



# Wild Meadows Wind Project Wildlife Habitat Assessment Danbury and Alexandria, NH

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# Table of Contents

	Page
<b>EXECUTIVE SUMMARY</b> .....	1
<b>1.0 INTRODUCTION</b> .....	1
1.1 PROJECT DESCRIPTION, SITE SETTING, AND TOPOGRAPHY .....	2
<b>2.0 METHODS</b> .....	4
2.1 FIELD WORK .....	4
2.2 VEGETATION COVER TYPES .....	4
2.3 NHWAP HABITAT RANKINGS .....	4
2.4 OTHER DATA SOURCES.....	5
<b>3.0 RESULTS</b> .....	5
3.1 NHWAP FOREST BLOCK AND COVER TYPES.....	5
3.2 FIELD OBSERVATIONS OF COVER TYPES.....	6
3.2.1 Hardwood/Conifer Covers.....	6
3.2.2 Low-Land Spruce-Fir .....	8
3.2.3 Rocky Outcrops.....	9
3.2.4 Wetlands and Waters .....	9
3.2.5 Forest Condition Summary .....	11
3.3 NHWAP HABITAT RANKINGS .....	13
3.4 WILDLIFE OBSERVED ON-SITE .....	13
3.4.1 Mammals .....	13
3.4.2 Birds .....	14
3.4.3 Reptiles and Amphibians .....	14
3.5 SPECIES OF SPECIAL CONCERN .....	14
3.5.1 Eastern Small-footed Bat .....	15
3.5.2 Northern Long-eared Bat.....	16
3.5.3 Sensitive Plant Species and Medium-level Fen System.....	17
<b>4.0 DISCUSSION</b> .....	17
4.1 HABITAT VALUES .....	17
4.1.1 Hardwood/Conifer Cover .....	17
4.1.2 Lowland Spruce-Fir .....	18
4.1.3 Rocky Ridge.....	19
4.1.4 Wetlands and Waters .....	19
4.2 IMPACTS .....	20
4.2.1 Impacts of Construction .....	20

4.2.2 Impacts of Operations ..... 21

**5.0 SUMMARY AND CONCLUSIONS ..... 21**

5.1 PROJECT HABITAT VALUE ..... 21

5.2 IMPACTS ..... 22

**6.0 LITERATURE CITED ..... 22**

**APPENDICES:**

- APPENDIX A: Explanation of NH Wildlife Action Plan Rankings
- APPENDIX B: Habitat Photo Log
- APPENDIX C: Wildlife Observed On-Site
- APPENDIX D: Wildlife Photo Log
- APPENDIX E: Agency Correspondence

## List of Figures

	Page
Figure 1. Wild Meadows Wind Project Footprint, turbine locations and associated NHWAP Forest Block.....	3
Figure 2. NH Wildlife Action Plan Cover Types.....	7
Figure 3. NH Wildlife Action Plan Habitat Rankings .....	10

## List of Tables

	Page
Table 1. NHWAP Habitat Rank Definitions .....	5
Table 2. NHWAP Cover Type by Percent within Project Footprint and Forest Block .....	6
Table 3. NHWAP Habitat Rankings by Percent within Project Footprint and Forest Block .....	13

## Executive Summary

The habitat present in and around the proposed Wild Meadows Wind Project is typical of New Hampshire's Central Highlands region, and consists of cover types that are common throughout this region of the state. The bird, mammal, amphibian and reptile species observed during wetlands and habitat surveys were also commonly occurring species, typical of forested habitats in central NH. Because of the ridgeline topography and steep slopes, streams in the project site are predominantly ephemeral and intermittent and wetlands tend to be small, encompassing a relatively small portion of the overall acreage of the project site. Although vernal pools are present throughout the site, they are not abundant and also tend to be small. Rocky outcrops are present in numerous locations along the ridgelines within the Project Footprint, and provide a small amount of a relatively unique habitat type.

Based on field observations and the NH Wildlife Action Plan habitat rankings, the habitat quality of the unfragmented forested block in which the Project is proposed is relatively high for wildlife species commonly associated with northern hardwood-conifer forest types, especially those that benefit from a mosaic of hardwood forest age classes. Due to the logging activities, forest stands in and around the site exhibit a wide range of age classes from recently cut to young and mature second growth. Most stands include some large diameter trees, creating a diversity of habitat conditions which can in turn support a diversity of wildlife species.

The predominant forest habitat types in and around the project are a mosaic of age classes and disturbance regimes, and the species that use this habitat are largely adapted to these conditions. Therefore, neither the construction-related nor operations-related impacts associated with the project are expected to significantly reduce the habitat value of the project area for the wildlife species known or likely to be present. In general, while the proposed project may cause the temporary or permanent displacement or mortality of some individual animals, it is not expected to have a population level effect on species known to be present in the region.

## 1.0 Introduction

On behalf of Atlantic Wind, LLC, a wholly owned subsidiary of Iberdrola Renewables, LLC, Normandeau Associates Inc (Normandeau) conducted an inventory of wildlife habitats at the site of the proposed Wild Meadows Wind Project, located in Grafton and Merrimack Counties, New Hampshire. Surveys were conducted during multiple site visits between 2010 and 2013 by a Certified Wildlife Biologist. In addition to the wildlife specific surveys, personnel conducting field work focused on wetland resources and vernal pools during the same period also recorded wildlife observations including sightings, sign, and trails. Based on the amount, variety, and quality of habitats observed, the value of this area to wildlife and the wildlife species likely to be present were estimated. The analysis was based on professional knowledge and a comparison with habitat values described in the NH Wildlife Action Plan (NHWAP; NHFG 2006). The following report summarizes the field findings,

presents the results of the assessments, provides photo documentation of observations (Appendix A), and presents habitat maps.

### **1.1 Project Description, Site Setting, and Topography**

The approximately 76 megawatt Wild Meadows Wind Project will be located in the Towns of Alexandria and Danbury, New Hampshire. The project will consist of the installation of 23 turbines (3.3 MW class) along two primary ridges. Ancillary facilities, including access roads, operations and maintenance facility, overhead and underground collection lines, and interconnection and substation facilities will also be constructed as part of the project.

The proposed project falls within the Sunapee Uplands of the Vermont-New Hampshire Upland ecoregion of New Hampshire, as defined by Sperduto and Nichols (2004). This heavily glaciated ecoregion covers the southwestern portion of the state. Maximum elevations in the ecoregion are roughly 2,300 feet, and it is a sloping plateau dissected by steep, narrow valleys and underlain by granite, gneiss, and schist. The Sunapee Uplands are characterized by isolated hills and peaks of hard, resistant rock (mostly granite) and small lakes and narrow valley streams are scattered through the area. Due to the characteristics of the underlying bedrock, soils in the Sunapee Uplands are typically shallow and stony, and are relatively poor compared to soils in other portions of the ecoregion. The characteristics of the soil are reflected in the composition and distribution of plant communities (Sperduto and Nichols 2004).

The proposed project is located on multiple low ridgelines separated by steep slopes and valleys, located in a relatively remote area with limited surrounding development (Figure 1). The proposed project includes Braley Hill (elevation 2,083 feet above sea level; ASL), Tinkham Hill (2,270 feet ASL), Pillsbury Mountain (elevation 1594 feet ASL), the Pinnacle (elevation 1981 feet ASL) and Forbes Mountain (elevation 2159 feet ASL). The following major streams are mapped near or on of the proposed project area: Wild Meadow Brook, Patten Brook, Taylor Brook, and Pine Brook (Figure 1). Additionally, tributaries to these streams are present on the property.

The proposed project site currently supports frequent commercial and private logging operations, agriculture, recreation, scattered houses and barns, and access roads, but is otherwise undeveloped. Timber harvesting is ongoing, and like most New Hampshire forest lands, the parcels have historically functioned as commercial woodland. The project site is ringed by town-maintained paved and gravel roads. Houses, a mix of seasonal camps and year-round residences are present in low densities on these roads.

For the purposes of this report, the Project Footprint refers to the area that will be altered by construction. The area which encompasses the Project Footprint is referred to as the Forest Block (Figure 1), which is the greater unfragmented land block, as defined by the NHWAP. This Forest Block corresponds to NHWAP Block 2126, which is identified as having 9640 acres of unfragmented habitat, which include buffers of the maintained roads that surround and extend into the block (NHWAP 2006). For the NHWAP analysis, road buffers were generated as raster data resulting in buffers of approximately 350 to 374 ft from public road centerlines; and 257 to 280 ft for private roads. These buffers were assumed to encompass most development that contributes to fragmentation, and no other potential sources of fragmentation were considered (NHFG 2005). For this analysis, the Forest Block is used as a





basis for describing local conditions and providing context for the resources that will be impacted by project construction.

## **2.0 Methods**

### **2.1 Field Work**

Habitat assessment surveys were conducted by a Certified Wildlife Biologist in the spring and fall of 2010, spring of 2011, and spring and summer of 2012. Normandeau staff biologists conducting other field work (wetland and vernal pool surveys) also recorded habitat and wildlife observations. General habitat features were noted, as well as unique and/or high value habitat features. In addition to habitat observations, evidence of wildlife were noted, including observation (visual and audio), feeding activity (e.g., browse), travel paths/corridors, burrows or dens, and scat. All field work was focused on the area that was surveyed for wetlands and vernal pools. The area surveyed for these resources consisted of roughly 1,610 acres, and encompassed the likely envelope of disturbance due to Project construction.

### **2.2 Vegetation Cover Types**

The upland vegetation cover types observed in the surveyed areas were classified according to the cover types defined in the New Hampshire Wildlife Action Plan (NHWAP; NHFG 2006). The NHWAP classifies the entire state by 18 cover type classes, and provides these data in GIS format, suitable for project-level mapping. Field observations were used to verify the composition and extent of each cover type depicted by the NHWAP mapping as present in the surveyed area. Stand age classification was based on field observations only, as the NHWAP cover type maps do not included stand age information. Wetland, stream and vernal pool boundaries were delineated in the field as part of the wetland survey, and the wetland cover types observed on-site were classified according to the Cowardin (1979) wetland classification system.

### **2.3 NHWAP Habitat Rankings**

The NHWAP habitat rankings of the Project Footprint and Forest Block were examined. The NHWAP classifies the entire state in terms of habitat quality, using models that assign wildlife habitat conditions by ranking the biological, landscape, and human impact factors most affecting each habitat type. Biological factors include rare plant and animal species and overall biodiversity. Landscape factors include size of habitat and how close it is to other patches of that habitat. Human impact factors include density of roads around the habitat, dams, recreational use, and pollution. These are examples of the many factors that were used. Different factors were chosen for each particular habitat as, for example, hiking trails may reduce the habitat quality in alpine areas but are far less damaging to hemlock-hardwood- pine forests (NHWAP 2006).

