

Habitat Fragmentation Analysis

Heritage Wind Project

Town of Barre

Orleans County, New York

Case No. 16-F-0546

Prepared by:



Environmental Design & Research,
Landscape Architecture, Engineering, & Environmental Services, D.P.C.
41 State Street, Suite 806
Albany, NY 12207
Contact: Gregory Liberman
Phone: (518) 451-9150

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

Heritage Wind, LLC (the Applicant) is proposing to construct a 184.8-megawatt (MW) wind energy facility (the Facility) in the Town of Barre in Orleans County, New York (see Figure 1). The Facility will include the construction and operation of up to 33 wind turbines, along with associated 34.5 kilovolt (kV) underground electrical collection lines, access roads, meteorological towers, an operation and maintenance (O&M) building, and a temporary construction staging/laydown area. These turbines and related facilities will be sited on privately-owned leased land within an approximately 5,800-acre Facility Site (see Figure 2). The Facility's physical footprint will be substantially smaller than the Facility Site and will have only minor impacts on land use as farming, logging, and other operations will be largely unaffected. To deliver electricity to the New York State power grid, the Applicant proposes to construct a collection substation, which will "step-up" power to 115 kV, and a point of interconnection (POI) substation that will tie in with National Grid's existing Lockport-Mortimer 115 kV transmission line directly north of the POI substation.

1.2 PURPOSE

The purpose of this report is to summarize the methodology and findings of a habitat fragmentation analysis conducted by Environmental Design & Research, Landscape Architecture, Engineering, & Environmental Services, D.P.C. (EDR) on behalf of the Applicant in support of Exhibit 22 of the Article 10 Application prepared for the Facility. The specific objectives of this analysis were to: (1) quantify potential direct and indirect impacts to forest and grassland habitat resulting from construction of the proposed Facility; (2) assess potential impacts to interior forest; and (3) evaluate potential habitat fragmentation impacts to representative avian and bat species that may utilize on-site forest and grassland habitat.

2.0 METHODOLOGY

2.1 RESOURCES

Data supporting this analysis included National Land Cover Database (NLCD) data developed by the Multi-Resolution Land Characteristics (MRLC) consortium (Yang et al., 2018), shapefiles demarcating the geographic locations of all Facility components and areas to be temporarily and permanently disturbed during construction (i.e., the limits of disturbance [LOD]), and ecological communities data prepared by EDR for Exhibit 22 of the Facility's Article 10 Application. The NLCD 2016 dataset covers the entire United States, and includes 16 different land cover classes (e.g., deciduous forest, cultivated crops) with a resolution (raster cell size) of 30 meters (Yang et al. 2018). NLCD data were used to assess direct and indirect impacts to forest and grassland habitat. Ecological community data were digitized within the Facility Site based on the system and definitions described by Edinger et al. (2014), and were used for the

interior forest impact analysis described below.¹ A Geographic Information System (GIS) was used to compile these data and perform the analyses described below.

2.2 DEFINITIONS

The following definitions were used for this habitat fragmentation analysis:

- **Fragmentation:** The process by which initially large areas of continuous habitat within a given landscape are transformed into smaller habitat areas that have an overall smaller total area. The resulting smaller habitat areas may be more isolated as a result of being disconnected from the original, larger expanse of habitat, and may not provide the same suitability to some species that utilize the habitat (Wilcove et al., 1986; Fahrig, 2003; Fischer and Lindenmayer, 2007).
- **Patch:** A continuous (and contiguous) area composed of the same type of habitat (e.g., forest, pasture, emergent wetland).
- **Forest Habitat:** Areas where tree cover is dominant. For the landscape containing the Facility Site, forest habitat corresponds to NLCD classes 41 (deciduous forest), 42 (evergreen forest), 43 (mixed forest), and 90 (woody wetlands) (Yang et al., 2018).
- **Grassland Habitat:** Areas where grasses and other herbaceous/graminoid vegetation are dominant. For the landscape containing the Facility Site, grassland habitat corresponds to NLCD classes 71 (grassland/herbaceous) and 81 (pasture/hay) (Yang et al. 2018).
- **Interior Forest:** Forest habitat areas that are more than 300 feet from the edge of a given patch (the edge is where a given patch transitions from forest to non-forest communities). Based on ecological communities identified for Exhibit 22 of the Facility's Article 10 Application, forest habitat areas include multiple Edinger et al. (2014) ecological community types within the forested uplands, terrestrial cultural, and palustrine forested mineral soil wetlands subsystems (e.g., Successional Southern Hardwoods, Pine Plantation, Silver Maple-Ash Swamp).¹

¹ Please refer to Exhibit 22 of the Facility's Article 10 Application for additional information pertaining to ecological communities.

2.3 DIRECT IMPACTS

NLCD raster data were used to represent existing (pre-construction) conditions, and assess direct impacts of the Facility on forest and grassland habitats. These data were clipped to the extent of the Facility LOD, and total acreage values were then computed for each land cover class within this area. The resulting acreage values represent the direct impacts that would result from Facility construction and installation of wind turbines, access roads, collection lines, and other components.

