Avian Risk Assessment for the High Bridge Wind Project Chenango County, New York

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TABLE OF CONTENTS

1.0 INTRODUCTION 1
2.0 FACILITY SITE AND FACILITY COMPONENTS 4
2.1 Facility Site 4
2.2 Facility Components 4
3.0 REVIEW OF PRE-CONSTRUCTION SURVEYS 7
3.1 Critical Issues Analysis 7
3.1.1 Sensitive Species Identified in the Critical Issues Analysis 7
3.1.2 Sensitive Species Identified During Follow-up Agency Correspondence 8
3.2 Pre-Construction Field Studies 8
3.2.1 Raptor Migration Surveys 8
3.2.1.1 Raptors & Vultures 9
3.2.1.2 Sensitive Species 9
3.2.2 Pre-Construction Breeding Bird Surveys 11
3.2.2.1 Sensitive Species 13
3.2.3 Eagle Use Surveys 13
3.2.3.1 Eagles 16
3.2.3.2 Raptors 16
3.2.3.3 Owls 17
3.2.3.4 Vultures 17
3.2.3.5 Sensitive Species 17
3.2.4 Raptor Nest Aerial Surveys 17
4.0 RISK ASSESSMENT 20
4.1 Construction-Related Impacts to Birds 20
4.1.1 Disturbance and Alteration of Habitat by Construction 20
4.1.2 Indirect Impacts: Disturbance or Displacement 20
4.1.3 Direct Impacts: Collision Mortality 20
4.2 Operations-Related Impacts to Birds 21
4.2.1 Indirect Impacts: Disturbance or Displacement 21
4.2.1.1 Breeding Birds 21
4.2.1.2 Waterfowl, Waterbirds, and Shorebirds 23
4.2.1.3 Raptors 23
4.2.2 Direct Impacts: Collision Mortality 24
4.2.2.1 Migratory Landbirds 24

4.2.2.2 Waterfowl, Waterbirds, and Shorebirds 25
4.2.2.3 Raptors.....26
4.2.3 Impacts to State-Threatened or Endangered Species.....27
4.2.3.1 Northern Harrier.....27
4.2.3.2 Peregrine Falcon 28
4.2.3.3 Bald Eagle 28
4.2.3.4 Golden Eagle.....31
4.2.3.5 State Species of Special Concern 32
4.2.3.6 State Species of Greatest Conservation Need.....33
4.2.3.7 Wildlife Concentration Areas 33
5.0 CONCLUSIONS 34
6.0 REFERENCES.....34

LIST OF TABLES

Table 1.1. Survey effort at the High Bridge Wind Project, Chenango County, New York. 2

Table 3.1. Federally and state-listed birds in Chenango County, New York (WEST 2016). 7

Table 3.2. Birds of Conservation Concern identified by the January 2019 US Fish and Wildlife Service Information, Planning, and Consultation report. 8

Table 3.3. Number of bald and golden eagle observations with a duration of one minute or more and eagle minutes[1] by month during eagle use surveys in the High Bridge Wind Project, Chenango County, New York, March 1, 2018 – February 10, 2019. 16

Table 4.1 Documented avian fatalities at wind energy facilities between 1997 and 2014 in the northeastern US and southern Ontario, Canada. (Note: Data represent individuals found and are not estimates of annual mortality; data were not corrected for biases related to searcher efficiency or carcass persistence). 25

Table 4.2. Seasonal raptor data (number of raptor observations per observer hour) during spring and fall 2018 for the High Bridge Wind Project, Chenango County, New York, compared to nearby HawkWatch sites[a]. 27

Table 4.1. Number of bald eagle (*Haliaeetus leucocephalus*) observations[1] and eagle minutes[2] by month during eagle use surveys at the High Bridge Wind Project March 1, 2018 – February 10, 2019. 30

Table 4.2. Number of golden eagle (*Aquila chrysaetos*) observations[1] and eagle minutes[2] by month during eagle use surveys at the High Bridge Wind Project March 1, 2018 – February 10, 2019. 32

LIST OF FIGURES

Figure 1.1 Location of the High Bridge Wind Project, Chenango County, New York. 3

Figure 2.1 Study Area, Survey area, and Facility Site boundaries for the High Bridge Wind Project, Chenango County, New York. 5

Figure 2.2 Location of the High Bridge Wind Project Facility Site and associated proposed infrastructure, Chenango County, New York. 6

Figure 3.1. Location of raptor migration survey (RMS) points within the High Bridge Wind Project, Chenango County, New York. 10

Figure 3.2. Location of the breeding bird survey (BBS) transects within the High Bridge Wind Project, Chenango County, New York. 12

Figure 3.3 Location of eagle use survey (EUS) points and 800-meter (2,625 feet) radius plots within the High Bridge Wind Project, Chenango County, New York. 15

Figure 3.4 Location of raptor nest aerial surveys within the High Bridge Wind Project and 16.1 kilometer (10.0 mile) buffer, Chenango County, New York. 19

LIST OF APPENDICES

Appendix A. List of Studies at Wind Energy Facilities in the Northeast Reporting Comparable Bird Fatality Rates and Data on Bird Species found as Fatalities

1.0 INTRODUCTION

High Bridge Wind, LLC ("High Bridge Wind") is developing the High Bridge Wind Project in Chenango County, New York (Figure 1.1). 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 offers a number of environmental benefits, including generating electricity with zero carbon emissions; however, the construction and operation of the Facility may present potential risks to birds. Per the High Bridge Wind Project Scoping Statement and Proposed Stipulations, the objective of this Avian Risk Assessment (ARA) is to evaluate the potential risk the Facility poses to birds (in particular, federal and State-listed species) as a result of:

- Habitat disturbance and alteration;
- Behavioral avoidance of turbines and other Facility components (i.e., displacement); and
- Direct collision mortality.

This ARA consists of a review of all pre-construction bird studies conducted in the Facility Site (Table 1.1) and relevant publicly available literature and sources that include the following to evaluate the risk posed by the Facility:

- New York Natural Heritage Program (NYNHP),
- US Fish and Wildlife Service Information, Planning and Consultation (IPaC) tool,
- New York Breeding Bird Atlas,
- US Geological Survey Breeding Bird Survey,
- Hawk Migration Association of North America,
- Christmas Bird Count,
- eBird,
- The Nature Conservancy (TNC),
- The Kingbird Publication, and
- Local Conservation Organizations (i.e., the Delaware-Otsego Audubon Society).

These studies follow the New York State Department of Environmental Conservation's (NYSDEC) *Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects* (Guidelines; NYSDEC 2016), which recommend that the baseline studies determine:

- The extent the proposed Facility Site is used by migrating, breeding, and wintering birds, and how the physical and biological features of the Facility Site and surrounding area may influence such use;

- The potential direct impact to birds as a result of Facility operation; and
- The potential indirect impact to birds and their habitats as a result of Facility construction and operation.

A review of the publicly available results of both the pre- and post-construction avian studies at other wind energy facilities in New York, the northeastern US, and southern Ontario, Canada, are included throughout where relevant to help assess the likely impact of the Facility.

Table 1.1. Survey effort at the High Bridge Wind Project, Chenango County, New York.

Study Type	Study Period	Reference
Critical Issues Analysis – USFWS Tier 1 Report	August 2016	WEST 2016
Pre-Construction Breeding Bird Surveys	May-July 2018	Ritzert et al. 2018
Raptor Migration Surveys	March 1-May 31, 2018 and August 15-December 31, 2018	Ritzert et al. 2019a
Eagle Use Surveys	March 2018–March 2019 (year 1)	Ritzert et al. 2019b
Raptor Aerial Nest Survey	March 16-18, 2019 and April 24, 2019	Ritzert 2019

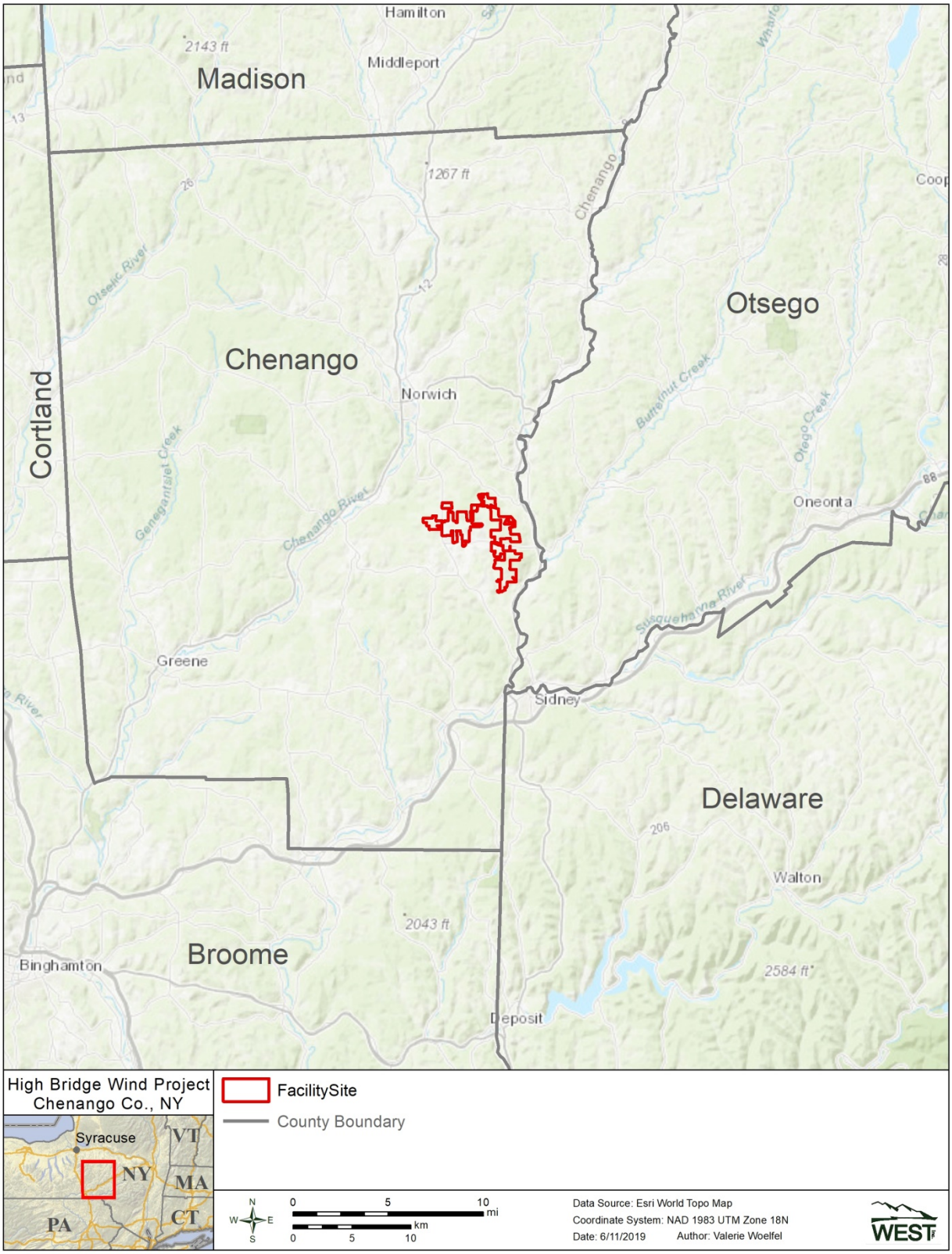

Figure 1.1 Location of the High Bridge Wind Project, Chenango County, New York.

2.0 FACILITY SITE AND FACILITY COMPONENTS

2.1 Facility Site

High Bridge began examining site suitability and started assessing avian resources in 2016 with a Critical Issues Analysis (CIA). The study area applied in this initial analysis ("CIA Study Area") is shown in Figure 2.1. Pre-construction field surveys began in 2018; the survey area was designed to encompass all potential Facility components locations (the "Survey Area"; see Figure 2.1). During the development process, High Bridge refined design of the Facility and reduced the overall footprint, as reflected in the current Facility Site, which is contained within both the CIA Study Area and the Survey Area (Figure 2.1). The Facility Site encompasses approximately 1,586.8 hectares (ha; 3,921 acres [ac]) in Chenango County in southcentral New York. 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 2017). The Facility Site also falls within the NYSDEC Central Appalachians Ecological Zone of New York (Edinger et al. 2014). Elevation within the Facility Site ranges from approximately 280 meters (m; 919 feet [ft]) above sea level (ASL) in the lowest valley to 617 m (2,024 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; Figure 2.2). 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.

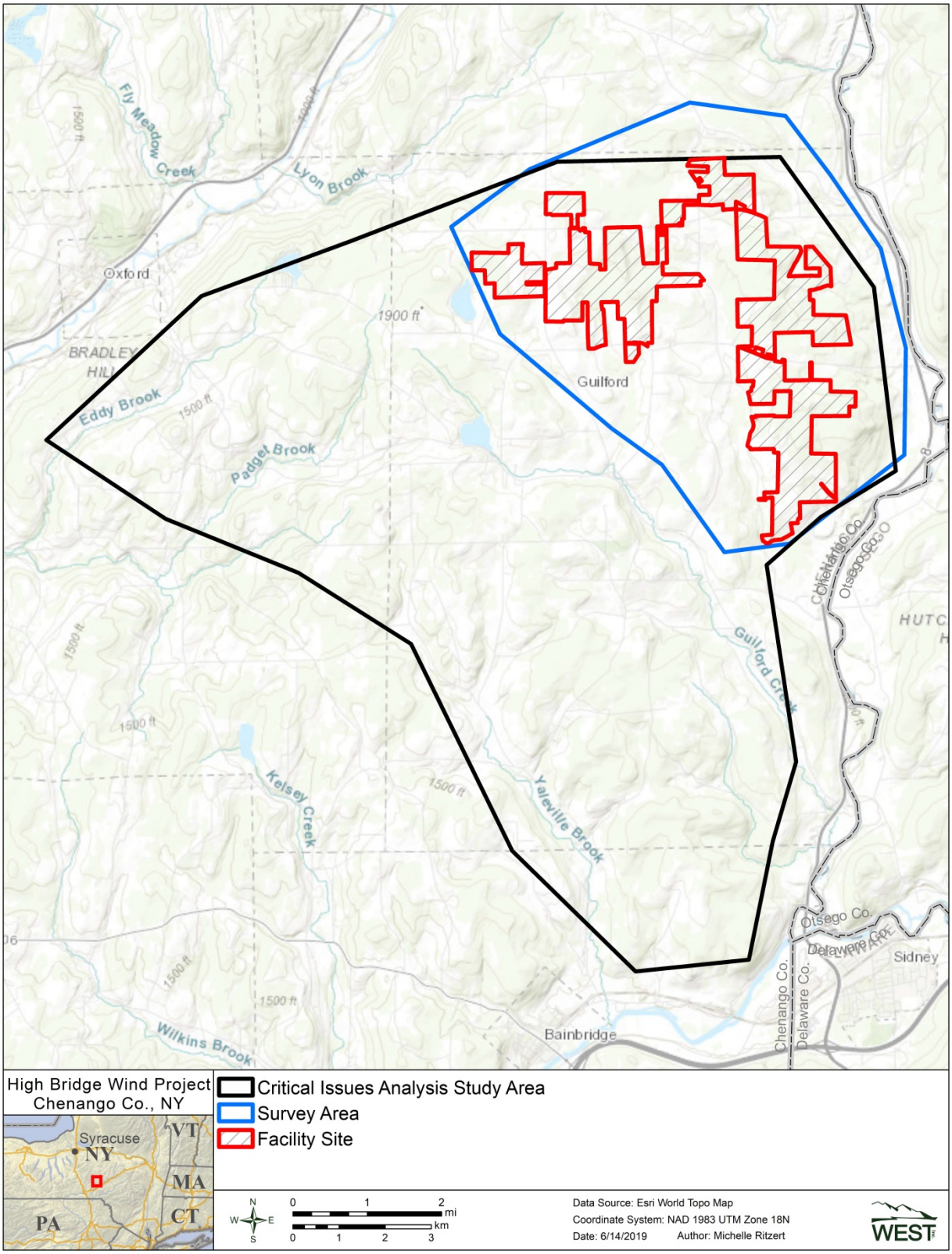

Figure 2.1 Study Area, Survey area, and Facility Site boundaries for the High Bridge Wind Project, Chenango County, New York.

