Habitat Fragmentation Analysis for the High Bridge Wind Project Chenango County, New York

Report

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Appendix A. Land Use/Land Cover for the County and Local Habitat Fragmentation Analysis for the High Bridge Wind Project in Chenango County, New York.

1.0 INTRODUCTION

High Bridge Wind, LLC ("High Bridge Wind") is developing the High Bridge Wind Project in Chenango County, New York. The term "Facility" will be used to describe all project components, including wind turbines, access roads, collection lines, an operations and maintenance (O&M) facility, collection and point of interconnection (POI) substations, temporary and permanent meteorological towers, and a laydown yard. The term "Facility Site" will be used to describe all parcels upon which Facility components will be located.

The Facility will offer a number of environmental benefits, including generating electricity with zero carbon emissions; however, the construction and operation of the Facility is anticipated to cause some level of direct impact to habitat through clearing and indirect impacts to areas near clearing. The objective of this habitat fragmentation analysis is to evaluate the amount of direct forested and grassland habitat loss during construction, the level of indirect impacts in forested and grassland habitats, and the potential impacts to birds and bats.

2.0 FACILITY SITE AND FACILITY COMPONENTS

2.1 Facility Site

The Facility Site is a proposed large wind energy conversion system encompassing approximately 1,586.8 hectares (ha; 3,921 acres [ac]) in Chenango County in southcentral New York (Figure 2.1). The Facility Site lies within the Northern Allegheny Plateau Ecoregion, which is characterized by rolling hills, open valleys, and low mountains (US Environmental Protection Agency 2010). The Facility Site also falls within the New York State Department of Environmental Conservation (NYSDEC) Central Appalachians Ecological Zone of New York (Edinger et al. 2014). Elevation within the Facility Site ranges from approximately 396 meters (m; 1,299 feet [ft]) above sea level (ASL) in the lowest valley to 610 m (2,001 ft) ASL at the highest peak.

2.2 Facility Components

The Facility will include up to 25 wind turbines with a nameplate generating capacity of up to 100.8 megawatts (MW). The rotor swept height (RSH) of the largest turbine proposed for the Facility will be approximately 46-204 m (151-669 ft) above ground level. Additional Facility details can be found in Exhibit 3 of the Article 10 Application.

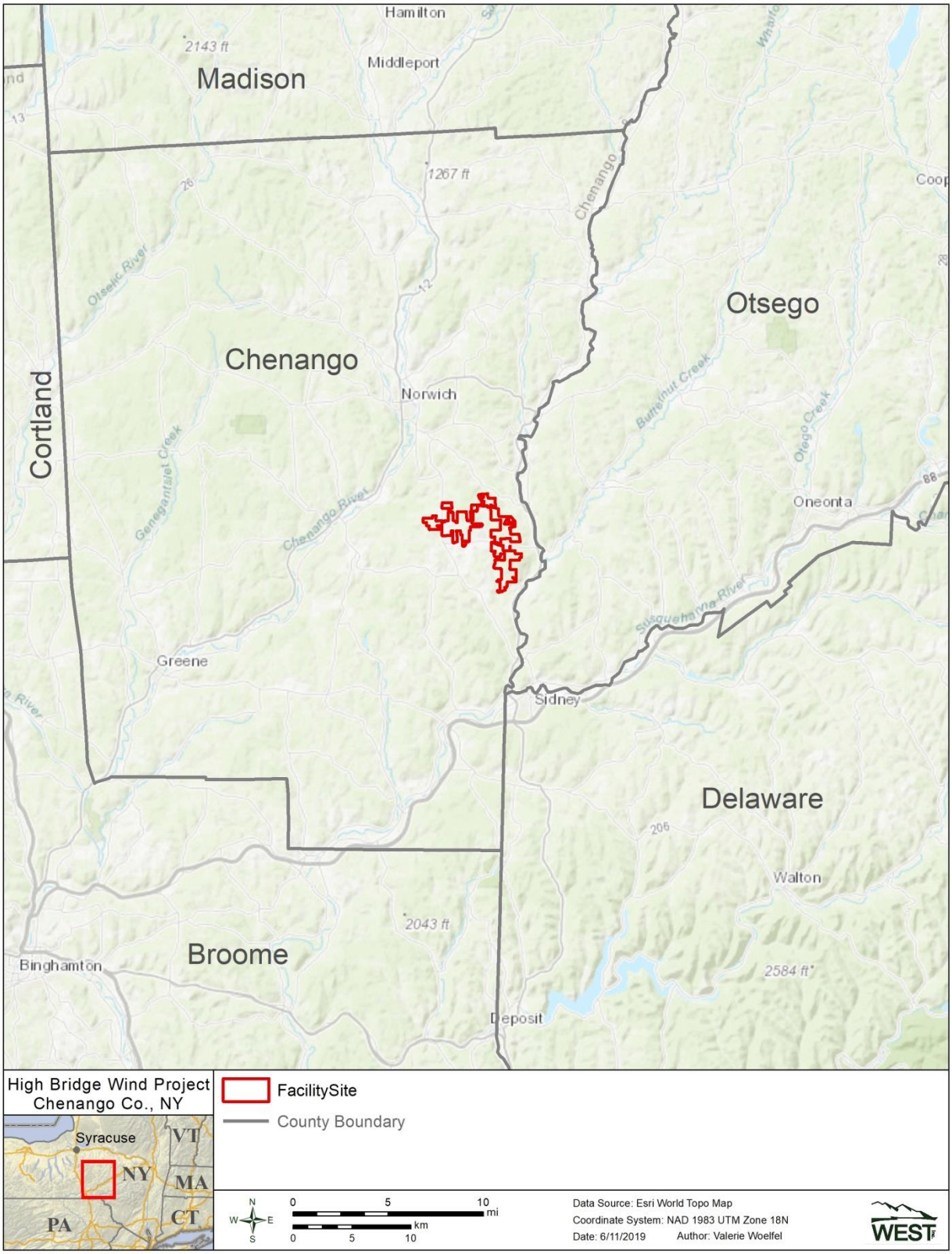

Figure 1.1. Overview of the High Bridge Wind Project, Chenango County, New York.

