

EXISTING NATURAL RESOURCE CONDITIONS AT THE PROPOSED DEERFIELD WIND PROJECT



January 31, 2006

Prepared for:

Deerfield Wind, LLC
c/o Vermont Environmental Research Associates (VERA)
Waterbury Center, VT



ARROWWOOD ENVIRONMENTAL
950 BERT WHITE ROAD
HUNTINGTON, VT 05462
(802) 434-7276 FAX: (802) 434-2102

Table of Contents

Executive Summary	1
1.0 Introduction	2
2.0 Existing Vegetation	2
2.1 Eastern Project Area	2
2.2 Western Project Area	5
2.3 Rare and Sensitive Plant Species	6
2.4 Non-Native Invasive Species	6
3.0 Wildlife Habitat	7
3.1 Management Indicator Species	7
3.2 Threatened and Endangered Species	12
3.3 Regional Foresters Sensitive Species	14
3.4 Species of Viability Concern	19
3.5 Neo-tropical Migratory Birds	23
3.6 Miscellaneous Wildlife	30
3.7 Special Wildlife Habitats	32
4.0 Wetlands	33
4.1 Spruce-Fir-Tamarack Swamps	34
4.2 Seeps	34
5.0 Surface Waters	35
6.0 Soil Resources	36
7.0 Geology	37
7.1 Surficial Geology.....	37
7.2 Bedrock Geology	37
8.0 Analysis of Access Routes for Western Project Area.....	38
8.1 Bishop Road Access	38
8.2 Old Route 9 Access	39
8.3 Route 9 Access	39
8.4 Southern Access	40
8.5 Putnam Road Access	41

List of Tables

- Table 1. Forest Composition of the Northern Hardwood Forest in the Eastern Project Area
- Table 2. Forest Composition of the Montane Yellow Birch-Red Spruce Forest in the Eastern Project Area
- Table 3. Forest Composition of the Northern Hardwood Forest in the Western Project Area
- Table 4. Management Indicator Species and their Preferred Habitats.
- Table 5. Summary of Impact of the Proposed Development on the Management Indicator Species.
- Table 6. Threatened or Endangered Species (TES) Tracked by GMNF
- Table 7. Regional Forester's Sensitive Species in the GMNF
- Table 8. Species of Viability Concern in the Green Mountain National Forest
- Table 9. Summary of Likely Affects of Proposed Wind Development on Declining NTMB Habitat.
- Table 10. Summary of Wetlands at the Proposed Deerfield Wind Project
- Table 11. Vegetation Composition of the Spruce-Fir-Tamarack Swamps in the Eastern Project Area
- Table 12. Vegetation Composition of the Seepage Wetlands in the Eastern Project Area
- Table 13. Summary Information for Streams along the Proposed Deerfield Wind Project
- Table 14. Soil Type Associations Found in the Eastern and Western Project Areas of the Deerfield Wind Project
- Table 15. Wetland and Stream Occurrences along the Bishop Road Access Route
- Table 16. Wetland and Stream Occurrences along the Old Route 9 Access Route
- Table 17. Wetland and Stream Occurrences along the Route 9 Access Route
- Table 18. Wetland and Stream Occurrences along the Southern Access Route

List of Maps

- Map 1: Existing Natural Resource Conditions, Northern Third of Project
- Map 2: Existing Natural Resource Conditions, Center of Project
- Map 3: Existing Natural Resource Conditions, Southern Third of Project
- Map 4: Non-Native Invasive Species of Existing Towers

EXECUTIVE SUMMARY

The site of the proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont received an environmental assessment by Arrowwood Environmental from 2003 to 2006. As part of this assessment, the existing natural resource conditions on the site were identified, mapped and evaluated. Special attention was paid to Management Indicator Species (MIS) and their habitats, Threatened, Endangered Species (TES), Regional Foresters Sensitive Species (RFSS), Species of Viability Concern (SVC), Neo-tropical Migratory Birds (NTMB) and specialized wildlife habitats. In addition, the existing forest vegetation, streams, wetlands and other surface waters were mapped and assessed.

Based on the environmental analysis outlined in this report, the proposed project will have a limited negative impact on three of the nine Management Indicator Species: the Barred Owl, the Blackpoll warbler and the Chestnut sided warbler. These impacts were determined to be limited because they are restricted to the clearing areas associated with the building of the access road and towers and do not represent a threat to the species. The environmental analysis also concluded that the proposed Deerfield Wind Project will have no affect on any Threatened, Endangered Species (TES) based on lack of suitable habitat for these species within the project area. Many of the species on the Species of Viability Concern (SVC) and Regional Foresters Sensitive Species (RFSS) lists do not likely occur within the study area. While there are a few wildlife species on these lists that likely occur within the project area, the project has been designed to avoid impacts to these species. The impact that the proposed project will have on Neo-tropical Migratory Birds is variable, depending on the species. While some species may be impacted by the project from limited loss of habitat, others may benefit from habitat creation and enhancement.

Within the project area and along the preferred access route (Putnam Road Access) eight wetlands have been identified and mapped. All but one of these wetlands has been avoided. One small seepage wetland will be impacted by the construction of the Putnam Road access site. Nine streams were mapped within this area and four stream crossings have been proposed to allow access to the wind turbines. Impact from these crossings will be minimized by following the guidelines put forth by the Vermont Fish and Wildlife Department for protecting aquatic organisms at stream crossings.

In addition to these assessments, this report also includes a description of the project area's existing vegetation, natural communities, soils and geology. The resources described in the report are shown on the four attached maps.

1.0 Introduction

The proposed Deerfield Wind Project is located near the site of the existing Searsburg Wind Power Facility in the towns of Searsburg and Readsboro, Vermont. The existing Searsburg Wind Power Facility was placed in service by Green Mountain Power Corp. (GMP) in 1997 on 35 acres of private land adjoining the Green Mountain National Forest (GMNF). This project included the construction of 11 turbines which produce a total of 6 megawatts of energy. The Deerfield Wind Project would involve the construction of 22 -24 turbines producing up to a total of 45 MW of power. In addition to the wind turbines themselves, this Project would involve the construction of 4 miles of additional access roads and transmission lines, a substation and maintenance building. The proposed Project would occur on GMNF land and consists of an Eastern Project Area and a Western Project Area (see attached maps).

The Eastern Project Area would continue along the same ridge as the existing Searsburg Wind Power facility. Access would be obtained from the existing facility. This Project Area includes the construction of 10-15 wind turbines and approximately 1.5 miles of access roads.

The Western Project Area is proposed along a ridgeline directly west of the existing facility across Vermont Route 8 (Maps 1 and 2). This area would consist of 10-15 wind turbines. The length of access road needed for the Western Project Area is dependent upon the access route used. Five different access routes have been assessed and are described in the following report. The main body of the report discusses the Putnam road access route because this route has been determined to have the least environmental impact. All of the alternate access routes, however, are described and compared in Section 8.

The following report describes the existing natural resource conditions of the Project Area in terms of vegetation, soils, geology, surface waters, wetlands, and wildlife habitat. The affect that the proposed development would have on each of these resources is also discussed.

2.0 Existing Vegetation

The Project site is located in the Southern Green Mountains biophysical region of the state (Thompson and Sorenson, 2000). The following section details the forest age class, forest composition, and forest structure of the existing vegetation at the proposed Deerfield Wind Project site. The Eastern and Western Project Areas are discussed separately below. Existing wetland vegetation within the Project Area is discussed in Section 4.0 Wetlands.

2.1 Eastern Project Area

The forests within the Eastern Project Area are typical for higher elevations areas in the Green Mountains. These communities are fairly common along the spine of the Green Mountains and the examples within the Eastern Project Area are typical examples of these montane communities. The Eastern Project Area encompasses two forest types, the Northern Hardwood forests and the Montane Yellow Birch-Red Spruce Forest. The Northern Hardwood forest

comprises approximately 30% of the Eastern Project Area while the Montane Yellow Birch-Red Spruce Forest comprises approximately 70%.

Northern Hardwood Forest

Table 1 shows the structure and abundance of different plant species in the northern hardwood forest of the Eastern Project Area. The hardwood dominated forests are characterized by a canopy mainly of beech (*Fagus grandifolia*) with lesser amounts of yellow birch (*Betula alleghaniensis*), balsam fir (*Abies balsamea*) and red maple (*Acer rubrum*). Though total canopy cover is approximately 80%, the trees tend to be stunted compared to similar forests at lower elevations. Average diameter at breast height (DBH) of the canopy trees is 17.5cm-22.5cm with occasional trees reaching 33cm diameter. A tall shrub layer consisting mainly of beech, red maple and balsam fir comprises approximately 15% cover. There is a fairly dense short shrub layer of hobble bush (*Viburnum alnifolium*) and beech. The herbaceous layer is relatively sparse and consists of intermediate fern (*Dryopteris intermedia*), shining clubmoss (*Lycopodium lucidulum*) and wood sorrel (*Oxalis acetosella*). Tip-up mounds are common forming a varied micro-topography. Coarse and fine woody debris is frequent occupying 1-2% of the forest floor. Surficial rocks occur occasionally while bedrock outcrops are uncommon.

Table 1. Forest Composition of the Northern Hardwood Forest in the Eastern Project Area

Strata	Height	% cover of Stratum	Tree Species	% Cover by Species
Tree Canopy	7-8 m	80%	<i>Fagus grandifolia</i>	60%
			<i>Betula alleghaniensis</i>	10%
			<i>Acer rubrum</i>	25%
			<i>Abies balsamea</i>	5%
Tall Shrub	1-3m	15%	<i>Fagus grandifolia</i>	10%
			<i>Acer rubrum</i>	3%
			<i>Abies balsamea</i>	3%
Short Shrub	<1m	55%	<i>Viburnum alnifolium</i>	40%
			<i>Fagus grandifolia</i>	20%
Herbaceous	<1m	20%	<i>Dryopteris intermedia</i>	10%
			<i>Lycopodium lucidulum</i>	5%
			<i>Oxalis acetosella</i>	3%

While the natural community designation is used throughout the state, many foresters also use Forest Survey Types. This classification is used by the USFS in categorizing the different vegetation types relating to forestry concerns. The Northern Hardwood forests described above correspond to the USFS forest type 81: Sugar maple-beech-yellow birch type. These stands have been mapped by the USFS as being pole timber stands, over 70% stocked with average DBH of 20-25 cm.

Montane Yellow Birch-Red Spruce Forest

A forest dominated by a mixture of conifers and hardwoods is also found in the Eastern Project Area. This forest is best classified as a Montane Yellow Birch-Red Spruce Forest. This forest is generally located on the slightly steeper knolls and ridges where soils are slightly more shallow and poor. These two forests form a mosaic along the mountain ridge in the Eastern Project Area. Table 2 shows the structure and abundance of different plant species in this montane forest in the Eastern Project Area.