2.4 INDIRECT IMPACTS

NLCD raster data were also used to assess indirect impacts of the Facility on forest and grassland habitat. This analysis was conducted at the local landscape level, which was defined as all areas within 2.5 miles (4.0 kilometers) of the Facility Site (the Study Area). NLCD data were clipped to the extent of this Study Area in order to determine the total acreage of each land cover class present within the vicinity of the Facility under existing conditions at the local landscape level. In addition, another version of the NLCD raster data clipped to the Study Area was created specifically for forest impact assessment. This “combined forest” raster merged all cells classified as forest habitat (values 41, 42, 43, and 90; see Section 2.3, above) into a single class in order to accurately characterize discrete forest habitat patches.

To define the extent of potential indirect impacts within the Study Area, the Facility LOD were buffered by 300 feet (91.44 meters). This distance of 300 feet represented the estimated extent of indirect disturbance as it relates to habitat fragmentation (i.e., edge effects), and was stipulated in Section 2.22(f)(1) of the Final Scoping Statement prepared for the Facility. This indirect disturbance area was converted into raster format using a GIS, and was then overlaid with the “combined forest” raster described above. All cells within the resulting raster were reclassified into a single value, which allowed for calculation of potential temporary and permanent habitat effects. Finally, summary tables were prepared to show original and proposed land cover, as well as total habitat acreage that may be indirectly affected.

2.5 INTERIOR FOREST IMPACTS

Ecological community data prepared for Exhibit 22 of the Facility’s Article 10 Application were used to assess potential impacts to interior forest areas. EDR identified all pre-construction interior forest areas within the Facility Site by combining all ecological community types that represent forest habitat (primarily Successional Southern Hardwoods and Silver-Maple Ash Swamp) and then removing forest areas less than 300 feet from patch edges. Post-construction interior forest areas were identified by further removing forest areas that intersected the indirect disturbance area (i.e.,

areas within 300 feet of the Facility LOD). Summary tables were then created to compare anticipated changes in interior forest total acreage, patch number, and mean patch size.

3.0 RESULTS

3.1 EXISTING CONDITIONS

The Study Area representing the local landscape surrounding the Facility totals approximately 60,152 acres (94 square miles). Under existing (pre-construction) conditions, the Study Area is characterized by a mix of NLCD land cover classes; however, cultivated crops and woody wetlands are the most common. Overall, forest habitat (including woody wetlands) totals approximately 23,191 acres (38.6%) and grassland habitat totals approximately 4,714 acres (7.8%). A summary of existing land cover is presented below in Table 1. The Study Area and existing land cover are also shown in Figure 3.

Table 1. Existing Land Cover within the Study Area

Classification¹	Total Area (acres)	Percent of Study Area
Cultivated Crops	27,874.4	46.3
Woody Wetlands	17,426.8	29.0
Deciduous Forest	4,925.6	8.2
Pasture/Hay	4,662.3	7.8
Developed, Open Space	1,892.4	3.1
Emergent Herbaceous Wetlands	1,249.6	2.1
Mixed Forest	764.6	1.3
Developed, Low Intensity	704.1	1.2
Open Water	177.9	0.3
Barren Land (Rock/Sand/Clay)	172.6	0.3
Developed, Medium Intensity	96.3	0.2
Evergreen Forest	74.1	0.1
Shrub/Scrub	56.7	0.1
Grassland/Herbaceous	51.8	0.1
Developed, High Intensity	23.1	0.0
Total Forest Habitat²	23,191.0	38.6
Total Grassland Habitat³	4,714.1	7.8
Overall Total	60,152.2	100.0

¹ Based on NLCD 2016 data (Yang et al., 2018).

² Includes deciduous forest, evergreen forest, mixed forest, and woody wetlands classifications.

³ Includes grassland/herbaceous and pasture/hay classifications.

3.2 DIRECT IMPACTS

When the Facility LOD are overlaid with the NLCD dataset, direct impact areas collectively include approximately 44 acres of forest habitat and approximately 17 acres of grassland habitat (all defined as NLCD class 81 [pasture/hay]).² These direct impact acreage values represent approximately 10.7% and 4.3% of land cover within the Facility LOD, and 0.8% and 0.3% of the area within the 5,813-acre Facility Site, respectively. Within these direct impact areas, only approximately 16 acres of forest habitat and 6 acres of grassland habitat will be permanently transformed into built structures/imperious areas. Remaining direct impacts to land cover within the Facility LOD are to cultivated crops (approximately 82.0%), developed land (approximately 3.0%), and emergent herbaceous wetlands (approximately 0.1%).

3.3 INDIRECT IMPACTS

Areas within 300 feet of the Facility LOD total approximately 2,419 acres, representing the maximum potential extent of indirect fragmentation effects. As described above in Section 2.4, this disturbance area was overlaid with NLCD land cover data in order to evaluate indirect impacts to forest and grassland habitat within the Study Area. Compared to existing conditions, the Facility may indirectly affect up to 355 acres (1.5%) of forest habitat and up to 113 acres (2.4%) of grassland habitat within the Study Area (the local landscape surrounding the Facility). It is important to note that all of these potential grassland habitat impacts are to lands classified as pasture/hay, which are disturbed on a regular basis as a result of agricultural operations. No areas of NLCD grassland/herbaceous cover are present within 300 feet of the Facility LOD. Indirect impacts to forest habitat and grassland habitat are summarized below in Table 2 and shown in Figure 4.