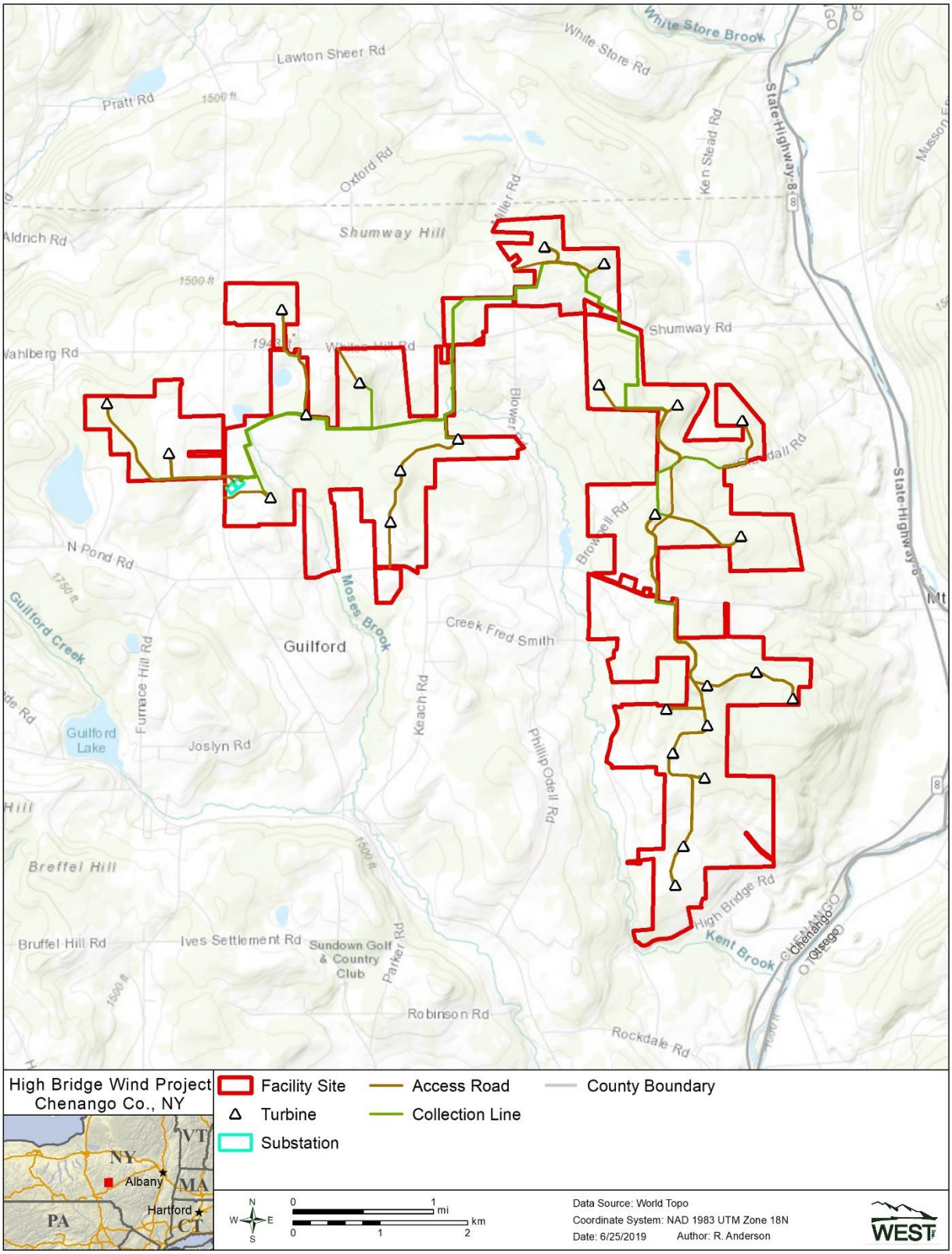

Figure 2.1. Location of the proposed High Bridge Wind Project infrastructure in Chenango County, New York.

3.0 METHODS

The National Land Cover Dataset (NLCD; US Geological Survey NLCD 2011, Homer et al. 2015) was used for land cover. Forested and grassland habitat was analyzed at the landscape level using FRAGSTATS software (McGarigal et al. 2012), utilizing pre-construction land cover (NLCD raster data) and predicted post-construction land cover (NLCD raster data with disturbance areas overlaid).

FRAGSTATS is a spatial pattern analysis program that enables the user to compute statistics which quantify and describe habitat composition and configuration. The final output consists of a suite of metrics that describe the landscape in ecologically relevant terms such as habitat fragmentation and dispersion. Each habitat metric is measured for each habitat type, and each continuous piece of habitat of the same type is defined as a patch. FRAGSTATS was utilized to quantify patterns of ecological interest in relation to patch shape, edge, isolation, and connectivity in the pre-construction landscape (NLCD data) compared to predicted pre-construction disturbance.

FRAGSTAT software was run as toolbox feature within ArcGIS 10.4 software (ArcGIS 2018). Given that user-defined inputs allow a multitude of possible metrics for any given output, only the most salient metrics for describing the landscape for the purposes of this analysis. These include: 1) the direct disturbance based upon the limits of the infrastructure (i.e., edge of access roads, boundary of turbine pads , and 2) the indirect degradation of habitat due to increased habitat edge and the division of continuous habitat. To account for direct and indirect habitat disturbance, the footprint of all Facility components was buffered by 91.44 m (300 ft). For the purpose of this analysis, this buffered area represents all displaced habitat.

Landscape analysis was conducted at the county-level (defined as Chenango County) and at the local-level (defined as a 4.0-kilometer [km; 2.5-mile {mi}]) buffer of Facility components, which extends into Otsego County, New York. Both the county-level and local-level analyses were conducted within their respective boundaries.

3.1 Habitat Metric Definitions:

- Patch: Continuous area of a given habitat type.
- Total Area: Total area of a habitat type within the county- and local-level analysis.
- Mean Patch Area: Mean area of all patches within the county- and local-level analysis.
- Percent Composition: Relative composition in relation to other habitat types (Appendix A).
- Total Edge: Total length of edge for all patches of the measured habitat (forest or grassland) within the county- or local-level.
- Edge Density: The sum of the lengths of all edge segments divided by the total landscape area: m (edge)/ha (individual habitat type) within the county- or local-level analysis.

- Clumpiness: Determines if the measured habitat (forest or grassland) is randomly distributed on the landscape (value closer to zero) or clumped together (value closer to one).
- Perimeter Area Fractal Dimension (PAFD): Measures the roughness of patches of measured habitat (forest or grassland). Higher values indicate uneven edges and lower values indicate smoother edges to habitat patches.
- Normalized Landscape Shape Index (LSI): This value is the relationship of the amount of linear edge of each patch of habitat and the amount of area within each patch. Values closer to one indicate patches with high linear edge compared to internal area (i.e., irregular shaped habitat patch) and values closer to zero indicate patches with lower linear edge compared to internal area (i.e., natural shaped habitat patch).

