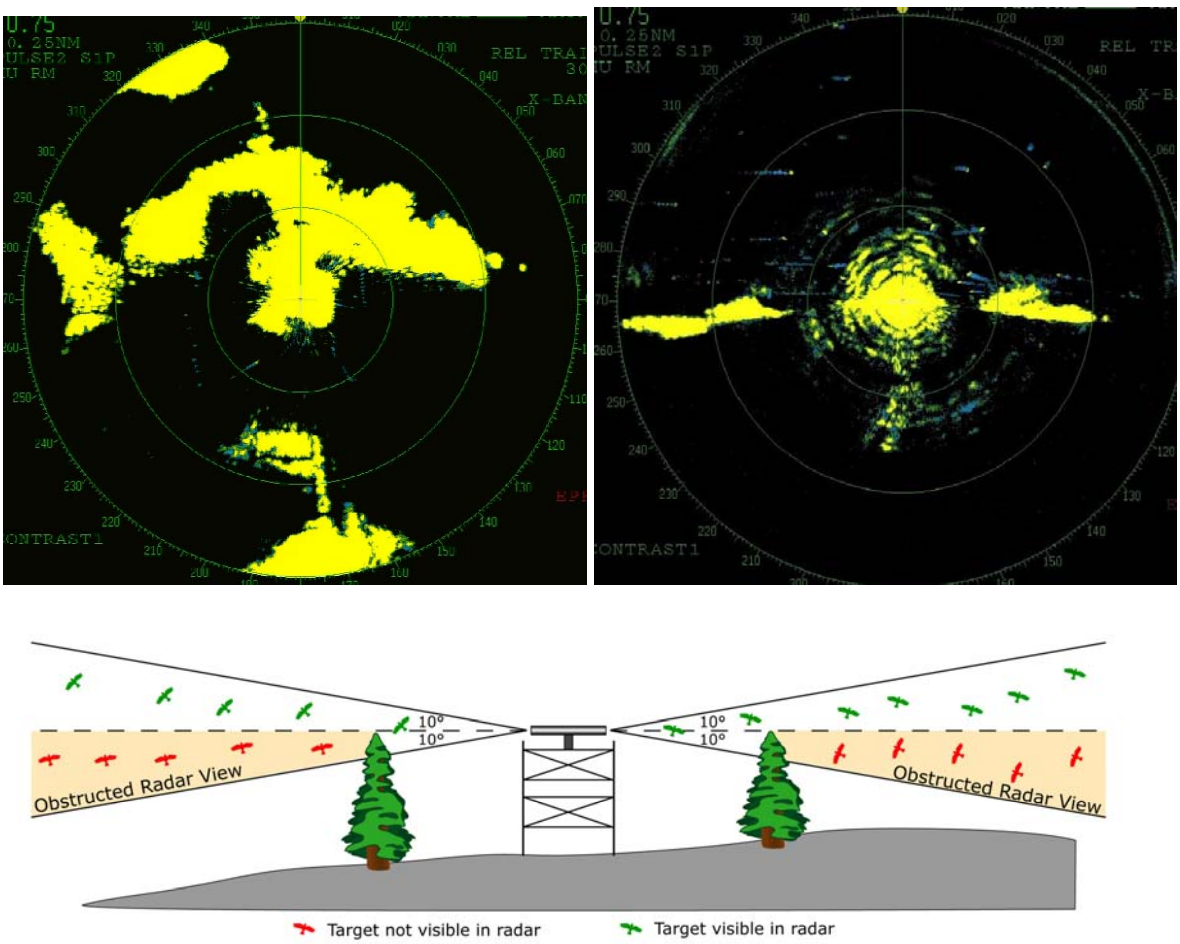

Figure 2-3. Proper site selection can reduce ground clutter to the center of the radar screen (bottom), so that the majority of the two-dimensional radar screen remains relatively uncluttered, allowing targets to be tracked as they both enter and leave the cluttered area (top; horizontal screenshot is on the left and vertical is on the right).

Because the anti-rain function of the radar must be turned down to detect small songbirds and bats, surveys could not be conducted during active rainfall. Therefore, surveys were planned largely for nights without rain. However, in order to characterize migration patterns during nights without optimal 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 90º to vertically survey the airspace above the radar (Harmata *et al.* 1999). In vertical mode, target echoes do not provide directional data, but do provide information on the altitude of targets passing through the vertical, 20º radar beam (Figure 2-4). Both modes of operation were used during each hour of sampling.

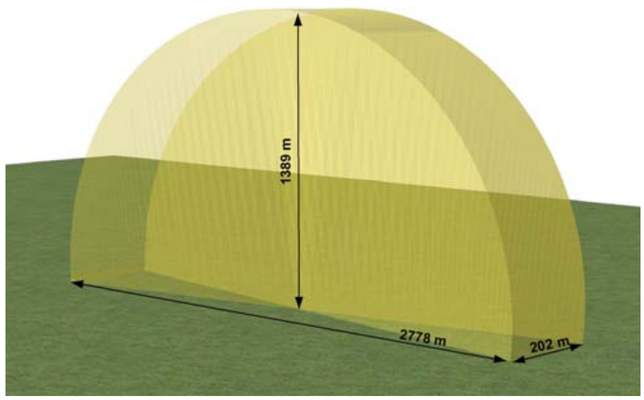

Figure 2-4. Detection Range of the radar in vertical mode

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

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

2.3.2 NEXRAD Data

National Weather Service's Next-Generation Radar (NEXRAD) was used to supplement the Stantec radar survey and help ensure there were no substantive data gaps. Nightly samples of reflectivity and velocity images were downloaded from the National Oceanic and Atmospheric

Administration's (NOAA) National Climate Data Center's website (http://www.ncdc.noaa.gov/oa/radar/jnx/index.php) for the closest NEXRAD radar site to the Project area for the entire spring migration period (April 15 to June 2). The closest NEXRAD data was from Portland, Maine, approximately 120 mi (193 km) south of the Project area.

2.3.3 Weather Data

Temperature, wind speed and direction were recorded on an hourly basis by an on-site meteorological tower mounted to the radar tower, approximately 20 feet above tree height for the duration of the radar survey period. The mean, maximum, and minimum temperature, mean and maximum wind speed, and mean wind direction were calculated for each night. This information was used during data analysis to help characterize any patterns in migration activity for particular nights and for the season overall.

2.3.4 Night Vision and Ceilometer Data

Four times during the first 6 hours of each survey night, night vision device (NVD) and ceilometer surveys were conducted. A NVD is an optical instrument that allows objects to be seen in near darkness by detecting ordinary ambient light, usually from the moon and stars, that is reflected by objects in the scene being viewed. NVDs contain an image intensifier tube that amplifies very weak light. A monocular NVD was used and mounted on the observers head for hands-free use with a harness attachment (i.e., night-vision goggles).

To enhance the distance the observer can see, Night vision observations were supplemented by directing a one-million candlepower spotlight (ceilometer) fixed with a red filter lens vertically into the sky in a manner similar to that described by Gauthreaux (1969). For each observation period, the ceilometer beam was observed with ATN NVG 7 Generation 3 night vision goggles for 5 minutes to document and characterize low-flying targets. The range of detection with this method was approximately 150 m (492'), which is just higher than the total height of the proposed turbines. The ceilometer was held in-hand to facilitate night vision tracking, as necessary, of any birds, bats, or insects passing overhead. Surveys were conducted from the radar survey site. All birds, bats, or insects observed with the NVD within the first five minutes of each hour of the survey period were recorded. Observations from each ceilometer/night vision period were recorded, including the number of birds, bats, and insects observed. This information was used during data analysis to help characterize activity of insects, birds, and bats that were in the air during that hour and for the night overall.

2.4 DATA ANALYSIS METHODS

2.4.1 Radar Data

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

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

Flight altitude data were summarized using linear statistics. Mean flight altitudes (± 1 standard error [SE]) were calculated by hour, night, and overall season. The percent of targets flying below 125 m (410'), the approximate maximum height of the proposed wind turbines with blades, was also calculated hourly, for each night, and for the entire survey period.

2.4.2 NEXRAD Data

NEXRAD data were analyzed to determine whether a sample was showing rain, migration, or both based on the reflectivity, shape, and dispersion of the image. If the NEXRAD showed migration activity, the intensity of migration was determined by comparing data over many nights to categorize activity as light, moderate, or heavy relative to other nights. Moderate to heavy nights of biological activity indicated a distinct migration event was occurring, and were distinguished from nights of light activity when the type of biological activity was less distinct or clear. Velocity data was then analyzed to determine the direction of the migratory activity. It is important to note that NEXRAD data does not allow an assessment of individual target movements (i.e., migration), but rather provides a more regional and time sensitive account of biological activity (including insects, blowing leaves, and dust) in the lower atmosphere within the range of the NEXRAD radar site.

Nightly samples of reflectivity and velocity images were 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 (Figure 2-5). 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, the same time period peak passage rates were observed with the Stantec radar system on-site.

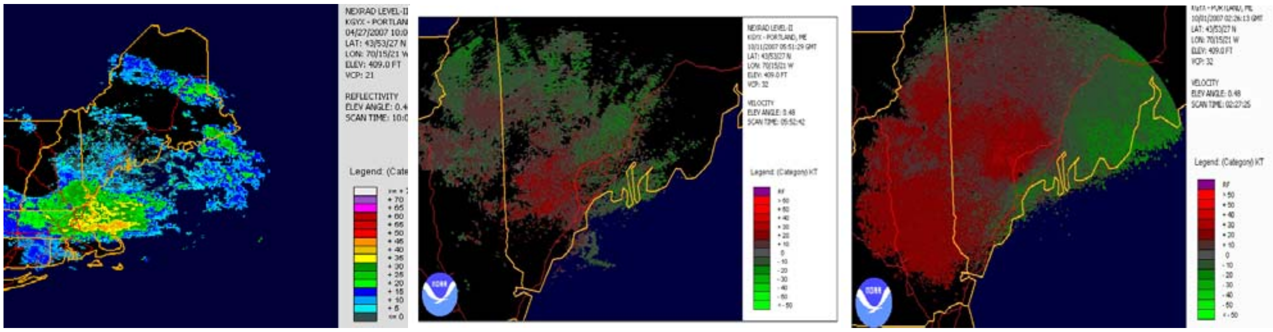

Figure 2-5. Examples of NEXRAD radar images from Portland International Airport depicting (from left to right) rain, light migration, and heavy migration activity

For data interpretation purposes, bird migration is discernable from most precipitation. Moderate to heavy nights of biological activity indicate a distinct migration event occurred. Bird activity was detected on some nights when rain occurred periodically. On those nights, radar reflectivity patterns indicative of migrating birds were observed forming and then dissolving during those periods between rain events. Nights exhibiting these conditions were given a classification of light migration activity.

Once the NEXRAD images were analyzed, 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 did indeed take place during periods of light to heavy migration. Then, the remainder of the nightly NEXRAD data was summarized to identify the proportion of nights with light to heavy migration activity within the entire season as compared to those nights sampled with the on-site radar.

The primary purpose of the NEXRAD analysis was to determine and help demonstrate the level of seasonal radar survey effort was appropriate for assessing a full season of migration activity and to help ensure there were no substantive data gaps. It is important to note that NEXRAD data does not allow an assessment of individual target movements (i.e., migration), but rather provides a more regional and time sensitive account of biological activity (including insects, blowing leaves, and dust) in the lower atmosphere within the range of the NEXRAD radar site.

2.5 RESULTS

Radar surveys were conducted during 21 nights from April 29 to May 26 (Appendix A, Table 1). On one night (5/15), due to equipment malfunction, data was only collected in horizontal mode.

2.5.1 Passage Rates

The overall passage rate for the entire survey period was 207 ± 10 targets per kilometer per hour (t/km/hr). Nightly passage rates varied from 50 ± 10 t/km/hr on May 25 to 452 ± 58 t/km/h on May 20 (Figure 2-6; also Appendix A, Table 1). Individual hourly passage rates ranged from 0 to 682 t/km/hr (Appendix A, Table 1). For the entire season, hourly passage rates were typically highest from the third to seventh hour after sunset (Figure 2-7).

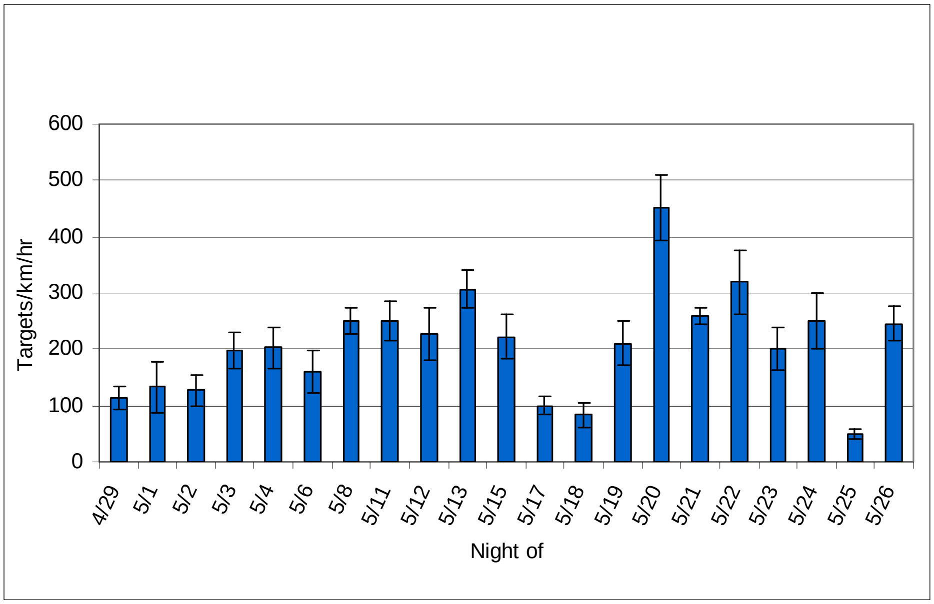

Figure 2-6. Nightly passage rates observed (error bars ± 1 SE)

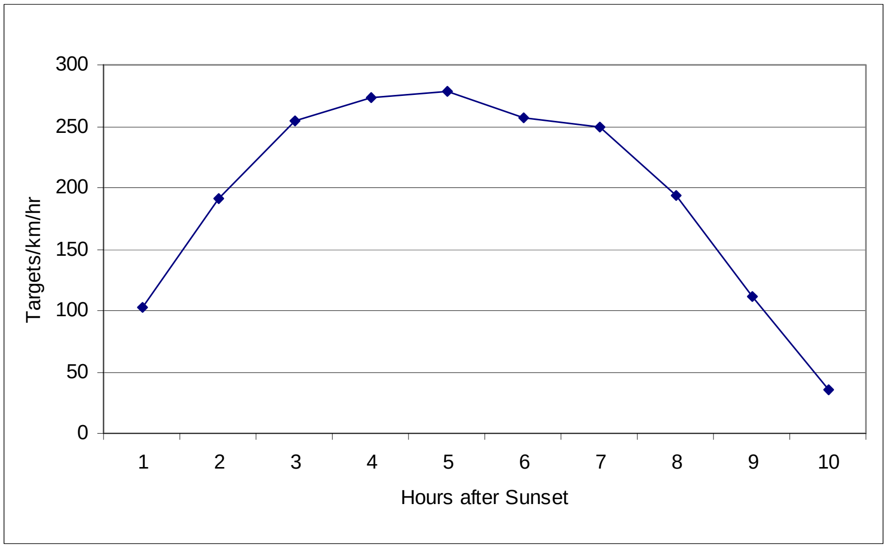

Figure 2-4. Hourly passage rates for entire season

2.5.2 Flight Direction

Mean flight direction through the Project area was 28° ± 79° (Figure 2-8). The majority of nights included mean nightly flight direction to the northeast, although a few nights included flight directions to the southwest or northwest (Appendix A, Table 2).

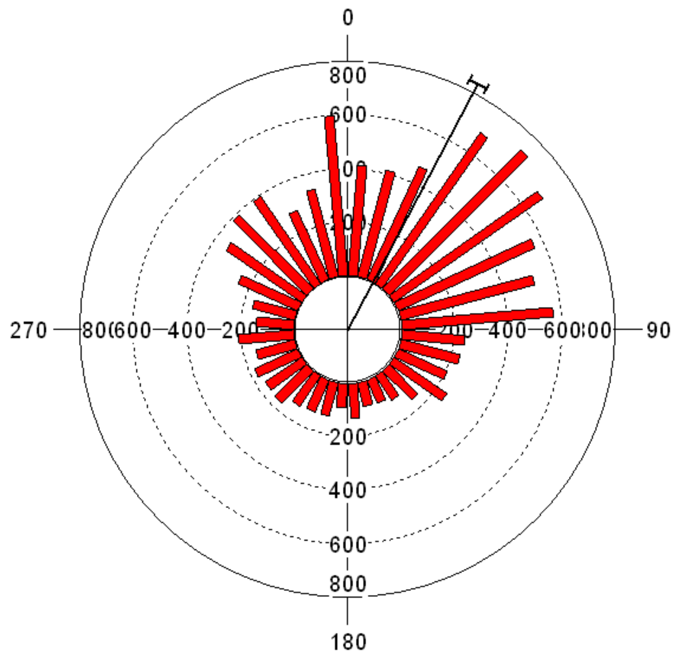

Figure 2-8. Mean flight direction for the entire season (the bracket along the margin of the histogram is the 95% confidence interval)

2.5.3 Flight Altitude

The seasonal average mean flight height of all targets was 293 ± 9 m (962 ± 30')) above the radar site. The average nightly flight height ranged from 167 ± 24 m (547 ± 79') on April 29 to 494 ± 30 m (1621 ± 98') on May 12 (Figure 2-9; Appendix A, Table 3). The percent of targets observed flying below 125 m (410'), the anticipated maximum turbine height was 18 percent for the entire season and varied nightly from 7 percent on May 13 to 49 percent on April 29 and May 17 (Figure 2-10). In general, nights with a greater percentage of targets flying below the proposed turbine height were also on nights with relatively low passage rates. Individual hourly flight heights ranged from 28 m during the first hour on April 29 to 819 during the tenth hour past sunset on May 4. For the entire season, the mean hourly flight heights were typically highest from the second to fifth hour after sunset (Figure 2-11).

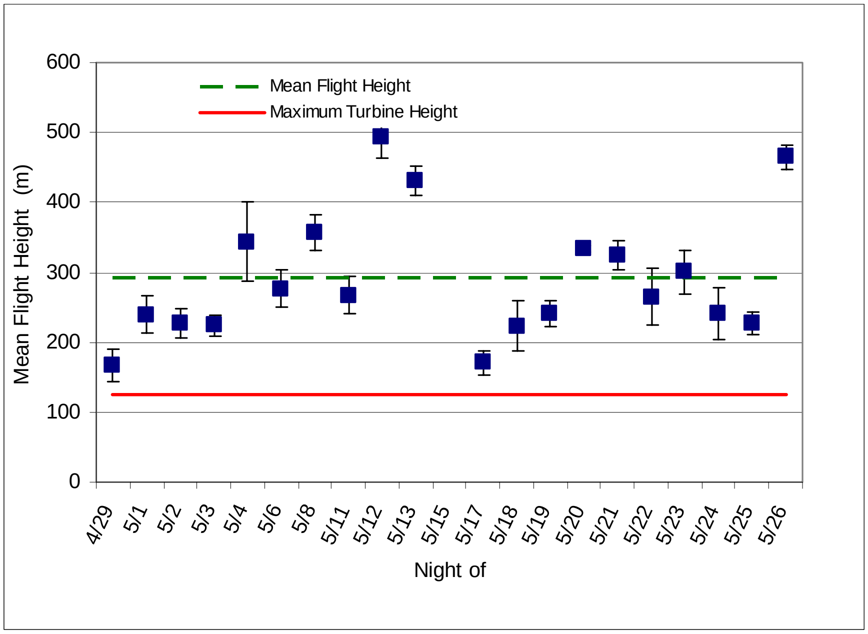

Figure 2-9. Mean nightly flight height of targets (error bars ± 1 SE)

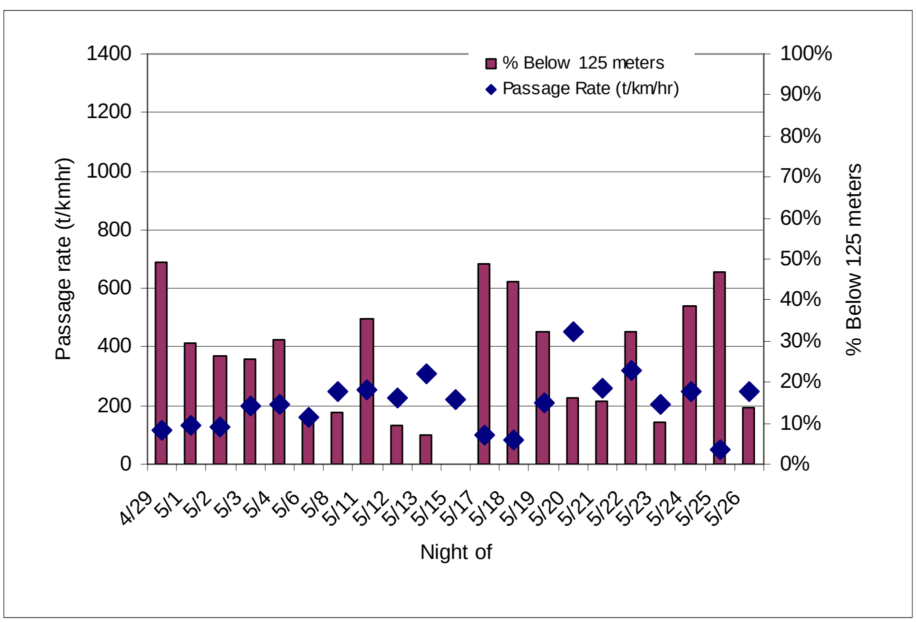

Figure 2-10. Percent of targets observed flying below a height of 125 m (410')

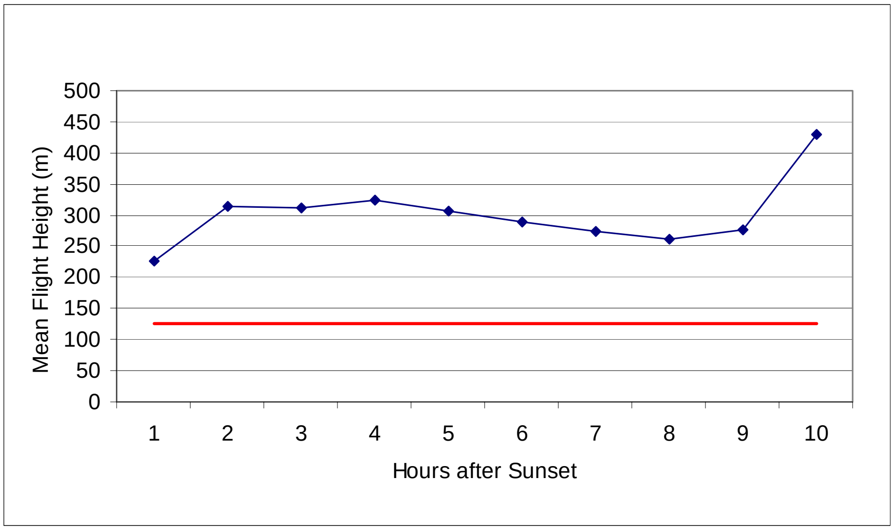

Figure 2-11. Hourly target flight height distribution

2.5.4 NEXRAD Data

A total of 45 nights of NEXRAD weather data were analyzed from April 15 to June 1, 2009, dates within the typical spring avian migration period. Detectable migration activity occurred on 40 of the 45 nights, with 5 nights of no detectable migration due to prolonged intense rain. There were 16 nights of light activity and 24 nights of moderate to heavy activity. Of the 20 nights when nocturnal radar surveys were conducted, 15 nights classified as heavy to moderate activity and 5 nights as light activity. There were no nights of radar sampling when there was less than at least light migration activity.

In general, the NEXRAD analysis indicates the seasonal migration period was adequately sampled and that nights of sampling with on-site radar occurred more frequently on nights with heavy to moderate activity in proportion to other nights of the migration season in which no on-site radar surveys occurred (Table 2-1). This activity is likely representative of the timeframe when majority of migrants are active and is also representative of migration during peak season.

Table 2-1. Summary of NEXRAD compared with on-site radar data collection for Kibby Expansion– Spring 2009

Migration Activity Category	Number of nights (NEXRAD)	Percent of Migration Nights	Number of nights with on-site radar	Percent of on-site radar data set
Rain	2	11%	0	0%
Light	16	36%	5	25%
Moderate to heavy	24	53%	15	75%

2.5.5 Weather Data

Mean nightly wind speeds in the Project area during the nights when radar surveys were conducted varied between 3 and 6 meters per second (m/s), with an overall mean of 4 m/s. Mean nightly temperatures varied between 1ºC and 15ºC, with an overall mean of 6ºC. There were no noticeable relationships between wind speed or temperature and nightly passage rates or flight heights.

2.5.6 Night Vision and Ceilometer Data

Night-vision data collected during the radar survey yielded a total of 256 5-minute observations. Although insects were frequently observed during each observation period, no bird or bat targets were observed.

2.6 DISCUSSION

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

Passage rates varied greatly between nights throughout the survey period (April 29 to May 26), indicating migration occurred in pulses, with rates of migration likely influenced by weather patterns and conditions from night to night. In comparison, flight heights remained fairly consistent throughout the survey period, with most mean hourly flight heights documented between 220 m and 360 m above the radar location. The nights with a higher percentage of targets observed flying below maximum turbine height were also on nights with the lowest passage rates. The mostly northeasterly flight direction observed is typical during spring migration. The results of the NEXRAD analysis, which used radar data from the typical spring migration season surrounding the Portland International Airport to qualitatively assess regional migration activity, indicated that radar surveys conducted in the Project area occurred during nights of measurable regional migration activity in the region and there were no substantial gaps in the data.

The results of the spring 2009 survey at Kibby Expansion were similar to the results of the preconstruction radar studies conducted during the spring 2006 migration period at the Kibby Wind Project (Woodlot 2006), which recently began operation. Sisk Mountain is approximately 2.6 miles west of Kibby Range. The seasonal mean passage rate at Kibby Range 1 (197 t/km/hr) was very similar to the Kibby Expansion (207 t/km/hr) and the ranges for passage rate and flight height, as well as flight direction, were also very similar (Table 2-2). Although the seasonal mean passage rate at Kibby Range 2 (512 t/km/hr) was twice as high as Kibby Expansion (207 t/km/hr), flight heights and flight directions were very similar (Table 2-2).

Table 2-2. Comparison of spring radar survey results between Kibby Wind (2006) and Kibby Expansion (2009)

Survey Site (year)	Passage Rate (t/km/hr)		Flight height (m)		Direction (º)
	Range	Mean	Range	Mean	Mean
Kibby Mountain (2006)	88 - 1500	456	254 - 624	368	67
Kibby Range 1 (2006)	6 - 471	197	158 - 656	412	50
Kibby Range 2 (2006)	18 - 757	512	88 - 787	378	86
Kibby Expansion (2009)	**50-452**	**207**	**167-494**	**293**	**27**

Data from regional surveys using similar methods and equipment conducted within the last several years are rapidly becoming available. These other studies provide an opportunity to compare the results from this Project to other projects in Maine and the region. However, it is important to note that there are limitations in comparing data from previous years with data from 2009, as year-to-year variation in continental bird populations may influence how many birds migrate through an area. Additionally, differences in site characteristics, particularly the topography, local landscape conditions, and vegetation surrounding a radar survey location, can play a large role in any radar's ability to detect targets and the subsequent calculation of passage rate. These differences should be recognized as one of the most significant limiting factors in making direct site-to-site comparisons of passage rates. In comparison, there is a relatively consistent pattern in flight altitude, with most birds appearing to fly at altitudes of 300 to 600 meters or more above the ground. Regardless of potential differences between radar survey locations, the results at the Project are within the typical range of results at projects on forested ridges in the northeast (Appendix A, Table 5).

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).

Some research suggests that bird migration may be affected by landscape features, such as coastlines, large river valleys, and mountain ranges. This has been documented for diurnally migrating birds, such as raptors, but is not as well established for nocturnally migrating birds (Sielman *et al*. 1981; Bingman 1980; Bingman *et al*. 1982; Bruderer and Jenni 1990; Richardson 1998; Fortin *et al*. 1999; Williams *et al.* 2001; Diehl *et al*. 2003). Those studies that suggest night-migrating birds are influenced by topography (and are concentrated to those features) typically have been conducted in areas of steep and abrupt topography, such as the most rugged areas of the northern Appalachians and the Alps. However, other studies in the northeast have not documented this type of concentration and no evidence of target concentration was observed in the spring 2009 survey. Targets were observed in most areas of the radar detection range and were evenly distributed in the visible areas of the radar, indicating that concentration to any one part of the Project area was not occurring.

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Appendix A

Radar survey results

Appendix A Table 1. Survey dates, results, level of effort, and weather - Spring 2009								
Date	**Passage rate**	**Flight Direction**	**Flight Height (m)**	**% below 125 meters**	**Hours of Survey**	**Temperature (C)**	**Wind Speed (m/s)**	**Wind Direction (degrees)**
4/29	113	45	167	49%	8	4	5	358
5/1	134	71	239	29%	9	6	6	11
5/2	127	9	226	26%	10	4	5	24
5/3	198	7	224	25%	10	5	4	15
5/4	203	192	343	30%	10	6	3	358
5/6	159	320	276	12%	9	7	4	352
5/8	250	24	357	13%	9	5	4	343
5/11	252	64	268	35%	9	5	4	353
5/12	227	29	494	9%	10	5	4	55
5/13	307	10	431	7%	10	6	3	20
5/15	223	47	N/A	N/A	10	3	5	354
5/17	100	61	171	49%	9	1	4	334
5/18	84	59	223	45%	9	4	5	334
5/19	211	49	240	32%	9	13	4	354
5/20	452	31	333	16%	8	15	5	345
5/21	260	23	323	15%	9	11	3	354
5/22	320	212	265	32%	9	9	6	350
5/23	202	354	300	10%	9	7	3	351
5/24	249	55	241	39%	9	3	4	354
5/25	50	157	228	47%	9	5	5	354
5/26	246	307	465	14%	9	8	3	354
Entire Season	**207**	**28**	**293**	**18%**	**9**			

Appendix A Table 2. Summary of passage rates by hour, night, and for entire season.														
Night of	**Passage Rate (targets/km/hr) by hour after sunset**										**Entire Night**			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Mean**	**Median**	**Stdev**	**SE**
4/29	34	61	100	132	175	189	129	86	N/A	N/A	113	114	54	20
5/1	354	236	240	197	81	79	N/A	0	13	4	134	81	127	45
5/2	11	103	114	193	254	219	157	104	96	17	127	109	80	27
5/3	129	210	275	286	336	270	168	150	132	27	198	189	94	31
5/4	168	393	329	282	193	186	211	137	124	7	203	189	110	37
5/6	64	43	124	179	283	304	275	129	32	N/A	159	129	107	38
5/8	N/A	186	189	293	264	275	261	379	343	64	250	264	94	24
5/11	46	175	300	329	307	300	354	268	186	N/A	252	300	98	35
5/12	11	86	150	246	381	321	336	357	325	57	227	284	139	46
5/13	254	364	399	389	373	304	317	264	351	51	307	334	103	34
5/15	86	264	179	282	361	325	339	289	43	60	223	273	121	40
5/17	0	82	161	90	129	136	107	96	96	N/A	100	96	45	16
5/18	0	18	43	107	114	93	161	168	50	N/A	84	93	60	21
5/19	180	193	279	314	296	343	207	60	25	N/A	211	207	111	39
5/20	232	361	614	682	564	432	393	336	N/A	N/A	452	413	154	58
5/21	N/A	282	275	368	293	304	293	243	21	N/A	260	288	103	14
5/22	57	404	586	407	332	343	400	200	150	N/A	320	343	160	57
5/23	68	179	286	318	307	196	232	229	0	N/A	202	229	108	38
5/24	121	118	282	286	411	396	346	282	0	N/A	249	282	140	49
5/25	7	32	79	61	82	82	26	50	30	N/A	50	50	28	10
5/26	118	239	346	304	314	289	264	243	94	N/A	246	264	86	31
Entire Season	**102**	**192**	**255**	**274**	**279**	**256**	**249**	**194**	**111**	**36**	**207**	**197**	**133**	**10**

Appendix A Table 3. Mean Nightly Flight Direction		
Night of	**Mean Flight Direction**	**Circular Stdev**
4/29	45.313°	51.425°
5/1	71.093°	36.893°
5/2	9.346°	65.685°
5/3	7.191°	56.247°
5/4	191.598°	48.748°
5/6	320.04°	54.001°
5/8	24.462°	52.268°
5/11	63.574°	66.473°
5/12	29.491°	52.606°
5/13	9.63°	50.236°
5/15	46.665°	88.909°
5/17	60.98°	56.609°
5/18	59.05°	43.982°
5/19	48.556°	50.943°
5/20	30.843°	46.236°
5/21	22.584°	58.051°
5/22	211.571°	112.491°
5/23	353.86°	64.835°
5/24	54.917°	102.953°
5/25	156.958°	94.506°
5/26	306.56°	82.681°
Entire Season	**27.974°**	**79.125°**

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

Night of	Mean Flight Height (m) by hour after sunset										Entire Night				% of targets below 125 meters
	1	2	3	4	5	6	7	8	9	10	Mean	Median	STDV	SE	
4/29	28	247	227	151	160	146	162	214	N/A	N/A	167	167	68	24	49%
5/1	120	250	232	253	275	N/A	307	N/A	--	--	239	239	64	26	29%
5/2	61	187	231	229	284	273	262	232	216	291	226	226	67	21	26%
5/3	166	212	311	274	283	218	182	207	190	202	224	224	48	15	25%
5/4	171	196	283	332	367	360	297	351	258	819	343	343	180	57	30%
5/6	174	171	228	303	357	286	311	408	250	N/A	276	276	80	27	12%
5/8	N/A	337	348	431	403	451	358	257	269	N/A	357	357	70	25	13%
5/11	342	389	310	257	268	276	158	271	137	N/A	268	268	80	27	35%
5/12	--	396	546	633	580	561	496	430	400	405	494	494	90	30	9%
5/13	375	504	466	443	450	407	383	325	398	561	431	431	69	22	7%
5/15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5/17	--	241	209	188	150	137	123	111	205	--	171	171	47	17	49%
5/18	387	430	224	157	147	126	176	192	87	302	223	223	114	36	45%
5/19	203	282	325	294	245	202	193	162	259	N/A	240	240	54	18	32%
5/20	339	341	318	313	340	332	347	333	N/A	N/A	333	333	12	4	16%
5/21	258	381	329	405	367	353	338	243	239	N/A	323	323	62	21	15%
5/22	401	313	276	425	258	123	154	171	--	N/A	265	265	112	40	32%
5/23	84	270	330	315	340	347	304	294	418	N/A	300	300	91	30	10%
5/24	83	415	327	302	187	240	227	147	--	N/A	241	241	106	37	39%
5/25	300	246	232	261	154	219	224	186	--	N/A	228	228	45	16	47%
5/26	360	471	462	496	517	436	456	442	546	N/A	465	465	53	18	14%
Entire Season	**226**	**314**	**311**	**323**	**307**	**289**	**273**	**262**	**277**	**430**	**293**	**282**	**120**	**9**	**18%**
-- indicates no vertical targets for that hour											N/A indicates no data collected during that hour during vertical operation due to equipment malfunction				

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)

Year	Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Citation
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
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	Dans Mountain, 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.
2005	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.
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.
2006	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.
2006	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.
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.
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.
2006	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.
2006	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.
2006	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.
2006	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.
2006	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.
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.
2007	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.
2007	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
2007	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.
2007	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.
2007	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.
2007	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.
2007	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.
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.
2008	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
2008	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.
2008	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.
2008	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.