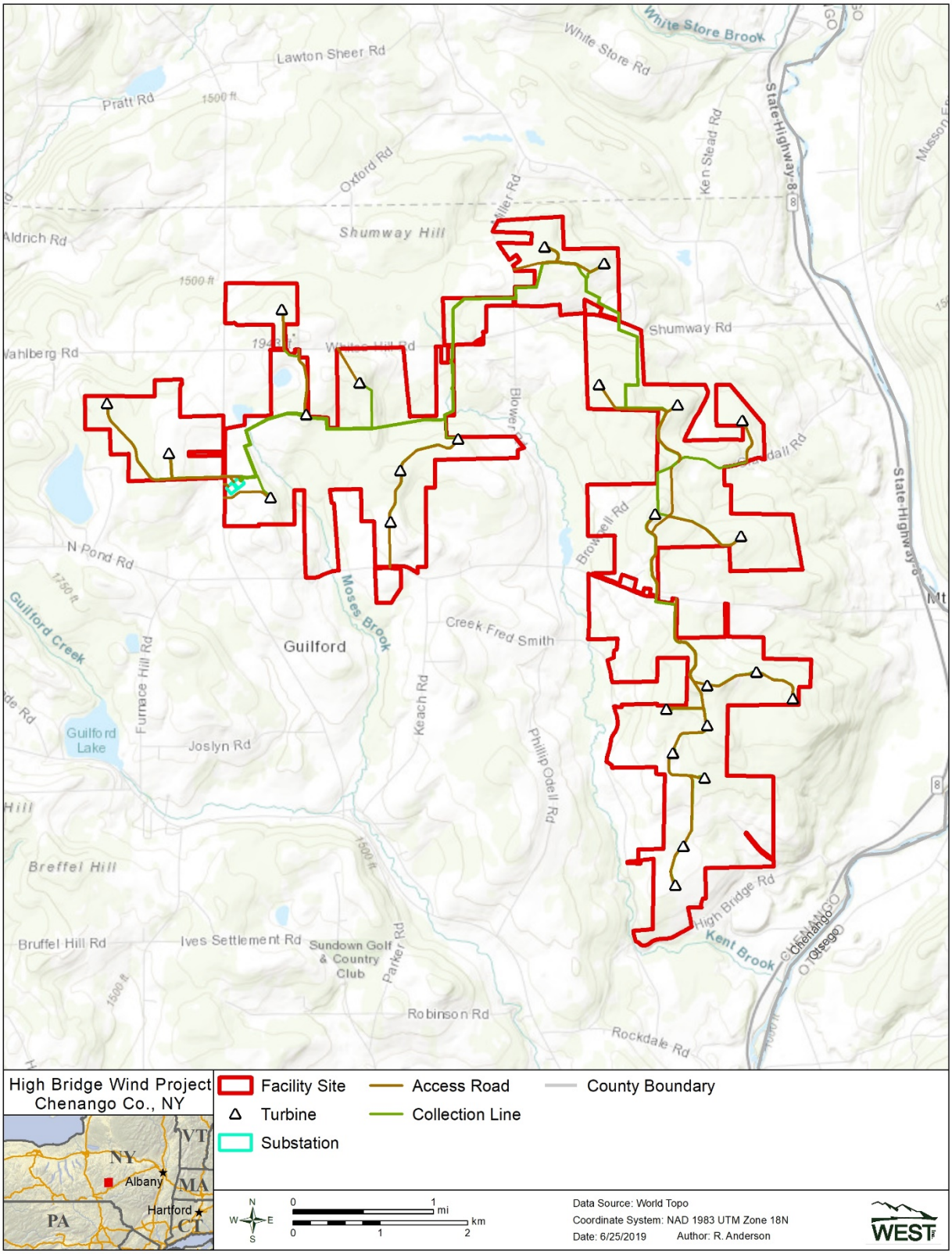

Figure 2.2 Location of the High Bridge Wind Project Facility Site and associated proposed infrastructure, Chenango County, New York.

3.0 REVIEW OF PRE-CONSTRUCTION SURVEYS

3.1 Critical Issues Analysis

WEST conducted a CIA in 2016 to review and summarize potential environmental siting issues within the CIA Study Area consistent with Tier 1 of the US Fish and Wildlife Service's (USFWS) *Land-Based Wind Energy Guidelines* (USFWS 2012). The CIA Study Area, as described in the CIA, encompasses the current Facility Site (Figure 2.1). The CIA was based primarily upon desktop review of publicly available environmental and site condition data. No reconnaissance level field investigation or other site visits were performed. As a follow-up to the 2016 CIA, the potential for protected species occurrence within the Facility Site was reevaluated in 2019 by accessing the USFWS Information Planning and Consultation (IPaC) website and requesting information regarding state-protected species from the New York Natural Heritage Program (NYNHP).

3.1.1 Sensitive Species Identified in the Critical Issues Analysis

The NYSDEC Nature Explorer database and IPaC website were used to determine federally and state-listed endangered or threatened species that may occur in Chenango County, as correspondence with the NYNHP was not initiated during the CIA (WEST 2016). At the time of the CIA, six state-threatened bird species were indicated as potentially occurring in Chenango County (Table 3.1). Additionally, the CIA Study Area was identified as occurring within the Appalachian Mountains Bird Conservation Region, which includes 25 species of Birds of Conservation Concern (BCC)[1] (WEST 2016). No federally threatened or endangered bird species were identified as occurring within Chenango County at the time of the CIA.

Table 3.1. Federally and state-listed birds in Chenango County, New York (WEST 2016).

Common Name	Scientific Name	Status*
bald eagle	*Haliaeetus leucocephalus*	BGEPA, ST
Henslow's sparrow	*Ammodramus henslowii*	ST
least bittern	*Ixobrychus exilis*	ST
northern harrier	*Circus hudsonius*	ST
pied-billed grebe	*Podilymbus podiceps*	ST
sedge wren	*Cistothorus platensis*	ST

BGEPA = Bald and Golden Eagle Protection Act (1940); ST = state-threatened species (New York State Department of Environmental Conservation Nature Explorer 2014).

According to the CIA, there were seven known bald eagle (*Haliaeetus leucocephalus*) nesting territories in Chenango County as of 2014 [redacted]. The CIA concluded that bald eagles likely occur as passing migrants and local residents within the forested portions of tributaries along Brackett Lake and large ponds present within the CIA Study Area, and golden eagles (*Aquila chrysaetos*) may occur as migrants moving over the entire CIA Study Area.

[1] Birds of conservation concern are not federally threatened or endangered species, but represent species that the USFWS has identified as a conservation priority.

3.1.2 Sensitive Species Identified During Follow-up Agency Correspondence

Additional information on federally and state-listed bird species focused in or near the current Facility Site was solicited from the NYNHP and USFWS IPaC database in 2019. The NYNHP database indicated the state-threatened bald eagle (also protected under the Bald and Golden Eagle Protection Act of 1940 [BGEPA]) had been documented nesting at eight locations within 16 km (10 mi) of the Facility Site, [redacted]. No other state-listed species were identified in the 2019 NYNHP correspondence. No federally threatened or endangered bird species were identified by the IPaC database as occurring within or near the Facility Site. The IPaC identified four BCC species with potential to occur within or near the Facility Site during the breeding season (Table 3.2).

Table 3.2. Birds of Conservation Concern identified by the January 2019 US Fish and Wildlife Service Information, Planning, and Consultation report.

Species	Season
Canada warbler (*Wilsonia canadensis)*	Breeding
prairie warbler (*Stetophaga discolor)*	Breeding
wood thrush (*Hylocichla mustelina)*	Breeding
yellow-billed sapsucker (*Sphyrapicus varius*)	Breeding

3.2 Pre-Construction Field Studies

Bird surveys conducted within the Survey Area included:

- Raptor Migration Surveys (March 3 – May 31, 2018 and August 15 – December 10, 2018)
- Pre-Construction Breeding Bird Surveys (May 21 – July 22, 2018)
- Eagle Use Surveys (Year 1: March 1, 2018-February 10, 2019; Year 2: on-going, anticipated completion March 2020)
- Raptor Nest Aerial Surveys (March 16-18, 2019, and April 24, 2019)

The following sections summarize results of the surveys to help assess potential impacts from development of the Facility Site. The survey methods and detailed results are described in the various reports cited within the summaries.

3.2.1 Raptor Migration Surveys

Raptor migration surveys (RMS) were conducted at two survey plots (Figure 3.1) during the spring (March 3 – May 31, 2018) and fall (August 15 – December 10, 2018) to estimate the overall rate of use of the Survey Area by migrating raptors and vultures following methods in the NYSDEC Guidelines (Ritzert et al. 2019a). Prior to the initiation of surveys, a work plan was submitted to the NYSDEC, USFWS, and Delaware-Otsego Audubon Society (DOAS). Comments were received via email (B. Denoncour, NYSDEC, pers. comm.; T. Wittig, USFWS, pers. comm.; and T. Salo, DOAS, pers. comm) and recommendations were incorporated into the final RMS work plan. Surveys were conducted consistent with the approved plans once per week and each plot was surveyed for at least seven consecutive hours (0800 hours to two hours prior to sunset) per visit during conditions favorable for raptor migration during the peak period for observing migrating raptors.

3.2.1.1 Raptors & Vultures

WEST completed 546 observation hours during all RMS. WEST observed fifteen distinct raptor and vulture species during RMS: 14 species in spring and 12 in fall. A mean of 2.25 raptors/observer-hour/survey was observed in spring and a mean of 1.63 was observed in fall. The most commonly observed raptor species overall were broad-winged hawk (*Buteo platypterus*: 499 observations) and red-tailed hawk (*B. jamaicensis*: 232).

3.2.1.2 Sensitive Species

No federally endangered or threatened species were recorded during RMS. The following state-listed species were observed during surveys (Ritzert et al. 2019a):

- State-endangered:
  - Peregrine falcon (*Falco peregrinus*: two observations);
  - Golden eagle (nine observations).
- State-threatened species:
  - Bald eagle: (68 observations);
  - Northern harrier (*Circus hudsonius*: 11 observations).
- State species of special concern:
  - Cooper's hawk (*Accipiter cooperii*: 49 observations)
  - Sharp-shinned hawk (*A. striatus*: 49 observations)
  - Osprey (*Pandion haliaetus*: 45 observations)
  - Red-shouldered hawk (*Buteo lineatus*: seven observations)
  - Common loon (*Gavia immer*: 16 observations)
  - Common nighthawk (*Chordeiles minor*: one observations)
- Species of greatest conservation need (SGCN)
  - American kestrel (*F. sparverius*: 45 observations)
- High priority species of greatest conservation need (HPSGCN)
  - Whimbrel (*Numenius phaeopus*: 100 observations)

The bald eagle and golden eagle are protected by the federal BGEPA and all 12 sensitive bird species observed are also protected under the federal Migratory Bird Treaty Act of 1918.

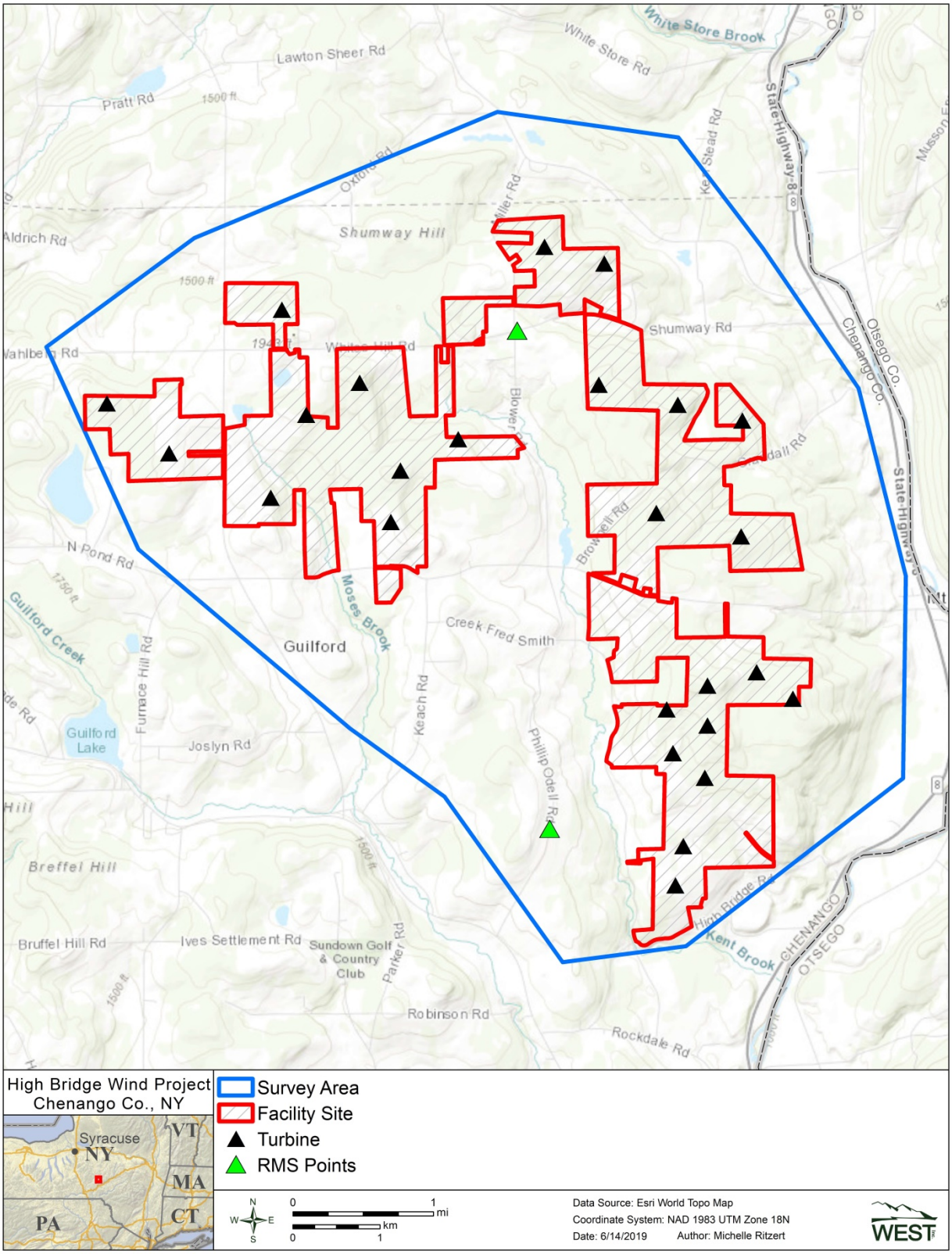

Figure 3.1. Location of raptor migration survey (RMS) points within the High Bridge Wind Project, Chenango County, New York.