3.2 Habitat Types

3.2.1 Forested Habitat

The following NLCD habitat types were combined to form the forested patch classification for analysis: Deciduous Forest, Evergreen Forest, Mixed Forest (NLCD cover types 41, 42, and 43, respectively; Homer et al. 2015).

3.2.2 Grassland Habitat

The following NCLD habitat types were analyzed individually: Grassland/Herbaceous (NLCD cover type 71) and Pasture/Hay (NLCD cover type 81; Homer et al. 2015).

4.0 RESULTS

Results of the analysis show habitat impacts (direct and indirect) at the county-level and local-level due to forest and grassland habitat conversion (Figures 4.1 and 4.2). Impacts are described in the sections below.

4.1 Habitat Disturbance

The Facility Components will overlay an area of approximately 27.08 ha (66.92 ac) and a total area of disturbance (direct disturbance of components[1] plus 91.44-m [300.00-ft] buffer of indirect disturbance) of approximately 565.13 ha (1,396.46 ac; Table 4.1, Figures 4.1 and 4.2). At the county-level this will result in an approximately 0.3% loss of forested habitat and 0.2% loss of total grassland habitat (herbaceous and hay/pasture; Table 4.2). At the local-level, forested habitat and total grassland habitat will be decreased by 4.3% and 2.5%, respectively (Table 4.2). Overall habitat loss for forested and grassland habitat combined will represent a 0.3% decrease at the county-level and a 3.7% decrease at the local-level.

[1] Direct disturbance in this report was based upon the geographic information system limits of each component and is not necessarily reflective of the limits of disturbance (temporary and permanent) represented in Table 22-1 or Table 22-4 of Exhibit 22

Table 4.1. Estimated Direct and Indirect Habitat Loss at the High Bridge Wind Project, Chenango County, New York.

	Direct Disturbance[1]		Indirect Disturbance[2]	
Turbine/Infrastructure Type	**Hectares**	**Acres**	**Hectares**	**Acres**
Turbines	2.02	4.99	65.67	162.27
Access Roads/Pads	9.35	23.11	369.96	914.20
Collection Lines	9.86	24.37	516.65	1,276.67
Collector Substation	1.67	4.13	9.64	23.82
Overall3	**22.68**	**56.05**	**565.13**	**1,396.46**

[1] Direct disturbance in this report was based upon the geographic information system limits of each component and is not necessarily reflective of the limits of disturbance (temporary and permanent) represented in Table 22-1 or Table 22-4 of Exhibit 22

[2] 91.44-meter (300.00-foot) buffer

[3] Dissolved total; does not represent sum of individual infrastructure disturbances.

Table 4.2. Estimated Forested and Grassland Habitat[1] Loss at the High Bridge Wind Project, Chenango County, New York.

		Pre-Construction		Post-Construction		
Habitat Type	**Spatial Scale**	**Hectares**	**Acres**	**Hectares**	**Acres**	**Change (%)**
Forest	Chenango County	143,674.83	355,027.69	143,265.15	354,015.35	-0.3
Herbaceous	Chenango County	2,655.45	6,561.75	2,651.22	6,551.30	-0.2
Hay/Pasture	Chenango County	49,277.97	121,768.33	49,159.17	121,474.77	-0.2
Total Grassland	**Chenango County**	**51,933.39**	**128,330.08**	**51,810.36**	**128,026.06**	**-0.2**
Total Forest and Grassland	**Chenango County**	**195,608.12**	**483,357.77**	**195,075.41**	**482,041.41**	**-0.3**
Forest	Local[2]	9,958.05	24,606.63	9,548.37	23,594.50	-4.1
Herbaceous	Local[2]	186.39	460.58	182.16	450.13	-2.3
Hay/Pasture	Local[2]	4,885.20	12,071.57	4,766.40	11,778.01	-2.4
Total Grassland	**Local[2]**	**5,071.59**	**12,532.15**	**4,948.56**	**12,228.14**	**-2.4**
Total Forest and Grassland	**Local[2]**	**15,029.63**	**37,138.99**	**14,496.92**	**35,822.64**	**-3.5**

[1]US Geological Survey National Land Cover Database 2011, Homer et al. 2015.

[2]4 kilometer (2.5 mile buffer)

