

WILDLIFE HABITAT EVALUATION

Hudson Logistics Center Steele Road Hudson, New Hampshire



PREPARED FOR:

Hillwood Enterprises, L.P.
5050 W. Tilghman Street | Suite 435
Allentown, PA 18104

PREPARED BY:

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500A Washington Street
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DATE: November 9, 2020



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500A Washington Street, Quincy, MA 02169

November 9, 2020

Hillwood Enterprises, L.P.
Attn: John Grace, Vice President, Development, and
Brian Kutz, Vice President of Development
5050 W. Tilghman Street | Suite 435
Allentown, PA 18104

Re: Wildlife Habitat Evaluation
Proposed Hudson Logistics Center
Steele Road
Hudson, NH 03051

Dear Mr. Grace and Mr. Kutz:

Lucas Environmental, LLC (LE) is pleased to submit this Wildlife Habitat Evaluation (the “WHE”) for the proposed Hudson Logistics Center, located at the current Green Meadow Golf Club on Steele Road in Hudson, New Hampshire. Enclosed please find the WHE, which includes a Wildlife Habitat Evaluation Narrative, Expected Wildlife Species Matrix, Photographic Documentation, and our Qualifications.

LE performed an evaluation of the wildlife habitat and vegetative communities for the entire Property for purposes of assessing the degree of potential impact and overall effect the proposed development Project may have on wildlife and related habitat, and demonstrating compliance with the wildlife-related criteria described under the Town of Hudson Wetlands Conservation Overlay District Ordinance (Article IX of Section 334 of the Code of the Town of Hudson, NH, or the “Wetlands Ordinance”). The WHE includes an assessment of the on-site resource areas consisting of wetlands and watercourses under the jurisdiction of the Wetlands Ordinance, as well as the uplands and the two 18-hole golf courses which are not within the jurisdiction of the Wetlands Ordinance. Information collected in the field includes plant species composition, abundance and distribution; soil data; animal species observations and associated habitat; documentation of feeding and nesting areas (if any), as well as a systematic investigation of important habitat features such as burrows, food sources, and breeding areas. The WHE includes an assessment of habitat on-site that may consist of important food, shelter, migratory and overwintering areas, and breeding areas for many birds, mammals, amphibians and reptiles.

LE has reviewed existing available information for the Property including Natural Resources Inventory, NH Wildlife Habitat Land Cover Maps, NH Highest Ranked Wildlife Habitat by Ecological Conditions Maps, and NH Natural Heritage Bureau Database for rare species, which have been included in reports prepared by others. Representative photographs of important habitat characteristics are included in the report. Note, the WHE is not a comprehensive wildlife species inventory, though observations of wildlife have been noted, as well as potential species that may be present based upon existing habitat.



500A Washington Street, Quincy, MA 02169

If you have any questions, please do not hesitate to contact me at 978.500.4295 or cry@lucasenvironmental.net. Thank you for your consideration in this matter.

Sincerely,
LUCAS ENVIRONMENTAL, LLC

A handwritten signature in black ink that reads 'Curtis R. Young'.

Curtis R. Young, PWS, CWS
Senior Consultant



SECTION I – NARRATIVE



WILDLIFE HABITAT EVALUATION

1.0 INTRODUCTION

This Wildlife Habitat Evaluation (the “WHE”) has been prepared for purposes of assessing and demonstrating compliance with the wildlife-related criteria described under the Town of Hudson Wetlands Conservation Overlay District Ordinance (Article IX of Section 334 of the Code of the Town of Hudson, NH, or the “Wetlands Ordinance”), in connection with the proposed Hudson Logistics Center, to be located at the current Green Meadow Golf Club on Steele Road in Hudson, New Hampshire (See Figure 1 – USGS Map and Figure 2 – Aerial Map).

The Project

We understand the Hudson Logistics Center is proposed to be located on portions of real property consisting of approximately 400-acres which is further identified as Town Tax Map 234, Lots 5, 34 and 35, and Town Tax Map 239, Lot 1 (the “Property”), as depicted on the Site Plan. We have been further informed that Hillwood Enterprises, LP (or Hillwood) is proposing to consolidate Tax Map 234, Lot 5, Tax Map 239, Lot 1, and a portion of Tax Map 234, Lot 34 into a single, consolidated lot on which a proposed condominium will be created to include three new units (individually and respectively to be known as Units “A”, “B” and “C”, as depicted on the Site Plan). The Hudson Logistics Center (or Project) will consist of three new distribution and logistics buildings, one to be sited on each of the proposed units, which will together constitute 2,603,400 sf of new building footprint. Primary access to the Hudson Logistics Center will be a new private driveway known as Green Meadow Drive extending approximately 2,670 feet from Lowell Road and terminating at a cul-de-sac which will provide access to the three units. Secondary access to the Property will be provided via a private access way on the northern portion of the Property which will connect with an access easement located on the abutting Sam’s Club parcel (the “Secondary Access”). The Project contemplates access and development impacts to the Wetlands Conservation Overlay District (the “District”) which are permitted Conditional Uses, as further described in Section 6.0 below.

For the purposes of this WHE and ease of habitat feature identification, LE has assigned each vegetative cover type containing potential wildlife habitat with a unique number that is used throughout this document. Table 1 summarizes the vegetative cover types identified, and includes a general description of the dominant plant species, and how each would be categorized by the New Hampshire Natural Heritage Bureau Natural Communities, Second Edition (2012). Figure 3 provides a Vegetative Cover Type map of the entire Study Area indicating the location of each habitat/cover type.

Each habitat type is described in further detail in Section 4 of this report. The descriptions include dominant vegetation observed and important habitat features observed in the habitat. Section 5 includes an overview of existing habitat and potential impacts to wildlife use and function, with a particular emphasis on areas subject to jurisdiction under the Wetlands Ordinance which are included within the boundaries of the District. Section 6 describes the applicable review criteria under the Wetlands Ordinance, and an analysis of potential impacts to habitat functions. defined under Section 334-35 of the Wetlands Ordinance to include: (1) Surface waters, excluding those wetlands which have developed as a result of the construction of stormwater treatment and/or detention facilities, agricultural use, waste treatment, or other water-dependent structures or uses, and manmade facilities; (2) Wetlands of any size; and, (3) a fifty-foot-wide buffer around wetlands and surface waters.

WILDLIFE HABITAT EVALUATION

In addition to the description of wildlife habitat features of the area, LE has developed a wildlife species matrix that describes species that may be anticipated to be found within the Study Area (See Appendix A). The matrix is based upon the publication entitled “General Technical Report NE-108, New England Wildlife: Habitat, Natural History, and Distribution,” by Richard M. DeGraaf and Deborah D. Rudis, reprinted August 1992 (hereinafter “GTR NH-108”). The publication compiles available information on the life history, distribution, and habitat for each inland vertebrate occurring in New England and provides a summary description of the important habitat needs of each species. In addition, any wildlife observed during the evaluation is indicated in the matrix.

Based upon the experience of LE wildlife biologists and data provided in GTR NE-108, the matrix is edited to include wildlife species that may occur within the Study Area, but were not necessarily observed. The matrix is not based on specific wildlife observations, although any observations made in the field contributed to the preparation and are included in the list. Not all species listed in the matrix are expected to utilize the Study Area to the same degree and species may be transient or active within the Study Area. The goal of the matrix is to provide a representative snapshot of the total variety of wildlife that could potentially find suitable habitat within each habitat area.

**TABLE 1
VEGETATIVE COVER TYPE SUMMARY**

Habitat ID	Cover Type	General Description	NH Natural Heritage Natural Community
1	Upland Forest: Oak	Oaks (red, white) dominant, with lesser abundance of sugar maple, red maple, and white pine.	Dry Appalachian oak forest.
2	Upland Forest: Mixed Oak-Red Maple-White Pine	Oaks and red maple are dominant, white pine is common or co-dominant, may include birches.	Mesic Appalachian oak-hickory forest.
3	Upland Forest: Red Maple	Red maple dominant, other species variable including black birch, gray birch, trembling aspen, white pine, red oak, black cherry.	Red maple - red oak - cinnamon fern forest, southern variant.
4	Upland Forest: White Pine	White pine dominant, may be exclusive or include other pines or hardwoods such as birches, oaks, and red maple.	Red oak-white pine forest.
5	Upland Forest: Sugar Maple/White Ash	Sugar maple dominant or co-dominant in overstory and understory, white ash common, white pine and red oak present.	Semi-rich oak - sugar maple forest.
6	Upland Forest: Riparian Zone	Mixed oak – pine forest along the Merrimack River.	Mesic Appalachian oak-hickory forest.

WILDLIFE HABITAT EVALUATION

**TABLE 1
VEGETATIVE COVER TYPE SUMMARY**

Habitat ID	Cover Type	General Description	NH Natural Heritage Natural Community
7	Early Successional Field/Shrubland	Dominated by dense shrubs and saplings, generally aspen, birches and sumac, may include small oaks or white pine. Trembling aspen with up to 10" DBH may be dominant in areas.	N/A
8	Wetland: Red Maple Swamp	Red maple dominant, may include other species as American elm and green ash. Drier areas may have some white pine and red oak. Cowardin Classification: Palustrine Forested Wetland	Seasonally flooded red maple swamp and Red maple - red oak - cinnamon fern forest, southern variant.
9	Wetland: Shrub Swamp	Shrub swamp dominant, may include areas of wet meadow. Palustrine Scrub Shrub	Mixed tall graminoid - scrub-shrub marsh.
10	Wetland: Emergent Marsh	Includes cattail marsh and wet meadows. Cowardin Classification: Palustrine Emergent Marsh	Emergent marsh and Cattail marsh.
11	Wetland: Open water	Includes impounded areas of Limit Brook within golf course. Cowardin Classification: Palustrine Unconsolidated Bottom	Aquatic bed, quiet water variant.
12	Wetland: Former Beaver Impoundment	Previous beaver flooded red maple swamp now consisting of standing dead trees. Cowardin Classification: Palustrine Forested Wetland and Palustrine Emergent Marsh	Seasonally flooded red maple swamp.
13	Knotweed Infestation	Japanese knotweed dominant, may include other invasive or non-invasive species.	N/A
14	Golf Course: Man Made Ponds	Constructed golf course water features.	N/A

WILDLIFE HABITAT EVALUATION

**TABLE 1
VEGETATIVE COVER TYPE SUMMARY**

Habitat ID	Cover Type	General Description	NH Natural Heritage Natural Community
15	Golf Course: Wooded Areas	Narrow wooded areas along fairways with an intact understory. Common trees include red, black, & white oaks, white pine, black locust, and red maple.	N/A
16	Golf Course	Includes: <ol style="list-style-type: none"> 1. Maintained golf course greens and fairways; 2. Clubhouse, paved areas, and maintenance facilities; 3. Individual or narrow treed areas with mowed/maintained understory; and 4. Less maintained grassed areas and meadows along fairways. 	N/A

2.0 METHODOLOGY

Each cover type within the Property was observed and evaluated for their ability to provide important habitat functions. LE wildlife biologists observed wildlife habitats and species present on the Property and collected habitat feature data on September 2, 3 and 11, 2020. Important habitat features observed, including topography, soil structure, plant community composition and structure and observed wildlife usage were recorded. Habitat features evaluated within the Study Area include, but are not limited to: cover type based on dominant vegetation, the presence/type of food sources, standing dead trees (snags), tree cavities, cover/perches/basking habitat, stream characteristics, evidence of dens and nests, and forested, shrub and emergent wetlands.

This evaluation generally examined the following throughout the Study Area:

1. Potential food, shelter, migratory, and breeding areas for wildlife;
2. Potential overwintering areas for mammals, reptiles and amphibians;
3. Potential turtle nesting areas, nesting sites for birds which typically reuse specific nesting sites, cavity trees, and isolated depressions that may function as vernal pools; and
4. Potential migratory areas within the Property and along the riparian corridor.

3.0 EXISTING CONDITIONS

The Study Area contains approximately 400 acres, consisting of the two 18-hole golf courses, associated golf play areas (ID 239-001 and ID 234-005), as well as an approximate 3.12 acre portion of an undeveloped parcel along Lowell Street (ID 234-034). Soils at the Property are primarily mapped as loamy sands and sandy loams. Of the total Study Area, approximately 77% is mapped as Windsor loamy sand, 10.6% as Agawam fine sandy loam, and 3.5% as Deerfield loamy fine sand. The vast majority of the golf courses are located on these mapped soils. Other soils mapped include the following hydric soils: Borohemists (5.0%), Pipestone loamy sand (2.1%) and Scarboro mucky fine sandy loam.

As indicated on the 2020 NH Wildlife Habitat Land Cover map prepared by NHWAP (See Figure 4 – 2020 NH Wildlife Habitat Land Cover), the following Habitat Land Covers are present at the Property:

- Marsh and Shrub wetland;
- Temperate Swamp;
- A small area of Northern hardwood-conifer forest;
- Appalachian oak-pine forest;
- Hemlock-hardwood-pine forest; and
- Open Water.

As reported in the Wetlands & Natural Resources report prepared for the Project by Gove Environmental Services, Inc. (“Gove”), based on an evaluation conducted in the spring of 2020, one area of vernal pool breeding was observed within the Study Area. This report also determined that wildlife habitat was a primary function or was supported within the following evaluation areas of the Property:

- The Merrimack River and its banks (wildlife habitat a primary function);
- Wetlands within the northeast portion of the Study Area (wildlife habitat supported);
- Wetlands located to the northwest and southwest of the abutting Mercury Systems property (wildlife habitat a primary function);
- Wetland area located south and east of the abutting Mercury Systems property (wildlife habitat supported);
- Wetlands associated with Limit Brook, north of Steele Road (wildlife habitat a primary function);
- Wetlands associated with Limit Brook, south of Steele Road (wildlife habitat a primary function);
- Four isolated excavated ponds on the golf course (These non-jurisdictional wetlands support limited wildlife habitat).