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.

Fall 2009 Nocturnal Migration Survey Report

for the Kibby Expansion Wind Project
In Kibby and Chain of Ponds Township, Maine

Prepared for

TRC Engineers LLC
14 Gabriel Drive
Augusta, ME 04330

Prepared by

Stantec Consulting
30 Park Drive
Topsham, ME 04086

November 2009

Executive Summary

During fall 2009, Stantec Consulting (Stantec), formerly Woodlot Alternatives, Inc.[1], conducted radar and bat detector surveys of nocturnal migration activity at the proposed Kibby Expansion Wind Project (Project) in Kibby and Chain of Ponds Township, Maine. The surveys are part of the planning process by TransCanada Maine Wind Development, Inc. (TransCanada) for a proposed wind project, which will include the erection of up to 15 wind turbines (45 megawatts) to be located on Sisk Mountain. These surveys represented the second season of investigation undertaken at this site.

The results of the field surveys provide useful information about site-specific nocturnal migration activity and patterns in the vicinity of the project area. These findings are especially relevant when considered along with the previous studies conducted near this location as part of the pre-construction survey effort for the currently operational Kibby Mountain wind project.

Nocturnal Radar Survey

The fall field survey included 20 nights of sampling from August 31 to October 10, 2009. Surveys were conducted using X-band radar, sampling from sunset to sunrise. Each hour of sampling included the recording of radar video files during horizontal and vertical operation. The radar was located on the summit of the Sisk Mountain ridgeline, in the saddle south of the northern summit, and provided good views of both the southern and northern portions of the project area.

The overall passage rate for the entire survey period was 458 targets per kilometer per hour (t/km/hr), and nightly passage rates varied from 44 to 1067 t/km/hr. Mean flight direction through the project area was 206º. The mean flight height of targets was 287 meters (m) (940 feet [']) above the radar site, and nightly flight heights ranged from 197 m (646') to 514 m (1687'). The percent of targets observed flying below 125 m (410') was 23 percent for the entire season and varied by night, from 11 to 49 percent.

Spring radar surveys at the Project area documented patterns in nocturnal migration similar to that documented at recent radar surveys in Maine, including at nearby Kibby Mountain, and throughout the northeast. These patterns include highly variable passage rages between nights, a generally northeastern flight direction, and flight heights between 200 and 500 m. Within nights, migration activity was generally greatest 2-3 hours after sunset and declined steadily through the end of the night. Additionally, the flight height of targets indicates that the

[1] All field work and any reporting and permitting activities performed prior to October 1, 2007, were conducted as Woodlot Alternatives, Inc. and will be herein referenced as work done by Woodlot. On October 1, 2007, Woodlot Alternatives, Inc. was acquired by Stantec Consulting Services, Inc. Work conducted on or after October 1, 2007 is herein referenced as work done by Stantec.

majority of nocturnal migration in the area occurs well above the height of the proposed wind turbines.

Bat Survey

Four Anabat® acoustic bat detectors were deployed in the Project area between mid August and mid October to document bat activity near the rotor zone of proposed wind turbines. Two detectors were placed in temporary towers which suspended detectors several meters above the surrounding forest canopy, one detector was positioned near the ground at the edge of a clearing, and the fourth detector, deployed near the end of the monitoring period, was suspended from the guy wires of an on-site met tower at a height of approximately 45 meters. Data were summarized by guild and species and tallied per detector on a nightly and hourly basis.

A total of 94 bat call sequences were recorded over 204 detector-nights ($\bar{x}$ =0.5 ± 0.1 SE recordings/detector/night [r/d/n]; range = 0 – 7). This detection rate is relatively low in comparison to other similar surveys, particularly because detectors were deployed in relatively low towers, where increased bat activity levels are generally documented. Acoustic bat activity levels were highest in mid August and declined steadily through mid October, following a similar decline in nightly mean temperature. The low number of recorded bat calls was insufficient to calculate correlations between activity level and weather variables. The majority of recorded call sequences were too brief to permit classification by species, although bats within the *Myotis* genus were among the most commonly identified, and most of the unidentified call sequences were within the frequency range of *Myotis* species. The little brown bat (*Myotis lucifugus*) and northern long-eared bat (*Myotis septentrionalis*) would be expected to be the most common resident species within the Project area based on their range and available habitat.

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Appendices

PN195600482[†]

[†] *This report was prepared by Stantec Consulting Services Inc. for TRC Engineers 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

TransCanada Maine Wind Development, Inc. (TransCanada) is considering construction of an expansion to the existing Kibby Wind Project to be located on Sisk Mountain in Kibby and Chain of Ponds Township, Maine (Figure 1). The project, Kibby Expansion Wind Project (the Project), is still in the preliminary stages of design; but, it is expected to consist of 15 turbines and will likely be 3.0 megawatt (mw) machines mounted on tubular steel towers with an approximate hub height of 80 meters and a maximum height of 125 meters (m) (410 feet [']).

In advance of permitting activities for the Project, TRC Engineers contracted Stantec Consulting, (Stantec) to conduct pre-construction radar surveys to characterize nocturnal migration in the Project area. The scope of surveys was based on a combination of standard methods that are developing within the wind power industry for pre-construction surveys and is consistent with several other studies conducted recently in Maine and throughout the Northeast region of the United States. Prior to conducting the studies, TRC had several meetings and discussions with appropriate regulatory agencies regarding the scope and methods for the pre-construction nocturnal radar migration surveys. These included discussions with Maine Department of Inland Fisheries and Wildlife (MDIFW) on February 24, 2009 and MDIFW and the United States Fish and Wildlife Service (USFWS) on March 10, 2009. Protocols for the pre-construction radar surveys were subsequently circulated to all interested agency staff for comments on April 7, 2009. The outcome of these meetings was that the Kibby Expansion project should follow methodology used during the pre-construction surveys conducted at the existing Kibby Wind Project in 2006. Site visits were also attended by Army Corps of Engineers, USFWS, and MDIFW on August 26, 2009 and September 1, 2009.

Stantec previously conducted radar surveys in the Project area between late April and late May, 2009, and summarized survey results in a previous report (Stantec 2009). This report summarizes results of fall radar surveys, conducted between August 31 and October 10, 2009 and summer/fall acoustic bat surveys, conducted between August 12 and October 15, 2009. Following is a brief description of the Project area, a review of the scientific methods used to conduct the various surveys, the results of those surveys, and a discussion of those results. Where appropriate, this report contains comparisons between spring and fall radar surveys, as well as comparisons with the operational Kibby Wind Project.

1.1 PROJECT AREA DESCRIPTION –

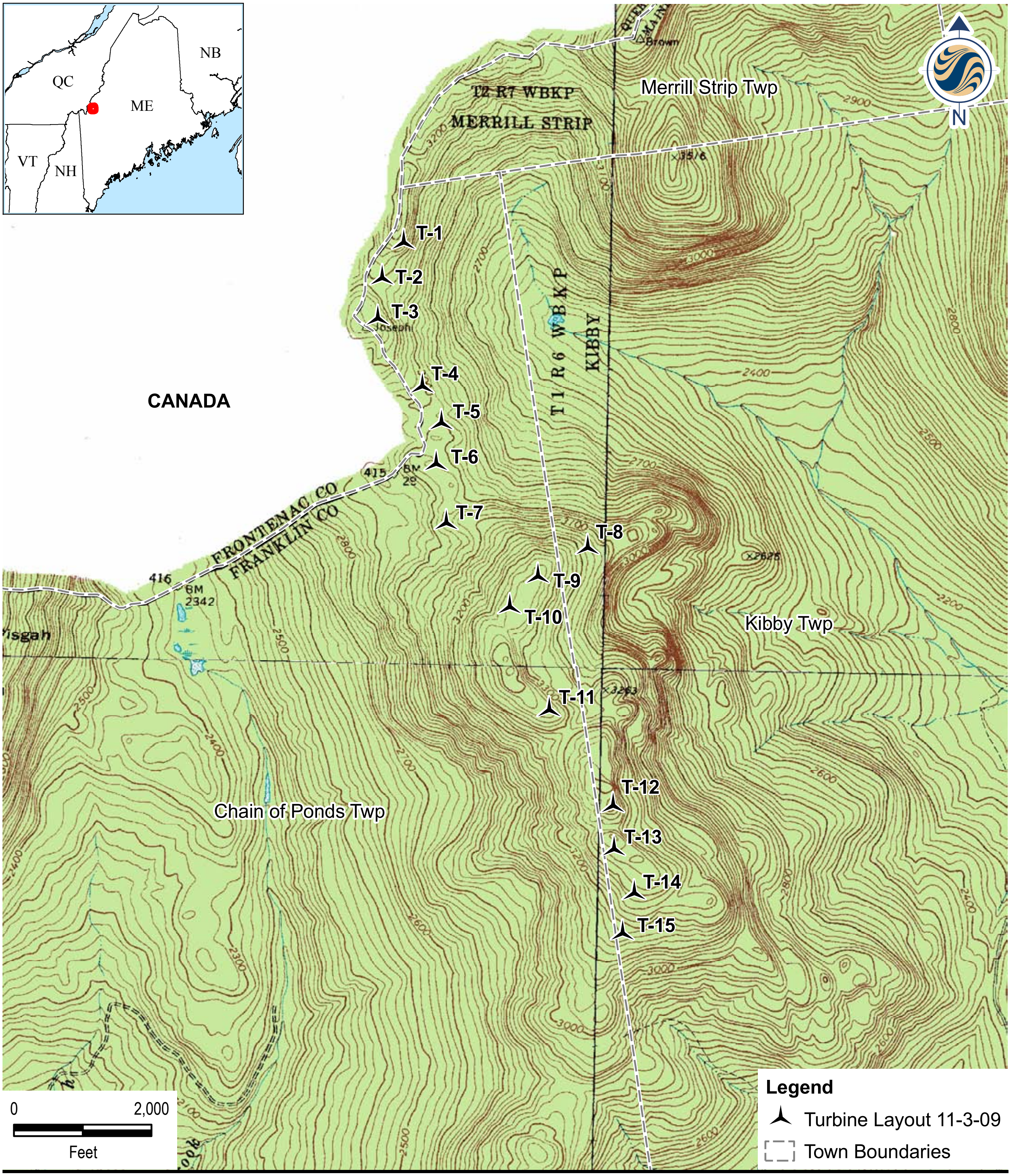
The project area is located in the Boundary Mountains of western Maine, in Franklin County. It is within the Western Mountains Biophysical Region of Maine, which borders northern New Hampshire and Quebec, Canada.

The Western Mountains Biophysical Region is best characterized by its rugged topography, cool climate, low annual precipitation, and high snowfall. The average maximum temperature in July is approximately 24ºC (75ºF), which is lower than any other part of the state except the Eastern

Coastal Region. The average minimum temperature in January is -18ºC (-1ºF), comparable to that of northern Maine. The average annual precipitation in this region is low, at approximately 15 centimeters (cm) (39 inches [in]) although this varies with elevation and aspect. Due to the rain shadow effect that mountains and mountain ranges produce, windward slopes may receive up to 20 cm (50 in) of annual precipitation while leeward slopes may receive less than 14 cm (35 in) (McMahon 1990).

The project area is located on Sisk Mountain (Figure 1-1). Elevations in the project area range from 853 meters (2800') to approximately 1036 meters (3400'). The summit is dominated by dense, stunted, balsam fir with mixed spruce/fir and maple/birch/beech in the saddles and side slopes. The project area has evidence of some past and recent timber harvesting activities at the lower elevations but is minimal along the summit. All 15 turbines will be located on private lands owned by Plum Creek Timber and Kennebec West Forest.

Soils within this region of Maine are generally cool, shallow, and well drained at elevations above 762 m (2,500'). The ridge tops are typically made up of shallow Saddleback soils while deeper Enchanted soils occur on upper slopes. Both of these soils are cryic and are characterized by a mean annual soil temperature between 0ºC and 8ºC (32ºF and 47ºF). Balsam fir (*Abies balsamea*) and red spruce (*Picea rubens*) are the dominant tree species along ridge tops above 762 m (2,500') and sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*) are the dominant tree species on the side slopes of the ridgelines. Within the maple/birch/beech forests of the lower elevations, hobblebush (*Viburnum lantanoides*) is the most common woody shrub species.



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Client/Project

Sisk Mountain Wind Project
Chain of Ponds Township, Maine

Figure No.
1-1

Title
Location Map
November 3, 2009

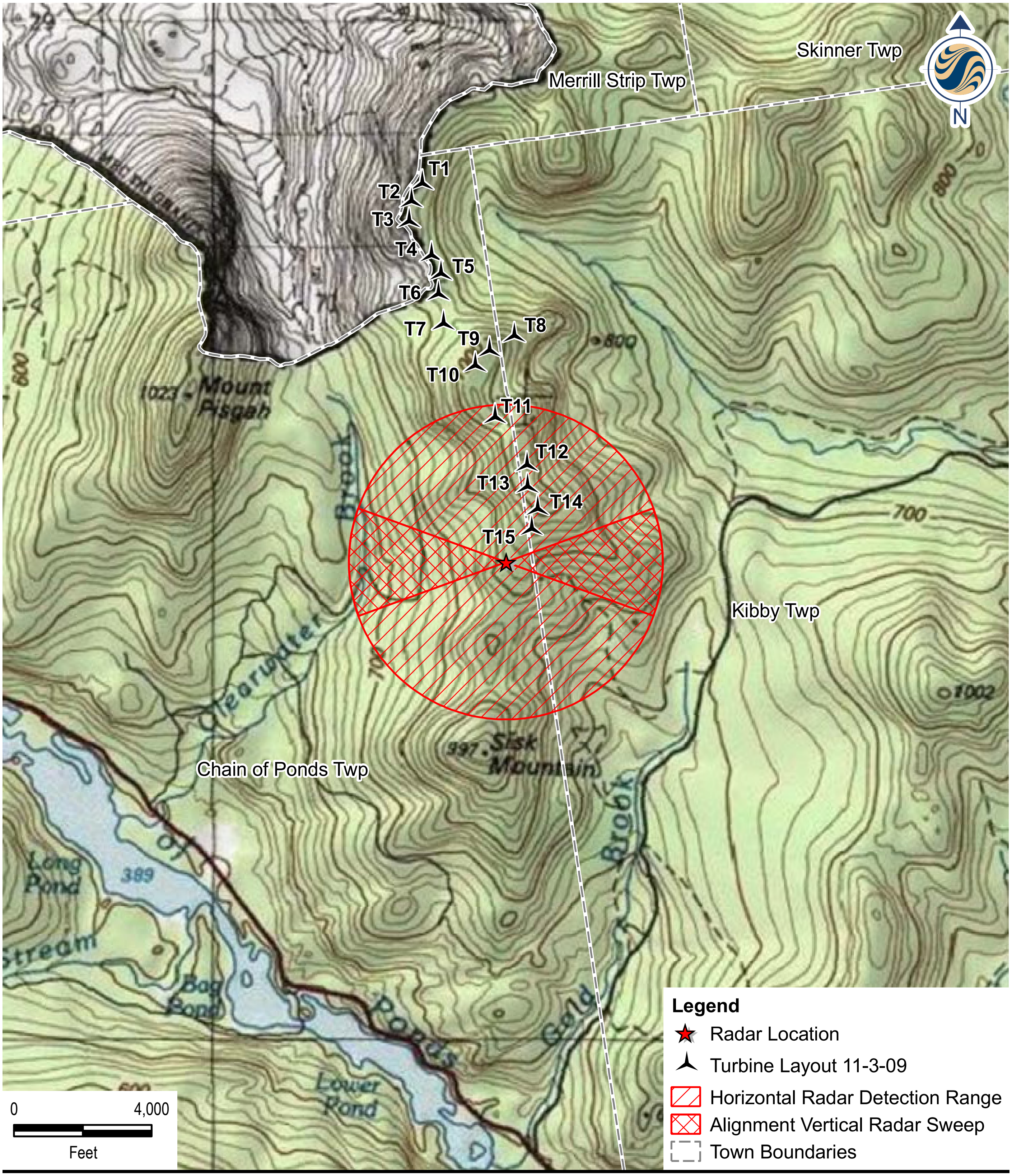
00482-F001-Locus.mxd

2.0 Nocturnal Radar Survey

2.1 INTRODUCTION

Nocturnal radar surveys were conducted in the Project area to characterize spring 2009 nocturnal migration patterns. The majority of North American passerines (songbirds) migrate at night and the strategy of migrating at night may have evolved to take advantage of more stable atmospheric conditions for their flapping flight (Kerlinger 1995). Additionally, migration during the night, with cooler nighttime temperatures, may provide a more efficient medium to regulate body temperature during more active, flapping flight and reduce predation risk while in flight (Alerstam 1990, Kerlinger 1995). Documenting the patterns of nocturnal migrants requires the use of radar or other non-visual technologies. The goal of the surveys was to document the overall passage rates for nocturnal migration in the vicinity of the Project area, including the number of migrants, their flight direction, and their flight altitude.

Radar surveys were conducted from sunset to sunrise on 20 nights between August 31 and October 10, 2009. The radar was deployed at the summit of Sisk Mountain (Figures 2-1, 2-2), at an elevation of 925 m (3035’). This location provided a good view in most directions, including all of the saddle between southern and northern summits as well as the upper reaches of the north and south summits. Although the radar’s view was partially obscured in some areas of the radar detection range, targets could be tracked as they moved in and out of those areas (Figure 2-4).



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Sisk Mountain Wind Project
Chain of Ponds Township, Maine

Figure No.
2-1

Title
Radar Location Map
November 3, 2009

00482-F002-Radar.mxd

Figure 2-2. Radar deployed on the summit of Sisk Mountain.

2.2 DATA COLLECTION METHODS

2.2.1 Radar Data

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

Objects on the ground detected by the radar cause returns on the radar screen (echoes) that appear as blotches called ground clutter. Large amounts of ground clutter reduce the ability of the radar to track birds and bats flying over those areas (Figure 2-3).

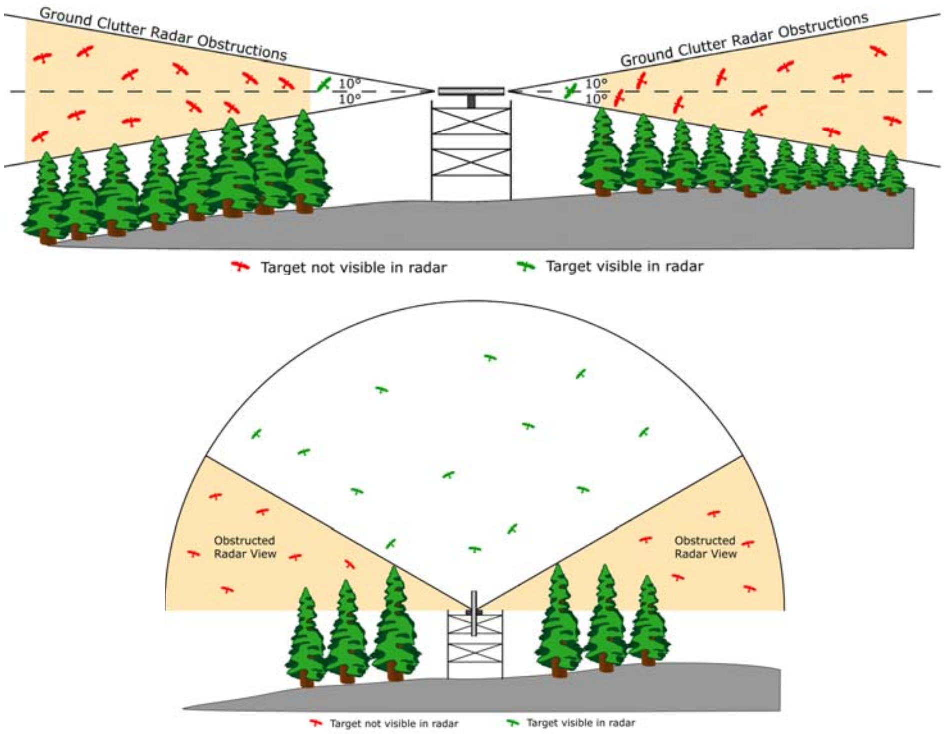


Figure 2-3. An example of ground clutter causing objects in horizontal mode (top) and vertical mode (bottom). Although the radar records three-dimensional space, it is translated by the radar screen into a two dimensional representation, which can cause targets to be obscured from view.

However, vegetation and hilltops near the radar can be used to reduce or eliminate ground clutter by "hiding" clutter-causing objects from the radar. These nearby features also cause ground clutter, but their proximity to the radar antenna generally limits the ground clutter to the center of the radar screen – targets are indistinguishable from the "clutter" as represented on the radar screen (Figure 2-4). 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.

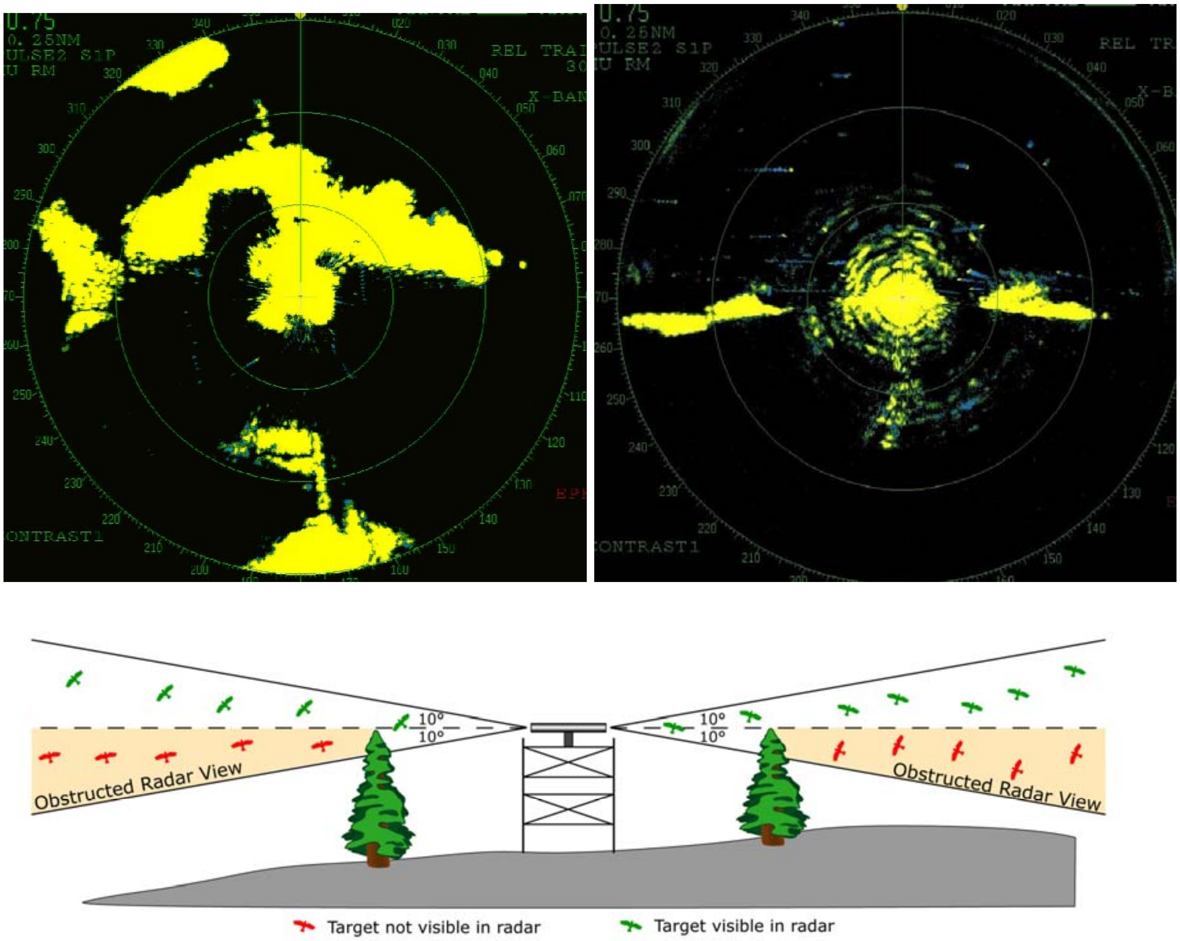


Figure 2-4. Proper site selection can reduce ground clutter to the center of the radar screen (bottom), so that the majority of the two-dimensional radar screen remains relatively uncluttered, allowing targets to be tracked as they both enter and leave the cluttered area (top; horizontal screenshot is on the left and vertical is on the right).

Because the anti-rain function of the radar must be turned down to detect small songbirds and bats, surveys could not be conducted during active rainfall. Therefore, surveys were planned largely for nights without rain. However, in order to characterize migration patterns during nights without optimal 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 2-4). By analyzing the echo trail, the flight direction and flight speed of targets can be determined.

In vertical mode, the radar unit is tilted 90º to vertically survey the airspace above the radar (Harmata *et al.* 1999). In vertical mode, target echoes do not provide directional data, but do provide information on the altitude of targets passing through the vertical, 20º radar beam (Figure 2-5). Both modes of operation were used during each hour of sampling.

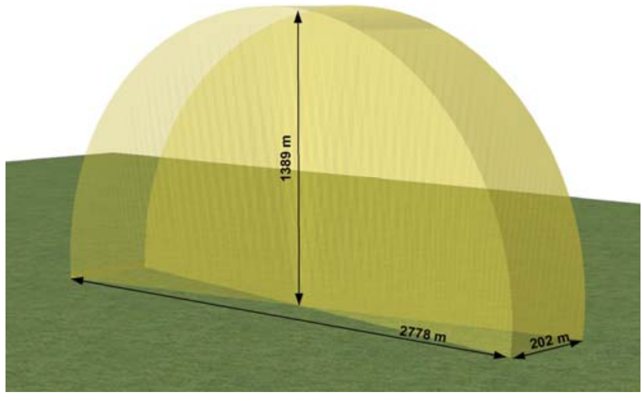


Figure 2-5. Detection Range of the radar in vertical mode

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

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

2.2.2 NEXRAD Data

National Weather Service's Next-Generation Radar (NEXRAD) was used to supplement the Stantec radar survey and help ensure there were no substantive data gaps. Nightly samples of reflectivity and velocity images were downloaded from the National Oceanic and Atmospheric Administration's (NOAA) National Climate Data Center's website (http://www.ncdc.noaa.gov/oa/radar/jnx/index.php) for the closest NEXRAD radar site to the Project area for the entire fall migration period (August 15 to October 15). The closest NEXRAD data was from Portland, Maine, approximately 120 mi (193 km) south of the Project area.

2.2.3 Weather Data

Temperature, wind speed and direction were recorded on an hourly basis by meteorological tower on a northern peak of the operational Kibby Wind Project for the duration of the radar survey period. The mean, maximum, and minimum temperature, mean and maximum wind speed, and mean wind direction were calculated for each night. This information was used during data analysis to help characterize any patterns in migration activity for particular nights and for the season overall.

2.2.4 Night Vision and Ceilometer Data

During the first third of the survey period (August 31 to September 10), night vision device (NVD) and ceilometer surveys were conducted. Four times during the first 6 hours of each survey night, night vision device (NVD) and ceilometer surveys were conducted. A NVD is an optical instrument that allows objects to be seen in near darkness by detecting ordinary ambient light, usually from the moon and stars, that is reflected by objects in the scene being viewed. NVDs contain an image intensifier tube that amplifies very weak light. A monocular NVD was used and mounted on the observers head for hands-free use with a harness attachment (i.e., night-vision goggles).

To enhance the distance the observer can see, night vision observations were supplemented by directing a one-million candlepower spotlight (ceilometer) fixed with a red filter lens vertically into the sky in a manner similar to that described by Gauthreaux (1969). For each observation period, the ceilometer beam was observed with ATN NVG 7 Generation 3 night vision goggles for 5 minutes to document and characterize low-flying targets. The range of detection with this method was approximately 150 m (492’), which is just higher than the total height of the proposed turbines. The ceilometer was held in-hand to facilitate night vision tracking, as necessary, of any birds, bats, or insects passing overhead. Surveys were conducted from the radar survey site. All birds, bats, or insects observed with the NVD within the first five minutes of each hour of the survey period were recorded. Observations from each ceilometer/night vision period were recorded, including the number of birds, bats, and insects observed. This information was used during data analysis to help characterize activity of insects, birds, and bats that were in the air during that hour and for the night overall.

2.3 DATA ANALYSIS METHODS

2.3.1 Radar Data

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

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

Flight altitude data were summarized using linear statistics. Mean flight altitudes (± 1 standard error [SE]) were calculated by hour, night, and overall season. The percent of targets flying below 125 m (410'), 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 NEXRAD Data

NEXRAD data were analyzed to determine whether a sample was showing rain, migration, or both based on the reflectivity, shape, and dispersion of the image. If the NEXRAD showed migration activity, the intensity of migration was determined by comparing data over many nights to categorize activity as light, moderate, or heavy relative to other nights. Moderate to heavy nights of biological activity indicated a distinct migration event was occurring, and were distinguished from nights of light activity when the type of biological activity was less distinct or clear. Velocity data was then analyzed to determine the direction of the migratory activity. It is important to note that NEXRAD data does not allow an assessment of individual target movements (i.e., migration), but rather provides a more regional and time sensitive account of biological activity (including insects, blowing leaves, and dust) in the lower atmosphere within the range of the NEXRAD radar site.

Nightly samples of reflectivity and velocity images were 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 (Figure 2-6). 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, the same time period peak passage rates were observed with the Stantec radar system on-site.

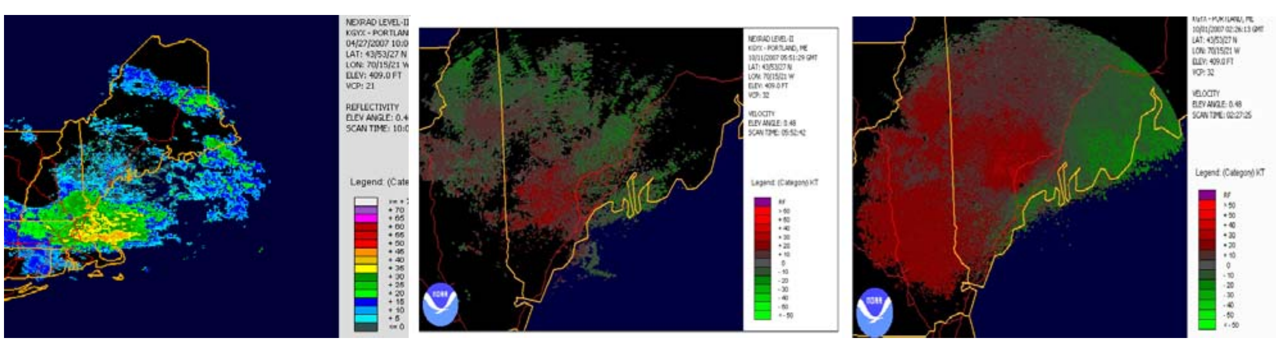


Figure 2-6. Examples of NEXRAD radar images from Portland International Airport depicting (from left to right) rain, light migration, and heavy migration activity

For data interpretation purposes, bird migration is discernable from most precipitation. Moderate to heavy nights of biological activity indicate a distinct migration event occurred. Bird activity was detected on some nights when rain occurred periodically. On those nights, radar reflectivity patterns indicative of migrating birds were observed forming and then dissolving during those periods between rain events. Nights exhibiting these conditions were given a classification of light migration activity.

Once the NEXRAD images were analyzed, 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 did indeed take place during periods of light to heavy migration. Then, the remainder of the nightly NEXRAD data was summarized to identify the proportion of nights with light to heavy migration activity within the entire season as compared to those nights sampled with the on-site radar.

The primary purpose of the NEXRAD analysis was to determine and help demonstrate the level of seasonal radar survey effort was appropriate for assessing a full season of migration activity and to help ensure there were no substantive data gaps. It is important to note that NEXRAD data does not allow an assessment of individual target movements (i.e., migration), but rather provides a more regional and time sensitive account of biological activity (including insects, blowing leaves, and dust) in the lower atmosphere within the range of the NEXRAD radar site.

2.4 RESULTS

Radar surveys were conducted during 20 nights between August 31 and October 10, 2009 (Appendix A, Table 1).

2.4.1 Passage Rates

The overall passage rate for the entire survey period was 458 ± 28 targets per kilometer per hour (t/km/hr). Nightly passage rates varied from 44 ± 8 t/km/hr on September 3 to 1067 ± 184 t/km/h on September 21 (Figure 2-7; also Appendix A, Table 2). Individual hourly passage rates ranged from 0 to 1861 t/km/hr (Appendix A, Table 2). For the entire season, hourly passage rates were typically highest from the second to third hour after sunset and then decreased significantly towards sunrise (Figure 2-8).