Table 2. Indirect Impacts to Forest and Grassland Habitat

Habitat Type	Pre-construction Acreage	Post-construction Acreage	Acreage Affected ³	Percent Affected ⁴
Forest ¹	23,191	22,836	355	1.5
Grassland ²	4,714	4,601	113	2.4

¹ Includes NLCD deciduous forest, evergreen forest, mixed forest, and woody wetlands classifications (Yang et al., 2018).

² Only the NLCD pasture/hay classification is present within the acreage affected.

³ Within 300 feet of the Facility limits of disturbance.

⁴ Based on existing conditions within 2.5 miles of the Facility Site (the local landscape).

² Please note that pastureland and hayfields are disturbed on a regular basis as a result of ongoing agricultural operations (e.g., grazing by livestock, mowing multiple times during the growing season).

3.4 INTERIOR FOREST IMPACTS

Under existing conditions, the Facility Site includes approximately 492 acres of interior forest distributed among 30 discrete patches ranging from 0.009 acre to 123.9 acres in size (mean patch size of 16.4 acres). Following construction of the Facility, approximately 448 acres of interior forest will remain distributed among 31 discrete patches (mean patch size of 14.5 acres). Therefore, interior forest effects may include: (1) a loss of up to 44 acres (-8.9%) of interior forest within the Facility Site; (2) splitting of one of the existing interior forest patches to form two new, smaller patches; and (3) a decrease in mean patch size from 16.4 acres to 14.5 acres. Interior forest areas (both pre-construction and post-construction) are depicted in Figure 5.

4.0 DISCUSSION

4.1 SUMMARY OF HABITAT IMPACTS

Though the Facility will result in some impacts to forest and grassland habitat, very few of these impacts will be permanent. Specifically, only 16 acres of forest habitat and 6 acres of grassland habitat will become permanent built/imperious Facility components. Together, these permanent impacts represent approximately 0.4% of the Facility Site, and only a small fraction (0.07%) of forest and grassland habitat present within the local landscape. Therefore, the Facility will result in only minor direct permanent impacts to forest and grassland habitat, and large areas of undisturbed habitat will remain in the immediate vicinity. Furthermore, it is important to note that affected grassland habitat consists of pastures and hayfields that are already subject to frequent disturbance as a result of ongoing agricultural operations (e.g., grazing, mowing).

Similarly, indirect impacts to forest and grassland habitat are also expected to be minor. Efforts have been made during the Facility design process to locate components within previously cleared areas to the greatest extent practicable, and this is supported by the finding that only 468 of 2,419 acres (19%) within 300 feet of the Facility LOD intersect existing forest and grassland habitat areas. Based on the analysis using NLCD data, indirect impacts are expected to affect only small amounts of existing forest and grassland habitat within the local landscape. As presented above in Table 2, large areas of forest and grassland habitat will remain for continued wildlife species use.

With respect to interior forest, the Facility will not result in significant changes. As detailed above, only 8.9% of on-site interior forest will be affected. This reflects the fact the many Facility components will be located away from forested areas.

4.2 POTENTIAL FRAGMENTATION IMPACTS TO BIRDS

Though minor, the impacts described above have the potential to affect some bird species that rely on particular types of large, intact forest or grassland habitat. Many bird species are habitat generalists, and can readily utilize a variety of habitats, including those that have been previously disturbed and/or fragmented. However, a smaller number of obligate species have more specialized habitat requirements. For instance, forest interior species typically need larger, unbroken, and/or more mature wooded areas that have more consistent abiotic conditions and food resources. For these species, changes to forest patch characteristics can result in a variety of edge effects that reduce habitat suitability (Bannerman, 1998). Based on the results of pre-construction avian studies conducted for the Facility and review of multiple data sources in support of Exhibit 22 of the Facility's Article 10 Application (NYSDEC, 2007; Cornell Lab of Ornithology, 2020), the following bird species may be expected to preferentially use on-site interior forest areas (Table 3).

Table 3. List of Forest Interior Bird Species

Common Name	Family	Scientific Name
American redstart	Parulidae	<i>Setophaga ruticilla</i>
black-billed cuckoo	Cuculidae	<i>Coccyzus erythrophthalmus</i>
black-throated blue warbler	Parulidae	<i>Setophaga caerulescens</i>
black-throated green warbler	Parulidae	<i>Setophaga virens</i>
broad-winged hawk	Accipitridae	<i>Buteo platypterus</i>
brown creeper	Certhiidae	<i>Certhia americana</i>
cerulean warbler	Parulidae	<i>Setophaga cerulea</i>
hairy woodpecker	Picidae	<i>Leuconotopicus villosus</i>
hermit thrush	Turdidae	<i>Catharus guttatus</i>
hooded warbler	Picidae	<i>Setophaga citrina</i>
northern goshawk	Accipitridae	<i>Accipiter gentilis</i>
ovenbird	Parulidae	<i>Seiurus aurocapilla</i>
pileated woodpecker	Picidae	<i>Dryocopus pileatus</i>
red-bellied woodpecker	Picidae	<i>Melanerpes carolinus</i>
red-breasted nuthatch	Sittidae	<i>Sitta canadensis</i>
red-eyed vireo	Vireonidae	<i>Vireo olivaceus</i>
scarlet tanager	Thraupidae	<i>Piranga olivacea</i>
sharp-shinned hawk	Accipitridae	<i>Accipiter striatus</i>
veery	Turdidae	<i>Catharus fuscescens</i>
yellow-rumped warbler	Parulidae	<i>Setophaga coronata</i>
yellow-throated vireo	Vireonidae	<i>Vireo flavifrons</i>