The NHWAP analysis assigns four ranking levels defined in Table 1. A detailed explanation of the analysis process is provided in Appendix A. The mapped results of the NHWAP analysis are available for users in GIS formats, allowing the NHWAP habitat rank data to be



overlaid with the Project Footprint and Forest Block boundaries to calculate the amount of area for each rank.

**Table 1. NHWAP Habitat Rank Definitions**

<b>Rank</b>	<b>Definition</b>
Highest Ranked Habitat in NH (Tier 1)	The highest quality 15% by area of each forest type; 100% of coastal and alpine habitats and the top 10% by area of the other habitats; a few other locations containing critically imperiled species.
Highest Ranked Habitat in the Biological Region (Tier 2)	The top 15% by area of each forest type and the top 50% of each terrestrial habitat type in each of NH’s nine ecoregion are considered Highest Ranked in the Biological Region. The top 50% of wetland habitats, all floodplain forests, and 30% of surface waters in each of NH’ seven major watersheds are considered Highest Ranked.
Supporting Landscapes (Tier 3)	Supporting Landscapes include the upland part of the watershed for surface waters, some very intact forest blocks, some known locations of WAP species and some locations of exemplary natural communities.
No Rank	Does not meet any of the above criteria.

## 2.4 Other Data Sources

For purposes of describing the site, field observations and NHWAP data were also augmented with other existing, publically available mapped data sources. The following data, mapped at 1:24,000 were obtained from the NH GRANIT GIS library:

- Surface waters, from the NH Hydrography Dataset developed by the USGS, USEPA, NH DES and UNH Complex Systems;
- Roads, from NH DOT;
- Political boundaries, from the USGS;

The on-line Natural Heritage Program database (NHB DataCheck) was consulted for information on the locations and distribution of protected species, exemplary natural communities, and natural resources of concern present on site, if any.

## 3.0 Results

### 3.1 NHWAP Forest Block and Cover Types

The NHWAP analysis of unfragmented forest blocks ranks each block by overall size, perimeter-to-area ratio, and by combining these two scores. The smallest blocks considered to be unfragmented range from 26 to 99 acres in area (Size Class 1); the largest block in the state is 215,944 acres, and there are seven blocks at least 100,000 acres in size. The unfragmented block encompassing the proposed project contains 9640 acres, which makes it part of Size Class 5. There are a total of 80 unfragmented blocks ranging in size from 4,000 to 9,999 acres. Just over 96% of the unfragmented habitat blocks in New Hampshire are smaller than 4,000 acres in size, and 2.2% of them fall into Size Class 5. Similarly, this forest

block has a greater perimeter-to-area ratio score and a greater combined score than 89.4% and 97.7% of all blocks in the New Hampshire, respectively.

The NHWAP cover type mapping (Figure 2) classifies about 95% of both the Project Footprint and the Forest Block as forested. Field observations verified this classification. The forest cover in and around the proposed project area is comprised of Lowland Spruce-fir cover types at the higher elevations, and Hardwood/Conifer types at the lower elevations (Table 2). Note that the NHWAP defines “lowland spruce fir” as spruce-fir cover types below 2,500 feet, and the entire project area is below this elevation. NHWAP-mapped wetlands, classified as Peatlands or Wet Meadows by the NHWAP cover type mapping, comprises less than two percent of the Forest Block, and less than 0.1% of the Project Footprint. Based on field delineations, 33,701 square feet of the Project Footprint is classified as wetlands; the NHWAP cover type maps are recognized to underestimate actual wetland acreages. Grassland (hay fields) and Floodplain Forest cover types are located at the lowest elevations only.

**Table 2. NHWAP Cover Type by Percent within Project Footprint and Forest Block**

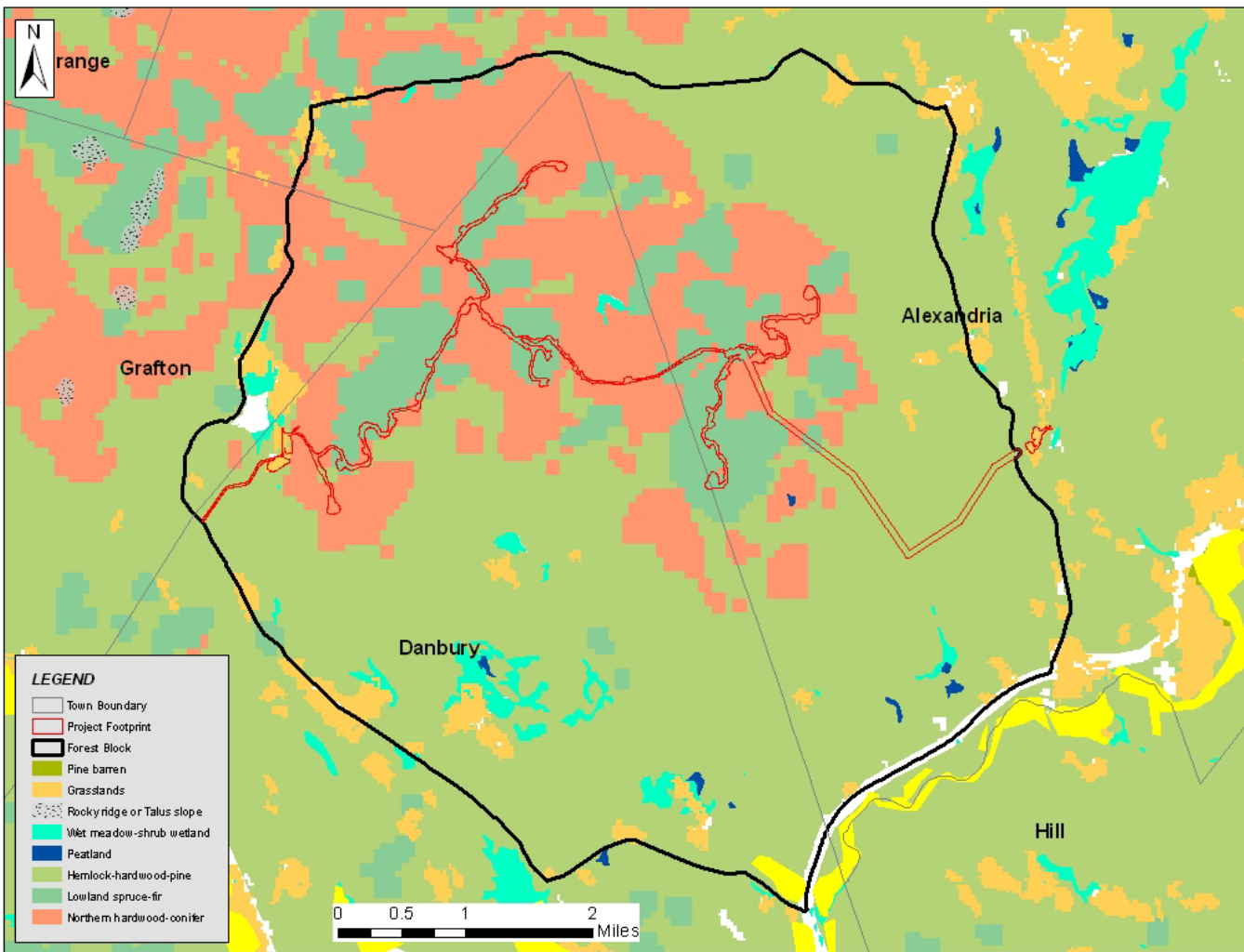
<b>WAP Cover Type</b>	<b>Project Footprint</b>	<b>Forest Block</b>
Northern Hardwood Conifer	33.21	24.18
Lowland Spruce-Fir	32.59	10.7
Hemlock Hardwood Pine	28.83	60.34
Grasslands	5.38	2.62
Wet Meadow/Shrub Wetland	0	1.79
Floodplain Forest	0	0.22
Peatlands	0	0.15

### **3.2 Field Observations of Cover Types**

The forests throughout the proposed project area are heavily managed. Ongoing, active cutting is primarily focused on Forbes Mountain and the southern ridge of Tinkham; sections of Braley Hill have been cut in the recent past. There are many logging roads and skidder trails, and the forest is multi-aged with relatively small harvested blocks. Despite the intensive forestry, large diameter trees are scattered across the site, often on steep slopes or ledge. Blow-downs, topped trees, and standing snags are also common. The eastern ridges have less evidence of recent logging, but show a range of stand ages due to cutting. In addition to elevation and soils, plant species composition within cover types appears driven by forest management history. The Hardwood-Conifer types in particular vary in composition, from essentially hardwood-only stands to those with abundant conifers. The major upland cover types, their notable habitat features, and distribution across the proposed project area are described in detail below. A similar discussion of wetland features follows. Photos of the primary cover types are presented in Appendix B.

#### **3.2.1 Hardwood/Conifer Covers**

The NHWAP cover type mapping indicates that a combination of Hardwood-Conifer and Hemlock-Hardwood-Pine cover types are the most common cover types in both the Project Footprint and the Forest Block, comprising approximately 62% and 84% of the cover,



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Figure 2. NH Wildlife Action Plan Cover Types

respectively (Table 2, Figure 2). Field survey in and around the project area revealed however, that white pine (*Pinus strobus*) and eastern hemlock (*Tsuga canadensis*) are relatively uncommon. Additionally, the majority of the project area is above the upper elevation limit of the Hemlock-Harwood-Pine cover types defined in the NHWAP (1,400 feet above MSL). American beech (*Fagus grandifolia*) and yellow birch (*Betula alleghaniensis*) are almost ubiquitous in the hardwood/conifer covers type, with their relative abundance dictated by soil richness. In the saddles between hills and where slopes are gentle and soils are well developed, these species are dominant along with sugar maple (*Acer saccharum*), paper birch (*Betula papyrifera*), red spruce (*Picea rubens*), the less common balsam fir (*Abies balsamea*) and red oak (*Quercus rubrum*). In recently cut areas, regenerating canopy species included red spruce, beech, paper birch, and black cherry (*Prunus serotina*). In general, the mixed hardwood/conifer cover varies from equitably mixed to predominantly hardwood stands. Recently cut and young stands tend to be hardwood and mixed covers, rather than conifer cover. However, some mature stands of hardwood and mixed covers are also present.