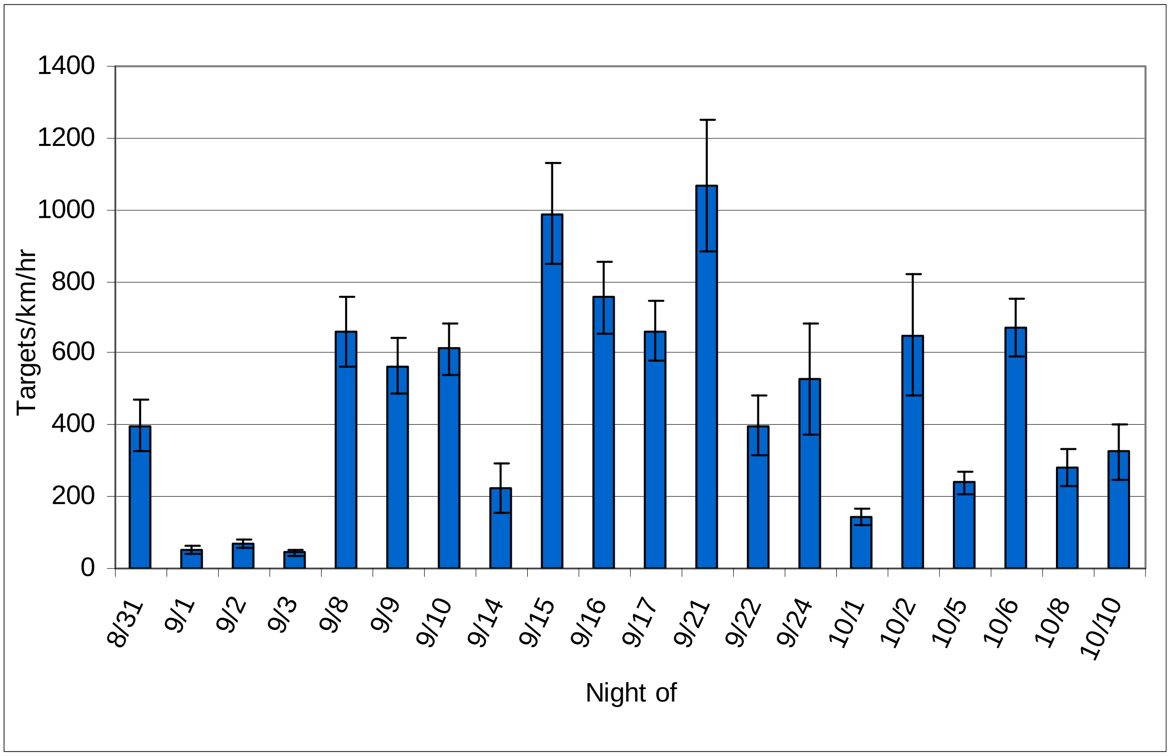


Figure 2-7. Nightly passage rates observed (error bars ± 1 SE)

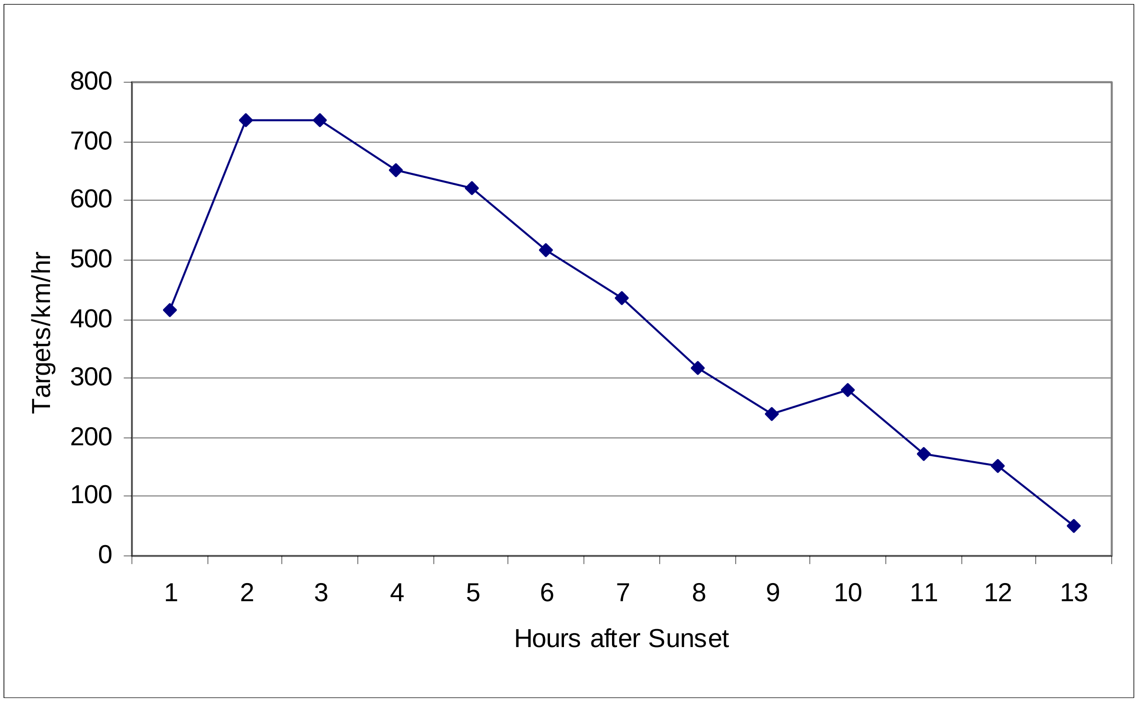


Figure 2-8. Hourly passage rates for entire season

2.4.2 Flight Direction

Mean flight direction through the Project area was 206° ± 84° (Figure 2-9). Flight directions were generally to the south but varied between nights (Appendix A, Table 3).

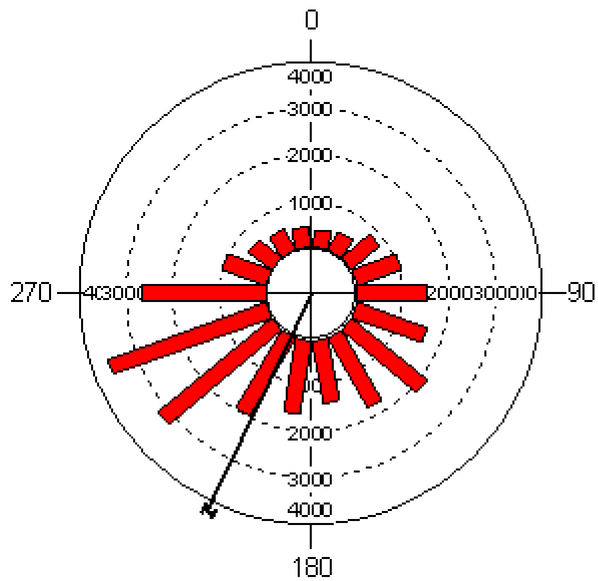


Figure 2-9. Mean flight direction for the entire season (the bracket along the margin of the histogram is the 95% confidence interval)

2.4.3 Flight Altitude

The seasonal average mean flight height of all targets was 287 m (940‘)) above the radar site. The average nightly flight height ranged from 197 m (646’) on October 6 to 514 m (1687’) on October 1 (Figure 2-10; Appendix A, Table 4). The percent of targets observed flying below 125 m (410’), the anticipated maximum turbine height was 23 percent for the entire season and varied nightly from 11 percent on September 1 to 49 percent on October 2 (Figure 2-11). For the entire season, the mean hourly flight heights were typically highest from the second to seventh hour after sunset (Figure 2-12).

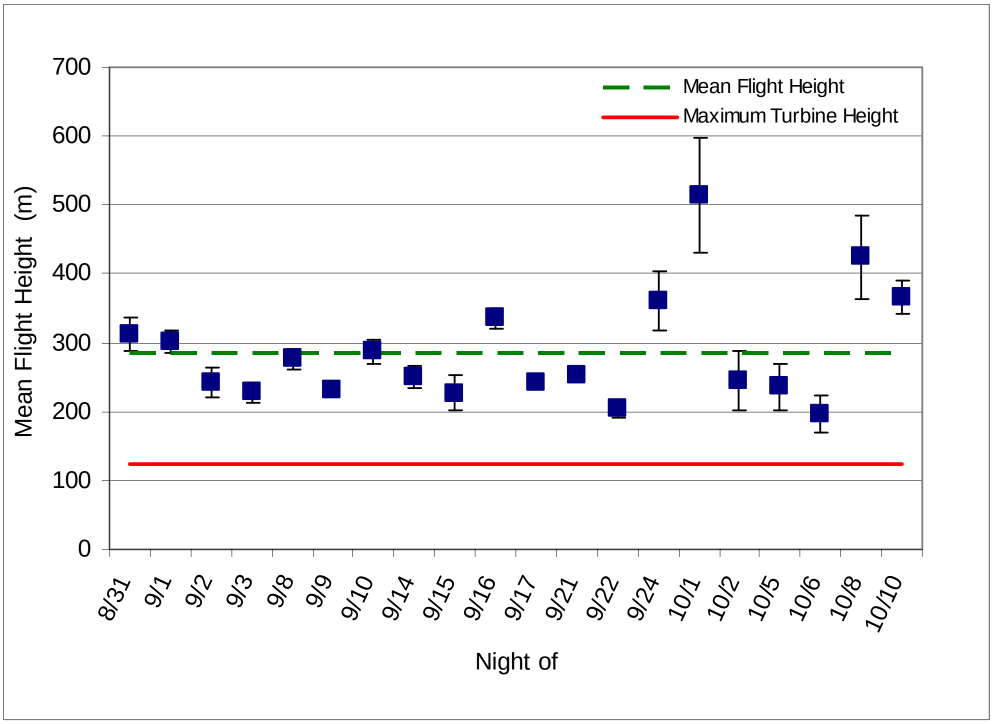


Figure 2-10 Mean nightly flight height of targets (error bars ± 1 SE)

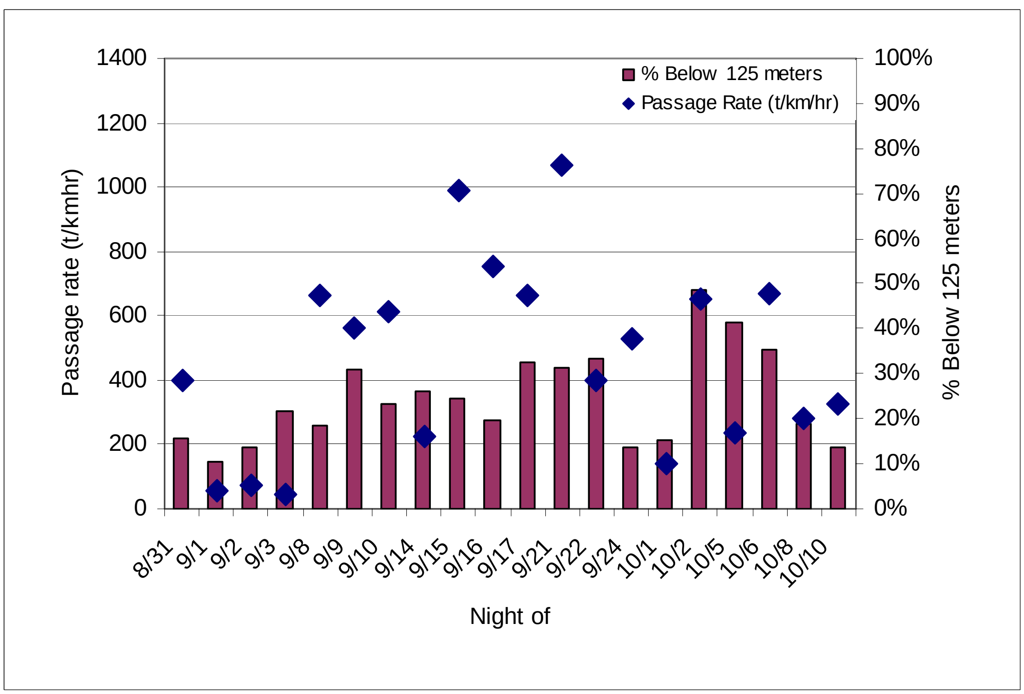


Figure 2-11. Percent of targets observed flying below a height of 125 m (410')

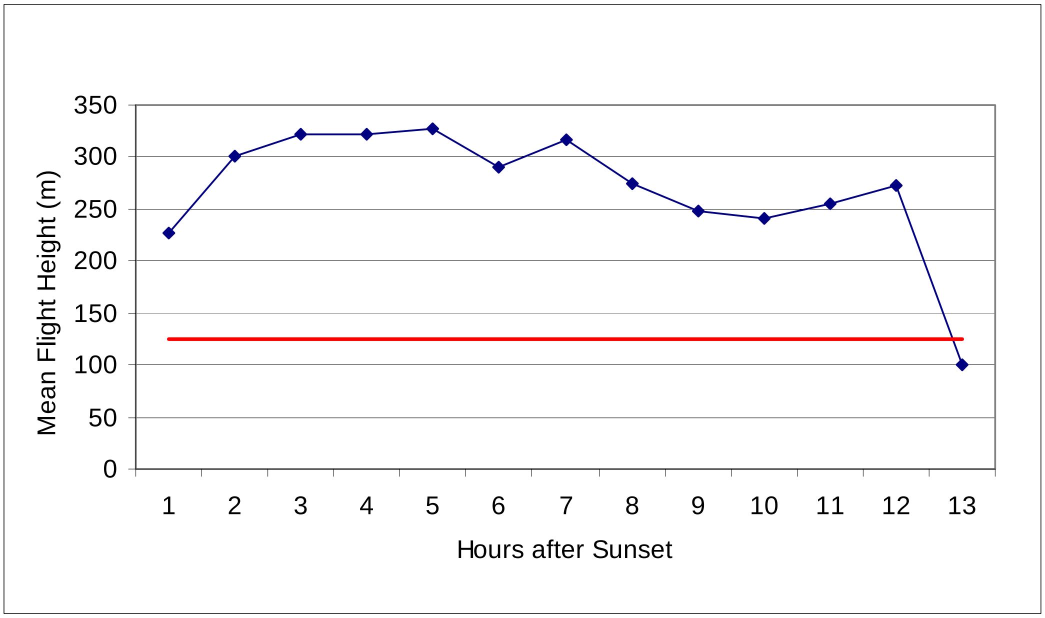


Figure 2-12. Hourly target flight height distribution

2.4.4 NEXRAD Data

A total of 62 nights of NEXRAD weather data were analyzed from August 15 to October 15, 2009, dates within the typical fall avian migration period. Detectable migration activity occurred on every night, with 5 nights of no detectable migration due to prolonged intense rain. There were 12 nights of light activity and 45 nights of moderate to heavy activity. All of the 20 nights when nocturnal radar surveys were conducted were classified as heavy to moderate activity.

In general, the NEXRAD analysis indicates the seasonal migration period was adequately sampled and that nights of sampling with on-site radar occurred during periods of heavy to moderate activity (Table 2-1). This activity is likely representative of the timeframe when majority of migrants are active and is representative of migration during peak season.

Table 2-1. Summary of NEXRAD compared with on-site radar data collection for Kibby Expansion– Fall 2009

Migration Activity Category	Number of nights (NEXRAD)	Percent of Migration Nights	Number of nights with on-site radar	Percent of on-site radar data set
Rain	5	8%	0	0%
Light	12	19%	0	0%
Moderate to heavy	45	73%	20	100%

2.4.5 Weather Data

Mean nightly wind speeds in the Project area during the nights when radar surveys were conducted varied between 0.7 and 17 meters per second (m/s). Mean nightly temperatures varied between 5ºC and 23ºC. There were no noticeable relationships between wind speed or temperature and nightly passage rates or flight heights.

2.4.6 Night Vision and Ceilometer Data

Night-vision data was collected during the first seven nights of the radar survey and yielded a total of 51 5-minute observations. Although insects were frequently observed during each observation period, no bird or bat targets were observed. After consultation with MDIFW, surveys were discontinued for the remainder of the survey period because no targets were observed during both the spring survey and the first seven nights of the fall radar survey.

2.5 DISCUSSION

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

Passage rates varied greatly between nights throughout the survey period (August 31 to October 10) indicating migration occurred in pulses, with rates of migration likely influenced by weather patterns and conditions from night to night. In comparison, flight heights remained fairly consistent throughout the survey period, with most mean hourly flight heights documented between 200 m and 400 m above the radar location. The mostly southwesterly flight direction observed is expected during fall migration and is comparable to most publicly available radar survey results in the northeast. The results of the NEXRAD analysis, which used radar data from the typical fall migration season surrounding the Portland International Airport to qualitatively assess regional migration activity, indicated that radar surveys conducted in the Project area occurred entirely during nights of moderate to heavy migration activity in the region and there were no substantial gaps in the sampling of data.

Overall the results of the fall 2009 survey were similar to the results of the spring 2009 surveys conducted in the same location (Table 2-2). The overall mean flight height for the fall was slightly lower than the spring; however the range in flight heights between the two seasons were very similar. The season mean passage rate documented during the fall was over twice that of spring which, can be expected due to recruitment of that years young into the migrating population. In addition, based on the results of radar surveys conducted at other wind projects in the northeast it is common for the fall passage rate to be greater than the spring seasons passage rate.

Table 2-2. Summary of spring and fall radar survey results at the Kibby Expansion Wind Power Project					
Survey Site (year)	**Passage Rate (t/km/hr)**		**Flight height (m)**		**Direction (º)**
	Range	**Mean**	**Range**	**Mean**	**Mean**
Spring 2009	50-452	207	167-494	293	27
Fall 2009	44-1067	458	197-514	201	206

The results of the fall 2009 survey at Kibby Expansion were also similar to preconstruction radar studies conducted during the fall 2005 migration period at the Kibby Wind Project (Woodlot 2006), which recently began operation. Sisk Mountain is approximately 2.6 miles west of Kibby Range (Table 2-3).

Table 2-3. Comparison of fall radar survey results between Kibby Wind (2005) and Kibby Expansion (2009)					
Survey Site (year)	**Passage Rate (t/km/hr)**		**Flight height (m)**		**Direction (º)**
	Range	**Mean**	**Range**	**Mean**	**Mean**
Kibby Mountain (2005)	109-1107	565	205-472	370	167
Kibby Range (2005)	7 - 783	201	134 - 492	352	196
Kibby Expansion Wind Power Project (2009)	**44-1067**	**458**	**197-514**	**201**	**206**

Data from regional surveys using similar methods and equipment conducted within the last several years are rapidly becoming available. These other studies provide an opportunity to compare the results from this Project to other projects in Maine and the region. However, it is important to note that there are limitations in comparing data from previous years with data from 2009, as year-to-year variation in continental bird populations may influence how many birds migrate through an area. Additionally, differences in site characteristics, particularly the topography, local landscape conditions, and vegetation surrounding a radar survey location, can play a large role in any radar's ability to detect targets by limiting its view of the surrounding airspace and the subsequent calculation of passage rate. These differences should be recognized as one of the most significant limiting factors in making direct site-to-site comparisons of passage rates. In comparison, there is a relatively consistent pattern in flight altitude, with most birds appearing to fly at altitudes of 300 to 600 meters or more above the ground. Regardless of potential differences between radar survey locations, the results at the Project are within the typical range of results at projects on forested ridges in the northeast (Appendix A, Table 5).

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).

Some research suggests that bird migration may be affected by landscape features, such as coastlines, large river valleys, and mountain ranges. This has been documented for diurnally migrating birds, such as raptors, but is not as well established for nocturnally migrating birds (Sielman *et al*. 1981; Bingman 1980; Bingman *et al*. 1982; Bruderer and Jenni 1990; Richardson 1998; Fortin *et al*. 1999; Williams *et al.* 2001; Diehl *et al*. 2003). Those studies that suggest night-migrating birds are influenced by topography (and are concentrated to those features) typically have been conducted in areas of steep and abrupt topography, such as the most rugged areas of the northern Appalachians and the Alps. However, other studies in the northeast have not documented this type of concentration and no evidence of target concentration was observed in the spring 2009 survey. Targets were observed in most areas of the radar detection range and were evenly distributed in the visible areas of the radar, indicating that concentration to any one part of the Project area was not occurring.

3.0 Acoustic Bat Survey

3.1 INTRODUCTION

Acoustic bat surveys have been conducted at most proposed wind projects in Maine in recent years, and were conducted at this Project area based on discussions with TransCanada, TRC, MDIFW, and USFWS. Specific methods followed those used in pre-construction studies conducted at the existing Kibby wind project nearby. Acoustic bat surveys provide information on seasonal and nightly activity patterns and species composition of resident and migratory bats within the Project area, which can be helpful in identifying potential impacts to bats during construction and operation of the Project.

Eight species of bats occur in Maine, based upon their normal geographical range. These are the little brown bat (Myotis lucifugus), northern long-eared bat, (M. septentrionalis), eastern small-footed bat (M. leibii), silver-haired bat (Lasionycteris noctivagans), tri-colored bat (Perimyotis subflavus), big brown bat (Eptesicus fuscus), eastern red bat (Lasiurus borealis), and hoary bat (L. cinereus) (Whitaker and Hamilton 1998). The proposed Project, located in the western mountains of Maine, is within the theoretical range of all species in the state. Stantec is unaware of any significant bat hibernacula in this area, although little information exists on locations of bat hibernacula in Maine. The timing and methods of surveys for this Project focused on documentation of migratory bat activity, which is likely greatest in the late summer and early fall based on results from similar surveys conducted in the region.

3.2 SURVEY DESIGN

3.2.1 Data Collection Methods

Anabat survey equipment (Titley Electronics Pty Ltd.) was used for the duration of the fall 2009 acoustic bat survey. Each Anabat detector was coupled with CF Storage ZCAIM (Titley Electronics Pty Ltd.), which programmed the on/off times and stored data on removable 1 GB compact flash cards. Anabat detectors are frequency division detectors, dividing the frequency of ultrasonic calls made by bats by a factor of 16 so that they are audible to humans, which record the bat calls for subsequent analysis. Anabat detectors were selected based upon their widespread use for this type of survey, their ability to be deployed for long periods of time, and their ability to detect a broad frequency range, which allows detection of all species of bats that could occur in the Project area.

Three bat detectors were deployed in the Project area for the majority of the survey period. Two detectors (North Tower and South Tower), deployed in mid August, were mounted on the top of portable towers (Photo 1), which positioned the detectors at a height of approximately 20 meters above ground level, or about 5 meters above the top of the surrounding forest canopy. A third detector (Radar Tree), also deployed in mid August, was deployed at a height of approximately

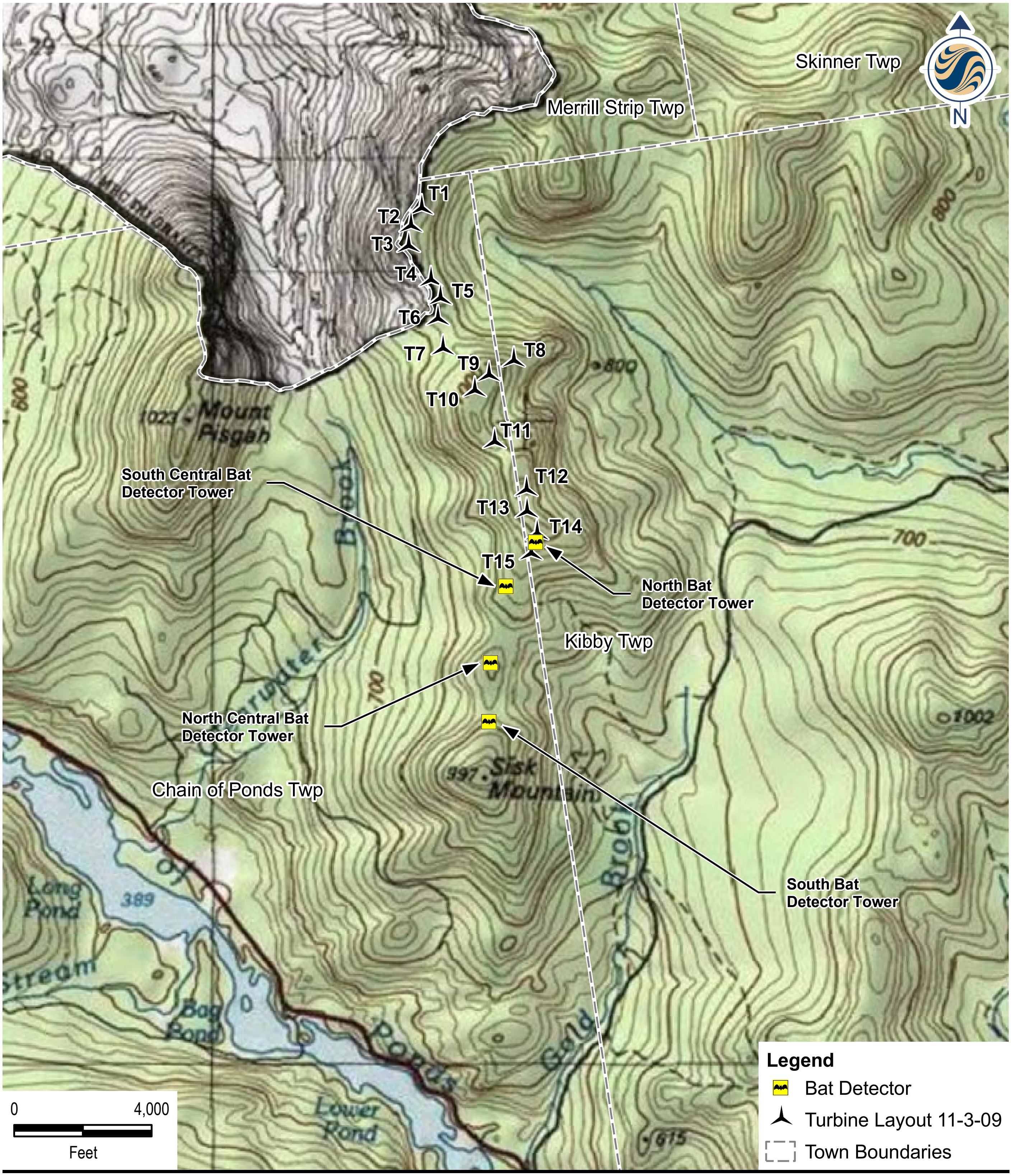
1.5 m along the edge of the small clearing in which Stantec's radar monitoring equipment was located and was positioned over a small bluff overlooking dense regenerating balsam fir.

Photo 1: Portable Tower Bat Detector

The fourth detector (Met High) was deployed in late September, soon after installation of a met tower (Photo 2). This detector was suspended from the guy wires of the met tower at a height of approximately 45 meters.

Photo 2: Met Tower Bat Detector

Figure 3-1 shows the locations of the four detectors, with names referenced in this report. Detectors were programmed to sample on a nightly basis beginning at least 30 minutes prior to sunset (17:00 to 19:00) and ending at least 30 minutes after sunrise (06:00-08:00) with start/stop times adjusted throughout the monitoring period.



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Client/Project

Sisk Mountain Wind Project
Chain of Ponds Township, Maine

Figure No.
3-1

Title
Bat Detector Location Map
November 3, 2009

00482-F003-Bat-Detector.mxd

3.2.2 Data Analysis Methods

Ultrasound recordings of bat echolocation may be broken into recordings of a single bat call or recordings of bat call sequences. A call is a single pulse of sound produced by a bat, while a call sequence is a combination of two or more pulses recorded in an Anabat file. Recordings containing less than two calls were eliminated from analysis as has been done in similar studies (Arnett *et al*. 2006a, 2006b).

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 Maine bats. This software screens all data recorded by the bat detector and extracts call files using a filter. Using the default settings for this initial screen also ensures comparability between data sets. Settings used by the filter include a max TBC (time between calls) of 5 seconds, a minimum line length of 5 milliseconds, and a smoothing factor of 50. The smoothing factor refers to whether or not adjacent pixels can be connected with a smooth line. The higher the smoothing factor, the less restrictive the filter is and the more noise files and poor quality call sequences are retained within the data set.

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

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

Bat call sequences were individually marked and categorized by species group, or “guild” based on visual comparison to reference calls. Qualitative visual comparison of recorded call sequences of sufficient length to reference libraries of bat calls allows for relatively accurate identification of bat species (O’Farrell *et al*. 1999, O’Farrell and Gannon 1999). Call sequences were classified to species whenever possible, based on criteria developed from review of reference calls collected by Chris Corben, the developer of the Anabat system, as well as other bat researchers. However, due to similarity of call signatures between several species, all classified calls have been categorized into five guilds[3] reflecting the bat community in the region of the Project area and is as follows:

- **Unknown (UNKN)** – All call sequences with less than five calls, or poor quality sequences (those with indistinct call characteristics or background static). These sequences were further identified as either "high frequency unknown" (HFUN) for sequences with a minimum frequency above 30 to 35 kHz, or "low frequency unknown" (LFUN) for sequences with a minimum frequency below 30 to 35 kHz.

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

- **Eastern red bat/tri-colored bat[4] (RBTB)** – Eastern red bats and tri-colored bats. These two species can produce calls distinctive only to each species. However, significant overlap in the call pulse shape, frequency range, and slope can also occur.

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

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

This method of guild identification represents a conservative approach to bat call identification. Since some species sometimes produce calls unique only to that species, all calls were identified to the lowest possible taxonomic level before being grouped into the listed guilds. Tables and figures in the body of this report will reflect those guilds. However, since species-specific identification did occur in some cases, each guild will also be briefly discussed with respect to potential species composition of recorded call sequences.

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

3.2.2.1 Weather Data

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

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

Data from a meteorological tower on nearby Kibby Mountain were obtained and used for assessing relationships between bat activity levels and wind speed, temperature, barometric pressure. Data from 10-minute intervals were obtained and summarized to derive nightly means, summarized between 1800 and 0800 for each night. Daily mean rainfall data were obtained from a weather station in Strong Maine, with data downloaded from Weather Underground.

3.3 RESULTS

3.3.1 Detector Call Analysis

Detectors were deployed beginning August 11 and continued to record data through October 15, for a total survey period of 208 potential detector nights (Table 3-1). The range of dates that each detector was deployed is summarized in Table 3-1. Detectors operated properly on all but 4 detector-nights, resulting 204 detector-nights of data and a 98% detector success rate. During this survey period, 94 bat call sequences were recorded, resulting in an overall call rate of 0.5 call sequences per detector-night (Table 3-1).

Table 3-1. Summary of bat detector field survey effort and results at the Sisk Mountain Wind Project, Fall 2009

Location	Dates Deployed	Calendar Nights	Detector-Nights*	Recorded Sequences	Detection Rate **	Maximum Sequences recorded ***
North Tower	8/12 to 10/14	64	60	32	0.5	3
Radar Tree	8/11 to 10/15	66	66	40	0.6	7
South Tower	8/13 to 10/13	62	62	22	0.4	4
Met High	9/29 to 10/14	16	16	0	0.0	0
Overall Results		***208***	***204***	***94***	***0.5***	--

* 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.

Activity levels were roughly similar between the three detectors deployed in August, with 32 sequences recorded at the North Tower, 40 at the Radar Tree, and 22 at the South Tower. No call sequences were recorded at the Met High detector, which was not deployed until late September (Table 3-2). At all three detectors where bat activity was documented, activity levels were highest in August, declined in September, and either remained level or declined further in October (Table 3-2; Figure 3-2). Nightly activity levels ranged from 0-7 call sequences per night, with no more than 7 call sequences detected at any site during the survey (Figures 3-3 and 3-4). Appendix B contains tables detailing the nightly acoustic bat activity and weather data for each night of surveys.

Table 3-2. Monthly summary of Fall 2009 acoustic bat survey results at the Sisk Mountain Wind Project						
Detector / Month	**Dates**	**Calendar Nights**	**Detector-Nights***	**Recorded Sequences**	**Detection Rate ****	**Maximum Sequences recorded *****
North Tower						
August	August 12-31	20	20	21	1.1	3
September	September 1-30	30	27	10	0.4	2
October	October 1-14	14	13	1	0.1	1
Radar Tree						
August	August 11-31	21	21	26	1.2	7
September	September 1-30	30	30	13	0.4	4
October	October 1-15	15	15	1	0.1	1
South Tower						
August	August 13-31	19	19	13	0.7	3
September	September 1-30	30	30	7	0.2	4
October	October 1-13	13	13	2	0.2	1
Met High						
September	September 29-30	2	2	0	0.0	0
October	October 1-14	14	14	0	0.0	0
Overall Results		**208**	**204**	**94**	**0.5**	--
* 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.						

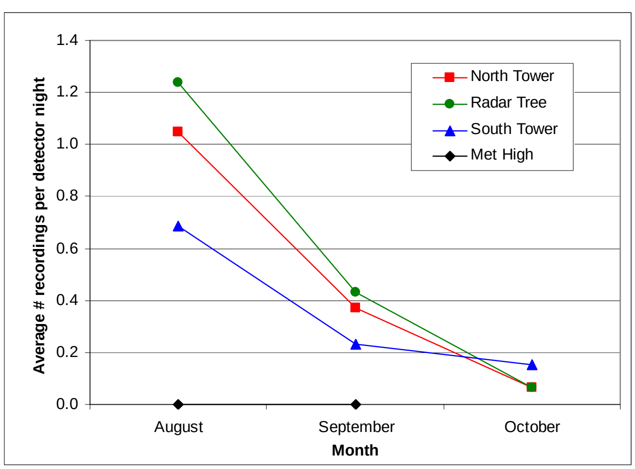

Figure 3-2. Seasonal trends in bat activity levels during fall 2009 surveys at Sisk Mountain

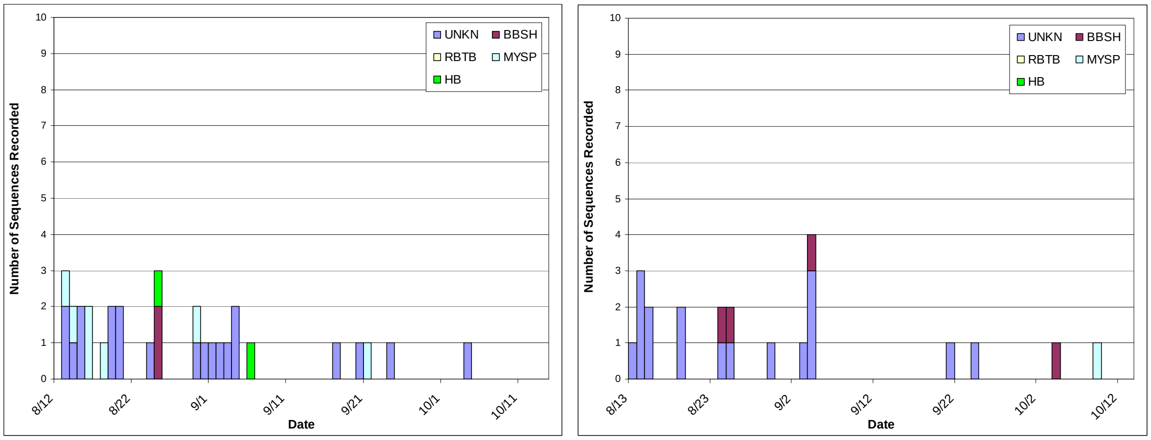

Figure 3-3. Nightly bat activity levels by guild at the North Tower (left) and South Tower (right) bat detectors, August through October, 2009. UNKN (*unknown guild*); RBTB (*red bat/tri-colored bat*); BBSH (*big brown/silver haired*); HB (*hoary bat*); MYSP (*myotis*).

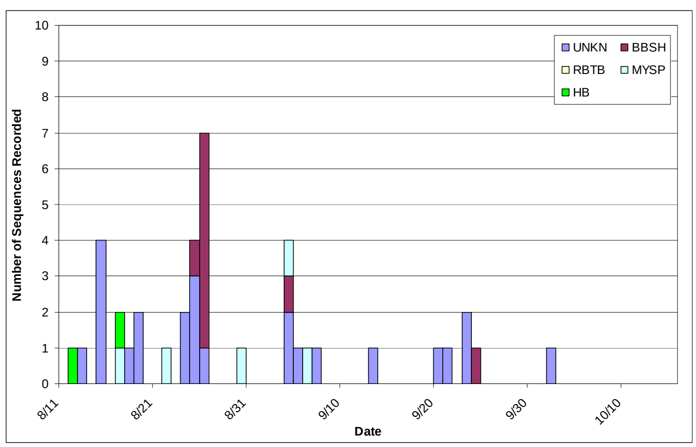

Figure 3-4. Nightly bat activity levels by guild at the Radar Tree detector, August through October, 2009. UNKN (*unknown guild*); RBTB (*red bat/tri-colored bat*); BBSH (*big brown/silver haired*); HB (*hoary bat*); MYSP (*myotis*).

Of the 94 recorded call sequences, 62 (66.0%) were classified as UNKN, 15 (16.0%) were classified as BBSH, 13 (13.8%) were classified as MYSP, and 4 (4.3%) were classified as HB. No RBTB calls were identified (Table 3-3). Within the UNKN category, most call sequences were identified as HFUN, and were likely calls of *Myotis* sp. bat, the only genus of bats identified during fall surveys within the HFUN range. Species composition of recorded bat calls was similar between detectors, with UNKN calls comprising the majority at all three detectors that recorded bat activity (Figure 3-5).