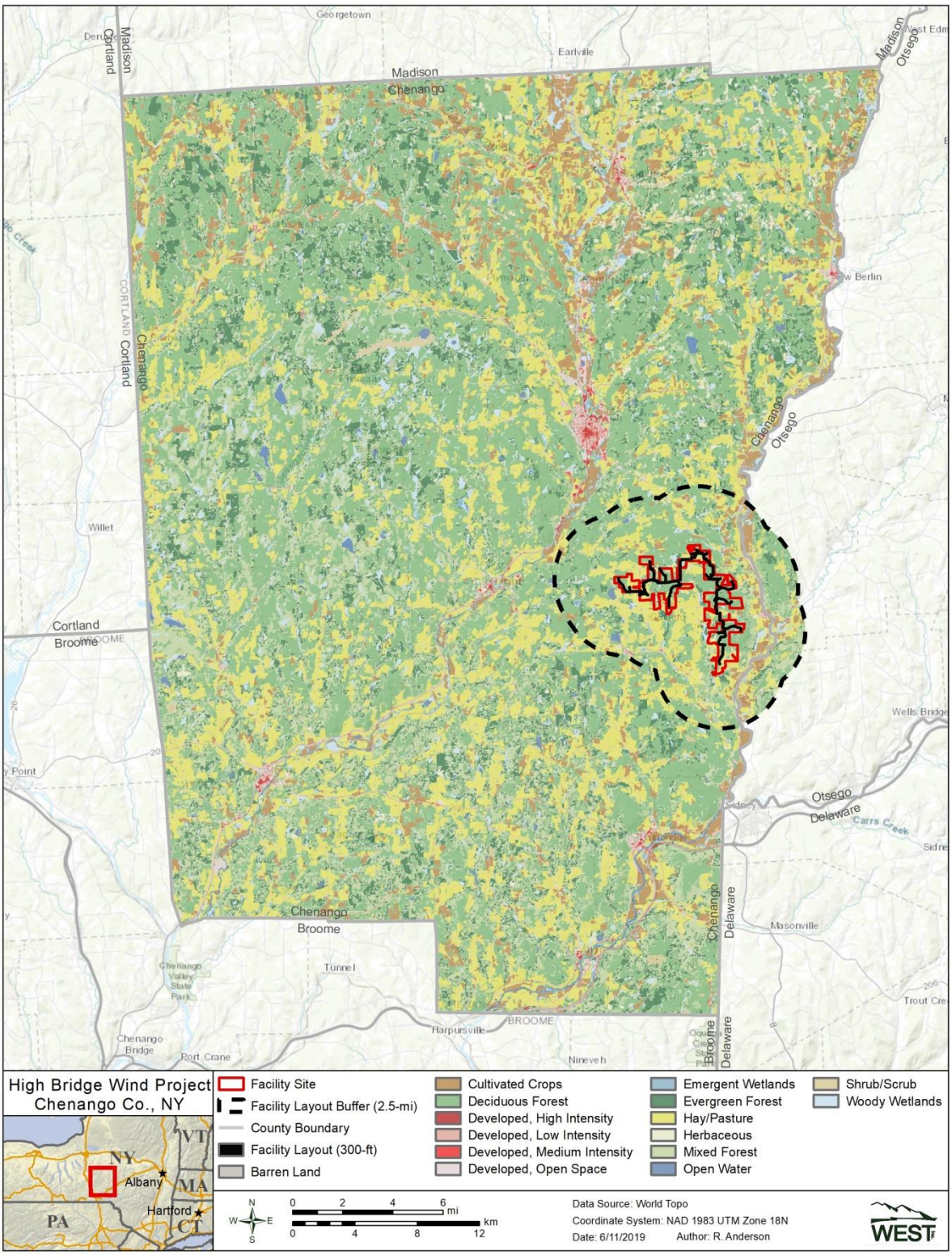

Figure 4.1. Land use/land cover with High Bridge Wind Project infrastructure, Chenango County, New York (US Geological Survey National Land Cover Database 2011, Homer et al. 2015).

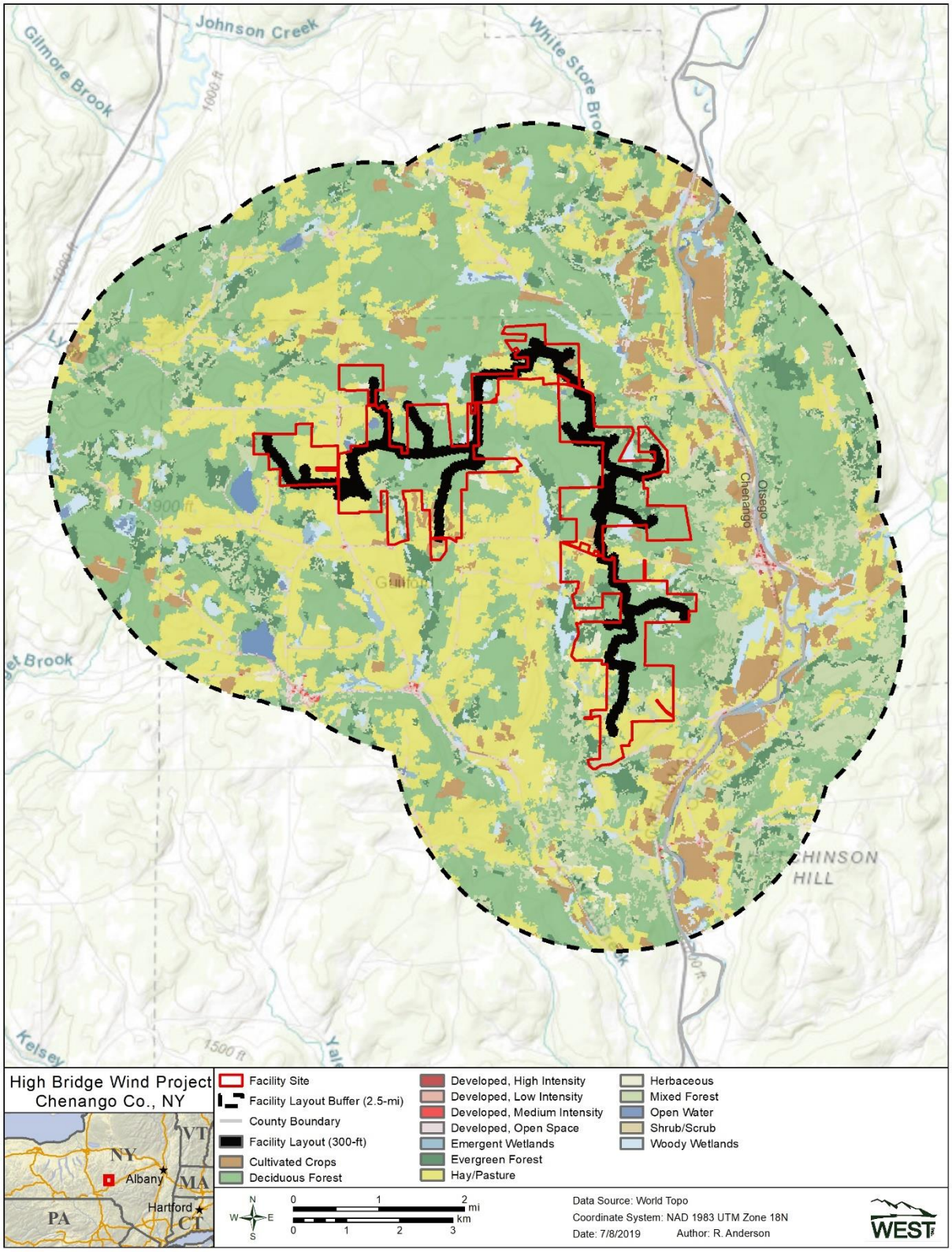

Figure 4.2. Land use/land cover and infrastructure planned for the High Bridge Wind Project, Chenango County, New York (US Geological Survey National Land Cover Database 2011, Homer et al. 2015).

4.2 Forest Habitat Composition

Mean patch area for forested patches will decrease by 1.4% at the county-level and 14.9% at the local-level (Tables 4.3 and 4.4). Relative composition of forest compared to the surrounding landscape will decrease by 0.3% at the county-level and 4.6% at the local-level. Total edge will increase by 0.2% at the county-level and 2.8% at the local-level. PAFD, clumpiness, and normalized LSI will remain the same at the county-level, while edge density will increase slightly. At the local-level, clumpiness and normalized LSI will remain the same, while edge density will increase slightly, and PAFD will decrease slightly.