3.2.2 Pre-Construction Breeding Bird Surveys

Breeding bird surveys (BBS) were conducted weekly from May 21 – July 22, 2018, to investigate breeding bird use and the potential presence of sensitive or state-listed birds near areas where turbine construction is proposed and in areas away from proposed turbine construction for comparison following methods in the NYSDEC Guidelines (Ritzert et al. 2018). A work plan was submitted to and approved by the NYSDEC and USFWS prior to commencing surveys. Birds were surveyed along 14 separate 300-m (984-ft)-long transects placed within major vegetation types (forested and non-forested [grassland/hayfield]) in the Survey Area where land access was granted: nine proposed turbine transects and five control transects (i.e., at least 800 m [2,625 ft] from proposed turbine locations; Figure 3.2). Since the time of BBS, four turbine locations have moved; however, the areas surveyed during BBS are representative of the current turbine locations. All transects comprised six 50-m (164-ft)-radius point-count survey plots placed in a straight line along the transect at the following distances: 25 m (82 ft), 75 m (246 ft), 125 m (410 ft), 175 m (574 ft), 225 m (738 ft), and 275 m (902 ft). Data were collected at each point-count survey plot; the aggregate data from all six point-count survey plots along a single transect were used to calculate transect-level statistics (Ritzert et al. 2018).

WEST observed ninety-four unique species of birds during breeding bird surveys. The most common species were:

- red-eyed vireo (*Vireo olivaceus*; 261 observations),
- ovenbird (*Seiurus aurocapilla*; 212*),*
- song sparrow (*Melospiza melodia*; 153),
- common yellowthroat (*Geothlypis trichas*; 144),
- gray catbird (*Dumetella carolinensis*; 123), and
- black-capped chickadee (*Poecile atricapillus*; 114).

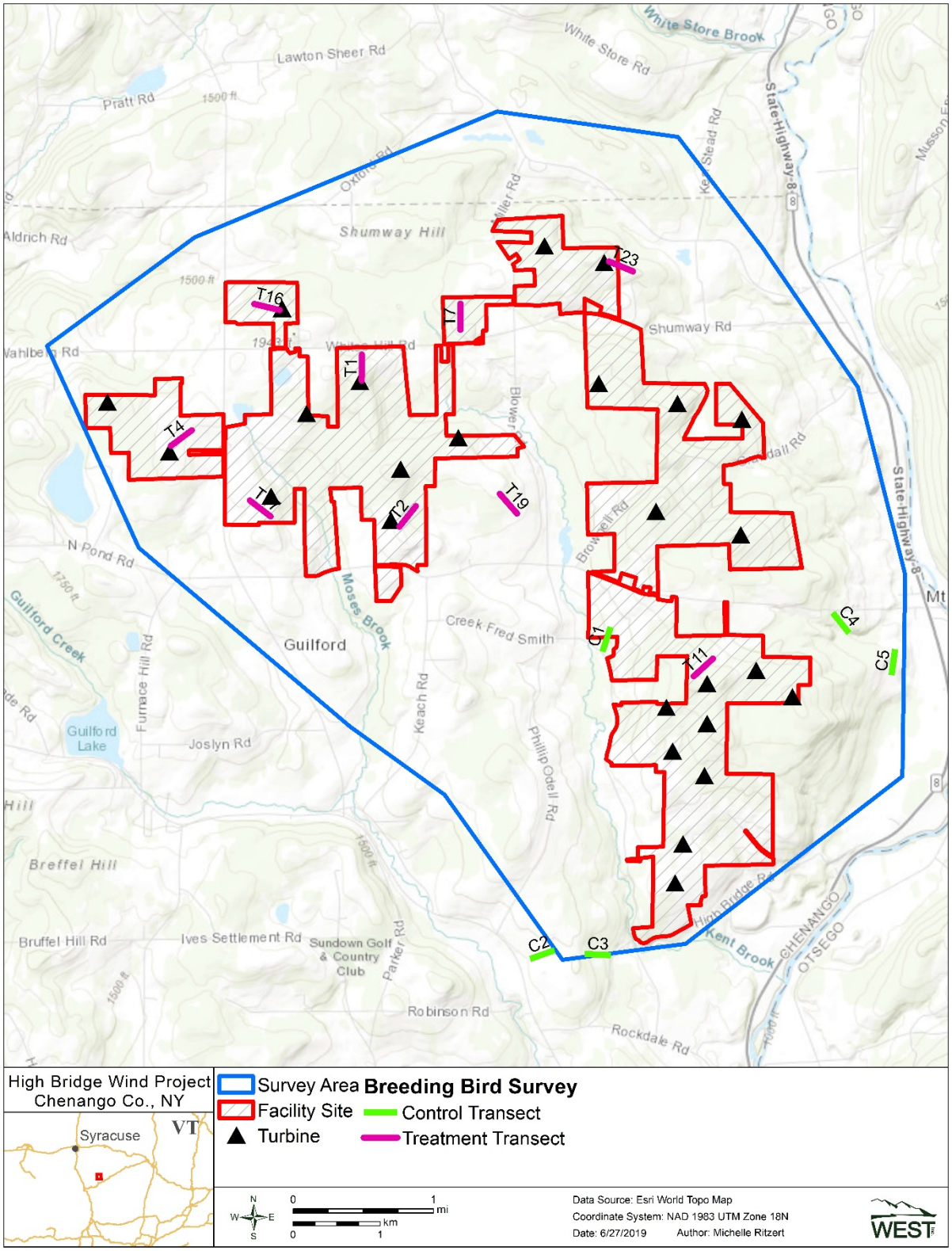

Figure 3.2. Location of the breeding bird survey (BBS) transects within the High Bridge Wind Project, Chenango County, New York.

3.2.2.1 Sensitive Species

WEST did not record any federally endangered or threatened species during BBS. The following state-listed species were observed during surveys or incidentally (i.e., outside of the scheduled survey time, not within the survey plot, or observed while on site for other studies (Ritzert et al. 2018):

- State-threatened:
  - Northern harrier (one observation)
- State species of special concern
  - Cooper's hawk (one observation)
  - Sharp-shinned hawk (one)
  - Grasshopper sparrow (*Ammodramus savannarum*; two)
- SGCN
  - American kestrel (one observation)
  - Black-billed cuckoo (*Coccyzus erythropthalmus*; seven)
  - Black-throated blue warbler (*Setophaga caerulescens*; 61)
  - Blue-winged warbler (*Vermivora cyanoptera*; 13)
  - Cedar waxwing (*Bombycilla cedrorum*; 110)
  - Louisiana waterthrush (*Parkesia motacilla*; one)
  - Prairie warbler (*Setophaga discolor*; 14)
  - Ruffed grouse (*Bonasa umbellus*; five)
  - Scarlet tanager (*Piranga olivacea*; 22)
  - Wood thrush (*Hylocichla mustelina*; 100)
- HPSGCN
  - Bobolink (*Dolichonyx oryzivorus*; 74 observations)
  - Brown thrasher (*Toxostoma rufum*; nine)
  - Canada warbler (*Cardellina canadensis*; 10)
  - Eastern meadowlark (*Sturnella magna*; three)

3.2.3 Eagle Use Surveys

Year 1 of eagle use surveys (EUS) were conducted from March 1, 2018, to February 10, 2019 (Ritzert et al. 2019b), and the second year of EUS is ongoing and will be completed from February 2019 to March 2020. Survey methods follow recommendations in the USFWS *Eagle Conservation Plan Guidance* (ECPG; USFWS 2013) to assess risk to bald and golden eagles across the US. Prior to the initiation of surveys, a work plan was submitted to the NYSDEC, USFWS, and DOAS. Comments were received via email (B. Denoncour, NYSDEC, pers. comm.; T. Wittig, USFWS, pers. comm.; and T. Salo, DOAS, pers. comm.) and recommendations were incorporated into the final EUS work plan.

The objective of the Year 1 surveys was to provide information regarding levels of use of the Survey Area and Facility Site by bald and golden eagles and other large bird species, particularly raptors.[2] This section presents the survey findings for:

- Eagles
- Raptors
- Owls
- Vultures
- Other sensitive species

WEST initially established and surveyed ten survey plots in the Survey Area in accordance with the USFWS' ECPG recommendations for 30% coverage of a project area (Figure 3.3). Four additional survey plots (11, 12, 13, and 14) were added May 31, 2018, in response to recommendations from the USFWS to add more survey plots, to increase coverage of the Survey Area (T. Wittig, USFWS, pers. comm.). Each survey plot was centered on a survey point and was 800 m in radius and 230 m (755 ft) in height (termed "cylinders"). The proportion of each 3-dimensional survey plot (inclusive of the area within 800 m of the survey point and up to 230 m [755 ft] above ground level) visible to a 1.8 m (6.0 ft) tall observer was calculated based on variation in terrain elevation and used to determine coverage of the Survey Area. Based on this calculation, the 14 survey plots cover approximately 37.9% of the Survey Area.

Survey intensity varied during the study period to include weekly surveys during the spring and fall migration periods due to potential bald and golden eagle migration near the Facility Site, and monthly surveys during the remainder of the year. Plots were surveyed for one hour during each visit for a total of 400 hours of sampling during the year 1 EUS.

[2] Defined here as kites, accipiters, buteos, harriers, falcons, and osprey

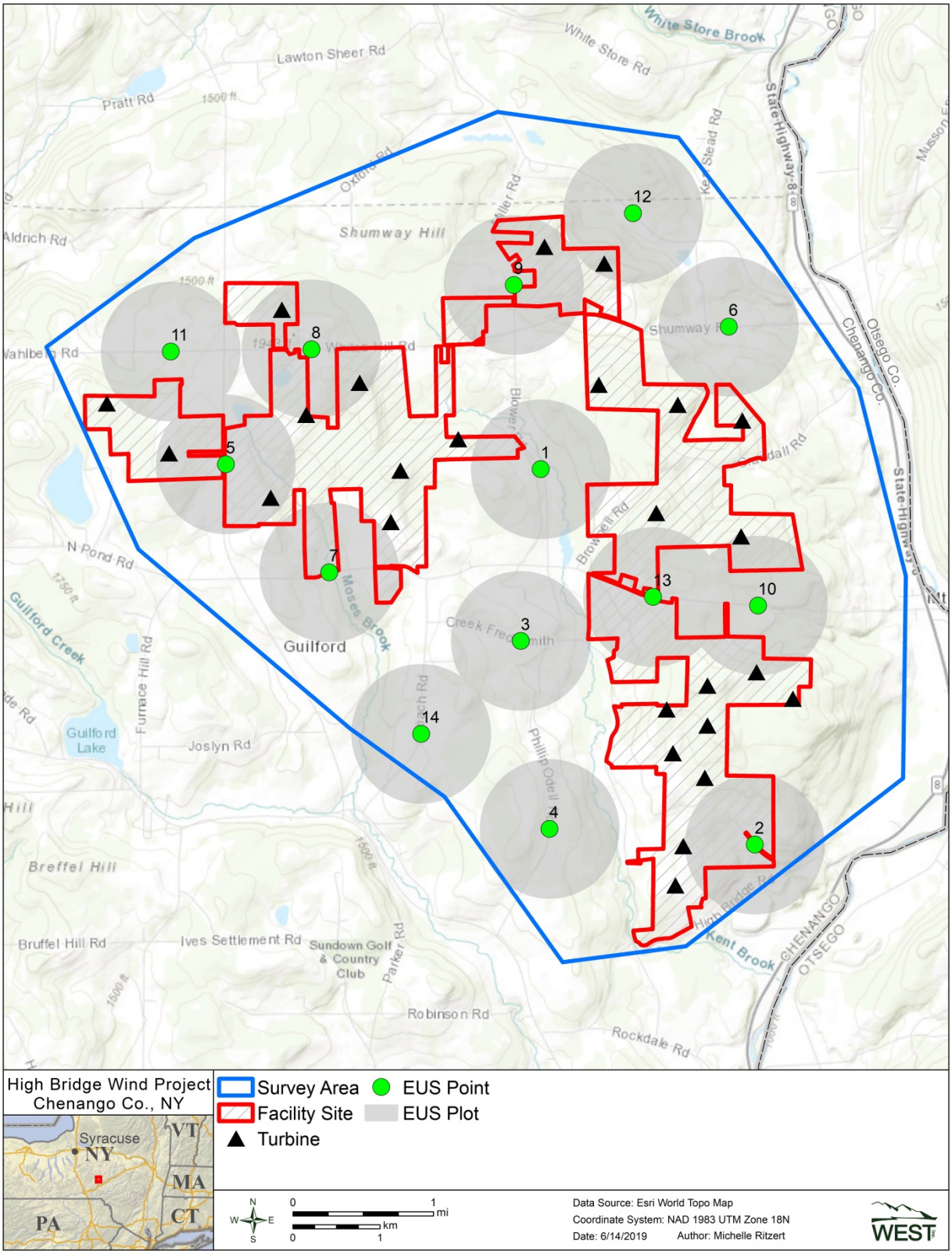

Figure 3.3 Location of eagle use survey (EUS) points and 800-meter (2,625 feet) radius plots within the High Bridge Wind Project, Chenango County, New York.

3.2.3.1 Eagles

Eagle minutes refer to a minute of observation of an individual eagle (bald or golden) recorded within the survey-plot cylinder. Overall 29 eagle observations totaling 107 eagle minutes were made within the survey-plot cylinders (Table 3.3). Bald eagle observations were recorded during seven of 12 months of surveys and golden eagle observations were recorded during two of 12 months (Table 3.3).

Table 3.3. Number of bald and golden eagle observations with a duration of one minute or more and eagle minutes[1] by month during eagle use surveys in the High Bridge Wind Project, Chenango County, New York, March 1, 2018 – February 10, 2019.

	Bald Eagles		Golden Eagles		Overall	
Month	**Eagle Observations**	**Eagle Minutes[1]**	**Eagle Observations**	**Eagle Minutes[1]**	**Eagle Observations**	**Eagle Minutes[1]**
March 2018	0	0	0	0	0	0
April 2018	3	5	1	0	4	5
May 2018	1	0	0	0	1	0
June 2018	3	14	0	0	3	14
July 2018	4	24	0	0	4	24
August 2018	0	0	0	0	0	0
September 2018	9	33	0	0	9	33
October 2018	3	4	2	13	5	17
November 2018	3	14	0	0	3	14
December 2018	0	0	0	0	0	0
January 2019	0	0	0	0	0	0
February 2019	0	0	0	0	0	0
Total	**26**	**94**	**3**	**13**	**29**	**107**

[1] Observations of eagles flying within an 800-meter (m; 2,625-foot [ft]) x 230-m (755-ft) cylinder

Ninety-four bald eagle minutes were recorded within nine of the 14 point-count cylinders during surveys; no bald eagles were observed at the remaining five point-count locations. [redacted].