Table 2. Forest Composition of the Montane Yellow Birch-Red Spruce Forest in the Eastern Project Area

Strata	Height	% cover of Stratum	Tree Species	% Cover by Species
Tree Canopy	12 m	80%	<i>Abies balsamea</i>	50%
			<i>Betula alleghaniensis</i>	10%
			<i>Acer rubrum</i>	20%
			<i>Picea rubens</i>	15%
Tall Shrub	2-3m	10%	<i>Acer rubrum</i>	2%
			<i>Abies balsamea</i>	8%
Short Shrub	1-2m	50%	<i>Viburnum alnifolium</i>	40%
			<i>Abies balsamea</i>	10%
			<i>Betula alleghaniensis</i>	5%
Herbaceous	<1m	35%	<i>Dryopteris campyloptera</i>	20%
			<i>Dryopteris intermedia</i>	10%
			<i>Mitchella repens</i>	5%
			<i>Dennstaedtia punctilobula</i>	10%

The canopy of this forest is dominated by balsam fir. Lesser amounts of yellow birch, red maple and red spruce are also found in the canopy. The average DBH of the canopy trees is 20-25 cm with occasional trees reaching 32-35 cm. Though average height is 12m, occasional shorter sub-canopy trees are common throughout this forest. A sparse tall shrub layer of red maple and balsam fir is present in the under-story. A fairly dense short shrub layer dominated by hobble bush is also present. The herbaceous layer is dominated by two species of wood fern, mountain wood fern (*Dryopteris campyloptera*) and intermediate wood fern (*D. intermedia*). Hay-scented fern (*Dennstaedtia punctilobula*) and partridge-berry (*Mitchella repens*) are also locally abundant. Coarse and fine woody debris is frequent occupying 3-8% of the forest floor. Surficial rocks occur occasionally while bedrock outcrops are infrequent.

This forest type corresponds to the USFS forest types 87 and 13. Type 87 is a sugar maple-beech-yellow birch-red spruce forest with a 25-65% softwood component. Type 13 is a red spruce-balsam fir forest. The stands of type 87 within the Project Area are variably stocked pole timber stands with average DBH of 17.5 - 22.5 cm. The conifer stands (type 13) consist of: 1) a saw timber stand 16-39% stocked with average DBH of 22.5 cm, and 2) a pole timber stand similarly stocked with average DBH of 20 cm.

2.2 Western Project Area

The existing vegetation in the Western Project Area is dominated by hardwood forests similar to that in the Eastern Project Area. This area lacks the montane forest present in the Eastern Project Area. The structure and abundance of the vegetation in the hardwood forest is presented in Table 3.

Table 3. Forest Composition of the Northern Hardwood Forest in the Western Project Area

Strata	Height	% cover of Stratum	Tree Species	% Cover by Species
Tree Canopy	12 m	85%	<i>Fagus grandifolia</i>	60%
			<i>Betula alleghaniensis</i>	10%
			<i>Acer saccharum</i>	20%
Tree Sub-Canopy	5-8 m	35%	<i>Fagus grandifolia</i>	30%
			<i>Acer saccharum</i>	5%
Short Shrub	<2 m	40%	<i>Viburnum alnifolium</i>	30%
			<i>Fagus grandifolia</i>	30%
Herbaceous	<1m	35%	<i>Dryopteris intermedia</i>	10%
			<i>Lycopodium lucidulum</i>	5%
			<i>Aster divaricatus</i>	3%
			<i>Carex intumescens</i>	1%
			<i>Epifagus virginiana</i>	2%

The tree canopy in this forest is dominated by beech with lesser amounts of sugar maple and yellow birch also present. The DBH of the canopy trees ranges from 22.5 - 30cm. A moderate sub-canopy layer is present consisting mainly of beech and sugar maple. The DBH of the sub-canopy trees ranges from 3.5 - 7.5 cm. There is a fairly dense short shrub layer of hobble bush and young beech. The herbaceous layer is a little more diverse than on the Eastern Project Area. The most common species is intermediate wood fern. This is replaced by mountain wood fern at the highest locations in this forest. Other species include whorled wood aster (*Aster divaricatus*), shining club moss, and beech drops (*Epifagus virginiana*). This forest is

fairly uniform throughout the Project Area in terms of floristic composition, abundance and structure.

This forest type corresponds to the USFS forest type 81: Sugar maple-beech-yellow birch type and one stand of beech (type 86). These stands have been mapped by the USFS as being well stocked poletimber stands or variably stocked sawtimber stands. Average DBH of 27.5-35cm.

Around proposed turbine locations 6W and 7W of Hill Engineers preliminary road designs dated 1/16/06, an early successional variant of this forest exists (labeled "clearcut area" on Map 2). This 25-acre area was clearcut in the late 1980s. The area is currently dominated by dense beech regeneration, and openings of brambles (*Rubus spp.*) and meadowsweet (*Spiraea alba*).

2.3 Rare and Sensitive Plant Species

An inventory for rare, threatened and endangered species was undertaken for the ridgeline of the Eastern and Western Project Areas. A complete species list was compiled during this inventory and is presented in the appendix of this report. No state or federally listed plant species were discovered during this inventory. In addition, no species occurring on the GMNF Regional Forester's Sensitive Plants or Species of Viability Concern list were discovered during this inventory. An inventory of the Putnam Road access route has not yet been conducted and will be completed before any proposed work commences.

2.4 Non-Native Invasive Species (NNIS)

In the fall of 2005, an inventory of Non-Native Invasive Plant Species (NNIS) was undertaken along the road and cleared areas of the existing Searsburg Wind Farm. The purpose of this inventory was to document the presence and extent of invasive plant species along the existing wind development.

Two NNIS species were discovered during this inventory: reed canary grass (*Phalaris arundinacea*) and giant reed grass (*Phragmites australis*). Five small colonies of reed canary grass and two small colonies of giant reed grass were documented. The location of these populations is shown on Map #4. Field forms describing each of these sites as well as the general site and setting will be sent under separate cover.

In all cases, the extent of invasion by these species was small relative to the amount of habitat present. However, invasive species are listed as invasive in part because of their ability to rapidly spread. While both of the giant reed grass populations were removed during the inventory, time constraints prevented the removal of the reed canary grass populations. Control of these populations should be undertaken soon in order to prevent large colonies developing on the site. In addition, the conditions that would be present in the areas of the proposed development would likely favor the establishment of some NNIS. Careful, periodic monitoring following construction of the project should be undertaken to prevent the establishment of these species.

3.0 Wildlife Habitat

The preceding section on vegetation outlines the major habitat types present within the Project Area. These include Northern Hardwood Forest and Montane Spruce-Fir Forest. A wide variety of wetland habitat types are also present and are outlined in Section 4.0. These different wildlife habitats are discussed below along with assessments of the Project Area for a wide variety of wildlife species.

Some of the location information presented for the species below was obtained from the Vermont Nongame and Natural Heritage (NNHP) program and is not for public dissemination.

3.1 Management Indicator Species

The Management Indicator Species are a suite of species developed by the USFS that represent a wide range of habitat requirements. This list was developed to help forest managers assess the impact of forest plans and individual projects on overall wildlife habitat diversity in the GMNF. Table 4 shows this list of Management Indicator Species.

Table 4. Management Indicator Species and their Preferred Habitats

Animal Species	Preferred Habitat
American bittern (<i>Botaurus lentiginosus</i>)	Marshes
American woodcock (<i>Scolopax minor</i>)	Upland openings and shrublands
Barred owl (<i>Strix varia</i>)	Mature hardwoods
Beaver (<i>Castor canadensis</i>)	Wetlands surrounded by aspen and birch
Blackpoll warbler (<i>Dendroica striata</i>)	High elevation, mature softwoods
Brook trout (<i>Salvelinus fontinalis</i>)	Cold streams
Chestnut-sided warbler (<i>Dendroica pensylvanica</i>)	Young hardwoods
Gray squirrel (<i>Sciurus canolinensis</i>)	Mature oak forests
Peregrine falcon (<i>Falco peregrinus</i>)	Cliffs
Ruffed grouse (<i>Bonasa umbellus</i>)	Young aspen and birch
Snowshoe hare (<i>Lepus americanus</i>)	Young softwood
Tree swallow (<i>Tachycineta bicolor</i>)	Pond and stream wetlands
White-tailed deer (<i>Odocoileus virginianus</i>)	Low elevation, mature softwood
Yellow-bellied sapsucker (<i>Sphyrapicus varius</i>)	Mature aspen and birch

Because these species represent certain habitat types, it is important to assess the impact of the proposed Project on the habitat type and not just on the species. This coarse filter approach differs from the fine filter approach presented in Sections 3.2 - 3.6 where the impact on individual species is considered. In the narrative below, each of these species/habitat types in

described. The likely impact that the proposed wind development would have on each of these habitat types is also discussed.

American Bittern / Marshes

This habitat type is open wetlands dominated by herbaceous vegetation. This can include cattail marshes, sedge meadows, wet old fields or mixed shallow emergent marshes. These plant communities are common throughout Vermont and the Northeast, typically occurring in lower elevation valleys and along river courses.

Occurrence within the Project: There are no marshes within the Project Area.

American woodcock / Upland openings and shrublands

Though they can nest in forests, the American woodcock requires openings for breeding. These openings can include old fields or open grassy or shrubby habitats. Woodcock are present throughout Vermont and the northeast.

Occurrence within the Project: Possible. The most likely habitat for this species is the shrubby clearcut areas shown on Map 2. The only upland opening present in this area is the clearing associated with the meteorological tower in the Western Project Area.

Likely Impact: The shrubby nature of the clearcut will see some localized impact from clearing and road building associated with the wind turbine development. As this clearcut succeeds to a more mature forest, however, this shrubby habitat will disappear. Permanent impact to this species is unlikely given that the habitat currently present is ephemeral.

Barred Owl / Mature hardwood forests

The barred owl inhabits mature hardwood forests throughout Vermont and the northeast. It is a fairly common owl largely because suitable habitat is widespread throughout the region.

Occurrence within the Project: Mature hardwood forests are present in both the Eastern and Western Project Areas. (See Section 2.0)

Likely Impact: The removal of mature hardwood trees for the construction of the road and the turbine clearance areas will result in the localized loss of this type of habitat. Impact will, however, be local and will not affect the overall abundance of this habitat type on the GMNF or in the region.

Beaver / Wetlands surrounded by aspen and birch

Beaver are renowned for creating open wetland habitats along running surface waters. These habitats are often fairly diverse and contain a mixture of open water wetland, deep or shallow emergent marshes and shrub swamps. Their complexity makes them valuable for a wide variety of different wildlife species.

Occurrence within the Project: This habitat type does not occur in the Project Area.

Blackpoll warbler / Mature high elevation softwood forests

The blackpoll warbler is a common member of higher elevation conifer dominated forests in the northeast. These montane communities occur throughout Vermont, mainly along the spine of the Green Mountains. They are also common throughout the Northeast along higher mountain ridges and peaks.

Occurrence within the Project: Conifer dominated montane forests occur in the Eastern Project Area.

Likely Impact: The removal of conifer trees for the construction of the road and the turbine clearance areas will result in the localized loss of this type of habitat. Impact will, however, be local and will not affect the overall abundance of this habitat type on the GMNF or in the region.

Brook trout / Cold streams

Brook trout is a native fish that occurs in cold, clean streams with at least some rock substrate. They are a particularly good indicator species because they are susceptible to water pollution, siltation and temperature fluctuations and generally only found in healthy stream ecosystems.

Occurrence within the Project: There are no cold stream habitats suitable for this species within the Project Area. There are, however, numerous high elevation wetlands and headwaters which may affect the quality of streams at lower elevations.