In mature hardwood/conifer stands striped maple (*Acer pennsylvanicum*) is a dominant understory species. Hobblebush (*Viburnum alnifolium*) and red raspberry (*Rubus idaeus*) are common shrub layer species along with the regenerating canopy species in recently cut stands. Herbaceous understory species are most prevalent in recently logged stands where ample light was available and in the mature stands where they do not have to compete with regenerating woody species. Dominant species include forbs typical of rich northern woods, including Canada mayflower (*Maianthemum canadensis*), wild oats (*Uvularia sessifolia*), bunchberry (*Cornus canadensis*), and bluebead lily (*Clintonia borealis*). Ferns are common, particularly spinulose ferns (*Dryopteris intermedia*) in the uplands, hay-scented fern (*Dennstaedtia punctiloba*) in recently logged areas, and cinnamon fern (*Osmunda cinnamomea*) in wetlands. Mosses are prevalent under conifers, and *Sphagnum* dominates wetlands and non-wetlands with sufficient moisture. Ground lichens are prevalent in areas with thin soils or exposed ledge. Litter quality reflects the age of the stand and exposure, but generally is abundant and includes a range of coarse branches and trees to medium and fine woody material. Standing dead trees are common in both the young and mature stands.

### 3.2.2 Low-Land Spruce-Fir

The lowland spruce-fir cover type is the second most common cover types in both the Project Footprint and the Forest Block, composing approximately 33% and 11% of the cover, respectively (Table 3). Although distribution varies by exposure and elevation, coniferous cover types dominate in areas of thin soil, including steep slopes and some of the ridges with shallow bedrock. This association is comprised primarily of red spruce and balsam fir, with a limited component of yellow birch and paper birch. Regenerating balsam fir and red spruce, mosses and spinulose fern are common in the understory. Red spruce dominates on the steeper slopes and drier sites, with little to no balsam fir. Balsam fir becomes more abundant, and occasionally dominates in richer sites with shallower slopes and more moisture.

### 3.2.3 Rocky Outcrops

Although not included the NHWAP cover type data for the Project Footprint, Rocky Outcrops were observed along the ridgelines throughout the surveyed area. These features range from sparsely forested to open, and vary in size and character. The trees growing in and around them also vary in size, likely due to the thin soils associated with the outcrops, and standing dead trees are common. In open areas, ground lichens, low-bush blueberry (*Vaccinium angustifolium*), grasses, and sedges are dominant. Notable outcrops include an extensive stand of recently cut spruce-fir on the ridgeline south east of Tinkham Hill, as well as parts of Tinkam Hill itself. The area on top of the south ridge of Tinkham is dominated by a multi-aged stand of red oak and contains some large diameter trees (24 inches or greater). Much of the overstory is dead or dying, with mosses, sedges, red raspberry and regenerating oaks in the understory. This area may have burned many years previously, hence the thin soils and dead trees.

### 3.2.4 Wetlands and Waters

Normandeau wetland scientists delineated wetlands within a roughly 1,610 acre envelope including and surrounding the Project Footprint. As indicated by the NHWAP cover type mapping (Table 2, Figure 2), and as would be expected given the topography, wetlands are present on only a small portion of the site. The wetland discussion below is based on the results of the field delineations, and these results indicate that that palustrine forested wetlands, palustrine emergent/scrub-shrub wetlands, and intermittent/ephemeral streams account for the majority of the wetland cover in the surveyed area. Other wetland and water features observed include scrub-shrub wetland areas, vernal pools, and perennial streams. Wetland and stream abundance appears to be driven by recent forest management as well as topography.

**Palustrine Wetlands:** Forested wetlands are the most common wetlands in the surveyed area, and including those that have a component of emergent wetland and/or shrub swamp, compose 61.7 % of the delineated wetlands. The most common overstory species in forested wetlands includes yellow birch, red spruce and red maple with occasional American beech and balsam fir. Near the ridges, the wetlands frequently have an overstory of mainly red spruce with a sphagnum understory. The majority of the emergent/scrub-shrub wetlands areas identified on-site are small and disturbance-related, and often associated with recently logged areas. The species composition of these wetlands is variable, but common species include soft rush (*Juncus effusus*), fringed sedge (*Carex crinita*), sensitive fern (*Onoclea sensibilis*), and cinnamon fern. Sphagnum moss is a frequent component. Hardwood saplings, raspberry and hobblebush are also common, particularly in wetlands containing both emergent and forested sections. A few emergent wetlands were identified in the hayfields near Airport Road, and were wet meadows that were mown frequently. Palustrine scrub-shrub wetlands are the least common wetland type on-site, composing just 4.4% of the delineated wetlands. In addition to the few exclusively scrub-shrub wetlands that were delineated, some forested or emergent wetlands also contained small sections of shrubby vegetation. Typical shrub species in this wetland cover type include speckled alder (*Alnus rugosa*), red raspberry, meadowsweet (*Spiraea latifolia*), and hobblebush. A large percentage of these wetlands are dominated by regenerating canopy species, indicating recovery from logging.



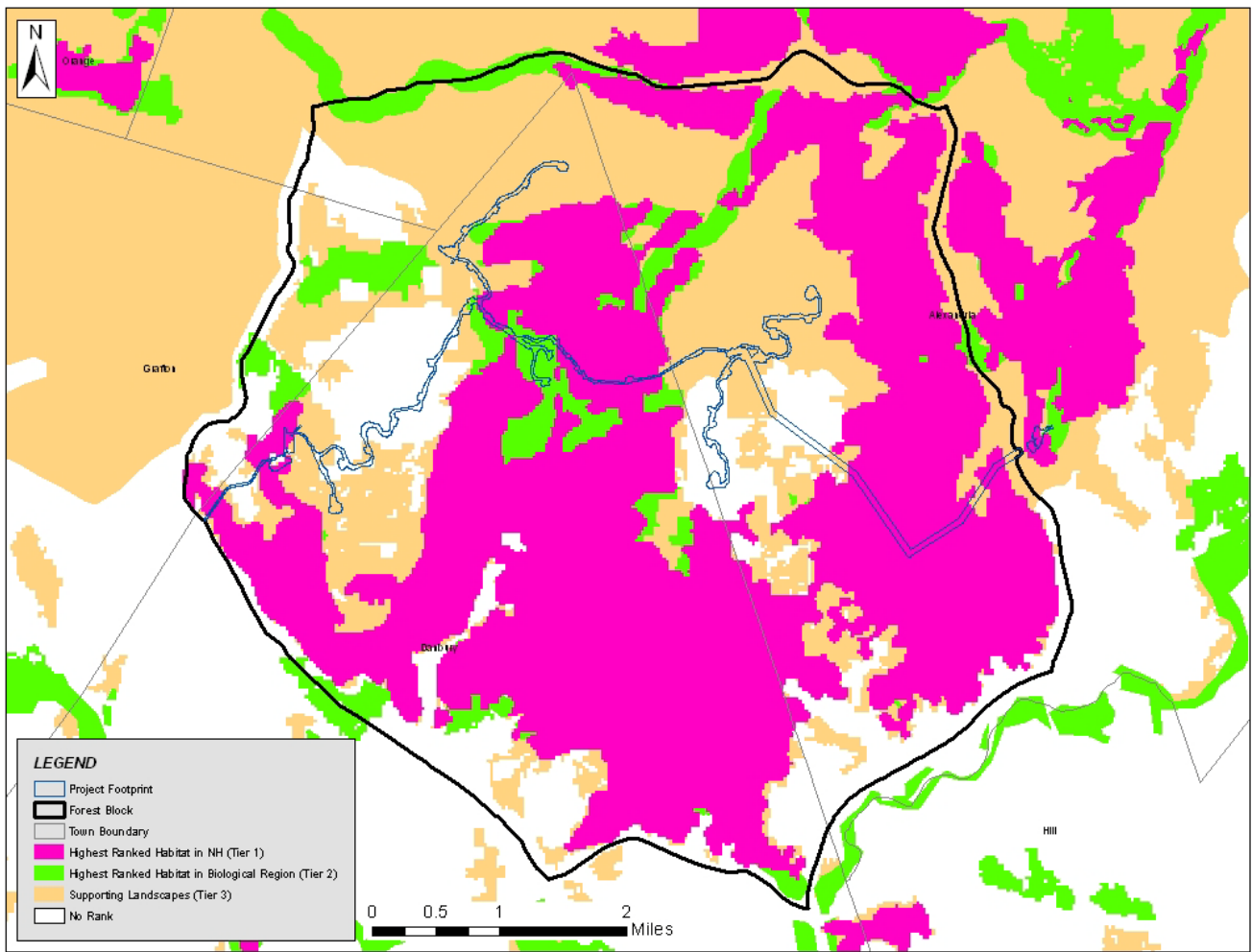


Figure 3. NH Wildlife Action Plan Habitat Rankings

**Vernal Pools:** Vernal pools have surface water or wetland areas that cycle annually from flooded to dry conditions. They typically form in depressions or basins, have no viable fish populations, and have no permanent inlet or outlet. The surveyed area was inspected by Normandeau field biologists for vernal pools in the springs of 2010, 2011, 2012 and 2013. A total of four vernal pools lie are impacted by the Project, ranging in size from 0.001 to 0.05 acres. An additional 25 vernal pools have impacts within 250 feet of the pool. The hydroperiod for most pools was classified as seasonally flooded, although several are semi-permanently flooded.

**Streams:** Streams within the Project area included perennial, intermittent and ephemeral, although the only streams impacted by the Project are either intermittent or ephemeral, with the exception of clearing over two perennial streams under the 75-wide electrical connector. Several slopes, including the western slope of Tinkham and south slope of Forbes Mountain have fairly elaborate networks of ephemeral streams that run down their slopes. In some areas, such as the west slope of Tinkham, forest management activities have resulted in ephemeral stream re-routing in skidder ruts.

**Ponds:** Various small ponds are present in the Forest Block, and near the Project Footprint, but no ponds are present in the Project Footprint itself. Grant's Pond, located along Wild Meadow Road, is approximately 39 acres in size, and the largest pond in the area. Wild Meadow Road and several residences occur along the west shore. The remaining shores are undeveloped wetland (primarily scrub-shrub) and upland forest. Another pond is located between Braley Hill and Forbes Mountain. This 6-acre beaver impoundment appears to be quite old and supports several beaver dams and an active beaver colony. Another pond, located south of the Pinnacle on Forbes Mountain Road is approximately 7 acres in size. This pond supports six active great blue heron nests and an active beaver colony.

### 3.2.5 Forest Condition Summary

The western portion of the project site includes Braley Hill, Tinkham Hill, Pillsbury Mountain and the Pinnacle. Near the ridgeline and summit of Braley Mountain, the overstory is dominated by recently cut hardwoods and mixed woods. The dominant species include yellow birch, sugar maple, and American beech. Conifers are mostly red spruce, with less balsam fir. In the most open areas, red raspberries and hay-scented fern compete with regenerating tree species and stump sprouts. Observations of a white-tailed deer fawn, young snowshoe hare and several broods of ruffed grouse attest to the value of the low, dense cover in this area. Numerous logging roads also weave through the area extending east of the Braley summit.