Thirteen golden eagle minutes were recorded within two of the point-count cylinders during surveys; no golden eagles were observed at the remaining 12 point-count locations. Golden eagles were observed in October and April, only. [redacted]. No concentrated areas of golden eagle use were recorded within the Survey Area.

3.2.3.2 Raptors

In addition to eagles, nine other diurnal raptor species were recorded during EUS. Red-tailed hawk (161 observations) and broad-winged hawk (84) were the most commonly observed raptors, accounting for 67% of the raptor observations. Diurnal raptor use was highest during the spring, followed by summer, fall, and winter.

3.2.3.3 Owls

Barred owl (*Strix varia*) was the only owl species observed during EUS. One observation was recorded during the fall.

3.2.3.4 Vultures

Turkey vulture (*Cathartes aura*) was the only vulture species observed during EUS (274 observations), and use was highest during the summer, followed by spring and fall. No vultures were recorded during the winter.

3.2.3.5 Sensitive Species

No federally listed endangered or threatened species were recorded during EUS. The following state-listed species were observed during surveys (Ritzert et al. 2019b):

- State-endangered
    - Golden eagle: five observations
- State-threatened
    - Bald eagle: 36 observations
    - Northern harrier: five observations
- State species of special concern
    - Cooper's hawk: 15 observations
    - Sharp-shinned hawk: 12 observations
    - Red-shouldered hawk: two observations
    - Common loon: eight observations
    - Osprey: 12 observations

3.2.4 Raptor Nest Aerial Surveys

Raptor nest aerial surveys were completed within the Survey Area and 16-km (10-mi) buffer of the Survey Area in 2019 (the "Raptor Nest Aerial Survey Area"; Ritzert 2019). An initial survey was conducted from March 16, 2019 to March 18, 2019, and a follow-up survey was conducted on April 24, 2019. The follow-up survey was conducted to check the status of all potential eagle nests documented during the initial survey. The survey route included flying transects over the entire Raptor Nest Aerial Survey Area.

Nest status was categorized using definitions originally proposed by Postupalsky (1974) and largely followed today (ECPG 2013). Nests were classified as occupied if any of the following were observed at the nest structure: (1) an adult in an incubating position; (2) eggs; (3) nestlings or fledglings; (4) presence of an adult (sometimes sub-adults); (5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed earlier in the breeding season; or (6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on its rim or underneath. Occupied nests were further classified as active if an egg or eggs were laid. Nests were classified as inactive if no eggs or chicks were present.

Nests not meeting the above criteria for "Occupied" during at least two consecutive surveys were classified as "Unoccupied."

No eagle nests were recorded within the Survey Area (or Facility Site) during aerial surveys (Figure 3.4). Twelve bald eagle nests (eight occupied and active [i.e., documented adult with eggs or nestlings], one occupied and inactive [i.e., documented adult nearby, no eggs or nestlings observed], and three unoccupied [not in-use]) were recorded in the 16-km (10-mi) buffer of the Survey Area. [redacted].

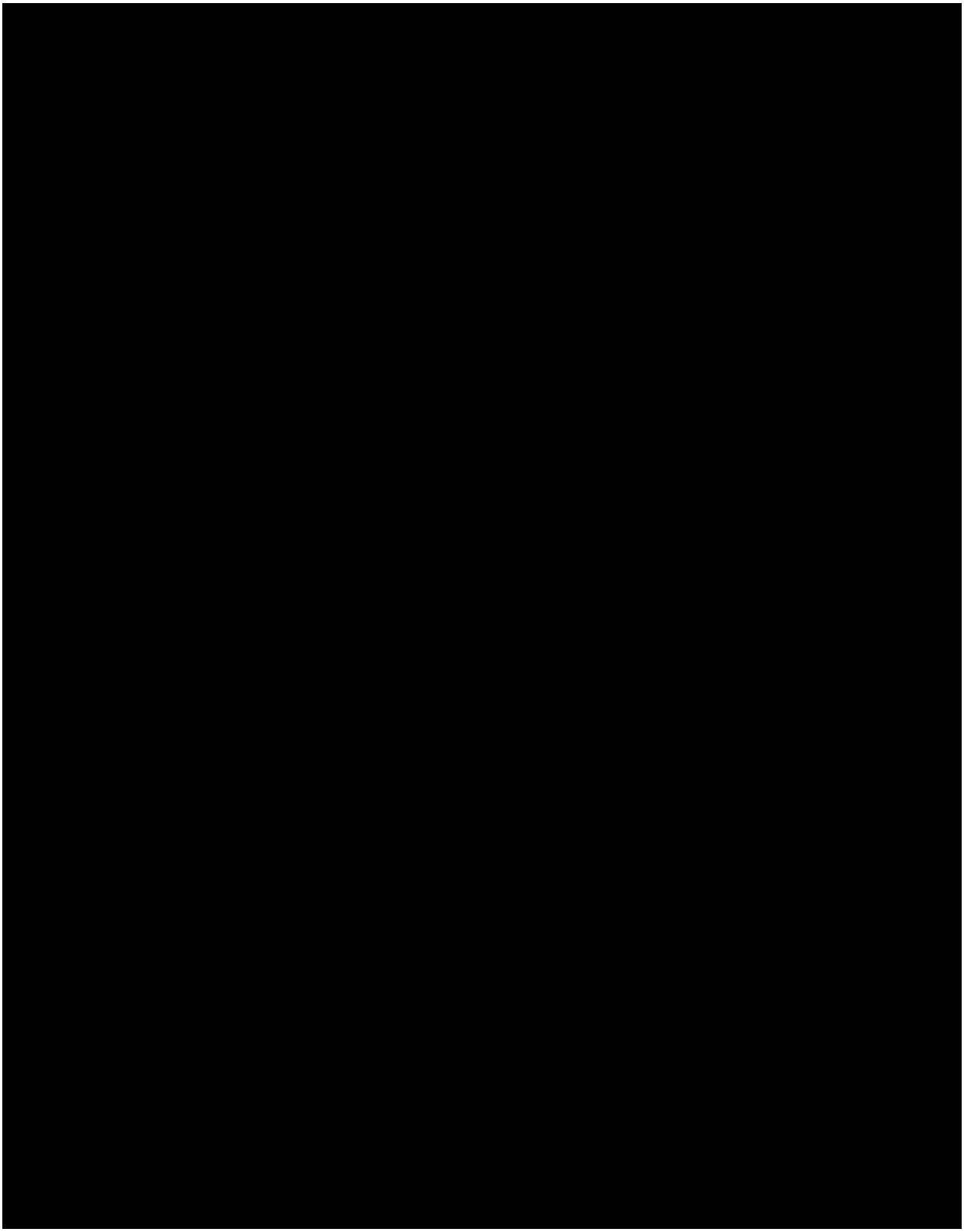

Figure 3.4 Location of raptor nest aerial surveys within the High Bridge Wind Project and 16.1 kilometer (10.0 mile) buffer, Chenango County, New York.

4.0 RISK ASSESSMENT

Impact to birds from wind energy development is generally believed to include temporary and permanent disturbance resulting from, 1) alteration of habitat, 2) behavioral avoidance of turbines, and 3) direct collision mortality (Strickland et al. 2011). For each of these risk categories, WEST reviewed the results from monitoring in the Facility Site in the context of results from nearby operating wind energy facilities and in the broader context of what is known about the effects of wind energy on birds. WEST's conclusions are based on available data and results drawn for each risk category.

4.1 Construction-Related Impacts to Birds

4.1.1 Disturbance and Alteration of Habitat by Construction

In total, the temporary habitat loss will be approximately 47.5 ha (117.4 ac) and permanent habitat loss will be approximately 45.0 ha (111.3 ac; approximately 2.3% of the total Facility Site). Many Facility components have been co-located to reduce the total amount of temporary and permanent habitat loss.

4.1.2 Indirect Impacts: Disturbance or Displacement

Facility Site construction may result in both indirect and direct impacts to birds (Strickland et al. 2011). Indirect effects from construction can include habitat loss or modification, linear clearings for roads and turbine pads which may fragment habitat blocks, and displacement or disturbance associated with increased human presence and construction activities. Facility Components have been sited to avoid and minimize impacts to undisturbed habitat with a goal of reducing impacts to birds occurring in the area. Any displacement or disturbance impacts during construction would be temporary and localized, and therefore unlikely to have substantial long-term effects to any particular species using the area (Howell and Noone 1992; Johnson et al. 2000a, 2002; Erickson et al. 2003; Madders and Whitfield 2006, Piorkowski 2006).

4.1.3 Direct Impacts: Collision Mortality

Direct impacts from construction may include incidental injury or mortalities due to construction equipment. Potential mortality is expected to be low as equipment used in wind energy facility construction generally moves at slow rates or is stationary for long periods (e.g., cranes). The highest risk of direct mortality to birds from construction is the potential destruction of a nest during initial tree clearing. WEST understands it is the Applicant's intent to conduct tree clearing at the Facility Site from November 1 to March 31, outside of the active nesting season for forest dwelling birds. However, there are a number of variables outside of the Applicant's control (i.e. Article 10 permitting risks) that make committing to clear trees in this window difficult given the proposed project construction schedule and commitments. If tree clearing needs to occur during the nesting season for forest dwelling birds (May 15 – July 15) or eagles (February 1 – June 30) in order to complete project construction and achieve a commercial operation date by December 2021, High Bridge will follow the Avoidance and Minimization Measures in Table 5.1 of the Net Conservation Benefit Plan (Ritzert et al. 2019c).

4.2 Operations-Related Impacts to Birds

Operations-related impacts to birds include indirect disturbance or displacement due to the presence of the Facility Site and direct impacts resulting from collisions (Strickland et al. 2011). These impacts are discussed in the sections below.

4.2.1 Indirect Impacts: Disturbance or Displacement

The operation of wind turbines and other Facility Site infrastructure will result in habitat alteration and potential disturbance to specific species. As described in the Habitat Fragmentation Analysis (Ritzert et al. 2019d), the total amount of permanent habitat lost due to Facility Components represents a comparatively small percentage of the overall Facility Site and surrounding landscape, which will remain relatively unchanged by development of the Facility. However, indirect impacts, such as disturbance or displacement to individuals of some bird species, can also result from operation of the Facility. These potential impacts are addressed below.

4.2.1.1 Breeding Birds

Indirect impacts, such as disturbance or displacement, are most likely to affect breeding and winter resident birds, since they remain in the vicinity of the turbines for extended periods of time. Breeding birds that are displaced may move to areas with fewer disturbances that provide lower quality or currently occupied habitat, which could affect breeding success. Winter resident birds that are displaced may similarly move to areas of lower quality habitat, which could affect overwinter survival. It is unclear how climate change may alter the distribution of some avian species on the landscape over the 30-year life of the Facility Site, but there is potential for local-scale effects of the Facility Site to be additive to those of climate change.

Available post-construction studies have indicated some level of displacement of breeding birds in locations that are in close proximity to operational turbines; however, most of the displacement studies have been in grassland habitats where small displacement effects from approximately 100 m (328 ft) to 200 m (656 ft) have been reported (see for example: Osborn et al. 1998, Leddy et al. 1999, Johnson et al. 2000a, Shaffer and Buhl 2016). Displacement impacts to grassland species are expected to be minimal due to the limited amount of grasslands in the Facility Site (1.7% of Facility Site; US Geological Survey [USGS] National Land Cover Database [NLCD] 2011, Homer et al. 2015]).

There is little information available on indirect effects from wind energy facilities on eastern forest birds. In a forested setting, breeding bird surveys conducted prior to, during, and after construction of the Green Mountain Power Corporation's Wind Power Facility in Searsburg, Vermont, the same diversity of species was detected during three survey periods following construction of the project; however, abundance and frequency of species occurrence at the study sites changed over the three periods (Kerlinger 2002a). Kerlinger (2002a) found that abundance of forest interior species declined, while abundance of habitat generalists increased from that documented during preconstruction studies. At the Marble River Wind Farm, which is located in northeastern New York in an agricultural and forested setting, surveys to monitor breeding bird avoidance of turbines

indicated there may have been some avoidance by bird species; however, no consistent trends were detected across bird types or species (Bay et al. 2015).

Some degree of displacement to breeding birds in the direct vicinity of turbines is anticipated for certain species as habitat will be altered and human activity will increase. Some bird species documented during the breeding bird surveys in the Facility Site, such as red-eyed vireo, ovenbird, black-throated green warbler (*Setophaga virens*), and Canada warbler have shown sensitivity to disturbance from wind energy development (Kerlinger 2002a). However, given the small amount of habitat in which displacement could occur compared to the total habitat available in the area surrounding the Facility Site, such displacement is not expected to adversely affect the viability of local breeding populations. Additionally, if individuals of these species are displaced from the Facility Site, it is unclear if displacement impacts would persist for the life of the Facility Site, given that many species likely habituate to the presence of turbines, as well as other anthropogenic disturbance (Ornithological Council 2007).

Avoidance of wind turbines by nesting raptors has only been reported in one study (Usgaard et al. 1997), while several studies have shown no avoidance behavior by nesting raptors (Johnson et al. 2000b, 2003; Erickson et al. 2004). Below are examples of experience at various wind projects:

- At the **Buffalo Ridge** facility in Minnesota, documented raptor nest density on 26,200 ha (64,741.6 ac) of land surrounding the wind energy facility was 5.94 nests/26,200 ha (64,741.6 ac). Yet, no nests were present in the 31,000 ha (76,602.7 ac) facility itself, even though habitat was similar (Usgaard et al. 1997). However, this analysis assumed that raptor nests are uniformly distributed across the landscape (an unlikely event), and only two nests were expected for an area 31,000 ha (76,602.7 ac) in size if the nests were distributed uniformly;
- Based on extensive monitoring using helicopter flights and ground observations, raptors continued to nest at the **Stateline wind** energy facility in eastern Washington at approximately the same levels after construction, and several nests were located within a 0.8 km (0.5 mi) of turbines (Erickson et al. 2004);
- At the **Foote Creek Rim** wind energy facility in southern Wyoming, one pair of red-tailed hawks nested within 0.5 km (0.3 mi) of the turbine strings, and seven red-tailed hawk nests, one great horned owl (*Bubo virginianus*) nest, and one golden eagle nest located within 1.6 km (1.0 mi) of the wind energy facility successfully fledged young (Johnson et al. 2000b). The golden eagle pair successfully nested 0.8 km (0.5 mi) from the facility for three different years after the facility became operational;
- Lastly, in Oregon, a Swainson's hawk (*Buteo swainsoni*) nested within 0.4 km (0.3 mi) of a turbine string at the **Klondike I** wind energy facility after the facility was operational (Johnson et al. 2003).

Although studies on the effects of bird displacement at wind energy facilities are limited, in particular for forested regions, most studies suggest indirect effects to be negligible or

immeasurable (Howell and Noone 1992; Johnson et al. 2000a, 2002; Erickson et al. 2003; Madders and Whitfield 2006, Piorkowski 2006).