The 2020 Highest Ranked Wildlife Habitats by Ecological Condition (2015 New Hampshire Wildlife Action Plan, New Hampshire Fish and Game Department, “NHWAP”) indicated that the Study Area is not located within a Highest Ranked Habitat in New Hampshire or within a Highest Ranked Habitat in the Biological Region, nor is it within a Supporting Landscape indicated on this map (See Figure 5 – 2020 Highest Ranked Wildlife Habitat by Ecological Condition). The Merrimack River adjacent to the Property is a New Hampshire Designated River under the New Hampshire Rivers Management and Protection Program and the associated ¼ mile buffer extends well onto the Study Area.

4.0 WILDLIFE HABITAT EVALUATION

The following section is intended to describe the observed cover types and associated habitat areas that may provide important wildlife habitat in terms of topography, soil composition and structure, and plant community composition and structure. Photographic documentation of various observed habitat features is included (See Appendix B – Photographic Documentation).

4.1 Habitat Type 1 – Upland Forest: Oak

The vegetation of this cover type is dominated by oaks, including red oak (*Quercus rubra*), white oak (*Quercus alba*) and black oak (*Quercus velutina*), with species such as sugar maple (*Acer saccharum*), red maple (*Acer rubrum*) and white pine (*Pinus strobus*) also present. This cover type can contain the NH NHB Natural Community *Dry red oak-white pine forest* where only red oak are present, or *Dry Appalachian oak forest* where other oaks are also present. Shrub and herbaceous vegetation in this cover type includes black cherry (*Prunus serotina*), glossy buckthorn (*Frangula alnus*), maple leaved viburnum (*Viburnum acerifolium*), Canada mayflower (*Maianthemum canadense*), poison ivy (*Toxicodendron radicans*), and hayscented fern (*Dennstaedtia punctilobula*).

Important habitat features provided by this cover type within the Study Area include hard mast (acorns), large tree size, large snags and cavity trees and large woody debris on the ground. Wildlife that can be expected to utilize the hard mast in this habitat includes species such as mice (*Peromyscus* sp.), chipmunk (*Tamias striatus*), gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), white tailed deer (*Odocoileus virginianus*), blue jay (*Cyanocitta cristata*), white breasted nuthatch (*Sitta carolinensis*), wood duck (*Aix sponsa*), and turkey (*Meleagris gallopavo*), among numerous other species. Small mammals, amphibians, and ground-nesting birds may utilize the downed woody material in these areas. Large trees with large cavities may be utilized by species such as porcupine (*Erethizon dorsatum*), fishers (*Martes pennant*), opossum (*Didelphis virginiana*), raccoon, barred owl (*Strix varia*), bats (*Myotis* spp.) and wood duck.

4.2 Habitat Type 2 – Upland Forest: Mixed Oak-Red Maple-White Pine

Within this cover type, oaks and red maple are dominant and white pine is common or co-dominant. This is a very common habitat type within the Study Area. This cover type can contain the NH NHB Natural Community *Mesic Appalachian oak-hickory forest*. Understory vegetation in this cover type includes White ash, black cherry, glossy buckthorn, Canada mayflower and poison ivy.

Also within this cover type is an area of assorted co-dominant trees, including red oak, white pine, black locust (*Robinia pseudoacacia*), trembling aspen and big tooth aspen (*Populus grandidentata*). Historic disturbance/excavation in this area is apparent, which may account for the variety of trees established. The understory contains a significant amount of invasive vegetation, particularly honeysuckle (*Lonicera* sp.) and Oriental bittersweet (*Celastrus orbiculatus*). Habitat value is primarily related to the food value of acorns and other tree seeds. Numerous woodchuck (*Marmota monax*) holes were observed within this area.

Important habitat features and species utilization provided by this cover type are similar to those for Habitat Type 1. In addition, the large white pines present provide potential nesting and perching sites for species such as the red tailed hawk (*Buteo jamaicensis*), which was observed on numerous occasions at the Property.

4.3 Habitat Type 3 – Upland Forest: Red Maple

Red maple is the dominant vegetation within this upland forested cover type. Other species are variable in abundance and may include gray birch, trembling aspen (*Populus tremuloides*), white pine, red oak and black cherry. This cover type can contain the NH NHB Natural Community *Red maple - red oak - cinnamon fern forest, southern variant*. Common understory vegetation consists of gray birch, glossy buckthorn, hazelnut (*Corylus sp.*), cinnamon fern, interrupted fern (*Osmunda claytoniana*) and Canada mayflower.

The seeds of red maple are eaten by chipmunks and squirrels, while some songbirds use stalks for nest-building. Red maple is a valuable browse for white-tailed deer during the late fall and winter. Other important habitat features of this cover type include the food value of catkins, buds and seeds that provide food for species such as ruffed grouse (*Bonasa umbellus*) and the twigs that are browsed by species such as cottontail rabbits (*Sylvilagus floridanus*), porcupine and beaver (*Castor canadensis*). Woodchuck burrows were observed in this area.

4.4 Habitat Type 4 – Upland Forest: White Pine

White pine is the dominant tree in this cover type. These habitats may contain exclusively white pine or include other pines, such as red pine (*Pinus resinosa*), or hardwoods such as birches, oaks and red maple, but white pine is always dominant. This cover type may contain the NH NHB Natural Community *Dry red oak-white pine forest* where only red oaks are present. Common understory vegetation in this cover type includes glossy buckthorn, hazelnut, black cherry, hayscented fern, lady fern (*Athyrium filix-femina*), teaberry (*Gaultheria procumbens*) and starflower (*Lysimachia borealis*). The understory is generally open with relatively sparse shrubs. Many of these areas contain large white pine trees greater than 24" DBH.

Important habitat features provided by this cover type include the food value of pine seeds which are consumed by numerous species of wildlife, including black capped chickadee (*Poecile atricapillus*), red breasted nuthatch (*Sitta canadensis*), white breasted nuthatch, beaver, porcupine, gray squirrel, and white tailed deer. Additional habitat value is provided by large tree size, large snags and cavity trees, large woody debris on the ground and potential nesting and perching sites.

4.5 Habitat Type 5 – Upland Forest: Sugar Maple-White Ash

Sugar maple is dominant or co-dominant in the overstory and understory, with white ash (*Fraxinus americana*) being common, and white pine and red oak generally present in lesser amounts. This cover type includes the NH NHB Natural Community *Semi-rich oak - sugar maple forest*. Common understory vegetation includes sugar maple, maple leaved viburnum, Canada mayflower and wild sarsaparilla (*Aralia nudicaulis*). This cover type is limited to a relatively small area in the eastern part of the Property, south of the access driveway for Mercury Systems facility.

Important habitat features provided by this cover type include seeds and browse for species such as chipmunk, gray squirrel, porcupine and white tailed deer. The relatively large size of a number of trees in this area also may provide habitat value associated with large trees such as nest sites for large birds and potential for large snags and large woody debris on the ground.

4.6 Habitat Type 6 – Upland Forest: Riparian Zone

This cover type occurs along the Merrimack River and includes white pine, red oak and red maple as dominants. Basswood (*Tilia americana*), silver maple (*Acer saccharinum*) are common and American sycamore (*Platanus occidentalis*) is also present. Two mature river birch trees (*Betula nigra*) were observed along the southwest banks of the river.

Important habitat features for this habitat type are similar to those for habitat types 1 and 2. In addition, at locations close to water along the Merrimack River, white pines can provide key nest and perch sites for bald eagles (*Haliaeetus leucocephalus*), great blue herons (*Ardea herodias*), and osprey (*Pandion haliaetus*). No bald eagle nests were observed in the Property. The Merrimack River riparian zone also provides a habitat corridor for wildlife movement and migration along the Property boundary; however this habitat value is significantly reduced due to the lack of readily accessible corridors under or over the northerly bridge structure. This cover type is inclusive of the banks of the Merrimack, which generally consist of steep/sandy well-defined banks. Portions of the sandy banks are exposed providing ideal burrowing habitat for aquatic mammals and reptiles.

4.7 Habitat Type 7 – Early Successional Field/Shrubland

This cover type is dominated by dense shrubs and saplings, generally consisting of aspen, birches and sumac, but may also include small oaks or white pine. At the Property, areas dominated by trembling aspen up to approximately 10" DBH are included in this cover type. Areas dominated by trees larger than this are not included.

This habitat type provides dense shrub & sapling thickets that can provide nesting habitat for species such as veery (*Catharus fuscescens*), cottontail rabbits and ruffed grouse. Where bare soil and abundant earthworms are present these areas can provide important habitat for American woodcock. These areas also provide cover for numerous wildlife including eastern towhee (*Pipilo erythrophthalmus*), whip-poor-will (*Caprimulgus vociferous*), and field sparrow (*Spizella pusilla*). The dense shrubs and young trees growing in these areas also provide an abundance of berries and fruit eaten by many wildlife species.

4.8 Habitat Type 8 – Wetland: Red Maple Swamp

Note: wetland resource areas were initially delineated, characterized, and classified by Gove in a report prepared titled "Wetlands & Natural Resources". This evaluation is not intended to supplement the wetland report or wetland impact assessment previously completed. This discussion is intended to give an overall assessment of the wildlife habitat associated with various general wetland types identified in the Property. These include red maple swamps, shrub swamps, emergent marshes, open water bodies associated with Limit Brook, and a former beaver impoundment as described below.

Red maple is the dominant tree in these wetland areas. Other common trees may include American elm (*Ulmus americana*) and ash (*Fraxinus sp.*). At drier locations, white pine and/or red oak may also be present. Common understory vegetation consists of elderberry (*Sambucus canadensis*), highbush blueberry (*Vaccinium corymbosum*), northern arrowwood (*Viburnum recognitum*), cinnamon fern, sensitive fern (*Onoclea sensibilis*), royal fern (*Osmunda regalis*), jewelweed (*Impatiens capensis*), and skunk cabbage (*Symplocarpus foetidus*). This habitat type includes the NH NHB Natural Communities *Seasonally flooded red maple swamp* and *Red maple - red oak - cinnamon fern forest, southern variant*.

This wetland habitat type is common within the eastern portion of the Property. Important habitat features include the developed plant community structure of the vegetative layers which can provide cover and breeding habitat for numerous species of wildlife such as breeding birds, small mammals such as mice, voles (*Microtus spp.*) and shrews (*Sorex spp.*), and larger mammals such as beaver, otter (*Lontra canadensis*), mink (*Neovison vison*), and white tailed deer. Red maple swamps are a primary habitat utilized by wood ducks for breeding where suitable cavity trees are available. Within the Property, numerous snags and cavity trees are present, including cavity trees large enough for species such as wood ducks. Seasonal flooding within these habitats can provide breeding habitat for amphibians such as spring peepers (*Pseudacris crucifer*) and gray treefrogs (*Hyla versicolor*). In addition, one vernal pool, providing breeding habitat for wood frogs (*Rana sylvaticus*), has been verified within this habitat (by others).

4.9 Habitat Type 9 – Wetland: Shrub Swamp

This habitat type includes areas where wetland shrubs are the dominant vegetative cover and may include adjacent areas of wet meadow. Common shrubs within this habitat include elderberry, highbush blueberry, winterberry holly (*Ilex verticillata*), glossy buckthorn and pussy willow (*Salix discolor*). Scattered trees, such as red maple, green ash (*Fraxinus pennsylvanica*) and American elm are present in locations. Herbaceous vegetation includes species such as jewelweed, royal fern, cinnamon fern and cattail (*Typha latifolia*). This habitat type includes areas of the NH NHB Natural Community *Mixed tall graminoid - scrub-shrub marsh*.

Important habitat features within this habitat type include the dense vegetative cover and the food value of soft mast (berries) produced by many of the shrubs common in this habitat. Many species of migratory birds use the dense shrub thickets as nesting habitat. Species that may utilize this habitat include alder flycatcher (*Empidonax alnorum*), veery, gray catbird (*Dumetella carolinensis*), common yellowthroat, yellow warbler (*Dendroica petechial*), swamp sparrow (*Melospiza georgiana*) and American woodcock. These swamps can also provide important habitat and cover for species such as river otter, mink, muskrat (*Ondatra zibethicus*), and beaver. In the winter, browsers such as cottontail rabbits may utilize these areas.

4.10 Habitat Type 10 – Wetland: Emergent Wetland

This habitat type includes cattail marsh and wet meadows, and may include adjacent fringes of wetland shrub wetland. This habitat is associated with Limit Brook within the southeast portion of the Property. Common vegetation includes cattail (*Typha latifolia*), purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), barnyard grass (*Echinochloa sp.*), jewelweed, joe-pye-weed (*Eutrochium purpureum*), woolgrass (*Scirpus cyperinus*) and sedges (*Carex sp.*) The fringes of this area may contain shrubs such as winterberry holly, buttonbush (*Cephalanthus occidentalis*), silky dogwood and pussy willow. This habitat type includes areas of the NH NHB Natural Communities *Emergent marsh* and *Cattail marsh*.

Persistent emergent wetland vegetation at least seasonally flooded during the growing season can provide habitat for mallard (*Anas platyrhynchos*), Canada goose (*Branta canadensis*), American bittern (*Botaurus lentiginosus*), sora (*Porzana carolina*), common snipe (*Gallinago gallinago*), red-winged blackbirds (*Aegialius phoeniceus*), swamp sparrows, and marsh wrens. Great blue heron and green heron (*Butorides virescens*) may use this habitat for feeding. In addition, standing water present for at least part of the growing season within these wetlands can be suitable for use by breeding amphibians, non-breeding amphibians, turtles, and foraging waterfowl.

4.11 Habitat Type 11 – Wetland: Open Water

This habitat type includes impounded areas of Limit Brook containing open water. Within these habitats, water depths are typically at least 2–3 ft. or shallower in mid-late summer and semi-permanently to permanently flooded. Vegetation within this habitat includes floating-leaved and submersed herbaceous species such as white water lily (*Nymphaea odorata*), yellow water lily (*Nuphar sp.*) and sweet flag (*Acorus calamus*). This habitat type includes areas of the NH NHB Natural Community *Aquatic bed, Quiet water variant*.