Mature hardwoods and mixed woods currently dominate the peak of Tinkham and in the saddle between Tinkham and Braley. Logging roads and some cutting is evident here, but the canopy is predominantly full with a range of age classes, including some large hardwoods and conifers. Dominant species include beech, yellow birch, sugar maple, red oak and red spruce. The southern ridge of Tinkham is dominated by a mix of mature and recently logged red spruce and balsam fir. Most is on shallow bedrock, visible as bare ledge, or shallow root systems. On the southeastern lower slopes of Tinkham, the soils are presumably richer as they support predominantly sugar maple, some of which are large diameter (24 inches or greater), with lesser amounts of beech and yellow birch. Herbaceous species typical of rich woods, such as spring beauty (*Claytonia virginica*), trout lily

(*Erythronium americanum*), and Dutchman's breeches (*Dicentra cucullaria*) are locally common. The western slope is steep, with shallow ledge and boulders. Mature red spruce dominates the steepest portions, with a sparse understory of regenerating spruce, spinulose ferns and mosses. Recent logging has greatly reduced the conifer overstory on the northern and southern ends of this slope.

Several areas of young, relatively uniform (3-6 inch dbh) hardwood stands occur on the northern ridge of Braley, the northeast ridge of Tinkham and the eastern shelf of Forbes, dominated by black cherry, yellow birch and beech.

Pillsbury Mountain, located south of Tinkham is predominantly hardwood, and has been recently logged. Sugar maple, beech and yellow birch are the dominant remaining tree species, with an understory of red raspberry, woodland ferns, and regenerating hardwoods and red spruce. Wetlands and streams are relatively uncommon on this small parcel.

The Pinnacle is an easterly ridge off Tinkham that is predominantly mature softwood (red spruce with minor balsam fir) and shallow bedrock. The top of the ridge is relatively level, and combined with the shallow bedrock, results in a higher density of wetlands and vernal pools than observed in other locations on the project.

The eastern side of the site encompasses Forbes Mountain has all three main cover types which are variable in age structure and composition. The predominant cover types are mature lowland spruce-fir on the southern ridge and a mix of mature and young northern hardwoods-conifer on the remainder of the site. Logging occurred in 2011 and 2012 within the surveyed area. At the base of a steep west facing slope below the peak, a drainage system with a watershed divide feeds an intermittent stream to the north and a perennial stream to the south.

The proposed electrical connection traverses the east flank of Forbes Mountain, and crosses over the south ridge of Pine Hill to reach the existing HVDC transmission line in Alexandria. The terrain is predominantly steep with shallow ledge and boulders. It is primarily mature second growth forest, with the typical mix of northern hardwoods and conifers such as red spruce and balsam fir. Several drainages cross the 75-wide corridor, including 2 perennial streams. The lower perennial stream forms the headwater of Pine Hill Brook.

The proposed substation connecting the project to the HVDC transmission line lies east of Forbes Mountain in lowlands adjacent to Bog Brook. The terrain is steep, dominated by a mix of red spruce, balsam fir, red oak and yellow birch. Much of the footprint of the substation includes areas of recent gravel mining, and has been colonized by early successional species such as cherry, red maple and alder. A mixed softwood stand adjacent to the proposed substation shows some sign of recent, light winter use by deer (fresh brows scars on young hemlocks). A spur off the Bog Brook wetland complex extends across Bog Road and would be partially impacted by the proposed substation. This wetland is predominantly shrub swamp and forested wetland, although it becomes dominated by emergent in the wetter sections closer to Bog Road. This wetland provides diffuse pockets of vernal pool habitat throughout much of its on-property extent.

**3.3 NHWAP Habitat Rankings**

As described in Section 2, the NHWAP ranks the entire state in terms of habitat quality, based on models (Section 2.3, Appendix A) that evaluate wildlife habitats by ranking the biological, landscape, and human impact factors most affecting each habitat type. The results of the NHWAP analysis for the Project Footprint and Forest Block are depicted in Figure 3 and summarized in Table 3. It should be noted that the results of the habitat quality analysis reported in the NHWAP are based on the model only, and were not fully ground verified by NHWAP. These results are recognized by the agencies to contain inconsistencies with actual conditions in the field. Some substantial inconsistencies are apparent in the Forest Block, and are discussed below.

**Table 3. NHWAP Habitat Rankings by Percent within Project Footprint and Forest Block**

<b>NHWAP Habitat Ranking</b>	<b>Project Footprint (%)</b>	<b>Forest Block (%)</b>
Highest Ranked in NH (Tier 1)	27.0	50.4
Highest Ranked in Biological Region (Tier 2)	6.6	6.3
Supporting Landscapes (Tier 3)	41.1	26.3
Unranked	25.2	17.0

At least 75% of both the Project Footprint and the Forest Block is NHWAP ranked habitat, and the Forest Block abuts additional areas of Tier 1 habitat to north (Figure 3). The majority of the Project Footprint area is classified as Tier 3 (Supporting Landscape) by the NHWAP, while the majority of the Forest Block is classified as Tier 1 (Highest ranked in NH). Much of the Unranked habitat within the Forest Block occurs on portions of Tinkham and Forbes Peaks. On the ground observations indicate that these areas do provide good-quality wildlife habitat even though they did not meet the NHWAP model criteria to be ranked.

**3.4 Wildlife Observed On-site**

The mammals, birds, reptiles and amphibians that were observed on-site are listed in Appendix C, along with scientific names. All species observed are typical of New Hampshire’s northern hardwood-conifer and lowland spruce/fir cover types, and are discussed briefly by taxonomic group below. None of the species observed have State or Federal status, but one is listed as Species of Special Concern (osprey) and an additional seven are noted in the NHWAP as Species of Greatest Conservation Concern (Appendix C). Examples of some of the wildlife observations are presented in Appendix D.

**3.4.1 Mammals**

Direct and indirect observations indicate that the site is heavily used by moose. The growth form of young trees and shrubs preferred by moose show a history of heavy browsing throughout the site, and moose pellet groups are abundant. Direct observations included a cow and new-born calf encountered on Braley, and multiple individuals have been encountered at other locations throughout the surveyed area. Black bear sign was also common. Beech trees with claw marks and a growth form characteristic of historic beech nut

feeding by bears were observed in larger beech stands. Bear scat, tracks, and excavated logs were also observed in various locations throughout the site. A bobcat was observed on the south side of Tinkham Hill. Coyote, deer, porcupine, fisher, red squirrel, chipmunk, and snowshoe hare, and various species of mice and/or their sign were also observed throughout the surveyed area, although in no great abundance or in any distinct concentration. A camera trap survey for American marten on-site (Stantec 2013a) recorded a similar suite of species.

### 3.4.2 Birds

At least 32 species of birds were observed on site over the course of the wetland, wildlife, and vernal pool studies. These species included year round residents, summer breeders, and transient migrants. During the breeding season, observations on the ridge-tops and slopes included a variety of woodpecker species, many wood warblers known to breed in this part of New Hampshire, hermit and wood thrush, several broods of ruffed grouse in recently cut stands, and an osprey, which soared over Tinkham. Black-throated blue warblers and chestnut-sided warblers were noteworthy for their abundance.

### 3.4.3 Reptiles and Amphibians

Observations of reptiles and amphibians included opportunistic encounters with adults and observations of eggs and larvae during the vernal pool surveys. Wood frog, spotted salamander, and blue spotted salamander egg masses as well as wood frog tadpoles were observed in vernal pools. Adult American toads, red efts, red-backed salamanders, green frogs, wood frogs and spring peepers were observed in low numbers throughout the surveyed area. Garter snakes were observed in various locations, and were the only reptile observed.

## 3.5 Species of Special Concern

A report detailing the records of the locations and distribution of protected species, exemplary natural communities, and natural resources of concern within a 10-mile radius of the proposed project was issued by NHNHB on October 4, 2013, and is valid for one year. There are no NHB records for rare species and/or exemplary communities within the proposed project area (Appendix E). However, these records do indicate that a sensitive area of wildlife habitat is present in the vicinity of the project area, as well as a sensitive plant species in two locations. A Medium-level Fen System was identified approximately one-half mile downstream of the Project on Bog Brook.

NHB records indicate that the sensitive wildlife habitat is a bat hibernaculum. This resource is located within the greater unfragmented forest block that the project area is located in, approximately one-half mile from the nearest proposed turbine. When last checked in 2010, 17 bats were observed, consisting of seven little brown bats (*Myotis lucifugus*), four northern long-eared bat (*Myotis septentrionalis*), and six *myotid* spp. dead of White Nose Syndrome. Seven of the remaining 11 were also infected. In 2008, the mine supported 57 northern long-eared bats and three small brown bats. Bat hibernacula have no legal status in New Hampshire, but their conservation status is ranked as “critically imperiled due to rarity or vulnerability”. They have no legal or conservation ranking at the federal level.



Preliminary discussions with US Fish and Wildlife Service and NH Fish and Game (Appendix B) identified three possible species of interest with the potential to be present in and around the project site: the State threatened American marten (*Martes americana*), the State endangered eastern small-footed bat (*Myotis leibii*) and the State Species of Special Concern northern long-eared bat. None of these species currently have federal status, but the USFWS has formally proposed listing the northern long-eared bat as endangered. The 60-day comment period on this proposal began October 2, 2013, and the USFWS will make a final decision on the proposal within 12 months.

Results of the on-site habitat assessment indicated that most forest stands have relatively low structure, making them unsuitable for marten. Additionally, the proposed project area is south of the known marten range in New Hampshire, which is generally restricted to the White Mountains and north (NHWAP 2006). Overall these factors indicate low suitability for marten in the surveyed area. A site-specific camera survey for marten was conducted in 2010, and did not record any marten (Stantec 2013a).

The project site is within the known range of northern long-eared bats and eastern small-footed bats, and a mist nest survey for bats was conducted in 2011 (Stantec 2013b). Although only a single bat (a female juvenile big brown bat [*Eptesicus fuscus*]) was captured over 28 net nights, habitat observations indicate that the two bat species of interest have some potential to be present and they are discussed below. The following sections provide basic ecology and habitat requirements for these two species.

### 3.5.1 Eastern Small-footed Bat

This non-migratory species roosts in caves and abandoned mines, and appears to be rare throughout its range in the eastern United States (NatureServe, 2009a). *M. leibii*'s known distribution includes all of New Hampshire, and its NHWAP species profile (Veilleux and Reynolds 2006a) indicates that records for this species exist from five towns, two of which are south of the project site, and three lie to the north. New Hampshire's one known colony hibernates in an abandoned, gated mine in Coos County (Veilleux and Reynolds 2006a).