Table 3-3. Distriubtion of detections by guild for detectors at the Sisk Mountain Wind Project, Fall 2009						
Detector	**Guild**					**Total**
	BBSH	**HB**	**MYSP**	**RBTB**	**UNKN**	
North Tower	2	2	7	0	21	32
Radar Tree	9	2	5	0	24	40
South Tower	4	0	1	0	17	22
Met High	0	0	0	0	0	0
Total	**15**	**4**	**13**	**0**	**62**	**94**
Guild Composition %	**16.0%**	**4.3%**	**13.8%**	**0.0%**	**66.0%**	

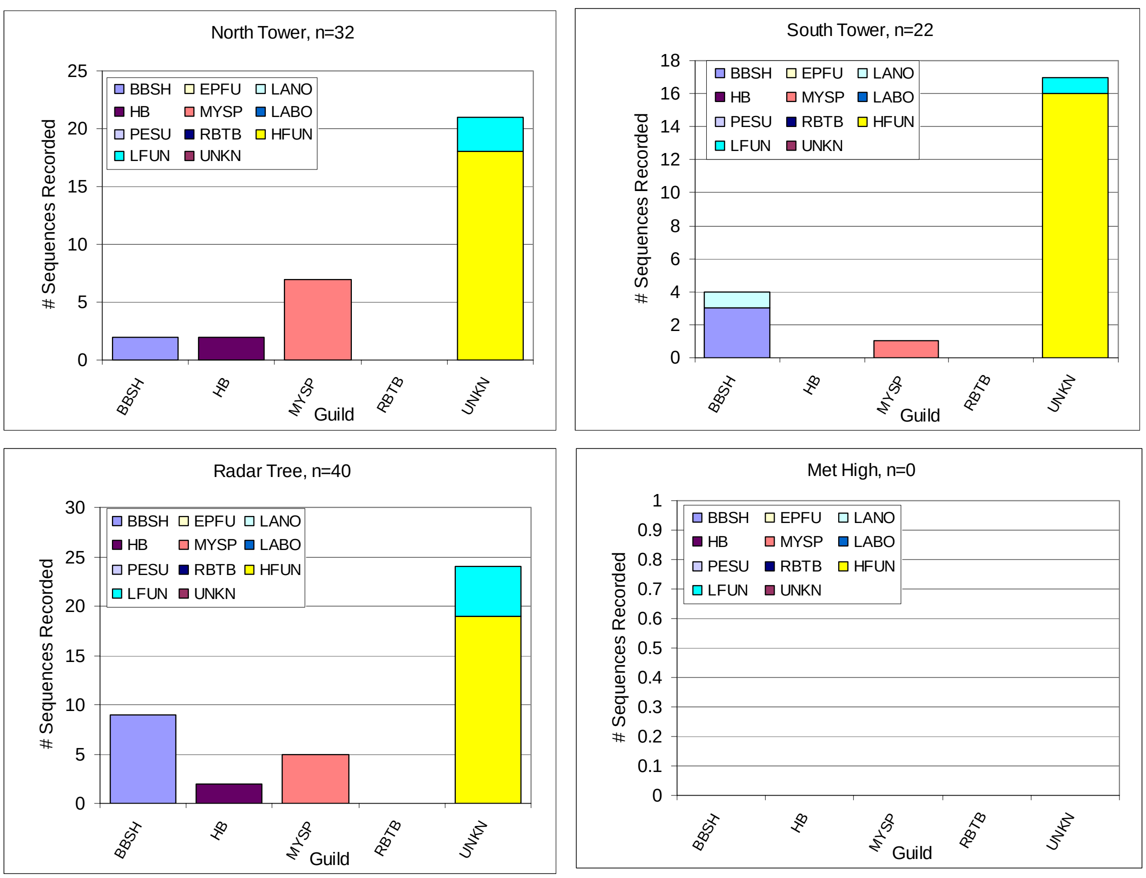

Figure 3-5. Guild and species composition of recorded bat call sequences at Sisk detectors from August through October, 2009. UNKN (*unknown guild*); RBTB (*red bat/tri-colored bat*); BBSH (*big brown/silver haired*); HB (*hoary bat*); MYSP (*myotis*).

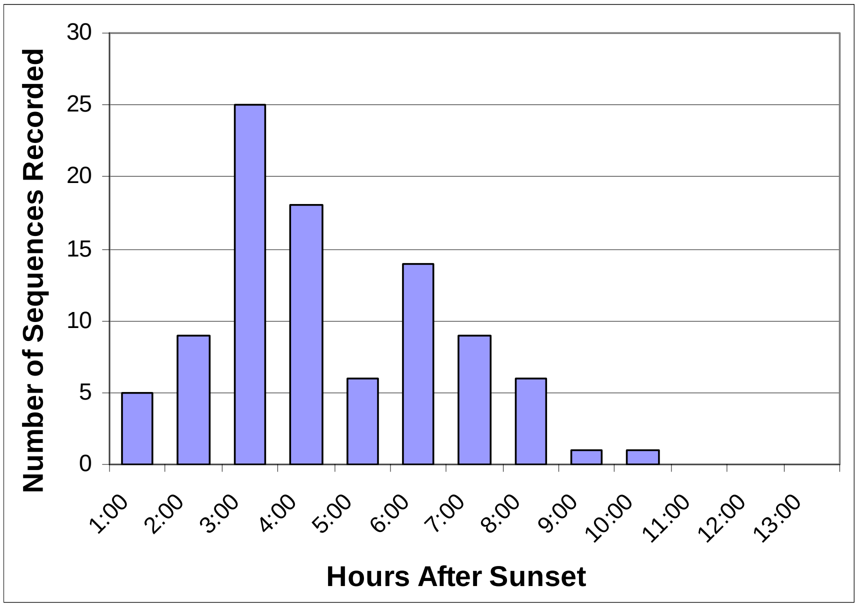

Figure 3-6. Overall timing of bat activity detected at Sisk Mountain, August through October, 2009

Due to the relatively small number of recorded call sequences, hourly timing was calculated for all data combined. Acoustic bat activity was documented during all hours between the first and tenth hours past sunset (Figure 3-6). Peak bat activity was recorded between 3 and 4 hours past sunset. Stantec has archived digital copies of all recorded acoustic call sequences, and can provide a copy of these files, including all information about species identification and timing of calls from each detector on an hourly and nightly basis, should that information be desired.

3.3.2 Weather Data

Mean nightly wind speeds from the met tower at the operational Kibby Wind Project from mid August through mid October ranged from between 3.7 and 29.5 meters per second (m/s) (Figure 3-7). Mean nightly temperatures ranged from a high of 21.9º C in mid August to a low of -6.0º C in mid October, with an overall mean of 10.0ºC (Figure 3-8). A total of 22.25 cm of rain fell during the survey period, according to weather data from Strong, Maine. The maximum daily rainfall was 3.89 cm on August 11, although rainfall amounts were generally highest between late September and mid October (Figure 3-9).

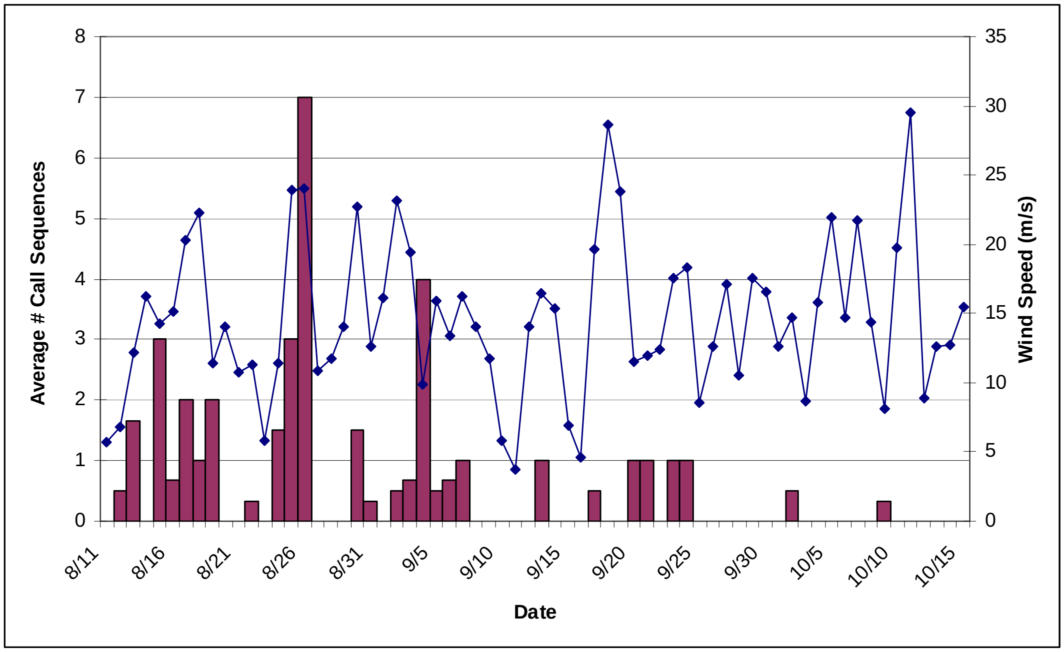

Figure 3-7. Nightly mean wind speed (m/s) (blue line) and bat call detections (columns)

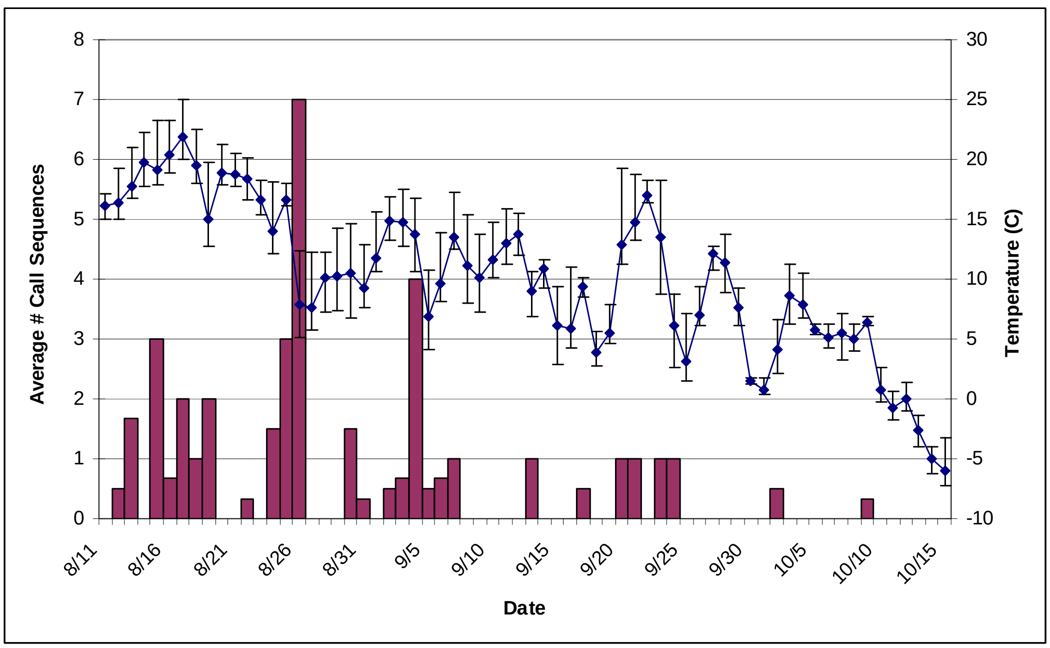

Figure 3-8. Nightly mean temperature (Celsius) (blue line) and bat detections (columns). Error bars represent nightly minimum and maximum temperature.

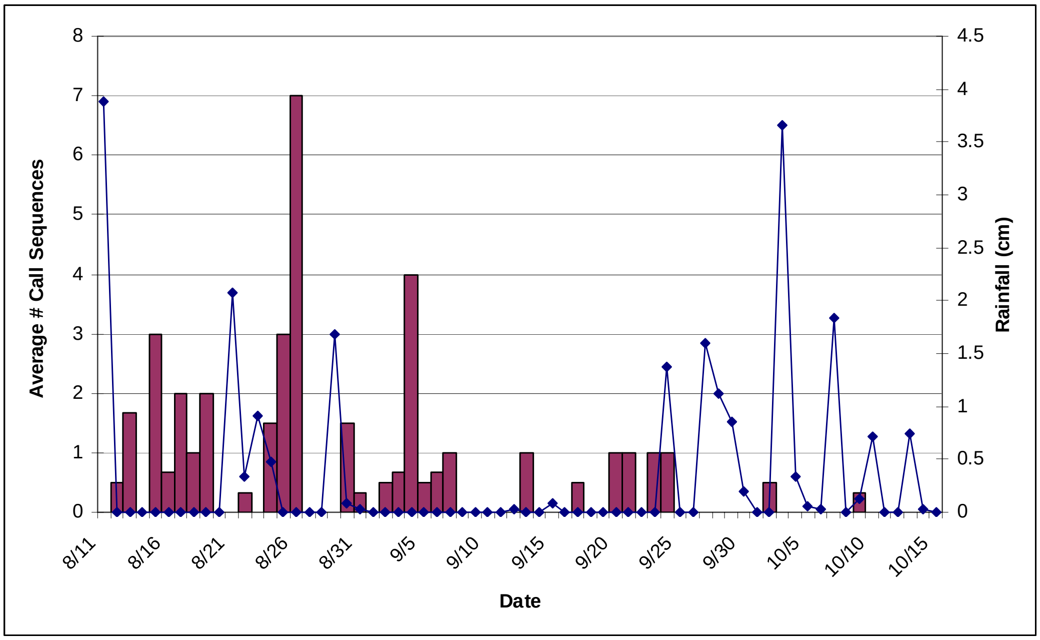

Figure 3-9. Nightly daily rainfall (cm) (blue line) and bat detections (columns)

3.4 DISCUSSION

Summer and fall acoustic bat echolocation surveys at Sisk Mountain documented relatively low levels of bat activity despite the fact that surveys were conducted during a time of year when bat activity would be expected to be highest. Activity levels were similar between three detectors distributed along 1.2 km of the Project area's ridgeline habitat. While activity levels were highest in August and declined through October, no more than seven call sequences were recorded at an individual detector on any night, monthly activity levels did not exceed 2 calls per detector night at any detector, and no detector recorded more than 7 call sequences on any night, including a detector mounted near ground level on the edge of a clearing. Microhabitat surrounding detectors and detector placement can influence the amount of acoustic activity recorded, complicating direct comparison of acoustic bat data between sites, although uniformly low activity levels were recorded during summer and fall acoustic surveys at Sisk Mountain. The fact that no bat activity was documented at the Met High detector was likely a result of the late deployment of this detector, which was installed soon after erection of the met tower.

Bat calls were identified to guild within this report, although calls were provisionally categorized by species when possible during analysis. Certain species, such as the eastern red bat and hoary bat have easily identifiable calls, whereas other species, such as the big brown bat and silver-haired bat are difficult to distinguish acoustically. Similarly, certain members of the Myotis genus, such as the little brown bat are far more common and have slightly more distinguishable calls than other species. The following paragraphs discuss each guild separately and address likely species composition of recorded bats within each guild.

The MYSP guild includes the three species of *Myotis* potentially occurring in the Project area (the little brown bat, northern long-eared bat, and eastern small-footed bat). Of these species, the little brown bat and northern long-eared bat are by far the most common in Maine, although acoustic data recorded during summer and fall surveys did not provide a sufficient number of high quality calls to attempt differentiation between species. Eastern small-footed bats have a limited range in Maine, and while theoretically could be present in the Project area, are expected to be far less common.

The RBTB guild includes the tri-colored bat and eastern red bat. Eastern red bats have relatively unique calls which span a wide range of frequency and have a characteristic hooked shape and variable minimum frequency. Tri-colored bats (formerly called eastern pipistrelles) tend to have relatively uniform calls, with a constant minimum frequency and a sharply curved profile. Neither of these species was detected during summer and fall surveys at the Project area, although both could occur in the area. Eastern red bats, in particular, likely migrate through the region during fall, although did not apparently do so in large numbers during the 2009 survey period as they were not detected.

The BBSH guild includes the big brown bat and silver-haired bat, both of which produce search-phase calls with minimum frequencies in the 25-30 kHz range. Certain types of calls by each species are easily distinguishable from the other based on minimum frequency and call profile, but other calls in this range have overlapping characteristics and are difficult to distinguish. Call sequences recorded at Sisk Mountain were not of sufficient length or quality to distinguish between these two species, although both species are likely present in the Project area. Whereas the big brown bat would be expected to occur in the Project area throughout the summer and fall, the silver-haired bat is a long-distance migratory species and would likely be present particularly during the fall migration period.

The HB guild consists of the hoary bat, the largest bat species in the northeast. Hoary bat calls are generally distinguishable from all other species in the region and are characterized by highly variable minimum frequencies often extending below 20 kHz, and a hooked profile similar to the eastern red bat. A total of 4 HB call sequences were identified during summer and fall surveys at Sisk Mountain, 2 at the North Tower, and 2 at the Radar Tree. Like silver-haired and eastern red bats, hoary bats are long-distance migrants and tend to be detected most frequently in this region during the fall migration period.

Whereas acoustic survey results are typically analyzed to determine potential correlations between activity levels and detector height or weather parameters, the small number of call sequences detected in over 200 detector-nights of monitoring was insufficient to conduct quantitative analyses. The decline in bat activity levels between August and October followed a general trend of cooling temperatures and matches patterns observed during most acoustic surveys. While bats continue to remain active through the late fall when temperatures are sufficiently warm, peaks in activity commonly observed between mid August and mid September are less frequent in late fall.

The results of the fall 2009 survey at Kibby Expansion were similar to the results of the preconstruction acoustic detector studies conducted during the fall 2006 period at the Kibby

Wind Project (Woodlot 2006), which recently began operation. Sisk Mountain is approximately 2.6 miles west of Kibby Range. Although detectors were operational for more nights in 2009 than during fall 2006, the overall detection rate at all detectors was less than 0.6 calls/detector night during both years.

Results of acoustic surveys must be interpreted with caution. In particular, low activity levels documented during one season of surveys do not necessarily indicate that activity levels are similarly low in different seasons or in different years, or that bats are not at risk of collision mortality following construction of a wind project. Also, detection rates are not necessarily correlated with the actual numbers of bats in an area, because it is not possible to differentiate between individual bats (Hayes 2000). Nevertheless, the low levels of acoustic activity documented during these surveys do suggest low use of the Project area by bats during the season sampled.

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Appendix A

Radar survey results

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Appendix A Table 1. Survey dates, results, level of effort, and weather - Fall 2009								
Date	**Passage rate**	**Flight Direction**	**Flight Height (m)**	**% below 125 m**	**Hours of Survey**	**Temperature (C)**	**Wind Speed (m/s)**	**Wind Direction (degrees)**
8/31/2009	399	156	313	16%	9.5	9.3	12.6	227
9/1/2009	54	112	301	11%	10.5	11.8	16.2	193
9/2/2009	70	107	243	14%	11	14.8	23.2	199
9/3/2009	44	102	228	22%	9.5	14.8	19.4	200
9/8/2009	661	201	276	19%	10	11.2	14.1	315
9/9/2009	565	247	231	31%	13	10.1	11.7	42
9/10/2009	612	235	287	23%	11	11.6	5.8	143
9/14/2009	224	95	250	26%	8	10.9	15.4	204
9/15/2009	989	203	227	24%	7	6.2	6.9	325
9/16/2009	756	239	335	20%	9	5.8	4.6	200
9/17/2009	662	108	241	32%	8	9.4	19.6	182
9/21/2009	1067	300	253	32%	13	14.7	11.9	149
9/22/2009	397	68	204	33%	12.5	17.0	12.4	152
9/24/2009	528	146	360	14%	8.5	6.1	18.3	241
10/1/2009	143	148	514	15%	9	0.7	12.6	181
10/2/2009	650	252	244	49%	12	4.1	14.7	89
10/5/2009	239	103	236	41%	10.5	5.8	22.0	202
10/6/2009	669	222	197	35%	12	5.2	14.7	107
10/8/2009	280	137	425	19%	12.5	5.0	14.4	188
10/10/2009	324	159	366	14%	13	0.8	19.7	193
Entire Season	**458**	**206**	**287**	**23%**	**210**			

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

Night of	Passage Rate (targets/km/hr) by hour after sunset													Entire Night			
	1	2	3	4	5	6	7	8	9	10	11	12	13	Mean	Median	Stdev	SE
8/31/2009	N/A	764	767	532	296	379	396	325	196	287	43	N/A	N/A	399	352	232	73
9/1/2009	56	143	82	32	18	77	29	39	34	73	11	N/A	N/A	54	39	38	11
9/2/2009	50	132	64	107	107	50	29	68	68	100	0	N/A	N/A	70	68	39	12
9/3/2009	96	64	50	54	54	46	32	25	21	39	0	N/A	N/A	44	46	25	8
9/8/2009	467	846	996	1364	964	810	660	486	433	414	254	236	N/A	661	573	342	99
9/9/2009	289	736	679	675	771	811	886	539	400	304	121	N/A	N/A	565	675	251	76
9/10/2009	518	814	993	793	846	675	682	525	386	511	554	43	N/A	612	614	250	72
9/14/2009	N/A	739	500	211	121	121	99	68	57	118	207	N/A	N/A	224	121	222	70
9/15/2009	639	1282	1389	1336	1121	568	587	N/A	N/A	N/A	N/A	N/A	N/A	989	1121	375	142
9/16/2009	346	1307	1043	732	846	818	714	554	439	N/A	N/A	N/A	N/A	756	732	298	99
9/17/2009	611	1132	857	686	550	582	504	375	N/A	N/A	N/A	N/A	N/A	662	596	236	83
9/21/2009	1189	1732	1657	1854	1861	1539	718	618	464	571	471	129	N/A	1067	954	636	184
9/22/2009	729	832	796	543	496	207	93	89	136	114	196	536	N/A	397	352	289	84
9/24/2009	846	1121	1021	1121	800	N/A	N/A	86	79	79	57	64	N/A	528	443	490	155
10/1/2009	43	182	186	150	246	132	125	79	N/A	N/A	N/A	N/A	N/A	143	141	64	23
10/2/2009	325	789	1514	1468	1432	1200	975	496	200	0	18	36	0	650	496	606	168
10/5/2009	96	204	186	182	493	332	264	150	286	411	157	214	129	239	204	116	32
10/6/2009	579	629	611	350	436	443	1000	996	657	1157	504	N/A	N/A	669	611	265	80
10/8/2009	289	482	386	318	489	611	268	339	171	114	111	50	16	280	289	183	51
10/10/2009	307	761	914	525	493	418	232	164	75	168	50	57	54	324	232	282	78
Entire Season	**415**	**735**	**735**	**652**	**622**	**517**	**436**	**317**	**241**	**279**	**172**	**152**	**50**	**458**	**375**	**415**	**28**

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

Appendix A Table 3. Mean Nightly Flight Direction		
Night of	**Mean Flight Direction**	**Circular Stdev**
8/31/2009	156	38
9/1/2009	112	68
9/2/2009	107	65
9/3/2009	102	71
9/8/2009	201	36
9/9/2009	247	30
9/10/2009	235	98
9/14/2009	95	31
9/15/2009	203	38
9/16/2009	239	43
9/17/2009	108	61
9/21/2009	300	65
9/22/2009	68	54
9/24/2009	146	35
10/1/2009	148	49
10/2/2009	252	29
10/5/2009	103	34
10/6/2009	222	67
10/8/2009	137	56
10/10/2009	159	35
Entire Season	206	84

Appendix A Table 4. Summary of mean flight heights by hour, night, and for entire season.																	
Night of	**Mean Flight Height (m) by hour after sunset**									**Entire Night**							**% of targets below 125 meters**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Mean**	**Median**	**STDV**	**SE**
8/31/2009	--	--	421	357	383	324	281	260	241	210	337	N/A	N/A	313	324	70	23	16%
9/1/2009	269	307	310	344	390	307	327	321	286	267	185	N/A	N/A	301	307	52	16	11%
9/2/2009	206	272	265	228	262	232	246	352	324	221	68	N/A	N/A	243	246	73	22	14%
9/3/2009	267	228	186	193	177	202	304	230	263	N/A	N/A	N/A	N/A	228	228	43	14	22%
9/8/2009	359	296	341	247	N/A	273	271	275	236	235	231	--	N/A	276	272	44	14	19%
9/9/2009	248	270	241	235	210	204	202	210	268	227	224	--	N/A	231	227	24	7	31%
9/10/2009	247	319	352	348	336	297	290	298	254	234	178	--	N/A	287	297	54	16	23%
9/14/2009	--	257	288	282	252	284	265	202	297	139	240	N/A	N/A	250	261	48	15	26%
9/15/2009	277	298	313	210	163	153	173	N/A	N/A	N/A	N/A	N/A	N/A	227	210	68	26	24%
9/16/2009	238	398	340	325	314	317	374	339	373	N/A	N/A	N/A	N/A	335	339	47	16	20%
9/17/2009	221	260	257	258	266	222	208	236	N/A	N/A	N/A	N/A	N/A	241	247	22	8	32%
9/21/2009	227	268	264	260	254	301	284	269	235	198	223	--	N/A	253	260	30	9	32%
9/22/2009	224	201	220	180	200	214	286	203	197	204	217	N/A	N/A	204	204	42	12	33%
9/24/2009	280	375	341	378	334	N/A	N/A	N/A	146	569	460	N/A	N/A	360	358	124	44	14%
10/1/2009	11	432	609	573	558	602	844	484	N/A	N/A	N/A	N/A	N/A	514	566	237	84	15%
10/2/2009	242	361	281	249	178	118	101	104	105	--	451	500	--	244	242	143	43	49%
10/5/2009	261	162	149	289	349	206	511	298	217	146	80	170	--	236	211	115	33	41%
10/6/2009	123	206	286	296	279	275	204	150	85	64	N/A	N/A	N/A	197	205	87	28	35%
10/8/2009	98	471	668	764	773	479	449	376	429	329	308	278	100	425	429	216	60	19%
10/10/2009	290	320	321	433	530	510	398	323	256	320	375	316	N/A	366	322	86	25	14%
Averages for Entire Season	227	300	323	322	327	291	317	274	248	240	255	272	100	287	268	122	9	23%

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

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

Year	Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Reference
Spring 2005										
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
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	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.
2005	Dans Mountain, 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.
2005	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										

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

Year	Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Reference
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.
2006	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.
2006	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.
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.
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.
2006	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.
2006	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.
2006	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.
2006	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.
2006	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										
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.
2007	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.

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

Year	Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Reference
2007	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
2007	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.
2007	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.
2007	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.
2007	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.
2007	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										
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.
2008	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
2008	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.
2008	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.
2008	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.
Fall 2004										
2004	Sheffield, Caledonia Cty, VT	18	176	Forested ridge	91	19-320	200	566	(125 m) 1%	Woodlot Alternatives, Inc. 2006. Avian and Bat Information Summary and Risk Assessment for the Proposed Sheffield Wind Power Project in Sheffield, Vermont. Prepared for UPC Wind Management, LLC.
2004	Casselman, 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

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

Year	Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Reference
2004	Dans Mountain, 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.
2004	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.
2004	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										
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
2005	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
2005	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
2005	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
2005	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.
2005	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
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
2005	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.
2005	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
2005	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

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

Year	Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Reference
2005	Kibby, Franklin Cty, ME (Range 1)	12	101	Forested ridge	201	12-783	196	352	(125 m) 12%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
2005	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
2005	Stamford, Delaware Cty, NY	48	418	Forested ridge	315	22-784	251	494	(110 m) 3%	Woodlot Alternatives, Inc. 2007. A Spring and Fall 2005 Radar and Acoustic Survey of Bird Migration at the Proposed Moresville Energy Center in Stamford and Roxbury, New York. Prepared for Invenergy, LLC. Rockville, MD.
2005	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.
2005	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
2005	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.
2005	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.
2005	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
2005	Kibby, Franklin Cty, ME (Valley)	5	13	Forested ridge	452	52-995	193	391	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
2005	Mars Hill, Aroostook Cty, ME	18	117	Forested ridge	512	60-1092	228	424	(120 m) 8%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird Migration at the Mars Hill Wind Farm in Mars Hill, Maine. Prepared for Evergreen Windpower, LLC.
2005	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.
2005	Deerfield, Bennington Cty, VT	32	324	Forested ridge	559	3-1736	221	395	(100 m) 13%	Woodlot Alternatives, Inc. 2006. Fall 2005 Bird and Bat Migration Surveys at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy, Inc.
2005	Kibby, Franklin Cty, ME (Mountain)	12	115	Forested ridge	565	109-1107	167	370	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.

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

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2005	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.
2005	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										
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.
2006	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
2006	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
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
2006	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
2006	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
2006	Stetson, Washington Cty, ME	12	77	Forested ridge	476	131-1192	227	378	(125 m) 13%	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Stetson Wind Project, Washington County, Maine. Prepared for Evergreen Wind V, LLC.
2006	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
2006	Lempster, Sullivan Cty, NH	32	290	Forested ridge	620	133-1609	206	387	(125 m) 8%	Woodlot Alternatives, Inc. 2007. A Fall 2007 Survey of Nocturnal Bird Migration,Breeding Birds, and Bicknell's Thrush at the Proposed Lempster Mountain Wind Power Project Lempster, New Hampshire. Prepared for Lempster Wind, LLC.
2006	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										
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

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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.
2007	Errol, Coos County, NH	29	232	Forested ridge	366	54 to 1234	223	343	(125 m) 15%	Stantec Consulting Inc. 2007. Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Windpark in Coos County, New Hampshire by Granite Reliable Power, LLC. Prepared for Granite Reliable Power, LLC.
2007	Lincoln, Penobscot Cty, ME	22	231	Forested ridge	368	82-953	284	343	(120 m) 13%	Woodlot Alternatives, Inc. 2008. A Fall 2007 Survey of Bird and Bat Migration at the Rollins Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
2007	Roxbury, Oxford Cty, ME	20	220	Forested ridge	420	88-1006	227	365	(130 m) 14%	Woodlot Alternatives, Inc. 2007. A Fall 2007 Survey of Bird and Bat Migration at the Record Hill Wind Project, Roxbury, Maine. Prepared for Roxbury Hill Wind LLC.
2007	Allegany, Cattaraugus Cty, NY	46	n/a	Forested ridge	451	n/a	230	382	(150 m) 14%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
2007	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.
2007	Wolfe Island, Ontario, Canada*	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										
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.
2008	Georgia Mountain, VT	21	n/a	Forested ridge	326	56-700	230	371	(120 m) 7%	Stantec Consulting Services Inc. 2008. A Fall 2008 Survey of Bird Migration at the Georgia Mountain Wind Project, Vermont. Prepared for Georgia Mountain Community Wind.
2008	Oakfield, Penobscot Cty, ME	20	n/a	Forested ridge	501	116-945	200	309	(125 m) 18%	Woodlot Alternatives, Inc. 2008. A Fall 2008 Survey of Bird and Bat Migration at the Oakfield Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.