Likely Impact: The Project has been designed to avoid impacts to streams and wetlands as much as possible. Where these resources need to be crossed, appropriate erosion prevention and sediment control measures will be applied to prevent adverse impacts to these resources.

Chestnut-sided warbler / Young hardwoods

This species is typical of young hardwood stands where dense saplings are regenerating. These early successional habitats are usually the result of logging practices or natural disturbances. This species is also assessed later in this report in Section 3.5 Neo-tropical Migratory Birds.

Occurrence within the Project: This habitat type occurs within the Project Area in the Western Project Area. This 25 acre area was clearcut in the late 1980s and is regenerating with a dense growth of young hardwood. This area is shown on the attached Wildlife Map.

Likely Impact: The removal of young hardwood trees for the construction of the road and the turbine clearance areas will result in the localized loss of this type of habitat. This will only occur in the clearcut area shown on the attached Wildlife Map. Impact will, however, be local and will not affect the overall abundance of this habitat type on the GMNF or in the region.

Gray squirrel / Mature oak Forests

The gray squirrel is here used as an indicator of mature oak forests. This habitat type is less common in Vermont than other hardwood types. The oak forest communities reach their dominance further south. In Vermont they are relegated to the valleys of Lake Champlain and the Connecticut River.

Occurrence within the Project: This habitat type does not occur in the Project Area.

Peregrine Falcon / Cliffs

The peregrine falcon requires open cliff faces for nesting. These small habitats are found scattered throughout Vermont and the Northeast, but are only locally abundant.

Occurrence within the Project: This habitat type does not occur within the Project Area.

Ruffed Grouse / Young aspen and birch

Though found in a wide variety of forests, the ruffed grouse thrives in young aspen and birch forests. These early successional forests usually result from logging or natural disturbance. This habitat type is common throughout Vermont and the Northeast.

Occurrence within the Project: This habitat type does not occur within the Project Area.

Snowshoe hare / Young softwood

Young spruce and fir forests often harbor healthy populations of snowshoe hare. This habitat type is fairly common throughout Vermont and the Northeast. These early successional forests arise due to logging activity or natural disturbance.

Occurrence within the Project: There are no early successional softwood forests within the Project Area.

Tree Swallow / Pond and stream wetlands

Wetlands associated with open water are the preferred habitat for this species. These habitats typically arise from beaver activity. These habitats are a common feature of the landscape in Vermont and throughout the Northeast.

Occurrence within the Project: This habitat type does not occur within the Project Area.

White-tailed Deer / Low elevation mature softwood forests

Though white-tailed deer use a wide variety of habitats, they often over-winter in deer yards composed of dense, mature softwood forests. This habitat type is common throughout Vermont and the Northeast.

Occurrence within the Project: One example of this habitat type occurs along the Putnam Road access route and one example occurs along the Southern access route. The site along the Putnam Road route is a dense stand of mature conifers approximately 2 acres in size. The Southern access site consists of a conifer hardwood mix forest approximately 51 acres in size. Both of these sites, as well as the rest of the study area were inventoried for the use by white-tailed deer as deer yards. Neither of these received substantial use by deer during the winter.

Likely Impact: The impact to this habitat type depends upon which access site is used. The Putnam Road access route uses the existing gravel road which runs adjacent to the conifer forest. Impact would likely be limited to the cutting of a few trees to widen the existing road. The Southern access route would require cutting through the mixed conifer forest. Impact to this habitat would consist of clearing trees for the access road. In both cases, the likely impact would be limited and local in scope. Neither alternative would result in a significant loss of this habitat type in the GMNF or the region. Also, neither alternative would result in the loss of over-wintering habitat for white-tailed deer.

Yellow-bellied Sapsucker / Mature aspen and birch forests

Yellow-bellied Sapsuckers nest in mature deciduous forest with abundant aspen and birch. Mature aspen and birch forests are fairly common in Vermont and throughout the northeast.

Occurrence within the Project: This habitat type does not occur within the Project Area.

Table 5 lists Management Indicator Species and habitat types along with summary information on the affect that the proposed development will likely have on each species and habitat type.

Table 5. Summary of Impact of the Proposed Development on the Management Indicator Species

Animal Species	Preferred Habitat	Habitat in Project Area	Likely Impact
American bittern	Marshes	No	NA
American woodcock	Upland openings and shrublands	Yes	None
Barred owl	Mature hardwoods	Yes	Limited Negative Impact
Beaver	Wetlands surrounded by aspen and birch	No	NA
Blackpoll warbler	High elevation, mature softwoods	Yes	Limited Negative Impact
Brook trout	Cold streams	No	NA
Chestnut-sided warbler	Young hardwoods	Yes	Limited Negative Impact
Gray squirrel	Mature oak forests	No	NA
Peregrine falcon	Cliffs	No	NA
Ruffed grouse	Young aspen and birch	No	NA
Snowshoe hare	Young softwood	No	NA
Tree swallow	Pond and stream wetlands	No	NA
White-tailed deer	Low elevation, mature softwood	Yes	Limited Negative Impact
Yellow-bellied sapsucker	Mature aspen and birch	No	NA

3.2 Threatened and Endangered Species

Table 6 shows a list of all Federal-listed Threatened or Endangered Species that are tracked by the Green Mountain National Forest (GMNF). There are no known historic or current records of any of these species within the Project Area. During the field work conducted for this inventory, no evidence of these species was reported. In order to determine the likelihood of presence for each of these species, the habitat requirements for each of these species is compared to the existing habitat within the Project Area. A discussion including distribution, range and habitat requirements is presented below.

Table 6. Threatened or Endangered Species (TES) tracked by GMNF

Name	Latin Name	Rank
Gray Wolf	<i>Canis lupus</i>	Threatened
Eastern Cougar	<i>Puma concolor cougar</i>	Endangered
Canada lynx	<i>Lynx canadensis</i>	Threatened
Indiana bat	<i>Myotis sodalis</i>	Endangered
Bald eagle	<i>Haliaeetus leucocephalus</i>	Threatened

Gray Wolf (*Canis lupus*)

While once abundant throughout North America, the gray wolf is currently extirpated from the Northeast. The nearest known occurrence of the gray wolf is in Canada. This species requires

an adequate prey base of large ungulates (deer, moose) as well as various smaller mammals such as beaver. They also require large tracts of road-less areas with low human density and limited human activity.

Occurrence within the Project: Unlikely. Given its current range and habitat requirements, this species is not likely to occur in the Project Area.

Eastern Cougar (*Puma concolor cougar*)

Like the gray wolf, the cougar was once widely distributed throughout North America but is now thought to be extirpated from the Northeast. There have been isolated sightings of cougars in northern Vermont as well as unconfirmed sightings near Middlebury, VT. At this time, however, it is believed that there are no breeding cougars in the state. This species requires an adequate prey base of deer, fox, beaver and various small mammals. It also requires fairly large tracts of wild land with little human presence.

Occurrence within the Project: Unlikely. Given its current range and status in the Northeast, this species is not likely to occur within the Project Area.

Canada Lynx (*Lynx canadensis*)

The lynx has also been extirpated from the southern part of its range- which includes most of New England. Sign of this elusive cat have been found in the very northern part of Vermont. Lynx are typically found in early successional forests with dense understories of conifers or deciduous trees. Their habitat requirements are closely linked with their staple prey, the snowshoe hare.

Occurrence within the Project: Unlikely. Given the current distribution of the lynx, it is unlikely that this species occurs in the Project Area.

Indiana Bat (*Myotis sodalis*)

Unlike the above listed species, the Indiana bat has not been extirpated from southern Vermont. This species requires limestone caves or mines for hibernacula. Most of the significant hibernacula in the region have been located for this species. During the summer, the Indiana bats form maternity colonies which require trees with exfoliating bark for roosting sites. In this region, these trees usually consist of shagbark hickory (*Carya ovata*) or American elm (*Ulmus americana*). A wide variety of large dying tree species may also be used if they have suitable exfoliating bark. These maternity colonies usually forage in floodplain forests, pastures, open wetlands and other upland hardwood forests. The ideal habitat for this species in the summer consists of a diverse landscape with 20%-60% forested cover and the remaining area open as wetlands, agricultural fields, or early successional habitats. Most of the Indiana bats in the state are found at the lower elevations. Most maternity colonies have been found at lower elevations because higher elevations tend to be wetter, cooler and have more temperature variation that is unsuitable for the Indiana bat. The closest known maternity colonies are in Manchester, Vermont.

A remote inventory of the Project Area and 3-mile radius was undertaken [Bat Habitat Assessment and Mapping Report, Arrowwood Environmental, May 2005] to determine the possible presence of suitable habitat in the area. There are no suitable hibernacula within the Project Area or the immediate vicinity. While there may be individual roost trees that may be suitable for this species, it is unlikely that maternity colonies exist within the Project Area. The lowest elevation present within the Project Area is approximately 2200 ft., with most of the impact occurring above 2800 ft. In addition, the habitat diversity within the Project Area and the surrounding vicinity is 90%-100% forested.

Occurrence within the Project: Unlikely. As mentioned above, the Indiana bat prefers a more varied landscape that includes a mixture of open and forested habitats. It also prefers lower elevations. It is therefore unlikely that this species occurs within the Project Area.

Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles are found throughout North America and are locally abundant in New England where suitable habitat is available. There are known nesting sites along the Connecticut River. Elsewhere in Vermont, Bald eagles This species is known nest along the Connecticut River between Vermont and New Hampshire although transient individuals may be found elsewhere in the state. One such individual has been sited in Whitingham Pond (Sadawga Pond) in Whitingham, VT approximately 6 miles from the Project Area. This species prefers to nest along large bodies of water such as coastal areas, large lakes, reservoirs and rivers. They feed largely on fish but are also known to consume small mammals, other birds and turtles. They require large trees in areas with little human disturbance for roosting and nesting.

Occurrence within the Project: Unlikely. None of the habitat requirements for this species are present within the project area.

3.3 Regional Forester's Sensitive Species

Table 7 shows the Regional Forester's Sensitive Species for the GMNF. There are no known historic or current records of any of these species within the Project Area. In order to determine the likelihood of presence for each of these species, the habitat requirements for each are compared to the existing habitat within the Project Area. A discussion including distribution, range and habitat requirements is presented below.

Table 7. Regional Forester's Sensitive Species in the GMNF

Name	Latin Name	Vermont State Rank ¹
Eastern small-footed bat	<i>Myotis leibii</i>	Threatened (S1)
Bicknell's thrush	<i>Catharus bicknellii</i>	Special Concern (S3)
Peregrine falcon	<i>Falco peregrinus anatum</i>	Rare (S2)
Common loon	<i>Gavia immer</i>	Rare (S2)
Wood Turtle	<i>Clemmys insculpta</i>	Special Concern (S3)
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	Special Concern (S2)
Boulder beach tiger beetle	<i>Cicindela ancocisconensis</i>	Very Rare (S1)
Southern pygmy clubtail	<i>Lanthus vernalis</i>	Not Ranked ²
Forcipate emerald	<i>Somatochlora forcipata</i>	Not Ranked ²
Harpoon clubtail	<i>Gomphus desertus</i>	Not Ranked ²
Brook floater	<i>Alasmidonta varicosa</i>	Threatened
Creek heelsplitter	<i>Lasmigona compressa</i>	Rare (S2)

¹The State Ranks are informational categories regarding the rarity of the species on a state level. S1 (Very Rare) indicates that there are 1-5 known occurrences of the species in the state; S2 (Rare) indicates that there are 6-20 occurrences of the species known in the state; S3 (Uncommon) indicates that there are more than 20 occurrences in the state but there is some threat to the species.