Because of its rarity, this species is difficult to study, and the understanding of its distribution and habitat preferences within its known range is limited. In general, *M. leibii* appear to prefer hilly and mountainous areas, in or near deciduous or evergreen forest. Most roost sites and hibernacula that have been found are in forested landscapes, and the majority of documented *M. leibii* summer roosts are in various types of rock crevices. In Virginia and West Virginia, this bat is associated with rock features in and near deciduous forest, and in other Appalachian states *M. leibii* is apparently restricted to caves and rocky outcrops associated with the Appalachian Highlands (In Pennsylvania, this species was documented in heavy hemlock in the foothills of mountains that rise to 600 m (2000 ft). Like many bat species, this species forages preferentially over open water, along streams, and along road corridors (NatureServe 2009a).

In New Hampshire, three radio tagged non-reproductive individuals roosted in various crevices and rock outcrops at the base of a dam in Surrey, Cheshire County (Veilleux and Reynolds 2006a). Range-wide, summer maternity roosts have been found under rocks on hillsides and open ridges, in cracks and crevices in rocky outcrops and talus slopes, as well as beneath the bark of dead and dying trees, and in buildings. In Virginia, reproductively

active females have been mist-netted along forested ridge tops near abundant exposed rock outcrops (NatureServe 2009a).

Based on the above discussion, the proposed project area appears to offer habitat that is potentially suitable for small-footed bats. Although information about elevational preferences is limited, this species has been documented in mountainous settings. Rocky outcrops surrounded by forest are present on Tinkham Hill, and smaller outcrops are present in other locations. Due to the irregular nature of these types of features, there may be at least some small areas that receive enough sun to make them attractive for roosting. The on-site forests have been logged extensively, creating a network of skidder trails that provide suitable foraging sites. However, access to water may limit the suitability of the ridgeline habitat in and around the Project Footprint. Bats drink on the wing and require water sources with an open flight line. Field observations indicate bats' use of water sources increases with size, but they will use pools as small as three feet in diameter (Taylor and Tuttle 2007). Although there is an extensive network of ephemeral and intermittent streams across the surveyed area, perennial streams are less common on the ridges therefore the bats would need to travel downslope to find reliable drinking water from streams. The various vernal pools documented on site may provide adequately-sized water sources, although open flight lines are likely limited on the smaller pools due to the forested canopy. Additionally, all but the largest vernal pools are likely dry by mid-summer in most years.

### 3.5.2 Northern Long-eared Bat

This non-migratory species is not currently listed as threatened or endangered by the State of New Hampshire, but does appear to be one of the less common bat species throughout its range (NatureServe 2010b). This species is often observed or captured incidentally in low numbers during the study of other species and its distribution is well documented throughout the northeastern United States and southeastern Canada. Its profile in the NH Wildlife Action Plan (Veilleux and Reynolds 2006b) indicates that its known distribution in the state includes 25 towns, including Grafton. Additionally, NHNHB records indicate that in 2007, 57 northern long-eared bat were recorded in the Mud Mine hibernaculum along with several little brown bats (Appendix B).

Northern long-eared bats hibernate in caves, rock overhangs, and mines. The majority of summer roosts, including maternity roosts, have been documented in forested habitats, including those managed for timber production. Roosts have been observed under loose bark, in tree hollows and crevices, and in wooden structures such as barns (NatureServe 2010b). In the White Mountain National Forest, the majority of northern long-eared bat roosts were in large snags, but live trees were also used. Large, tall trees/snags with intact bark and moderate levels of decay were commonly used, especially if they had hollows (Veilleux and Reynolds 2006b). Unlike many bat species, the northern long-eared bat forages extensively under and over the canopy of forested habitats, as well as in forest openings, and uncommonly over open water (NatureServe 2010b).

Based on the above discussion, the proposed project area appears to offer habitat that is potentially suitable for northern long-eared bat. Although information about elevational preferences is unavailable, this species prefers forested habitats and suitable roost trees are present in and around the Project Footprint. Numerous scattered large-diameter trees, both alive and dead, occur over much of the surveyed area, with extensive forests suitable for

foraging. However, as discussed above, the availability of suitable drinking water may limit the habitat suitability of the ridgelines for this species.

### **3.5.3 Sensitive Plant Species and Medium-level Fen System**

The two records for a sensitive state-threatened plant species are not located near any proposed disturbances associated with any project components. The specific species and location are confidential information per request of NHNHB; however it is known to prefer rocky slopes and the area around cliff bases within rich, mesic forests (Haines, 2011). It is less common in wet mesic forests that are influenced by high pH bedrock. The bedrock in the area of the known occurrence of this species within the project lands is mapped as Pennsylvanian or Mississippian Intrusive Rocks, according to bedrock geology mapping for the State of NH. This geology is confined to the northeastern flank of Forbes. The only portion of the project footprint that encroaches on this geological type is a small area area of the proposed electrical connector. The NH Wildlife Action Plan (NHWAP) habitat mapping indicates that the area is Hemlock Hardwood Pine forest.

The project area was reviewed for similar habitat and other indicators of high-pH soils that might be suitable for this plant species, and none were identified. With the exception of a small section of the electrical connector, the bedrock geology of the project area is different than that where the known occurrences exist. Our field observations identified a fairly uniform Northern hardwood-conifer community (Sperduto and Kimball 2011) at similar elevations as the occurrences within the project area. Some small pockets of semi-rich woodlands (Sperduto and Kimball 2011) were observed elsewhere within the project area, however no occurrences of this sensitive state-threatened plant species have been observed..

The medium-level fen system is described as small and in excellent condition by NHNHB (Appendix B). This area was not visited because of its one-half mile distance from the project and the minimal disturbance anticipated by the project.

## **4.0 Discussion**

### **4.1 Habitat Values**

#### **4.1.1 Hardwood/Conifer Cover**

Northern hardwood-conifer forest cover is generally found between 1,400–2,500 ft. in elevation in northern New Hampshire and the Western Highlands, with some occurrences found down to about 1,000 feet in elevation (Sperduto 2005). This cover type is the second most common cover type in New Hampshire after hemlock-hardwood-pine associations, covering approximately 20% of the State (NHWAP 2006). Because of its wide distribution, many wildlife species are adapted to using northern hardwood-conifer forest, and it is known to support 137 vertebrate species in the state, including 42 mammals, 73 birds, 8 reptiles, and 14 amphibians (NHWAP 2006). Typical species using this cover type include American woodcock, bald eagle, Canada warbler, Cooper's hawk, northern goshawk, ruffed grouse, purple finch, wild turkey, veery, wood thrush, blue-spotted salamander, spotted salamander, wood frog, ribbon snake, garter snake, spotted turtle, wood turtle, eastern red bat, hoary bat, silver-haired bat, black bear, bobcat, white-tailed deer, and moose. A full

range of age classes, well distributed on the landscape is important to support the diversity of wildlife species that depend on this forest type (NHWAP 2006). The pattern of forest harvesting in the surveyed area has created an abundance of younger age classes, but older stand do remain, and many of the typical species listed above were observed on-site (Appendix D).

The common tree species that compose the hardwood/conifer cover type offer food value to a wide variety of wildlife. Red maple was observed frequently on the project site in wet areas as mature trees and as saplings in the understory. The seeds, buds or flowers of red maple are favored by many birds. Gray and red squirrels and eastern chipmunks typically remove the hull and wing of the seed and then eat or store it. Moose, white-tailed deer, and porcupine browse the bark, twigs, and foliage of red maple. Striped maple is also abundant on the site. This species is an important winter and spring forage species for moose, and logging in many areas of the project site have created good openings for this small understory tree.

Beechnuts, which are high in fat content and abundant in good production years, also provide important food value to wildlife. Beechnuts are a favorite of ruffed grouse, tufted titmice, porcupine, gray and red foxes, and chipmunks, all of which will preferentially eat this energy-rich food source when available. Beechnuts are also well known to provide a key food resource for black bears preparing to enter hibernation, and large beech trees often have characteristic scares on their bark left by the claws of climbing bears, as well as bent and broken branches in the crown as a result of bear feeding activities. Due to the history of cutting on-site, pure stands of mature beech tend to be small. However, beech was a common component of the hardwood stands on-site, and many of the mature beech trees in the surveyed area showed characteristic bark and branch damage from repeated black bear visits. Locations with a notable number of bear-scared beeches included the saddle between Tinkham and Braley, and the northern side of Forbes Mountain. The young beech stands on Pillsbury Mountain were also scarred by bear.

Another important component of the mixed forest cover types was the raspberry and blackberry shrubs which were abundant in all recently cut areas. The fruit of these two shrubs are eaten by a wide variety of mammals and birds, and the leaves, buds, and stems are eaten extensively by deer and small mammals. Besides the great value as a food source, shrubs also provided high quality cover.

### 4.1.2 Lowland Spruce-Fir

Lowland spruce-fir forests occur between 1,000 and 2,500 feet in elevation in New Hampshire and are comprised of a mosaic of lowland spruce-fir forest and red spruce swamp communities. Lowland spruce-fir forest cover is New Hampshire's third most common forest type, covering approximately 10% of the State. This forest type is known to support 101 vertebrate species in the state, including 9 amphibians, 2 reptiles, 53 birds, and 37 mammals (NHWAP 2006). Of the bird species, 15 are essentially restricted to or heavily dependent on spruce-fir forest, and seven require mature age classes. Typical species that use this cover type include bay-breasted warbler, Cooper's hawk, Northern goshawk, palm warbler, purple finch, spruce grouse, three-toed woodpecker, wood turtle, hoary bat, white-tailed deer, black bear, and moose (NHWAP 2006). There is broad overlap between the species that use this cover type and the northern hardwood-conifer type discussed above.

Typical vegetation for lowland spruce-fir includes red spruce, balsam fir, hobblebush, and bunchberry (NHWAP 2006). These species offer food and shelter to many species of wildlife. For example, red spruce seeds and buds are frequently browsed by many birds and small mammals, and this species provided food and nest sites for blue-headed vireos, golden-crowned kinglets, and magnolia warblers (DeGraaf and Yamasaki 2001). Deer mice, porcupine, and red squirrel also use red spruce for both food and cover (DeGraaf and Yamasaki 2001). In the surveyed area, red spruce is a common to dominant component of the spruce-fir stands, and a common overstory species in forested wetlands.

An important habitat value of lowland spruce-fir is winter range for white-tailed deer. Softwood stands with dense overstories have shallower snow depths as compared to hardwood stands, allowing deer to save energy when walking through snow. Dense softwoods also provide a thermal benefit by shielding deer from wind. High value deer wintering areas (DWA) are used repeatedly and can be identified even in summer by the characteristic, historic brows scars on preferred shrubs and trees. With the exception of the softwood stand adjacent to the proposed substation, no recently used DWA were observed in the surveyed area, and the overall amount of deer sign observed was low.