Note:

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

Appendix B

Bat survey results

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

		BBSH			HB	MYSP	RBTB			UNKN							
Night of	Operational?	BBSH	Big brown	Silver-haired	Hoary	MYSP	Eastern red	Tri-colored	RBTB	HFUN	LFUN	UNKN	Total	Wind Speed (m/s)	Barometric Pressure (kPa)	Rainfall (cm)	Temperature (celsius)
08/12/09	1												**0**	7	1017	0.0	16
08/13/09	1					1				2			**3**	12	1019	0.0	18
08/14/09	1					1				1			**2**	16	1018	0.0	20
08/15/09	1									2			**2**	14	1018	0.0	19
08/16/09	1					2							**2**	15	1019	0.0	20
08/17/09	1												**0**	20	1017	0.0	22
08/18/09	1					1							**1**	22	1014	0.0	20
08/19/09	1									2			**2**	11	1012	0.0	15
08/20/09	1									1	1		**2**	14	1014	0.0	19
08/21/09	1												**0**	11	1012	2.1	19
08/22/09	1												**0**	11	1011	0.3	18
08/23/09	1												**0**	6	1011	0.9	17
08/24/09	1										1		**1**	11	1016	0.5	14
08/25/09	1	2			1								**3**	24	1018	0.0	17
08/26/09	1												**0**	24	1012	0.0	8
08/27/09	1												**0**	11	1019	0.0	8
08/28/09	1												**0**	12	1021	0.0	10
08/29/09	1												**0**	14	1020	1.7	10
08/30/09	1					1				1			**2**	23	1009	0.1	11
08/31/09	1									1			**1**	13	1020	0.0	9
09/01/09	1									1			**1**	16	1023	0.0	12
09/02/09	1										1		**1**	23	1024	0.0	15
09/03/09	1									1			**1**	19	1019	0.0	15
09/04/09	1									2			**2**	10	1015	0.0	14
09/05/09	0												**0**	16	1023	0.0	7
09/06/09	1				1								**1**	13	1029	0.0	10
09/07/09	1												**0**	16	1027	0.0	13
09/08/09	1												**0**	14	1017	0.0	11
09/09/09	1												**0**	12	1027	0.0	10
09/10/09	0												**0**	6	1032	0.0	12
09/11/09	1												**0**	4	1030	0.0	13
09/12/09	1												**0**	14	1022	0.0	14
09/13/09	1												**0**	16	1011	0.0	9
09/14/09	1												**0**	15	1008	0.0	11
09/15/09	0												**0**	7	1018	0.1	6
09/16/09	1												**0**	5	1028	0.0	6
09/17/09	1									1			**1**	20	1027	0.0	9
09/18/09	1												**0**	29	1013	0.0	4
09/19/09	1												**0**	24	1022	0.0	6
09/20/09	1									1			**1**	11	1024	0.0	13
09/21/09	1					1							**1**	12	1025	0.0	15
09/22/09	1												**0**	12	1023	0.0	17
09/23/09	1												**0**	18	1017	0.0	13
09/24/09	1									1			**1**	18	1015	1.4	6
09/25/09	1												**0**	9	1028	0.0	3
09/26/09	1												**0**	13	1028	0.0	7
09/27/09	1												**0**	17	1015	1.6	12
09/28/09	1												**0**	11	997	1.1	11
09/29/09	1												**0**	18	996	0.9	8
09/30/09	1												**0**	17	1007	0.2	2
10/01/09	1												**0**	13	1012	0.0	1
10/02/09	1												**0**	15	1017	0.0	4
10/03/09	1												**0**	9	1019	3.7	9
10/04/09	1									1			**1**	16	1013	0.3	8
10/05/09	1												**0**	22	1007	0.1	6
10/06/09	1												**0**	15	1008	0.0	5
10/07/09	1												**0**	22	1006	1.8	5
10/08/09	0												**0**	14	1015	0.0	5
10/09/09	1												**0**	8	1014	0.1	6
10/10/09	1												**0**	20	1014	0.7	1
10/11/09	1												**0**	29	1019	0.0	-1
10/12/09	1												**0**	9	1024	0.0	0
10/13/09	1												**0**	13	1021	0.7	-3
10/14/09	1												**0**	13	1019	0.0	-5
By Species		**2**	**0**	**0**	**2**	**7**	**0**	**0**	**0**	**18**	**3**	**0**	**32**				
By Guild		**2**			**2**	**7**	**0**			**21**							
		BBSH			**HB**	**MYSP**	**RBTB**			**UNKN**			**Total**				

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

		BBSH			HB	MYSP	RBTB			UNKN							
Night of	Operational?	BBSH	Big brown	Silver-haired	Hoary	MYSP	Eastern red	Tri-colored	RBTB	HFUN	LFUN	UNKN	Total	Wind Speed (m/s)	Barometric Pressure (kPa)	Rainfall (cm)	Temperature (celsius)
08/11/09	1												**0**	6	1010	3.9	16
08/12/09	1				1								**1**	7	1017	0.0	16
08/13/09	1									1			**1**	12	1019	0.0	18
08/14/09	1												**0**	16	1018	0.0	20
08/15/09	1									4			**4**	14	1018	0.0	19
08/16/09	1												**0**	15	1019	0.0	20
08/17/09	1				1	1							**2**	20	1017	0.0	22
08/18/09	1									1			**1**	22	1014	0.0	20
08/19/09	1									1	1		**2**	11	1012	0.0	15
08/20/09	1												**0**	14	1014	0.0	19
08/21/09	1												**0**	11	1012	2.1	19
08/22/09	1					1							**1**	11	1011	0.3	18
08/23/09	1												**0**	6	1011	0.9	17
08/24/09	1									2			**2**	11	1016	0.5	14
08/25/09	1	1								2	1		**4**	24	1018	0.0	17
08/26/09	1	6									1		**7**	24	1012	0.0	8
08/27/09	1												**0**	11	1019	0.0	8
08/28/09	1												**0**	12	1021	0.0	10
08/29/09	1												**0**	14	1020	1.7	10
08/30/09	1					1							**1**	23	1009	0.1	11
08/31/09	1												**0**	13	1020	0.0	9
09/01/09	1												**0**	16	1023	0.0	12
09/02/09	1												**0**	23	1024	0.0	15
09/03/09	1												**0**	19	1019	0.0	15
09/04/09	1	1				1				2			**4**	10	1015	0.0	14
09/05/09	1									1			**1**	16	1023	0.0	7
09/06/09	1					1							**1**	13	1029	0.0	10
09/07/09	1									1			**1**	16	1027	0.0	13
09/08/09	1												**0**	14	1017	0.0	11
09/09/09	1												**0**	12	1027	0.0	10
09/10/09	1												**0**	6	1032	0.0	12
09/11/09	1												**0**	4	1030	0.0	13
09/12/09	1												**0**	14	1022	0.0	14
09/13/09	1									1			**1**	16	1011	0.0	9
09/14/09	1												**0**	15	1008	0.0	11
09/15/09	1												**0**	7	1018	0.1	6
09/16/09	1												**0**	5	1028	0.0	6
09/17/09	1												**0**	20	1027	0.0	9
09/18/09	1												**0**	29	1013	0.0	4
09/19/09	1												**0**	24	1022	0.0	6
09/20/09	1									1			**1**	11	1024	0.0	13
09/21/09	1										1		**1**	12	1025	0.0	15
09/22/09	1												**0**	12	1023	0.0	17
09/23/09	1									2			**2**	18	1017	0.0	13
09/24/09	1	1											**1**	18	1015	1.4	6
09/25/09	1												**0**	9	1028	0.0	3
09/26/09	1												**0**	13	1028	0.0	7
09/27/09	1												**0**	17	1015	1.6	12
09/28/09	1												**0**	11	997	1.1	11
09/29/09	1												**0**	18	996	0.9	8
09/30/09	1												**0**	17	1007	0.2	2
10/01/09	1												**0**	13	1012	0.0	1
10/02/09	1										1		**1**	15	1017	0.0	4
10/03/09	1												**0**	9	1019	3.7	9
10/04/09	1												**0**	16	1013	0.3	8
10/05/09	1												**0**	22	1007	0.1	6
10/06/09	1												**0**	15	1008	0.0	5
10/07/09	1												**0**	22	1006	1.8	5
10/08/09	1												**0**	14	1015	0.0	5
10/09/09	1												**0**	8	1014	0.1	6
10/10/09	1												**0**	20	1014	0.7	1
10/11/09	1												**0**	29	1019	0.0	-1
10/12/09	1												**0**	9	1024	0.0	0
10/13/09	1												**0**	13	1021	0.7	-3
10/14/09	1												**0**	13	1019	0.0	-5
10/15/09	1												**0**	15	1020	0.0	-6
By Species		**9**	**0**	**0**	**2**	**5**	**0**	**0**	**0**	**19**	**5**	**0**	**40**				
By Guild		**9**			**2**	**5**	**0**			**24**							
		BBSH			**HB**	**MYSP**	**RBTB**			**UNKN**			**Total**				

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

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

		BBSH			HB	MYSP	RBTB			UNKN							
Night of	Operational?	BBSH	Big brown	Silver-haired	Hoary	MYSP	Eastern red	Tri-colored	RBTB	HFUN	LFUN	UNKN	Total	Wind Speed (m/s)	Barometric Pressure (kPa)	Rainfall (cm)	Temperature (celsius)
08/13/09	1									1			**1**	12	1019	0.0	17
08/14/09	1									3			**3**	16	1018	0.0	18
08/15/09	1									2			**2**	14	1018	0.0	18
08/16/09	1												**0**	15	1019	0.0	19
08/17/09	1												**0**	20	1017	0.0	20
08/18/09	1												**0**	22	1014	0.0	18
08/19/09	1									2			**2**	11	1012	0.0	13
08/20/09	1												**0**	14	1014	0.0	18
08/21/09	1												**0**	11	1012	2.1	18
08/22/09	1												**0**	11	1011	0.3	17
08/23/09	1												**0**	6	1011	0.9	15
08/24/09	1	1								1			**2**	11	1016	0.5	12
08/25/09	1	1								1			**2**	24	1018	0.0	16
08/26/09	1												**0**	24	1012	0.0	5
08/27/09	1												**0**	11	1019	0.0	6
08/28/09	1												**0**	12	1021	0.0	7
08/29/09	1												**0**	14	1020	1.7	7
08/30/09	1										1		**1**	23	1009	0.1	7
08/31/09	1												**0**	13	1020	0.0	8
09/01/09	1												**0**	16	1023	0.0	11
09/02/09	1												**0**	23	1024	0.0	13
09/03/09	1									1			**1**	19	1019	0.0	13
09/04/09	1			1						3			**4**	10	1015	0.0	11
09/05/09	1												**0**	16	1023	0.0	4
09/06/09	1												**0**	13	1029	0.0	8
09/07/09	1												**0**	16	1027	0.0	13
09/08/09	1												**0**	14	1017	0.0	8
09/09/09	1												**0**	12	1027	0.0	7
09/10/09	1												**0**	6	1032	0.0	10
09/11/09	1												**0**	4	1030	0.0	11
09/12/09	1												**0**	14	1022	0.0	12
09/13/09	1												**0**	16	1011	0.0	7
09/14/09	1												**0**	15	1008	0.0	9
09/15/09	1												**0**	7	1018	0.1	3
09/16/09	1												**0**	5	1028	0.0	4
09/17/09	1												**0**	20	1027	0.0	9
09/18/09	1												**0**	29	1013	0.0	3
09/19/09	1												**0**	24	1022	0.0	5
09/20/09	1												**0**	11	1024	0.0	11
09/21/09	1									1			**1**	12	1025	0.0	13
09/22/09	1												**0**	12	1023	0.0	16
09/23/09	1												**0**	18	1017	0.0	9
09/24/09	1									1			**1**	18	1015	1.4	3
09/25/09	1												**0**	9	1028	0.0	2
09/26/09	1												**0**	13	1028	0.0	6
09/27/09	1												**0**	17	1015	1.6	11
09/28/09	1												**0**	11	997	1.1	9
09/29/09	1												**0**	18	996	0.9	6
09/30/09	1												**0**	17	1007	0.2	1
10/01/09	1												**0**	13	1012	0.0	0
10/02/09	1												**0**	15	1017	0.0	2
10/03/09	1												**0**	9	1019	3.7	6
10/04/09	1	1											**1**	16	1013	0.3	7
10/05/09	1												**0**	22	1007	0.1	5
10/06/09	1												**0**	15	1008	0.0	4
10/07/09	1												**0**	22	1006	1.8	3
10/08/09	1												**0**	14	1015	0.0	4
10/09/09	1					1							**1**	8	1014	0.1	6
10/10/09	1												**0**	20	1014	0.7	0
10/11/09	1												**0**	29	1019	0.0	-2
10/12/09	1												**0**	9	1024	0.0	-1
10/13/09	1												**0**	13	1021	0.7	-4
By Species		**3**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**16**	**1**	**0**	**22**				
By Guild		**4**			**0**	**1**	**0**			**17**							
		BBSH			HB	MYSP	RBTB			UNKN			Total				

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

Appendix B Table 4. Summary of acoustic bat data and weather during each survey night at the Met High Detector, Fall 2009

		BBSH			HB	MYSP	RBTB			UNKN							
Night of	Operational?	BBSH	Big brown	Silver-haired	Hoary	MYSP	Eastern red	Tri-colored	RBTB	HFUN	LFUN	UNKN	Total	Wind Speed (m/s)	Barometric Pressure (kPa)	Rainfall (cm)	Temperature (celsius)
09/29/09	1												**0**	18	996	0.9	8
09/30/09	1												**0**	17	1007	0.2	2
10/01/09	1												**0**	13	1012	0.0	1
10/02/09	1												**0**	15	1017	0.0	4
10/03/09	1												**0**	9	1019	3.7	9
10/04/09	1												**0**	16	1013	0.3	8
10/05/09	1												**0**	22	1007	0.1	6
10/06/09	1												**0**	15	1008	0.0	5
10/07/09	1												**0**	22	1006	1.8	5
10/08/09	1												**0**	14	1015	0.0	5
10/09/09	1												**0**	8	1014	0.1	6
10/10/09	1												**0**	20	1014	0.7	1
10/11/09	1												**0**	29	1019	0.0	-1
10/12/09	1												**0**	9	1024	0.0	0
10/13/09	1												**0**	13	1021	0.7	-3
10/14/09	1												**0**	13	1019	0.0	-5
By Species		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**				
By Guild		**0**			**0**	**0**	**0**			**0**							
		BBSH			**HB**	**MYSP**	**RBTB**			**UNKN**			**Total**				

ATTACHMENT A.3-4

Breeding Bird Survey Protocol

Bicknell's Thrush (*Catharus bicknelli*) and Breeding Bird Survey Protocol for the Sisk Wind Power Project

Prepared for:

TransCanada Maine Wind Development Inc.
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Toronto, Ontario M5E IJ4

Prepared by:

TRC

249 Western Avenue

Augusta, ME 04330

May 2009

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1.0 INTRODUCTION

1.1 Project Description

TransCanada Maine Wind Development (TransCanada) is assessing the development of a wind power generating facility in the Boundary Mountains of Western Maine known as the Sisk Wind Power Project (Sisk Project). The proposed Sisk Wind Power Project is located in the unincorporated townships of Kibby and Chain of Ponds in Franklin County, Maine. The general project area is located along the ridgeline of Sisk Mountain, as shown in Figure 1. The surrounding area is currently actively managed for forest products.

The Sisk Project is immediately adjacent to the recently permitted Kibby Wind Power Project (Kibby Project). TransCanada intends to conduct baseline studies in addition to the existing information from the Kibby Wind Power Project licensing effort to determine the level of potential impact associated with the proposed Sisk Project.

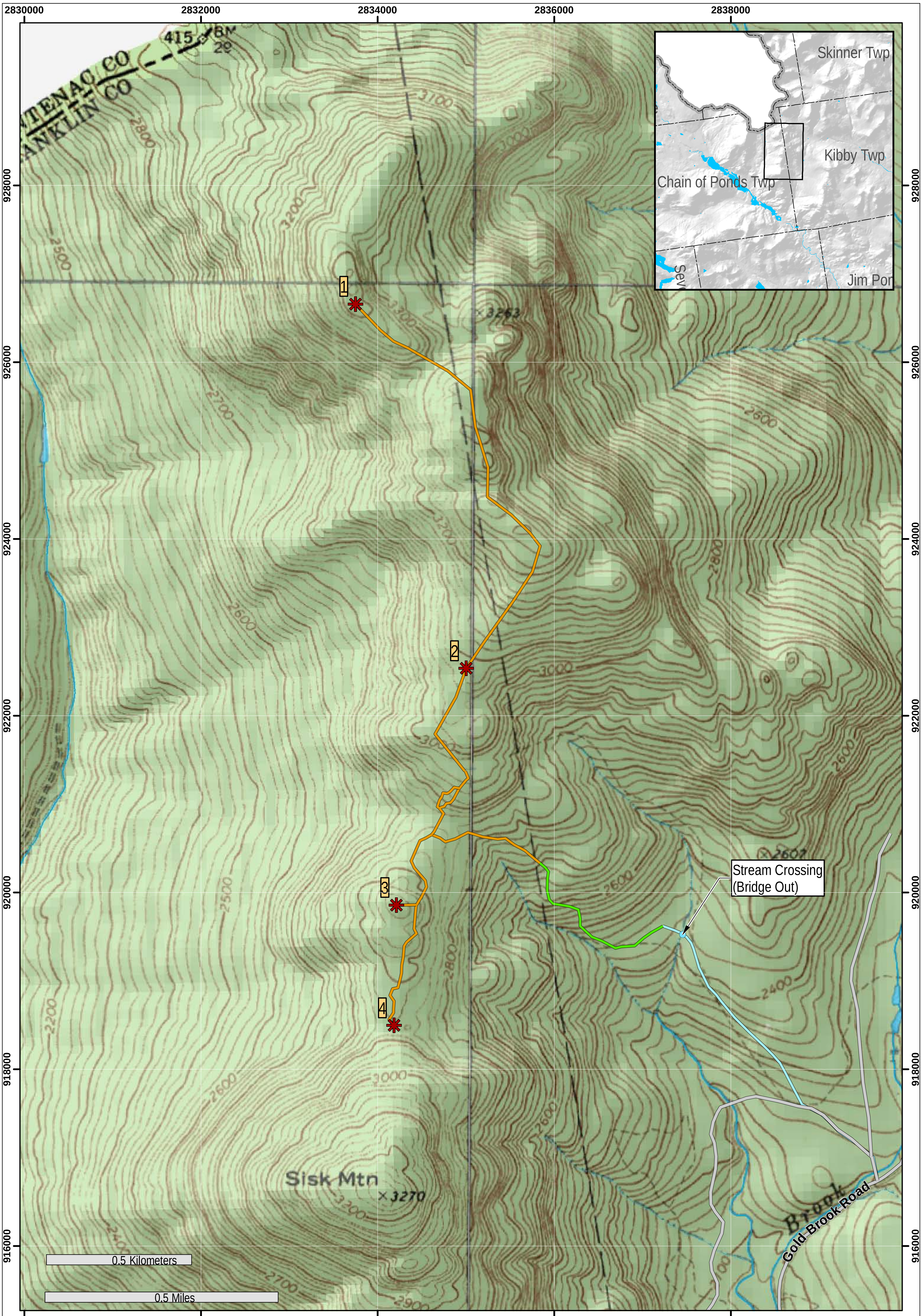
The Maine Department of Inland Fisheries and Wildlife (MDIFW) and the United States Fish and Wildlife Service (USFWS) have recommended that TransCanada perform breeding bird surveys with an emphasis on detecting Bicknell's thrush in the Sisk Project area. Similar surveys have been previously performed in the Kibby Project area in 1992, 2005, and 2006. Due to the immediate juxtaposition of the Sisk Project to the Kibby Project area, much of the historic data are useful when assessing the Sisk Project.

1.2 Purpose and Objectives

The purpose of breeding bird surveys is to document breeding bird use, with an emphasis on detecting Bicknell's thrush, within the proposed Sisk Wind Power Project Area.

The objectives of breeding bird surveys are to:

- produce a comprehensive list of breeding bird species in the Sisk Project area;
- compile a species index and relative abundance for birds breeding in the Sisk Project area;
- calculate frequency of occurrence for each species by dividing the number of survey routes where each species was detected by the total number of survey routes;
- characterize habitat that is available for species which occur in the Sisk project area;
- estimate the availability of suitable habitat for Bicknell's thrush within the Sisk Project area;
- qualitatively assess the general patterns of breeding bird use in the vicinity of the proposed Sisk Wind Power Project; and
- Estimate population density of Bicknell's thrush within the Sisk Project area.



Sisk Mountain
Proposed Meteorological Tower
Sites and Access

Figure 1

Legend	
Potential Met Sites	Maintained Road
Stream	Existing Winter Road
	Existing Skid Trail
	Potential Access Trail

Notes: Base map: 24k USGS Topographic Map. Elevation shading derived from MEDEM10 courtesy of Maine OGIS. Coordinate Grid: NAD83 UTM Zone 19N, Meters

249 Western Ave
Augusta, ME 04330
TRC

Created:
2/6/2009

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2.0 EXISTING INFORMATION

2.1 Status of Bicknell's Thrush in Maine

Bicknell's thrush (*Catharus bicknelli*) is recognized by the State of Maine as a "Species of Special Concern". This title refers to "any species of fish or wildlife that does not meet the criteria as Endangered or Threatened but is particularly vulnerable and could easily become a Threatened Species or an Endangered or Extirpated Species due to restricted distribution, low or declining numbers, specialized habitat needs or limits, or other factors, or is a species suspected to be Endangered or Threatened or likely to become so but for which insufficient data are available" (12 M.R.S.A. Part 10 Chapter 701).

Prior to 1995, Bicknell's thrush was considered a sub-species to the gray-cheeked thrush (*Catharus minimus*) (Ouellett 1993, American Ornithologist's Union 1995). Bicknell's thrush has specialized habitat needs and is restricted in distribution in Maine (and other New England states and New York) to high elevation (700 m and higher) stunted spruce-fir forests and is found in low numbers in most of these areas (Atwood et al. 1996). The species also breeds in Canada, mainly in small, high elevation pockets of habitat in southern Quebec, the highlands of New Brunswick, and Cape Breton Island. The Canadian Wildlife Service identified the Bicknell's Thrush as one of its highest priority species for monitoring, research and conservation (Whittam and Ball 2003).

Suitable Bicknell's thrush habitat occurs at higher elevations within the Sisk Project area, and the species has been observed nearby in Kibby Township. Specific details on this species occurrence in the Kibby area are discussed in Section 2.2.

2.2 Previous Studies

Numerous breeding bird studies have been performed in the vicinity of Kibby Mountain and Kibby Range in the past decades. As described above, these mountains are immediately to the northeast and east of Sisk Mountain, respectively. In the early 1990's, U.S. Windpower performed breeding bird studies as part of their permit application to LURC for a proposed project located in the same general area as the existing Kibby Project. In 2005 and 2006, TRC (on behalf of TransCanada) performed breeding bird surveys (with an emphasis on detecting Bicknell's thrush) as part of their pre-application studies for the Kibby Project. In 2006, BioDiversity Research Institute (BRI) captured and banded several Bicknell's thrush on Kibby Mountain and Kibby Range.

U.S. Windpower

U.S. Windpower performed breeding bird surveys in the Kibby vicinity in 1992. The results of these studies were described in their LURC permit application (ND&T 1993). The Application describes breeding bird surveys at 24 points located in representative habitats and on or near tops of the mountains or ridges in the project vicinity. Each point was visited four times: twice in the morning (½ hour before sunrise to 9 AM); once between 9 AM and 5 PM; and once between 6 PM to ½ hour after sunset. Each survey point visit lasted for 10 minutes. The study period was June 1 through July 30.

In total, this 1992 study identified 43 species of breeding birds during ridge top surveys (see Appendix A). Listed among these is the gray-cheeked thrush (*Catharus minimus*), with a total of four individuals recorded over the course of the study (ND&T 1993).

TransCanada

In June 2005, TRC (on behalf of TransCanada) performed initial site visits to the Kibby Project area while investigating potential meteorological tower sites. During these site visits, biologists recorded 25 species of breeding birds in the Kibby Project area (see Appendix A). Bicknell's thrush were not observed during these site visits.

In the fall of 2005, TRC performed foraging migrant surveys along the trail leading to the fire tower on the summit of Kibby Mountain. Three Bicknell's thrush and one thrush that could not be differentiated as a Bicknell's or a gray-cheeked were documented during these surveys.

In 2006, TRC, with assistance from BRI, conducted detailed breeding bird surveys on Kibby Mountain and Kibby Range. These surveys were designed to emphasize detection of Bicknell's Thrush, and included detailed spot-mapping and habitat evaluation components targeted for this species. These breeding bird surveys documented 34 breeding bird species in the Kibby Project area (See Appendix A). Bicknell's thrush were documented on the ridge of Kibby Range during the first week of June, but were not detected thereafter; this species was, however, detected in a regenerating clearcut on a lower elevation slope (below 2,700 feet elevation) of Kibby Range throughout the month of June.

BioDiversity Research Institute

As mentioned above, as part of a study un-related to the Kibby Project, BioDiversity Research Institute (BRI) performed an effort to capture and band Bicknell's thrush in the Kibby vicinity in 2006. On June 29 and 30, 2006, BRI captured and banded three Bicknell's thrush (two males and one female) in breeding condition. These birds were captured in a clearcut on a lower slope of Kibby Range where Bicknell's thrush were documented during breeding bird surveys for the Kibby Project. Furthermore, BRI captured and banded five (four males and one female) Bicknell's thrush near the Kibby Mountain fire tower on July 1, 2006.

3.0 STUDY PROTOCOL

Breeding bird surveys for the Sisk Project will be performed using point count methods. The survey protocol for this effort is based that used for the Kibby Project, with some updates to reflect more recent protocols. The original Kibby protocol was developed based on methods used for the Vermont Institute of Natural Science's *Mountain Birdwatch* program (VINS 2005) and Bird Studies Canada's *High Elevation Landbird Program* (*HELP*) (Whittam & Ball 2002, and 2003). More recent protocols which have been referenced for the Sisk Project protocol include the 2007 version of the VINS *Breeding Landbird Monitoring Program* (VINS 2007), the most recent posting of the VINS *Mountain Birdwatch All Species Survey Procedures* (VINS 2009), and *Mountain Birdwatch Protocol and Standard Operating Procedures for Monitoring High-Elevation Landbirds in the Northern Appalachian and Laurentian Regions* (Hart and Lambert 2008).

Surveys will be augmented by use of playbacks for Bicknell's thrush, as described by Rimmer et al 1996, Whittam and Ball 2002 and 2003, and VINS 2009. Early season point counts will be used to help site survey plots for more detailed Bicknell's thrush studies.

Bicknell's thrush surveys will be conducted using spot-mapping techniques. The survey protocol for spot mapping is based on methods presented in the United States Department of Agriculture (USDA) Forest Service's *Handbook of Field Methods for Monitoring Landbirds"* (Ralph et al.1993), and the United States Geological Survey (USGS) *Manager's Monitoring Manual: Territory Mapping* (USGS 2009a).

3.1 Site Selection

3.1.1 Breeding Bird Point Counts

Point counts will be conducted at intervals along survey transects. Approximately three total survey transects will be established on ridge within the project area. Each survey transect will be made up of five points, each 250 m apart (Whittam & Ball 2002, VINS 2005). The location of these transects will be selected based on aerial photography, topography and/or presence of suitable Bicknell's thrush habitat. Each of the five points along the survey transect will consist of a central point from where observations will be made. Each of the points along a transect will be located with Global Positioning System (GPS). Elevation will also be recorded for each point, based on aerial survey topographic data and GPS data. Flagging may be used to locate transects and each survey point, however, all flagging will be removed upon the final survey and no permanent markers will be used. A map depicting proposed transect and survey point locations is provided in Appendix D.

Because the ridge of Sisk Mountain currently has no developed trails, the transects will be located in areas where there are no trails. In these cases, access will be marked with survey tape, however, cutting vegetation will be avoided to the extent practical. In all areas, access will be limited to on foot only.

3.1.2 Bicknell's Thrush Spot Mapping

Spot mapping will be performed on one plot, which will be selected based on the results of breeding bird point count surveys. If no Bicknell's thrush are detected during breeding bird point count surveys, then no spot mapping will be performed; if Bicknell's thrush are detected, then a spot mapping parcel will be selected.

Once the plot location is selected based on point count results, actual plot size and dimensions will be determined. USGS (2009a) notes that the larger the plot size, the more reliable the resulting data, due to the difficulty in mapping edge territories. For this reason, we propose to use the largest plot size practical, although this may be limited given the difficult terrain within the study area. Based on recommendations by Robbins (1970) for plots within closed habitats, we propose a spot mapping plot that is approximately 10 hectare (ha) in size. Plot size may need to be adjusted, based on location specific conditions, including topography and habitat patch size and shape; exact plot dimensions will be refined in the field. The plot will be located at or above elevations that are known to be suitable for this species, and within areas of suitable vegetation.

The spot mapping plot will be marked, using flagging, in a grid at 50 m intervals (as suggested for dense vegetation in Ralph et al. 1993). If extremely dense vegetation necessitates, smaller intervals will be used. If vegetation at chosen plot sites is too dense to be navigable, we will revert to methods described by Rimmer et al. (1996) for spot mapping under such circumstances. In such cases, vantage points will be located throughout the plot area from which observations can be made. Vantages should be scattered throughout the area as to provide adequate coverage. Ralph et al. (1993) suggests that 25 m of coverage can be expected from a given location in dense vegetation. Each vantage point will be located using GPS, and will be navigated to using map and compass.

A detailed map of the plot will be created for use during surveys. All plot perimeters will be located using GPS.

3.2 Number and Timing of Surveys

3.2.1 Breeding Bird Point Counts

All breeding bird point count surveys will be conducted between June 1 and June 21, with the possibility of extending surveys to July 15 should field survey conditions warrant. Surveys occurring between June 1 and June 12 will focus on siting Bicknell's thrush spot-mapping parcels. Surveys will be conducted at dawn or dusk. Dawn surveys will occur between 4:30 AM and 6:30 AM (VINS 2005), and dusk surveys will occur between 7:00 PM and 10:00 PM (Whittam & Ball 2002).

All five points along each survey transect shall be visited at least twice during the study period. Surveys will only be performed in weather conditions that do not hamper observations; therefore, inclement weather may preclude surveys. Acceptable weather conditions are defined by temperatures that are above 35ºF, and absence of rain and/or wind that could interfere with intensity or audibility of bird sounds. Steady drizzle, prolonged rain and/or windy periods that interfere with audibility are not acceptable for sampling. Wind speeds must be less than 4 on the Beaufort scale to allow proper audibility of bird sounds. Surveys may be delayed up to 30 minutes if weather conditions are poor upon arrival at a survey site, however, if poor conditions persist after that time, surveys will be rescheduled for another morning (VINS 2005).

3.2.2 Bicknell's Thrush Spot Mapping

Spot mapping for Bicknell's thrush will be conducted between May 28 and July 15. This timeframe allows for initial presence/absence of Bicknell's thrush to be established using point count surveys, then establishment and layout of study parcels prior to spot-mapping commencement. Surveys will be conducted at dawn or dusk. Dawn surveys will occur between 4:30 AM and 6:30 AM (VINS 2005), and dusk surveys will occur between 7:00 PM and 10:00 PM (Whittam & Ball 2002).

The spot mapping plot will be visited for a target of eight times over the course of the breeding season (USGS 2009a, Ralph et al. 1993). As with breeding bird surveys, spot mapping of Bicknell's thrush will be limited to days with appropriate weather conditions.

3.3 Breeding Bird Survey Protocol

3.3.1 Breeding Bird Point Counts

Breeding bird surveys will consist of performing point counts (or listening periods) at each of five determined points along each of the established transects. These surveys will focus on identifying and quantifying bird species present and will incorporate an emphasis on detecting presence of Bicknell's thrush. The procedure will adhere to that which is described in the VINS Mountain Birdwatch Manual (VINS 2009).

All five points along a survey transect will be assessed consecutively, in the same survey event. The survey at each point will consist of 10 minutes of silent listening. Stopwatches will be used to mark time. Observers will record all birds that are detected (seen or heard) during the listening period, and will record the approximate distance and behavior of the birds from the observation point as described in VINS 2009.

If no Bicknell's thrush are detected during the listening period at each survey point, the observer will conduct playback surveys specific to Bicknell's thrush at the end of the listening period. Playback surveys will consist of a one-minute broadcast of Bicknell's thrush vocalizations (as used and provided by the VINS Mountain Birdwatch Program), followed by 2 minutes of silent listening at each station (VINS 2009).

Personnel performing the surveys will be experienced bird watchers familiar with breeding bird species found in the project area (as reflected in Appendix A), and able to identify them by sight and by sound. Training for this survey will help eliminate error or bias, and will include listening to breeding bird vocalizations and studying field guides.

3.3.2 Bicknell's Thrush Spot Mapping

The survey protocol for spot mapping is based on methods presented in the USDA Forest Service's *Handbook of Field Methods for Monitoring Landbirds* (Ralph et al. 1993), and the USGS *Manager's Monitoring Manual: Territory Mapping* (USGS 2009a).

It is expected that a single survey of a 10 ha plot will take at least 3-4 hours per visit; it follows that larger parcels will require more time (USGS 2009a). For plots greater than 10 ha, two observers may perform the survey, working in different areas of the plot (Ralph et al. 1993).

Spot mapping events will consist of one observer (or two for plots >10 ha) walking marked gridlines within the plot area. Surveys will begin at a different location for each visit and proceed by walking gridlines systematically until the entire area has been covered. Surveyors will proceed along their route at a moderate pace to avoid attracting attention from birds and avoid causing alarm calls from birds in the area. Surveyors may stop as necessary to confirm observations of Bicknell's thrush and other bird species, take notes, and to mark on their map. The location of each Bicknell's thrush that is detected will be marked on a detailed map of the plot. Information regarding behavior will also be annotated.

If vantage points are used instead of marked gridlines, due to density of vegetation, then observers will divide their time evenly among the vantages, such that all can be reached during the morning hours.

Personnel performing the surveys will be experienced bird watchers familiar with breeding bird species found in the project area (as reflected in Appendices A and B). In particular, observers will be able to differentiate the song and call notes of Bicknell's thrush from other thrushes that may be encountered. Training for this survey will help eliminate error or bias, and will include listening to thrush vocalizations and studying field guides.

If little Bicknell's thrush activity is noted after three spot mapping events, the plot may be relocated to optimize data collection. Any changes in study plan or plot location will be communicated to MDIFW.

3.4 Data Collection

3.4.1 Breeding Bird Point Counts

Breeding birds will be recorded directly onto field cards and Data Coding Sheets based on those used by the VINS Mountain Birdwatch Program (VINS 2009). Data sheets for breeding bird surveys at Sisk Mountain are provided in Appendix B. Data over the course of each 10 minute listening period will be divided into 2, 3 and 5 minute segments. Information such as observer, route name, date, start time at each point, and weather information will also be entered on each data sheet. Weather information will include temperature, cloud conditions, precipitation, and wind direction and speed (Beaufort scale).

Species of birds seen or heard outside of point count areas during surveys will be noted separately as incidental observations in order to establish a comprehensive species occurrence list. An Incidental Observation Form is provided with the data sheets in Appendix B.

3.4.2 Bicknell's Thrush Spot Mapping

All observations of Bicknell's thrush will be recorded on detailed maps of the spot mapping plot. These maps will include notes such as time of observation, direction of travel (if bird is moving), simultaneous observations, type of vocalization, etc. Appropriate codes for such observations (based on those presented in Ralph et al. 1993 and VINS 2009) will be provided on each plot map (see example field codes on field card data sheets in Appendix B). Information such as observer, plot name, date, start and end time, and weather information will also be entered on each data sheet. Weather information will include temperature, cloud conditions, precipitation, and wind direction and speed (Beaufort scale).

Other breeding bird species seen or heard during spot mapping surveys will be noted separately as incidental observations in order to establish a comprehensive species occurrence list.

3.5 Habitat Evaluation Protocol

Habitat parameters associated with point count and spot mapping locations will be quantified using methods described by James and Shugart (1970). This methodology was developed specifically for making habitat measurements associated with estimating bird populations; it is still used by the national Breeding Bird Survey (USGS 2009b), as well as other current studies.

Quantitative estimates of vegetation will be made using tenth-acre (0.04-hectare) circular plots, consisting of a 37-foot (11.28-m) radius around a center point. For point count transects, tenth-acre habitat evaluation plots will coincide with listening station locations. Along trail-based transects, a 40-foot offset will be used to avoid cataloging the area of the trail. One plot will be evaluated alongside each survey point, with the offset side determined in each instance through a random coin toss. For spot-mapping parcels, tenth-acre plots will be centered on randomly selected grid points within the interior of the parcel (James and Shugart 1970, Ring et al. 2005). No less than six total tenth-acre plots will be measured within the spot mapping parcel.

Data collected at each tenth-acre plot will include:

- species and size class of all trees encountered within the plot;
- estimated number (and dominant species) of woody stems less than 3 inches diameter at breast height;
- estimated canopy cover and ground cover; and
- estimated canopy height.

All data will be recorded onto a data sheet (see Appendix C). Vegetation density will be quantified using these data, and calculations will be performed as described in James and Shugart (1970).

This effort will deviate from the James and Shugart (1970) protocol in the use of certain tools to gather data. Instead of using a “reach stick” to determine diameter, a forester’s diameter tape will be used. Instead of using a bright yardstick at the center of the 37’-foot-radius circle, the center will be marked with flagging tape, and a measuring tape or a laser range finder (LRF) will be used to determine distance (any flagging used will be removed at the end of the survey). Finally, instead of using a mirror and level to determine canopy height, the LRF will be used.

