Exhibit Q. 2011 Bat Mist-Netting Report

Pesi 340.02

FINAL REPORT

MIST NET SURVEYS OF SUMMER BATS ON THE PROPOSED REPUBLIC WIND FARM SENECA AND SANDUSKY COUNTIES, OHIO

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1.0 Project Description

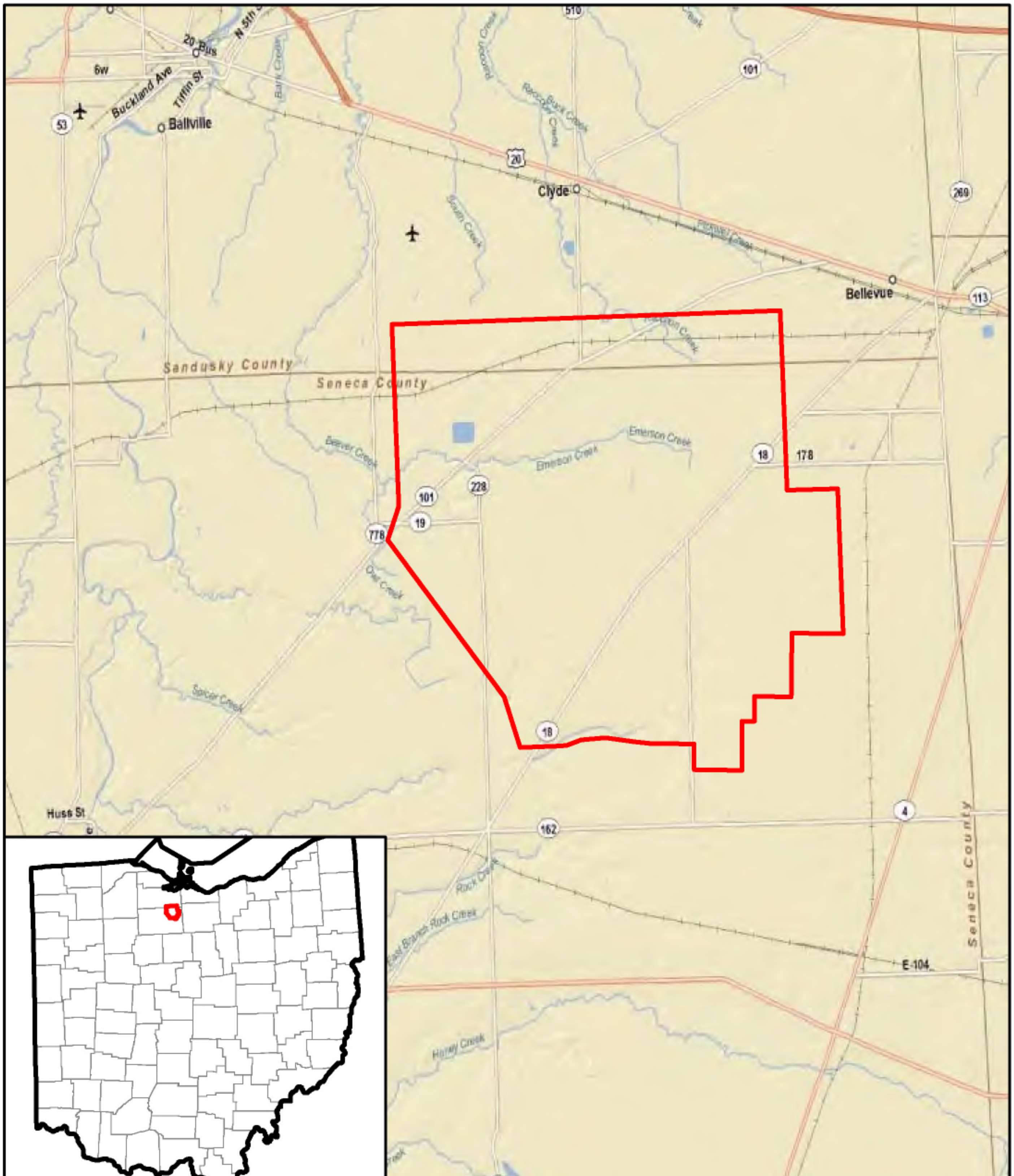
Republic Wind, LLC (Republic), is proposing to construct a commercial wind energy facility within a wind resource area consisting of approximately 16,028 hectares (39,607 ac) in Seneca and Sandusky counties, Ohio. The project area is referred to as the Republic Wind Farm (Project). On behalf of Republic, Tetra Tech EC, Inc. (Tetra Tech) contracted Environmental Solutions & Innovations, Inc. (ESI) to perform a summer mist net survey for summer bats on the Project site.