The open water is utilized by the following species which were observed directly: kingfisher (*Ceryle alcyon*), great blue heron, bull frog (*Rana catesbeiana*), green frog (*Rana clamitans melanota*), and painted turtles (*Chrysemys picta*). Other species which may utilize this habitat include various species of fish, eastern newt (*Notophthalmus v. viridescens*), American toad (*Bufo americanus*), snapping turtle (*Chelydra serpentina*), northern water snake (*Nerodia sipedon*), mallard and wood duck.

4.12 Habitat Type 12 – Wetland: Former Beaver Impoundment

This cover type consists of a previous beaver flooded red maple swamp now containing primarily standing dead trees (snags). This cover type is limited to an area along the northern portion of the Property, south of Circumferential Highway. Understory vegetation consists of a mix of dense herbaceous and shrub species, including northern arrowwood, royal fern, cinnamon fern, sensitive fern and jewelweed. This habitat type includes areas of the NH NHB Natural Community *Seasonally flooded red maple swamp*.

Important habitat features that are present in this area are a high density of standing snags, numerous cavities within these snags, dense shrub and herbaceous layers and numerous large (approximately 12” diameter) dead woody material on the ground. In addition, the dense herbaceous and shrub provide cover for a variety of wildlife. At least thirty-five species of birds that occur in the Northeast United States use

cavities in dead or deteriorating trees. Snags also provide essential habitat requirements for cavity-using amphibians, reptiles and mammals in addition to providing important habitat structure for nesting, roosting, feeding and perching for various species of wildlife. Snags and tree cavities are present within both the wetland and upland areas at the Property but are generally more common within the forested wetlands, and are particularly prevalent in this area.

4.13 Habitat Type 13 – Japanese Knotweed Infestation

Japanese knotweed (*Polygonum cuspidatum*) is the dominant vegetation within these areas although other invasive or non-invasive species, such as Oriental bittersweet and pokeweed (*Phytolacca americana*) may be present. Although these areas provide dense vegetative cover that may be utilized by some species, the overall habitat value is low. These areas present opportunity for management by removing invasive vegetation and establishing native vegetation high in wildlife food and cover value.

4.14 Habitat Type 14 – Golf Course: Man Made Ponds

This habitat type includes constructed isolated golf course water features (ponds). These areas are variable, with some ponds being dry and others still containing water at the time of the evaluation. Some of these ponds have a fringe of shrub habitat while others are mowed to the water line. Vegetation observed within a dry basin included smartweed (*Polygonum sp.*), wool grass, and lurid sedge (*Carex lurida*). Vegetation observed along the fringe of ponds containing water included Oriental bittersweet, gray birch, Virginia creeper, jewelweed, pokeweed, purple loosestrife, and woolgrass.

Species such as green frog, green heron, and great blue heron were observed utilizing these areas. Other species that may use these areas while water is present include kingfisher, eastern newt, American toad, snapping turtle, northern water snake, and mallards. The shrub fringe provides similar habitat as shrub swamp or shrubland although limited due to the limited size of the habitat.

4.15 Habitat Type 15 – Golf Course: Wooded Areas

These narrow wooded areas located along fairways have been maintained in a natural state, with understory vegetation allowed to grow. Common trees include red, black and white oaks, white pine, black locust and red maple. Understory vegetation typically consists of young growth of the overstory species as well as lowbush blueberry (*Vaccinium angustifolium*), hayscented fern, Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron radicans*).

Trees are generally fairly large, and depending on location can average from 12-15" DBH to 24-30" DBH. Because of the presence of numerous large oak and pine trees, these areas provide habitat values as described for Cover Types 1 and 5 (oak dominated and white pine dominated areas), but generally more limited and primarily associated with the food value of hard and soft mast.

4.16 Habitat Type 16 – Golf Course

This cover type is inclusive of the golf course and its ancillary facilities. These primarily consist of the following:

1. Individual or narrow treed areas along fairways with mowed/ no understory and are considered to be part of the course of play;
2. Golf course areas mowed infrequently which are allowed to grow to upland meadow;
3. Maintained golf course greens and fairways; and
4. The clubhouse, paved areas, and maintenance facilities.

The narrow treed areas consist of the same tree species as Habitat Type 15, the Golf Course: Wooded Areas, and so provide some of the same habitat value associated with the food value of acorns and potential perching locations for hunting raptors such as the red tailed hawk. The upland meadow areas provide habitat value for various pollinator insects and the fairways provide habitat for foraging wildlife such as woodchuck, gray squirrel, chipmunk, American robin and yellow-shafted flicker. In general the clubhouse, paved areas and maintenance facilities provide limited, if any, wildlife habitat value.

5.0 IMPACTS TO WILDLIFE HABITAT

Using the criteria established by the Wetlands Ordinance as a basis for evaluating potential wildlife-related impacts of the Project under the proposed conditions, the Property was evaluated to determine if the topography, soil composition, plant communities, and/or additional habitat features were likely to provide important habitat value for wildlife. With this information the potential impacts from construction and operation of the facility were reviewed to identify potential wildlife impacts and to identify effective mitigation measures to offset likely impacts to wildlife or any lost habitat.

Sixteen vegetative cover types were identified within the Property and each was evaluated for potential wildlife habitat value. Impacts within the District that occur within the maintained golf course are not a primary concern since these areas do not significantly contribute to wildlife habitat function within the Property. With regards to the impacts specifically within the District in undeveloped portions of the Property, the proposed Project will generally impact forested uplands and wetlands. Wildlife habitat within the limit of work for the access roads will be lost as a result of the Project, and wildlife utilizing these areas will be displaced to the adjacent areas; however it is expected the restoration of golf course areas will fully mitigate for these impacts. Refer to Section 7.0 for a detailed discussion of the proposed mitigation measures. Wetland impact areas within the District generally consist of habitat types that are common throughout the Property and region. Therefore, generally speaking, there are no significant impacts to wildlife or wildlife habitat, including unique or rare wildlife habitat types. With regards to this specific Project and the Property, LE has identified four aspects to the overall design that require further discussion and analysis to assess whether there are impacts to wildlife habitat within the District as required by the Ordinance. These include potential impacts to: habitat connectivity; sound; lighting; and concerns related to specific wildlife species. These are discussed below.

5.1 Habitat Connectivity

One of the primary concerns with any large scale development project is the possibility of reducing habitat connectivity by fragmenting the wetland wildlife habitat with roadways. One of the design goals for the Project is to maintain habitat connectivity within these wetland areas on the eastern portion of the Property, as well as along the riparian zone of the Merrimac River.

Only one stream crossing is proposed for the Project and that is associated with the Secondary Access Road in the north eastern portion of the Property. One non-stream crossing is proposed for Green Meadow Drive. Current animal movements and related corridors are predominantly located around the perimeters of the property and will continue to be utilized. Habitat connectivity along the Merrimac River will remain intact since there are no proposed new development components within the Shoreland Protection Zone. In fact, this Merrimack River zone will be enhanced by naturalizing the extensive area of maintained golf course turn in this area using a meadow seed mix, and section of native shrubs and trees. Wildlife will be able to move along the river in a north to south direction as they do in present day. The Circumferential Highway to the north of the Property limits any connectivity to habitats north of the Property under existing conditions. This will not change following construction of the Project.

The 2009 New Hampshire Stream Crossing Guidelines (the “Guidelines”), in part, recognize the importance of habitat continuity with respect to stream crossings. Stream crossings in general, if designed or replaced without consideration for river and stream ecology and geomorphology, have the potential to degrade aquatic habitats. The Guidelines reflect the need for aquatic organisms to move upstream and downstream throughout their life cycles because the survival of a population depends on access to spawning habitat, feeding areas, shelter, and the dispersal and colonization of available habitat by juveniles. In addition, many species of fish, amphibians, reptiles, and mammals use riparian zones as travel corridors, and the movement of these species may be impacted by restricted crossings.

The Guidelines recommend crossings be designed to maintain river/stream continuity and facilitate passage for wildlife and fish. The best designs for accomplishing this involve open bottom structures or bridges that not only span the river/stream channel, but also span one or both of the banks allowing dry passage for wildlife that move along the watercourse. Where the crossing involves high traffic volumes or physical barriers to wildlife movement, the crossing structure should be sized to pass most wildlife species (minimum height and openness requirements). Openness ratio is the cross-sectional area of a structure opening, in square meter, divided by its crossing length in linear meters. For a box culvert, $\text{openness} = (\text{height} \times \text{width}) / \text{length}$. In most cases, a geomorphically compatible stream crossing structure will allow for aquatic organism passage without the specific need to meet an openness ratio of 0.25 meters. In areas where the passage of semi-aquatic wildlife, such as turtles and amphibians, is a concern, it is recommended that an openness ratio of at least 0.25 meters be included in stream crossing design.

The Guidelines also suggest the width design of crossings on streams should account for both hydrology and sediment transport characteristics. To avoid impacts to downstream areas, flow velocities and sediment transport within the structure should not be significantly different from the stream above and below the crossing. In most cases, this should be accomplished by spanning, at a minimum, 1.2 times the bankfull width plus 2-feet.

Two new access roadways, the Secondary Access Road and Green Meadow Drive, are proposed within the eastern portion of the Property. The stream crossing design on the Secondary Access Road has been modified to maintain habitat connectivity using the Guidelines. The Secondary Access roadway (Impact Area 1) will cross a vegetated wetland as well as an unnamed stream. The unnamed stream flows north and ultimately discharges to a culvert under Circumferential Highway. The proposed crossing has been revised to incorporate a 12-foot wide by 5.5-foot high open bottom box culvert to achieve desired compliance with the Guidelines. The open bottom culvert will include a natural substrate on either side of the stream to allow passage for small aquatic and terrestrial wildlife. Following installation of the box culvert, the streambed will be visually inspected to ensure there are no impacts to the upstream and downstream conditions (i.e. hydraulic gradient, substrate, and topography). The existing stream bed and wetland substrate material will be removed and replaced in new crossings. These design features will fully comply with the Stream Crossing Guidelines and allow habitat connectivity for wildlife.

The following summarizes the design goal of the Secondary Access roadway relative to the Guidelines.

Openness Ratio

General Standard = >0.82 feet (0.25 meters)

Provided: $((12 \text{ feet by } 5.5 \text{ feet})/75 \text{ feet})$
= 0.88 feet (0.27 meter)

Crossing Span

General Standard = $(1.2 \times \text{Bankfull width}) + 2 \text{ feet}$.

Calculation = $(1.2 \times 5 \text{ feet}) + 2 \text{ feet} = 8$

Provided = 12 feet

Green Meadow Drive will cross several wetland areas but crossing of an intermittent or perennial stream is not proposed. Although the Guidelines do not directly apply to wetland crossings where no stream is present, the intent of the design is to provide a wildlife passage culvert at Impact Area F. The crossing at Impact Area F has been revised to eliminate the 18-inch closed bottom culvert and replace it with a 22-foot wide by three-foot high open bottom structure which will allow for passage of small aquatic and terrestrial wildlife. Allowing for this connectivity allows for passage from the northern portion of the Property and the southern portion of the Property, specifically Limit Brook. Wildlife on the east side of the Property will be able to travel south to the southern property line and then west towards the Merrimac River under the proposed conditions.

Openness Ratio of Wetland Crossing at Impact Area F

General Standard = >0.82 feet (0.25 meters)

Provided: $((22 \text{ feet by } 3 \text{ feet})/80 \text{ feet})$
= 0.83 feet (0.25 meter)

5.2 Sound

In the short term, temporary sound (noise) impacts will result from construction of the Project. As with most construction projects, these effects will be temporary, will occur mostly during normal working hours and may, for short durations, be audible off-Property. More variable noise levels during construction may affect foraging, breeding, and nesting behavior of wildlife in the immediate Project area. Noise during construction will be temporary but may possibly cause wildlife to reduce their use of land immediately adjacent to the Property during normal working hours. But when these impacts are considered in the context of the Property setting (e.g., existing noise resulting from Circumferential Highway and Lowell Road), it is considered unlikely that these short-term impacts will result in a significant impact to the wildlife community in the area.

The Project will employ common and practical Best Management Practices (“BMPs”) to mitigate short-term noise impacts. Long-term increased noise levels will occur; resulting in a potential overall increase in ambient sound levels from increased truck and vehicle traffic, idling trucks, and trucks backing up. The proposed Project incorporates several sound mitigation components that complies with the state and local noise ordinance requirements. Limitations on vehicle idling are also included, consistent with Env-A 1102.02 (Idling Limitations for Motor Vehicles). Additionally, limitations to the degree practicable on loudspeaker use, vehicle idling and other high decibel noises are also included, consistent with the Town of Hudson Noise Ordinance (Chapter 249 of the Hudson Town Code).

Wildlife species that are tolerant of development, such as those commonly occurring wildlife at the Property, are not anticipated to be affected by the proposed noise levels as they are accustomed to existing noise levels from Circumferential Highway, Lowell Road and from the on-site and abutting property activity and will acclimate to the facility operational noise levels after the Hudson Logistics Center is completed.

5.3 Lighting

Operation of the facility will result in an increase in ambient light during the night; however, proposed light levels are not anticipated to significantly exceed light levels used by residential or commercial developments of a similar scale, particularly beyond the developed area of the Property. Refer to the Lighting Plans in the Project Plan Set. Lighting will be shielded to prevent lighting affecting the nearby Shoreland Protection Zone and the proposed Conservation Areas to the East. The lighting will also be adjusted at the proposed wetland crossing for Green Meadow Drive (Impact Area F) and the Secondary Access roadway to encourage use of the culvert structures by wildlife.

5.4 Concerns with Specific Wildlife Species

Concern has been raised over the impacts of the proposed development on specific wildlife species, particularly the bald eagle (*Haliaeetus leucocephalus*), other birds of prey like hawks, the New England cottontail (*Sylvilagus transitionalis*), and the Eastern box turtle (*Terrapene carolina carolina*).