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APPENDIX A:
Historic Breeding Bird List Documentation in the Kibby Region

Appendix A: Historic Breeding Bird List Documentation in the Kibby Region				
Common Name	***Scientific Name***	**Entity / Year of Documentation**		
		U.S. Windpower 1992	TRC 2005	TRC 2006
American Redstart	*Setophaga ruticilla*	X	X	X
American Robin	*Turdus migratorius*	X X		
Bay-breasted Warbler	*Dendroica castanea*	X X		
Bicknell's Thrush	*Catharus bicknelli*			X
Black-backed Woodpecker	*Picoides arcticus*	X		X
Blackburnian Warbler	*Dendroica fusca*	X		
Black-capped Chickadee	*Poecile atricapillus*	X	X	X
Blackpoll Warbler	*Dendroica striata*	X	X	X
Black-throated Blue Warbler	*Dendroica caerulescens*	X	X	X
Black-throated Green Warbler	*Dendroica virens*	X		X
Blue Jay	*Cyanocitta cristata*			X
Blue-headed Vireo	*Vireo solitarius*	X		X
Boreal Chickadee	*Poecile hudsonica*	X		X
Brown Creeper	*Certhia americana*			X
Canada Warbler	*Wilsonia canadensis*	X		
Cedar Waxwing	*Bombycilla cedrorum*	X		X
Chestnut-sided Warbler	*Dendroica pensylvanica*	X X		
Chipping Sparrow	*Spizella passerina*	X		
Common Raven	*Corvus corax*	X		
Common Yellowthroat	*Geothlypis trichas*	X X		
Dark-eyed Junco	*Junco hyemalis*	X X		X
Downy Wookpecker	*Picoides pubescens*			X
Fox Sparrow	*Passerella iliaca*	X		
Golden-crowned Kinglet	*Regulus satrapa*	X X		X
Gray Jay	*Perisoreus canadensis*	X		X
Gray-cheeked Thrush	*Catharus minimus*	X		
Great Horned Owl	*Bubo virginianus*	X		
Hairy Woodpecker	*Picoides villosus*	X		X
Hermit Thrush	*Catharus guttatus*	X		X
Least Flycatcher	*Empidonax minimus*	X	X	X
Magnolia Warbler	*Dendroica magnolia*	X	X	X
Mourning Warbler	*Oporornis philadelphia*	X		X
Myrtle Warbler	*Dendroica coronata*	X X		X
Nashville Warbler	*Vermivora ruficapilla*	X		X
Northern Flicker	*Colaptes auratus*	X		

Appendix A: Historic Breeding Bird List Documentation in the Kibby Region				
Common Name	***Scientific Name***	**Entity / Year of Documentation**		
		U.S. Windpower 1992	TRC 2005	TRC 2006
Ovenbird	*Seiurus aurocapilla*	X		X
Palm Warbler	*Dendroica palmarum*	X		X
Pine Grosbeak	*Pinicola enucleator*	X X		
Pine Siskin	*Carduelis pinus*	X X		
Purple Finch	*Carpodacus purpureus*	X		X
Red-breasted Nuthatch	*Sitta canadensis*	X		X
Red-eyed Vireo	*Vireo olivaceus*	X		X
Red-tailed Hawk	*Buteo jamaicensis*	X		
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	X		
Ruby-crowned Kinglet	*Regulus calendula*	X		
Ruffed Grouse	*Bonasa umbellus*	X X		X
Sharp-shinned Hawk	*Accipiter striatus*	X		
Swainson's Thrush	*Catharus ustulatus*	X X		X
Tree Swallow	*Tachycineta bicolor*	X X		
Veery	*Catharus fuscescens*	X		
White-throated Sparrow	*Zonotrichia albicollis*	X X		X
Winter Wren	*Troglodytes troglodytes*	X X		X
Yellow-bellied Flycatcher	*Empidonax flaviventris*			X
Yellow-bellied Sapsucker	*Sphyrapicus varius*			X
TOTAL SPECIES DOCUMENTED PER YEAR:		***43***	***25***	***34***

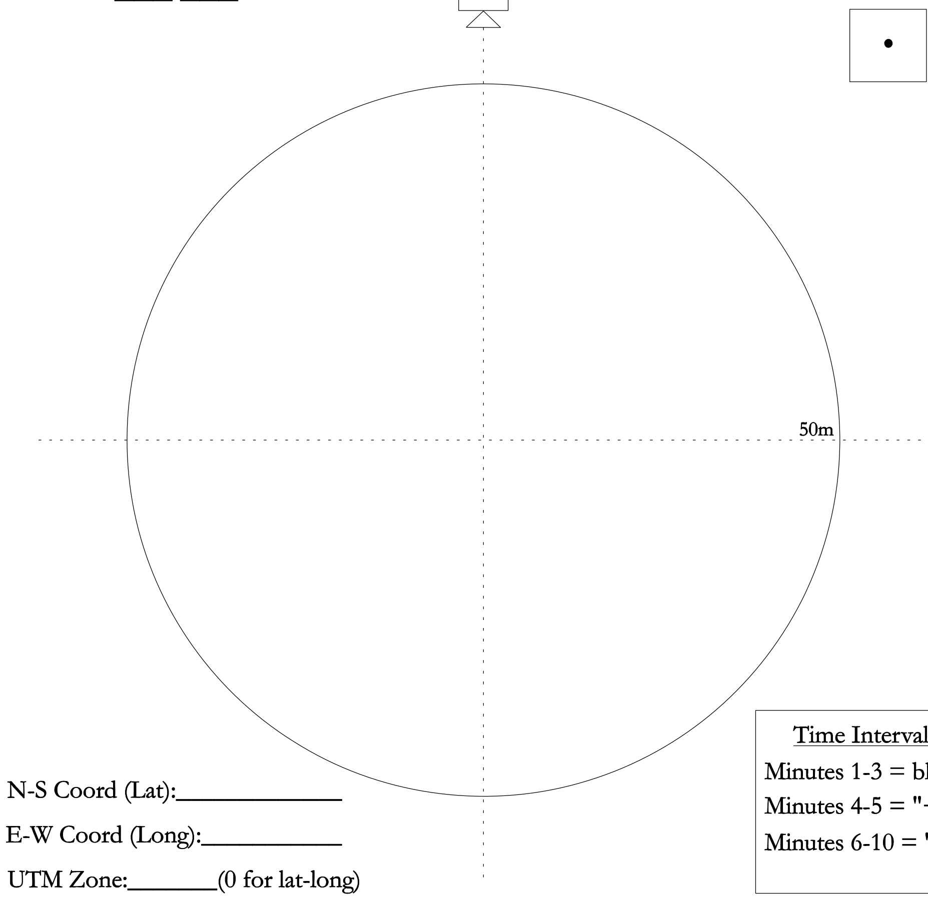
APPENDIX B:
Point Count Data Sheets

- *Point Count Transect Field Card*
- *Transect Data Coding Sheet*
- *Playback Data Sheet*
- *Incidental Observation Form*

STATION 1

TIME ___:___

WIND



N-S Coord (Lat):___________

E-W Coord (Long):__________

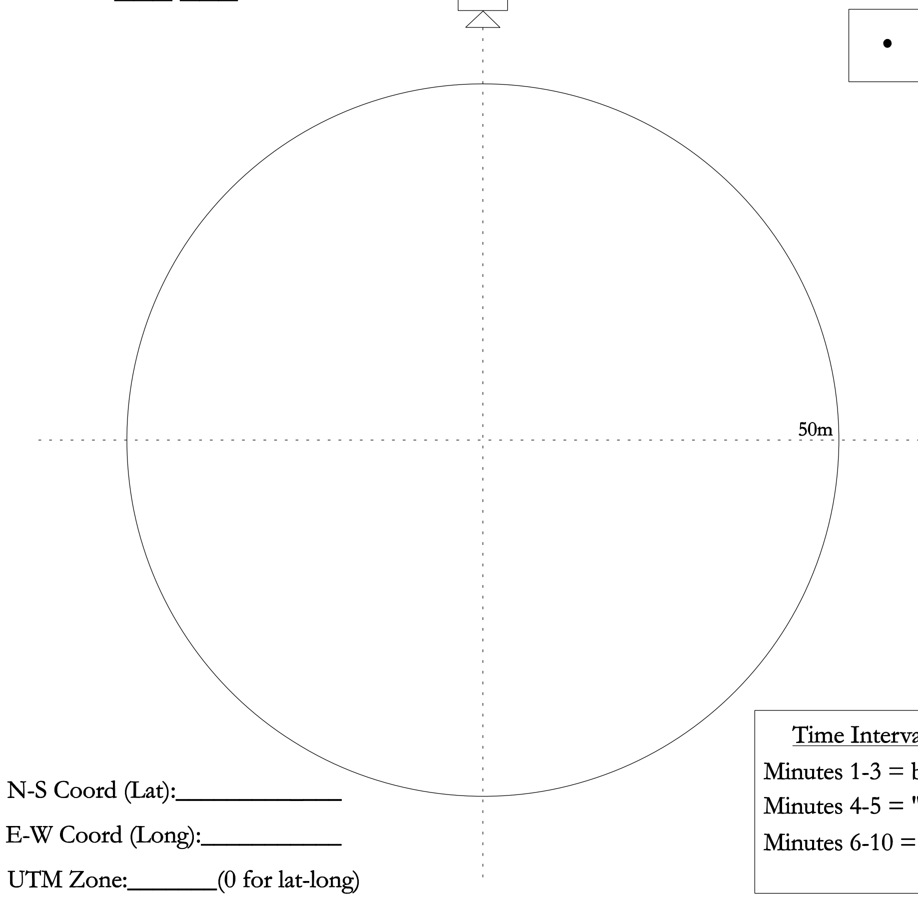
UTM Zone:_______(0 for lat-long)

Time Interval
Minutes 1-3 = blank
Minutes 4-5 = "+"
Minutes 6-10 = "•"

STATION 2

TIME ___:___

WIND



N-S Coord (Lat):___________

E-W Coord (Long):__________

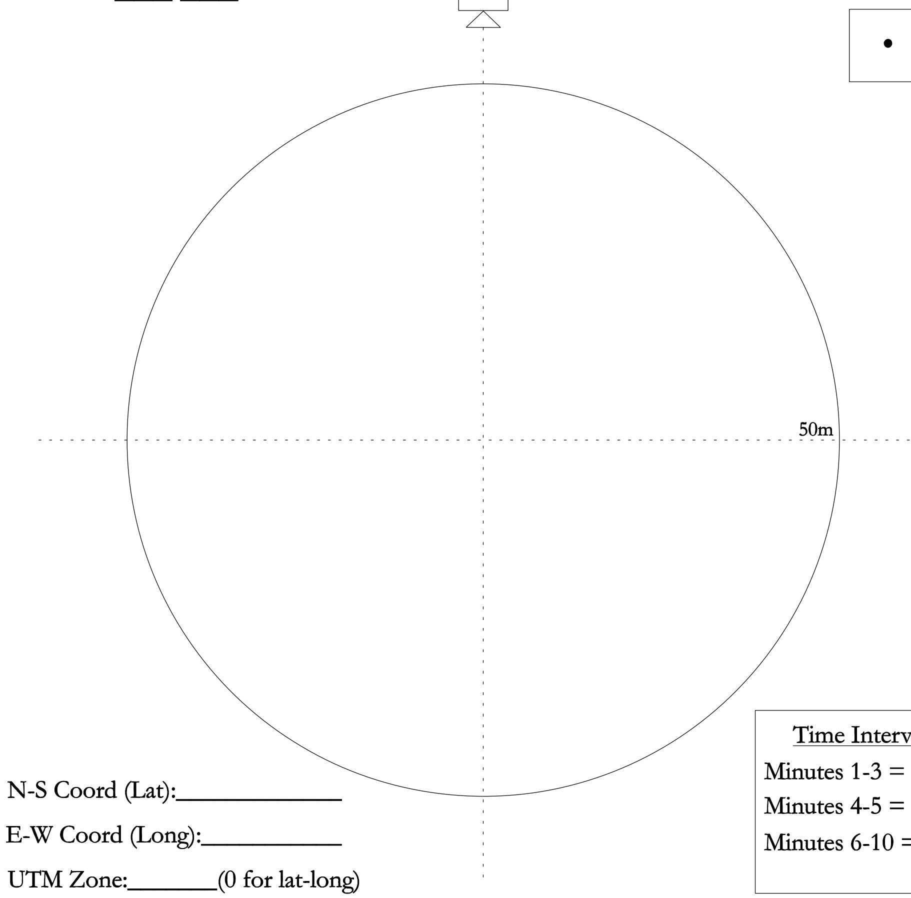
UTM Zone:_______(0 for lat-long)

Time Interval
Minutes 1-3 = blank
Minutes 4-5 = "+"
Minutes 6-10 = "•"

STATION 3

TIME ___:___

WIND



N-S Coord (Lat):___________

E-W Coord (Long):__________

UTM Zone:_______(0 for lat-long)

Time Interval
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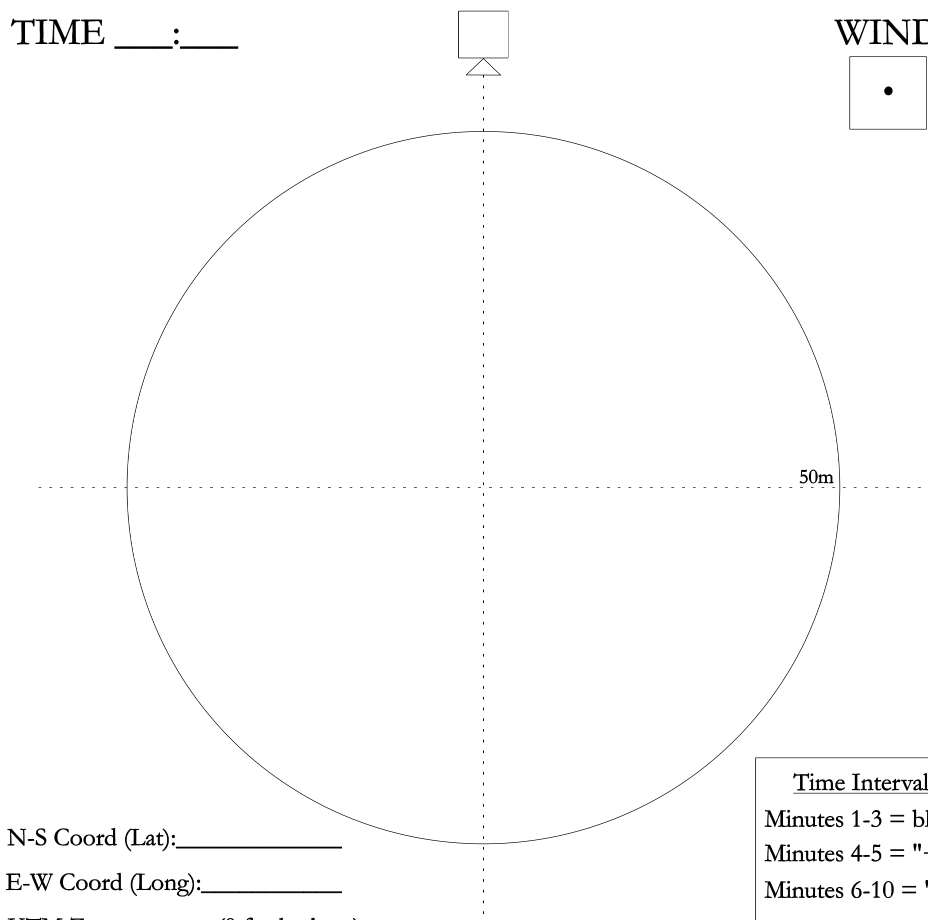
Minutes 4-5 = "+"
Minutes 6-10 = "•"

STATION 4

TIME ___:___

WIND



N-S Coord (Lat):___________

E-W Coord (Long):__________

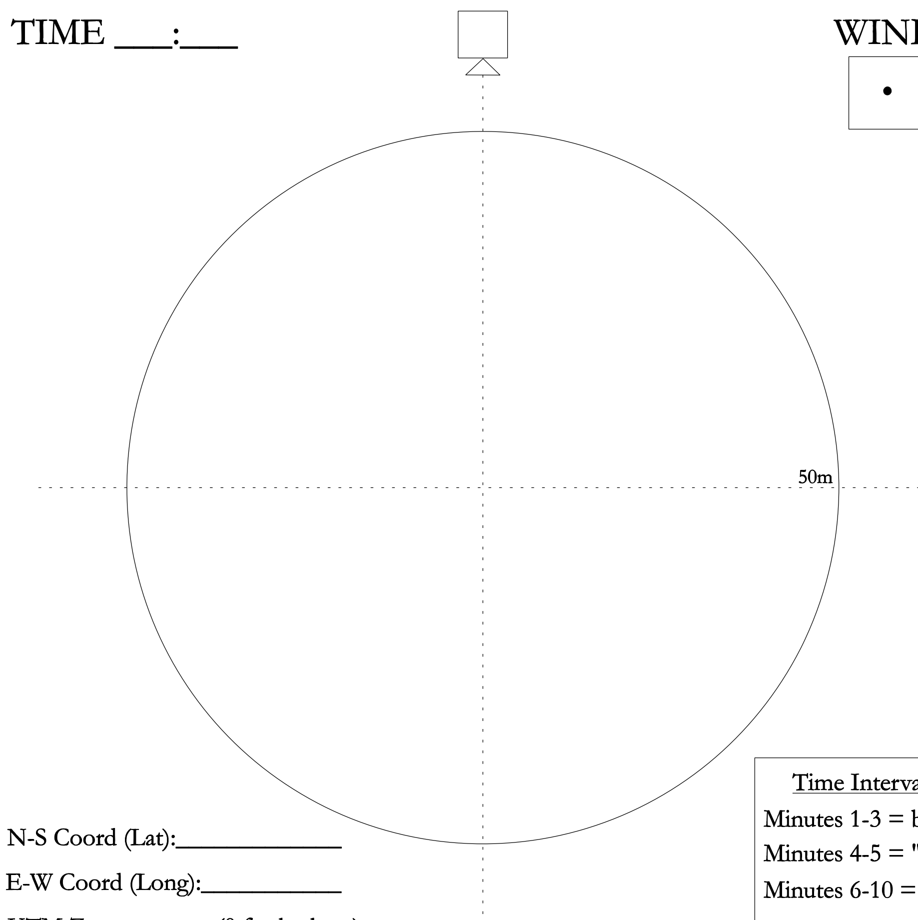
UTM Zone:_______(0 for lat-long)

Time Interval
Minutes 1-3 = blank
Minutes 4-5 = "+"
Minutes 6-10 = "•"

STATION 5

TIME ___:___

WIND



N-S Coord (Lat):___________

E-W Coord (Long):__________

UTM Zone:_______(0 for lat-long)

Time Interval
Minutes 1-3 = blank
Minutes 4-5 = "+"
Minutes 6-10 = "•"

POINT COUNT TRANSECT FIELD CARD

Site/Transect:	
Date:	
Observer:	
Temp (F):	
Cloud Code (0-6):	
Wind Code (0-6):	

Wind Codes
0=calm, smoke rises vertically
1=(1-3 mph) rising smoke drifts, indicating direction of wind
2=(4-7 mph) leaves rustle, wind can be felt on face
3=(8-13 mph) leaves and twigs move
4=(13-18 mph) thin branches in constant motion, raises loose paper
5=(>18 mph) trees sway, resistance felt when walking into wind

Cloud Codes
0=clear or a few clods
1=partly cloudy/variable
2=cloudy/overcast
3=fog
4=drizzle
5=showers
6=rain

MAPPING SYMBOLS

BITH - position of singing male

BITH - female observed

BITH - observed, sex unknown

BITH * - nest

BITH - approximate position of singing male

BITH - male observed

BITH ← BITH known change in position

BITH - calling, sex unknown

BITH - pair together, assumed mated

BITH ← - - BITH assumed change in position

NOTE: This sheet is based on Vermont Institute of Natural Sciences "Mountain Birdwatch - All Species" field card.

BREEDING BIRD SURVEY DATA SHEET			
Transect		Start Time	Date
Observer		End Time	
WEATHER	Temperature	sky code (0-6)	Wind Speed (0-5)
Sky Codes: 0 = clear or a few clouds, 1 = partly cloudy/variable, 2 = cloudy/overcast, 3 = fog, 4 = drizzle, 5 = showers, 6 = rain			
Wind codes: 0 = calm, 1 = 1-3 mph, 2 = 4-7 mph, 3 = 8-12 mph, 4 = 13-18 mph, 5 = 19-25 mph			

Start Time	Point #	Species	Approx Dist. (m)	Behavior Code

Start Time	Point #	Species	Approx Dist. (m)	Behavior Code

Behavior codes: **S** = singing male, **C** = calling, **D** = drumming, **I** = individual seen, **F** = family group, **N** = active nest

Data sheet based on VINS Mountain Birdwatch - FBMP Data Coding Sheet

Playback Data Sheet

Conduct playback survey only if no Bicknell's thrush were detected upon completion of the point count survey route, during or between point counts. In addition, plot the position of any BITH detected on a Point Count Location Map for each point.

Observer:	Date:
Route:	Start time:
	End time:

Point #:	Comments:
Playback time (min/sec): /	
Response: song call visual none	
Number of BITH responding:	

Point #:	Comments:
Playback time (min/sec): /	
Response: song call visual none	
Number of BITH responding:	

Point #:	Comments:
Playback time (min/sec): /	
Response: song call visual none	
Number of BITH responding:	

Point #:	Comments:
Playback time (min/sec): /	
Response: song call visual none	
Number of BITH responding:	

Point #:	Comments:
me (min/sec): /	
Response: song call visual none	
Number of BITH responding:	

Incidental Wildlife Observation Form

Sisk Wind Power Project

Species Observed:	# :
	Age (A/J/U) :
	Gender (M/F/U):
Date of Observation:	Time of Observation:
Observer:	Recorded by:
Location:	
GPS:	
Habitat Description:	
NOTES:	

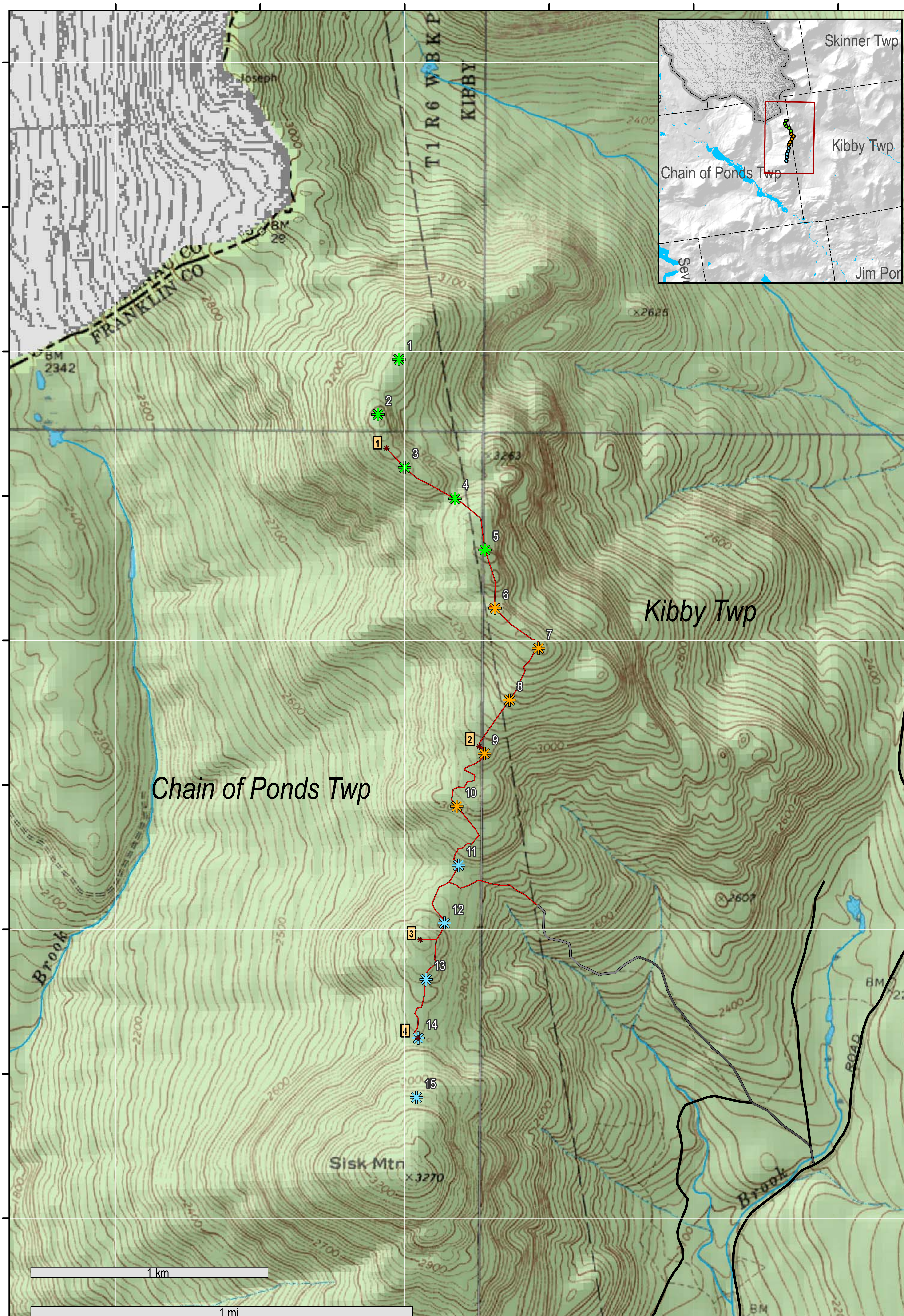
APPENDIX C:
Data Sheet for Habitat Evaluations

Vegetation Data Sheet

Location:		Study Plot:	Plot Size:
General Area Description:			Date:
Topography:			Observer:
Tenth-acre circles			
Trees		Diameter Size Classes (inches): A= <3 B = 3-6, C = 6-9, D = 9-15, E = 15-21, F = 21-27, G = 27-33, H = 33-40, I = >40	
Species and Size Class		Circle #:_______	**Shrubs** Number of woody stems less than 3 inches DBH intercepted in 2 armlength transects: Note species
1			
2			
3			
4			
5			**Ground Cover** 20 random + or - sitings through ocular tube for presence or absence of green vegetation: Note species
6			
7			
8			
9			
10			
11			
12			**Canopy Cover** 20 + or - sitings through ocular tube for presence or absence of green vegetation on transect: Note species
13			
14			
15			**Canopy Height** Maximum canopy height in feet: Note species
16			
17			
18			
19			
20			**Photos**
21			
22			
23			
24			**Slope and Bearing**
25			
26			
27			
28			**Other Notes**
29			
30			
31			
32			

Species Abbreviations: black spruce-PIMA; red spruce-PIRU; white spruce-PIGL; hemlock-TSCA; balsam fir-ABBA; N. white cedar-THOC; quaking aspen-POTR; bigtooth aspen-POGR; balsam poplar-POBA; hop-hornbeam-OSVI; yellow birch-BEAL; gray birch-BEPO; paper birch-BEPA; alder-ALRU; Am. beech-FAGR; Am. mtn. ash-SOAM; showy mtn. ash-SODE; serviceberry-AMAR; pin cherry-PRPE; sugar maple-ACSA; red maple-ACRU; striped maple-ACPE; mtn. maple-ACSP; black ash-FRNI; white ash-FRAM; green ash-FRPE

APPENDIX D:
Map of Proposed Transect and Survey Point Locations



Transects		Access	
*	1	—	Maintained Road
*	2	—	Existing Winter Road
*	3	—	Existing Skid Trail
*	Met Sites	—	Potential New Access Trail

N

Notes: Base map: 24k USGS Topographic Map. Elevation shading derived from MEDEM10 courtesy of Maine OGIS. Coordinate Grid: NAD83 UTM Zone 19N, Meters

Sisk Wind Power Project

Breeding Bird Survey
Transect Locations

249 Western Ave
Augusta, ME 04330
TRC

Created:
5/21/2009

S:\Projects\TRC\Augusta\165796-Sisk_Mtn\MXD\FIELD_MAPS\SWPP_BBS_FIELD_MAP_052109.mxd

EXHIBIT A.4 NOISE EVALUATION

A.4.1 General Information on Noise

Noise is defined as unwanted sound resulting from vibrations in the air. The range of pressures that cause the vibrations that create noise is large. Noise is therefore measured on a logarithmic scale, expressed in decibels (dB). The frequency of a sound is the “pitch” (high or low). The unit for frequency is hertz (Hz). Most sounds are a composite of frequencies. The normal human ear can usually distinguish frequencies from 20 Hz (low frequency) to about 20,000 Hz (high frequency), although people are most sensitive to frequencies between 500 and 4,000 Hz. The individual frequency bands can be combined into one overall dB level.

Noise is typically measured on the A-weighted scale (dBA). The A-weighted scale was developed and has been shown to provide a good correlation with the human response to sound and is the most widely used descriptor for community noise assessments (Harris 1991). The faintest sound that can be heard by a healthy ear is about 0 dBA, while an uncomfortably loud sound is about 120 dBA. In order to provide a frame of reference, some common sound levels are listed below.

- Pile driver at 100 feet 90 to 100 dBA
- Chainsaw at 30 feet 90 dBA
- Truck at 100 feet 85 dBA
- Noisy urban environment 75 dBA
- Lawn mower at 100 feet 65 dBA
- Average speech 60 dBA
- Typical suburban daytime 50 dBA
- Quiet office 40 dBA
- Quiet suburban nighttime 35 dBA
- Quiet rural area 30 dBA

A.4.2 Applicable Noise Standards

The recently enacted PL 2007, Chapter 661, which provides for an “expedited permitting process” for grid-scale wind power developments requires at 12 MRSA, §685-B(4-B)(A) that such developments meet the Maine Department of Environmental Protection’s (MDEP) comprehensive noise standard (Chapter 375.10, Control of Noise). The standard limits noise at protected locations, which are defined as any area accessible on foot containing a residence, house of worship, school, library, hospital, nursing home, etc. Limits are provided for protected locations based on the existing ambient noise levels and existing zoning.

At protected locations where the existing zoning or, if un-zoned, the existing use is predominantly commercial, transportation or industrial, hourly average sound levels from a development must be limited to 70 dBA during the day (7 a.m. to 7 p.m.) and 60 dBA at night (7 p.m. to 7 a.m.), measured at the property line of the receiver. For protected locations where the zoning or, if un-zoned, the existing use is not predominantly commercial, transportation or industrial, hourly average sound levels must be limited to 60 dBA during the day and 50 dBA at night. Further, if the existing all-encompassing ambient levels (interpreted as being the L_{eq} level) are below 45 dBA during the day or below 35 dBA at night, then this would be defined as a "Quiet Area." The allowable project-related noise levels in quiet areas at protected locations are limited to 55 dBA during the day and 45 dBA at night. At protected locations more than 500 feet from living and sleeping quarters, however, the daytime hourly sound level limits apply regardless of the time of day. Stated differently, the nighttime limits apply only within 500 feet of sleeping or living quarters on a protected location. The DEP noise standards also limit noise at the proposed project property lines to no greater than 75 dBA. The 75 dBA limit applies during any hour of the day at a project's property line where there are no existing or planned residential, commercial or industrial uses nearby. If the project's property line coincides with a protected location (e.g., residential) then the more restrictive of the above limits applies.

A.4.3 Construction Noise

The MDEP standard at 38 MRSA, §484.3.A provides no limitations on daytime construction noise (defined as the period of time between 7 a.m. and 7 p.m. or daylight hours, whichever is longer). Nighttime construction activity is not anticipated. If nighttime construction becomes essential to comply with external factors, for example to accommodate blade lifts, TransCanada will meet the standards for nighttime construction under MDEP Chapter 375.10.

A.4.4 Operational Noise

A.4.4.1 Wind Turbine Noise Sources

Older technology wind turbine installations have been documented as generating low frequency noise problems and complaints due to both aerodynamic noise and mechanical noise. The older technology consisted of fixed turbines mounted on lattice towers. Wind passing through the tower into the rotor created an aerodynamic wake. These problems have been corrected in modern designs through design features that include upwind turbines on monopole towers, improved blade design, and highly insulated nacelles (Curry & Kerlinger, L.L.C. 2004; Danish

Wind Industry 2004). The Kibby Expansion Project will contain modern wind turbine technology.

Aerodynamic noise is generated by wind passing over the turbine blades which, in modern turbines, creates a broadband sound. Mechanical noise associated with modern wind turbines has been virtually eliminated through improved component design and high efficiency insulation of the nacelle, which houses the gearbox and drive train.

There are no other sources of noise associated with operation of the Kibby Expansion Project, other than the project transformer. Noise from the transformer, located over 9000 meters from the protected areas, will be negligible. Any traffic associated with Project operation would be very minimal, limited to an occasional car or pickup type truck.

The maximum sound levels at protected locations were conservatively modeled and are well below the most restrictive nighttime limit of 45 dBA. Specifically, predicted sound levels at the nearest camps, which are more than two miles from the closet turbine, range from 20.2 to 25.4 dBA.

A.4.5 Noise Study

The Noise Study for the Kibby Expansion Project is provided in Attachment A.4.

ATTACHMENT A.4

Noise Study

NOISE STUDY

for the

Kibby Expansion Wind Power Project
Franklin County, Maine

Prepared for:

TransCanada
In business to deliver

Prepared by:
TRC

57 East Willow Street
Millburn, NJ 07041

TRC

November 2009

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TABLES AND FIGURES

1.0 INTRODUCTION

TRC conducted a noise assessment of the proposed Kibby Expansion Wind Power Project (the Kibby Expansion Project) on behalf of TransCanada Maine Wind Development, Inc (TransCanada). The Kibby Expansion Project, which would be located in Kibby and Chain of Ponds Townships, Franklin County, Maine, will include up to 15 wind turbine generators (WTGs) and associated facilities that can generate up to 45 megawatts (MW) of electric power. The noise assessment included a characterization of the existing ambient noise environment in the area through an ambient noise monitoring program, and an analysis of potential noise levels due to Project operation. Nearby protected locations were identified and included in this assessment. Construction noise is also addressed.

1.1 General Information on Noise

Noise is defined as unwanted sound resulting from vibrations in the air. The range of pressures that cause the vibrations that create noise is large. Noise is therefore measured on a logarithmic scale, expressed in decibels (dB). The frequency of a sound is the "pitch" (high or low). The unit for frequency is hertz (Hz). Most sounds are a composite of frequencies. The normal human ear can usually distinguish frequencies from 20 Hz (low frequency) to about 20,000 Hz (high frequency), although people are most sensitive to frequencies between 500 and 4,000 Hz. The individual frequency bands can be combined into one overall dB level.

Noise is typically measured on the A-weighted scale (dBA). The A-weighted scale was developed and has been shown to provide a good correlation with the human response to sound and is the most widely used descriptor for community noise assessments (Harris 1991). The faintest sound that can be heard by a healthy ear is about 0 dBA, while an uncomfortably loud sound is about 120 dBA. In order to provide a frame of reference, some common sound levels are listed below.

- Pile driver at 100 feet — 90 to 100 dBA
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- Average speech — 60 dBA
- Typical suburban daytime — 50 dBA
- Quiet office — 40 dBA
- Quiet suburban nighttime — 35 dBA
- Quiet rural area — 30 dBA

1.2 Applicable Noise Standards

The recently enacted PL 2007, Chapter 661, which provides for an "expedited permitting process" for grid-scale wind power developments, requires at 12 MRSA §685-B(4-B)(A) that such developments meet the Maine Department of Environmental Protection's (MDEP) comprehensive noise standard (Chapter 375.10, Control of Noise). The standard limits noise at protected locations, which are defined as any area accessible on foot containing a residence, house of worship, school, library, hospital, nursing home, etc. Limits are provided for protected locations based on the existing ambient noise levels and existing zoning.

At protected locations where the existing zoning or, if un-zoned, the existing use is predominantly commercial, transportation or industrial, hourly average sound levels from a development must be limited to 70 dBA during the day (7 a.m. to 7 p.m.) and 60 dBA at night (7 p.m. to 7 a.m.), measured at the property line of the receiver. For protected locations where the zoning or, if un-zoned, the existing use is not predominantly commercial, transportation or industrial, hourly average sound levels must be limited to 60 dBA during the day and 50 dBA at night. Further, if the existing all-encompassing ambient levels (interpreted as being the L_{eq} level) are below 45 dBA during the day or below 35 dBA at night, then this would be defined as a "Quiet Area." The allowable project-related noise levels in quiet areas at protected locations are limited to 55 dBA during the day and 45 dBA at night. At protected locations more than 500 feet from living and sleeping quarters, however, the daytime hourly sound level limits apply regardless of the time of day. Stated differently, the nighttime limits apply only within 500 feet of sleeping or living quarters on a protected location. The DEP noise standards also limit noise at the proposed project property lines to no greater than 75 dBA. If the project's property line coincides with a protected location (e.g., residential) then the more restrictive of the above limits applies.

The MDEP standard at 38 MRSA §484.3.A provides no limitations on daytime construction noise (defined as the period of time between 7 a.m. and 7 p.m. or daylight hours, whichever is longer). Nighttime construction activity is not anticipated. If nighttime construction is required, for example to accommodate blade lifts, TransCanada will meet the standards for nighttime construction under MDEP Chapter 375.10.

2.0 PRECONSTRUCTION CONDITIONS

An ambient noise monitoring survey was conducted in accordance with the MDEP noise standard near the proposed Kibby Expansion Project. The area surrounding the project is characterized by rural, undeveloped land. The nearest identified protected locations were several seasonal camps to the southwest, the closest being located over two miles away from the southern-most WTG. The location of the proposed turbines, existing camps, and the selected noise monitoring location are depicted in Figure 1. Data collected at the noise monitoring location were judged to be representative of ambient conditions in the area of the camps.

The ambient noise environment in the area of the camps is characterized largely by natural sounds such as rustling vegetation, insects, and birds and local vehicular traffic on Highway 27, and aircraft overflights. Ambient noise levels, especially in a rural setting such as this are generally related to near ground level wind speed, as increasing winds generate increasing sounds such as rustling vegetation. The exception to this is along roads, where the diurnal noise pattern is affected by traffic noise. As will be discussed in subsequent sections, WTGs do not generate operational noise until the cut-in wind speed is reached. Cut-in for the Vestas V90 turbines proposed for this project is 4 meters per second (m/s) at hub height. The sound output from these WTGs gradually increases, reaching a maximum at a wind speed of approximately 9 m/s at hub height.