The Project straddles the Seneca/Sandusky county line, just east of the town of Green Springs in Sandusky County, Ohio (Figure 1) and covers part of the Fremont East, Clyde, Watson, and Fireside USGS 1/24000 Quadrangles. Indiana bats are resident in the state of Ohio during summer, and are known to hibernate in caves and mines within the state and in neighboring states of Indiana and Kentucky. The closest major hibernaculum is Preble Mine approximately 196.34 kilometers (122 mi) southwest of the Project in Preble County. The closest designated critical habitat for this species is Ray's Cave approximately 402.34 kilometers (250 mi) southwest of the Project in Greene County, Indiana. The closest county with documented maternity records is Lucas County to the northwest (Appendix A).

Based on previous agency coordination, Ohio Department of Natural Resources (ODNR) indicated that the Project met the need for a moderate monitoring and that sampling would require 25 mist-net sites.

2.0 Regulatory Setting

On 26 October 2007, the Department of the Interior signed a Charter to create the Federal Advisory Committee (FAC) to develop "effective measures to avoid or minimize impacts to wildlife and their habitats related to land-based wind energy facilities". Based in part on guidance provided by this committee, both ODNR and U.S. Fish and Wildlife (USFWS) have developed guidance for pre- and post-construction wildlife studies at commercial wind facilities. This survey is designed to comply with the Tier 3 study guidance found in the USFWS Draft Land-Based Wind Energy Guidelines (USFWS 2011) and the On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio developed by the ODNR (ODNR 2008). These guidelines provide a framework for compliance with a variety of natural resources regulations, including the Endangered



Project Boundary

N
W E
S

Figure 1. Location of the proposed Republic Wind Energy Facility in Seneca and Sandusky counties, Ohio.

Project No. 340

0 3 6 KM

Base Map: ESRI Street Map

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Species Act (ESA). Of particular concern is that the Project (as is the entire state of Ohio) is within the known range of the federally endangered Indiana bat (*Myotis sodalis*). As such, efforts to determine whether this species is present during summer are an important consideration of the study design, although these efforts should also be sufficient to document other species of bats present at the site.

The Federal Endangered Species Act (ESA) [16 U.S.C. 1531 et seq.] was codified into law in 1973. This law provides for the listing, conservation, and recovery of endangered and threatened species of plants and wildlife. Under the ESA, the U.S. Fish and Wildlife Service (USFWS) is mandated to monitor and protect listed species. Many states enacted similar laws.

Because the Project is within the range of the federally-endangered Indiana bat (*Myotis sodalis*), this study was designed to comply not only with the ODNR moderate intensity survey requirements for a commercial wind energy facility, but also to determine whether the site is occupied by a maternity colony of Indiana bats.

Section 9 of the ESA prohibits the "take" of listed species. "Take" is defined by the ESA as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" Both the USFWS and ODNR wind energy guidelines are designed to address regulatory issues related to the take of state and federally-listed species.

ESI completed all field efforts in accordance with our Federal U.S. Fish & Wildlife Permit # TE02373A-1 and ODNR Wild Animal Permit-Scientific Collection # 14-70.

3.0 Methods

3.1 Survey Objectives

As described in Section 2.0, the survey was designed to meet ODNR and USFWS guidelines as a mechanism for ESA compliance. While these guidelines do not outline specific goals or objectives, various benchmarks may be inferred, based on aspects of the survey process.

3.1.1 Presence or Probable Absence of Indiana Bats or Other Species of Concern

Capture of a federally listed Indiana bat or other species of concern may indicate that further evaluation of the effects of the Project on the species may be necessary. Evaluation of effects can lead to determination of whether the Project should be developed, appropriate avoidance and minimization measures, and need for compensation for species or habitat losses. Table 1 provides listing status of eleven

Table 1. Bats of Ohio and their listing status.