The bald eagle is known to occur in many reaches of the Merrimac River over the past decade. It is not uncommon for transient eagles to travel great distances upstream and downstream a waterbody like the Merrimac River. Bald eagles generally nest near coastlines, rivers, large lakes or streams that support an

adequate food supply. They often roost and nest in the tallest trees because they provide the visibility and accessibility needed to locate aquatic prey. During the breeding season, bald eagles are sensitive to a variety of human activities. Bald eagles tend to avoid areas where large populations of humans congregate and are active on the landscape. There are not currently any bald eagle nests within the Property along the Merrimac, presumably due to the presence of Circumferential Highway, and possibly even the activities of the golf course. The risk to the bald eagle as a result of the proposed Project is low as the vegetated sections Shoreline Protection Zone will be significantly expanded, restored, and permanently protected with the proposed Project. Following the mitigation in the Shoreline Protection Zone, this stretch of the river will have one of the largest and longest protected shoreline areas in Hudson. It is not expected that bald eagles will begin to nest within the Property once the Project is completed as there are no nests currently reported in the area, however the proposed conditions in the riparian zone will increase the opportunity and conditions favorable to nesting as the eagle population continues to expand. The Project will not impede the eagle's ability to forage up and down the river and the expanded vegetated riparian zone will promote use of the shoreline for nesting, foraging and roosting.

Several raptors have been observed within the Property, specifically the red-tailed hawk (*Buteo jamaicensis*) and Cooper's hawk (*Accipiter cooperii*). It is highly likely that they are utilizing the golf course for foraging of food and prey. Although the portions of the Property occupied with the proposed buildings and parking areas under proposed conditions, there will remain the portions of the Property following development that will be naturalized with a meadow seed mix. Open meadows will provide excellent foraging habitat for hawks.

LE understands that there have been claims that the New England cottontail has allegedly been observed on the property. It is important to note that it is nearly impossible to distinguish a New England cottontail from the more common eastern cottontail by visual inspection. The New England cottontail is only readily identified by DNA analysis or skull analysis because they look too similar to the eastern cottontail rabbit. We understand that there has been no DNA analysis of cottontails to date. The NH Natural Heritage Bureau (NHB) does not recognize the species as present in the vicinity of the Property and they most likely would have been involved in any detailed testing for the species.

The NHB has a record of the Eastern box turtle approximately 1.5 miles east of the Property. Similar to most species of upland turtles, Eastern box turtles utilize a range of habitats across the landscape. Eastern box turtles favor open woodlands, although they can be found in pastures, marshy meadows, riparian zones and floodplains. There are no reported observations of the turtles in the Property, likely a result of the absence of favorable habitat requirements, and, as a result, there is low potential for an impact to this species.

6.0 HUDSON WETLANDS CONSERVATION DISTRICT

The primary purpose of this WHE is to demonstrate the proposed Project's compliance with the wildlife-related criteria under the Wetlands Ordinance. Within the defined boundaries of the Wetlands Conservation District, Section 334.33.D. of the Wetlands Ordinance states that, in part, *"...the wetlands and buffers in the Town of Hudson are a valuable natural resource requiring careful management to maintain their usefulness to public health, safety and welfare. The Town of Hudson finds that wetlands and buffers:(4) Preserve and protect important wildlife habitat and maintain ecological balance..."*.

6.1 Use-Specific Conditional Use Permit Criteria

The Project contemplates access and condominium unit development impacts to the District which are permitted Conditional Uses. Specifically, we have been informed that a Conditional Use Permit under the Wetlands Ordinance is required for access and unit development impacts to be located within discrete impact areas within the District, as defined by the Wetland Ordinance. The proposed impacts are primarily associated with the construction of the private driveways known as Green Meadow Drive and the Secondary Access, both of which are required to provide access to the Property's uplands which are located on the western side of the Property. While the District does not regulate "manmade facilities", the Site Plan also depicts two manmade ponds (golf course water features) totaling 44,730 sf which may be impacted by the Project, and accordingly no conditional use permit is required for these impacts from the Planning Board pursuant to Section 334-35(C) of the Zoning Ordinance. The following addresses the individual conditional use permit criteria of Section 334-36(C)(2) of the Zoning Ordinance, applying to the Access Impacts, and Section 334-36(C)(4), applying to the Lot Development Impacts.

6.2 Access Impact Specific Criteria (Section 334-36(C)(2))

Pursuant to Section 334-36(C)(2), the Wetlands Ordinance provides that streets, roads, and other access ways are permitted as conditional uses if: 1) the access way is essential to the productive use of the land beyond the District; 2) the access ways are located and constructed in such a way as to minimize the potential for detrimental impact to the District; 3) the access ways are planned, designed, and constructed in a manner consistent with applicable State and local standards; 4) there are no viable alternatives available. The vast majority of the District impacts occasioned by the Project are Access Impacts caused by construction of Green Meadow Drive and the Secondary Access. To summarize, the only viable way to access the uplands on the western part of the Property is for access ways to traverse areas of land within the District on the eastern side of the Property. In this case, the proposed access ways have been designed to limit the extent of wetland impacts and the effect which the proposed impacts have on wetland functions and values as they relate to wildlife impacts as described in greater detail below. It appears that Hillwood meets the specific conditional use permit criteria of Section 334-36(C)(2) of the Zoning Ordinance.

6.3 Unit Development Impact Specific Criteria (Section 334-36(C)(4))

Pursuant to Section 334-36(C)(4), Unit Development Impacts are permitted as conditional uses where the applicant can demonstrate that: 1) the use will not significantly interfere with wetland functions and values, water quality, or wildlife habitat pursuant to the statement of purpose of the Zoning Ordinance, or,

WILDLIFE HABITAT EVALUATION

2) in the alternative, the use will impact wetlands functions and values; but, in the opinion of the Planning Board, such uses are not contrary to the public interest and will result in significant public benefit provided:

- Compensatory mitigation is provided such that those District functions and values to be impacted will be off-set in whole. Such mitigation may be located on or off site. As a guide to the type and extent of compensatory mitigation considered, reference shall be made to the New England District Compensatory Mitigation Guidance, US Army Corps of Engineers, New England District, Regulatory Division, 7-22010 as amended; and ‘
- The Applicant has demonstrated avoidance and minimization to the fullest extent practical.

6.4 Conditional Use Permit Criteria

With respect to the proposed uses and potential impacts described above, Section 334-37.A provides that the Planning Board shall find, that to the extent possible, the Project avoids and minimizes impacts to land situated within the District, including for purposes of this WHE, the following:

(1) The proposed activity minimizes degradation of land situated within the District and offsets potential adverse impacts to functions and values of wetlands, surface waters, and vernal pools including but not limited to their capacity to:

- (a) Support fish and wildlife; and*
- (f) Support wetland vegetation;*

The vast majority of impacts to the District are associated with constructing the access roads to the Property. The proposed buildings, parking lot areas, and stormwater management features have been designed to avoid and minimize impacts to the District. There are no viable alternate access roadway layouts or configurations that would further reduce impacts or better preserve high-value wetlands and wildlife habitats to create site access. However, the vast majority of site development will be in areas that are active portions of the golf course and are heavily managed and generally open areas with low wildlife habitat function and value. Displaced wildlife will have permanently protected and restored high functional habitat as mitigation for these lost low value habitat areas. Two non-jurisdictional man-made ponds on the courses will be filled as part of construction and prior to their filling the ponds will be seined to remove any existing turtles or fish and they will be relocated at suitable habitat on the Property. Golf holes and turf grass areas within the protected areas will be revegetated, including a substantial buffer zone area adjacent to the vernal pool in the northeastern portion of the Property. Travel corridors within the eastern protected area will be enhanced by installation of open bottom box culverts and the crossing of the small brook in the north of the Property will conform to the Stream Crossing Guidelines. The corridor along the Merrimack will be substantially enhanced by the restoration of the full 250 foot Shoreline Protection Zone. Any potential adverse impacts to the capacity of the District to support fish, wildlife, and support wetland vegetation will be fully mitigated. Refer to Section 7 for a description of the proposed mitigation plan.

In addition to the Section 334-37.A(1) criteria described above, Section 334-37.A(2) requires a finding that the proposed activity will have no significant negative environmental impact to abutting or downstream properties and/or hydrologically connected water and/or wetland resources, including for purposes of this WHE:

- (b) Loss of fish and wildlife habitat;*
- (c) Loss of unique habitat having demonstrable natural, scientific, or educational value;*
- (d) Loss or decrease of beneficial aquatic organisms and wetland plants and their habitat; and*
- (f) Destruction of the economic, aesthetic, recreational, and other public and private uses and values of the wetland to the community.*

There are no anticipated adverse impacts to abutting or downstream properties and/or downstream properties and/or hydrologically connected water resources. The proposed stormwater management system has been designed in accordance with the Town of Hudson current, and soon to be adopted, requirements, the New Hampshire Stormwater Manual, and the New Hampshire Department of Environmental Services. The system incorporates elevated levels of stormwater quality, maintains or decreases the existing peak rate of runoff for all storm events analyzed, and provides above the required groundwater recharge volumes. Additionally the areas surrounding Limit Brook will be protected by a proposed Conservation Easement, further protecting the quality of downgradient waters and wetlands. There will not be diminished water quality leaving the Property that would harm off-property aquatic organisms or other wildlife.

The Merrimac River supports natural, scientific, economic, aesthetic, and recreational functions and values, none of which will be diminished by the proposed Project. The 26-acre Riparian Naturalization program proposed within the Shoreland Protection Zone will only enhance these functions and values through the reduction of impervious surfaces, addition of native plantings and habitat features, and will be protected long-term through a legal covenant. The restored Zone will provide an enhanced travel corridor along the Property waterfront for wildlife and enhance the use of the area for roosting and foraging of bald eagles and other avian species. The implementation of the mitigation provisions will permanently protect more than 116-acres of important wildlife habitat and it is not expected that the species composition of the wildlife communities on or adjacent to the Property will be altered by the Project.

Moreover, Section 334-37.A(3) requires a finding that the proposed activity or use cannot practicably be located otherwise on the Property to eliminate or reduce impact to the Wetland Conservation Overlay District, and, Section 334-37.A(4) requires that the proposed activity incorporates the use of those Best Management Practices recommended by the New Hampshire Department of Environmental Services and/or other state agencies having jurisdiction.

As stated above, the Project was designed to minimize impacts to the Wetland Conservation Overlay District and to wetland functions and values and preserve the highest value wetlands and wildlife habitats on the Property. There are no alternate layouts that would further reduce impacts or better preserve high-value wetlands and wildlife habitats. Several BMPs have been incorporated into the Project design with respects to impacts on wildlife with respect to habitat continuity, sound, lighting, and invasive species management.

Lastly, and prior to making a decision on any Conditional Use Permit pursuant to the Wetland Ordinance, the Planning Board shall receive a written comment from the Conservation Commission. The Conservation Commission may recommend that the Planning Board impose conditions of approval if deemed necessary to mitigate the potential for adverse effects of the proposed activity or use.

7.0 PROPOSED MITIGATION

To compensate for the unavoidable impacts to the Wetland Conservation District and impacts to wildlife habitat proposed by the Project, a comprehensive mitigation plan is proposed. These activities will have significant potential mitigation value. The following summarizes the mitigation components of the Project:

- The primary compensatory mitigation for the proposed 114,179 square feet of wetland impact and 270 linear feet of stream impact is a contribution to the Aquatic Resources Mitigation in the amount of \$701,142.17.
- Establishing Conservation Easements (“CE”) on the land east of the building envelope and the Shoreland Protection Zone associated with the Merrimac River. Excluding the access roads this totals approximately 90-acres along the eastern portion of the Property which will encompass nearly the entirety of the Limit Brook wetland corridor. In addition, Hillwood proposes an additional 26 acres of conservation easement area along the Merrimack River, as discussed below.
- Associated with the approximate 26-acre Riparian Naturalization program proposed within the Shoreland Protection Zone of the Merrimac River, approximately 25,761 square feet of impervious surfaces will also be removed. This will enhance the use for migrating and resident birds, including hawks, eagles and other birds and wildlife for nesting, resting, cover and foraging.
- A significant area within the future CE to the northeast of the development is currently part of the active golf course complex. These areas of tees, greens, and fairways are proposed for restoration and naturalization to create open meadows and shrub habitat (dense thicket/young woods). A portion of this restoration will enhance habitat for vernal pool species in the northeast of the Property as vernal pool species do not use managed turf grass areas as habitat. Similar restoration in the southeast portion of the CE will restore naturally vegetated buffer along Limit Brook where it is currently thin or absent.
- Modifications have been made to the proposed crossings at the Secondary Access roadway and Impact Area F at Green Meadow Drive to improve habitat continuity. Larger open bottom box culverts have been incorporated into the design to allow for wildlife passage at each location.
- The proposed lighting will be directed away from the CE areas along the eastern portion of the Property and the Riparian Naturalization Area.
- Noise limitations on vehicle idling are also included, consistent with Env-A 1102.02 (Idling Limitations for Motor Vehicles). Additionally, limitations to the degree practicable on loudspeaker use, vehicle idling and other high decibel noises are also recommended, consistent with the Town of Hudson Noise Ordinance (Chapter 249 of the Hudson Town Code). Electric vehicles will be used in the parking fields to temporarily store trailers, further reducing noise levels in compliance with the Town Code.

8.0 SUMMARY AND CONCLUSION

LE has analyzed critical aspects to the overall design of the Project to assess whether there are impacts to wildlife habitat within the District as required by the criteria established by the Wetlands Ordinance. As demonstrated above, there will be no significant impacts to important wildlife habitat. Further, concerns related to habitat connectivity, sound, lighting and specific wildlife species have been addressed and fully mitigated. The portions of the District within the maintained golf course do not significantly contribute to wildlife habitat function within the Property currently. Elsewhere, the proposed Project will generally impact forested uplands and wetlands that are common throughout the Property and region. These impacts are largely unavoidable as safe and effective access to the Property is required and there are no impacts to unique or rare wildlife habitat types. Establishing CEs on the land on the eastern part of the Property surrounding Limit Brook and the Shoreland Protection Zone associated with the Merrimac River on the western part of the Property will preserve the most ecologically significant resources on the Property. Excluding the access roads this totals more than 90-acres along the eastern portion of the Property and 26-acres along the Merrimac River. The extent of the proposed easement will encompass nearly the entirety of the Limit Brook wetland corridor.