Table 4.3. Predicted County-Level Forested Habitat[1] Landscape Changes at the High Bridge Wind Project, Chenango County, New York.

Habitat Metric	Before	After	Change (%)
Total Area	143,674.83ha (355,027.69. ac)	143265.15ha (354,015.35 ac)	**-0.3**
Mean Patch Area	75.94 ha (187.65 ac)	74.85 ha (184.96 ac)	**-1.4**
% Composition[2]	60.9	60.7	**-0.3**
Total Edge	12,008.46 km (7,461.71 mi)	12,033.18 km (7,477.07 mi)	**0.2**
Edge Density	50.92	51.02	
PAFD	1.44	1.44	
Clumpiness	0.84	0.84	
Normalized LSI	1.00	1.00	

[1] US Geological Survey National Land Cover database 2011, Homer et al. 2015

[2] Percentage of total landscape.

ha=hectare; ac=acres; km=kilometers; mi=miles; PAFD=Perimeter Area Fractal Dimension; LSI=Landscape Shape Index.

Table 4.4. Predicted Local Buffer (4.0 km [2.5 mi]) Forested Habitat[1] Landscape Changes at the High Bridge Wind Project, Chenango County, New York.

Habitat Metric	Before	After	Change (%)
Total Area	9,958.05 ha (24,606.84 ac)	9,548.37 ha (23,594.50 ac)	**-4.1**
Mean Patch Area	56.95 ha (140.72 ac)	48.47 ha (119.77 ac)	**-14.9**
% Composition[2]	57.2	54.6	**-4.6**
Total Edge	887.25 km (551.31 mi)	911.97 km (566.67 mi)	**2.8**
Edge Density	50.74	52.15	
PAFD	1.40	1.40	
Clumpiness	0.84	0.84	
Normalized LSI	0.09	0.09	

[1] US Geological Survey National Land Cover database 2011, Homer et al. 2015

[2] Percentage of total landscape.

ha=hectare; ac=acres; km=kilometers; mi=miles; PAFD=Perimeter Area Fractal Dimension; LSI=Landscape Shape Index.

4.3 Grassland Habitat Composition

4.3.1 Herbaceous Habitat

Mean patch area at the county-level will increase slightly by 0.1%, while percent composition, total edge, and edge density will decrease slightly (0.2%, 0.2%, and 4.61 to 4.60, respectively;

Table 4.5). County-level PAFD, clumpiness, and normalized LSI will remain the same. At the local-level, mean patch area, percent composition, total edge, and edge density will decrease (less than 0.1%; 2.3%, 2.3%, and 5.97 to 5.83, respectively; Table 4.6). PAFD decreased slightly, normalized LSI increases slightly, and clumpiness remains the same at the local-level (Table 4.6).

Table 4.5. Predicted County-level Herbaceous Habitat[1] Landscape Changes at the High Bridge Wind Project, Chenango County, New York.

Habitat Metric	Before	After	Change (%)
Total Area	2,655.45 ha (6,561.75 ac)	2,651.22 ha (6,551.30 ac)	**-0.2**
Mean Patch Area	2.45 ha (6.05 ac)	2.45 ha (6.05 ac)	**0.1**
% Composition[2]	1.1	1.1	**-0.2**
Total Edge	1,087.62 km (675.82 mi)	1,085.22 km (674.32 mi)	**-0.2**
Edge Density	4.61	4.60	
PAFD	1.46	1.46	
Clumpiness	0.69	0.69	
Normalized LSI	0.30	0.30	

[1] US Geological Survey National Land Cover database 2011, Homer et al. 2015

[2] Percentage of total landscape

ha=hectare; ac=acres; km=kilometers; mi=miles; PAFD=Perimeter Area Fractal Dimension; LSI=Landscape Shape Index

Table 4.6. Predicted Local Buffer (4.0 km [2.5 mi]) Herbaceous Habitat[1] Landscape Changes at the High Bridge Wind Project, Chenango County, New York.

Habitat Metric	Before	After	Change (%)
Total Area	186.39 ha (460.58 ac)	182.16 ha (450.13 ac)	**-2.3**
Mean Patch Area	1.41 ha (3.49 ac)	1.41 ha (3.49 ac)	**<0.1**
% Composition[2]	1.1	1.0	**-2.3**
Total Edge	104.31 km (64.82 mi)	101.91 km (63.32 mi)	**-2.3**
Edge Density	5.97	5.83	
PAFD[2]	1.65	1.63	
Clumpiness	0.58	0.58	
Normalized LSI[3]	0.41	0.41	

[1] US Geological Survey National Land Cover database 2011, Homer et al. 2015

[2] Percentage of total landscape

ha=hectare; ac=acres; km=kilometers; mi=miles; PAFD=Perimeter Area Fractal Dimension; LSI=Landscape Shape Index

4.3.2 Hay/Pasture Habitat

Mean patch area for hay/pasture will decrease by 1.1% at the county-level and 11.7% at the local-level (Tables 4.7 and 4.8). Percent composition and total edge will also decrease at the county-level (0.2% and 0.1%, respectively; Table 4.7) and local-level (2.4% and 1.0%, respectively; Table 4.8). Edge density and PAFD will decrease at both the county- and local-levels; however, there were no significant changes in the clumpiness or normalized LSI indices.

Table 4.7. Predicted County-level Hay/Pasture Habitat[1] Landscape Changes at the High Bridge Wind Project, Chenango County, New York.

Habitat Metric	Before	After	Change (%)
Total Area	49,277.97 ha (121.768.33 ac)	49,159.17 ha (121,474.77 ac)	**-0.2**
Mean Patch Area	25.89 ha (63.99 ac)	25.60 ha (63.27 ac)	**-1.1**
% Composition[2]	20.9	20.8	**-0.2**
Total Edge	9,888.09 km (6,144.17 mi)	9,878.07 km (6,137.95 mi)	**-0.1**
Edge Density	41.92	41.88	
PAFD	1.54	1.53	
Clumpiness	0.81	0.81	
Normalized LSI	0.15	0.15	

[1] US Geological Survey National Land Cover database 2011, Homer et al. 2015

[2] Percentage of total landscape

ha=hectare; ac=acres; km=kilometers; mi=miles; PAFD=Perimeter Area Fractal Dimension; LSI=Landscape Shape Index

Table 4.8. Predicted Local Buffer (4.0 km [2.5 mi]) Hay/Pasture Habitat[1] Landscape Changes at the High Bridge Wind Project, Chenango County, New York.