Existing ambient noise levels near the camps were measured continuously over an eight day period between October 16, 2009 and October 23, 2009. Meteorological conditions during the monitoring period were obtained from the Greenville, Maine Municipal Airport. Temperatures varied, ranging from 25 degrees Fahrenheit up to 52 degrees Fahrenheit. Skies ranged from clear to overcast. Winds also varied, with mostly calm winds with some moderate winds interspersed. Strong winds with gusts up to 35 mph occurred from late evening October 22 to mid-day October 23. Precipitation occurred from 2 a.m. to 11 a.m. on October 22.

2.1 Monitoring Methodology

Noise levels were measured using a Larson-Davis Laboratories Model 820 Precision Integrating Sound Level Meter meeting the requirements of ANSI Standard S1.4-1983 for Type 1 precision meters. The microphone was mounted at a height of about 2 feet above the ground and fitted with a foam windscreen to reduce wind-generated noise. Certificates of calibration for the monitor and microphone are contained in Appendix A.

The meters were programmed to measure and record the 10-minute L_{eq}, L_{10}, L_{50} and L_{90} statistical levels on a continuous basis. Only the L_{eq} levels are presented in this report to correspond with noise metrics used by the MDEP. The L_{eq} is a measure of all the sound energy present during the measurement period. The 10-minute L_{eq} levels were combined to produce hourly L_{eq} levels.

2.2 Noise Monitoring Results

The MDEP noise standard utilizes the arithmetic average of the daytime and nighttime noise levels in order to determine the applicable noise limits. A tabular summary of the monitoring data is provided in Table 1. Hourly L_{eq} levels ranged from a minimum of 21.8 dBA to a maximum of 52.2 dBA, with higher levels occurring during the rain and high wind events on October 22, 2009.

A review of the data in Table 1 reveals that the hourly average daytime noise level was 33.4 dBA. The nighttime average level was 30.2 dBA. Because both the average daytime noise level was below 45 dBA and the nighttime level was below 35 dBA, the nearest protected locations are considered quiet areas under MDEP's noise standard. Accordingly, the applicable MDEP hourly sound level noise standard at protected locations is 55 dBA during the day and 45 dBA at night. As noted above, the 45 dBA standard applies only within 500 feet of living or sleeping quarters on protected locations. Because the WTGs will operate when there is an adequate amount wind, be it day or night, the Kibby Expansion Project will need to meet the 45 dBA nighttime limit within 500 feet of living or sleeping quarters on protected locations and 55 dBA elsewhere on protected locations

3.0 CONSTRUCTION NOISE

Based on 38 MRSA §484.3.A, noise generated between the hours of 7 a.m. and 7 p.m. or during daylight hours, whichever is longer, by construction of a development is not regulated. Nighttime construction activity is not anticipated. If nighttime construction activity is required, TransCanada will meet the standards for nighttime construction under MDEP Chapter 375.10.

4.0 OPERATION NOISE

This section describes the operational noise characteristics of WTGs, as well as the methods and results from the operational noise analysis for the Kibby Expansion Project.

4.1 Wind Turbine Noise Sources

Older technology wind turbine installations have been documented as generating low frequency noise problems and complaints due to both aerodynamic noise and mechanical noise. The older technology consisted of fixed turbines mounted on lattice towers. Wind passing through the tower into the rotor created an aerodynamic wake. These problems have been corrected in modern designs through design features that include upwind turbines on monopole towers, improved blade design, and highly insulated nacelles (Curry & Kerlinger, L.L.C. 2004; Danish Wind Industry 2004). The Kibby Expansion Project will utilize modern wind turbine technology.

Aerodynamic noise is generated by wind passing over the turbine blades which, in modern turbines, creates a broadband sound. Mechanical noise associated with modern wind turbines has been virtually eliminated through improved component design and high efficiency insulation of the nacelle, which houses the gearbox and drive train.

4.2 Operational Noise

The commercially available CadnaA model (DataKustik, 2006) was used for this analysis. The software takes into account spreading losses, ground and atmospheric effects, shielding from terrain, barriers and buildings, and reflections from surfaces. The software is standards-based and the ISO 9613 Part 2 standard was used for air absorption and other noise propagation calculations (ISO 1993). These model capabilities are especially important in an area such as the Kibby Expansion Project site, as the effects of the complex terrain can be accounted for. By default, the model assumes that all receptors are downwind of the noise sources thereby producing a conservative result. The following model options were selected:

- The ground absorption coefficient was selected as 0 where a value of 0 is a highly reflective ground surface such as pavement or calm water and 1 is a highly absorptive surface such as plowed fields and forests. A value of 1 would be most realistic for the project area, but the value of 0 yields a conservative result to avoid under-predicting expected noise levels.

- Standard atmospheric conditions were selected (temperature of 50 degrees Fahrenheit and a relative humidity of 70 percent), which are favorable to the propagation of sound. This is also a conservative selection since different combinations more applicable to the site will generally produce slightly lower modeled results on the order of tenths of a decibel.

- The search radius was set to 8 kilometers. This means that the contributions of all turbines within 8 kilometers of each receptor or grid point were calculated in the total for those locations. Because of the scattering of sound in the atmosphere, particularly when it is windy, noise from any more distant turbines should not realistically have any contribution, although the model might show a slight increase.

- No credit was taken for the extensive tree cover, which in reality will act to further reduce noise levels.

Table 2 shows the sound power levels used in the model, by octave band, of the Vestas V90 WTGs under consideration as provided by Vestas, and the project 50 MVA electrical transformer. The Vestas data also contain a +/- 2 dB tolerance. Accordingly, a +2dB tolerance was added across the spectrum for modeling purposes. Sound power is the total acoustic power produced by a noise source and is independent of the distance from the source. It is reported in decibels referenced to 10^{-12} watts.

All WTGs operating simultaneously at full load were included in the model, and all noise was assumed to emanate from the hub height (80 meters above the ground). There are no other sources of noise associated with operation of the Kibby Expansion Project, other than the project transformer. Noise from the transformer, located over 9000 meters from the protected areas, will be negligible. Any traffic associated with project operation would be very minimal, limited to an occasional car or pickup type truck.

4.2.1 Noise Modeling Results and Comparison to MDEP Standard

Calculated noise levels at the nearby protected locations are provided in Table 3. A review of the data in this table reveals that the highest modeled noise level was 25.4 dBA at Site 2, well below the MDEP nighttime noise standard for quiet areas.

In addition to the tabular data presented, a noise contour map is also included as Figure 2, which depicts the expected noise levels in the area. This figure shows that all of the protected locations are outside of the 45 dBA standard contour. The turbine locations are depicted as red crosses and the camps are represented with black and white circles on the contour map.

The calculated Kibby Expansion Project noise levels are conservative, as they are for all turbines operating at the same time under maximum sound output conditions. At times, the turbines will be operating at less than full sound output. Additionally, wind direction and other meteorological conditions will act to reduce sound levels even further at protected locations.
As discussed earlier, the aerodynamic noise generated by the WTGs is broadband in nature. Also, the noise levels presented above are those that would be experienced for people outdoors and were based on conservative assumptions for model inputs. Accordingly, the Kibby Expansion Project will meet all applicable noise limits, including the nighttime limits for quiet areas.

5.0 CONCLUSION

TRC, under contract to TransCanada, conducted a detailed noise study of the proposed Kibby Expansion Project. The study included identification of nearby protected locations, an ambient noise monitoring program to identify baseline conditions, detailed computer noise modeling, and a demonstration of compliance with MDEP noise standards.

The ambient noise monitoring program, conducted continuously over an eight day period at the nearest identified protected locations, revealed that the daytime hourly average noise levels were less than 45 dBA and nighttime hourly average noise levels were less than 35 dBA. As such, the area is defined as a quiet area under MDEP's noise standard, and project related noise is limited to the quiet area limits of 45 dBA and 55 dBA at nearby protected locations. The noise modeling study revealed that project noise levels would be well below the MDEP standards, with the highest calculated noise level of only 25.4 dBA at the nearest protected area.

6.0 REFERENCES

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Tables

Table 1 – Kibby Expansion Project Summary of Hourly Background Measured L_{eq} Noise Levels (dBA)

TransCanada Kibby Expansion									
Hour Ending	October 16, 2009	October 17, 2009	October 18, 2009	October 19, 2009	October 20, 2009	October 21, 2009	October 22, 2009	October 23, 2009	Average by Hour
1	---	25.4	26.3	22.5	25.7	30.2	29.3	35.3	27.8
2	---	22.9	23.2	21.8	23.0	27.5	44.4	33.4	28.0
3	---	27.5	22.7	29.1	33.3	32.1	48.7	33.0	32.3
4	---	24.9	24.7	25.2	30.1	29.9	48.8	32.2	30.8
5	---	22.9	23.0	30.3	29.1	30.5	49.7	31.0	30.9
6	---	25.7	23.8	29.8	32.9	29.7	47.1	33.6	31.8
7	---	26.1	25.6	29.6	29.8	29.7	44.4	30.1	30.7
8	---	27.8	33.3	31.4	32.7	32.2	43.3	33.0	33.4
9	37.9	30.3	31.7	31.4	30.0	33.6	44.0	33.8	34.1
10	36.1	30.1	29.8	35.3	33.6	33.0	40.3	33.4	33.9
11	36.8	29.5	29.9	30.1	33.1	35.1	42.6	---	33.9
12	34.2	27.5	31.0	32.3	34.3	34.2	48.0	---	34.5
13	36.2	30.6	34.0	35.5	34.0	37.6	40.1	---	35.4
14	30.1	30.6	33.2	36.1	35.4	38.0	41.2	---	34.9
15	28.0	29.3	30.2	33.3	35.2	37.7	40.8	---	33.5
16	29.5	27.6	30.2	30.8	31.4	34.9	36.4	---	31.5
17	27.2	27.4	28.2	29.2	31.2	33.0	43.2	---	31.4
18	26.9	26.4	28.4	26.3	28.4	31.4	48.5	---	30.9
19	27.9	28.7	31.8	30.5	29.3	33.4	52.2	---	33.4
20	28.7	27.3	27.5	29.2	27.6	25.4	52.2	---	31.1
21	27.6	25.5	26.9	32.6	27.3	28.3	47.3	---	30.8
22	24.4	25.9	29.2	25.8	23.6	31.4	45.6	---	29.4
23	26.7	23.8	25.1	31.4	29.2	31.0	42.1	---	29.9
24	26.3	22.8	22.5	31.6	28.5	35.5	37.5	---	29.3
								Average Day	**33.4**
								Average Night	**30.2**

Table 2 – Kibby Expansion Project Un-Weighted Sound Power Levels of Turbines and Transformer

3MW Vestas Turbine Sound Power Level											
Turbine Load Level	**WS at Hub (m/s)**	**Octave Band Center Frequency (Hz)**									**Total dBA**
		31	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Full Load	9.0	94.0	96.2	102.0	105.4	106.4	107.7	103.9	101.2	96.6	111.4
Kibby Expansion Transformer		91.0	97.0	99.0	94.0	94.0	88.0	83.0	78.0	71.0	94.4
Note: Total dBA PWL derived from Vestas General Specification V90 – 3.0 MW. Octave band data are estimated based on similar turbines. WTG data include a +2 dB tolerance per Vestas specifications.											

Table 3 – Kibby Expansion Project Noise Modeling Results

Protected Location	Calculated Project Sound Level	Most Restrictive Hourly Sound Standard
1 – Site 1	23.8	45
2 – Site 2	21.9	45
3 – Site 3	22.5	45
4 – Site 4	22.3	45
5 – Site 5	21.9	45
6 – Site 6	24.2	45
7 – Site 7	24.2	45
8 – Site 8	24.2	45
9 – Site 9	25.4	45
10 – Site 10	23.1	45
11 – Site 11	20.2	45

Table 4 – Kibby Expansion Project Octave Band Noise Modeling Results

Octave Band Noise Modeling Results										
	Octave Bands									Total
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	A-weighted
Site	dB	dB	dB	dB	dB	dB	dB	dB	dB	dBA
1	21.8	23.5	27.7	27.6	23.7	15.4	0	0	0	23.8
2	19.7	21.5	25.6	25.6	21.8	13.7	0	0	0	21.9
3	20	21.8	26	26	22.4	14.7	0	0	0	22.5
4	19.9	21.7	25.9	25.9	22.2	14.4	0	0	0	22.3
5	19.7	21.5	25.6	25.6	21.8	13.8	0	0	0	21.9
6	22	23.7	27.9	27.8	24.1	16.1	0	0	0	24.2
7	21.9	23.7	27.9	27.8	24	16	0	0	0	24.2
8	20.7	22.5	26.8	27.2	24.1	17.6	0	0	0	24.2
9	23	24.7	28.9	29	25.3	17.7	0	0	0	25.4
10	20.1	21.9	26.1	26.3	22.9	15.9	0	0	0	23.1
11	18.9	20.7	24.6	24.1	20	11.4	0	0	0	20.2

Figures

Figure 1 – Kibby Expansion Project Site Location

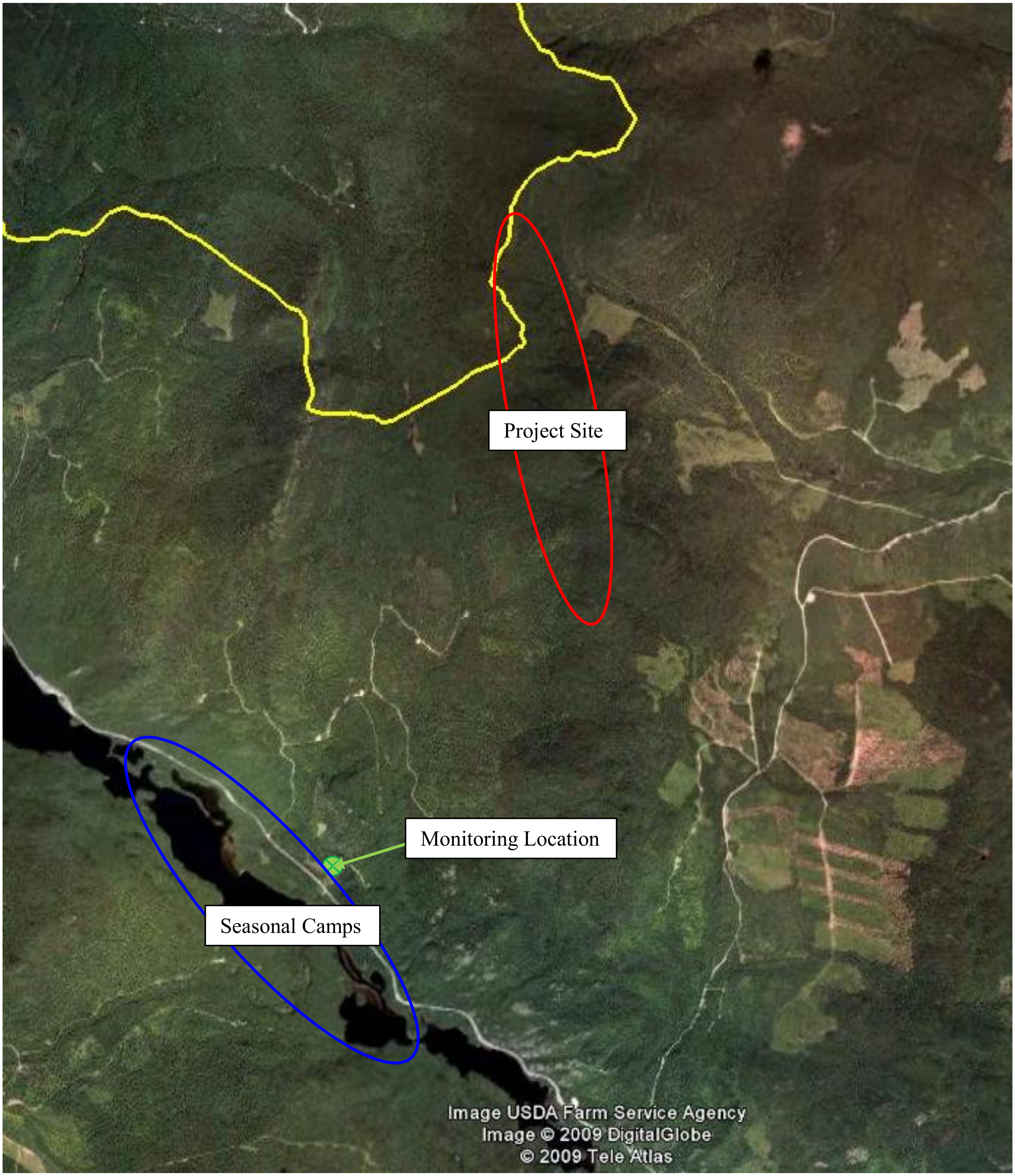
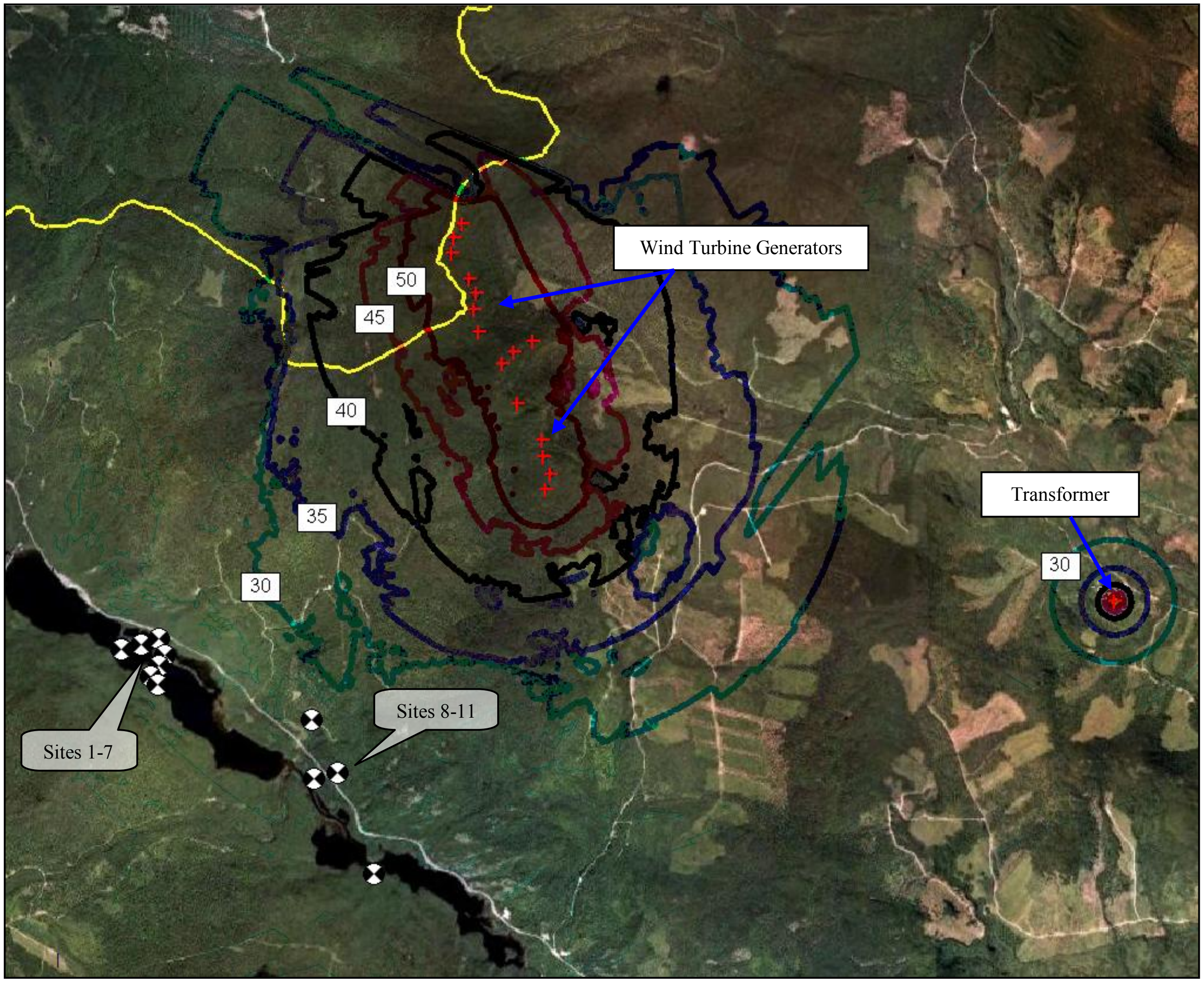


Figure 2 – Kibby Expansion Project Operational Noise Contour Map



Appendix A

Sound Level Meter Calibration Certificates

Certificate of Calibration and Conformance

Instrument Model **820**, Serial Number **1688**, was calibrated on November 22, 2008. The instrument meets factory specifications according to The Modal Shop Production Test Procedure PRD-P227, ISO 10012, ANSI S1.4 1983, IEC 651-Type 1 1979, and IEC 804-Type 1 1985.

Instrument found to be in calibration as received: YES
Date Calibrated: November 22, 2008
Calibration due:

Calibration Standards Used

Manufacturer	Model	Serial Number	Interval	Cal Due	Traceability No.
Larson Davis	LDSigGn/2209	0760 / 0101	12 Months	2/18/2009	2008-102748

Certified Reference Standards are traceable to the National Institute of Standards and Technology (NIST)

Calibration Environmental Conditions

Ambient Temperature: 73.4°F   Relative Humidity: 42%

Notes

This Certificate attests that this instrument has been calibrated under the stated conditions with Measurement and Test Equipment (M&TE) Standards traceable to the National Institute of Standards and Technology (NIST). All of the Measurement Standards have been calibrated to their manufacturers' specified accuracy / uncertainty. Evidence of traceability and accuracy is on file at The Modal Shop and/or Larson Davis Corporate Headquarters. An acceptable accuracy ratio between the Standard(s) and the item calibrated has been maintained. This instrument meets or exceeds the manufacturer's published specification unless noted.

This calibration complies with ISO 10012. The collective uncertainty of the Measurement Standard used does not exceed 25% of the applicable tolerance for each characteristic calibrated unless otherwise noted.

Due to state-of-the-art limitations, 4:1 calibration ratios are not possible on pressure measurement standards, microphones and acoustic calibrators. Calibration ratios for these types of devices are limited to 1:1.

The results documented in this certificate relate only to the item(s) calibrated or tested. Calibration interval assignment and adjustment are the responsibility of the end user. This certificate may not be reproduced, except in full, without the written approval of The Modal Shop.

Technician: Ed Devlin
Service Center: The Modal Shop, Inc.

Signature: Edward A. Devlin

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A PCB GROUP CO.

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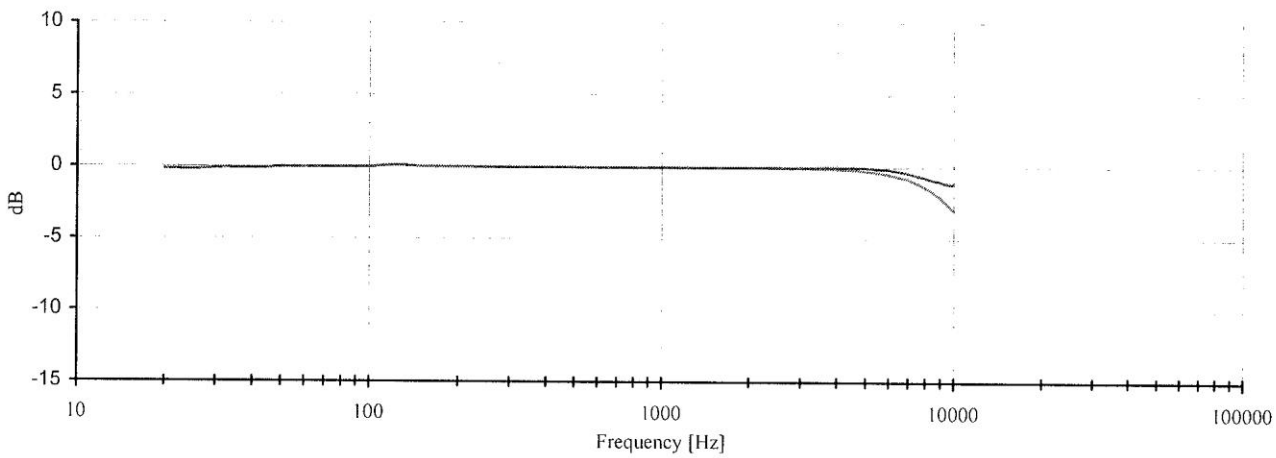
www.modalshop.com

~Calibration Certificate~

Description: Random Microphone
Manufacturer: PCB
Model Number: 377A60
Serial Number: 110256

Customer : TMS Rental



Test Results:

Sensitivity:	**250 Hz**	**1kHz**	
	-26.36	-26.38	dB re. 1V/Pa
	48.10	47.97	mV/Pa
Cal. Results:	In Tolerance		

Frequency Response Characteristics : The upper curve is the random incidence characteristic for the microphone with protection grid. The lower curve is the pressure response recorded by electrostatic actuator.

Sensitivity : The stated sensitivity is the open-circuit sensitivity. When used with a typical preamplifier the sensitivity will be 0.2 dB lower.

Polarization Voltage : 200 V

Traceability : The calibration is traceable through NIST TN 822/274345-07.

Notes :
Calibration results relate only to the items calibrated.
This certificate may not be reproduced, except in full, without written permission.
This calibration is performed in compliance with ISO 9001, ISO 17025 and ANSI Z540.
Measurement uncertainty at 95% confidence level: 0.25 dB
Calibrated per procedure PRD-P204.

User Note : As Found / As Left: In Tolerance.

Cal Date:	15-Jun-2009	15:46:59	Temperature:	72 (22)	°F (°C)
Due Date:			Humidity:	36	%
Technician:	Ed Devlin		Pressure:	1020	mbar
Approval:	*[signature]*				

Reference Equipment Used:

Manuf.	*Model*	*Serial*	*Cal. Date*	*Due Date*
G.R.A.S.	40AG	58093	8/19/2008	8/19/2009

ACCREDITED
2649.01

EXHIBIT A.5 PUBLIC SAFETY AND RELATED TURBINE SETBACKS

Recently enacted wind power legislation requires a demonstration that the proposed generating facilities will be constructed with setbacks adequate to protect public safety.[1] Recent guidance associated with LURC's development application states that this requirement is fulfilled by submitting documentation that the turbine design meets accepted safety standards, and has appropriate overspeed control and evidence that the generating facilities have been sited with appropriate safety related setbacks from adjacent properties and adjacent existing uses. Chapter 10.26 (dimensional) setbacks are discussed in Exhibit B.13.

A.5.1 Turbine Design Certification/Overspeed Control

Evidence that the turbine design meets acceptable safety standards is provided in the certificate of design compliance from the manufacturer of the WTGs, Vestas, in Attachment A.5-1. Evidence from the manufacturer specifying that the overspeed controls (such as variable pitch and mechanical brakes) and related safety mechanisms are part of the Vestas V90 WTG design is provided as Attachment A.5-2.

A.5.2 Public Safety Setbacks

The LURC Guidance Documents recommend a minimum setback from property lines, roads, or other structures (measured to the center of the wind turbine base) equal to the local setback requirements or 1.5 the maximum turbine blade height (or 615 feet), whichever is greater.[2]

The Project has been sited with appropriate safety related setbacks. The Vestas V90 WTGs proposed herein are 410 feet to the tip of the rotor at maximum height. According to LURC's guidance, the property line safety factor of 1.5 times the total height of the WTG results in a recommended setback of 615. The easement granted to TransCanada by Plum Creek Maine Timberlands, LLC ("Plum Creek") for the Kibby Expansion Project extends to the Kibby/Chain of Ponds Township line on the west. Similarly, the easement granted to TransCanada by Kennebec West Forest, LLC ("KWF") for the Kibby Expansion Project extends to the Kibby/Chain of Ponds Township Line on the east. All turbines are located more than 615 feet from the traveled portion of any existing public road and other structures (with the exception of the collector system infrastructure). Eight (8) of the proposed turbine locations are located more than 615 feet from property lines, roads and other structures. Seven (7) of the proposed turbine locations (turbines 8, 9, 11, 12, 13, 14, and 15) will be located closer than the recommended 615 feet from the township boundaries/property lines. In all locations where turbines are proposed closer than the recommended setback area, the abutting parcels are non-residential parcels in

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1 See, e.g., 35-A M.R.S.A. § 3402(1).

2 LURC Grid Scale Wind Energy Development Permit Application, Guidance Document issued September 3, 2008, and Checklist for LURC applications, Appendix B(5).

active forest management. As such, there is a low potential for a public safety problem at this site. In addition, TransCanada has obtained waivers from the adjacent landowners, KWF and Plum Creek, to construct the turbines within the recommended safety setback locations. The waviers are expressly included in the Plum Creek easements provided in Exhibit B.5, Attachment B.5. TransCanada has obtained a separate waiver from KWF and that document is also provided in Exhibit B.5, Attachment B.5.

ATTACHMENT A.5-1

Vestas V90 Design Safety Certification

Class I
Item no. 950046.R3
2006-05-23

IEC Design Evaluation Statement
IEC DE-205703-4
V90 – 3.0 MW

VCS 50 Hz

Issued by DNV

DET NORSKE VERITAS

DESIGN EVALUATION CONFORMITY STATEMENT

Vestas V90 3MW

IEC DE-205703-4
Conformity Statement number

2006-05-23
Date of issue

Manufacturer:
Vestas Wind Systems A/S
Alsvej 21
DK-8900 Randers

This conformity statement attests compliance with IEC 61400-1 ed. 3: 2005 concerning the design. The conformity evaluation was carried out according to **IEC WT 01: 2001 "IEC system for conformity testing and certification of wind turbines, Rules and procedures"**. Any change in the design is to be approved by DNV. Without approval the Statement loses its validity.

Evaluation reports:
Final Verification Report: WTDK-2554

Wind Turbine specification:
IEC WTGS class: IA/IIA. For further information see Appendix 1 of this Certificate.

Date: 2006-05-23
f/**Henrik Bach**
Management Representative
Det Norske Veritas, Danmark A/S

PRODUCTS
RvA C257

Date: 2006-05-23
Torben Søndergaard
Project Manager
Det Norske Veritas, Danmark A/S

DET NORSKE VERITAS, DANMARK A/S

DET NORSKE VERITAS
DANMARK A/S
IEC DE-205703-4
CONFORMITY STATEMENT

APPENDIX 1 - WIND TURBINE TYPE SPECIFICATION

General:

IEC WTGS class:	1A	2A
Rotor diameter:	90 m	90 m
Rated power:	3000 kW	3000 kW
Rated wind speed V_r:	13.4 m/s	13.4 m/s
Hub heights:	65m, 80 m	105 m
Operating wind speed range V_{in}-V_{out}:	4 – 25 m/s	4 – 25 m/s
Design life time:	20 years	20 years

Wind conditions:

V_{ref} (hub height)	50 m/s	42.5 m/s
V_{e50} (hub height)	70 m/s	59.5 m/s
V_{ave} (hub height):	10 m/s	8.5 m/s
I_{ref} at V_{hub} = 15 m/s:	0.16	0.16

Electrical network conditions:

Normal supply voltage and range:	6-33 kV
Normal supply frequency and converter types:	50 Hz VCS

Other environmental conditions (where taken into account):

Air density:	1.225 kg/m^3
Operational ambient temperatures:	-20 to 45 °C
Stand still ambient temperatures:	-40 to 50 °C

Main components:

Blade type:	Vestas 44m blade
Gear box alternatives:	Hansen EF901CE55-K1, i=104.6 Hansen EF901DE55-K1, i=104.6
Main bearing alternatives:	FAG: U60-807110QFAG SKF: BT2-8125/HA1
Generator alternatives:	Leroy Somer G54-10/4P: Mk 4, Mk 5 & Mk 6 (50 Hz VCS) Weier DVSGM 560/4L: MK 2 &MK 3 (50 Hz VCS) Leroy Somer G54-9/4P: Mk 7 (60 Hz VCRS)
Yaw gear	SOM PG 1604 R=1391/1
Tower type:	Tubular steel tower
Crane and service load	Integrated, 800kg
Service Lift	Avanti, type Shark, max working load 240 kg
Controller	VMP 6000

ATTACHMENT A.5-2

Vestas V90 Overspeed Central and Related Safety Mechanisms

4 Turbine Protection Systems

4.1 Braking Concept

The main brake on the turbine is aerodynamic. Braking the turbine is done by full feathering the three blades (individual turning of each blade). Each blade has a hydraulic accumulator as power supply for turning the blade.

In addition there is a mechanical disc brake on the high speed shaft of the gearbox with a dedicated hydraulic system. The mechanical brake is only used as a parking brake, and when activating the emergency stop push buttons.

4.2 Short Circuit Protections

Breakers	**Generator / Q8 ABB E3H- A-2500 1000 V**	**Controller / Q22 ABB T4L-250 A-150A 400 V**	**VCRS / Q7 ABB T5L600 400 V**
Breaking Capacity, I_{cu}, I_{cs}	50 kA @1000 IEC 85kA@600V UL	100 kA @480V	100 kA @480V
Making Capacity, I_{cm}	105 kA	440 kA @415V IEC	440 kA @415V IEC
Thermo Release, I_{th}	1.0-2.5 kA	60-150A	240-600A
Magnetic Release, I_m	3.75-37.5 kA	0.15-1.5kA	0.9-7.2kA

Table 4-1: Short Circuit Protection Data

4.3 Overspeed Protection

The generator RPM and the main shaft RPM are registered by inductive sensors and calculated by the wind turbine controller in order to protect against over-speed and rotating errors.

The turbine is equipped with a VOG (Vestas Overspeed Guard), which is an independent computer module measuring the rotor RPM, and in case of an overspeed situation the VOG activates full feathering of the three blades independently of the turbine controller in the turbine.

Overspeed Protection	
VOG Sensors Type	Inductive
Trip Levels	19.36 (Rotor RPM)/2,110 (Generator RPM)

Table 4-2: Overspeed Protection Data

4.4 Lightning Protection of Blades, Nacelle, Hub & Tower

The Lightning Protection System (LPS) helps protect the wind turbine against the physical damages caused by lightning strikes. The LPS consists of five main parts.

- Lightning receptors.
- Down conducting system. A system to conduct the lightning current down through the wind turbine to help avoid or minimise damage to the LPS system itself or other parts of the wind turbine.
- Protection against over-voltage and over-current.
- Shielding against magnetic and electrical fields.
- Earthing System

Lightning Protection Design Parameters			**Protection Level I**
Current Peak Value	i_{max}	[kA]	200
Total Charge	Q_{total}	[C]	300
Specific Energy	W/R	[MJ/Ω]	10
Average Steepness	di/dt	[kA/μs]	200

Table 4-3: Lightning Protection Design Parameters

NOTE Lightning strikes are considered force majeure, i.e. damage caused by lightning strikes is not warranted by Vestas.

4.5 Earthing

The Vestas Earthing System consists of a number of individual earthing electrodes interconnected as one joint earthing system.

The Vestas Earthing System includes the TN-system and the lightning protection system for each wind turbine. It works as an earthing system for the medium voltage distribution system within the wind park.

The Vestas Earthing System is adapted to the different types of foundation a turbine can be erected on. A separate set of documents describe the earthing system in detail, depending on the type of foundation the turbine is erected on.

In terms of lightning protection of the wind turbine, Vestas has no separate requirements for a certain minimum resistance to remote earth (measured in ohms) for this system. The earthing for the lightning protection system is based on the design and construction of the Vestas Earthing System.