### 4.1.3 Rocky Ridge

The NHWAP (2006) defines Rocky Ridge habitat as rocky outcrops, bedrock ridges, and summits that occur below the alpine zone and identifies two types of Rocky Ridge habitat in New Hampshire. Based on the surrounding cover type and elevation the rocky outcrops in the Forest Block are classified as montane rocky ridge. Montane rocky ridges occur on outcrops and shallow-to-bedrock ridges and summits at mid-elevations in central and Northern New Hampshire, and are dominated by some combination of red spruce, red pine (*Pinus resinosa*), and red oak. In general, this cover type has a moderate to sparse woodland canopy structure, ranging from completely open patches to thin forest, with much open bedrock exposure. In combination with talus slopes, rocky ridges provide crucial habitat for several rare wildlife species in New Hampshire, including state endangered timber rattlesnake and eastern small-footed bats, and state threatened peregrine falcon (NHWAP 2006). None of these species were observed or are known to occur in the surveyed area, and none are likely to occur with the possible exception of eastern small-footed bat. Bobcats, noted in the NHWAP (2006) as a species of greatest conservation concern also commonly den in rocky outcrops, and a bobcat was observed near the rocky outcrops on Tinkham.

### 4.1.4 Wetlands and Waters

Palustrine wetlands are divided into three sub-categories: forested, shrub-scrub, and emergent. Species that rely on upland forested habitat also thrive in forested wetlands, which are the most prevalent wetland type in the surveyed area. In addition to vernal pool obligate breeders, other wetland-dependent species can be found in forested wetlands, including red-spotted newt, green frog, northern leopard frog, spring peeper, and gray tree frog. Species such as white-tailed deer, moose, snowshoe hare, many species of bats, and small rodents such as star-nosed mole rely on forested wetlands for a portion of their life cycle. Wet meadows provide habitat for many of the wildlife species on site, including foraging for large mammals such as white-tailed deer, moose, and black bear, foraging and nesting habitat for avian species such as song sparrows and breeding habitat for American



toads. Scrub-shrub wetlands also provide preferred nesting habitat for a variety of birds, including common yellow throats and song sparrows, and cover for snowshoe hare and ruffed grouse.

Vernal pools serve as breeding grounds for a specific set of obligate species. When vernal pools become inundated with water in the spring, wood frogs, spotted salamanders, blue-spotted salamanders, and Jefferson salamanders lay eggs in the pools. Larval caddisflies, beetles, dragonflies and many other invertebrates inhabit the waters of vernal pools, both feeding on and providing food for the larval amphibians. On the Wild Meadows ridges, wood frog, spotted, blue spotted, and Jefferson's salamander egg mass and wood frog tadpoles were observed in the vernal pools.

As noted in Section 3, streams are classified as perennial, intermittent or ephemeral. Ephemeral streams are temporary streams that flow after snowmelt and heavy rains but dry up soon after runoff ceases. Intermittent streams have more permanent channels, typically flowing until mid-summer, and may contain isolated pools or surface water when there is no flow (Cowardin et al 1979). Intermittent streams are most notably used as habitat by invertebrates and amphibians. Green frogs frequently feed using the stream banks and those intermittent streams with sufficient pooling and rock/cobble habitat can be used by northern dusky salamanders. Depending on the gradient of the stream, either riverine or wetland-specialized invertebrate taxa can live out their larval stages in intermittent streams. Some examples include dragonfly, caddisfly, mayfly, stonefly, mosquito, midge and fly larvae. Ephemeral streams provide little to no habitat value for stream adapted species.

## 4.2 Impacts

### 4.2.1 Impacts of Construction

Construction of access roads and turbine pads for the proposed wind energy facility will create incisions into a currently unfragmented block of forested habitat as defined by the NHWAP (2006) and cause a limited amount of habitat conversion and loss. The incisions into the existing forest cover will be relatively narrow and are unlikely to have a fragmenting effect for most species present on site. The access roads will have only infrequent traffic, will be single lane and unpaved with no curb. All species that were observed on site are known to cross forest openings, including roads with low traffic volumes. The total amount of forest cover that will be converted from forest to early successional types (grass, shrubs) or permanently lost (hard surfaces of roads, turbine pads) is small compared to the total amount available in the Forest Block (1.4%). Many of the species present use and benefit from the early successional habitats currently available due to the extensive logging operations. Similar habitat will be created when parts of the Project Footprint are allowed to regenerate after construction is complete, and is expected to be used by the same suite of species. Some areas of rocky outcrop habitat may be impacted as a result of construction, as this cover type is located mostly along the ridgelines where the turbines will be constructed. Impacts to this habitat type may reduce the suitability of the project site for individuals of some species that depend on this habitat for food or shelter (e.g., bobcat).

During construction, the combination of habitat alteration and construction related disturbance will likely displace individuals of all resident species from the construction

envelope. However, after construction is complete, species should return, although habitat alteration will likely result in some change in distribution and density, as compared to preconstruction conditions.

No impacts to listed plant species or habitats identified by NHNHB are anticipated due to construction.

### **4.2.2 Impacts of Operations**

The results of the preconstruction bird and bat surveys conducted for the proposed project are consistent with the results of similar studies conducted at similar locations through New England (Stantec 2013b, Stantec 2013c). Operation impacts of wind projects in the Northeast have been assessed through post-construction mortality surveys for birds and bats. These surveys indicate that mortality due to turbine strike is generally low for both species groups, but tends to be somewhat greater for bats. Publicly available data for wind-energy facilities in the Northeast indicate that the range of overall bird fatality estimates range from zero to 13.9 fatalities/MW. Bat fatality estimates range from 1.5 to 39.7 fatalities/MW (WEST 2011). Studies indicate that most mortality takes place during migration, so impacts to resident birds and bats are likely limited, as compared to migrants passing through the project area.

Currently no research exists on the effect of wind operations on other wildlife species, but the known biology of the species known and likely to be present in and around the project site suggests that they will acclimate to the low intensity disturbance associated with operations, and any impacts to those species will be negligible.

No impacts to listed plant species or habitats identified by NHNHB are anticipated due to project operation.

## **5.0 Summary and Conclusions**

### **5.1 Project Habitat Value**

The habitat present in and around the project site is typical for this region of New Hampshire, and consists of cover types that are common throughout the state. Mammal species using the site are typical of NH's central highlands. Black bear and moose sign was common to abundant throughout the project area, with white-tailed deer and snowshoe hare sign relatively less common. Evidence of coyote, fisher, red squirrel, chipmunk and small rodents was ubiquitous, but not exceptionally common. Use by northern long-eared bat and eastern small-footed bats is a possibility, given the suitable forested and ledge habitats on many of the ridges, and the nearby hibernaculum, which has been known to support northern long-eared bat, although site specific studies of summer habitat did not identify either species. The bird, amphibian and reptile species observed during wetlands and habitat surveys were also typical of forested habitats in central NH. Based on NHWAP maps, the general habitat present in and around the project site provides supporting habitat to four known, nearby high-value habitat features, consisting a bat hibernaculum, the beaver pond, the Bog Brook wetland complex, and heron rookery.

Wetlands are recognized to provide greater habitat value than an equal area of most upland habitats, and their low abundance within the surveyed area may increase their relative value. Because of the ridgeline topography and steep slopes, streams in the project site are predominantly ephemeral and intermittent and wetlands tend to be small, encompassing a relatively small portion of the overall acreage of the project site. Although vernal pools are present throughout the site, they are not abundant and also tend to be small.

The habitat quality of the entire Forest Block, including the Project Footprint, is relatively high for wildlife species commonly associated with northern hardwood-conifer forest types, especially those that benefit from a mosaic of hardwood forest age classes. Due to the logging activities, forest stands exhibit a wide range of age classes from recently cut to young and mature second growth. Most stands include some large diameter trees, creating a diversity of habitat conditions which can in turn support a diversity of wildlife species. The habitat value for strict spruce-fir associated wildlife species is less, as there are fewer spruce-fir stands and large diameter trees in these stands are uncommon. Many strict spruce-fir associates rely on the structural characteristics of older stands which, due to the logging history, are not present. The rocky outcrops represent good quality habitat for some species which rely on this type of habitat, as evidenced by the direct sighting of bobcat.

### 5.2 Impacts

Neither the construction-related or operations-related impacts associated with the project will significantly reduce the habitat value of the project area for wildlife species known to be present, with the possible exception of species that use rocky outcrops, e.g., bobcat. In general, while the proposed project may cause the displacement or mortality of individuals of some species, it is not expected to have a population level effect on species known to be present in the region.

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## **APPENDIX A**

### **Explanation of NH Wildlife Action Plan Rankings**



The following description is downloaded from:

[http://www.wildlife.state.nh.us/Wildlife/Wildlife\\_Plan/highest\\_ranking\\_habitat.htm](http://www.wildlife.state.nh.us/Wildlife/Wildlife_Plan/highest_ranking_habitat.htm)

(Accessed August 15, 2011)

### **Highest Ranked Wildlife Habitat by Ecological Condition**

For the NH Wildlife Action Plan maps, the condition of wildlife habitats was analyzed by ranking the biological, landscape and human impact factors most affecting each habitat type. Biological factors include rare plant and animal species and overall biodiversity. Landscape factors include size of habitat and how close it is to other patches of that habitat. Human impact factors include density of roads around the habitat, dams, recreational use, and pollution. These are examples of the many factors that were used. Different factors were chosen for each particular habitat as, for example, hiking trails may reduce the habitat quality in alpine areas but are far less damaging to hemlock-hardwood-pine forests.

NHFG biologists developed condition filters to provide data and maps that show which habitats are in the best ecological condition in the state. These filters are a set of GIS data that indicate to what degree a particular patch of habitat has good biological diversity (particularly in terms of rare species), is connected to other similar patches in the landscape, and is negatively impacted by humans. There is a different filter for each habitat, but each filter includes biological, landscape, and human impact factors.

All 16 habitat types were assessed for condition as well as all surface waters. Streams and rivers were assessed in watershed units developed by the US Geological Survey (HUC 12). For each category (biological, landscape and human impact), a single score was calculated by weighting all factors equally. Then the scores from each category were weighted evenly to come up with a single condition score. Scores for each habitat polygon can be viewed in the attribute table in GIS or using the identify feature on the GRANIT Data Mapper program. These condition analyses were redone in 2010 to reflect the updated wildlife land cover and to use more up-to-date information. In addition, a more accurate analysis of forests was done. Large blocks of forests will contain some habitat which is in better ecological condition than other parts. This new analysis method was designed to show that.