Based on the habitat fragmentation analysis performed for the Facility, effects on these forest interior bird species are expected to be minimal given the relatively small amount of impact anticipated to on-site interior forests. In other words, large areas of suitable interior forest will remain following Facility construction, and will continue to support these and other bird species. Moreover, the local landscape surrounding the Facility will continue to provide thousands of acres of forest habitat, which includes substantial areas of interior forest.

Impacts to grassland bird species are also anticipated to be minor. Though some existing pastureland and hayfields will be directly and indirectly affected by Facility construction, large areas of similar habitat are present within the local landscape. Moreover, the typical suite of grassland bird species that utilize these types of open fields are continually confronted by other forms of disturbance under existing conditions (i.e., mowing, planting, grazing, mechanized vehicle use, and other activities associated with ongoing agricultural operations). Therefore, the grassland habitat areas affected by the Facility area already subject to considerable disturbance.

4.3 POTENTIAL FRAGMENTATION IMPACTS TO BATS

The forest habitat impacts described above may also have the potential to affect certain bat species that occur at the Facility Site; however, these effects are expected to be minimal based on the large amount of available, suitable habitat that will remain undisturbed. In other words, despite some direct and indirect impacts to on-site forest habitat, bat species will still have access to substantial areas of foraging and roosting habitat (habitat availability and quality are not expected to be limiting factors for any extant populations in New York). Table 4 presents a list of the bat species that may be expected to utilize forest habitat within or near the Facility Site during certain times of the year (including migratory periods, as applicable) (IUCN, 2020; NYSDEC, 2020; USFWS, 2019; USFWS, 2020).

Table 4. List of Bat Species

Common Name	Scientific Name
big brown bat	<i>Eptesicus fuscus</i>
eastern red bat	<i>Lasiurus borealis</i>
hoary bat	<i>Lasiurus cinereus</i>
little brown bat	<i>Myotis lucifugus</i>
northern long-eared bat	<i>Myotis septentrionalis</i>
silver-haired bat	<i>Lasionycteris noctivagans</i>
tricolored bat	<i>Perimyotis subflavus</i>

4.4 CUMULATIVE FRAGMENTATION IMPACTS

Given the results presented above and a review of publicly available information regarding operational wind energy projects, cumulative impacts of forest and grassland habitat fragmentation associated with the Facility and other nearby wind projects are expected to be minimal. Currently, only two operational wind projects are present in relatively close proximity to the Facility, and these are both located more than 30 miles south of the Facility Site (USGS, 2020). The first of these wind projects is the High Sheldon Wind Farm in Wyoming County, which includes 75 turbines and an installed capacity of 112.5 MW. Based on a review of current aerial orthoimagery, most of the turbines associated with this project are located within agricultural cropland (i.e., open row crop fields) or on the edges of large forest patches. Considerable areas of remaining interior forest habitat and undeveloped open fields appear to be present surrounding this facility. The second of these wind projects is the Orangeville Wind Farm in the Town of Orangeville, Wyoming County. This facility includes 52 turbines with a combined capacity of 84.2 MW. Forest impacts from the construction of this facility appear to have been somewhat greater than that of High Sheldon Wind Farm or the Facility, but considerable unbroken patches of interior forest, as well as large open fields, remain in the immediate vicinity. Therefore, wind energy projects do not appear to represent a significant contributor to forest or grassland habitat fragmentation in the vicinity of the Facility.