With regard to the preservation of more unique and valuable habitat, the individual habitat types impacted are not generally critical to the survival of wildlife or to the maintenance of existing diversity, nor do they represent Exemplary Natural Communities. The 2020 Highest Ranked Wildlife Habitats by Ecological Condition indicated that the Property is not located within a Highest Ranked Habitat in New Hampshire or within a Highest Ranked Habitat in the Biological Region, nor is it within a Supporting Landscape indicated on this map.

Section 334.33.D. of the Wetlands Ordinance states that, in part, “...the wetlands and buffers in the Town of Hudson are a valuable natural resource requiring careful management to maintain their usefulness to public health, safety and welfare. The Town of Hudson finds that wetlands and buffers:....(4) Preserve and protect important wildlife habitat and maintain ecological balance...”.

As demonstrated above, the Project avoids and minimizes impacts to land situated within the District. The proposed activity will have no significant negative environmental impact to abutting or downstream properties and/or hydrologically connected water and/or wetland resources. The applicant has also demonstrated that the use will not significantly interfere with wildlife habitat.

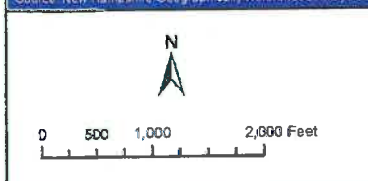
LE does not anticipate that the impacts to the resource areas will cause any impairment of the capacity of these wetland resource areas to provide important wildlife habitat functions. The work at the impact areas will not substantially reduce the Property’s overall capacity to provide important wildlife habitat functions (e.g. shelter, food, breeding areas) given the significant restoration of habitat and large expanse of the areas that will be subject to the proposed CE within the eastern portion of the Property and along the Merrimac River. Furthermore, the Property does not contain any specified habitats of any rare, threatened, or endangered species of wildlife.



SECTION II – FIGURES



Source: New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT) Web Mapping Services



USGS Map
Hudson Logistics Center
Steele Road
Hudson, New Hampshire

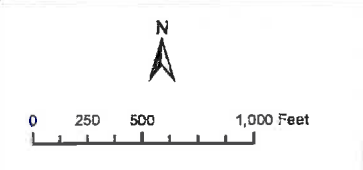
FIGURE 1



LUCAS
 ENVIRONMENTAL, LLC



Source: New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT) Web Mapping Services



Aerial Map
Hudson Logistics Center
Steele Road
Hudson, New Hampshire

FIGURE 2

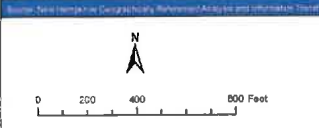


LUCAS
 ENVIRONMENTAL, LLC



Legend

Vegetative Cover: Type	9: Wetland: Shrub Swamp
1: Upland Forest: Oak	10: Wetland: Emergent Marsh
2: Upland Forest: Mixed Oak-Maple-Pine	11: Wetland: Open Water (Limit Brook)
3: Upland Forest: Red Maple	12: Wetland: Former Beaver Impoundment
4: Upland Forest: White Pine	13: Knotweed Infestation
5: Upland Forest: Sugar Maple/Ash	14: Golf Course: Man Made Pond
6: Upland Forest: Riparian Zone	15: Golf Course: Wooded Area
7: Early Successional Field/Shrubland	16: Golf Course
8: Wetland: Red Maple Swamp	Vernal Pool



Vegetative Cover Type Map
Hudson Logistics Center
Steele Road
Hudson, New Hampshire

2020 NH WILDLIFE HABITAT LAND COVER

-  Coastal Island/Rocky coast
-  Dune
-  Salt marsh
-  Peatland
-  Marsh and Shrub wetland
-  Northern or Temperate Swamp
-  Floodplain Forest
-  Grassland
-  Pine barren
-  Cliff or Talus slope
-  Rocky ridge
-  Alpine
-  High-elevation Spruce-fir
-  Low-elevation Spruce-fir
-  Northern hardwood-conifer
-  Appalachian oak-pine
-  Hemlock-hardwood-pine
-  Open Water
-  Sand/Gravel
-  Developed Impervious
-  Developed or Barren
-  Conservation or public land

Base map data provided by NH GRANIT at UNH May 2020. Intended for planning use only.

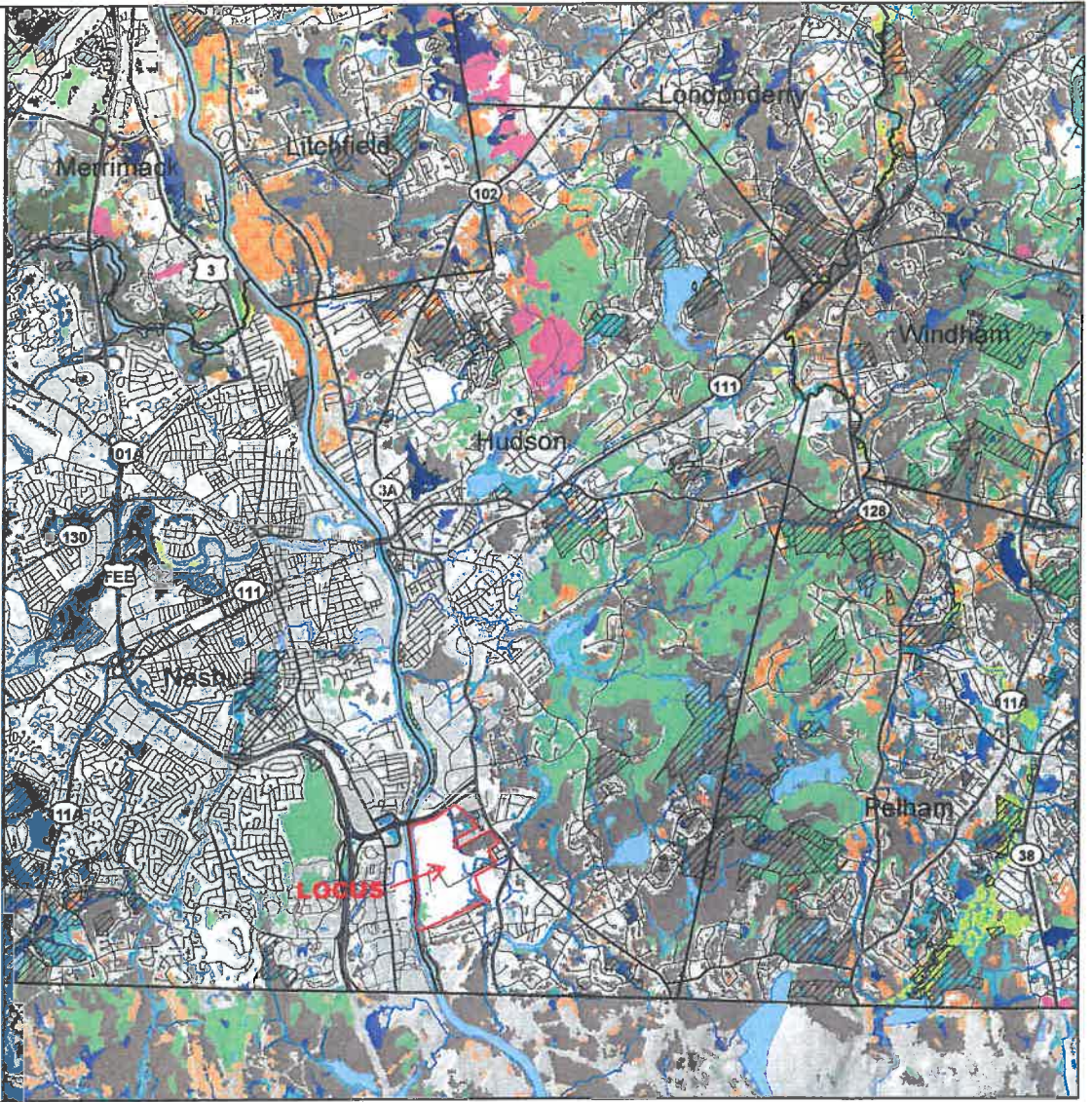


NEW HAMPSHIRE
Wildlife Action Plan

Sept. 2015, spatial data Apr. 2020

0 2 4 Kilometers

0 1 2 Miles



2020 HIGHEST RANKED WILDLIFE HABITAT BY ECOLOGICAL CONDITION

- Highest Ranked Habitat in New Hampshire
- Highest Ranked Habitat in the Biological Region
- Supporting Landscapes
- Conservation or public

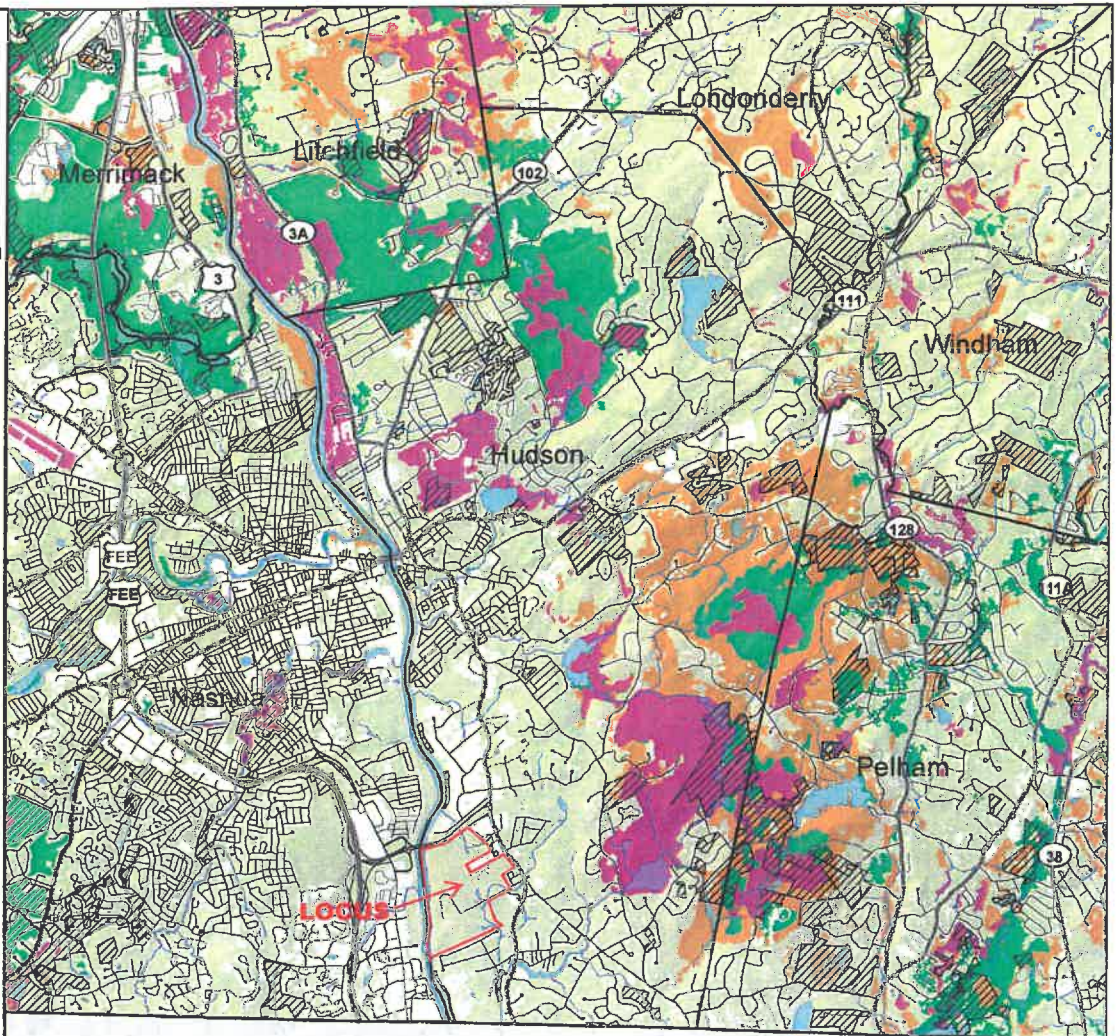
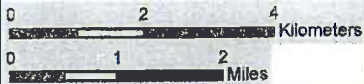
Biological region = TNC ecoregional subsection for terrestrial habitats or Aquatic Resource
Mitigation region for wetlands and floodplain forest.

Base map data provided by NH GRANIT at UNH May 2020. Intended for planning use only.