Bat Species	Status
Big brown bat	
Little brown bat	Undergoing 90 day review by USFWS
Northern bat	Undergoing status review by USFWS
Indiana bat	Federally endangered
Eastern small-footed bat	State species of concern
Tri-colored bat	
Eastern red bat	
Hoary bat	
Silver-haired bat	
Evening bat	
Rafinesque's big-eared bat	State species of concern

bat species recorded in the State of Ohio (Brack et al. 2010). Appendix A provides ecology of listed species, and those species which may be listed during the life of the project.

3.1.2 Habitat of Indiana Bats or Other Species of Concern

If Indiana bats or other species of concern are captured, ODNR guidelines require identification of roosting and foraging habitat through the use of radio-telemetry. Identification of habitat use can aid in the evaluation of the potential effects of the Project on these species. Identification of maternity roosts, and subsequent exit counts, can suggest local population sizes, and thus potential effects. Roosting and foraging behavior can suggest habitat preferences and aid in the identification of preferred roosting and foraging habitat. Proximity of roosting and foraging habitat to the Project area can also aid in the evaluation of the potential effects of Project development on the listed species.

3.1.3 Maternity colonies of All Other Bat Species

ODNR requires radio telemetry to attempt to identify the location of the maternity colony in instances where more than fifteen reproductive females of one common colonial species (e.g., big brown bat, little brown, or northern bat) are captured in one night of mist netting.Similar to species of concern, data collected on maternity colonies of these species may provide insight to potential effects from Project development.

3.1.4 Bat Community Composition

While secondary to determining potential Project effects on listed species or larger colonies of non-listed species, local bat community composition may provide insight on reducing effects to all bat species in regions where wind energy development is likely. Certainly, data collected and recorded in a standardized manner should be comparable over different spatial and temporal scales. Thus, adherence to ODNR survey guidelines may ensure consistency in evaluation of effects to listed and non-listed species.

3.2 Survey Effort

Notwithstanding the foregoing, bat surveys are difficult to standardize because of the large amount of variability that exists at an individual survey site or between survey sites. Sampling efforts followed guidelines provided by the Indiana Bat Recovery Team in the 2007 Indiana Bat Draft Recovery Plan (First Revision) (Table 2) as supplemented by guidance provided in ODNR's On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio (ODNR 2008) (Table 3).

ODNR's guidelines provide ODNR the discretion to assess the site and determine the level of survey effort required. The following categories were used to determine the level of effort:

Minimum

- These areas are large tracts of agricultural lands that do not come within 500 meters of a woodland ≥ 10 hectares, wetlands ≥ 3 hectares, or large water body (i.e. rivers, lakes, or reservoirs)

Moderate

- Primarily agricultural or grasslands, with patches of forests, wetlands, and/or other habitat

Extensive

- These include those areas within proximity to migratory corridors, staging areas, Audubon Important Bird Areas (IBA's), or the Lake Erie shoreline (3-mile buffer)

Based on previous agency coordination, ODNR indicated that the Project met the need for a moderate monitoring study and recommended sampling at 25 mist net sites. A summary of moderate monitoring guidelines is provided in Table 3.

Each net site was sampled on two nonconsecutive nights. Within each net site, four individual net sets were placed. Mist nets were 6, 9, or 12 meters (18, 30 or 42 feet) wide, and 2-4 individual nets were stacked on each set of poles such that the entire set ranged in height from approximately 6 to 9 meters (20-30 feet). At least one net set at each site was 7.5 meters (24.6 feet) or taller in height. Following the USFWS and ODNR protocols, ESI conducted surveys within the 15 June to 31 July window, from 12 to 30 July 2011 at 25 net sites to provide adequate survey coverage of the Project.