4.2.1.2 Waterfowl, Waterbirds, and Shorebirds

Potential displacement impacts to waterfowl, waterbirds, and shorebirds from Facility Site construction and operation are not expected to be substantial. Open water habitats (open water and emergent herbaceous wetlands) preferred by these species are limited within the Facility Site (0.3% and less than 0.1% of area, respectively; USGS NLCD 2011, Homer et al. 2015) and wind turbines will be sited so that large areas of wetlands will be avoided to the maximum extent practicable. In addition, two years of post-construction surveys at a wind farm in Iowa that experienced high use by waterfowl due to its proximity to three wildlife management areas showed no displacement of waterfowl (Jain 2005). However, a three-year study of breeding duck pairs of five species demonstrated a reduction in the number of reproductive pairs near active wind projects in North and South Dakota compared to reference areas (Loesch et al. 2012). Based on the lack of preferred habitat present and avoidance of those areas in turbine siting, the Facility Site is not anticipated to have substantial displacement impacts to waterfowl, waterbirds, and shorebirds.

4.2.1.3 Raptors

Most studies on raptor displacement at wind energy facilities indicate displacement effects to be negligible (Howell and Noone 1992; Johnson et al. 2000a, 2002; Madders and Whitfield 2006). Notable exceptions include a study in Scotland that described territorial golden eagles avoiding the entire wind energy Facility Site, except when intercepting non-territorial birds (Walker et al. 2005). Hen harriers (*Circus cyaneus:* a species related to northern harriers) and buzzards (*Buteo buteo*) showed reduced flight activity around turbines at a wind energy facility in Europe (Pearce-Higgins et al. 2009). A study in Wisconsin found that raptor abundance was 47% less post-development compared to pre-construction levels; however, whether this possible displacement effect will remain constant over time, become more pronounced, or decrease through habituation was unknown (Garvin et al. 2011). Finally, a study at the Buffalo Ridge wind energy facility in Minnesota found evidence of northern harriers avoiding turbines on both a small scale (less than 100 m [328 ft] from turbines) and a larger scale (105 – 5,364 m [344 – 17,598 ft]) in the year following construction (Johnson et al. 2000a). However, the northern harriers appeared to habituate to the facility, with no large-scale displacement of northern harriers detected two years after the facility was built (Johnson et al. 2002). Alternatively, a multi-year study at the Wolfe Island Wind Plant in Ontario, Canada, reported that fluctuations in northern harrier populations more closely mirrored prey populations, which led the authors to speculate that variable raptor densities on the island were largely driven by prey populations and likely not a result of wind turbine avoidance behavior (Stantec Ltd. 2014d). Additionally, northern harriers have been observed foraging within the Maple Ridge Wind Project in Lewis County, New York, since its completion in 2006 (Jain et al. 2007, 2009b).

4.2.2 Direct Impacts: Collision Mortality

Turbines pose a collision risk for birds and every wind energy facility in the US likely results in some bird mortality (Strickland et al. 2011, Loss et al. 2013, Erickson et al. 2014). Avian fatality rates have been fairly consistent across the US at most wind energy facilities that have been studied with appropriate methods. Evaluation of studies among wind energy facilities across North America showed that fatality rates for all birds ranged from zero birds/MW/year to 77.0 birds/MW/year (Smallwood 2013). In the northeastern US (New York, Maine, New Hampshire, Maryland, and Pennsylvania) and southern Ontario, Canada, regional avian fatality rates have ranged from zero birds/MW/year to 11.99 birds/MW/year (zero birds/turbine/year to 23.98 birds/turbine/year; Appendix A1), and at facilities in New York, bird fatality rates have ranged from 0.37 birds/MW/year to 6.20 birds/MW/year (0.75 birds/turbine/year to 15.50 birds/turbine/year; Appendix A1).

4.2.2.1 Migratory Landbirds

Bird fatality rates have been observed to peak during the spring and fall migration seasons at most wind energy facilities (Johnson et al. 2002, Erickson et al. 2014). Based upon differences in abundance, use of habitat, and behavior, bird species groups have experienced varied direct impacts from wind turbines. Table 4.1 shows the general distribution of fatalities across bird species groups, as reported by publicly available post-construction mortality studies conducted in varied habitat types (e.g., agricultural, upland, forested ridgeline, coastal, and grassland) in the northeastern US and southern Ontario, Canada. Nineteen bird types were documented either during standard searches or as incidental carcasses at the various facilities. Passerines (i.e., songbirds) accounted for the highest percentage of wind-related fatalities in the region (Table 4.1) and across the US as a whole (National Wind Coordinating Collaborative 2010, Erickson et al. 2014). Nocturnal migrating passerines are the bird species group most commonly found as fatalities at wind facilities (National Research Council [NRC] 2007, Erickson et al. 2014).

Table 4.1 Documented avian fatalities at wind energy facilities between 1997 and 2014 in the northeastern US and southern Ontario, Canada. (Note: Data represent individuals found and are not estimates of annual mortality; data were not corrected for biases related to searcher efficiency or carcass persistence).

Bird Type	# Individual Fatalities	% of Total Fatalities
Passerines (Songbirds)	2,455	74.9
Unidentified Birds	200	6.1
Raptors	120	3.7
Upland Game Birds	78	2.4
Shorebirds	70	2.1
Cuckoos	63	1.9
Vultures	59	1.8
Gulls/Terns	48	1.5
Waterfowl	40	1.2
Doves/Pigeons	40	1.2
Woodpeckers	35	1.1
Swifts/Hummingbirds	30	0.9
Large Corvids	17	0.5
Waterbirds	6	0.2
Kingfishers	5	0.2
Goatsuckers	4	0.1
Owls	3	0.1
Rails/Coots	3	0.1
Loons/Grebes	2	0.1
Total	**3,278**	**100**

Northeastern projects with publicly available fatality data by species or bird type are listed in Appendix A3.

Large-scale night migration-related mortality events of the type seen at communications towers (e.g., see Erickson et al. 2005) are rare at wind energy facilities. Generally, the few large-scale mortality events documented at wind energy facilities have been determined to be due to improper lighting (e.g., upward facing lights at substations, lights left on in nacelles), and minimization measures for facility lighting have since been developed to minimize such avian attractants (Young et al. 2004, Stantec 2011a). Provided that High Bridge implements a light management plan (downward facing and motion-activated lights as practicable, intermittent Federal Aviation Administration lighting, leaving work lights off in nacelles), collision risk is expected to be similar to the New York State or regional average for migratory landbirds at the Facility Site.

4.2.2.2 Waterfowl, Waterbirds, and Shorebirds

Although waterfowl, waterbird, and shorebird fatalities at wind energy facilities have been highly variable, national research has demonstrated that these bird types less often collide with inland turbines than other groups (Everaert 2003, Kingsley and Whittam 2005). Of publicly available information of wind facilities in the northeastern US and southern Ontario, waterfowl, waterbirds, and shorebirds composed approximately 3.5% of all bird mortality (Table 4.1). Waterfowl do not seem especially vulnerable to turbine collisions and population level impacts are not likely based on publically available evidence. The relatively low percentage of waterfowl fatalities has been consistent in fatality studies for wind energy facilities throughout the region and US. For example, at nine wind energy facilities in the Midwest and western US, waterfowl made up 2.5% of the 1,033 fatalities (Erickson et al. 2001). The NRC analyzed data from 14 studies (including four also used in Erickson et al. 2001) throughout the US and found that waterfowl composed about 2.0%

of fatalities (NRC 2007). Johnson and Stephens (2011) summarized results from 21 fatality monitoring studies in western North America and found that waterfowl, primarily mallards (*Anas platyrhynchos*), accounted for 1.9% of 1,247 avian fatalities. Finally, Johnson and Erickson (2011) reported a cumulative fatality rate of 2.1% for water-dependent species (waterfowl, waterbirds, and shorebirds combined) for 25 one-year studies at 23 wind energy facilities in the Columbia Plateau Ecoregion of Oregon and Washington.

In the Facility Site, incidental waterbird, waterfowl, and shorebird use was documented during EUS and RMS. Waterbird, waterfowl, and shorebird use was mostly composed of Canada goose (*Branta canadensis*) and snow goose (*Chen caerulescens*) use and other species were observed in relatively low numbers. The Facility Site will expose low numbers of waterbirds, waterfowl, and shorebirds to risk from the turbines, but the available data suggest that impacts will be low generally due to low frequency of collision for these bird species groups and their generally low use of the Facility Site.

4.2.2.3 Raptors

Raptor migration surveys completed at the Facility Site show the number of raptor observations (excluding vultures) per observer hour were lower than spring and fall migration data from Hawk Migration Association of North America locations in the region (Table 4.2). High concentrations of migrating raptors are not expected as topographic and physiographical features of the Facility Site do not appear to be conducive to concentrating migrant raptors: the Facility Site is located in an area of rolling hills and there are no prominent north-south trending ridgelines. Additionally, the spring migration of raptors generally occurs along a broad front south of the Great Lakes, and this is borne out by the lower regional passage rates in spring compared to fall and the more evenly dispersed passage among spring watchsites (Table 4.2). The broad frontal nature of spring migration also is reflected in the smaller number of spring versus fall hawkwatches in the region. In Pennsylvania, records of spring raptor migration surveys are publically available for 18 wind projects, and average passage in those studies was 2.5 birds/observer-hour (Taucher et al 2013). Migratory raptors have accounted of a low percentage of fatalities at these Pennsylvania facilities (red-tailed hawk: 2%, turkey vulture 1%, all other species: < 1%), and it reasonable to expect similar direct impacts on migratory raptors at the Facility Site.

The most frequently observed raptor species during RMS and Year 1 EUS were broad-winged hawk and red-tailed hawk, both of which are relatively common species. Although raptors migrate through the Facility Site, risk to raptors has generally been low at wind energy facilities across the northeastern US and southern Ontario, Canada, where raptors composed only 3.7% of observed fatalities (Table 4.1). In New York, publicly available post-construction monitoring data revealed that raptor fatality rates averaged 0.17 raptors/MW/year and ranged from zero raptors/MW/year to 0.83 raptors/MW/year (Appendix A2). Given the moderate raptor use at the Facility Site, and the results of mortality monitoring studies at other New York wind facilities, raptor fatality rates at the Facility Site are expected to be similar to those at other New York wind facilities and are considered unlikely to adversely impact raptor populations.

Table 4.2. Seasonal raptor data (number of raptor observations per observer hour) during spring and fall 2018 for the High Bridge Wind Project, Chenango County, New York, compared to nearby HawkWatch sites[a].

	Hawkwatch Site				
Month/Season	**High Bridge**	**Franklin Mountain**	**Hawk Mountain**	**Waggoner's Gap**	**Tussey Mountain**
Spring	2.25	-	2.73	-	2.65
Fall	1.63	11.20	9.38	19.86	-

[a] obtained from Hawk Migration Association of North America (HMANA)

4.2.3 Impacts to State-Threatened or Endangered Species

4.2.3.1 Northern Harrier

The state-threatened northern harrier was identified as potentially occurring within Chenango County during initial agency correspondence, but was not reported as occurring within the Facility Site during follow-up correspondence with the NYNHP in 2019. However, 17 observations of northern harriers were recorded during all surveys. Northern harriers occur in large, open wetlands and grasslands, and will nest in a variety of habitats including fields, grasslands, meadows, marshlands, and other open habitats with little or no woody vegetation (Pennsylvania Game Commission [PGC] 2012). Of the 381.69 ha (943.16 ac) of suitable nesting habitat (hay/pasture and herbaceous areas) within the Facility Site, approximately 17.4 ha (42.9 ac), or 1.1% would be permanently lost due to Facility Site construction. Northern harriers are known to breed in Chenango County and have been recorded within a block of the New York State Breeding Bird Atlas that overlaps the Facility Site (McGowan and Corwin 2008). One northern harrier observation was recorded during breeding bird surveys. Northern harrier observations recorded during eagle use surveys and RMS within the breeding season (April 15-August 31: PGC 2012) suggest the species may breed within or near the Facility Site. Nine observations of northern harriers were recorded between April 30 and May 16, 2018, including observations of three immature birds. Based on discussions in Section 4.3.1.3, there is some potential for displacement impacts to northern harriers from the Facility Site; however, large-scale displacement is not likely to occur and the Facility Site is not likely to impact the local northern harrier population through displacement.

Northern harriers appear to be at low risk of collision with wind turbines (Garvin et al. 2011), as the species is rarely found as a fatality at other wind energy facilities (Erickson et al. 2001, Whitfield and Madders 2006, Garvin et al. 2011), despite the fact that this species has been observed flying at many wind energy facilities. Only three of the known 23 northern harrier fatalities occurred in the northeastern US and southern Ontario, Canada, and the majority (19 out of 23) of fatalities occurred during migration in California and the Pacific Northwest at wind energy facilities within the Pacific Flyway Corridor (Appendix A3). Two fatalities occurred at the Wolfe Island Wind Plant in Ontario on May 13, 2010, and May 17, 2012 (Stantec Ltd. 2011c, 2014d), which coincides with the breeding season. These two recorded wind turbine-related northern harrier fatalities represented 1.0% and 2.0% of the species composition recorded at the site for 2010 and 2012, respectively. During winter raptor surveys on Wolfe Island, there were 58 and 123 northern harrier observations recorded in 2010 and 2012 respectively. The above data

indicates that northern harriers are exposed to minimal collision risk throughout most of the year, but the species may exhibit a behavioral tendency that increases risk during the breeding period.

Northern harriers may fly within the RSH during aerial courtship displays that occur at nesting sites during the breeding season, but otherwise, northern harriers are known to hunt, eat, and perch low to the ground (MacWhirter and Bildstein 1996, Smith et al. 2011), which likely decreases the potential for this species to collide with wind turbine blades and explains the relatively few individuals reported as fatalities. Data collected during the EUS in the Survey Area indicate that flights by northern harriers within the RSH are a relatively uncommon event in the Survey Area, where 66.7% of flights recorded were below the likely RSH. Local and regional data suggest that northern harriers are year-round residents in the Facility Site and Chenango County, and risk of collision may exist in all seasons. Risk during migration for this species is largely unknown, but generally, northern harriers migrate in the day, when individuals may be able to see and likely avoid turbines.

Given that wind turbines are believed to pose a low risk of collision and displacement to northern harriers, impacts from Facility Site construction and operation are not expected to result in population declines for this species and are not considered a potential impact of the construction and operation of the Facility.

4.2.3.2 Peregrine Falcon

The state-endangered peregrine falcon was not identified as potentially occurring within the Facility Site during agency correspondence; however, two observations were recorded during RMS. Peregrine falcons occur mostly in open country, including open forests, and nest high on rocky outcrops and buildings (White et al. 2002). Impacts to peregrine falcon from Facility Site construction and operation are expected to be low due to the limited number of observations recorded during surveys and the lack of documented nesting locations and potential nesting locations. Additionally, no records of peregrine falcon fatalities have been reported in publicly available post-construction fatality monitoring studies in the northeastern US and southern Ontario, Canada (see Appendix A3 for a list of studies examined).