**NEW HAMPSHIRE
Wildlife Action
Plan**

Sept. 2015, spatial data Apr. 2020





SECTION III – APPENDICES

EXPECTED WILDLIFE SPECIES MATRIX



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Amphibians						
Spotted Salamander (<i>Ambystoma maculatum</i>)	Mesic woods. semi-permanent water (pH 7-9) for breeding.	8,14	8,9,14	1,2,3,5,6		
Red-spotted Newt (<i>Notophthalmus v. viridescens</i>)	Water with aquatic vegetation for adult newt.	8,10,11,14	8,10,11,14	8,11,14		
Redback Salamander (<i>Plethodon cinereus</i>)	Logs. stumps, rocks. etc.	1,2,3,4,5,6,8	1,2,3,4,5,6,8	1,2,3,4,5,6		
Four-toed Salamander (<i>Hemidactylium scutatum</i>)	Wet woodlands.	8,9	8,9	1,2,3,5,6,8		
Northern Two-lined Salamander (<i>Eurycea bislineata</i>)	Streams for breeding.	6,8,9	6,8,9	6,8,9		
Eastern American Toad (<i>Bufo americanus</i>)		8,9,10,11,14	8,9,10,11,14	1,2,3,5,8		X
Northern Spring Peeper (<i>Hyla crucifer</i>)	Pools for breeding.	8,9,10,11,14	8,9,10,11,14	7,8,9		
Gray Treefrog (<i>Hyla versicolor</i>)	Seeps, aquatic sites for breeding.	6,8,9,10,11,14	6,8,9,10,11,14	1,2,3,8		X
Bullfrog (<i>Rana catesbeiana</i>)	Deep permanent water with floating and emergent vegetation.	10,11,14	10,11,14	11,14		X
Green Frog (<i>Rana clamitans melanota</i>)	Riparian habitat.	9,10,11,14	9,10,11,14	11,14		X
Wood Frog (<i>Rana sylvatica</i>)	Vernal woodland pools. Backwaters of slow moving stream.	8,9,14	8,9,14	8,9,10		
Pickerel Frog (<i>Rana palustris</i>)	Shallow. clear water of bogs or woodland streams.	6,8,9,10	6,8,9,10	10,11,14		



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Reptiles						
Common Snapping Turtle (<i>Chelydra serpentina</i>)	Aquatic habitat, sandy or gravelly soil or banks.	10,11,14	10,11,14	10,11,14		
Stinkpot (<i>Sternotherus odoratus</i>)	Permanent water bodies. Entirely aquatic except when laying eggs.	11	11	11		
Eastern Painted Turtle (<i>Chrysemys picta</i>)	Ponds with projecting or floating logs.	10,11,14	10,11,14	11		X
Northern Water Snake (<i>Nerodia sipedon</i>)	Branches, logs overhanging water, or boulders of dams and causeways in reservoirs.	10,11,14	10,11,14	8,9,10		
Northern Brown Snake (<i>Storeria dekayi</i>)		1,2,3,4,5,6,7,8,9	1,2,3,4,5,6,7,8,9	1,2,3,4,5,6,7,8,9		
Northern Redbelly Snake (<i>Storeria o. occipitamaculata</i>)		1,2,3,4,5,6,7,8	1,2,3,4,5,6,7,8	1,2,3,4,5,6,7,8		
Eastern Garter Snake (<i>Thamnophis sirtalis</i>)		1,2,3,4,5,6,7,8	1,2,3,4,5,6,7,8	1,2,3,4,5,6,7,8		
Eastern Ribbon Snake (<i>Thamnophis sauritus</i>)	Mesic woodlands with aquatic habitat.	8,9,10,11,12	8,9,10,11,12	8,9,10,11,12		
Northern Ringneck Snake (<i>Diadophis punctatus edwardsi</i>)	Mesic areas with abundant cover.	1,2,3,4,5,6,8	1,2,3,4,5,6,8	1,2,3,4,5,6,8		
Eastern Milk Snake (<i>Lampropeltis t. Triangulum</i>)	Slash, woodpiles, debris or loose soil for egg laying.	1,2,3,4,5,6,7,8	1,2,3,4,5,6,7,8	1,2,3,4,5,6,7,8		



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Birds						
American Bittern (<i>Botaurus lentiginosus</i>)	Undisturbed tall marsh vegetation.	9,10	9,10			
Great Blue Heron (<i>Ardea herodias</i>)	Tall trees. Undisturbed traditional rookery.	12	9,10,11			X
Green-backed Heron (<i>Butorides striatus</i>)		9,10,11	9,10,11			X
Canada Goose (<i>Branta canadensis</i>)		10,	10,15			
Wood Duck (<i>Aix sponsa</i>)	Trees at least 16" dbh with large cavities and 4" diameter entrance holes.	1,2,3,6,8,11,12,14	1,2,3,6,8,11,12,14			
American Black Duck (<i>Anas rubripes</i>)	Wooded wetlands, stream banks (inland).	8,10,11	8,10,11			
Mallard (<i>Anas platyrhynchos</i>)		8,10,11,14	8,10,11,14			X
Hooded Merganser (<i>Lophodytes cuculiatius</i>)	Undisturbed wooded areas with cavity trees (15" dbh min.); clear fresh water.	8,11,12	8,11,12			
Turkey Vulture (<i>Cathartes aura</i>)	Forest clearings.	1,2,3,5,6	16			
Osprey (<i>Pandion haliaetus</i>)	Clear lakes, rivers containing fish. Elevated nest sites.	6	6,11			
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	Large, undisturbed water bodies containing fish. Large living trees near shore.	6	6,11	6	6	
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	Extensive undisturbed open mixed woodlands.	1,2,3,4,5,6,8	1,2,3,4,5,6,8	1,2,3,4,5,6,8	1,2,3,4,5,6,8	



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Cooper's Hawk (<i>Accipiter cooperii</i>)		1,2,3,4,5,6,8	1,2,3,4,5,6,8	1,2,3,4,5,6,8	1,2,3,4,5,6,8	X
Red-shouldered Hawk (<i>Buteo lineatus</i>)	Cool, moist, mature forest. Wooded wetlands.	8	7,8,15			
Broad-winged Hawk (<i>Buteo platypterus</i>)	Extensive woodlands with roads or clearings.	1,2,3,4,5,6	1,2,3,4,5,6			
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	Mature forest-field ecotone.	1,2,3,4,5,6,8,15	1,2,3,4,5,6,8,15,16	1,2,3,4,5,6,8,15,16	1,2,3,4,5,6,8,15,16	X
Ruffed Grouse (<i>Bonasa umbellus</i>)	Fallen logs amidst dense saplings.	2,7	2,7	2,7	2,7	
Wild Turkey (<i>Melagris gallopavo</i>)	Open, mast-producing woodlands, large conifers for roosting, woodland clearings.	1,2,4	1,2,4,15,16	1,2,4	1,2,4,15,16	
King Rail (<i>Rallus elegans</i>)	Stable water levels.	9,10	9,10,14			
Virginia Rail (<i>Rallus limicola</i>)	Wetlands with sedge and cattails.	9,10,14	9,10,14			
Killdeer (<i>Charadrius vociferus</i>)	Bare ground, sparse vegetation.	14,15,16	14,15,16			X
Spotted Sandpiper (<i>Actitis macularia</i>)		6,10	6,10			
Wilson's Snipe (<i>Gallinago delicata</i>)	Moist organic soils, low scattered vegetation, bogs, swamps, large open spaces.	9,10,12	9,10,12			
American Woodcock (<i>Scolopax minor</i>)	Fertile moist soil containing earthworms, clearings and dense swales.	7,9,10,12	7,9,10,12			
Rock Dove (<i>Columba livia</i>)		16	16	16	16	



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Mourning Dove (<i>Zenaidra macroura</i>)	Open land with bare ground.	15,16	15,16	15,16	15,16	X
Black-billed Cuckoo (<i>Coccyzus erythrophthalmus</i>)	Low dense thickets.	7	7			
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)	Low dense thickets.	7,9,15	7,9,15			
Eastern Screech-Owl (<i>Otus asio</i>)	Cavity trees (12" DBH minimum).	1,2,3,6,8,12,15	1,2,3,6,8,12,15	1,2,3,6,8,12,15	1,2,3,6,8,12,15	
Great Horned Owl (<i>Bubo virginianus</i>)	Large abandoned hawk nests. large tree cavities.	1,2,3,4,5,8	1,2,3,4,5,8	1,2,3,4,5,8	1,2,3,4,5,8	
Barred Owl (<i>Strix varia</i>)	Cool, damp lowlands; cavity trees with minimum dbh of 20".	1,2,3,8	1,2,3,8	1,2,3,8	1,2,3,8	
Northern Saw-whet Owl (<i>Aegolius acadicus</i>)	Cavity trees with minimum dbh of 12" near forest clearings.	1,2,3,4,5,6,8	1,2,3,4,5,6,8	2,4	2,4	
Whip-poor-will (<i>Caprimulgus vociferous</i>)	Ungrazed woodlands with openings.	2	2			
Ruby-throated Hummingbird (<i>Archilochus colubris</i>)	Flowers, preferably red.	2,6,8,15	2,6,8,15,16			
Belted Kingfisher (<i>Ceryle alcyon</i>)	Perches over streams. ponds. banks for nest sites.	6,11	6,11			X
Red-bellied Woodpecker (<i>Melanerpes carolinus</i>)	Extensive mature woodlands with dead trees or trees with large dead limbs.	1,2,3,6,8,14,15	1,2,3,6,8,14,15,16	1,2,3,6,8,14,15	1,2,3,6,8,14,15,16	X
Yellow-bellied Sapsucker (<i>Sphyrapicus varius</i>)	Trees with minimal dbh of 10" especially aspens containing sound decayed wood.	1,2,3,5,6,8	1,2,3,5,6,8			X(sign)
Downy Woodpecker (<i>Picoides pubescens</i>)	Trees. limbs with decay column (minimum DBH 10").	2,3,6,8,12	2,3,6,8,12,15	2,3,6,8,12	2,3,6,8,12,15	X



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Hairy Woodpecker (<i>Picoides villosus</i>)	Trees, limbs with decay column (minimum DBH 10").	2,3,4,6,8,12	2,3,4,6,8,12,15	2,3,4,6,8,12	2,3,4,6,8,12,15	X
Northern Flicker (<i>Cotaptes auratus</i>)	Open areas; trees with column of decayed wood (minimum DBH 12"); forest edges.	1,2,3,4,5,6,8,12	1,2,6,15,16			X
Pileated Woodpecker (<i>Dryocopus pileatus</i>)	Mature forest; trees with column of decayed wood at least 20" DBH.	1,2,3,4,5,6,8	1,2,3,4,5,6,8	1,2,3,4,5,6,8	1,2,3,4,5,6,8	X(sign)
Eastern Wood-Pewee (<i>Contopus virens</i>)	Forest edge or open woods.	1,2,6,8	1,2,6,8			
Alder Flycatcher (<i>Empidonax alnorum</i>)	Thickets, low shrubs and clearings.	9	9			
Willow Flycatcher (<i>Empidonax traillii</i>)	Low deciduous trees and shrubs with clearings, thick hardwood seedlings.	7,9,12	7,9,12			
Least Flycatcher (<i>Empidonax minimus</i>)	Open deciduous or mixed forest, edges.	1,2,3,5,6,8,12	1,2,3,5,6,8,12			
Eastern Phoebe (<i>Sayornis phoebe</i>)	Exposed perches; cliffs or ledges in streamside clearings, woodland edges.	16	16			
Great Crested Flycatcher (<i>Myiarchus crinitus</i>)	Mature cavity trees, deciduous forest, edges.	2,3,8,12	2,3,8,12			
Eastern Kingbird (<i>Tyrannus tyrannus</i>)	Clearings, fields, orchards.	8,9,12	8,9,12			
Tree Swallow (<i>Tachycineta bicolor</i>)	Cavity trees (minimum DBH 10"): open areas, especially near water.	8,9,12	8,9,12,16			
Northern Rough-winged Swallow (<i>Stelgidopteryx serripennis</i>)		6	6			
Bank Swallow (<i>Riparia riparia</i>)	Sandy or clay banks stabilized by a grassy, overhanging top.	6	6			



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Barn Swallow (<i>Hirundo rustica</i>)	Abandoned or little-used buildings.	16	16			
Blue Jay (<i>Cyanocitta cristata</i>)		1,2,6,15	1,2,6,15,16	1,2,6,15	1,2,6,15,16	X
American Crow (<i>Corvus brachyrhynchos</i>)		1,2,3,4,5,6,8,15	1,2,3,4,5,6,8,15,16	1,2,3,4,5,6,8,15	1,2,3,4,5,6,8,15,16	X
Black-capped Chickadee (<i>Parus atricapillus</i>)	Cavity trees or stubs in small woodlands: clearings or open woodlands.	1,2,3,4,5,6,8,12,15	1,2,3,4,5,6,8,12,15	1,2,3,4,5,6,8,12,15	1,2,3,4,5,6,8,12,15	X
Tufted Titmouse (<i>Parus bicolor</i>)	Cavity trees at least 8" DBH.	3,6,8,12,15	3,6,8,12,15	3,6,8,12,15	3,6,8,12,15	X
Red-breasted Nuthatch (<i>Sitta canadensis</i>)	Cavity trees in mixed or coniferous woods (minimum DBH 12").	4	4	2,4,6	2,4,6	
White-breasted Nuthatch (<i>Sitta carolinensis</i>)	Cavity trees in hardwoods or mixed woods (minimum DBH 12").	1,2,3,4,5,6,8,12	1,2,3,4,5,6,8,12	1,2,3,4,5,6,8,12	1,2,3,4,5,6,8,12	X
Brown Creeper (<i>Certhia americana</i>)	Woodlands containing trees with sloughing or loose bark.	2,3,6,8	2,3,6,8	2,3,6,8	2,3,6,8	
Carolina Wren (<i>Thryothorus ludovicianus</i>)	Cavity trees amid brushy vegetation, thickets, swamps.	6,7,8,9,16	6,7,8,9,16	6,7,8,9,16	6,7,8,9,16	X
House Wren (<i>Troglodytes aedon</i>)	Cavity trees. Shrubs.	6,8,15,16	6,8,15,16			
Blue-gray Gnatcatcher (<i>Polioptila caerulea</i>)	An abundant supply of Arthropods	2,3,6,8,9	2,3,6,8,9			
Eastern Bluebird (<i>Sialia sialis</i>)	Low cavities, open country.	15	15			
Veery (<i>Catharus fuscescens</i>)	Moist woodlands with understory of low trees and shrubs.	8,9	8,9			