For the five matrix forest types, instead of assessing condition based on habitat polygons, the forests were assessed in a raster grid, meaning each forest was split into 30mX30 m pixels (0.22 acre) so that the places where the habitat really was more intact would truly be identified. The types of information included in the condition analysis was similar to the 2005 analysis.

For use in conservation planning, the habitats were then ranked to show the habitats that were Highest Ranking in the State. This was done so that the top 15% by area of each forest type, and top 10% by area of the other habitats were considered highest ranking. Since the three coastal habitats and alpine habitats are so rare, all of them are top ranked. A few other locations, that of critically imperiled species, were also added as top ranked so that these critical habitats, even if degraded, were considered as a high priority. The Highest Ranked Wildlife Habitat in the state is colored pink on the map.

Since NH is so ecologically diverse, the habitats were then ranked within their ecoregional subsection. The Nature Conservancy had developed ecoregions, geographical areas with similar physical characteristics that influence biology, and these were used in the models. **There are 9 ecoregional subsections in NH**. The top 15% by area of forests and the top 50% of other terrestrial habitats in each ecoregion are considered Highest Ranking in the Biological Region. If these were not already top ranked in the state (pink), they are colored green on this map.

To provide a similar comparison for surface waters and wetlands, The Nature Conservancy also developed watershed groupings, which are geographic areas with similar features that influence aquatic biology ([link to watershed groupings map](#)). The top 50% of wetland habitats, all floodplain forests and 30% of surface waters were ranked highest in the biological region. If these were not already top ranked in the state (pink), they are colored green on this map.

Habitats will not stay in good condition if the surrounding landscape is destroyed. This is particularly true of surface waters. A third ranking, Supporting Landscapes consists of the upland part of the watershed for surface waters, some very intact forest blocks, some known locations of WAP species and some locations of exemplary natural communities. These areas are shown orange on this map.

**APPENDIX B**  
**Habitat Photo Log**

Picture Number: 1

Feature: Ledge Habitat

Comments: Rocky outcrop/ledge, note the sparse understory.



Picture Number: 2

Feature: Ledge Habitat

Comments: Rocky ledge habitat, east facing slope.





Picture Number: 3

Feature: Hardwood Forest

Comments: Hardwood forest dominated by American beech.



Picture Number: 4

Feature: Hardwood Forest

Comments: Hardwood forest dominated by American beech and red maple.





Picture Number: 5

Feature: Hardwood Forest

Comments: Early to mid-successional hardwood forest dominated by pin cherry and yellow birch.



Picture Number: 6

Feature: Softwood Forest

Comments: Softwood forest dominated by red spruce and balsam fir.





Picture Number: 7

Feature: Softwood Forest

Comments: Softwood forest dominated by red spruce.



Picture Number: 8

Feature: Mixed hardwood/softwood Forest



Picture Number: 9



Feature: Mixed Forest

Comments: Mixed hardwood and softwood forest.



Picture Number: 10

Feature: Intermittent Stream

Comments: Intermittent stream down a steep grade, exposing tree roots.



Picture Number: 11



Feature: Ephemeral Stream



Picture Number: 12  
Feature: Perennial Stream



Picture Number: 13



Feature: Palustrine Scrub-Shrub Wetland

Comments: Scrub-shrub wetland dominated by Rubus species.



Feature: 14

Palustrine Emergent and Forested Wetland

Comments: Emergent wetland (foreground) and mixed forested wetland (background, right).



Picture Number: 15



Feature: Palustrine Emergent and Forested Wetland

Comments: Wetland includes both emergent (center) and forested (right) community types.



**APPENDIX C**  
**Wildlife Observed On-Site**

Table 1D. Wildlife observed on site by cover type.

Common Name	Scientific Name	Observation/Activity	NHWAP Ranking <sup>1</sup>	Cover type <sup>2</sup>
<b>Amphibians</b>				
American toad	<i>Bufo americanus</i>	Terrestrial		W, NHC
Blue-spotted salamander	<i>Ambystoma laterale</i>	Egg masses		
Eastern newt	<i>Notophthalmus viridescens</i>	Red eft/adults in pool on Tinkham		W, NHC
Green frog	<i>Rana clamitens</i>	Streams and pools		W
Spotted salamander	<i>Ambystoma maculata</i>	Egg masses		W, NHC
Spring peeper	<i>Pseudacris crucifer</i>	Adult		W, NHC
Wood frog	<i>Rana sylvatica</i>	Eggs, larvae, adult		W, NHC
<b>Reptiles</b>				
Garter snake	<i>Thamnophis sirtalis</i>	Terrestrial		NHC, W, S-F
<b>Birds</b>				
American crow	<i>Corvus brachyrhynchos</i>	Ubiquitous		NHC, W, S-F
American redstart	<i>Setophaga ruticilla</i>	Hillslopes	noted	NHC
American robin	<i>Turdus migratorius</i>	Ubiquitous		NHC, W, S-F
American goldfinch	<i>Carduelis tristis</i>	Open area		
Black-and-white warbler	<i>Mniotilta varia</i>	Hill slopes		NHC
Blackburnian warbler	<i>Dendroica fusca</i>	Ridges		S-F
Black-capped chickadee	<i>Poecile atricapillus</i>	Ubiquitous		NHC, W, S-F
Black-throated blue warbler	<i>Dendroica caerulescens</i>	Ubiquitous		NHC
Blue jay	<i>Cyanocitta cristata</i>	Ubiquitous		NHC, W, S-F
Broad-winged hawk	<i>Buteo platypterus</i>	Hill slopes		NHC, W, S
Common raven	<i>Corvus corax</i>	Soaring		NHC, W, S
Dark-eyed junco	<i>Junco hyemalis</i>	Ridges		S-F, NHC
Downy woodpecker	<i>Picoides pubescens</i>	Ubiquitous		NHC, W, S-F
Eastern wood peewee	<i>Contopus virens</i>	Hill slopes		NHC
Hermit thrush	<i>Catharus guttatus</i>	Hill slopes		NHC
Magnolia warbler	<i>Dendroica magnolia</i>	Ubiquitous		S-F
Nashville warbler	<i>Vermivora ruficapilla</i>	Saplings		NHC
Northern flicker	<i>Colaptes auratus</i>	Ubiquitous		NHC
Osprey	<i>Pandion haliaetus</i>	Soaring	SC	
Ovenbird	<i>Seiurus aurocapillus</i>	Ridges		NHC
Pileated woodpecker	<i>Dryocopus pileatus</i>	Ridges		NHC
Red-breasted nuthatch	<i>Sitta Canadensis</i>	Ridges		S-F, NHC
Red-eyed vireo	<i>Vireo olivaceus</i>	Hill slopes		NHC
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	Hill slopes		NHC
Ruby-crowned kinglet	<i>Regulus calendula</i>	Ridges		S-F, NHC
Ruffed grouse	<i>Bonasa umbellus</i>	Ridges		NHC
Veery	<i>Catharus fuscescens</i>	Mesic sites	noted	NHC, W
White-throated sparrow	<i>Zonotrichia albicollis</i>	Ubiquitous		NHC, W, S-F
Wild turkey	<i>Meleagris gallopavo</i>	Hill slopes		NHC
Winter wren	<i>Troglodytes troglodytes</i>	Ridges		S-F, W, NHC
Wood thrush	<i>Hylocichla mustelina</i>	Hill slopes	noted	NHC
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	Ubiquitous		NHC, W, S-F
Yellow-rumped warbler	<i>Dendroica coronate</i>	Ridges		NHC, W, S-F
<b>Mammals</b>				
Small rodents	<i>Cricetidae</i>	Tunnels, tracks		NHC, W, S-F
Black bear	<i>Ursus Americana</i>	Scat, tracks, foraging	BGP	NHC, W, S-F
Bobcat	<i>Lynx rufus</i>	Sighting		RO, NHC, W, SF
Chipmunk	<i>Tamias striatus</i>	Sighting		NHC
Eastern Coyote	<i>Canis latrans</i>	Scat		NHC, W, S-F
Fisher	<i>Martes pennant</i>	Tracks		NHC, W, S-F
Moose	<i>Alces alces</i>	Sighting, scat, tracks, browse	BGP	NHC, W, S-F
Porcupine	<i>Erethizon dorsatum</i>	Scat		NHC
Red squirrel	<i>Tamiasciurus hudsonicus</i>	Sighting, forage		S-F
Snowshoe hare	<i>Lepus americanus</i>	Sighting, scat, browse		S-F, W, NHC

## WILD MEADOWS HABITAT ASSESSMENT

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White-tail deer	<i>Odocoileus virginianus</i>	Scat, tracks, browse	BGP	NHC, W, S-F
Woodchuck	<i>Marmota momax</i>	Burrow		NHC

1. **BGP** = species managed under NHFG's Big Game Plan, **noted** = species of conservation concern in the NHWAP, but has no special status other wise **SC** = Species of Special Concern,
2. NHC = Northern Hardwood Conifer, RO = Rocky outcrop, S-F = Spruce-fir, W = Wetland

**APPENDIX D**  
**Wildlife Photo Log**



# Wild Meadows Wildlife Photolog

**Picture Number:** 1

**Feature:**

Bear Sign

**Comments:**

Mature American beech with distinctive claw marks from black bear, north side of Forbes Mountain.



**Picture Number:** 2

**Feature:**

Grouse Eggs

**Comments:**

Grouse nest containing eggs on Braley Hill.



**Picture Number:** 3

**Feature:**

**Comments:**

Weasle tracks, Pillsbury Mountain



**Picture Number:** 4

**Feature:**

**Comments:**

Small diameter beech stand, with some bear scarring, Pillsbury Mountain.





**Picture Number:** 5

**Feature:**

Moose Sign

**Comments:**

Characteristic growth form of shubs heavily browsed by moose, east side of Tinkham Hill.



**Picture Number:** 6

**Feature:**

Moose Sign

**Comments:**

Bark stripped by moose, Braley Hill.



**Picture Number:** 7

**Feature:**

Pileated Woodpecker Sign

**Comments:**

Characteristic wood chips and tree trunk excavated by a pileated woodpecker, Tinkham Hill.



**Picture Number:** 8

**Feature:**

Spring Peeper

**Comments:**

Adult spring peeper.





**Picture Number:** 9

**Feature:**

Bear Sign

**Comments:**

Bear tracks on access road.



**Picture Number:** 10

**Feature:**

Snowshoe Hare

**Comments:**

Snowshoe hare photographed on the north side of Forbes Mountain.