A part of the Vestas Earthing System is the main earth bonding bar placed where all cables enter the wind turbine. All earthing electrodes are connected to this main earth bonding bar. Additionally, equipotential connections are made to all cables entering or leaving the wind turbine.

Requirements in the Vestas Earthing System specifications and work descriptions are minimum requirements from Vestas and IEC. Local and national requirements, as well as project requirements, may require additional measures.

4.6 Corrosion Protection

Classification of corrosion categories protectionfor atmospheric corrosion is according to ISO 12944-2.

Corrosion Protection	External Areas	Internal Areas
Nacelle	C5	C3 and C4 Climate Strategy: Heating the air inside the nacelle compared to the outside air temperature lowers the relative humidity and helps ensure a controlled corrosion level.
Hub	C5	C3
Tower	C5-I (Onshore) C5-M (Offshore)	C3

Table 4-4: Corrosion Protection Data for Nacelle, Hub and Tower

5 Safety

The safety specifications in Section 5 provide limited general information about the safety features of the turbine and are not a substitute for Buyer and its agents taking all appropriate safety precautions, including but not limited to (a) complying with all applicable safety, operation, maintenance, and service agreements, instructions, and requirements, (b) complying with all safety-related laws, regulations, and ordinances, and (c) conducting all appropriate safety training and education.

5.1 Access

Access to the turbine from the outside is through the bottom of the tower. The door is equipped with a lock. Access to the top platform in the tower is by a ladder or lift (optional). Access to the nacelle from the top platform is by ladder. Access to the transformer room in the nacelle is equipped with a lock. Unauthorized access to electrical switch boards and power panels in the turbine is prevented according to IEC 60204-1 2006.

5.2 Escape

In addition to the normal access routes, alternative escape routes from the nacelle are through the crane hatch, from the spinner by opening the nose cone, or from the roof of the nacelle. Rescue equipment is placed in the turbine.

The hatch in the roof can be opened from both the inside and outside.

Escape from the tower lift is by ladder.

An emergency plan placed in the turbine describes evacuation and escape routes.

5.3 Rooms/Working Areas

The tower and nacelle are equipped with connection points for electrical tools for service and maintenance of the turbine.

5.4 Floors, Platforms, Standing-, Working Places

All floors have anti-slip surfaces.

There is one floor per tower section.

Rest platforms are provided at intervals of 9 metres along the tower ladder between platforms.

Foot supports are placed in the turbine for maintenance and service purposes.

5.5 Climbing Facilities

A ladder with a fall arrest system (rigid rail or wire system) is mounted through the tower.

There are anchorage points in the tower, nacelle, hub and on the roof for attaching a fall arrest harness.

Over the crane hatch there is an anchorage point for the emergency descent equipment.

Anchorage points are coloured yellow and are calculated and tested to 22.2 kN

5.6 Moving Parts, Guards and Blocking Devices

All moving parts in the nacelle are shielded.

The turbine is equipped with a rotor lock to block the rotor and drive train.

It is possible to block the pitch of the cylinder with mechanical tools in the hub.

5.7 Lights

The turbine is equipped with light in the tower, nacelle, transformer room and in the hub.

There is emergency light in case of loss of electrical power.

5.8 Noise

When the turbine is out of operation for maintenance, the noise level in the nacelle is below 80 dB(A). In operation mode ear protection is required.

5.9 Emergency Stop

There are emergency stop push buttons in the nacelle, hub and in the bottom of the tower.

5.10 Power Disconnection

The turbine is equipped with breakers to allow for disconnection from all its power sources during inspection or maintenance. The switches are marked with signs and are located in the nacelle and in the bottom of the tower.

5.11 Fire Protection/First Aid

It is required that a handheld 5-6 kg CO_2 fire extinguisher is located in the nacelle during service and maintenance. A bracket for the fire extinguisher is located at the left yaw gear.

It is also a requirement that a first aid kit is located in the nacelle during service and maintenance.

Above the generator there is a fire blanket which can be used to put out small fires.

5.12 Warning Signs

Additional warning signs inside or on the turbine which should be reviewed before operating or servicing of the turbine.

5.13 Offshore Installation

In addition to the safety equipment mentioned above, offshore turbines are provided with a fire extinguisher and first aid box at the bottom of the tower, and a survival kit on the second platform in the tower.

5.14 Manuals and Warnings

Vestas OH&S manual and manuals for operation, maintenance and service of the turbine provide additional safety rules and information for operating, servicing or maintaining the turbine

EXHIBIT A.6 TANGIBLE BENEFITS

The Kibby Expansion will result in significant tangible benefits to the surrounding communities, Franklin County, and the entire State of Maine. On a local level, and as has been experienced in connection with construction of the Kibby Project, the surrounding communities will benefit through the significant direct and indirect economic impacts of construction, payment of taxes and increased payments to Eustis/Stratton as part of the host community benefits package. Additionally, the Project will provide regional environmental and energy benefits and help the State meet its commitments to reduce greenhouse gas emissions.

A.6.1 Environmental Benefits

The Project will have a capacity to generate 45 MW of clean renewable power. With the variability of wind and other operational considerations factored in, the Project is expected to generate an average of up to 120 million kilowatt hours per year. This is equivalent to the electricity needs of approximately 17,000 average Maine households. As set forth in 35-A M.R.S.A. §§ 3401 and 3454, the Project will provide environmental benefits due to avoided air pollution, waste disposal and emissions related considerations, and will contribute to the State's greenhouse gas reduction objectives.

A.6.2 Energy Benefits

The Wind Energy Act also establishes that the Project will provide the energy benefits set forth in 35-A M.R.S.A. § 3402. The energy benefits of wind power include increased diversification of energy resources and reduced dependence on fossil fuel based energy generation.

An increase in renewable energy production will also help to reduce both the level and volatility of electricity prices in the region and assist Maine in meeting its renewable energy portfolio standards, which require an increasing percentage of the electricity provided in Maine to come from eligible renewable energy sources. See 35-A M.R.S.A. §§ 3210, 3210-C.

A.6.3 Economic Benefits

As has already occurred in connection with the Kibby Project, the Kibby Expansion is expected to have a significant economic benefit on the region, primarily through payment of substantial property taxes, the creation of jobs in an area with a higher than average unemployment rate, and a host community benefit payment to the Town of Eustis/Stratton.

A.6.3.1 Direct and Indirect Employment-Construction

The economic impacts of construction projects are somewhat different than the economic impacts of ongoing operations. Because of their relatively short duration, construction projects do not result in the creation of additional permanent jobs. Rather, the construction activity and employment may be said to support the wages and employment of other people in the economy as a result of the Project. Although it is difficult to predict with precision the amount of direct and indirect employment construction benefits that will result from the Project, the experience at Kibby is instructive.

TransCanada emphasizes local sourcing of materials and workers on its projects wherever possible. The prime contractors and the vast majority of their subcontractors used to construct the Kibby Project are based in Maine. Throughout construction to date TransCanada has demonstrated its commitment to benefiting the local economy and encouraged these companies to hire and purchase locally.

A period of fifteen months has passed between the beginning of construction (August 2008) through the last month for which data was available (October 2009) at the time this application was filed. In that time, the Kibby Project has supported and created a considerable number of Maine jobs and injected a substantial amount of money into the State and local economies.

Through fifteen months of construction, TransCanada and its contractors have spent approximately $81 million in Maine. Of that total, more than $7.3 million has been spent in Franklin (primarily) and Somerset Counties. These figures include the cost of materials, wages, room and board, etc. during the course of the construction work to date.

The peak construction period occurred in the summer of 2009, when all aspects of the work on the ridges and transmission infrastructure were in progress simultaneously. A total of 315 construction workers were employed during this peak period. Average annual employment to date has been 176 workers. Exact data is not available on where these workers reside, but a conservative estimate is that more than 80% of these workers have been from Maine.

As described above, the construction experience at Kibby has been consistent with the benefits predicted by Charles Colgan, PhD, (Professor of Public Policy and Management in the Muskie School at the University of Southern Maine, and former Maine State Economist). Table A.6 provides a summary of Dr. Colgan's estimated construction impacts for one year of the estimated two-year construction period for the Kibby Project. (See Kibby Wind Power Project Rezoning Petition and Development Application (ZP 709), Section 9, Table 9-1.)

Table A.6: Economic Impacts of Kibby Wind Power Project Construction[1]

		Employment		
		Directly Employed by Kibby[2]	**Indirect & Induced Impacts[3]**	**Total**
One-Year Impacts	Androscoggin-Franklin-Oxford Counties	200	70	270
	Maine		30	300
		Wages & Salaries ($Million)		
		Directly Employed by Kibby	**Indirect & Induced Impacts**	**Total**
One-Year Impacts	Androscoggin-Franklin-Oxford Counties	$7.50	$0.82	$8.32
	Maine		$0.83	$9.15

The Expansion Project will allow a proportionate level (based on a project investment of $100 million for the Expansion Project as compared to $320 million for the Kibby Wind Power Project) of economic benefits to continue for an additional year.

A.6.3.2 Direct and Indirect Employment-Operations

TransCanada has hired one person to oversee operations to date and contracted with Vestas, the turbine manufacturer, for the first five years of turbine maintenance for the Kibby Project. Vestas has hired seven people to fulfill this contract to date. With only half of the project in operation, a total of eight people have been hired for long-term operations and maintenance positions. All of these people have been Maine residents and most have come from Franklin County. Several more long-term positions are expected to be filled to maintain the twenty-two turbines associated with the second phase of the Kibby Project, which are slated to come online in the fall of 2010.

[1] The income figures noted here include both direct employment and wages (those people directly employed by TransCanada and its contractors) plus the indirect and induced effects. Indirect effects are the employment and wages of firms supplying goods and services to the project and its contractors. Induced effects occur when the wages paid by the direct and indirect employees' wages are spent in the local economy.
[2] Estimated by TransCanada.
[3] Estimated by REMI model.

TransCanada estimated that 10 permanent employees would be hired for the Kibby Project. Dr. Colgan used this figure to determine that the total wages earned as a result of the 10 permanent employees associated with operation of the Kibby Project (direct, indirect and induced) in the Androscoggin-Franklin-Oxford region would be $0.7 million per year and in Maine $0.896 million. (See Kibby Wind Power Project Rezoning Petition and Development Application (ZP 709), Section 9, Table 9-2.) There will be 1 additional permanent position required for operation of the Kibby Expansion. The substantial economic benefits estimated for the Kibby Project will be enhanced by approximately 10 percent, based on the ratio of permanent employees between the two projects.

A.6.3.3 Other Economic Benefits

One final aspect of economic impacts identified by Dr. Colgan that cannot be effectively analyzed using econometric models is the potential benefit to energy security and energy costs. The Expansion Project will sell into the New England power market. This integrated electric power market is vulnerable to price spikes as a result of instability in world fossil fuel markets. With over half of New England's energy generation coming from fossil fuels, the region, including Maine, will experience periodic spikes in electricity prices that will drain away economic resources that would otherwise be used to support economic activity and associated employment. Mitigating effects of the more stable prices of electricity produced using wind turbines would offset negative impacts occurring from fossil fuel price instability. These economic impacts are a reality despite being more difficult to predict than the employment and income impacts noted above. (See generally Kibby Wind Power Project Rezoning Petition and Development Application (ZP 709), Section 9.2.5.)

A.6.3.4 Real Property Taxation and Local Benefits

The Kibby Expansion Project will also contribute to the economy through payment of taxes. Because it is located in the unorganized territories, TransCanada will pay property taxes to the State pursuant to the Unorganized Territory Educational and Services Tax, 36 M.R.S.A. §§ 1060- 1610. The tax is levied each year upon all non-exempt real and personal property located within the Unorganized Territory Tax District and is comprised of three separate components based on budgets for the following: 1) a shared tax for all state services provided statewide in the unorganized territories, including funding for the school budget and funding for the Department of Health and Human Services; Department of Forestry; and the LURC, among other agencies; 2) county taxes for the unorganized territories' prorated share of the county governmental functions such as the sheriff, jail and others; and 3) county services (such as road clearing on county roads, fire, trash, etc.) specific to the unorganized territories in each county.

While the value of the Expansion Project for tax purposes has not yet been determined, TransCanada will pay a significant amount of taxes on the Project and will be one of, if not the, largest single taxpayer in the unorganized territories in Franklin County.

Finally, TransCanada has offered to increase the community benefits package to the Town of Eustis/Stratton for the expanded wind farm. Because this nearby organized township will not benefit to the same degree from taxes paid on the Project[4], TransCanada is proposing an annual payment to ensure that the residents in Eustis/Stratton realize a meaningful economic benefit from the Project. TransCanada recognizes that the people who live and work in closest proximity to the Project should realize an economic or other concrete benefit from the Project and is committed to ensuring that occurs. To that end TransCanada will increase its current community benefits package for the Kibby Project of $132,000 per year ($1,000/MW) by an additional $45,000 per year (an additional $1,000/MW) for the 45 MW Kibby Expansion for a total annual benefit of $177,000.

A.6.4 Summary of State and Local Benefits

As discussed above, the Kibby Expansion Project is expected to result in the following state and local benefits:

- An increase in the community benefits package for the Town of Eustis/Stratton from $132,000 per year ($1,000/MW) to $177,000 per year for the additional 45 MW
- Additional property tax revenues over the life of the Project;
- Additional state income tax revenues over the life of the Project;
- One additional permanent employee for Project operation;
- The considerable economic spin off benefits from construction; and
- The energy and environmental benefits associated with generation of clean renewable energy and as set forth in 35-A M.R.S.A. § 3402(1).

[4] The Town of Eustis/Stratton will benefit from the portion of taxes that are paid for the unorganized territories' share of Franklin County governmental services such as the sheriff and police departments, and other administrative functions.

EXHIBIT A.7 DECOMMISSIONING

Due to the continuing need for low cost zero-emission power, it is expected that the Kibby Expansion Project would be re-powered at the end of its expected 25 year life, thus extending its operating period for an additional 25 years or more. While the moving parts in the turbines are subject to wear and tear over their expected life, the non-moving parts, including the collector system and turbine pads are expected to have an almost limitless life with proper maintenance. For the turbines themselves, design improvements should be expected that would justify replacing the current model with a newer, more efficient one at the end of the 25 year period.

During its initial 25 year period, a wind project is expected to have a high market value, since the capital costs of the project have been made and the operating costs are extremely low. Thus, the Project should never be required to be dismantled or decommissioned during that period.

In the unlikely event the Project should be required to be decommissioned, the market value of the turbines – whether as complete units or as parts – would be expected to be high, as the demand for wind projects is expected to remain strong for the foreseeable future. Nevertheless, in the unlikely event that the Project had to be decommissioned, TransCanada would take all appropriate steps and make available the necessary funds to ensure that the towers and associated infrastructure were removed and appropriately disposed of.

Decommissioning of the Project would consist of the dismantlement, removal, resale or reuse at another site as applicable, and appropriate disposal of:

- The nacelles, blades, and towers;
- All aboveground collector system structures;
- The substation; and
- The met tower(s).

All areas disturbed during decommissioning would be re-graded to blend in with surrounding topography and allowing natural vegetation to become re-established, unless the landowner requests otherwise in writing.

It is difficult to accurately estimate the costs necessary to decommission a wind project in the future and, as noted above, it is likely that a project would be re-powered instead of decommissioned. Consistent with regulatory guidance on demonstrated financial assurance for the decommissioning of the project, TransCanada will put in place a letter of credit or parental guarantee (substantially in the form of the parental guarantee provided in Attachment A.7) to fund the necessary decommissioning activities associated with the Project. The amount of the letter of credit or parental guarantee is based on the following preliminary estimate of decommissioning costs in 2009 US dollars.

Table A.7: Decommissioning Cost Estimate[1]

Cost per WTG (3.0MW Unit)	US$
WTGs	$108,532
Foundations	15,000
Substation	92,800
Collector/Scada System	58,777
Transportation & Disposal	75,046
Other Demobilization/Decommissioning Costs (Met Tower(s), etc.)	26,526
Expenditures per WTG	**$376,681**
Salvage Credits per WTG	**$212,796**
Net expenditures per 3.0MW WTG	**$163,885**
Total Estimate for 15 WTGs = 45MW	**$2,458,281**

[1] Includes costs associated with removing foundations to two feet below grade, stabilization and allowing natural vegetation to become re-established.

TransCanada has over $20 billion of assets and an "A" credit rating. Should TransCanada's Guarantor credit rating ever fall below investment grade, TransCanada will provide a Letter of Credit from a financial institution of investment grade standing.

TransCanada will put in place a parental guarantee or letter of credit in an amount equal to 50% of the estimated decommissioning costs less salvage value by December 31 of the first year of commercial operation. No later than December 31 of year 15 of commercial operation, TransCanada will reassess the decommissioning costs and put in place financial assurance in the amount of 100% of the then estimated decommissioning costs less salvage value.

Further, TransCanada will submit a detailed decommissioning plan and schedule no later than:

(1) 60 days after the date the Project ceases to generate electricity as set forth in a written notice from TransCanada to LURC stating an intention to cease electrical generation at the Project; or

(2) If no such notice has been provided, 60 days after the Project has not generated electricity for twelve consecutive months, except that the operator may submit evidence to LURC demonstrating that although the Project has not generated electricity for twelve consecutive months, the Project has not been abandoned and should not be decommissioned.

The detailed decommissioning plan will include a description of the work required to physically remove all wind turbines and associated foundations to a depth of 24 inches below final grade, buildings, cabling, electrical components, and any other associated facilities to the extent they are not otherwise in or proposed to be placed into productive use. The plan would also include a detailed description of how the site is to be restored and any relevant, associated landowner requests.

ATTACHMENT A.7

TransCanada Corporation Example Parental Guarantee

GUARANTEE

This Guarantee is made as of the _____ day of _______________, 2008.

Recitals

A. **[■]**, a _________________ corporation (the "Counterparty"), and **TransCanada Maine Wind Development Inc.** (the "Corporation") have entered into **[insert agreement details]**, referred to herein as the "Contract".

B. The Corporation is a direct or indirect wholly-owned subsidiary of TransCanada PipeLines Limited or TransCanada PipeLine USA Ltd. or both of them (individually and collectively, the "Guarantor").**]**

C. The Guarantor has agreed to guarantee the Corporation's financial obligations to the Counterparty under the Contract.

In consideration of the Counterparty's agreement to extend credit to the Corporation, the premises and agreements contained in this Guarantee and other good and valuable consideration (the receipt and sufficiency of which the parties acknowledge), the Guarantor agrees with the Counterparty as follows:

1. **Guarantee.** Subject to Section 3, the Guarantor unconditionally and irrevocably guarantees, jointly and severally, all the debts and liabilities, present or future, direct or indirect, absolute or contingent, matured or not, at any time owing by the Corporation to the Counterparty or remaining unpaid by the Corporation to the Counterparty under the Contract including, without limitation, purchase prices, commissions, fees, demand charges, commodity charges and any other charge, balancing fees and damages payable by the Corporation under the Contract (collectively, the "Obligations").

2. **Liability as principal debtor.** The Counterparty may recover from the Guarantor as a principal debtor any Obligations that the Counterparty may not recover from the Guarantor as guarantor under Section 1, and the Guarantor agrees to pay all such Obligations to the Counterparty as principal debtor. The provisions of this Guarantee shall apply generally with the necessary changes as to the points of detail to the liability of the Guarantor as principal debtor hereunder.

3. **Aggregate liability.** The aggregate liability of the Guarantor under this Guarantee to the Counterparty, whether as guarantor or as principal debtor, is limited to **US$ [■]** The foregoing provision shall not limit the liability of the Guarantor for legal fees, interest, costs, expenses and other amounts payable under any section of this Guarantee.

4. **Guarantee absolute.** The liability of the Guarantor whether as guarantor or as principal debtor is absolute and unconditional and is not affected by:

   (a) any change in the time, manner or place of payment of the Obligations or in any other term of the Contract or the

Corporation's failure to carry out any of its obligations under the Contract;

(b) any force majeure (other than a force majeure under the Contract that relieves the Corporation of liability for the performance of any Obligations) or act of government in relation to, or directly or indirectly affecting, the Contract, the Obligations, the Corporation, the Guarantor or the Counterparty;

(c) any change in the financial condition of the Guarantor, the Corporation or the Counterparty;

(d) any change in the corporate existence, structure or ownership of the Corporation;

(e) if the Counterparty, Corporation or the Guarantor, respectively is a partnership, any change in the membership of the Counterparty, Corporation or the Guarantor through the death or retirement of one or more partners or the introduction of one or more partners or otherwise, any change in the constitution of the Counterparty, Corporation or the Guarantor, or any incorporation of the Counterparty, Corporation or the Guarantor;

(f) the bankruptcy, winding-up, liquidation, dissolution, insolvency, reorganization or other similar proceeding affecting the Corporation or its assets or any resulting release, stay or discharge of any Obligations;

(g) any lack or limitation of power, incapacity or disability on the part of the Corporation or of its directors, partners or agents or any other irregularity, defect or informality on the part of the Corporation in the Obligations; or

(h) any other law, regulation or other circumstance that might otherwise constitute a defense available to, or a discharge of, the Corporation in respect of any of the Obligations.

5. **No release.** The liability of the Guarantor is not released, discharged, limited or in any way affected by anything the Counterparty does, suffers or permits in connection with any duties or liabilities of the Corporation to the Counterparty or any security for those duties or liabilities, including without limitation any loss of or in respect of any security received by or from the Corporation or others. The Counterparty, without notifying the Guarantor or releasing, discharging, limiting or otherwise affecting the Guarantor's liability, may:

(a) grant time, renewals, extensions, indulgences, releases and discharges to the Corporation;

(b) take or abstain from taking security or collateral from the Corporation or from perfecting security or collateral of the Corporation;

(c) accept compromises from the Corporation;

(d) apply all money at any time received from the Corporation, or from security, upon that part of the Obligations as the Counterparty sees fit or change any such application in whole or in part from time to time as the Counterparty sees fit;

(e) amend the Contract from time to time after the date of this Guarantee; or

(f) otherwise deal with the Corporation and all other persons and security as the Counterparty sees fit.

6. **No exhaustion of remedies.** The Counterparty is not bound or obliged to exhaust its recourse against the Corporation or any other persons or any security or collateral it may hold or take any other action before being entitled to demand payment from the Guarantor.

7. **No set-off.** Until the Counterparty has received payment in full, the Guarantor may not claim or assert any set-off, deduction, counterclaim or crossclaim against the Counterparty in respect of any liability of the Counterparty to the Guarantor or the Corporation. In addition, all amounts payable by the Guarantor under this Guarantee shall be paid without any deduction or withholding whatsoever unless and to the extent that the Guarantor shall be prohibited by law from doing so, in which case the Guarantor shall pay to Counterparty such additional amount as shall be necessary to ensure that Counterparty receives the full amount it would have received if no such deduction or withholding had been made.

8. **Continuing guarantee.** This Guarantee is a continuing guarantee and is binding as a continuing obligation of the Guarantor. This Guarantee shall apply to and secure any ultimate balance due or remaining due to the Counterparty and the Guarantor shall continue to be bound, despite the repayment, from time to time during the term of this Guarantee, of the whole or any part of the amount owed by the Corporation to the Counterparty. This Guarantee continues to be effective even if at any time payment of any of the Obligations is rendered unenforceable or is rescinded or must otherwise be returned by the Counterparty upon the occurrence of any action or event including, without limitation, the bankruptcy, reorganization, winding-up, liquidation, dissolution or insolvency of the Corporation or otherwise, all as though such payment had not been made.

9. **Representations and warranties.** The Guarantor represents and warrants that:

(a) its execution, delivery, observance and performance of this Guarantee does not and will not conflict with or result in a breach of the articles, by-laws, constating documents or other organizational documents of the Guarantor, or of the terms or provisions of any judgment, law, decree, order, statute, rule, regulation or agreement, indenture or instrument to which the Guarantor is a party or by which the Guarantor is bound or to which the Guarantor is subject, or constitute a default under any of them;

(b) this Guarantee has been duly authorized, signed and delivered by the Guarantor; and

(c) this Guarantee constitutes a legal, valid and binding obligation of the Guarantor enforceable against the Guarantor in accordance with its terms, except as enforceability may be limited by principles of equity, or by bankruptcy, insolvency, reorganization, moratorium or other similar laws.

10. **Demand for payment.** The Guarantor shall make immediate payment to the Counterparty of the Obligations or any of them after the Counterparty demands such payment from the Guarantor. The Counterparty is entitled to make demand upon the Guarantor at any time upon a default in payment of any amount owing by the Corporation to the Counterparty and upon that default the Counterparty may, at its option, treat all Obligations as immediately due and payable and may forthwith collect from the Guarantor the total amount guaranteed under this Guarantee.

11. **Interest.** The Guarantor shall pay interest from and including the due date until payment is made in full, to the Counterparty on the unpaid portion of the Obligations according to the Contract. If interest is not provided for in the Contract, then the Guarantor shall pay interest to the Counterparty at an annual rate equal to the lower of (i) the then-effective prime rate of interest published under “Money Rates” by *The Wall Street Journal*, plus 2% per annum from the due date, or (ii) the maximum applicable lawful interest rate, the rate in either case to be calculated daily from and including the due date.

12. **Stay of acceleration.** If acceleration of the time for payment of any amount payable by the Corporation in respect of the Obligations is stayed on the insolvency, bankruptcy, arrangement or reorganization of the Corporation or on any moratorium affecting the payment of the Obligations, the Guarantor shall nonetheless pay immediately on demand all amounts that would otherwise be subject to acceleration.

13. **Termination.** This Guarantee terminates on **[■]**, 200 **[■]**, (the “Termination Date"). From and after the Termination Date, the Guarantor will not be liable pursuant to this Guarantee for any obligations arising after the Termination Date, PROVIDED HOWEVER THAT the Guarantor will continue to remain liable for any and all Obligations arising prior to the Termination Date.

14. **Subrogation.** The Guarantor has no right to be subrogated to any of the Counterparty’s rights in the Obligations until the Counterparty has received payment finally satisfying all Obligations.

15. **Liability for Taxes.** Any and all payments made by the Guarantor to Counterparty shall be made in full, without set-off or counterclaim, and free and clear of and without deduction for any and all present and future taxes, liens, imposts, stamp taxes, deductions, charges or withholdings, and all liabilities with respect thereto and any interest, additions to tax and penalties imposed with respect thereto. If the Guarantor shall be required by law to deduct any taxes, deductions, charges or withholdings from or in respect of any sum payable hereunder to Counterparty (i) the sum payable shall be increased as may be necessary so that after making all required deductions (including

deductions applicable to additional sums payable under this section) Counterparty receives an amount equal to the sum it would have received had no such deductions been made and (ii) the Guarantor shall pay the full amount deducted to the relevant taxation authority or other authority in accordance with applicable law.

16. **Waivers.** The Guarantor waives diligence, division, presentment, protest, notice of acceptance of this instrument and any other notice not expressly required by this Guarantee.

17. **No merger.** Neither an action or proceeding brought under this Guarantee regarding the Obligations nor any judgment or recovery in consequence of that action or proceeding operates as a bar or defence to any further action or proceeding that may be brought under this Guarantee. Any action, proceeding, judgment or recovery does not constitute a merger of any of Counterparty's rights or remedies under this Guarantee. Any judgment obtained by Counterparty in whole or in part of any of the Obligations under this Guarantee does not constitute a merger of this Guarantee into that judgment.

18. **Foreign currency obligations.** The Guarantor shall make payment in the currency (the "Original Currency") in which the Corporation is required to pay its Obligations or any portion of them. If the Guarantor makes payment in a currency other than the Original Currency (whether voluntarily or under an order or judgment of a court or tribunal of any jurisdiction), the payment constitutes a discharge of the Guarantor's liability only to the extent of the amount of the Original Currency that the Counterparty is able to purchase with the amount of the currency it receives on the date of receipt. The Guarantor agrees to indemnify and save the Counterparty harmless from and against any loss arising out of any currency-related deficiency in payment. This indemnity constitutes a separate and independent obligation giving rise to a separate cause of action. An officer's certificate from the Counterparty certifying any deficiency or loss is, in the absence of manifest error, prima facie evidence of that deficiency or loss.

19. **Payment of Costs and Expenses**. The Guarantor shall be liable and responsible for all legal fees (which include legal fees on both outside counsel on a solicitor and own client basis, and in-house counsel on a reasonable basis), disbursements and all other costs and expenses of collection incurred by Counterparty in enforcing the payment or satisfaction of any of the Obligations or in enforcing the payment, or satisfaction of any liability or obligation of the Guarantor hereunder.

20. **Benefit of the Guarantee.** This Guarantee enures to the benefit of and is binding on the respective executors, administrators, successors and permitted assignees of the Guarantor and the Counterparty.

21. **Entire agreement.** Notwithstanding anything else stated in this Guarantee, this Guarantee constitutes the entire agreement between the Counterparty and the Guarantor with respect to the Guarantee's subject matter and cancels and supersedes any prior understandings and agreements between the Counterparty and the Guarantor. There are no representations, warranties, terms, conditions, undertakings or collateral agreements, expressed, implied or statutory, between the parties other than as expressly stated in this Guarantee.

22. **No Waiver, Remedies.** No failure on the part of the Counterparty to exercise, and no delay in exercising, any right under this Guarantee operates as a waiver of it, nor does any single or partial exercise of any right under this Guarantee preclude the other or further exercise of it or any other right. The remedies in this Guarantee are cumulative and not exclusive of any remedies provided by law.

23. **Severability.** If any provision of this Guarantee is determined to be invalid or unenforceable in whole or in part, such invalidity or unenforceability will apply only to that provision and all other provisions of this Guarantee will continue in full force. If this Guarantee is determined to be invalid or unenforceable for any reason, such invalidity or unenforceability will not apply to any of the representations and warranties provided in Section 9, which is deemed to be a separate and independent legal, valid, binding and enforceable agreement between the Guarantor and the Counterparty and will continue in full force. The Counterparty is entitled to proceed with any remedy available to it as a result of the Guarantor's breach of any of the representations and warranties provided in Section 9.

24. **Notices.** Any notice, demand, request or other communication to be given in connection with this Guarantee must be addressed to the Counterparty at:

[■]
[■]

Attention: **[■]**
Fax: (■) **[■]**

And to the Guarantor at:

TransCanada Corporation
450 – 1st Street SW
Calgary, Alberta
Canada T2P 5H1

Attention: Vice-President, Risk Management
Fax: (403) 920-2359

Any notice, demand, request or other communication is deemed to have been received by the party to whom it is sent at the time of its delivery if personally delivered, or on the business day following its receipt if mailed by registered mail, or on the business day following its successful transmittal if sent by facsimile transmission or other form of electronic transmission, as the case may be, but if mail, facsimile transmission or other form of electronic transmission is interrupted by force majeure or other cause beyond the control of the parties, then the party sending the notice, demand, request or communication shall use any of the services that have not been so interrupted to deliver the notice, demand, request or other communication, in order to ensure prompt receipt of the notice, demand, request or other communication, by the other party. Each party may notify the other of any change of address in the manner provided above.

25. **Assignment.** The Counterparty may assign its rights under this Guarantee without the prior consent of the Corporation or the Guarantor. The Guarantor may not assign its obligations under this Guarantee.

26. **Governing law.** This Guarantee is governed by and to be construed according to the laws of New York without giving effect to any choice or conflict of law rules or provisions thereof which may direct the application of the laws or rules of another jurisdiction. The Guarantor agrees to the non-exclusive jurisdiction of the Alberta New York courts and courts of appeal with respect to any matter arising under this Guarantee. The Guarantor agrees that a judgment, after exhaustion of all available appeals, in any action or proceeding under this Guarantee is conclusive and binding upon the Guarantor and may be enforced in any other jurisdiction by a suit upon that judgment, a certified copy of which is conclusive evidence of the judgment.

27. **Facsimile Signature.** A signature delivered by facsimile shall be deemed to be an original signature for purposes of the Guarantee and shall be binding upon the Guarantor as an original signature. Notwithstanding that the Guarantor may deliver a signature by facsimile, the Guarantor covenants to deliver an originally executed Guarantee to Counterparty within a reasonable period of time after executing the Guarantee.

IN WITNESS WHEREOF the Guarantor has signed and delivered this Guarantee.

TRANSCANADA PIPELINES LIMITED	**TRANSCANADA PIPELINE USA LTD.**
Per: ______________________________	Per: ______________________________
(Name) (Title)	(Name) (Title)
Per: ______________________________	Per: ______________________________
(Name) (Title)	(Name) (Title)

[Bank Letterhead]

Irrevocable Standby Letter of Credit [Date]

[Issuing Bank Name and Address]

Beneficiary (the "Beneficiary"):

[Company Name]

[Company Address]

Applicant (the "Applicant"):

[Company Name]

[Company Address]

Ladies and Gentlemen:

At the request of our client, [Applicant], we hereby issue in your favor our Irrevocable Standby Letter of Credit No. __________, in the amount of [currency and amount] (the "Stated Amount") effective immediately and expiring [date 1 year after issue date above] *or as otherwise indicated herein*.

Funds under this Letter of Credit are available to you against your sight draft(s) drawn on us, mentioning thereon our Letter of Credit No. ________ accompanied by your written statement signed by an authorized officer of the Beneficiary certifying that:

1) The Beneficiary is making a drawing under this Letter of Credit pursuant to the [Contract] dated as of [date], in the amount of $_______ (the "Drawing Amount"), and
2) The Drawing Amount hereunder does not exceed the Stated Amount reduced by all payments of any previous drawing(s) under this Letter of Credit.

We hereby undertake you to honor each draft drawn under and in compliance with the terms of this Letter of Credit if duly presented by courier or in person together with the documents specified above at our office in [City] located at [address and fax number] on or before the stated expiration date. We shall honor the same no later than 14:00 [time zone] on the next banking day in accordance with your payment instructions. For purposes of this Letter of Credit, the phrase "banking day" shall mean any day other than Saturday, Sunday or a day which the issuing bank is authorized or obligated by law or executive order to close.

Partial drawings and multiple presentations are permitted under this Letter of Credit.

All charges relating to the issuance of this Letter of Credit are for the account of the Applicant.

It is also a condition of this Letter of Credit that it shall be deemed automatically extended, without amendment, for one year from the expiry date hereof, or any future expiration date, ***but not beyond the maximum final expiration date of this Letter of Credit, [date],*** *unless at least thirty (30) days prior to any such date, we notify you in writing by registered mail, or by overnight receipted courier delivery, that we elect not to renew this Letter of Credit for any such additional period.* This Letter of Credit shall terminate on the day following delivery by registered mail, or by overnight receipted courier, to us of written notice by the Beneficiary of the termination of the Applicant's obligation to maintain this Letter of Credit which notice shall be in the form attached hereto as Annex 1 (the "Termination Notice").

This Letter of Credit is subject to the International Chamber of Commerce's International Standby Practices (ISP 98) and, as to matters not addressed by the ISP 98, shall be governed by the Laws of the [Province of Alberta or State of New York] and applicable [Canadian or US Federal Law] and the parties hereby irrevocably agree to attorn to the non-exclusive jurisdiction of the courts of the [Province of Alberta or State of New York].

____________________	____________________
Authorized Signature	Authorized Signature
[Name & Title]	[Name & Title]

Annex 1

[Beneficiary Letterhead]

Termination Notice

[Date]

[Issuing Bank Name and Address]

Ladies and Gentlemen:

We refer to Irrevocable Standby Letter of Credit No. ___________. We hereby certify to you that the obligation of [Applicant] to maintain this Letter of Credit is terminated. This notice serves as the Termination Notice provided for under the Letter of Credit.

____

Authorized Signature
[Name & Title]