² The state rankings for this group of species (the Odonates) are currently being developed.

Eastern small-footed bat (*Myotis leibii*)

The eastern small-footed bat is known to hibernate in caves in New Hampshire and Vermont. The closest known hibernaculum is in Manchester, Vermont. It prefers to hibernate in caves and abandoned mines. Its summer habitat includes roosts sites on rocky cliffs, mines and buildings. Unlike the Indiana bat, the summer habitat of this species is usually within 25 miles of the hibernacula. There are no known hibernacula within the Project Area. A remote inventory of the Project Area and surrounding vicinity indicates that there are no rock outcrops within the Project Area but a few suitable sites within a 3 mile radius were identified (see Bat Habitat Assessment and Mapping Report, Arrowwood Environmental, May 2005). Some of these potential sites were explored in the field by USFS and state of Vermont biologists and recordings of bat echolocation calls were made. Analysis of these calls revealed that two bat species were present at these sites, the Big Brown Bat (*Eptesicus fuscus*) and possibly the Red Bat (*Lasiurus borealis*) on the night that the recordings were made. Given, however, that this data is from only one field visit, a definitive determination of the small footed bats absence cannot be made. More extensive field work is required to determine presence or absence with certainty. A report on this field work by Joe Torres of the USFS [12/21/05] suggests that if this species is found within the Project Area, it is not present in very high numbers and it is not

likely to be affected by the Project. This is due to the lack of suitable habitat within the Project Area and the results of the field survey.

Occurrence within the Project: Unlikely within Project Area. Suitable habitat is not present within the Project Area. A preliminary inventory of suitable habitat within a 3-mile radius of the Project Area revealed no bats of this species.

Bicknell's Thrush (*Catharus bicknellii*)

Bicknell's thrush is a migratory songbird that occurs in the high elevation conifer forests of New England and Canada. This species is known to nest in high elevation conifer forests where the spruce and fir trees are dense and stunted. This habitat can arise along the higher mountains where krummholz occurs or on the lower mountain peaks where disease, high winds or other disturbance has created areas of dense, short, early successional conifers.

Occurrence within the Project: Unlikely. Although the Project Area includes high elevation forests, suitable habitat in terms of stunted conifers is rare. A USFS inventory for this species was conducted in June 2005. No Bicknell's thrush were found to exist within the Project Area. Another inventory for Bicknell's thrush was undertaken by Kerlinger and Dowdell (Breeding Bird Study for the Searsburg/Readsboro Expansion Wind Project, 2003) and no individuals were discovered.

Peregrine falcon (*Falco peregrinus anatum*)

The Peregrine falcon is widely distributed throughout the region but only locally abundant where suitable habitat exists. This species requires open ledges and cliffs with views overlooking open water areas and wetlands. They have also been known to nest in tall buildings in cities. These habitats offer abundant prey of small birds which comprise their main diet. The closest historic site for this species was on the Deerfield River cliffs, about 1.5 miles east of the Project Area. These cliffs have not been used by the Peregrine falcon, however, since 1940.

Occurrence within the Project: Unlikely. There are no suitable cliff or ledge sites for this species within the Project Area.

Common loon (*Gavia immer*)

The Common loon is found throughout the region and lives on large, relatively undisturbed lakes. These bodies of water must have a minimally fluctuating hydrology (reservoirs are often unsuitable) with abundant small islands for nesting and shallow coves for rearing young. Their main diet is fish but they will also eat various crustaceans, insects and amphibians.

Occurrence within the Project: Unlikely. There are no bodies of water within the Project Area.

Wood Turtle (*Clemmys insculpta*)

The wood turtle is found throughout the region and relies on slow moving, meandering streams with sandy bottoms. The closest known population in Vermont is the town of Vernon. Overhanging vegetation along the banks of the streams is also important. This species often leaves the rivers during the summer when it prefers meadows and forested areas. It requires sandy soils in which to lay its eggs. It is an omnivore and eats everything from mushrooms to amphibians and plants to fish.

Occurrence within the Project: Unlikely. There are no slow-moving, sandy bottomed streams within the Project Area.

Jefferson salamander (*Ambystoma jeffersonianum*)

This species is found in isolated locations throughout the region. It spends most of its time under the duff layer of undisturbed hardwood forests. One of its main habitat requirements, however, is the presence of a vernal pool in which it breeds every spring. These vernal pools are usually woodland pools that hold water in the spring months and then dry up during the summer months. They can also breed on the edges of wetlands where open water is present and fish are absent. It feeds on worms, crustaceans and insects. The closest confirmed location of these species (or its related hybrids) is in Sunderland, Vermont, though they likely occur elsewhere but have not been documented.

Occurrence within the Project: Possible. The only likely place for breeding of this species is in Wetland Q, within the Western Project Area, shown on Map 1.

Likely Impact: If this species does breed in Wetland Q, it likely uses the surrounding hardwood forest as habitat. The construction of the access road at this location may, therefore, eliminate some areas currently used by this species. The construction of busy roads (especially paved roads) can often effectively separate individuals from their breeding habitat because of high mortality experienced when crossing roads. Low-traffic dirt roads, however, generally do not pose a migration barrier for this species. This wetland area will not be impacted if the Putnam Road or Southern Access Route is used as access to the Western Project Area.

Boulder tiger beetle (*Cicindela ancocisconensis*)

The boulder tiger beetle is an elusive beetle that has been found in a few scattered locations in Vermont. It occurs in the cobble and sandy substrate along small streams and moderate-sized rivers. The closest known location for this species is in Jamaica, Vermont along the West River.

Occurrence within the Project: Unlikely. There is no suitable habitat within the Project Area.

Southern pygmy clubtail (*Lanthus vernalis*)

This species of dragonfly is found in scattered locations throughout the region. Its required habitat is small, cold, rocky or gravelly streams within a forested matrix. These streams can be either small permanent streams or semi-permanent streams. Adults hunt in adjacent forested areas and clearings. This species has been documented in Bennington County.

Occurrence within the Project: Possible. The best habitat for this species is located in Streams 7 and 14 shown on Map 1. These are both perennial streams and occur near the lower part of the Putnam Road access route.

Likely Impact: The Putnam Road access route as currently designed would avoid direct impacts to the stream. This species would therefore not be impacted.

Forcinate emerald (*Somatochlora forcipata*)

This medium-sized dragonfly is rare throughout the region. It is found in peatland habitats such as bogs and fens and along the streams associated with these wetlands. Adults forage for insects in the peatlands, along stream banks, in forest openings and along roads. There are unconfirmed reports of this species in Rutland and Windham Counties.

Occurrence within the Project: Unlikely. The Project Area lacks any peatland habitat required by this species.

Harpoon clubtail (*Gomphus descriptus*)

This clubtail dragonfly is found throughout the region but appears to be rare in New England. It requires fast moving streams and rivers with rocky or sandy substrates. The adults forage in fields, forest openings and along forest edges. There have been unconfirmed reports of this species in Windham County and verified reports in Rutland County. This species is listed as Endangered in Massachusetts.

Occurrence within the Project: Possible. The best habitat for this species is located in Streams 7 and 14 on shown on Map1. These are both perennial streams and occur near the lower part of the Putnam Road access route.

Likely Impact: The Putnam Road access route as currently designed would avoid direct impacts to the stream. This species would therefore not be impacted

Brook floater (*Alasmidonta varicosa*)

This mussel is known in Vermont only from the lower reaches of the West River in Windham County (towns of Dummerston, Newfane, Townshend and Jamaica). The habitat that it prefers is rivers with a substrate of sand, gravel and cobble. It is usually found in waters less than 3 feet deep.

Occurrence within the Project: Unlikely. There is no appropriate habitat for this species within the Project Area.

Creek heelsplitter (*Lasmigona compressa*)

This species of mussel is most common in Vermont in the Champlain Basin. It prefers larger streams and rivers near their confluence with Lake Champlain or other large lakes or rivers, though it can occasionally be found in smaller streams as well. The closest known location for this species is in the headwaters of Otter Creek in Mt. Tabor, Vermont.

Occurrence within the Project: Unlikely. The Project Area contains no suitable habitat for this species and is outside of the known range of the species.

3.4 Species of Viability Concern

Table 8 lists the Species of Viability Concern for the GMNF. This list is compiled and used by the Forest Service to document and track species that may be at risk on national forest lands. There are no known historic or current records of any of these species within the Project Area. In order to determine the likelihood of presence for each of these species, the habitat requirements for each are compared to the existing habitat within the Project Area. A discussion including distribution, range and habitat requirements is presented below.

Table 8. Species of Viability Concern in the Green Mountain National Forest

Name	Latin Name	Vermont State Rank ¹
Rusty blackbird	<i>Euphagus carolinus</i>	Special Concern (S3)
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	Special Concern (S2)
Atlantic Salmon	<i>Salmo salar</i>	Secure (S4)
Blue-spotted salamander	<i>Ambystoma laterale</i>	Special Concern (S3)
Four-toed salamander	<i>Hemidactylum scutatatum</i>	Special Concern (S2)
West Virginia white	<i>Pieris virginianensis</i>	Special Concern (SU)
Ebony boghaunter	<i>Williamsonia fletcheri</i>	Not Ranked ²
Delicate emerald	<i>Somatochlora franklini</i>	Not Ranked ²
Black meadowhawk	<i>Sympetrum danae</i>	Not Ranked ²
Gray petaltail	<i>Tachopteryx thoreyi</i>	Not Ranked ²

¹The State ranks are informational categories regarding the rarity of the species on a state level. S1 (Very Rare) indicates that there are 1-5 known occurrences of the species in the state; S2 (Rare) indicates that there are 6-20 occurrences of the species known in the state; S3 (Uncommon) indicates that there are more than 20 occurrences in the state but there is some threat to the species; SU indicates that the status for the species is uncertain in the state.

² The state rankings for this group of species (the Odonates) are currently being developed.

Rusty Blackbird (*Euphagus carolinus*)

The rusty blackbird is found throughout the region but is restricted to areas with suitable habitat. It generally nests in conifer swamps, tree-bordered open wetlands, treed peatlands and in alder thickets. They generally occur in swamps between 1000ft and 4000ft in elevation. They are omnivorous, relying on insects, grains, fruit and other birds. The nearest location for this species is in Lake Hancock, in Stamford, Vermont approximately 7.5 miles from the Project Area.

Occurrence within the Project: Possible. The most likely habitat for this species is in Wetland Q, near the Old Route 9 potential alternative access route. (refer to Section 8.0)

Likely Impact: The preferred access route of Putnam Road, which is approximately ¾ mile to the east of the Old Route 9 access route, would avoid impact to this wetland. There would, therefore, be no impact to this species if this route is employed. The Old Route 9 access route would leave a 100 ft buffer between the road and Wetland Q.