5.0 CONCLUSION

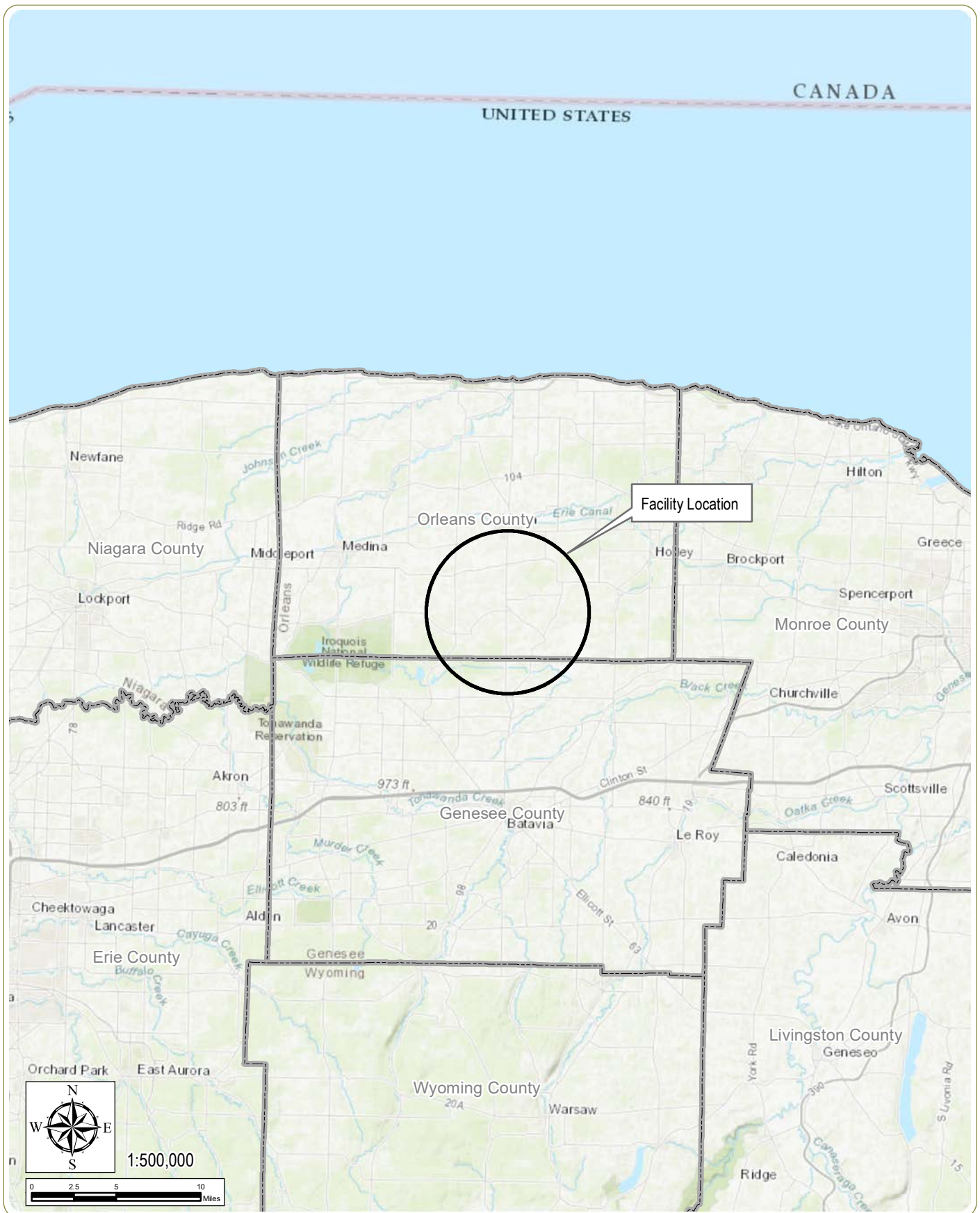
Overall, the Facility may result in some temporary and permanent impacts as a result of habitat modification associated with construction. However, direct permanent habitat loss and conversion impacts will be minimal, and indirect effects on forest and grassland habitat within 300 feet of the Facility LOD will occur within a relatively small area (particularly compared to the total habitat available in the surrounding area). Moreover, the forest and grassland habitat that may be affected is not unique or otherwise notable, and large areas of similar habitat are present within the same landscape. Therefore, habitat fragmentation impacts associated with the Facility are not expected to adversely affect local, regional, or statewide populations of any avian or bat species known or expected to occur at the Facility Site.

6.0 REFERENCES

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FIGURES



Heritage Wind Project

Town of Barre, Orleans County, New York

Figure 1: Regional Facility Location

- Notes:** 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service.
 2. This map was generated in ArcMap on February 4, 2020.
 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.