Table 2. USFWS Indiana Bat Mist Net Survey Guidelines

USFWS NETTING GUIDELINES

1. Netting Season: 15 May to 15 August, when Indiana bats occupy summer habitat.
2. Equipment (Mist Nets): constructed of the finest, lowest visibility mesh commercially available – monofilament or black nylon – with the mesh size approximately 38 millimeter (1.5 in).
3. Net Placement: mist nets extend approximately from water or ground level to tree canopy and are bounded by foliage on the sides. Net width and height are adjusted for the fullest coverage of the flight corridor at each site. A "typical" net set consists of three (or more) nets "stacked" on top of one another; width may vary up to 20 meters (60 ft).
4. Net Site Spacing:
   - Streams – one net site per 1 kilometer (0.6 mi)
   - Land Tracts – two net sites per 1 square kilometer (246 ac)
5. Minimum Level of Effort Per Net Site:
   - Two net locations (sets) per net site, with locations (sets) at least 30 meters (100 ft) apart
   - Two (calendar) nights of netting
   - At least four net–nights (1 net–night = 1 net set deployed for 1 night); typically, two net sets are deployed at one site for two nights, resulting in four net-nights
   - Sample Period: begin at dusk and net for 5 hours (approximately 0200h)
   - Nets are monitored at approximately 10-minute intervals
   - No disturbance near the nets between checks
6. Weather Conditions: net only if the following weather conditions are met:
   - No precipitation
   - Temperature $\geq$ 10° Celsius (50° F)
   - No strong winds

Source: U.S. Fish and Wildlife Service, 2007

Nets were on a pulley system allowing biologists to raise and lower them as necessary to retrieve bats. Nets were erected at dusk and kept in place for at least 5 continuous netting hours. The nets were attended continuously and checked at least every 10 minutes.

3.3 Net site Selection

Thirty potential net sites (primarily in and adjacent to isolated woodlots) were pre-selected by ESI and Tetra Tech biologists prior to field deployment and approved by ODNR and USFWS (See appendix B). As outlined in the study plan additional four sites were located by biologists while conducting field work. As per ODNR and USFWS guidance, only 25 sites were netted. Exact net site and net locations are determined by assessing waterways, upland trails, and field margins for suitable foraging and commuting flyways. Ideally, the nets are draped across the flyway between the vegetation at each side, and will extend up to the canopy, as feasible. Exact net placement is based upon canopy cover, presence of a flight corridor, water, and habitat conditions near the site. Nets are set to maximize coverage of flight paths used by bats along suitable corridors. Riparian corridors often provide successful mist net sites; however, upland corridors (e.g., trails or logging roads) also provide suitable sites. Some of the isolated woodlands selected for sampling did not have suitable flyways through them. As such, some nets were placed within openings in the woodlots, woodlot edges, or along wooded fencerows.

Table 3. ODNR Moderate Monitoring Mist Net Survey Guidelines for Proposed Commercial Wind Facilities.

ODNR MODERATE MONITORING NETTING GUIDELINES

1. Netting Season: 15 June to 31 July.
2. Net Placement:
   - Nets are placed on pulley systems that allow at least two standard nets to be "stacked" on top of each other and with one set of poles allowing 3 nets to be stacked and reach 7.5 meters from the substrate.
   - Proposed net sites are to be inspected by ODNR personnel prior to beginning sampling efforts.
3. Net Site Spacing: Land Tracts – two net sites per 1 square kilometer (246 ac) of forested habitat
4. Minimum Level of Effort Per Net Site:
   - Four net locations (sets) per net site, with all locations (sets) within at least 30 m (100 ft) of each other
   - Two non-consecutive (calendar) nights of netting
   - At least eight net–nights (1 net–night = 1 net set deployed for 1 night);
   - Sample Period: begin at dusk and net for 5 hours (approximately 0200 h)
   - Photos of all species captured
5. Marking of Bats:
   - Small dots of nontoxic, water-soluble paint applied to one forearm of all bats to temporarily identify recaptures.
   - Indiana and Rafinesque's Big-Eared bats banded with bands provided by ODNR
   - Eastern Small-Footed Bats are not banded due to risk of injury
   - All Indiana, Rafinesque's big-eared, and eastern small-footed bats are radio-tagged and tracked to both day roosts and night foraging areas
   - When more than 15 reproductive bats of the common colonial species are captured one will be radio-tagged and tracked to its day roosts.

Source: Ohio Department of Natural Resources 2009

Net site selection also included consideration of habitat characterization described in current literature and ESI personnel's experience with the species. Habitat with the following characteristics was selected to the degree feasible:

- Large trees (>40 centimeters [16 in] dbh) frequently used for maternity roosts
- An open canopy, apparently important for warming roost sites
- An open, uncluttered understory, used for traveling and foraging

Site selection was based upon expectation of bat activity and maximizing coverage of the Project area (Figure 2). Appendix C provides data sheets and Table 4 contains coordinates for mist net sites.