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Hermit Thrush (<i>Catharus guttatus</i>)	Coniferous or mixed woodlands with dense undergrowth.	1,2,3,4,5,6,8	1,2,3,4,5,6,8			
Wood Thrush (<i>Hyllocichla mustelina</i>)	Cool, moist, mature deciduous or mixed forest.	2,3,6,8	2,3,6,8			
American Robin (<i>Turdus migratorius</i>)		6,15	6,15,16	2,6,8,15,16	2,6,8,15,16	X
Gray Catbird (<i>Dumetella carolinensis</i>)	Shrubs, thickets in open country or forest understory.	7,9	7,9			X
Northern Mockingbird (<i>Mimus polyglottos</i>)	Low thickets: high perches ; persistent fruits.	7,9	7,9	7,9	7,9	X
Brown Thrasher (<i>Toxostoma rufum</i>)	Hardwood forest-field ecotone Open country, shrubs, trees.	7,9	7,9			
Cedar Waxwing (<i>Bombycilla cedrorum</i>)	Open deciduous and coniferous woodlands, thickets with persistent fruits (winter).	1,2,3,6,15	1,2,3,6,15	1,2,3,6,7,9,15	1,2,3,6,7,9,15	
European Starling (<i>Sturnus vulgaris</i>)	Cavity trees with 10" minimum.	12,15,16	12,15,16	15,16	15,16	X
Blue-headed Vireo (<i>Vireo solitarius</i>)	Mixed or predominantly coniferous woodland.	2,4,6	2,4,6			
Yellow-throated Vireo (<i>Vireo flavifrons</i>)	Mature deciduous forest.	1,2,3,5,6,8	1,2,3,5,6,8			
Warbling Vireo (<i>Vireo gilvus</i>)	Scattered deciduous trees, shade trees.	1,2,3,5,6,15	1,2,3,5,6,15			
Red-eyed Vireo (<i>Vireo olivaceus</i>)		1,3,5	1,3,5			
Blue-winged Warbler (<i>Vermivora pinus</i>)	Old fields with scattered shrubs and small trees.	7,9	7,9			



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Nashville Warbler (<i>Vermivora ruficapilla</i>)	Scattered trees interspersed with brush, thickets, slash.	3,7,8,9	3,7,8,9			
Yellow Warbler (<i>Dendroica petechia</i>)	Scattered small trees or dense shrubs esp. near water.	8,9	8,9			
Chestnut-sided Warbler (<i>Dendroica pensylvanica</i>)	Spouts and brush at wood margins; hardwood seedling stands.	7	7			
Black-throated Blue Warbler (<i>Dendroica caerulescens</i>)	Hardwood or mixed woodlands with well-developed understory.	1,2,3,5,6,8	1,2,3,5,6,8			
Black-throated Green Warbler (<i>Dendroica virens</i>)	Coniferous or mixed woodlands.	4	4			X
Pine Warbler (<i>Dendroica pinus</i>)	Pine forest.	4	4			X
Black-and-white Warbler (<i>Mniotilta varia</i>)		1,2,3,5,6,8	1,2,3,5,6,8			
American Redstart (<i>Setophaga ruticilla</i>)		7,9	7,9			
Ovenbird (<i>Seiurus aurocapillus</i>)		1,2,3,5,6	1,2,3,5,6			
Northern Waterthrush (<i>Seiurus noveboracensis</i>)	Cool, shaded , wet ground with shallow pools.	8	8			
Common Yellowthroat (<i>Geothlypis trichas</i>)		7,9	7,9			
Canada Warbler (<i>Wilsonia canadensis</i>)	Dense deciduous or ericaceous understory.	5,8,9	5,8,9			
Scarlet Tanager (<i>Piranga olivacea</i>)		1,2,3,5,6,8	1,2,3,5,6,8			
Northern Cardinal (<i>Cardinalis cardinalis</i>)	Thickets, vines.	1,2,7,8,9	1,2,7,8,9	1,2,7,8,9,	1,2,7,8,9	X



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Rose-breasted Grosbeak (<i>Pheucticus ludovicianus</i>)	Forest-field ecotone, thickets, sapling stands of hardwoods.	1,8,10	1,8,10			
Indigo Bunting (<i>Passerina cyanea</i>)	Forest-field ecotones.	7,9	7,9			
Eastern Towhee (<i>Pipilo erythrophthalmus</i>)	Dense, brushy understory, well-drained soils.	1,2,7	1,2,7			
American Tree Sparrow (<i>Spizella arborea</i>)	Open country, weed fields (winter).			7,9,16	7,9,16	
Chipping Sparrow (<i>Spizella passerina</i>)	Clearings with bare ground, conifers or thorny shrubs.	6,15,16	6,15,16			X
Field Sparrow (<i>Spizella pusilla</i>)	Old fields.	7	7	7	7	
Savannah Sparrow (<i>Passerculus sandwichensis</i>)	Moderate height grasses and other vegetation.					X
Song Sparrow (<i>Melospiza melodia</i>)		7,9,15,16	7,9,15,16	7,9,15,16	7,9,15,16	X
White-throated Sparrow (<i>Zonotrichia albicollis</i>)		2,3,6,8	2,3,6,7,8,9	2,3,6,8,15	2,3,6,8,15	
Dark-eyed Junco (<i>Junco hyemalis</i>)		2,4,6,7	2,4,6,7	2,4,6,7,15	2,4,6,7,15	
Red-winged Blackbird (<i>Aegialius phoeniceus</i>)	Grasslands, marshes.	9,10	9,10			
Common Grackle (<i>Quiscalus quiscula</i>)	Wet, open country. Shrub swamps. Pond edges.	9,10	9,10			
Brown-headed Cowbird (<i>Molothrus ater</i>)		1,2,3,4,6,15	1,2,3,4,6,15			X
Northern Oriole (<i>Icterus galbula</i>)	Tall scattered deciduous (preferably elm) trees.	15	15			



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Purple Finch (<i>Carpodacus purpureus</i>)	Coniferous trees.	4	4			
House Finch (<i>Carpodacus mexicanus</i>)	Open ground with low seed-producing plants.	15,16	15,16	15,16	15,16	
Pine Siskin (<i>Carduelis pinus</i>)	Conifers.			4	4	
American Goldfinch (<i>Carduelis tristis</i>)	Open, weedy fields with scattered small trees.	7,9,14	7,9,14	7,9,14	1,9,14	X
Evening Grosbeak (<i>Coccothraustes vespertinus</i>)	Spruce and fir forest (breeding season). In winter, box elders and other maples, also fruiting shrubs.			2,4,6	2,4,6	
House sparrow (<i>Passer domesticus</i>)		16	16	16	16	
Mammals						
Virginia Opossum (<i>Didelphis virginiana</i>)	Log or tree cavity.	1,2,3,4,5,6,8,12	1,2,3,4,5,6,8,12	1,2,3,4,5,6,8,12	1,2,3,4,5,6,8,12	
Masked Shrew (<i>Sorex cinereus</i>)	Damp woodlands, ground cover.	3,6,8	3,6,8	3,6,8	3,6,8	
Smoky Shrew (<i>Sorex fumeus</i>)	Loose damp leaf litter.	3,5,6,8	3,5,6,8	3,5,6,8	3,5,6,8	
Northern Short-tailed Shrew (<i>Blarina brevicauda</i>)	Low vegetation, damp, loose leaf litter.	3,6,8,9,10	3,6,8,9,10	3,6,8,9,10	3,6,8,9,10	
Hairy-tailed Mole (<i>Parascalops breweri</i>)	Loose, moist, well-drained soil.	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	X
Star-nosed Mole (<i>Condylura cristata</i>)	Wet muck, humus.	8,9,10,11,12	8,9,10,11,12	8,9,10,11,12	8,9,10,11,12	



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Eastern Cottontail (<i>Sylvilagus floridanus</i>)	Brush piles, stone walls, dens or burrows; herbaceous and shrubby cover.	7,9	7,9	7,	7,	X
Showshoe Hare (<i>Lepus americanus</i>)	Dense brushy or softwood cover	7,9	7,9	7,9,4	7,9,4	
Eastern Chipmunk (<i>Tamias striatus</i>)	Forest edge or shrub cover, elevated perches, logs.	1,2,6,15	1,2,6,15	1,2,6,15		X
Woodchuck (<i>Marmota monax</i>)	Open land.	1,2,6,15	1,2,6,15	1,2,6,15		X
Gray Squirrel (<i>Sciurus carolinensis</i>)	Tall trees for dens or leaf nests.	1,2,6,15	1,2,6,15	1,2,6,15		X
Red Squirrel (<i>Tamiasciurus hudsonicus</i>)	Woodlands with mature trees, conifers preferred.	2,4	2,4	2,4		
Southern Flying Squirrel (<i>Glaucomys Volans</i>)	Mature woodland with cavity trees; favors cavities with entrance diameters of 1.6 to 2 inches.	1,2,3,5,6,12	1,2,3,5,6,12	1,2,3,5,6,12	1,2,3,5,6,12	
Northern Flying Squirrel (<i>Glaucomys sabrinus</i>)	Mature trees, cavities for winter dens; arboreal lichens.	1,2,3,5,6,12	1,2,3,5,6,12	1,2,3,5,6,12	1,2,3,5,6,12	
Beaver (<i>Castor canadensis</i>)	Woodland streams. Lack of disturbance.	8,9,11,12	8,9,11,12	8,9,11,12	8,9,11,12	X(sign)
White-footed Mouse (<i>Peromyscus leucopus</i>)		1,2,3,4,5,6,7,8,9	1,2,3,4,5,6,7,8,9	1,2,3,4,5,6,7,8,9	1,2,3,4,5,6,7,8,9	
Southern Red-backed Vole (<i>Myodes gapperi</i>)	Springs, brooks, seeps, bogs, debris or slash cover.	3,4,8	3,4,8	3,4,8	3,4,8	
Meadow Vole (<i>Microtus pennsylvanicus</i>)	Herbaceous vegetation, loose organic soils.	7,9	7,9	7,9	7,9	
Woodland Vole (<i>Microtus pinetorum</i>)	Ground cover of leaves or grass; moist well-drained soils.	1,2,3,5,7,9	1,2,3,5,7,9	1,2,3,5,7,9	1,2,3,5,7,9	



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Muskrat (<i>Ondatra zibethicus</i>)	Wetlands with dense emergent vegetation, stable water levels.	10,11,14	10,11,14	10,11,14	10,11,14	
Southern Bog Lemming (<i>Synaptomys cooperi</i>)	Moist soils.	8,9,10	8,9,10	8,9,10	8,9,10	
Norway Rat (<i>Rattus norvegicus</i>)	Buildings, dumps or loose soil for burrows near food supply.	16	16	16	16	
House Mouse (<i>Mus musculus</i>)	Buildings in winter.	16	16	16	16	
Meadow Jumping Mouse (<i>Zapus hudsonius</i>)	Herbaceous ground cover, loose soils.	9,10	9,10	9,10		
Woodland Jumping Mouse (<i>Napaeozapus insignis</i>)	Moist, cool woodland, loose soils, herbaceous cover; no WF – hibernates.	3,6,9	3,6,9	3,6,9		
Porcupine (<i>Erethizon dorsatum</i>)	Rock ledges or den trees.	2,4,6	2,4,6	2,4,6	2,4,6	
Coyote (<i>Canis latrans</i>)		7,9,10,15,16	7,9,10,15,16	7,9,10,15,16	7,9,10,15,16	X (scat)
Red Fox (<i>Vulpes vulpes</i>)		1,3,7,15,16	1,3,7,15,16	1,3,7,15,16	1,3,7,15,16	
Gray Fox (<i>Urocyon cinereoargenteus</i>)	Hollow logs. Tree cavities. Rock crevices.	7,9	7,9	7,9	7,9	
Raccoon (<i>Procyon lotor</i>)	Hollow trees. Dens usually located 10 ft. or more above ground.	8,11,16	8,11,16	8,11,16	8,11,16	
Fisher (<i>Martes pennant</i>)	Hollow trees, logs.	2,7	2,7	2,7	2,7	
Ermine (<i>Mustela erminean</i>)		7,9	7,9	7,9	7,9	



EXPECTED WILDLIFE SPECIES MATRIX

SPECIES	IMPORTANT HABITAT NEEDS	B	BF	W	WF	OBS
Long-tailed Weasel (<i>Mustela frenata</i>)		6,8,9	6,8,9	6,8,9	6,8,9	
Striped Skunk (<i>Mephitis mephitis</i>)		16	16	16	16	
River Otter (<i>Lutra canadensis</i>)	Body of water such as stream, pond, lake, river.	8,11,12	8,11,12	8,11,12	8,11,12	
Bobcat (<i>Felis rufus</i>)	Rock ledges, under windfalls or in hollow logs.	7	7	4	4	
White-tailed Deer (<i>Odocoileus virginianus</i>)	Softwood yarding cover in North.	1,2,3,7,8,9	1,2,3,7,8,9	1,2,3,4,8	1,2,3,4,8	X(sign)

B = Breeding Habitat; BF = Feeding Habitat in Breeding Season; W = Overwintering Habitat; WF = Overwintering Feeding Habitat; OBS = Species Observed During Evaluation

Note: The species listed above may occur within the Study Area, based upon their natural history and observations. No detailed observations have been made, other than those listed in the main evaluation narrative.



APPENDIX B

PHOTOGRAPHIC DOCUMENTATION

PHOTOGRAPHIC DOCUMENTATION

DATE: September 2, 3 and 11, 2020



Photograph 1: Forested upland vegetation typical of Habitat Area 1.



Photograph 2: Forested upland vegetation typical of Habitat Area 2.

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Photograph 3: Forested upland vegetation in Habitat Area 3, note large woody debris on ground.



Photograph 4: Forest vegetation typical of Habitat Area 3.

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Photograph 5: Forested upland vegetation typical of Habitat Area 4.



Photograph 6: Large sugar maple in Habitat Area 5.

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Photograph 7: Upland riparian habitat along the Merrimack River typical of Habitat Area 6, note vegetation overhanging the water.



Photograph 8: Dense shrub and sapling vegetation within Habitat Area 7.

PHOTOGRAPHIC DOCUMENTATION

DATE: September 2, 3 and 11, 2020



Photograph 9: PFO vegetation typical of Habitat Area 8.



Photograph 10: PSS/EM vegetative cover typical of Habitat Area 9.

PHOTOGRAPHIC DOCUMENTATION

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Photograph 11: PEM vegetative cover typical of Habitat Area 10.



Photograph 12: Open water typical of Habitat Area 11 Limit Brook impoundments.

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DATE: September 2, 3 and 11, 2020



Photograph 13: Habitat Area 12 high snag density within a drained beaver impoundment.



Photograph 14: Typical Japanese knotweed dominated area of cover type 13.

PHOTOGRAPHIC DOCUMENTATION

DATE: September 2, 3 and 11, 2020



Photograph 15: Typical golf course constructed pond water feature of Habitat Area 14.