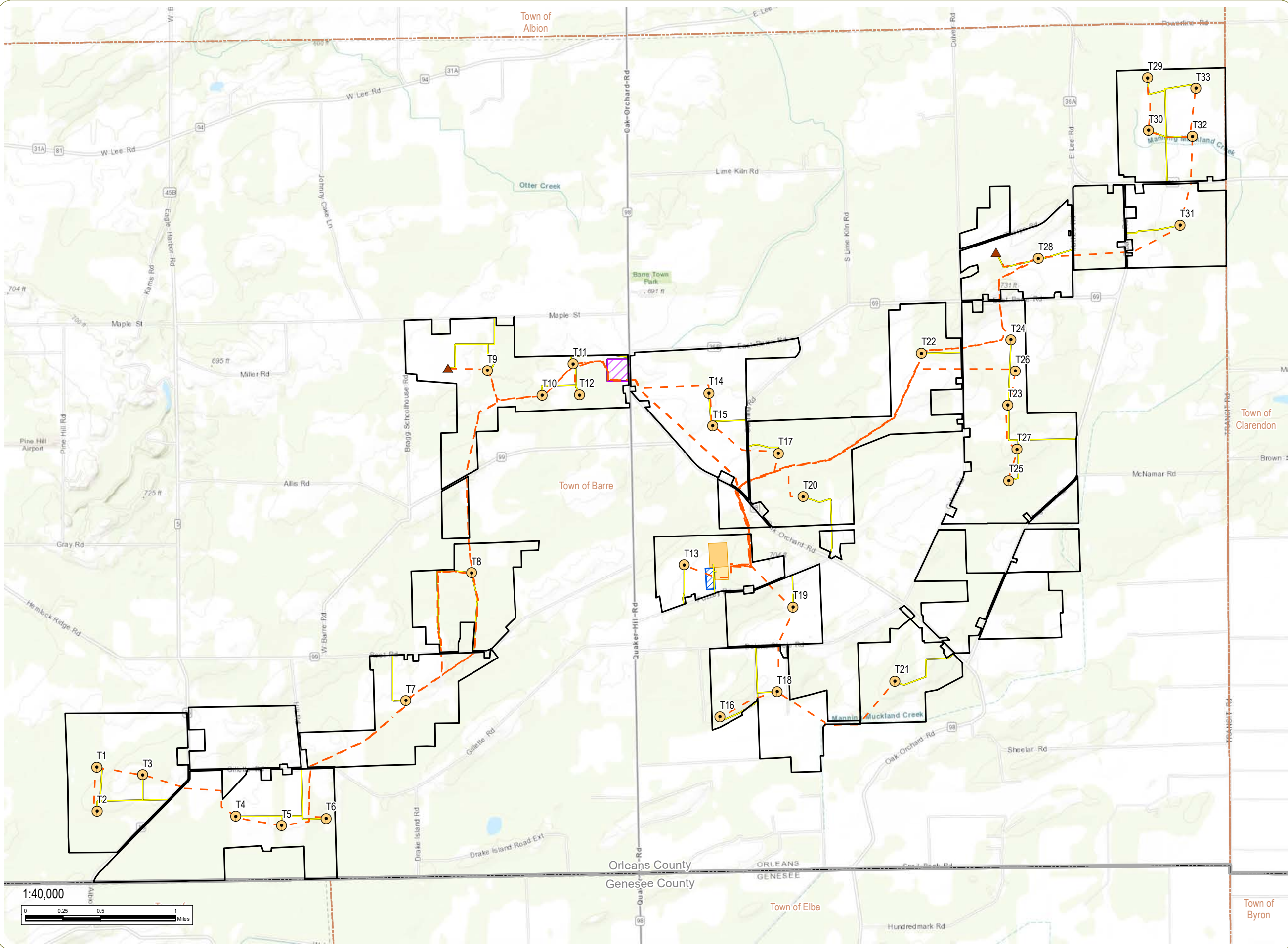
Heritage Wind Project

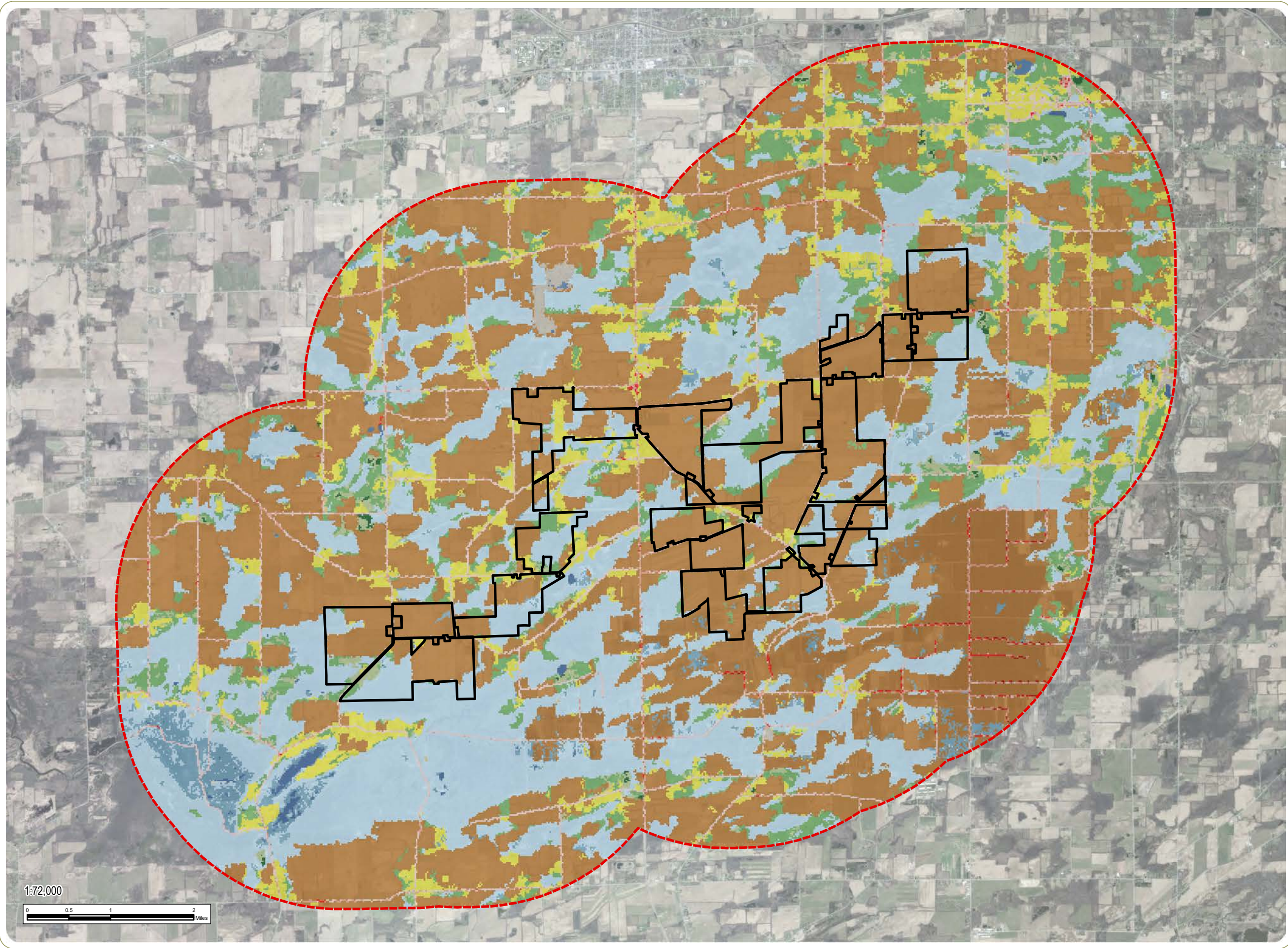
Town of Barre, Orleans
County, New York

Figure 2: Facility Layout

- Wind Turbine
- Met Tower
- Access Road
- Collection Line
- Collection Substation
- POI Substation
- O&M Building
- Laydown Yard
- Facility Site
- Town Boundary
- County Boundary

Notes: 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on February 4, 2020. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data. 4. This figure depicts preliminary turbine locations, which are subject to change.