Table 4. Mist net site GPS coordinates on the proposed Republic Wind Farm in Seneca and Sandusky counties, Ohio.

Site	Net	Latitude	Longitude
2	A	N41 15 36.4	W83 00 26.9
	B	N41 15 56.5	W83 00 28.7
	C	N41 15 59.1	W83 00 30.2
	D	N41 15 56.9	W83 00 31.7
3	A	N41 14 50.5	W82 57 13.5
	B	N41 14 51.4	W82 57 13.9
	C	N41 14 51.1	W82 57 15.7
	D	N41 14 51.1	W82 57 17.5
4	A	N41 14 52.3	W82 56 14.0
	B	N41 14 51.5	W82 56 15.4
	C	N41 14 52.7	W82 56 15.4
	D	N41 14 55.0	W82 56 14.8
5	A	N41 13 41.8	W83 02 38.6
	B	N41 13 44.5	W83 02 40.0
	C	N41 13 32.1	W83 02 41.5
	D	N41 13 41.4	W83 02 44.1
7	A	N41 13 19.7	W83 01 24.6
	B	N41 13 19.2	W83 01 25.6
	C	N41 13 19.4	W83 01 29.2
	D	N41 13 20.5	W83 01 21.6
8	A	N41 13 42.7	W83 0 53.6
	B	N41 13 43.8	W83 0 53.3
	C	N41 13 44.4	W83 0 52.2
	D	N41 13 46.8	W83 0 52.7
9	A	N41 14 08	W82 59 49.5
	B	N41 14 08	W82 59 53.5
	C	N41 14 09.2	W82 59 54.2
	D	N41 14 07	W82 59 55.3
10	A	N41 13 47.8	W82 59 41.8
	B	N41 13 48.5	W82 59 42.8
	C	N41 13 48.5	W82 59 44.3
	D	N41 13 48.9	W82 59 46.0
11	A	N41 13 3.7	W82 58 5.4
	B	N41 13 4.3	W82 58 2.6
	C	N41 13 7.0	W82 58 2.4
	D	N41 13 5.8	W82 58 0.8
12	A	N41 13 11.3	W82 56 25.8
	B	N41 13 14.7	W82 56 27.7
	C	N41 13 14.5	W82 56 30.7
	D	N41 13 12.5	W85 56 30.5
14	A	N41 13 02.6	W82 53 37.4
	B	N41 13 04.6	W82 53 41.2
	C	N41 13 02.9	W82 53 43.5
	D	N41 13 05.6	W82 53 44.4
15	A	N41 12 02.9	W83 00 54.7
	B	N41 12 04.1	W83 00 56.6
	C	N41 12 02.6	W83 00 57.6
	D	N41 12 02.7	W83 00 59.4
16	A	N41 12 27.6	W82 57 7.2
	B	N41 12 26.5	W82 57 7.2
	C	N41 12 25.5	W82 57 10.3
	D	N41 12 27.2	W82 57 10.8
20	A	N41 11 02.2	W83 00 22.4