Photograph 16: Typical vegetation of isolated fairway wooded areas, cover type 15.

PHOTOGRAPHIC DOCUMENTATION

DATE: September 2, 3 and 11, 2020



Photograph 17: Fairway trees typical of cover type 16.



Photograph 18: Upland meadow vegetation typical of cover type 16.

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DATE: September 2, 3 and 11, 2020



Photograph 19: Area of fairway rough in foreground typical of cover type 16.



Photograph 20: Example of snags with cavities, an important habitat feature that is relatively common at the Study Area.

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Photograph 21: Snag adjacent to old field/young woods habitat providing a perch for a red tailed hawk.



Photograph 22: Undercut banks habitat feature along unnamed perennial stream on northern portion of the site.



Photograph 23: Large trees, such as this red oak, are relatively common at the site, particularly for oaks, white pine and red maple.



Photograph 24: Acorns (hard mast) produced by the numerous oaks at the site are an important food source for many wildlife species.

PHOTOGRAPHIC DOCUMENTATION

DATE: September 2, 3 and 11, 2020



Photograph 25: Small mammal borrows, such as this woodchuck burrow, are common at the site.



Photograph 26: Dense shrub cover present within both wetlands and uplands at the site provide cover for a variety of wildlife species.



Photograph 27: Large woody debris on the ground is a common habitat feature within wooded areas of the site.



Photograph 28: Streams and ponds and associated mud flat areas provide feeding habitat for a variety of wildlife, such as this green heron.

PHOTOGRAPHIC DOCUMENTATION

DATE: September 2, 3 and 11, 2020



Photograph 29: Isolated golf course ponds provide feeding habitat for a variety of wildlife, such as this great blue heron.



Photograph 30: Several potential vernal pools were observed within forested wetland areas at the site.

PHOTOGRAPHIC DOCUMENTATION

DATE: September 2, 3 and 11, 2020



Photograph 31: Large trees with large cavities can provide important habitat for a variety of wildlife.



Photograph 32: Eroded sandy banks along the Merrimack River may provide habitat for species such as bank swallows, although none were observed.

PHOTOGRAPHIC DOCUMENTATION

DATE: September 2, 3 and 11, 2020



Photograph 33. Trees and branches overhanging the Merrimack River can provide perching habitat for birds such as kingfishers and bald eagles, although neither of these was observed at the site.



Photograph 34: Two large river birch trees were observed within the Study Area along the bank of the Merrimack River.



APPENDIX C

QUALIFICATIONS

CURTIS R. YOUNG
Senior Consultant

EDUCATION

Syracuse University

B.S. in Forestry

State University of New York, College of Forestry

B.S. in Forest Zoology/Botany

M.S. program in Forest Zoology/Botany

Cornell University

M.S. in Fisheries Science/Animal Behavior

Hazardous Materials and Site Investigations - OSHA 29 CFR 1910.120

Society of Wetland Scientists Professional Wetland Scientist #651

New Hampshire Certified Wetland Scientist #139

TECHNICAL SOCIETIES

American Association for the Advancement of Science

American Fisheries Society

Society of Wetland Scientists (Active Member)

Association of Massachusetts Wetland Scientists (Active Member)

New Hampshire Association of Natural Resource Scientists (Life Member)

PROFESSIONAL EXPERIENCE

Lucas Environmental LLC, March 2020 to date

My Young provides consulting services to Lucas Environmental LLC on topics relating to wetland science, rare species studies, wildlife habitat evaluations, invasive plant control, ecological studies and site permitting.

Wetlands Preservation, Inc., 1986 to 2020

As President and Senior Consultant of WPI, Mr. Young provided consulting services in the evaluation and mitigation of industrial and residential development impacts on wetland resources. Mr. Young was involved in providing consulting services on WPI projects in Massachusetts, New Hampshire, Maine, Michigan, Ohio and Pennsylvania. Typical projects involved activities related to wetland delineation, site survey reports, rare species and wildlife habitat evaluations, evaluation of fisheries impacts, rare species impact mitigation plans, invasive species control plans, site design review and impact mitigation, site permitting, replacement wetland design and landscaping, and construction monitoring. Mr. Young also performed site reviews to assess site wetland problems, site design options and development and permitting strategies. He also participated in presentations to regulatory commissions and agencies and in provision of expert testimony on environmental-related issues. He has served on the MassDEP technical committee developing the current wildlife habitat evaluation protocol and currently serves on the Mass Home Builders Public Policy Committee and the National Association of Industrial and Office Properties (NAIOP) Environmental Committee and the DEP subcommittee to develop revised buffer zone regulations.

Stone & Webster Engineering Corporation, 1973 to 1987

Senior Scientist

Mr. Young held a variety of increasingly responsible positions with SWEC. Prior to leaving SWEC, he was the Project Manager for a 250-person engineering support team (including environmental services) on a large power facility in Connecticut. Previous to this position, he held the position of Regional Manager in the Worldwide Business Development Department.

Before joining Marketing and Project Management, Mr. Young was a Senior Environmental Scientist in the Environmental Engineering Division where he was responsible for planning and executing investigations at large industrial and commercial project sites for site selection and pre- and post-operational environmental impact studies. He was involved in providing environmental consulting services throughout the United States.

He managed both aquatic and terrestrial ecology studies and was the acting Supervisor of SWEC's Socioeconomic and Land Planning Group. He was active in the development of conceptual designs for fish protection devices in hydroelectric facilities and cooling water intake structures and their impact on the environment. He was responsible for the preparation of pertinent sections of environmental reports and other federal and state permit applications and has presented expert testimony regarding site selection and environmental impacts before federal, state and local commissions.

Ichthyological Associates, Newbold Island, NJ, 1971 to 1973
Research Biologist

In the position of Research Biologist, Mr. Young was in charge of ichthyoplankton, wetland and terrestrial ecology studies conducted as a basis for the environmental impact evaluation of Newbold Island Power Generating Station. The studies involved sampling with standardized methodologies to evaluate the qualitative and quantitative ecology of the early development stages of the fishes in the upper estuary of the Delaware River. Studies were also conducted of the wetland and terrestrial habitats of areas in the vicinity of the proposed facility which might be impacted by its development.

Cornell University, Department of Natural Resources, 1969 to 1971

While a graduate student, Mr. Young was a Research Assistant, Teaching Assistant, and New York State Biological Aide. The emphasis of his work was on anadromous rainbow trout behavior research involving a fish passage facility, an artificial spawning and incubation channel, and several lake and stream sampling studies designed to assess the population dynamics of Cayuga Lake rainbow trout. An M.S. thesis on the ecology of young pumpkinseed sunfish was accepted for a degree confirmed in January 1971.

State University of New York, College of Forestry, 1968 to 1969

As a Graduate Teaching Assistant, Mr. Young assumed primary responsibility for directing, organizing, and teaching laboratories in Limnology and General Zoology and participated in research studies on larval fish of Oneida Lake, New York, funded by the National Science Foundation.

U.S. Department of Agriculture, Northeast Forest Experiment Station, 1966

As a Statistical Clerk and Forest Surveyor, Mr. Young compiled data for the Northeastern Pulpwood Reports and Forest Inventory Surveys. Experience gained in forest survey techniques, aerial photograph interpretation and forest-type mapping.

Joseph H. Orzel, PWS

Project Manager | Professional Wetland Scientist
Land Development & Permitting

Biography

Joseph Orzel is a Professional Wetland Scientist (PWS) and has assisted clients with environmental permit issuance at the federal, state, and local levels since 1994. He routinely conducts wetland delineations and identification of regulated wetland resource areas, as well as natural resource site assessments, wildlife habitat assessments, and has conducted fisheries research and radio-telemetry. Joe's project experience ranges from construction, planting, and monitoring of wetland restoration/replication areas to environmental and construction monitoring. Joe is also experienced in vernal pool evaluations, and performs peer reviews of permit applications for various municipalities. His technical expertise includes wetland delineation, wildlife habitat evaluations, vernal pool surveys, and rare species work.

Joe has knowledge in a variety of ecological disciplines including wetland ecology, biology, Geographic Information Systems (GIS), and wildlife biology. He is experienced in regulatory disciplines, specifically the Massachusetts Wetlands Protection Act (WPA), Massachusetts Environmental Policy Act (MEPA), Massachusetts Endangered Species Act (MESA), Section 401 and 404 of the Clean Water Act, National Pollution Discharge Elimination System (NPDES) program, and the Natural Heritage & Endangered Species Program (NHESP).

Professional Experience

Wetland Delineation and Permitting

Joe has routinely worked on projects that included wetland delineation and permitting under local, state, and federal regulations for commercial, residential, and industrial projects. Site development issues have included rare species work, wetland restoration and mitigation plans, vernal pool assessments, and balancing the needs and concerns of local, state, and federal agencies.

Wetland Replication and Restoration

Over the course of his career Joe has been involved in a variety of projects requiring wetland compensatory mitigation, and has designed and supervised the construction of a number of wetland restoration and replication areas. This includes one of the first wetland replication areas (possibly the first) to be certified as a vernal pool by the Massachusetts Natural Heritage and Endangered Species Program.

Wildlife Habitat Evaluation

Joe has conducted numerous wildlife habitat evaluations in wetlands as well as in uplands and regularly conducts both Simplified and Detailed Wildlife Habitat Evaluations as specified under the Massachusetts DEP Wildlife Habitat Protection Guidance. Often these evaluations are associated with conducting alternatives analyses in order to characterize, quantify and ultimately minimize wetland impacts, and to establish habitat replication or restoration goals when designing mitigation areas.

Peer Review – Massachusetts

Joe has assisted municipalities with review of Notice of Intent (NOI) and Abbreviated Notice of Resource Area Delineation (ANRAD) applications for compliance with the Wetlands Protection Act. Tasks often include review of resource area identification and delineation and intermittent versus perennial stream determinations. Municipalities include Beverly, Salem, Andover, Gloucester, and Wellesley, Massachusetts.

Publications

Miller, D., L. Gradischer, J. Orzel, W. Leak, and E. Miller. 1987. Changes in vegetation and breeding bird use of an Atlantic white cedar swamp from 1951 to 1984. Pages 229-231 in A.D. Laderman, ed. Atlantic white cedar wetlands. Westview Press, Boulder, CO



Education

University of New Hampshire
Masters of Science Program, Wildlife Ecology,

State University of New York College at Fredonia
Bachelors of Science, Biology

Certifications

Professional Wetland Scientist #3194
Society of Wetland Scientists

Professional Affiliations

Society of Wetland Scientists

Massachusetts Association of Conservation Commissions

Association of Massachusetts Wetland Scientists

New Hampshire Association of Natural Resource Scientists

Thomas E. Liddy, PWS, CWS

Environmental Consultant | Professional Soil Scientist
Land Development & Permitting

Biography

Thomas Liddy is a Professional and Certified Wetland Scientist (PWS/CWS) has assisted clients with environmental permit issuance at the federal, state, and local levels since 2001. He routinely conducts wetland delineations and identification of regulated wetland resource areas, as well as natural resource site assessments, including rare species surveys, wildlife habitat assessments, and terrestrial and aquatic vegetative cover type mapping. Tom's project experience ranges from siting and permitting of energy generation facilities and infrastructure, commercial development, lake and pond management and ecological and environmental monitoring. Tom is also experienced as an environmental monitor for erosion control and endangered species, and he performs peer reviews of permit applications for various municipalities. His technical expertise includes wetland delineation, soil profile descriptions, soil evaluations, terrestrial and aquatic vegetation mapping, and rare species survey and habitat assessments.

Tom has knowledge in a variety of ecological disciplines including soil science, wetland ecology, biology, Geographic Information Systems (GIS), and watershed hydrology. He is experienced in regulatory disciplines, specifically the Massachusetts Wetlands Protection Act (WPA), Massachusetts Environmental Policy Act, Massachusetts Endangered Species Act (MESA), Section 401 and 404 of the Clean Water Act, New Jersey Department of Environmental Protection (DEP) Division of Land Use Regulation Permitting, and New York State Article 7 Certificate of Environmental Compatibility and Public Need for Electric and Gas Transmission Facilities.

Professional Experience

Wetland Delineation and Permitting

Tom has routinely worked on projects that included wetland delineation and permitting under local, state, and federal regulations for commercial, residential, and industrial projects. Site development issues have included endangered species work, wetland fill and mitigation plans, work within Watershed Protection Areas, impacts to historic properties, and balancing the needs and concerns of local, state, and federal agencies.

Energy Generation and Permitting – locations throughout New England

Tom has led technical writing and permit application preparation associated with the siting and construction of energy generation facilities (fossil fuel combustion, wind generation, solar and gas storage) and linear transmission (pipelines and electrical transmission interconnections) for projects throughout New England and the Mid-Atlantic states.

Ecological Monitoring and Research

Tom has conducted and participated in numerous biological surveys, studies, and long term studies of terrestrial and aquatic ecosystems. Studies were associated with avian studies in support of wind turbine projects and of long term trends of vegetation, hydrology, water levels, and rare species in a variety of ecosystems ranging from rare Atlantic white cedar swamps to upland forests to lakes and ponds.

Peer Review – Massachusetts

Tom has assisted municipalities with review of Notice of Intent (NOI) and Abbreviated Notice of Resource Area Delineation (ANRAD) applications for compliance with the Wetlands Protection Act. Tasks often include review of resource area identification and delineation and intermittent vs. perennial stream determinations. Municipalities include Scituate, Southborough, Spencer, Marlborough, Milton, Hanover, Andover, Wellesley, Wrentham, Hopkinton, and Brookline, Massachusetts.



Education

University of Rhode Island, Bachelor of Science, Environmental Science and Management, 2001

Certifications

Professional Wetland Scientist #1723
Society of Wetland Scientists

Certified Wetland Scientist (NH) #243
Joint Board of Licensure and
Certification – State of NH

Registered Professional Soil Scientist
Society of Soil Scientists of Southern
New England

Professional Affiliations

Society of Wetland Scientists

Massachusetts Association of
Conservation Commissions

Association of Massachusetts Wetland
Scientists

Society of Soil Scientists of Southern
New England