Habitat Metric	Before	After	Change (%)
Total Area	4,885.20 ha (12,071.57 ac)	4766.40 ha (11,778.01 ac)	**-2.5**
Mean Patch Area	30.16 ha (74.52 ac)	26.63 ha (65.80 ac)	**-11.7**
% Composition[2]	27.9	27.3	**2.4**
Total Edge	986.82 km (613.18 mi)	976.80 km (606.96 mi)	**-1.0**
Edge Density	56.43	55.86	
PAFD	1.55	1.50	
Clumpiness	0.79	0.79	
Normalized LSI	0.15	0.15	

[1] US Geological Survey National Land Cover database 2011, Homer et al. 2015

[2] Percentage of total landscape

ha=hectare; ac=acres; km=kilometers; mi=miles; PAFD=Perimeter Area Fractal Dimension; LSI=Landscape Shape Index

5.0 DISCUSSION

5.1 Site-Specific Factors

Construction of the Facility Site is anticipated to cause impacts to forest and grassland habitats; however, most impacts will be temporary. Permanent habitat loss from construction of turbines, access roads and pads, and collector lines and substation will total approximately 22.68 ha (56.05 ac), or approximately 4.0% of the anticipated temporary habitat loss (565.13 ha [1,396.46 ac]).

Although an area centered on the turbine will be temporarily cleared of vegetation during construction, the majority of the cleared area around the turbine will be revegetated, but not allowed to return to forest, with the exception of a gravel access road accessing and encircling the base of each turbine. A total of 2.02 ha (5.00 ac) will be permanently converted to gravel pads for up to 25 turbines. This may ultimately increase the herbaceous habitat type in the short-term and eventually return to forested habitat in the future depending upon High Bridge's vegetation management. Forest clearing impacts can be characterized as one of three types:

- **Permanent loss** in which forests would be replaced with built facilities (e.g., access roads, turbines)
- **Permanent conversion** in which forests would be cleared and maintained as successional communities for the life of the Facility Site (areas under the turbines, and along collection lines or access roads), and
- **Temporary impacts** in which forest would be allowed to regrow following construction (along the periphery of access roads and turbine sites). In these areas, High Bridge will only remove stumps where necessary to install underground components, will not use herbicides to prevent sprouting, and will not remove trees as part of routine vegetation management during Facility Site operation. Ecological succession would restore the forested condition of these areas over time if left unmanaged.

5.2 Habitat Metrics

At the county-level, overall habitat disturbance is predicted to be low for forested habitats (0.3% reduction) and total grassland habitats (0.2% reduction; Table 4.2). Habitat disturbance at the local-level is predicted to be slightly higher with a 4.1% reduction in forested habitat and 2.4% reduction in total grassland habitat. Details on how each habitat patch type (forested, herbaceous, and hay/pasture) is predicted to be impacted based on the measured habitat metrics are presented below (see section 3.1 for description of each metric).

5.2.1 Forest

Forested habitat composes the majority of the area at the county-level (63.0%) and local-level (58.7%; Appendix A); however, predicted forest lost due to clearing for Facility Site construction is expected to have limited functional effects to forested habitats. At the county-level there will be a minimal reduction in the mean area of all forest patches (1.4% reduction) and the relative composition of forested habitat in relation to other habitat types (0.3% reduction). There will be a slight increase in the total length of edge for all forest (0.2% increase) and edge density (50.92 m/ha to 51.02 m/ha). There will be no change to the PAFD, clumpiness, and normalized LSI indices at the county-level.

At the local-level, predicted forest loss due to clearing for Facility Site construction is expected to have relatively higher impacts than at the county-level. The mean area of forest patches will be reduced by 14.9%, relative composition of forested habitat in relation to other habitat types will be reduced by 4.6%, and total edge for all forest will increase by 2.8%. Edge density will increase from 50.74 m/ha to 52.15 m/ha and the PAFD index will decrease slightly. There will be no change in the clumpiness or normalized LSI indices at the local-level.

5.2.2 Grassland

5.2.2.1 Herbaceous

Herbaceous areas (NLCD cover type 71) are limited at both the county-level (1.2% of area) and local-level (1.1%; Appendix A) and are generally scattered on the landscape (Appendix A; Figures 4.1 and 4.2). Facility Site construction is expected to result in a limited impact to herbaceous areas at the county-level as indices such as edge density, PAFD, clumpiness, and normalized LSI will change slightly or remain unchanged between the pre-construction and predicted post-construction values. At the local-level, the mean area of herbaceous patches will decrease by less than 0.1%, while relative composition of grassland habitat in relation to other habitat types will decrease by 2.3%.

5.2.2.2 Hay/Pasture

Areas of hay/pasture compose the second most common habitat type at the county-level (21.6% of area) and local-level (28.8%; Appendix A). Similar to expected impacts to forested habitats discussed above, construction of the Facility Site is not expected to have a substantial impact on hay/pasture habitat. At the county-level there will be minimal change in the measured metrics between the pre-construction and predicted post-construction values. The local-level impacts will be relatively higher, but are also expected to be minimal. There will be a 11.7% reduction in the mean area of all hay/pasture patches and a 2.4% reduction in relative composition of hay/pasture habitat in relation to other habitat types, but all other measured metrics will only change slightly or remain unchanged between the pre-construction and predicted post-construction values.

5.3 Habitat Fragmentation Impacts to Birds and Bats

Habitat fragmentation occurs when large blocks of contiguous habitat (e.g., forest, grasslands) are divided into smaller segments, which may cause reduction of the genetic or demographic viability of the population surviving in the remaining segment (US Fish and Wildlife Service [USFWS] 2012). There is concern that site clearing, access roads, transmission lines, and turbine tower arrays may fragment continuous habitat areas into smaller patches, which is of particular concern to species that require large expanses of habitat for breeding or foraging. There is also concern that development of wind energy infrastructure may increase edge effects on some species resulting in greater susceptibility to colonization by invasive species, increased risk of predation, and increased competition for species that favor landscapes with a mosaic of vegetation (USFWS 2012). Impacts to state-listed bird and bat species from construction of the Facility Site are presented in the Net Conservation Benefit Plan (Ritzert et al. 2019).