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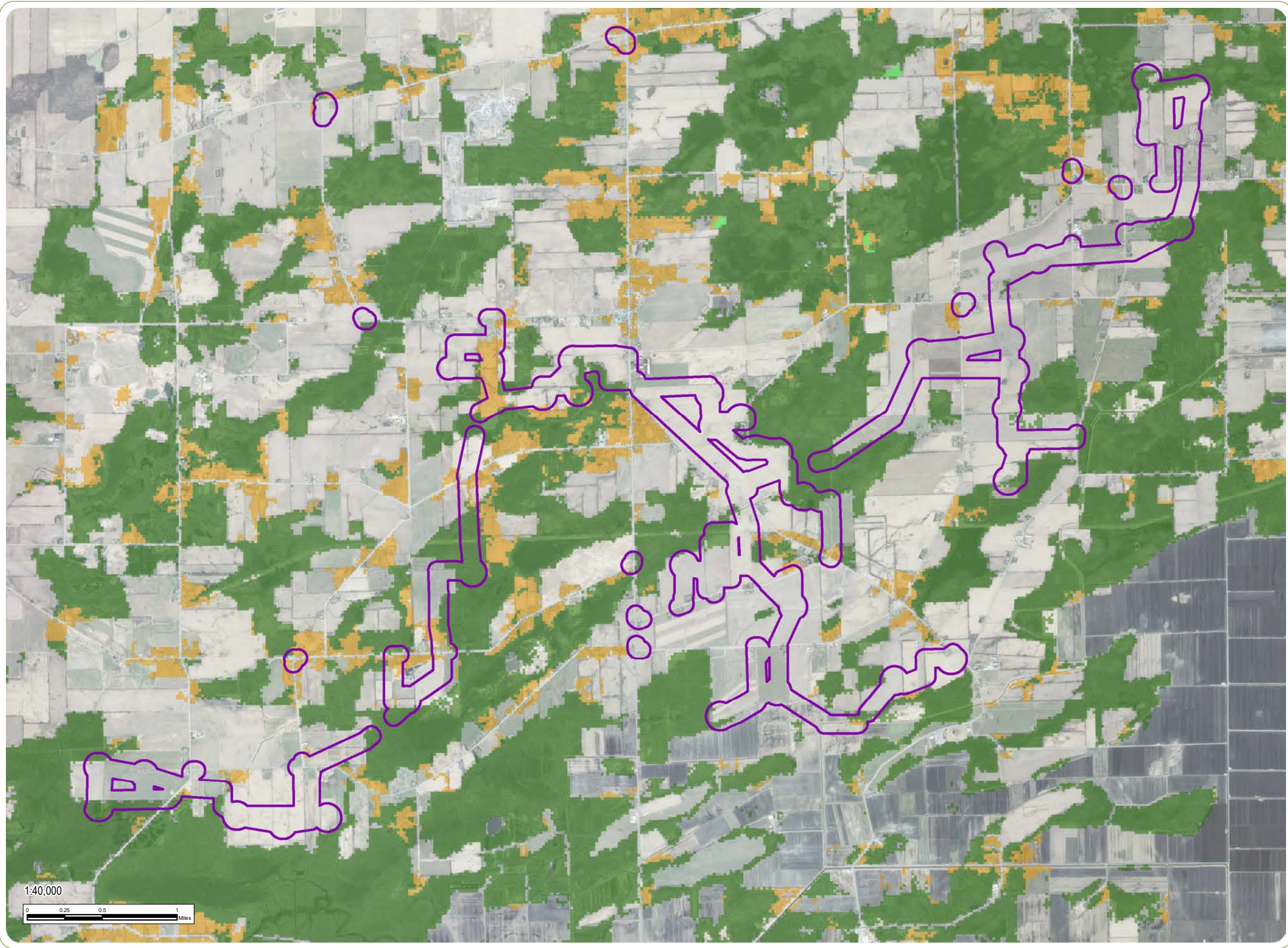
**Figure 3: Existing Land
Cover**

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land (Rock/Sand/Clay)
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands
- Facility Site
- 2.5-Mile Study Area

Notes: 1. Basemap: NYSDOP "2015" orthoimagery map service; ESRI StreetMap North America, 2012. 2. This map was generated in ArcMap on February 4, 2020. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.