Red-headed woodpecker (*Melanerpes erythrocephalus*)

The red-headed woodpecker is known in Vermont only from the Champlain Valley and the Connecticut River Valley. It breeds in deciduous forests with low stem density and abundant standing dead trees. It also forages on forest edges and savannah-like openings with scattered trees.

Occurrence within the Project: Unlikely. The Project Area is not in the current known range of this species. The Project Area contains no savannah-like habitats.

Atlantic Salmon (*Salmo salar*)

Atlantic Salmon are anadromous fish that breed in fresh water streams but spend most of their lives feeding and growing in the salt waters of the Atlantic ocean. They feed mainly on insects, mollusks, crustaceans and other fish.

Occurrence within the Project: Unlikely. There is no suitable habitat in the Project Area.

Blue-spotted salamander (*Ambystoma laterale*)

In Vermont, the blue-spotted salamander is known to occur only in the Champlain Valley. Like the Jefferson salamander, it spends most of its time in the soil and duff layer of deciduous forests. For breeding, it requires vernal pools or wetlands that have seasonally flooded areas. This can include hardwood swamps, the edges of emergent marshes or beaver floodings. It feeds on earthworms, slugs and insects.

Occurrence within the Project: Unlikely. The Project Area is outside of the known range of this species.

Four-toed salamander (*Hemidactylium scutatum*)

The range of this secretive species includes southern Vermont and all of Massachusetts, but it is rare throughout this area. The four-toed salamander can occur in hardwood forests where it hides under rotting logs, leaf litter and stones. However, it seems to prefer areas dominated by Sphagnum moss for shelter. It is most commonly found in wet forested swamps and woodlands with an abundance of Sphagnum moss. It lays its eggs in standing water or slow-moving streams that run through these moss dominated wetlands. It eats insects, spiders and earthworms. The closest known location for this species is in Woodford State Park, approximately 2 miles from the Project Area.

Occurrence within the Project: Possible. The three conifer swamps in the Eastern Project Area (Wetlands A, B and C shown on Map 3) are the most likely habitats for this species within the Project Area. However, there may be lack of suitable aquatic habitat for the larval stage of this species because the standing water present in these wetlands (and its drainages) appears to be somewhat ephemeral.

Likely Impact: The Project as proposed represents a modification which involved moving the location of a turbine (4E) in the Eastern Project Area to avoid impacts to these wetlands. No cutting, dredging or filling of these wetlands will occur. The closest activity to these wetlands occurs near Wetland A where a minimum 25ft buffer would remain between the edge of the cleared areas around the turbine and the wetland boundary. This clearing area may have a limited affect on the adult four-toed salamanders by removing the overstory vegetation in that area. This affect, however, will be temporary in that once construction activity is completed, this area will be allowed to re-vegetate.

West Virginia white (*Pieris virginiensis*)

The West Virginia White is a delicate white butterfly that ranges from the Great Lakes east to New England and south along the Appalachians to northern Georgia. In Vermont it has been documented in Chittenden, Rutland and Bennington Counties. It is found in relatively undisturbed deciduous and mixed forests. It can only be seen in the spring when it feeds on nectar from many spring wildflowers including spring beauties, toothworts, violets and trout lilies. Threats to this species include logging, development and invasive plants such as garlic mustard.

Occurrence within the Project: Unlikely. The key habitat requirement of extensive spring wildflower populations are not found in the areas of the proposed development.

Ebony boghaunter (*Williamsonia fletcheri*)

This dragonfly is found in only a few scattered locations throughout the Northeast. It breeds in wetlands dominated by Sphagnum moss, where the female oviposits her eggs in shallow water on the peat mat. They prefer wetlands that are adjacent to conifer or mixed conifer/hardwood

forests. It is known in Vermont only from Washington County. This species is endangered in Massachusetts.

Occurrence within the Project: Possible. The three conifer swamps in the Eastern Project Area (Wetlands A, B and C shown on Map 3) are the most likely habitats for this species within the Project Area. However, like the four-toed salamander, there may be lack of suitable aquatic habitat for the larval stage of this species because the standing water present in these wetlands (and drainages) appears to be somewhat ephemeral. In addition, these wetlands are likely too small and offer no significant open water habitat that this species prefers.

Likely Impact: The Project as proposed represents a modification which involved moving the location of a turbine (4E) to avoid impacts to these wetlands. No cutting, dredging or filling of these wetlands will occur. The closest activity to these wetlands occurs near Wetland A where a minimum 25ft buffer would remain between the edge of the cleared areas around the turbine and the wetland boundary. If this species occurs within these wetlands, impact from the proposed development is unlikely.

Delicate emerald (*Somatochlora franklinii*)

This dragonfly is known in Vermont only from the Northeast Kingdom in Caledonia and Essex Counties. The habitat for this species consists of shallow, spring-fed water in sedge and sedge/moss fens. The preferred habitat is small, shallow puddles within these wetlands.

Occurrence within the Project: Unlikely. The Project Area is outside of the known range of this species. The required habitat for this species is not found within the Project Area.

Black meadowhawk (*Sympetrum danae*)

In Vermont, this species is known from Washington, Essex and Grand Isle Counties. It lives in a wide variety of fens, bogs and marshes. It has been found in a wide range of boreal habitats and large grassy meadows with shallow pools.

Occurrence within the Project: Unlikely. The Project Area is outside of the known range of this species. The required habitat for this species is not found within the Project Area.

Gray petaltail (*Tachopteryx thoreyi*)

The gray petaltail dragonfly is a more southern Vermont species with only unconfirmed reports from Massachusetts and Windham County, Vermont. It prefers woodland seep habitats where ground water surfaces and forms the headwaters of small streams. In the south, it can also occur along sandy rivers and in fens.

Occurrence within the Project: Possible. There are a number of seepage wetlands that occur within the Project Area that may support this species. These include: Wetlands X, Y and Z along the Route 9 access route; Wetland U along the Bishop Road access route; Wetlands J and R along the Southern access Route; and Wetlands D and E in the Western Project Area.

Wetland F along the Putnam Road access route is a Seepage type wetland but does not form the headwaters of a stream and is likely too small to support the Gray petaltail.

Likely Impact: The Route 9 access route would involve the partial filling of Wetlands X, Y and Z. This would likely result in a negative impact to this species if the species occurs in these wetlands. The Bishop Road access route would involve the partial filling of Wetland U, also negatively impacting this species. The preferred route, however, is the Putnam Road access which would not pose any threat to this species. Wetlands D and E occur within the Western Project Area. These wetlands are approximately 500 feet from the proposed tower locations. This area will remain forested. No impact to this species is expected at these locations.

3.5 Neo-tropical Migratory Bird (NTMB) Habitat

Neo-tropical migratory birds include a wide range of bird species that breed in North America and migrate to the tropics over the winter months. Many of these species have experienced a sharp decline in population over the past century. These population declines are most likely attributed to a loss of habitat. This loss of habitat may be a result of tropical deforestation. In some cases, however, the cause is linked to changing habitat in the breeding grounds of North America. An increase in forest fragmentation has created many smaller islands of forest and significantly increased edge habitat. Increased open country and edge habitat has resulted in a loss of habitat, an increase in nest predation, and an increase in nest parasitism by the cow-bird.

The U.S. Fish and Wildlife Service has conducted Breeding Bird Surveys on much of the national forest lands. These surveys have identified a number of at-risk species. Some species identified are experiencing population declines in Northern New England and many of these species occur on the GMNF land. These species are listed below. Brief habitat descriptions and ecological notes are included along with likely occurrence and impact for each species. The potential impact of the proposed Project are discussed if the species likely occurs in the project area. The discussion of these impacts is limited to loss of habitat from the development. Potential affects resulting from bird collisions with the turbines is discussed elsewhere [Phase I Avian Risk Assessment for the Deerfield Wind Project (Curry and Kerlinger, 2006)].

For a complete list of breeding bird species present in the Project Area, refer to the Breeding Bird Survey for the Searsburg/Readsboro Expansion Wind Project (Kerlinger and Dowdell, 2003). An "*" is included in the Occurrence field for each species described below that was documented in the Project Area by Kerlinger and Dowdell.

Golden-winged warbler (*Vermivora chrysoptera*)

This species of warbler breeds in early successional habitats such as old shrubby fields and recently abandoned agricultural fields. Its decline is believed to be attributed to the loss of these early successional habitats and their conversion to more forested habitats. It is listed as "Threatened and Declining" on the Partners in Flight watch list.

Occurrence within the Project: Unlikely. There is no suitable habitat within the Project Area.

Yellow-billed cuckoo (*Coccyzus americanus*)

This species is an infrequent breeder in southern Vermont. It relies on open woodland type habitats such as shrubby fencerows, shrubby old fields, and riparian thickets. Shrubby, dense undergrowth appears to be essential habitat for breeding.

Occurrence within the Project: Unlikely. There is no suitable habitat within the Project Area.

Olive-sided flycatcher (*Contopus borealis*)

This species is found in limited numbers throughout Vermont in areas dominated by coniferous forest. The Olive-sided flycatcher relies on conifer swamps, bogs, high elevation wetlands, and montane conifer forests for breeding. They prefer montane forests with abundant standing dead trees and openings within these forests. This species is listed as "Threatened and Declining" on the Partners in Flight watch list.

Occurrence within the Project: Possible. This species may occur in the Montane Yellow Birch-Red Spruce Forest in the Eastern Project Area.

Likely Impact: The addition of wind turbines within the conifer forest in the Eastern Project Area may increase habitat for this species by creating openings in the forest.

Tree swallow (*Tachycineta bicolor*)

This familiar species is most often found in habitats near open water. These habitats include open agricultural land, wet meadows, open wetlands, and fields. They require cavities in trees for nesting and often place their nests on the shores of lakes, ponds or streams.

Occurrence within the Project: Unlikely. There is no suitable habitat within the Project Area.

Barn swallow (*Hirundo rustica*)

This species of swallow is a well-known member of the farm and field habitat common in Vermont. It feeds on insects in these open habitats and often nests in man-made structures.

Occurrence within the Project: Unlikely. There is no suitable habitat within the Project Area.

Canada warbler (*Wilsonia canadensis*)

This Canada warbler is fairly common along the spine of the Green Mountains of Vermont. It is found in a wide variety of deciduous and coniferous forest habitats including subalpine forests, talus slopes, clear cuts, forested swamps, shrub swamps, forested ravines and riparian thickets. This species is listed as "Threatened and Declining" on the Partners in Flight watch list.

Occurrence within the Project: * Documented occurrence in Western Project Area.

Likely Impact: Expansion of the wind turbines may eliminate some areas currently used by this species.

Wood thrush (*Hylocichla mustelina*)

This large thrush is found throughout Vermont. It prefers mature deciduous forest for nesting, especially moist bottomland sites. It is less common in conifer and mixed conifer-deciduous forests and is uncommon in higher elevation forests in the state. This species is listed as "Threatened and Declining" on the Partners in Flight watch list.

Occurrence within the Project: Unlikely. Most of the forest within the Project Area is higher elevation forest. This species is generally found in lower elevation sites.

Nashville warbler (*Vermivora ruficapilla*)

Although widespread throughout Vermont, the Nashville warbler is relatively uncommon. It breeds in a wide variety of habitats including young deciduous forests, conifer swamps, bogs, high elevation forests, riparian woodlands and thickets. It is rarely found in large forested blocks. Rather, it prefers a mixture of open and forested habitats and the edge associated with such a mixture.