Site	Net	Latitude	Longitude
	B	N41 11 02.7	W83 00 23.9
	C	N41 11 04.0	W83 00 20.8
	D	N41 11 04.3	W83 00 24.9
21	A	N41 10 42.9	W83 0 13.9
	B	N41 10 42.1	W83 0 15.5
	C	N41 10 44.3	W83 0 16.6
	D	N41 10 45.3	W83 0 17.7
22	A	N41 11 27.4	W82 59 08.7
	B	N41 11 30.5	W82 59 07.9
	C	N41 11 27.8	W82 59 05.6
	D	N41 11 27.1	W82 59 04.3
23	A	N41 10 26.2	W82 57 48.4
	B	N41 10 27.5	W85 57 52.5
	C	N41 10 29.2	W82 57 52.4
	D	N41 10 30.7	W82 57 53.8
24	A	N41 10 6..8	W82 56 50.4
	B	N41 10 4.6	W82 56 49.8
	C	N41 10 4.1	W82 56 47.6
	D	N41 10 1.9	W82 56 48.8
26	A	N41 10 32.4	W82 55 54.5
	B	N41 10 31.3	W82 55 54.9
	C	N41 10 29.6	W82 55 57.1
	D	N41 10 25.0	W82 55 53.7
27	A	N41 09 27.1	W82 59 20.5
	B	N41 09 27.6	W82 59 22.2
	C	N41 0 30.1	W82 59 22.1
	D	N41 09 28.0	W82 59 27.1
30	A	N41 09 12.1	W82 55 33.6
	B	N41 09 11.6	W82 55 34.6
	C	N41 09 10.6	W82 55 34.0
	D	N41 09 09.2	W82 55 33.3
31	A	N41 09 13.8	W82 59 23.8
	B	N41 09 13.2	W82 59 21.7
	C	N41 09 11.4	W82 59 21.2
	D	N41 09 12.8	W82 59 19.6
32	A	N41 13 02.3	W82 54 29.7
	B	N41 13 04.5	W82 54 29.8
	C	N41 13 05.9	W82 54 29.4
	D	N41 13 05.1	W82 54 27.7
33	A	N41 10 41.2	W82 59 19.2
	B	N41 10 40.3	W82 59 15.6
	C	N41 16 40.9	W82 59 13.0
	D	N41 10 39.2	W82 59 17.1
34	A	N41 09 38.4	W82 57 42.9
	B	N41 09 40.1	W82 57 43.3
	C	N41 09 40.2	W82 57 38.1
	D	N41 09 38.7	W82 57 36.7

NOTE: Numbers are not sequential because some pre-selected sites were not netted due to land-owner access or were deemed unsuitable following field visit by permitted bat biologists.