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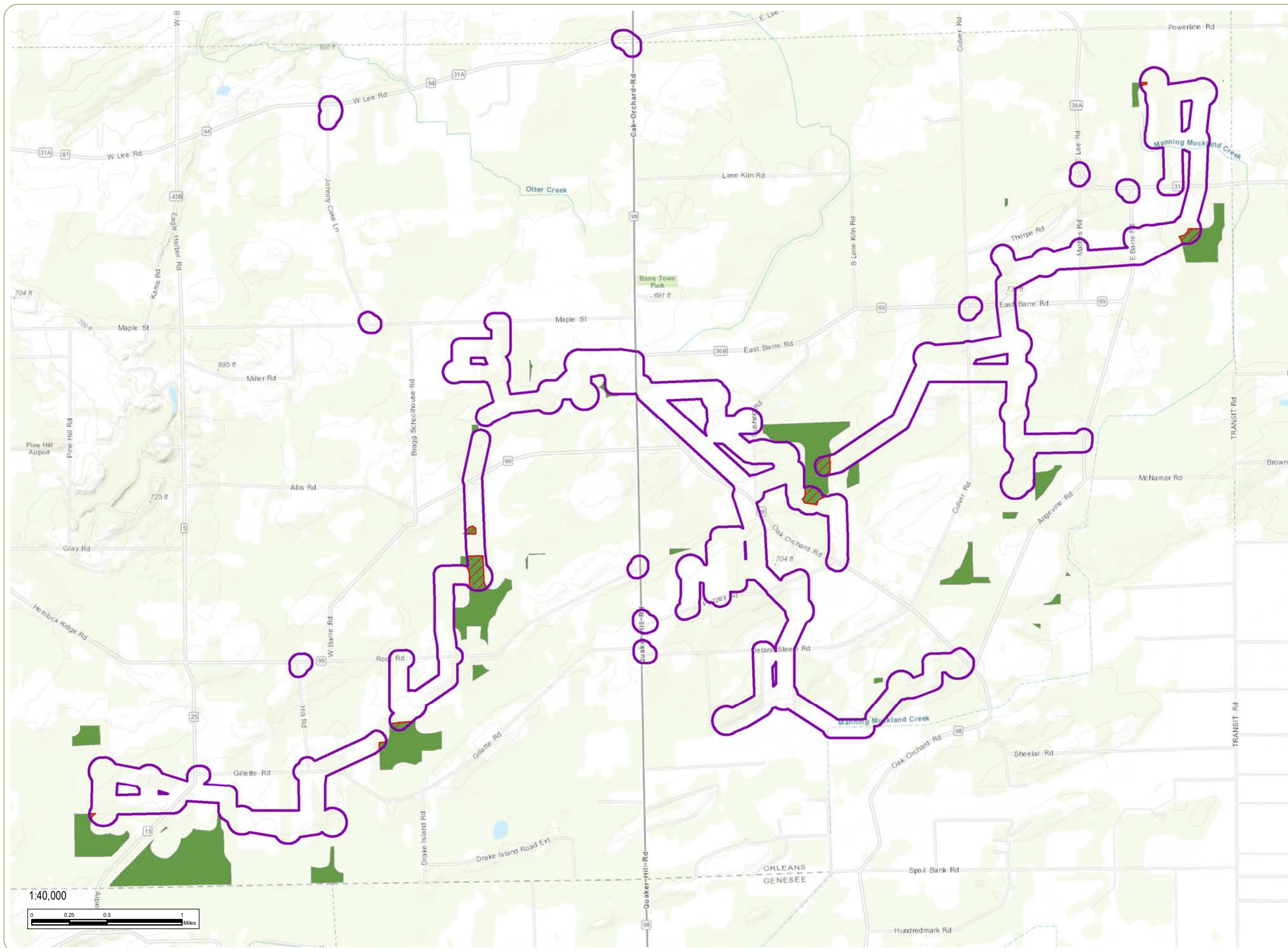
**Figure 4: Indirect Habitat
Effects**

- Forest Habitat
- Grassland/Herbaceous Habitat
- Pasture/Hay Habitat
- 300-foot Disturbance Area

Notes: 1. Basemap: NYSDOP "2015" orthoimagery map service; ESRI StreetMap North America, 2012. 2. This map was generated in ArcMap on February 4, 2020. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.






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Figure 5: Interior Forest

-  Interior Forest Impact
-  Interior Forest
-  300-foot Disturbance Area

Notes: 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service; ESRI StreetMap North America, 2012. 2. This map was generated in ArcMap on February 27, 2020. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.