Occurrence within the Project: Possible.

Likely Impact: Expansion of the wind turbines within the conifer forest (primarily in the Eastern Project Area) may increase habitat for this species by creating a mixture of forested and open habitats within the high elevation forest.

Chestnut sided-warbler (*Dendroica pensylvanica*)

Though rare in the early 1800s the Chestnut sided-warbler is today an abundant and conspicuous part of the Vermont avian community. It is found in early successional forests, shrubby old fields and edges of forests and clearings. It is generally absent from larger tracts of undisturbed forest.

Occurrence within the Project: * Documented occurrence in the Western Project Area. May also occur along the lower elevations of the Putnam Road access route.

Likely Impact: Given that this species generally prefers edge habitats to unbroken forests, expansion of the wind turbines will likely increase the habitat for this species.

Black-throated blue warbler (*Dendroica caerulescens*)

The Black-throated blue warbler is a species that is found throughout Vermont where suitable habitat is available. It generally breeds in the understory of upland deciduous woods. It prefers areas with at least a scattered canopy cover and a dense undergrowth of shrubs such as hobblebush, mountain maple, striped maple or deciduous tree saplings. It is abundant in many types of forests (including higher elevations forests) with dense shrub undergrowth.

Occurrence within the Project: * Documented occurrence in the Western and Eastern Project Areas.

Likely Impact: Expansion of the wind turbines may eliminate some areas currently used by this species. This loss of habitat will be confined to the areas that are cleared for the access road and turbines. This limited habitat loss will not likely affect the survival of the species.

American redstart (*Setophaga ruticilla*)

This species of warbler is very common throughout Vermont. It occurs in a wide variety of habitats including deciduous forests, open farm fields, hedgerows, shrub thickets, clearcuts and mixed forests. It most commonly breeds, however, in deciduous woods with a dense shrubby undergrowth.

Occurrence within the Project: * Documented occurrence in the Western Project Area.

Likely Impact: Expansion of the wind turbines may eliminate some areas currently used by this species.

Common yellowthroat (*Geothlypis trichas*)

The common yellowthroat is one of the most common and abundant warblers in Vermont. It occurs in shrubby and open habitats such as marshes, swales, wet meadows, thickets, clearcuts, beaver wetlands, and old fields. It occurs in both high and lower elevation sites, though may be more common at lower elevations.

Occurrence within the Project: * Documented occurrence in the Western Project Area.

Likely Impact: Expansion of the wind turbines may eliminate some areas currently used by this species.

Scarlet tanager (*Piranga olivacea*)

The scarlet tanager is found throughout Vermont, though may be less common in the Champlain Valley. This species relies on un-fragmented forests for breeding and foraging. They will generally not nest in forest stands that are less than 25 acres. They prefer mature forests comprised of oak and beech.

Occurrence within the Project: * Documented occurrence in the Eastern Project Area.

Likely Impact: Expansion of the wind turbines may eliminate some areas currently used by this species. The forest fragmentation that occurs as a result of this Project, however, will not produce patches of forest less than 25 acres. The overall forest habitat at the sites, therefore, will not likely be degraded.

Rose-breasted Grosbeak (*Pheucticus ludovicianus*)

The Rose-breasted grosbeak is one of the most common and widespread birds in the state. It is found in a wide variety of habitats including clear cuts, overgrown agricultural fields and shrub dominated wetlands. The preferred habitat is deciduous forests with a healthy undergrowth of shrubs. They are generally not found above 2,500 feet in elevation.

Occurrence within the Project: * Documented occurrence in the Western Project Area.

Likely Impact: Expansion of the wind turbines may eliminate some areas currently used by this species.

Vesper sparrow (*Pooecetes gramineus*)

The Vesper sparrow is only locally common in Vermont. Most populations are located in the heavily agricultural areas of the state. This distribution is related to the habitat requirement of this species: old pastures, gravel pits, and open agricultural fields.

Occurrence within the Project: Unlikely. No suitable habitat exists within the Project Area.

Bobolink (*Dolichonyx oryzivorus*)

The bobolink is found throughout Vermont, but is generally absent from heavily forested regions. This species nests in dense grassy fields, usually hay fields. They can occasionally be found in overgrown pastures but do not nest in fields that are shrubby. They are not generally found above 2,500 feet in elevation.

Occurrence within the Project: Unlikely. No suitable habitat exists within the Project Area.

Red-winged blackbird (*Agelaius phoeniceus*)

The red-winged blackbird is an abundant and conspicuous member of Vermont's avian community. It usually nests in open wetlands that contain a dense graminoid layer. Scattered shrubs and trees are often used as perches. They also occasionally nest in upland habitats that have the same dense grassy vegetation.

Occurrence within the Project: Unlikely. No suitable habitat exists within the Project Area.

As can be seen from Table 9, habitat for some species of declining NTMB is expected to increase while habitat for others is expected to decrease. These increases and decreases will likely be minor in scope because they are restricted to the clearing of the forest for roads and turbines and the new habitat that is thereby created. The total area that will be cleared for this purpose is less than 80 acres.

Table 9. Summary of Likely Affects of Proposed Wind Development on Declining NTMB Habitat

Bird Species	Occurrence ¹	Abundance in Vermont ²	Change in Habitat
Olive-sided flycatcher (<i>Contopus borealis</i>)	Possible	Locally common	Increase
Canada warbler (<i>Wilsonia canadensis</i>)	Documented	Fairly common	Decrease
Nashville warbler (<i>Vermivora ruficapilla</i>)	Possible	Common	Increase
Chestnut sided-warbler (<i>Dendroica pensylvanica</i>)	Documented	Abundant	Increase
Black-throated blue warbler (<i>Dendroica caerulescens</i>)	Documented	Fairly Common	Decrease
American redstart (<i>Setophaga ruticilla</i>)	Documented	Common	Decrease
Common yellowthroat (<i>Geothlypis trichas</i>)	Documented	Common	Decrease
Scarlet tanager (<i>Piranga olivacea</i>)	Documented	Common	Decrease
Rose-breasted Grosbeak (<i>Pheucticus ludovicianus</i>)	Documented	Fairly Common	Decrease

¹ Species occurrence documented by Kerlinger and Dowdell (2003) Breeding Bird Survey for the Searsburg/Readsboro Expansion Wind Project.

² Abundance designations from New England Wildlife (DeGraaf and Yamasaki, 2001)

As can be seen from the above data, the habitat for this suite of species is extremely variable and ranges from open farmland to continuous mature forests. The overall affect of the proposed development must, therefore be considered on a species-by-species basis as presented above. The existing vegetation described in Section 1.0, describes a forest that is mature, saw-log sized timber with varying amounts of structure (sub-canopy, tall and short shrub layers, etc.) This forest age-class will be changed where clearing will take place for the road and turbine locations. As mentioned above, some of the major threats to NTMB are loss of habitat and increase in forest fragmentation resulting in an increase in nest predation and parasitism.

Loss of habitat is mentioned in the species descriptions above as a likely impact from this development for some species of NTMB. This affect, however is likely to be a localized, small scale impact. This is because no large, clearings are proposed for this Project. The permanent clearings that would occur are the result of the road and turbine clearings. These clearings comprise an area less than 80 acres. Most of the forested habitat within would therefore remain intact having a very minor change on the overall forest age class of the area. The proposed Project is located within an area designated as a 3.1 type Management Area by the

U.S. Forest Service. This indicates that this is an area that “emphasizes a mosaic of vegetative conditions in a roaded, intensively managed, but naturally appearing environment.”

Forest fragmentation has often been cited as a cause of NTMB population decline. This fragmentation has resulted in 1) and increase in nest predation; and 2) and increase in nest parasitism from the cowbird. An increase in open land, agricultural fields, suburban development, and forest patches has favored a wide range of bird and mammal species that thrive in a fragmented landscape. Some of these species are known predators of nests. These include blue-jays, American crows, common grackles, gray squirrels, raccoons, skunks, rats, and domestic and feral cats and dogs. The position and extent of the clearing proposed for this development is not likely to increase the habitat for any of these species. These species are generally known to thrive in lower elevations and are associated with larger clearings and human activity.

Nest parasitism from the cow-bird is also a major concern for NTMB populations. The cow-bird is known to lay its eggs in other bird's nests, often eating or ejecting one of the host eggs in the process. Cow-bird nestlings often hatch before the host species' eggs hatch and offspring are often larger, grow faster and are more demanding feeders. This can put a strain on the host species and often results in lower successful reproduction. Cow-birds parasitize a wide range of species including flycatchers, warblers, finches, vireos and sparrows. Historically, the cow-bird is a species of the Great Plains. As human development and agriculture expanded, so did the range of the cowbird. The species has expanded to include almost all of North America. They thrive in open grasslands, active agricultural fields, and forest edges near these openings. They can also occasionally be found in open woodlands and in areas where scattered trees or shrubs are interspersed with open grassy areas. However, their most preferred habitat is around active dairy farms where they are associated with manure left from dairy cows. Increased parasitism from cow-birds has been noted along forest edge habitat when those forest edge habitats are located within ½ mile of active dairy farms.

Given the preferred habitat for the cow-bird, it is unlikely that the proposed development would result in habitat creation actually occupied by this species. As mentioned above, the cow-bird prefers open woodlands, open fields and fields with scattered trees or shrubs. The clearings created for this development would consist of gravel roads and gravel-based clearings for the wind turbines. Extensive grassy areas or areas with scattered trees and shrubs would not arise as a result of this development. There are not active dairy farms located in close juxtaposition to the proposed Project. In addition, previous studies of the existing Searsburg Wind Tower facilities have indicated that cow-birds were not found at the site after construction. This was an indication that fragmentation under these circumstances was minimal (Kerlinger, 2002). Cow-bird parasitism on NTMB would therefore not likely increase as a result of the proposed wind turbine development.

3.6 Miscellaneous Wildlife Species and Habitats

Moose (*Alces alces*)

Moose are present throughout Vermont and the Northeast. They occur in a wide variety of forest types, though balsam fir, aspen and birch appear to be preferred. During the summer they are often found near water foraging on the roots and tubers of aquatic plants. Fall and winter forages consist of young balsam fir, and young shrubs and hardwood saplings. They often use regenerating clearcuts, logged areas and sites of natural disturbance. These areas usually harbor dense shrubs and sapling re-growth. Unlike deer, they are mostly solitary during the winter, though hemlock and other conifer cover types may be important as winter habitat.

Occurrence within the Project: Present. The moose habitat within the Eastern Project Area is located in the vicinity of proposed Turbine #1E. The mature spruce-fir forest with the greatest sign of use (i.e. moose scat and browse) is located approximately 285-300 feet to the southeast of the proposed turbine site. The limits of clearing would extend from the turbine foundation out approximately 210 feet. A treed buffer of approximately 75-100 feet would remain in place. There could be a very slight displacement of over-wintering moose due to the presence of the wind turbines and maintenance personnel.

Moose also utilized the food present in the clearcut along the western ridge (Clearcut area on Map 2). This stand is the site of a hardwood forest clearcut which was conducted in the late 1980s. It currently consists of dense hardwood (mainly beech) regeneration.