**APPENDIX E**  
**NH Natural Heritage Bureau Correspondence**

# Memo



NH NATURAL HERITAGE BUREAU  
NHB DATACHECK RESULTS LETTER

**To:** Chris Hernick, Horizons Engineering, Inc.  
34 School St  
Littleton, NH 03561

**From:** Melissa Coppola, NH Natural Heritage Bureau

**Date:** 10/4/2013 (valid for one year from this date)

**Re:** Review by NH Natural Heritage Bureau

NHB File ID: NHB13-2964

Town: Danbury, Alexandria

**Location:** The project is located in the northern-most section of the Town of Danbury (approximately north of Pillsbury Mountain) and an area of the Town of Alexandria between said section of Danbury and the national electric grid power lines adjacent to Bog Road.

**Description:** Iberdrola Renewables wishes to construct a 23 turbine wind farm along ridgelines in the towns of Danbury and Alexandria. The project also includes the construction of an operations and maintenance area, an electrical substation, and transmission lines.

**cc:** Kim Tuttle

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

**Comments:** NHB is requesting surveys for the sensitive plant species. Please contact NHB for further details about the particular habitats that should be searched.

## Natural Community

Medium level fen system

State<sup>1</sup>

Federal

Notes

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Level fens are stagnant, and as such are characterized by low nutrient levels, relatively high acidity levels, and accumulations of peat. The primary threats to this community are changes to its hydrology (especially that which causes pooling), increased nutrient input from stormwater runoff, and sedimentation from nearby disturbance.

Sensitive Plant Species (not public information)

Please contact NHB to request details about this species. NHB recommends surveys where appropriate habitat exists.

## Vertebrate species

Sensitive Wildlife Habitat

State<sup>1</sup>

Federal

Notes

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Contact the NH Fish & Game Dept (see below).

## Memo



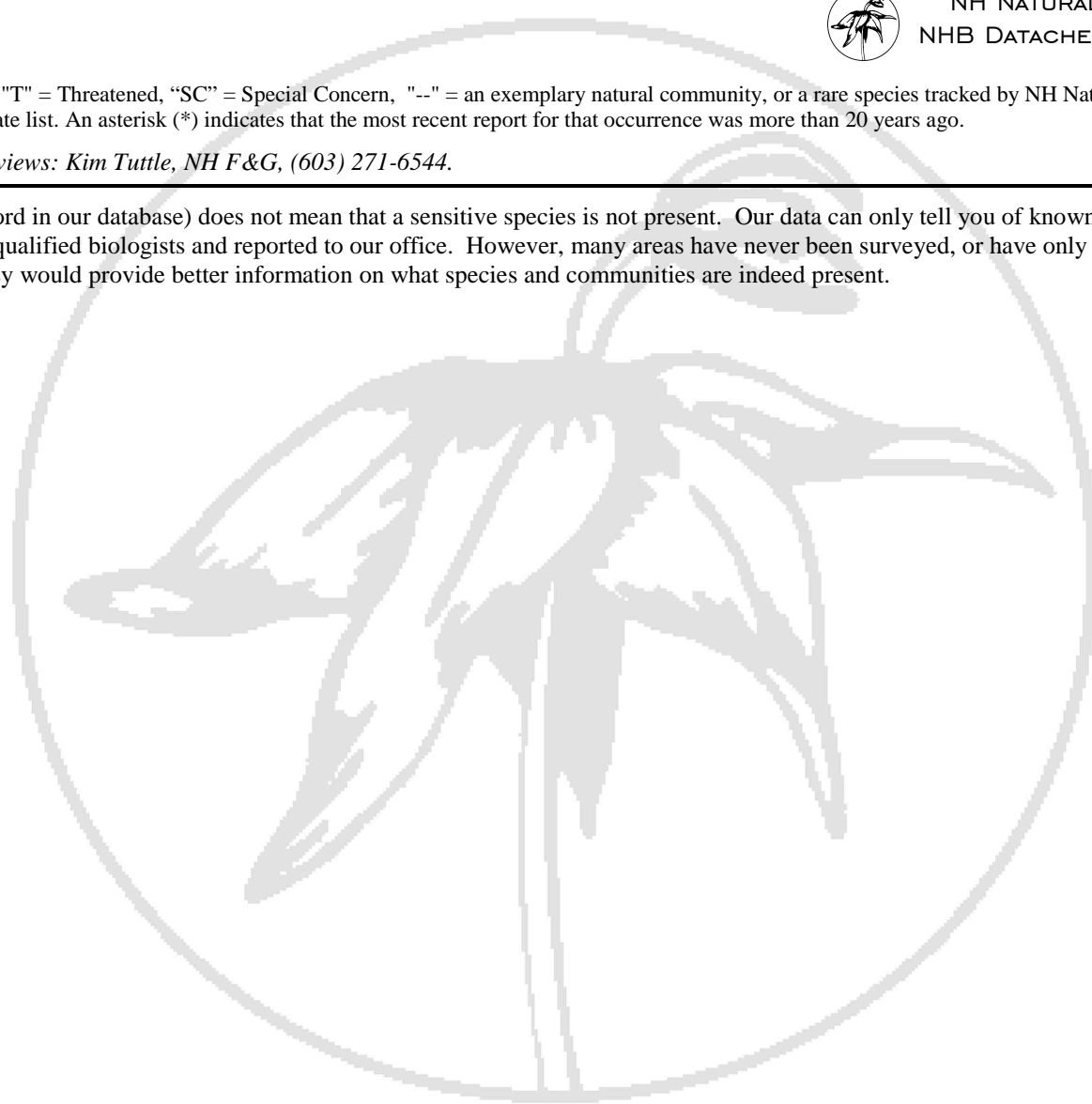
NH NATURAL HERITAGE BUREAU  
NHB DATACHECK RESULTS LETTER

<sup>1</sup>Codes: "E" = Endangered, "T" = Threatened, "SC" = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (\*) indicates that the most recent report for that occurrence was more than 20 years ago.

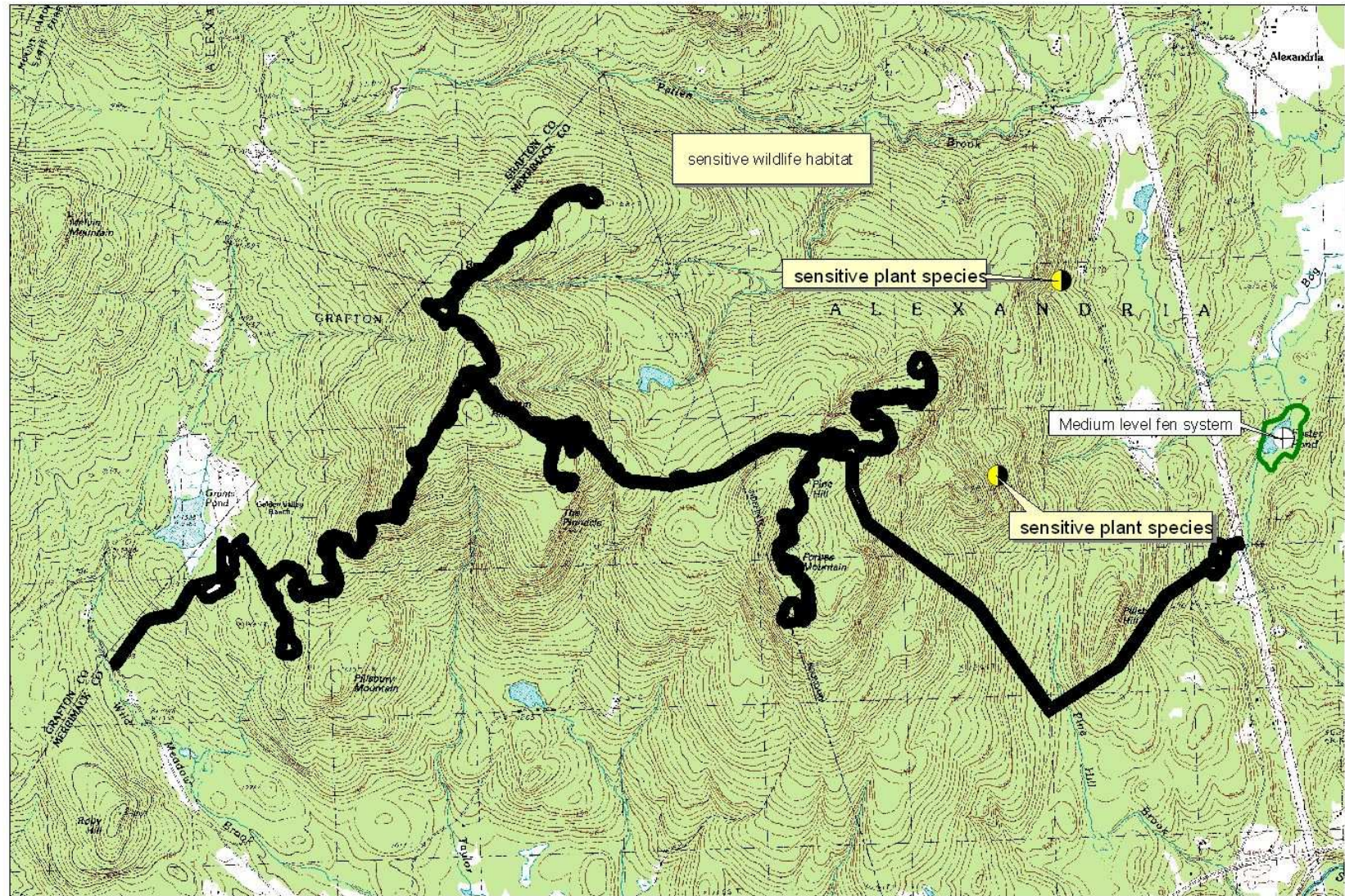
*Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.*

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A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.









## New Hampshire Natural Heritage Bureau - System Record

### Medium level fen system

**Legal Status**

Federal: Not listed  
 State: Not listed

**Conservation Status**

Global: Not ranked (need more information)  
 State: Rare or uncommon

**Description at this Location**

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).  
 Comments on Rank:

Detailed Description: 1992: A small example of this natural community with some northern (*Ledum groenlandicum*, *Abies balsamea*) and southern (*Woodwardia virginica*, *Toxicodendron vernix*, *Peltandra virginica*) affinities. No rare flora found. Overall, community in excellent condition.

General Area:  
 General Comments:  
 Management  
 Comments:

**Location**

Survey Site Name: Alexandria Bog  
 Managed By:

County: Grafton	USGS quad(s): Danbury (4307157)
Town(s): Alexandria	Lat, Long: 433519N, 0714727W
Size: 21.2 acres	Elevation: 605 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: From Bristol, take Rte 104 west about 1 mile. Bear right onto Pattee Hill Road. Soon, turn right onto Akita Road. Follow Akita Road ca. 0.75 miles to site. Access Foster Pond "Fen" by canoe, or by foot from east upland edge.

**Dates documented**

First reported: 1992-08-31	Last reported: 1993-06-18
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