5.3.1 Impacts to Birds

Sensitivity to habitat fragmentation varies by species. Forest interior species require large forest areas to breed successfully and maintain viable populations (Bannerman 1998). Forest interior habitat located deep within woodlands has a more stable climatic environment, provides less nest disruption, and has fewer predators than habitat near forest edges. As forests are cut, edges are created with less stable climates that are exposed to more wind, sun, and drier conditions. These areas are also more prone to disturbance and a higher number of predators than forest interiors.

Bird species that utilize forest edge are typically habitat generalists adapted to use the variety of vegetation and food resources located in the forest edge (Bannerman 1998).

Forest interior bird species are sensitive to forest fragmentation and have shown reproductive dysfunction from fragmentation (Donovan and Flather 2002, Robinson et al. 1995). Twenty-seven forest interior bird species were observed during breeding bird surveys (Table 5.1) indicating the Facility Site has suitable nesting habitat for those species. The aforementioned species should continue to find suitable nesting habitat in the Facility Site as no large-scale changes to interior forested habitats are expected (Tables 4.3 and 4.4). As expected, 95% of the recorded forest interior species were observed within forested habitats during breeding bird surveys; however, 10 of the species recorded were also recorded in non-forested habitat suggesting variation in the habitats used in the Facility Site during the breeding season.

Ground- or open-nesting species using trees or shrubs have been found to be the most sensitive to fragmentation and include several species observed during breeding bird surveys in the Facility Site (hooded warbler [*Setophaga citrina*], black-and-white warbler [*Mniotilta varia*], black-throated-blue warbler [*Setophaga caerulescens*], veery [*Catharus fuscescens*], and ovenbird [*Seiurus aurocapilla*]; Birds of North America 2018). As no large-scale changes to total grassland habitats are expected (Tables 4.5 – 4.8), those species should continue to find suitable nesting habitat.

Table 5.1. Observations of forest interior species during breeding bird surveys in the High Bridge Wind Project, May 21 – July 22, 2018.

Species		Observations
red-eyed vireo	*Vireo olivaceus*	283
ovenbird	*Seiurus aurocapilla*	242
veery	*Catharus fuscescens*	106
wood thrush	*Hylocichla mustelina*	100
black-throated blue warbler	*Setophaga caerulescens*	61
black-and-white warbler	*Mniotilta varia*	43
black-throated green warbler	*Setophaga virens*	26
American redstart	*Setophaga ruticilla*	23
scarlet tanager	*Piranga olivacea*	22
red-bellied woodpecker	*Melanerpes carolinus*	14
hermit thrush	*Catharus guttatus*	12
Blackburnian warbler	*Setophaga fusca*	11
Canada warbler	*Cardellina canadensis*	9
hooded warbler	*Setophaga citrina*	9
black-billed cuckoo	*Coccyzus erythropthalmus*	7
brown creeper	*Certhia americana*	6
red-breasted nuthatch	*Sitta canadensis*	6
pileated woodpecker	*Dryocopus pileatus*	6
ruffed grouse	*Bonasa umbellus*	5
hairy woodpecker	*Picoides villosus*	4
broad-winged hawk	*Buteo platypterus*	3
blue-headed vireo	*Vireo solitarius*	2
Louisiana waterthrush	*Parkesia motacilla*	1
northern parula	*Setophaga americana*	1
sharp-shinned hawk	*Accipiter striatus*	1
yellow-rumped warbler	*Setophaga coronata*	1

Table 5.1. Observations of forest interior species during breeding bird surveys in the High Bridge Wind Project, May 21 – July 22, 2018.

Species		Observations
yellow-throated vireo	*Vireo flavifrons*	1
Total	**27 species**	**1,005**

Whereas there is little information available on the effects of forest clearing for wind energy development to eastern forest birds, there is information on the effects of roads and powerline development on these species. For example, forest edge habitat that occurs adjacent to large clear-cuts, large transmission lines, or other large forest openings has decreased presence of forest interior bird species, but increased use by edge species. However, narrow openings, such as roads, created within larger forested areas appear to have a more limited effect with less reduction in use by forest dwelling species and no substantial reduction in nest success (King and DeGraaf 2002, Ortega and Capen 1999, Askin 1994). The primary impact from construction of the Facility Site is likely an increase in predator activity along forest edges, which may result in increased nest predation and brown-headed cowbird (*Molothrus ater*) parasitism (Kroodsma 1982, Manolis et al. 2002). However, other species that use brushy habitats or edges may be positively affected by increased edge created as a result of Facility Site construction. Considering only 4.1% of forested habitat at the local-level is expected to be cleared for construction (Table 4.2) and the landscape consists of a patchwork of forested and non-forested habitat, it is unlikely the Facility Site will cause substantial forest fragmentation impacts to bird communities.

Facility Site construction is also expected to result in a loss of 2.3% of herbaceous habitat at the local-level (Table 4.2). However, habitat fragmentation impacts to grassland birds are not expected to be substantial given the limited amount of herbaceous habitat present (1.1% of the area at the local-level), which is generally scattered throughout the Facility Site and already subjected to fragmentation from development. At the landscape level, habitats similar to those within the Facility Site are abundant within the surrounding landscape thus allowing birds to utilize these areas during construction and operation of the Facility Site.

5.3.2 Impacts to Bats

Forested fragmentation effects on bats are not well understood and effects may differ among species based upon each species' ecology (e.g., preferred prey, foraging areas, roosting needs, and flight morphology). Each bat species, except northern long-eared bat (*Myotis septentrionalis*), known to occur in Chenango County, New York is discussed below with potential impacts due to loss of forested habitat. Northern long-eared bats are discussed in the Net Conservation Benefit Plan (Ritzert et al. 2019).

5.3.2.1 Eastern Red Bat

Eastern red bat (*Lasiurus borealis*) is the most commonly captured tree bat in North America (Barbour and Davis 1969, Bishop-Boros 2014), and is assumed to be common throughout all habitats where trees are present within New York State, with the exception of highly developed urban areas (Walters et al. 2007). Forest fragmentation at the Facility Site is unlikely to have a substantial impact on the suitability of foraging or roosting habitat of this species. Based on extant

research, eastern red bats show flexibility when selecting roosts and utilize a variety of foraging habitats as long as tree stands remain within the landscape. Overall, impacts to the New York eastern red bat population due to potential habitat fragmentation and edge effects resulting from the construction of the Facility Site are unlikely.