The moose utilization observed within this stand is primarily summer and fall use. Given that only a small area of this stand will be impacted by the proposed wind development, this use will most likely continue after construction of the Project.

Moose sign was observed within the red-spruce-eastern hemlock natural community located near the Western Project Area. This area is shown on Map 3. Moose may use this community for shelter during certain winter months. This site was assessed for moose use in January 2006 and was not occupied by moose or white-tailed deer. No winter scats of either of these species were evident. In addition, only small areas of woody (likely winter) browse were found within the conifer stand. Overall, this conifer patch has limited value as over-wintering habitat for moose. This area would only be impacted if the Southern access route is developed. One of the advantages of employing the Putnam Road access route instead of the Southern route is that impact to this conifer stand would be avoided.

There also appears to be important moose habitat in the area around the Western Project outside of the study area. At lower elevations on both the western and eastern sides of the ridge, there are many beaver influenced wetlands that likely serve as important moose habitat. These are shown on Map 2. These areas have not been assessed in the field.

Likely Impact: In general, the affects of the proposed development on moose habitat will likely be localized and minor. As mentioned above, there may be a slight displacement of

over-wintering moose in the Eastern Project Area. In other areas, a small increase in woody moose browse should result from the turbine clearings. Moose will also benefit from the low traffic volume on plowed gravel roads during winter. Moose will likely utilize these snow-free corridors for movements on the landscape. The wetlands around the Western Project Area will not likely be impacted from the proposed development because they are 1500 feet from any proposed disturbance.

White-tailed Deer (*Odocoileus virginianus*)

White-tailed deer are common throughout the Northeast in forests, forest edges, open fields, swamps and woodland openings. In the winter, they congregate ("yard") in forests with dense conifer cover. The severity of winter temperatures and snow depth can often determine survivability into spring. These dense stands of conifers, or deer yards, are therefore key to the over-wintering success of deer in Vermont and other northern habitats.

Occurrence within the Project: Present. Deer sign has been documented in scattered locations throughout the Project Area. Deer are feeding on the wide variety of vegetation present as outlined in Section 2.0. There are, however, no state mapped deer yards in the Project Area. A field inventory focused on locating possible deer yards was undertaken in 2004. This study included a 300 foot radius of the turbine locations and supporting roads. No deer yards were recorded during this inventory.

Likely Impact: Expansion of the wind turbines may eliminate some areas currently used by this species. This is a result of the clearing of forested land for the placement of the access road and the wind turbines. However, as mentioned above, the most critical habitat for this species is the conifer stands used for yarding. No deer yards exist within the Project Area. Overall impact on this species from the proposed development will therefore be minimal.

Pine Marten (*Martes americana*)

This medium sized member of the weasel family is known mainly from extreme northern New England. It is listed as Endangered in Vermont. Pine martens generally rely on large, usually mature, forested tracts for hunting and breeding. They are known from a wide variety of forest types including: spruce and fir forests, hemlock forests, cedar swamps, and mixed conifer-hardwood forests. They feed on a wide variety of small mammals including moles, shrews, voles, mice, red squirrels, chipmunks and snowshoe hare. They have also been known to take ruffed grouse and other birds when they can catch them.

Occurrence within the Project: Unlikely. The Project Area is outside of the known range of this species

Fisher (*Martes pennati*)

This large weasel is found throughout Vermont in conifer and mixed conifer-hardwood forests. They prefer continuous, dense canopy cover to more open stands or clearings. They den in

hollow tree cavities, old porcupine dens, woodchuck burrows or areas under large boulders. They consume a wide variety of animals including snowshoe hare, mice, voles, squirrels, moles, porcupine, raccoons, carrion, and shrews.

Occurrence within the Project: Likely. It is likely that the Project Area is included in part of the home range of an individual of this species.

Likely Impact: Expansion of the wind turbines may eliminate some areas currently used by this species. This is a result of the clearing of forested land for the placement of the access road and the wind turbines.

3.7 Special Wildlife Habitats

In addition to species specific habitat elements, there are a number of generalized wildlife habitat elements that occur throughout the Project Area. These include standing dead trees (snags), old apple trees, permanent (maintained) wildlife openings, den trees, clearcut areas, downed logs and wetlands. Vernal pools, which are especially important for some species of wildlife, do not occur within the Project Area but may occur at the lower elevations outside of the Project Area.

As much as possible, these special wildlife features have been mapped. The accompanying maps (Maps 1-3) show the locations of clearcuts, wildlife openings, wetlands and streams. Other habitat elements such as snags, isolated apple trees, den trees, and downed logs occur throughout the Project Area. Due to the scattered distribution and abundance of these features, these locations were not mapped. The proposed development will likely result in the elimination of some of these habitat features. These features are widely scattered on the landscape and also occur throughout the forested area unaffected by the proposed development. It is unlikely, therefore, that the proposed development would have a significant detrimental impact on the abundance of the wildlife habitat features.

The permanent wildlife openings maintained by the USFS act to break up the closed canopy of the surrounding forest and allow undergrowth to thrive. Brambles and dense shrub and herbaceous undergrowth provide habitat for a wide variety of species (see Sections 3.1 - 3.6). In addition, all of the wildlife openings that are shown on the attached maps contain at least one old apple tree. Clearing around these trees (or "releasing") allows the apple trees to grow more vigorously and produce more abundant crops of wild apples. These apples are used by a wide variety of wildlife including deer, moose and black bear. Because they usually produce a better crop of apples, these trees are more valuable for wildlife than the isolated apple trees growing under the shade of the forest canopy. Care has been taken in the design of the turbine locations and access road to avoid impact to these wildlife habitat areas.

While eight wetlands have been identified and mapped in the Project Area, there are much larger wetland complexes just outside of the Project Area. These occur below the ridgeline of the Western Project Area. As shown on the attached maps (Maps 1-3), a series of large beaver-influenced wetlands flank both the east and west side of the ridge. The largest of these wetland complexes occurs in the small valley west of the ridge. This series of wetlands runs north to

Route 9 and beyond. These wetlands are undoubtedly used by a wide variety of wildlife including black bear, moose, deer, mink, otter, beaver, various reptiles and amphibians, song birds, waterfowl, birds of prey and small mammals. While much of this wildlife diversity is confined to the wetlands or their immediate vicinity, some wider-ranging species also utilize habitat within the Project Area. Moose, deer and bear, for example, likely use the wetland habitat in conjunction with the higher elevation habitat found within the Project Area. Care has been taken in the design of the turbine locations and access road to avoid impact to the wetlands located within the Project Area.

One fairly recent clearcut area occurs within the Project Area. This site is in the Western Project Areas around proposed Turbine 5W and 6W. This 25-acre stand was cut in the late 1980s and is currently a dense thicket of regenerating hardwood (mostly beech) and brambles. This area is relatively significant for wildlife because it creates variation on the landscape and harbors different habitat types than the surrounding forests.

There is also more recent clearcuts on private land to the north of the Project Area across Route 9. In addition to some selective cutting, a series of 1 acre clear-cuts were done recently. Approximately 50 of these patch cuts were done, mostly at higher elevations (2600-2700 feet). As these clearcuts regenerate, they will likely create habitat for species such as moose, deer and a wide variety of small mammals and birds.

4.0 Wetlands

Eight wetlands occur within the Project Area of the proposed Deerfield Wind Project. This includes wetlands near the turbine sites and along the Putnam Road access route. All of these wetlands are presented in Table 10 and shown on the attached Maps 1-3. Wetlands present within the Project Areas and along the Putnam Road access route are described in detail in this section along with likely impacts of the Project on the wetland resource. Other wetlands (along the alternate access routes) are discussed in Section 8.

Table 10. Summary of Wetlands at the Proposed Deerfield Wind Project

Wetland	Type	Class	Location	Impact
A	Spruce-Fir-Tamarack Swamp	III	Eastern Project	Impact Avoided
B	Spruce-Fir-Tamarack Swamp	III	Eastern Project	Impact Avoided
C	Spruce-Fir-Tamarack Swamp	III	Eastern Project	Impact Avoided
D	Seepage	III	Eastern Project	Impact Avoided
E	Seepage	III	Eastern Project	Impact Avoided
F	Seepage	III	Putnam Road Access	Filled; 402 sq. ft.

G	Red Maple-Black Ash Swamp	III	Putnam Road Access	Impact Avoided
H	Seepage	III	Putnam Road Access	Impact Avoided

4.1 Spruce-Fir-Tamarack Swamp

There are three very similar examples of this type in the Eastern Project Area. These wetlands are shown on Map 3 (Wetlands A, B and C). They are all relatively small wetlands and show characteristics of the Seep community. They sit in small topographic bowls that collect water from the surrounding uplands. The hydrology is largely driven by ground water seepage, though all three wetlands also have small surface water inputs. All three wetlands drain into small streams to the northeast or southwest. Hummocks and hollows from peat moss form a varied micro-topography. Standing water in the hollows is common. The vegetation structure and composition is presented in Table 11.

With the exception of the herbaceous layer, overall species composition of these small wetlands is similar to that of the surrounding upland forests. Both canopy cover and short shrub abundance is lower in the swamps. The herbaceous layer is dominated by hydrophytic plants such a gynandrous sedge (*Carex gynandra*), goldthread (*Coptis trifolia*), and three-seeded sedge (*Carex trisperma*).

Table 11. Vegetation Composition of the Spruce-Fir-Tamarack Swamps in the Eastern Project Area

Strata	Height	% cover of Stratum	Tree Species	% Cover by Species
Tree Canopy	5-7 m	40%	<i>Abies balsamea</i>	30%
			<i>Betula alleghaniensis</i>	10%
Short Shrub	1-2m	10%	<i>Viburnum alnifolium</i>	8%
			<i>Abies balsamea</i>	2%
Herbaceous	<1m	10%	<i>Carex gynandra</i>	5%
			<i>Coptis trifolia</i>	5%
			<i>Carex trisperma</i>	5%
Moss	<1m	80%	<i>Sphagnum spp.</i>	80%

Impacts: As can be seen from Table 9, impact to these wetlands has been avoided by careful turbine placement. The location of Turbine 4E has been moved in order to avoid direct impacts to Wetlands A and B. Clearing of vegetation for the turbines will need to occur within approximately 25 feet of Wetland A. No dredging, filling or excavation work would be conducted within these wetlands. Heavy equipment would be excluded from entering these areas by the placement of wetland flagging prominently along the border of the wetlands.

4.2 Seepage Wetlands

There are three seepage wetlands located within the Project Area. These are shown on the Maps 1 and 3 (Wetlands D, E and F). These seeps are non-treed wetlands that are the sites of ground water discharge. These areas often form the headwaters of small streams and, statewide, can range in size from small 8ftX10ft areas to seepages nearly an acre in size. Wetlands D and E are found on the eastern slope of the Eastern Project Area and form the headwaters of a small brook which drains northeast. Standing water collects seasonally in these small wetlands. Wetland F is a small (approximately 400 sq ft.) seepage wetland located near Route 8. During wet periods, a small flow out of this wetland enters the ditch along Route 8. This flow does not form a distinct channel. Table 12 shows the general structure and composition of these seeps.