4.2.3.3 Bald Eagle

Bald eagles are large raptors, weighing up to 6.5 kilograms (kg; 14.3 pounds [lbs.]) with a wingspan up to 2.3 m (7.5 ft; NYSDEC 2018a). Bald eagles may live 15 to 25 years, but they do not develop the distinguishing white head and white tail feathers until they are four to five years old (USFWS 2007). Female eagles typically lay one to three eggs once per year, with survival rates as high as 70% in some cases; eaglets start flying within three months and are independent about one month later (USFWS 2007).

Bald eagles are a species of sea eagle endemic to North America. Historically, bald eagles nested in forests along shorelines of oceans, lakes, and rivers throughout most of North America, often moving south in winter to areas where water remains ice-free. Historically, there were as many as 80 bald eagle nest sites in New York, but reproductive impairment from pesticides and heavy metals caused major declines in local bald eagle populations (NYSDEC 2018a). The

Environmental Protection Agency banned dichlorodiphenyltrichloroethane (DDT) in 1972, and in 1976 the New York State Bald Eagle Restoration Project was initiated to reestablish a breeding population in the state (NYSDEC 2018a), and as a result, the New York bald eagle population has greatly increased in the past few decades (NYSDEC 2016a). As of 2017, NYSDEC estimated an all-time high of 323 breeding pairs of bald eagles in New York State, with approximately 73% of 442 identified bald eagle breeding territories confirmed as occupied, up from 309 breeding pairs in 2016 and 264 breeding pairs in 2015 (NYSDEC 2017).

Eagle use surveys and raptor migration surveys documented bald eagle use in the Survey Area in spring, summer, and fall. No bald eagles were observed during the winter (December 2018 – February 2019; Ritzert et al. 2019b). No bald eagle nests were documented in the Survey Area (including the Facility Site) and use of the Survey Area in summer mostly occurred in the most proximal areas to nests outside of the Survey Area.

Regardless of the season, bald eagles prefer habitat with trees near open water with abundant fish, their primary food, but they also rely on waterfowl, turtles, rabbits, snakes, other small animals, and carrion (NYSDEC 2018a). Breeding pairs often build their nests in tall trees that protrude above the surrounding canopy, and can have more than one nest (called “alternate” nests) depending on the region (NYSDEC 2018a). Each year bald eagles enlarge their nests, which have been recorded as large as 3.0 m (9.8 ft) wide and 6.0 m (19.7 ft) deep, weighing over two tons (USFWS 2007).

One year of eagle use surveys was completed at the Survey Area and surrounding area from March 2018 to February 2019 in accordance with the USFWS *Eagle Conservation Plan Guidance* (ECPG; USFWS 2013). An additional year of eagle use surveys is underway in 2019-2020. In the first year of surveys, 400 hours of surveys were completed, during which 26 bald eagles were observed for 94 ‘eagle minutes’. Eagle minutes are defined as eagle observations within 800 m [2,625 ft] of the survey point and below 200 m [656 ft] altitude from the ground (Table 4.1); they are intended by USFWS to estimate eagle exposure to turbines. Survey effort was stratified by season to sample migration seasons most intensively, therefore increased survey effort was used during the spring (March 1 – March 31) and fall migration (October 15 – December 8) seasons.

Table 4.1. Number of bald eagle (*Haliaeetus leucocephalus*) observations[1] and eagle minutes[2] by month during eagle use surveys at the High Bridge Wind Project March 1, 2018 – February 10, 2019.

Month	Survey Hours	Bald Eagle Observations[1]	Bald Eagle Minutes[2]	Eagle Minutes per Survey Hour
March 2018	40	0	0	0
April 2018	25	3	7	0.28
May 2018	20	1	0	0
June 2018	28	3	14	0.5
July 2018	35	4	24	0.69
August 2018	28	0	0	0
September 2018	35	9	33	0.94
October 2018	49	3	4	0.08
November 2018	49	3	14	0.29
December 2018	42	0	0	0
January 2019	35	0	0	0
February 2019	40	0	0	0
Totals	**400**	**26**	**96**	**0.24**

[1] Observations regardless of distance
[2] Observations of eagles flying within an 800-meter (m; 2,625-foot [ft]) x 230-m (755-ft) cylinder

The Facility Site is a mix of deciduous forest (58.2%, 923 ha 2,280 ac]) and hay/pasture (22.5%; 356 ha [880 ac]), with smaller amounts of mixed forest, evergreen forest, cultivated crops, woody wetlands, herbaceous areas, open water, and scrub/shrub (Yang et al. 2018, Multi-Resolution Land Characteristics [MRLC] 2019). Based upon observations of bald eagles during eagle use surveys, individuals generally fly over the Survey Area during fall migration with the greatest number of sightings corresponding with the early fall peak of migration associated with southern breeding bald eagles (Goodrich and Smith 2008), suggesting that most of the eagles observed during this periods were likely transients. A smaller peak of bald eagle use of the Survey Area occurred in June and July, which is consistent with movements of locally breeding birds and their offspring.

[redacted].

Aerial surveys of nests were completed in the Survey Area and a surrounding 16.1 km (10.0 mi) buffer) in the spring of 2019. No bald eagle nests were documented within the Survey Area or Facility Site. Eight occupied and active, one occupied and inactive, and three unoccupied bald eagle-sized nests were documented in the 16.1 km (10.0 mi) buffer around the Survey Area (Figure 3.4) [redacted].

4.2.3.4 Golden Eagle

Golden eagles are a long-lived (up to 30 years or more), large raptor, that weigh 3.2 – 6.4 kg (7.0-14.0 lbs) and have a wingspan up to 1.9 m (6.2 ft; NYSDEC 2018b). Golden eagles are distinguished from bald eagles by a smaller, darker bill, feathers present on the legs down to the toes, and its golden-brown body plumage with lighter, golden feathers on the head and nape. Immature golden eagles are often hard to distinguish from immature bald eagles; however, the presence of white patches on the underside of the wing with a broad white tail that has a dark band indicates an immature golden eagle (NYSDEC 2018b). A clutch consists of one or two eggs that incubate for 35-45 days before hatching. Once hatched, golden eaglets fledge in 65-75 days (NYSDEC 2018b). Eastern golden eagles primarily feed on live prey such as deer, turkey, squirrels, and other medium-sized birds and mammals (Eastern Golden Eagle Working Group 2015); however, they feed on carrion and waterfowl as well during the winter (NYSDEC 2018b).

Golden eagles are found across much of the US; however, they are more common in the western US than the eastern US (NYSDEC 2018b). The Adirondacks formerly contained approximately six nesting pairs of golden eagles. However, no golden eagles have been recorded nesting in New York since 1979 and the last successful fledgling golden eagle was recorded in 1972 (NYNHP 2017). The disappearance of breeding golden eagles in New York coincides with the recovery of forests in New York (NYNHP 2017); although recent telemetry research indicates the species mostly uses forested landscapes during winter (Miller et al. 2017). The NYSDEC monitors historic golden eagle breeding areas; however, no reintroduction of breeding golden eagles has been attempted in New York to date and no nest records for golden eagles currently exist (NYSDEC 2018b).

Golden eagles use a variety of habitats across the US including tundra, grasslands, forests, woodland, brushlands, and arid deserts (USFWS 2011); eastern golden eagles wintering in the US primarily use forests, open areas, and steep hillsides (Miller et al. 2017; Duerr et al. in press). Historical golden eagle nests in the eastern US were found on cliff ledges or in the largest trees in forested stands providing an unobstructed view of the surrounding habitat (NYNHP 2017). Eastern US golden eagles migrate from Canadian provinces to milder areas throughout the eastern US during the winter, particularly forested ridges along the Appalachian Mountains (Miller et al. 2017). They migrate mostly during daytime along north/south cliffs and ridges using thermal and terrain-generated updrafts (USFWS 2011, Duerr et al. 2012).

One year of eagle use surveys was completed at the Survey Area and surrounding area from March 2018 to February 2019 in accordance with the USFWS ECPG (USFWS 2013); an additional year of eagle use surveys is underway in 2019-2020. During the first year of eagle use surveys, 400 hours of surveys were completed during which of three golden eagle observations were made totaling 13 eagle minutes; eagle minutes are used by USFWS to estimate exposure to turbines. Survey hours were stratified by season to sample migration most intensively; therefore the observation hours during spring and fall migration were higher than the rest of the year. Golden eagles were only observed during the spring (April) and fall migration (October).

Table 4.2. Number of golden eagle (*Aquila chrysaetos*) observations[1] and eagle minutes[2] by month during eagle use surveys at the High Bridge Wind Project March 1, 2018 – February 10, 2019.

Month	Survey Hours	Golden Eagle Observations[1]	Golden Eagle Minutes[2]	Eagle Minutes per Survey Hour
March 2018	40	0	0	0
April 2018	25	1	0	0
May 2018	20	0	0	0
June 2018	28	0	0	0
July 2018	35	0	0	0
August 2018	28	0	0	0
September 2018	35	0	0	0
October 2018	49	2	13	0.27
November 2018	49	0	0	0
December 2018	42	0	0	0
January 2019	35	0	0	0
February 2019	40	0	0	0
Totals	**400**	**3**	**13**	**0.03**

[2.] Observations regardless of distance
[1] Observations of eagles flying within an 800-meter (m; 2,625-foot [ft]) x 230-m (755-ft) cylinder

Golden eagle flights within the Survey Area were uncommon, and therefore no pattern was discernable. Isolated flights were observed in the southwestern, central, and northeastern portions of the Survey Area. Timing of golden eagle observations within the Survey Area was consistent with the early portion of the species' fall migration period and the late spring migration period in eastern North America (Goodrich and Smith 2008, Miller 2019).

Aerial surveys for eagle nests were completed in the Survey Area and a surrounding 16.1 km (10.0 mi) buffer in 2019. No golden eagle nests were documented in the Survey Area (or Facility Site) or within the 16.1 km (10.0 mi) buffer (Figure 3.4).

4.2.3.5 State Species of Special Concern

WEST documented seven state species of special concern during surveys within the Facility Site (Cooper's hawk, sharp-shinned hawk, red-shouldered hawk, common loon, osprey, common nighthawk, and grasshopper sparrow). Twenty-four observations of common loons were recorded during RMS and EUS. No common loon nesting habitat is present within the Facility Site and impacts to this species are not expected based on the limited number of observations during all Facility Site surveys. Only one observation each was reported for common nighthawk and grasshopper sparrow during all surveys, suggesting limited use of the Facility Site and a low risk of impacts from construction and operation of the Facility Site.

The remaining species of special concern are raptors which have shown negligible displacement impacts and lower fatality rates at wind energy facilities across the northeastern US and southern Ontario, Canada (see Section 4.3.1.3 and 4.3.2.3). All of the raptor species observed likely pass through the Facility Site during migration and may be at risk of turbine collision; however, impacts from the construction and operation of the Facility Site are not expected to cause local population declines.

One observation of Cooper's hawk and one of sharp-shinned hawk were recorded during breeding bird surveys. Forest clearing for infrastructure construction represents the most immediate impact to breeding raptors. However, forest clearing is anticipated to be conducted between November 1 and March 31, which is outside the nesting period for many forest dwelling bird species and minimizes or avoids impacts to these species. If tree clearing is needed during the nesting season for forest dwelling birds (May 15 – July 15) or eagles (February 1 – June 30), High Bridge will follow the Avoidance and Minimization Measures outlined in Table 5.1 of the Net Conservation Benefit Plan (Ritzert et al.2019c).

4.2.3.6 State Species of Greatest Conservation Need

Ten state species of greatest conservation need (SGCN; American kestrel, black-billed cuckoo, black-throated blue warbler, blue-winged warbler, cedar waxwing, Louisiana waterthrush, prairie warbler, ruffed grouse, scarlet tanager, and wood thrush) and four species of HPSGCN (bobolink, brown thrasher, Canada warbler, and eastern meadowlark) were observed during breeding bird surveys and RMS.

Six SGCN or HPSGCN were observed in limited numbers (10 or fewer observations) during surveys (Canada warbler, black-billed cuckoo, Louisiana waterthrush, ruffed grouse, brown thrasher, and eastern meadowlark), suggesting limited potential for population level impacts from Facility Site construction and operation.

Potential impacts to American kestrel from Facility Site construction and operation are expected to be minimal as raptors have generally shown negligible displacement impacts and lower fatality rates at wind energy facilities across the northeastern US and southern Ontario, Canada, (see Section 4.3.1.3 and 4.3.2.3).

One group of whimbrels was recorded during RMS. As whimbrels do not breed in New York, the observation was likely of a group of migrants. No whimbrel fatalities have been reported at wind energy facilities across the northeastern US and southern Ontario, Canada (see Appendix A3 for list of studies examined). Impacts to this species are generally not expected from Facility Site construction and operation.

The remaining SGCN and HPSGCN are passerines and potential impacts to these species from Facility Site construction and operation are expected to be minimal. While potential collision risk for these species may be possible in the Facility Site, cumulative collision fatalities for small passerines at wind energy facilities across the US and Canada have proven to be insignificant at a population level (Erickson et al. 2014). Additionally, the SGCN and HPSGCN species observed during surveys are still considered fairly common in the region (Pardieck et al. 2018) and are not listed as threatened, endangered, or of special concern.

4.2.3.7 Wildlife Concentration Areas

No wildlife concentration areas have been identified within the Facility Site; therefore, no direct impacts to wildlife concentration areas are expected. The two closest potential concentration areas are the state recognized Pharsalia Woods Important Bird Area (IBA; 14.0 km [8.7 mi] west

of the Facility Site) and globally recognized Catskills Peaks IBA (15.5 km [9.6 mi] south of the Facility Site; National Audubon Society 2019). The Pharsalia IBA is composed of high-elevation forests surrounded by open farmland and contains some of the largest unfragmented stands of hardwood and mixed forest in New York (WEST 2016).

The aforementioned IBA's support a variety of breeding forest birds, including the state-threatened northern harrier, and four raptor species of special concern (sharp-/shinned hawk, Cooper's hawk, northern goshawk [*Accipiter gentilis*], and red-shouldered hawk). The Catskills Peaks IBA includes one of the state's largest contiguous forest tracts. Numerous species of birds are known to occur within the IBA, including the state-threatened bald eagle, and state species of special concern cerulean warbler (*Setophaga cerulea*), Cooper's hawk, northern goshawk, osprey, red-shouldered hawk, and sharp-shinned hawk, which have all been recorded at the IBA during the breeding season. No direct or indirect impacts to either IBA are expected from construction and operation of the Facility Site.

5.0 CONCLUSIONS

Construction and operation of the Facility Site will result in only minor loss of available habitat, differing levels of disturbance and displacement across species, and collision risk with turbines that is likely to resemble that reported by most New York State wind energy facilities. Based on the data collected to date available, impacts at the Facility Site level are not likely to result in population level effects locally, regionally, or range-wide for species affected. A cumulative impact assessment of avian and bat impacts is presented in a separate document.

Data collected on site indicates a fairly typical risk profile based on species composition and relative abundance and it's anticipated that the results of post-construction monitoring would be similar to other wind projects in New York State.