5.3.2.2 Silver-Haired Bat

The silver-haired bat (*Lasionycteris noctivagans*) is assumed to be common throughout forested habitats within New York State and typically roosts beneath exfoliating bark or hollows of a tree in woodlands near water sources (Barbour and Davis 1969). Based on habitat requirements of the silver-haired bats and the limited amount of forested habitat affected at the local-level, it is unlikely Facility Site construction will have a direct impact on the success of the local population. Overall, impacts to the New York silver-haired bat population due to potential habitat fragmentation and edge effects resulting from the construction of the Facility Site are unlikely.

5.3.2.3 Hoary Bat

Hoary bat (*Lasiurus cinereus*) is physically the largest bat species in New York State and generally assumed to be common throughout all habitats within the state (Barbour and Davis 1969). Hoary bats are widespread and foraging patterns are not well known. Overall, impacts to the New York hoary bat population due to potential habitat fragmentation and edge effects resulting from the construction of the Facility Site are unlikely.

5.3.2.4 Little Brown Bat

As of 2013, the little brown bat (*Myotis lucifugus*) was reported to occur throughout the entire State of New York (New York Natural Heritage Program [NYNHP] 2018). Historically, the little brown bat was one of the most common and widespread bat species in North America and New York. Between 2007 and 2012, however, the state-wide species population declined 90% (NYNHP 2018) due to the effects of white nose syndrome in its most populous hibernacula. Roosting habitat for little brown bat may be directly affected in the form of tree clearing for Facility Site construction; however, potential beneficial effects to this species include an increase in foraging potential from newly formed open areas and forest edge. Overall, impacts to the New York little brown bat population due to potential habitat fragmentation and edge effects resulting from the construction of the Facility Site are unlikely.

5.3.2.5 Eastern Small-Footed Bat

Eastern small-footed bat (*Myotis leibii*) is a species of special concern in New York State. Eastern small-footed bats are typically found in heavily forested mountain regions up to 610 m (2,001 ft) in areas with talus slopes, cliffs, rock outgroups or other rocky features with abundant cracks/crevices that have a moderate to high level of solar exposure (Barbour and Davis 1969, Harvey et al. 1999, Boyles et al. 2009). No rocky or talus areas were identified in the Facility Site. Talus or rocky features formerly shaded by forest canopy cover that may become open and converted into potential roosting habitat with tree clearing from both construction and maintenance activities, may create artificial roosts for eastern small-footed bat. Overall, impacts

to the New York eastern small-footed bat population due to potential habitat fragmentation and edge effects resulting from the construction of the Facility Site are unlikely.

5.3.2.6 Tri-colored bat

Tri-colored bat (*Perimyotis subflavus*) has been confirmed present in all 62 New York State counties (NYNHP 2018). Although the tri-colored bat is common within New York State and overall region, few studies have addressed details of summer habitat requirements and behavior, especially within the State. Little is known of habitat preferences of the species in the region; however, given the extant body of knowledge of observations in other regions, it is possible the suitability of some forested habitat, namely upland forest foraging habitat and any forested riparian habitat, may be affected by Facility Site construction. Though, notably, the footprint of the Facility Site, which overlies mostly upland areas, is unlikely to impact the forested riparian areas, which typically show the most suitability for tri-colored bat maternity roost habitat. Overall, impacts to the New York tri-colored bat population due to potential habitat fragmentation and edge effects resulting from the construction of the Facility Site are unlikely.

5.3.2.7 Big Brown Bat

The big brown bat (*Eptesicus fuscus*) is among the most abundant of North American bats, and as a habitat generalist, shows perhaps the greatest tolerance for human development and disturbance than any other bat species in New York State (Barbour and Davis 1969). Edge habitat has been shown to be an important habitat feature for foraging and commuting and individuals may use linear features to navigate and orient themselves within the landscape (Verboom and Huitema 1997). Overall, impacts to the New York big brown bat population due to potential habitat fragmentation and edge effects resulting from the construction of the Facility Site are unlikely.

6.0 CONCLUSION

Construction of the Facility Site has the ability to displace wildlife, either permanently or temporarily. However, permanent habitat loss is expected to be minimal. Careful site planning has been implemented for the Facility Components so that large areas of forest and wetlands will be avoided to the extent practicable. Additionally, habitat within the Facility Site is not unique and forested and grassland habitat is present in the 4.0 km (2.5 mi) buffer and surrounding Chenango County. Thus, impacts due to habitat loss from Facility Site construction are not expected to adversely affect local populations of any resident bird or bat species.

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Appendix A. Land Use/Land Cover for the County and Local Habitat Fragmentation Analysis for the High Bridge Wind Project in Chenango County, New York.

Appendix A. Land Use/Land Cover[1] (NLCD 2011, Homer et al. 2015) for the County and Local Habitat Fragmentation Analysis for the High Bridge Wind Project in Chenango County, New York.

	County[2]			Local[3]		
Habitat	**Hectares**	**Acres**	**% Composition**	**Hectares**	**Acres**	**% Composition**
Forest (Deciduous, Mixed, and Evergreen)	143,678.52	355,036.81	63.0	9,964.44	24,622.63	58.7
Hay/Pasture	49,278.06	121,768.55	21.6	4,886.01	1,2073.58	28.8
Cultivated Crops	15,112.34	37,343.38	6.6	1,112.26	2,748.44	6.6
Developed, Open Space	6,672.82	16,488.89	2.9	397.34	981.85	2.3
Shrub/Scrub	5,211.48	12,877.84	2.3	60.32	149.04	0.4
Developed, Low Intensity	1,464.50	3,618.85	0.6	67.46	166.69	0.4
Open Water	1,666.58	4,118.20	0.7	179.32	443.11	1.1
Herbaceous	2,655.81	6,562.64	1.2	186.75	461.47	1.1
Emergent Herbaceous Wetlands	1,675.10	4,139.25	0.7	108.42	267.91	0.6
Developed, Medium Intensity	346.73	856.79	0.2	8.81	21.78	0.1
Barren Land	125.82	310.90	<0.1	0	0	0
Developed, High Intensity	101.52	250.86	<0.1	1.17	2.89	<0.1

[1] US Geological Survey National Land Cover database 2011, Homer et al. 2015

[2] Facility Site, Chenango County, and the 4 kilometer (km; 2.5 mile [mi]) buffer.

[3] Facility Site plus the 4 km (2.5 mi) buffer