Table 12. Vegetation Composition of the Seepage wetlands in the Eastern Project Area

Strata	Height	% cover of Stratum	Tree Species	% Cover by Species
Herbaceous	<1m	50%	<i>Carex intumescens</i>	10%
			<i>Glyceria melicaria</i>	30%
			<i>Carex cf. scabrata</i>	5%
Moss	<1m	25%	<i>Sphagnum spp.</i>	25%

Impacts: As can be seen from Table 10, Wetland F would be impacted as part of the construction of the Putnam Road access route to the Western Project Area. The placement of the road cannot be moved to avoid this wetland due to the clearances and turning radii required for the construction vehicles.

5.0 Surface waters

No part of the proposed Project occurs on the shorelines of ponds, lakes or reservoirs. The proposed Project (including the Putnam Road access route) does make 4 stream crossings. Table 13 lists each stream with a brief description and the potential impact from the proposed development. The stream number presented in the table refers to the stream number shown on the Maps 1-3.

Table 13. Summary Information for Streams Along the Proposed Deerfield Wind Project

Stream	Location	Description	Impact
1	Eastern Project Area; Drains Wetland A	Intermittent stream, 1-2' wide, soil/pebble/rock substrate, diffuse in places	One road crossing
2	Eastern Project Area; Drains Wetland B	Ephemeral stream, 1-2' wide, muck substrate, diffuse in places	One road crossing
3	Eastern Project	Intermittent stream, 1' wide, rock substrate	One road crossing
4	Eastern Project Area; Drains Wetland C	Intermittent stream, 1.5-4' wide, sand, gravel and silt substrate, diffuse in places	One road crossing
5	Eastern Project Area	Intermittent stream, underground in places, 1-2' wide, silt and gravel substrate	Avoided
6	Eastern Project Area	Intermittent stream, 1-2' wide, gravel substrate, somewhat diffuse	Avoided
7	Putnam Road Access; Drains Wetland H	Perennial stream, 3-4' wide, rock and sand substrate	Avoided
8	Eastern Project Area; Feeds Wetland B	Ephemeral stream, 1-2' wide, silt and gravel substrate	Avoided
9	Eastern Project Area; Feeds Wetland B	Ephemeral stream, 1-2' wide, silt and gravel substrate	Avoided
14	Putnam Road Access	Perennial stream, 2-4' wide, gravel and rock substrate	Avoided
15	Putnam Road Access	Ephemeral, diffuse, organic substrate (detritus)	Avoided

Impacts: As can be seen from Table 13, the proposed access roads involve a total of four stream crossings. Each stream crossing will be carefully designed so that natural stream flow is maintained and erosion from the new road is prevented. A detailed Erosion Prevention and Sediment Control Plan will be developed which will outline the specific steps that will be taken in order to ensure that the integrity of the streams within the Project Area are maintained.

6.0 Soil Resources

The Natural Resource Conservation Service has mapped a total of eight soil types in the Project Area. These types are Mundal, Wilmington, Houghtonville, Rawsonville, Glebe, Stratton, Londonderry and Hogback. Most of these soils are mapped in associations. Information on each of these soil type associations is presented in Table 14.

Table 14. Soil type associations found in the Eastern and Western Project Areas of the Deerfield Wind Project

Soil Type	Texture	Prime Ag.	Erodibility	Slopes	Hydric
Mundal- Wilmington Association	Fine sandy loam	N	Potentially highly erodible	8-15%	Y
Houghtonville- Rawsonville Association	Fine sandy loam	N	Highly erodible	15-25%	N
Rawsonville-Hogback Association	Fine sandy loam	N	Highly erodible	25-60%	N
Glebe- Stratton Association	Fine sandy loam and Clay and silt loams	N	Highly erodible	25-50%	N
Glebe- Stratton- Londonderry Association	Fine sandy loam and Clay and silt loams	N	Highly erodible	15-60%	N
Houghtonville- Monadnock Association	Fine sandy loam	N	Highly erodible	15-25%	N

As seen from Table 14 all of the soils in the Project Area are highly erodible or potentially highly erodible. This is due to the texture of the soils and the steep slopes that exist on the site. Soil probes were inspected during the 2005 field work. These probes indicate that there is also some inclusion of silt loam soils throughout the Project Area.

7.0 Geology

7.1 Surficial Geology

Both the Eastern and Western Project Areas of the Deerfield Wind Project are composed of unsorted glacial till.

7.2 Bedrock Geology

The Western Project Area is dominated by the Mount Holly complex. This complex consists of a profound unconformity dominated by quartzite, quartz-mica-schist and gneiss. A small area of the Putnam Road access site goes through an area of this Mount Holly complex that is dominated by calcite and dolomite marbles.

The Eastern Project Area consists of two different bedrock formations. The northern part of the ridge consists of the Readsboro member of the Cavendish formation and is composed of quartz-muscovite schists. The southern part of the ridge consists of the Hoosac formation which is composed of quartz-sericite-albite-biotite-chlorite schists. This formation can be locally carbonaceous. A section of the proposed development will also pass through a thin sliver of the Hoosac formation which is composed of amphibolite and actinolitic greenstone.

8.0 Analysis of Access Routes to the Western Project Area

A series of alternate access routes for the Western Project ridgeline were explored during the 2005 field season. Each route was assessed for its feasibility in terms of clearances, turning radii, steepness of slope, and environmental impact. Each of the alternate routes is shown on Map 1 and discussed separately below:

8.1 Bishop Road Access

The Bishop Road access begins from a northwest point of the Western Project Area off Route 9 at Old Route 9. and runs parallel to the private road, Bishop Road, before it joins up with an old skidder trail to access the northern end of the western turbines. This route is approximately 5400 feet long, the entire length of which would be new road construction.

The existing vegetation along the Bishop Road access site is a fairly uniform Northern Hardwood Forest as described in Section 2.2 above. Wildlife habitat present along this route is typical for this vegetation type as described in Section 3.0.

The streams and wetlands associated with the Bishop Road alternate access route are shown in Table 15.

Table 15. Wetland and Stream Occurrences along the Bishop Road Access Route

	Type	Impact
Wetlands		
T	Conifer swamp	Wetland buffer zone impact from road
U	Seepage	Wetland partially filled for road
V	Shrub Swamp	Avoided
Streams		
20	Perennial stream, 1-3' wide, cobble and rock substrate	Avoided; road within 10' of stream

Table 15 shows that the Bishop Road access route would involve partially filling a seepage wetland (Wetland U) and impacting the buffer zone of a Conifer Swamp (Wetland T). It may be possible to avoid direct impacts to Stream 20 and Wetland V.

The rationale for not pursuing this access route is based on the negative impact of 5400 feet of new road construction. The environmental impacts of such a road are unnecessary given the presence of an existing gravel road along the Putnam Road access route.

8.2 Old Route 9 Access

The Old Route 9 access runs south from the Old Route 9 loop to a skidder trail where it goes east to the Western Project Area. This route is approximately 5000 feet long, the entire length of which would be new road construction. The existing vegetation along the Old Route 9 access is a fairly uniform Northern Hardwood Forest as described in Section 2.2 above. Wildlife habitat present along this route is typical for this vegetation type as described in Section 3.0. The streams and wetlands associated with this access are shown in Table 16.

Table 16. Wetland and Stream Occurrences along the Old Route 9 Access route

	Type	Impact
Wetlands		
Q	Beaver wetland complex	Avoided
Streams		
13	Perennial stream, 2-4' wide, rock substrate	Avoided; road within 10' of stream
20	Perennial stream, 1-3' wide, cobble and rock substrate	One road crossing
21	Perennial stream, 1-3' wide, cobble and rock substrate	One road crossing

As seen from Table 16 this access route would involve two stream crossings. Direct impact to the large beaver wetland nearby could be avoided. The rationale for not pursuing this access route is based on the negative impact of 5000 feet of new road construction. The environmental impacts of such a road are unnecessary given the presence of an existing gravel road along the Putnam Road access route.

8.3 Route 9 Access

The Route 9 access route heads south off of Route 9 and then would veer east to avoid wetland and stream impacts. The total length of this route is approximately 5200 feet, the entire length of which is new road construction.

The existing vegetation along the Route 9 access is a fairly uniform Northern Hardwood Forest as described in Section 2.2 above. Much of the route, however appears to be occupied by scattered seepages and ephemeral stream flowages. The soils along the southern part of this route are mapped as hydric. Field visits suggest that these hydric soils may occur along the northern part of this route as well. Shallow soils with perched water tables appear to be common along this route.

Wildlife habitat present along this route is typical for Northern hardwood forests and seepage wetlands as described in Section 3.0. The streams and wetlands associated with the Route 9 access route are shown in Table 17.

Table 17. Wetland and Stream Occurrences along the Route 9 Access Route

	Type	Impact
Wetlands		
P	Old field	Wetland entirely filled for road
X	Seepage	Wetland partially filled for road
Y	Seepage	Wetland partially filled for road
Z	Seepage	Wetland partially filled for road
Streams		
12	Perennial stream, 2-4' wide, rock substrate	One road crossing
16	Ephemeral stream, 1' wide, in old skidder trail	One road crossing
17	Ephemeral stream, 1' wide, in old skidder trail	One road crossing
18	Ephemeral stream, 1' wide, silt and cobble substrate, underground in places	One road crossing
19	Intermittent stream, 1' wide, cobble and rock substrate	One road crossing

Table 17 shows this access route would involve five stream crossings. In addition, Wetland P would need to be entirely filled and three other wetlands partially filled for the access road. The abundance of wetlands and streams along this route would create difficult road building conditions and substantial environmental impacts if the access road were to be built here.

8.4 Southern Access

The Southern Access route starts off of Route 8 across from the Crosier Cemetery and loops northeast to the southern-most turbine location. The total length of this route is approximately 3340 feet. A portion of this route is currently an unimproved two-track road. The existing vegetation along the Southern Access consists of Northern Hardwood Forest and a Red Spruce-Northern Hardwood Forest. Wildlife habitat present along this route is typical for Northern hardwood forests and mixed conifer/hardwood forests as described in Section 3.0. The streams and wetlands associated with the Southern access are shown in Table 18.

Table 18. Wetland and Stream Occurrences along the Southern Access Route

	Type	Impact
Wetlands		
J	Seepage	Avoided
R	Seepage	Avoided
S	Old field wetland	Wetland partially filled for road
Streams		
10	Ephemeral stream, .5-1' wide, silt and cobble substrate	One road crossing
11	Intermediate stream, .5-1' wide, rock and cobble substrate	Avoided

Table 18 shows this access route would involve one stream crossing and the partial filling of Wetland S for the road. The rationale for not pursuing this access route is based on the negative impact of 3300 feet of new road construction. The environmental impacts of such a road are unnecessary given the presence of an existing gravel road along the Putnam Road access route.

8.5 Putnam Road Access

The Putnam Road access route begins at the junction of Putnam Road and Route 8. It heads west along Town Road #2, also known as Putnam Road and continues along the USFS right of way. The total length of this route is approximately 3900 feet. Most of this length occurs along an existing gravel road. This road was built to support logging trucks before it was seeded back to herbaceous vegetation.

The environmental impacts of this access route are presented in the main part of this report along with the impacts to the development. Because of the short length of this route, the existing gravel road along most of the route and the lack of wetland and stream crossings, the Putnam Road access route is the preferred route access to the Western Project Area.