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Appendix A. List of Studies at Wind Energy Facilities in the Northeast Reporting Comparable Bird Fatality Rates and Data on Bird Species found as Fatalities

Appendix A1. Wind energy facilities in the northeastern US (New York, Maine, New Hampshire, Maryland, and Pennsylvania) and southern Ontario, Canada, with publicly available and comparable fatality rate data for all bird species.

Wind Energy Facility	Fatality Estimate (birds/MW/year)	Fatality Estimate (birds/turbine/ year)	No. of Turbines	Total MW
Arthur, ON (2012)	11.99	23.98	5	10
Bull Hill, ME (2013)	8.65	15.46	19	34
Stetson Mountain I, ME (2013)	6.95	10.42	38	57
Naylor Wind Farm, ON (2012)	6.63	13.26	5	10
Point-Aux-Roches Wind Farm, ON (2012)	6.46	11.73	27	49
Criterion, MD (2011)	6.40	16.01	28	70
Wolfe Island Ecopower Centre, ON (2010)	6.38	14.54	86	198
Steel Winds I & II, NY (2013)	6.20	15.50	14	35
South Side Wind Farm, ON (2012)	5.57	11.14	5	10
Spruce Mountain Wind Project, ME (2014)	5.03	10.06	10	20
Mount Storm, WV (2011)	4.24	8.49	132	264
Naylor Wind Farm, ON (2011)	4.00	8.00	5	10
Pinnacle, WV (2012)	3.99	9.58	23	55.2
Gosfield WPP, ON (2012)	3.97	9.13	22	51
Comber WEP, ON (2013)	3.94	9.06	72	166
Mount Storm, WV (2009)	3.85	7.70	132	264
Kent Breeze Wind Farm, ON (2012)	3.80	9.49	8	20
Record Hill, ME (2012)	3.70	8.46	22	50.6
Naylor Wind Farm, ON (2013)	3.64	7.26	5	10
Criterion, MD (2013)	3.49	8.74	28	70
Rollins, ME (2014)	3.43	5.14	40	60
North Malden, ON (2012)	3.41	6.82	5	10
Lempster, NH (2009)	3.38	6.75	12	24
Oakfield, ME (2017)	3.38	10.13	48	148
Stetson Mountain II, ME (2012)	3.37	5.06	17	25.5
South Side Wind Farm, ON (2011)	3.31	6.59	5	10
Stetson II, ME (2014)	3.25	4.87	17	26
Oakfield, ME (2016)	3.14	9.42	48	148
Roth Rock, MD (2011)	3.12	7.84	20	50
Ripley, ON (2008)	3.09	6.17	38	76
Wolfe Island Ecopower Centre, ON (2009)	3.04	6.99	86	198
Melancthon Ecopower Centre, ON (2009)	3.00	4.50	133	
Grand Valley Wind Farm Project, ON (2013)	2.99	6.59	9	20
Oxley Wind Farm, ON (2015)	2.96	5.93	3	6
Kent Breeze Wind Farm, ON (2011)	2.94	7.36	8	20
Rollins, ME (2012)	2.90	4.35	40	60
Casselman, PA (2009)	2.88	4.32	23	34.5
Record Hill, ME (2016)	2.85	6.51	22	51
North Malden, ON (2011)	2.84	5.68	5	10
Gracey Wind Farm, ON (2011)	2.76	5.53	5	10
Kent Breeze Wind Farm, ON (2013)	2.70	6.70	8	20
Mountaineer, WV (2003)	2.69	4.04	44	66
Raleigh, ON (2012)	2.68	4.03	52	78
Stetson Mountain I, ME (2009)	2.68	4.03	38	57
Noble Ellenburg, NY (2009)	2.66	3.99	54	80
Lempster, NH (2010)	2.64	5.27	12	24
Mount Storm, WV (2010)	2.60	5.20	132	264
Mohawk Point, ON (2011)	2.52	4.16	6	10
Arthur Wind Farm, ON (2011)	2.50	5.00	5	10

Appendix A1. Wind energy facilities in the northeastern US (New York, Maine, New Hampshire, Maryland, and Pennsylvania) and southern Ontario, Canada, with publicly available and comparable fatality rate data for all bird species.

Wind Energy Facility	Fatality Estimate (birds/MW/year)	Fatality Estimate (birds/turbine/ year)	No. of Turbine s	Total MW
Goshen WEC, ON (2015)	2.50	4.04	63	102
Port Alma & Chatham, ON (2011)	2.50	5.77	88	202
Bluewater WEC, ON (2016)	2.49	4.04	37	60
Groton, NH (2013)	2.45	4.89	24	48
Bluewater, ON (2015)	2.44	3.97	37	60
Gesner WEP, ON (2015)	2.43	4.86	5	10
Summerhaven Wind Energy Centre, ON (2015)	2.43	5.39	56	124
Port Alma, ON (2010)	2.42	5.56	44	101
Maple Ridge, NY (2007)	2.34	3.87	195	321.75
Hancock, ME (2017)	2.33	6.99	17	51
Plateau Wind Farm, ON (2012)	2.31	3.48	18	27
Noble Bliss, NY (2009)	2.28	3.42	67	100
Talbot Wind Farm, ON (2012)	2.22	5.10	43	99
Plateau Wind Farm, ON (2013)	2.20	3.29	18	27
Conestogo WEC, ON (2013)	2.19	5.03	10	23
Gosfield WPP, ON (2011)	2.18	5.02	22	51
St. Columbian Wind Project, ON (2016)	2.18	4.80	15	33
Criterion, MD (2012)	2.14	5.34	28	70
Oxley Wind Farm, ON (2014)	2.12	4.24	3	6
Maple Ridge, NY (2007-2008)	2.07	3.42	195	321.75
Comber WEP, ON (2014)	1.99	4.59	72	166
Dufferin Wind, ON (2015)	1.99	3.73	49	91
Kent Breeze Wind Farm, ON (2014)	1.98	4.95	8	20
Port Alma & Chatham, ON (2012)	1.95	4.49	88	202
Passadumkeag, ME (2016)	1.91	6.32	13	43
Noble Altona, NY (2010)	1.84	2.76	65	97.5
Record Hill, ME (2014)	1.84	4.20	22	50.6
Mohawk Point, ON (2009)	1.82	3.02	6	10
Bingham Wind Project, ME (2017)	1.81	5.98	56	185
Melancthon Wind Plant, ON (2010)	1.81	2.73	133	
Raleigh, ON (2011)	1.79	2.68	52	78
High Sheldon, NY (2010)	1.76	2.64	75	112.5
Mars Hill, ME (2008)	1.76	2.65	28	42
Summerhaven Wind Energy Centre, ON (2014)	1.76	3.91	56	124
Jericho WEC, ON (2015)	1.73	2.84	92	150
Kibby, ME (2014)	1.72	5.18	44	132
Comber WEP, ON (2015)	1.70	3.91	72	166
Noble Wethersfield, NY (2010)	1.70	2.55	84	126
East Lake St. Clair, ON (2015)	1.68	3.03	55	99
South Kent Wind Project, ON (2015)	1.68	3.69	124	270
Mars Hill, ME (2007)	1.67	2.47	28	42
Point-Aux-Roches Wind Farm, ON (2013)	1.67	3.03	27	49
Gesner WEP, ON (2014)	1.66	3.32	5	10
Noble Chateaugay, NY (2010)	1.66	2.48	71	106.5
Erieau Wind Farm, ON (2015)	1.65	2.99	55	99
Enbridge Ontario Wind Power, ON (2009)	1.64	2.70	110	182
Grand Valley Wind Farm Project, ON (2012)	1.64	3.78	9	20
Arthur Wind Project, ON (2013)	1.62	3.25	5	10
Gracey Wind Farm, ON (2013)	1.62	3.21	5	10

Appendix A1. Wind energy facilities in the northeastern US (New York, Maine, New Hampshire, Maryland, and Pennsylvania) and southern Ontario, Canada, with publicly available and comparable fatality rate data for all bird species.

Wind Energy Facility	Fatality Estimate (birds/MW/year)	Fatality Estimate (birds/turbine/ year)	No. of Turbines	Total MW
Wolfe Island Ecopower Centre, ON (2011)	1.61	3.71	86	198
Noble Clinton, NY (2008)	1.59	2.39	67	100
Cohocton/Dutch Hill, NY (2013)	1.58	3.96	50	125
Gesner Wind Energy, ON (2013)	1.58	3.16	5	10
Harrow Wind Farm, ON (2011)	1.57	2.59	24	40
High Sheldon, NY (2011)	1.57	2.36	75	112.5
North Malden, ON (2013)	1.53	3.05	5	10
Casselman, PA (2008)	1.51	2.27	23	34.5
Groton, NH (2014)	1.50	3.01	24	48
Beech Ridge, WV (2013)	1.48	2.22	67	100.5
Munnsville, NY (2008)	1.48	2.22	23	34.5
Stetson Mountain II, ME (2010)	1.42	2.14	17	25.5
Cohocton/Dutch Hill, NY (2009)	1.39	3.43	50	125
Conestogo WEC, ON (2015)	1.36	3.13	10	23
Bornish WEC, ON (2015)	1.34	2.17	45	73
Cohocton/Dutch Hills, NY (2010)	1.32	1.98	50	125
Noble Bliss, NY (2008)	1.30	1.95	67	100
East Lake St. Clair, ON (2014)	1.29	2.33	55	99
Howard, NY (2012)	1.29	2.50	27	54
Conestogo WEC, ON (2014)	1.24	2.83	10	23
Beech Ridge, WV (2012)	1.19	1.79	67	100.5
Stetson Mountain I, ME (2011)	1.18	1.77	38	57
Erieau Wind Farm, ON (2014)	1.15	2.08	55	99
Gracey Wind Farm, ON (2012)	1.14	2.25	5	10
Cruickshank Wind Farm, ON (2010)	1.13	1.87	5	8
Noble Clinton, NY (2009)	1.11	1.67	67	100
Bornish WEC, ON (2016)	1.10	1.78	45	73
Mohawk Point, ON (2010)	1.05	1.73	6	10
Grand Renewable Wind, ON (2015)	0.98	2.17	67	149
Groton, NH (2015)	0.98	1.96	24	48
Melancthon 1 Wind Plant, ON (2007)	0.93	1.40	45	68
Cruickshank Wind Farm, ON (2009)	0.90	1.49	5	8
Locust Ridge, PA (Phase II; 2009)	0.84	1.68	51	102
Noble Ellenburg, NY (2008)	0.83	1.25	54	80
Wolfe Island Ecopower Centre, ON (2012)	0.77	1.76	86	198
Enbridge Ontario Wind Power, ON (2010)	0.76	1.25	110	182
Locust Ridge, PA (Phase II; 2010)	0.76	1.51	51	102
Ernestown Wind Park, ON (2015)	0.70	1.40	5	10
Port Alma, ON (2009)	0.70	1.60	44	101
Grand Valley, ON (2016)	0.68	1.69	16	40
Talbot Wind Farm, ON (2011)	0.65	1.49	43	99
Adelaide Wind, ON (2016)	0.44	0.98	18	40
Howard, NY (2013)	0.37	0.75	27	54
Quixote One, ON (2015)	0.00	0.00	1	2
Springwood Wind Project, ON (2015)	0.00	0.00	4	8

Appendix A1 (*continued*). Wind energy facilities in the northeastern US (New York, Maine, New Hampshire, Maryland, and Pennsylvania) and southern Ontario, Canada, with publicly available and comparable fatality rate data for all bird species.

Wind Energy Facility	Citation	Wind Energy Facility	Citation
Adelaide Wind, ON (2016)	Stantec Consulting Ltd. (Stantec Ltd.) 2017a	Mars Hill, ME (2008)	Stantec 2009a
Arthur Wind Farm, ON (2011)	M.K. Ince and Associates, Ltd. 2012	Melancthon 1 Wind Plant, ON (2007)	Stantec Ltd. 2008
Arthur Wind Project, ON (2013)	Natural Resource Solutions, Inc. (NRSI) 2014a	Melancthon Ecopower Centre, ON (2009)	Stantec Ltd. 2010c
Arthur, ON (2012)	NRSI 2013a	Melancthon Wind Plant, ON (2010)	StantecLtd. 2010d
Beech Ridge, WV (2012)	Tidhar et al. 2013a	Mohawk Point, ON (2009)	NRSI 2010
Beech Ridge, WV (2013)	Young et al. 2014a	Mohawk Point, ON (2010)	NRSI 2011b
Bingham Wind Project, ME (2017)	TRC 2017a	Mohawk Point, ON (2011)	NRSI 2012b
Bluewater WEC, ON (2016)	NRSI 2017a	Mount Storm, WV (2009)	Young et al. 2009a, 2010b
Bluewater, ON (2015)	NRSI 2016a	Mount Storm, WV (2010)	Young et al. 2010a, 2011b
Bornish WEC, ON (2015)	NRSI 2016b	Mount Storm, WV (2011)	Young et al. 2011a, 2012a
Bornish WEC, ON (2016)	NRSI 2017b	Mountaineer, WV (2003)	Kerns and Kerlinger 2004
Bull Hill, ME (2013)	Stantec Consulting, Inc. (Stantec) 2014a	Munnsville, NY (2008)	Stantec 2009b
Casselman, PA (2008)	Arnett et al. 2009	Naylor Wind Farm, ON (2011)	NRSI 2012c
Casselman, PA (2009)	Arnett et al. 2010	Naylor Wind Farm, ON (2012)	NRSI 2013c
Cohocton/Dutch Hill, NY (2009)	Stantec 2010	Naylor Wind Farm, ON (2013)	NRSI 2014d
Cohocton/Dutch Hill, NY (2013)	Stantec 2014b	Noble Altona, NY (2010)	Jain et al. 2011a
Cohocton/Dutch Hills, NY (2010)	Stantec 2011b	Noble Bliss, NY (2008)	Jain et al.2009c
Comber WEP, ON (2013)	Stantec Ltd. 2014a	Noble Bliss, NY (2009)	Jain et al. 2010c
Comber WEP, ON (2014)	Stantec Ltd. 2014b	Noble Chateaugay, NY (2010)	Jain et al. 2011b
Comber WEP, ON (2015)	Stantec Ltd. 2016	Noble Clinton, NY (2008)	Jain et al. 2009d
Conestogo WEC, ON (2013)	NRSI 2014b	Noble Clinton, NY (2009)	Jain et al. 2010a
Conestogo WEC, ON (2014)	NRSI 2015a	Noble Ellenburg, NY (2008)	Jain et al. 2009e
Conestogo WEC, ON (2015)	NRSI 2016c	Noble Ellenburg, NY (2009)	Jain et al. 2010b
Criterion, MD (2011)	Young et al. 2012b	Noble Wethersfield, NY (2010)	Jain et al. 2011c
Criterion, MD (2012)	Young et al. 2013	North Malden, ON (2011)	NRSI 2012d
Criterion, MD (2013)	Young et al. 2014b	North Malden, ON (2012)	NRSI 2013d
Cruickshank Wind Farm, ON (2009)	Stantec Ltd. 2010a	North Malden, ON (2013)	NRSI 2014e
Cruickshank Wind Farm, ON (2010)	Stantec Ltd. 2012a	Oakfield, ME (2016)	Stantec 2017b
Dufferin Wind, ON (2015)	NRSI 2016d	Oakfield, ME (2017)	TRC 2018
East Lake St. Clair, ON (2014)	Dillon Consulting 2015a	Oxley Wind Farm, ON (2014)	NRSI 2014f

Appendix A1 (*continued*). Wind energy facilities in the northeastern US (New York, Maine, New Hampshire, Maryland, and Pennsylvania) and southern Ontario, Canada, with publicly available and comparable fatality rate data for all bird species.

East Lake St. Clair, ON (2015)	Dillon Consulting 2016a	Oxley Wind Farm, ON (2015)	NRSI 2016h
Enbridge Ontario Wind Power, ON (2009)	Stantec Ltd. 2010b	Passadumkeag, ME (2016)	Ritzert et al. 2017
Enbridge Ontario Wind Power, ON (2010)	Stantec Ltd. 2011a	Pinnacle, WV (2012)	Hein et al. 2013a
Erieau Wind Farm, ON (2014)	Dillon Consulting 2015b	Plateau Wind Farm, ON (2012)	NRSI 2013e
Erieau Wind Farm, ON (2015)	Dillon Consulting 2016b	Plateau Wind Farm, ON (2013)	NRSI 2014g
Ernestown Wind Park, ON (2015)	Bowfin Environmental Consulting, Inc. 2016	Point-Aux-Roches Wind Farm, ON (2012)	NRSI 2013f
Gesner WEP, ON (2014)	M. K. Ince and Associates, Ltd. 2015	Point-Aux-Roches Wind Farm, ON (2013)	NRSI 2014h
Gesner WEP, ON (2015)	NRSI 2016e	Port Alma & Chatham, ON (2011)	Stantec Ltd. 2012c
Gesner Wind Energy, ON (2013)	Stantec Ltd. 2014c	Port Alma & Chatham, ON (2012)	Stantec Ltd. 2013b
Gosfield WPP, ON (2011)	Stantec Ltd. 2012b	Port Alma, ON (2009)	M. K. Ince and Associates Ltd. 2010
Gosfield WPP, ON (2012)	Stantec Ltd. 2013a	Port Alma, ON (2010)	Stantec Ltd. 2011b
Goshen WEC, ON (2015)	NRSI 2016f	Quixote One, ON (2015)	Leader Resources Services Corp. 2016
Gracey Wind Farm, ON (2011)	NRSI 2012a	Raleigh, ON (2011)	Dillon Consulting 2012a
Gracey Wind Farm, ON (2012)	NRSI 2013b	Raleigh, ON (2012)	Dillon Consulting 2013
Gracey Wind Farm, ON (2013)	NRSI 2014c	Record Hill, ME (2012)	Stantec 2013a
Grand Renewable Wind, ON (2015)	Dillon Consulting 2016c	Record Hill, ME (2014)	Stantec 2015b
Grand Valley Wind Farm Project, ON (2012)	Stantec Ltd. 2015a	Record Hill, ME (2016)	Stantec 2017a
Grand Valley Wind Farm Project, ON (2013)	Stantec Ltd. 2015a	Ripley, ON (2008)	Jacques Whitford 2009
Grand Valley, ON (2016)	Stantec Ltd. 2017b	Rollins, ME (2012)	Stantec 2013b
Groton, NH (2013)	Stantec and Western EcoSystems Technology, Inc. (WEST) 2014	Rollins, ME (2014)	Stantec 2015c
Groton, NH (2014)	Stantec and WEST 2015a	Roth Rock, MD (2011)	Atwell, LLC 2012
Groton, NH (2015)	Stantec and WEST 2015b	South Kent Wind Project, ON (2015)	NRSI 2016i
Hancock, ME (2017)	TRC 2017b	South Side Wind Farm, ON (2011)	NRSI 2012e
Harrow Wind Farm, ON (2011)	NRSI 2011a	South Side Wind Farm, ON (2012)	NRSI 2013g
High Sheldon, NY (2010)	Tidhar et al. 2012a	Springwood Wind Project, ON (2015)	McIntosh Perry Consulting Engineers, Ltd. 2016
High Sheldon, NY (2011)	Tidhar et al. 2012b	Spruce Mountain Wind Project, ME (2014)	Tetra Tech, Inc. 2015

Appendix A1 (*continued*). Wind energy facilities in the northeastern US (New York, Maine, New Hampshire, Maryland, and Pennsylvania) and southern Ontario, Canada, with publicly available and comparable fatality rate data for all bird species.

Howard, NY (2012)	Tidhar et al. 2013c	St. Columban Wind Project, ON (2016)	Cole Engineering Group, Ltd. 2017
Howard, NY (2013)	Lukins et al. 2014	Steel Winds I & II, NY (2013)	Stantec 2014d
Jericho WEC, ON (2015)	NRSI 2016g	Stetson II, ME (2014)	Stantec 2015d
Kent Breeze Wind Farm, ON (2011)	BioLogic Incorporated 2012	Stetson Mountain I, ME (2009)	Stantec 2009c
Kent Breeze Wind Farm, ON (2012)	BioLogic Incorporated 2013	Stetson Mountain I, ME (2011)	Normandeau Associates 2011
Kent Breeze Wind Farm, ON (2013)	BioLogic Incorporated 2014	Stetson Mountain I, ME (2013)	Stantec 2014e
Kent Breeze Wind Farm, ON (2014)	BioLogic Incorporated 2015	Stetson Mountain II, ME (2010)	Normandeau Associates 2010
Kibby, ME (2014)	TRC Engineers LLC 2015	Stetson Mountain II, ME (2012)	Stantec 2013d
Laurel Mountain, WV (2013)	Stantec 2014c	Summerhaven Wind Energy Centre, ON (2014)	NRSI 2015b
Lempster, NH (2009)	Tidhar et al. 2010	Summerhaven Wind Energy Centre, ON (2015)	NRSI 2016j
Lempster, NH (2010)	Tidhar et al. 2011	Talbot Wind Farm, ON (2011)	Dillon Consulting 2011
Locust Ridge, PA (Phase II; 2009)	Arnett et al. 2011	Talbot Wind Farm, ON (2012)	Dillon Consulting 2012b
Locust Ridge, PA (Phase II; 2010)	Arnett et al. 2011	Wolfe Island Ecopower Centre, ON (2009)	Stantec Ltd. 2010e
Maple Ridge, NY (2007)	Jain et al. 2009a	Wolfe Island Ecopower Centre, ON (2010)	Stantec Ltd. 2011c
Maple Ridge, NY (2007-2008)	Jain et al. 2009b	Wolfe Island Ecopower Centre, ON (2011)	Stantec Ltd. 2012d
Mars Hill, ME (2007)	Stantec 2008	Wolfe Island Ecopower Centre, ON (2012)	Stantec, Ltd. 2014d

Appendix A2. Wind energy facilities in New York with publicly available and comparable fatality rate data for raptor species. Fatality estimate given as the number of fatalities per megawatt (MW) year.

Wind Energy Facility	Fatality Estimate	No. of Turbines	Total MW
Steel Winds I & II, NY (2013)	0.83	14	35
Munnsville, NY (2008)	0.59	23	34.5
Noble Ellenburg, NY (2009)	0.25	54	80
Noble Clinton, NY (2009)	0.16	67	100
Noble Wethersfield, NY (2010)	0.13	84	126
Noble Bliss, NY (2009)	0.12	67	100
Noble Ellenburg, NY (2008)	0.11	54	80
Noble Bliss, NY (2008)	0.10	67	100
Noble Clinton, NY (2008)	0.10	67	100
Cohocton/Dutch Hills, NY (2010)	0.08	50	125
Noble Chateaugay, NY (2010)	0.08	71	106.5
High Sheldon, NY (2010)	0.06	75	112.5
Maple Ridge, NY (2007-2008)	0.03	195	321.75
Cohocton/Dutch Hill, NY (2009)	0	50	125
Noble Altona, NY (2010)	0	65	97.5
High Sheldon, NY (2011)	0	75	112.5

Data from the following sources:

Wind Energy Facility	Citation	Wind Energy Facility	Citation
Cohocton/Dutch Hill, NY (2009)	Stantec Consulting, Inc. (Stantec) 2010	Noble Bliss, NY (2009)	Jain et al. 2010c
Cohocton/Dutch Hills, NY (2010)	Stantec 2011b	Noble Chateaugay, NY (2010)	Jain et al. 2011b
High Sheldon, NY (2010)	Tidhar et al. 2012a	Noble Clinton, NY (2008)	Jain et al. 2009d
High Sheldon, NY (2011)	Tidhar et al. 2012b	Noble Clinton, NY (2009)	Jain et al. 2010a
Maple Ridge, NY (2007-2008)	Jain et al. 2009b	Noble Ellenburg, NY (2008)	Jain et al. 2009e
Munnsville, NY (2008)	Stantec 2009b	Noble Ellenburg, NY (2009)	Jain et al. 2010b
Noble Altona, NY (2010)	Jain et al. 2011a	Noble Wethersfield, NY (2010)	Jain et al. 2011c
Noble Bliss, NY (2008)	Jain et al.2009c	Steel Winds I & II, NY (2013)	Stantec 2014d

Appendix A3. Wind energy facilities in the Northeastern US (New York, Pennsylvania, Maine, Maryland, and New Hampshire) with cumulative fatality data for all bird species.

Wind Energy Facility	Estimate Reference	Wind Energy Facility	Estimate Reference
Beech Ridge, WV (2012)	Tidhar et al. 2013a	Noble Bliss, NY (2009)	Jain et al. 2010c
Beech Ridge, WV (2013)	Young et al. 2014a	Noble Bliss/Wethersfield, NY (2011)	Kerlinger et al. 2011
Bingham Wind Project, ME (2017)	TRC 2017a	Noble Chateaugay, NY (2010)	Jain et al. 2011b
Bull Hill, ME (2013)	Stantec Consulting, Inc. (Stantec) 2014a	Noble Clinton, NY (2008)	Jain et al. 2009d
Bull Hill, ME (2014)	Stantec 2015a	Noble Clinton, NY (2009)	Jain et al. 2010a
Casselman, PA (2008)	Arnett et al. 2009	Noble Ellenburg, NY (2008)	Jain et al. 2009e
Casselman, PA (2009)	Arnett et al. 2010	Noble Ellenburg, NY (2009)	Jain et al. 2010b
Cohocton/Dutch Hill, NY (2009)	Stantec 2010	Noble Wethersfield, NY (2010)	Jain et al. 2011c
Cohocton/Dutch Hill, NY (2013)	Stantec 2014b	Oakfield, ME (2017)	TRC 2018
Cohocton/Dutch Hills, NY (2010)	Stantec 2011b	Passadumkeag, ME (2016)	Ritzert et al. 2017
Criterion, MD (2011)	Young et al. 2012b	Pinnacle, WV (2012)	Hein et al. 2013a
Criterion, MD (2012)	Young et al. 2013	Pinnacle Operational Mitigation Study, WV (2012)	Hein et al. 2013b
Criterion, MD (2013)	Young et al. 2014b	Port Dover and Nanticoke, ON (2014)	Stantec Ltd. 2015b
Grand Valley, ON (2016)	Stantec Consulting Ltd.(Stantec Ltd.) 2017b	Prince Wind Farm, ON (2006)	NRSI 2008
Hancock, ME (2017)	TRC 2017b	Prince Wind Farm, ON (2007)	NRSI 2008
Harrow, ON (2010)	Natural Resources Solutions Inc. (NRSI) 2011a	Prince Wind Farm, ON (2008)	NRSI 2009
Howard, NY (2012)	Tidhar et al. 2013c	Record Hill, ME (2012)	Stantec 2013a
Howard, NY (2013)	Lukins et al. 2014	Record Hill, ME (2014)	Stantec 2015b
Kibby, ME (2011)	Stantec 2012	Record Hill, ME (2016)	Stantec 2017a
Lempster, NH (2009)	Tidhar et al. 2010	Ripley, ON (2008)	Jacques Whitford 2009
Lempster, NH (2010)	Tidhar et al. 2011	Ripley, ON (Fall 2009)	Golder Associates 2010
Locust Ridge, PA (Phase II; 2009)	Arnett et al. 2011	Rollins, ME (2012)	Stantec 2013b
Locust Ridge, PA (Phase II; 2010)	Arnett et al. 2011	Roth Rock, MD (2011)	Atwell, LLC 2012
Madison, NY (2001-2002)	Kerlinger 2002b	Sheldon, NY (2010)	Tidhar et al. 2012a
Maple Ridge, NY (2006)	Jain et al. 2007	Sheldon, NY (2011)	Tidhar et al. 2012b
Maple Ridge, NY (2007)	Jain et al. 2009a	Spruce Mountain, ME (2012)	Tetra Tech 2013
Maple Ridge, NY (2007-2008)	Jain et al. 2009b	Spruce Mountain Wind Project, ME (2014)	Tetra Tech 2015
Maple Ridge, NY (2012)	Tidhar et al. 2013b	Steel Winds I & II, NY (2012)	Stantec 2013c
Mars Hill, ME (2007)	Stantec 2008	Steel Winds I & II, NY (2013)	Stantec 2014d
Mars Hill, ME (2008)	Stantec 2009a	Steel Winds I, NY (2007)	Grehan 2008
Melancthon, ON (Phase I; 2007)	Stantec Ltd. 2008	Stetson Mountain I, ME (2009)	Stantec 2009c
Meyersdale, PA (2004)	Arnett et al. 2005	Stetson Mountain I, ME (2011)	Normandeau Associates 2011
Mount Storm, WV (2008)	Young et al. 2009b	Stetson Mountain I, ME (2013)	Stantec 2014e
Mount Storm, WV (2009)	Young et al. 2009a, 2010b	Stetson Mountain II, ME (2010)	Normandeau Associates 2010

Appendix A3. Wind energy facilities in the Northeastern US (New York, Pennsylvania, Maine, Maryland, and New Hampshire) with cumulative fatality data for all bird species.

Wind Energy Facility	Estimate Reference	Wind Energy Facility	Estimate Reference
Mount Storm, WV (2010)	Young et al. 2010a, 2011b	Stetson Mountain II, ME (2012)	Stantec 2013d
Mount Storm, WV (2011)	Young et al. 2011a, 2012a	Wolfe Island, ON (May-June 2009)	Stantec Consulting Ltd. (Stantec Ltd.) 2010e
Mountaineer, WV (2003)	Kerns and Kerlinger 2004	Wolfe Island, ON (July-December 2009)	Stantec Ltd. 2010f
Mountaineer, WV (2004)	Arnett et al. 2005	Wolfe Island, ON (January-June 2010)	Stantec Ltd. 2011c
Munnsville, NY (2008)	Stantec 2009b	Wolfe Island, ON (July-December 2010)	Stantec Ltd. 2011d
Noble Altona, NY (2010)	Jain et al. 2011a	Wolfe Island, ON (January-June 2011)	Stantec Ltd. 2011e
Noble Altona, NY (2011)	Kerlinger et al. 2011a	Wolfe Island, ON (July-December 2011)	Stantec Ltd. 2012d
Noble Bliss, NY (2008)	Jain et al.2009c	Wolfe Island, ON (January-June 2012)	Stantec Ltd. 2014d