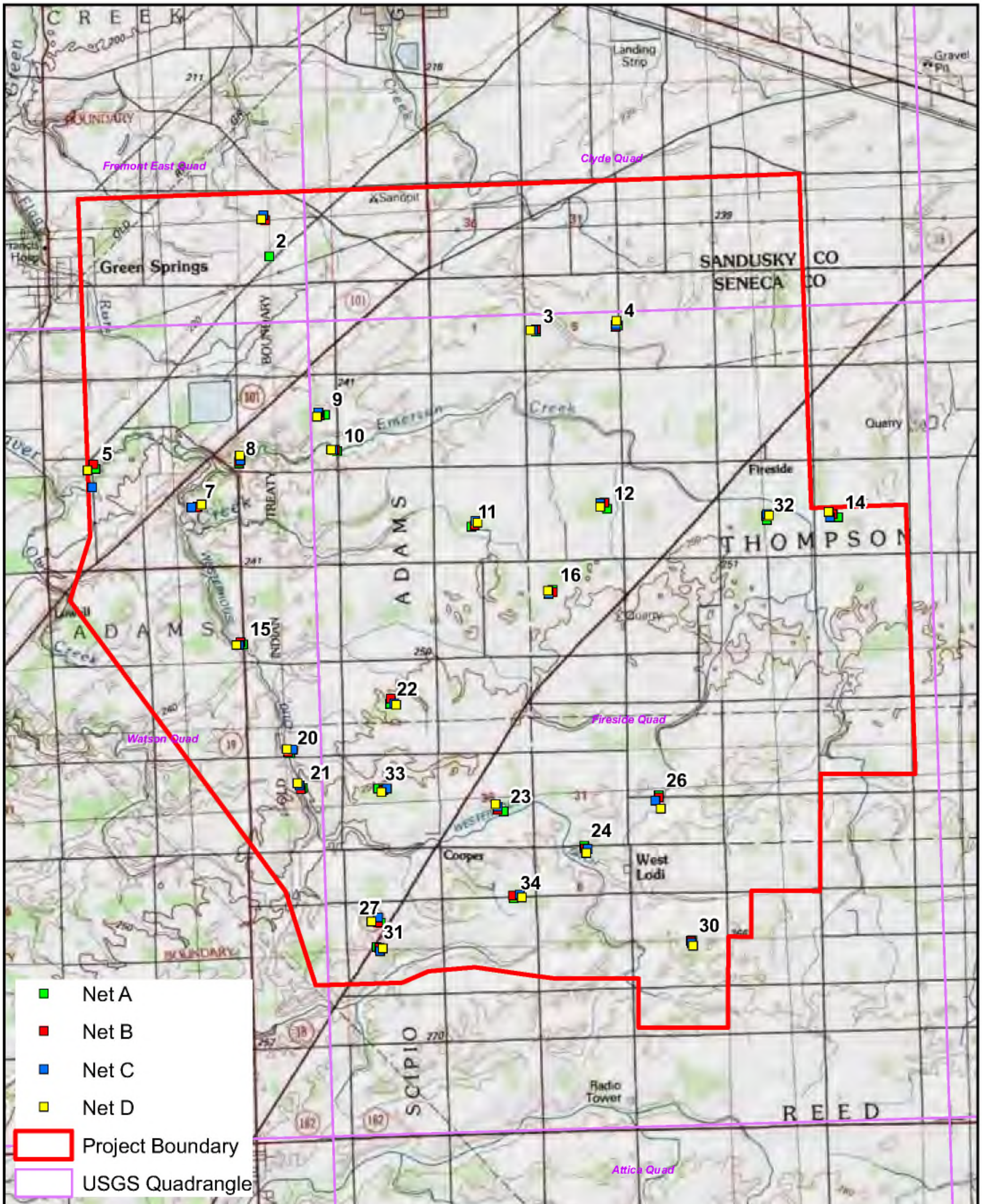

Figure 2. Mist net sites on the proposed Republic Wind Energy Facility in Seneca and Sandusky counties, Ohio.

N
W E
S

Project No. 340

0 1750 3500 Meters

Base Map: USGS Topographic Map

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3.4 Habitat Assessment

Habitat assessment at the net site focused on features indicative of suitability for Indiana bats. A habitat description for the net site was completed (Appendix C). The emphasis of this description was habitat form: size and relative abundance of large trees and snags that potentially serve as roost trees, canopy closure, understory clutter/openness, distance to water, and flight corridors. Habitat form was emphasized because the Indiana bat roosts in many tree species.

Habitat characterization identifies components of canopy and subcanopy layers. Trees that reach into the canopy are canopy trees, regardless of their diameter/size. As defined in the Indiana Bat Habitat Suitability Index Model (3D/Environmental 1995) dominant trees are the large trees in the canopy (>40 centimeters [16 in] dbh). Current literature seems to suggest that these trees have the greatest likelihood of being used by bat maternity colonies. Many smaller trees are often also found in the canopy, and in some situations, the canopy can be entirely composed of small-diameter trees. ESI's habitat characterization identifies both dominant and subdominant elements of the canopy.

The subcanopy vegetation layer is well defined in classical ecological literature. It is that portion of the forest structure between the ground vegetation (to approximately 0.6 meter (2 ft) and the canopy layers, usually beginning at about 7.6 meters (25 ft). The amount of vegetation in the understory is termed clutter. Many species of bats, including the Indiana bat, tend to avoid areas of high clutter.

3.5 Bat Capture

The netting setup allows bats to be caught live and released unharmed near the point of capture. Bats were identified to species using a combination of morphological characteristics (e.g., ear and tragus, calcar, pelage, size/weight, length of right forearm, and overall appearance of the animal). The species, sex, reproductive condition, age, weight, length of right forearm, and time and location/net site of capture were recorded for all bats captured. Age (adult or juvenile) of bats is determined by examining ephiphyseal-diaphyseal fusion (calcification) of long bones in the wing. Weight was measured to 0.1 gram using an Avinet spring scale. Length of the right forearm of each bat was measured to at least the nearest 1.0 mm using either dial calipers or metric ruler. The reproductive condition of captured bats was classified as descended male (reproductive), non-descended male, non-reproductive female, pregnant female (based on gentle abdominal palpation), lactating female, or post-lactating female. Processing is typically completed within 30 minutes of the time each bat is removed from the net. Data sheets containing all bat capture data are provided in Appendix C. Photographs of each species of bat captured are provided in Appendix D.

In response to the current White Nose Syndrome ("WNS") issue, the latest WNS protocols (currently White-Nose Syndrome Decontamination Protocol and Supporting Decontamination Documentation for Researchers), distributed by USFWS on 25 January 2011 was followed. Wing damage was categorized using the "Wing-Damage Index Used for Characterizing Wing Condition of Bats Affected by White-nose Syndrome" established by Jon Reichard in 2008.

3.6 Analysis of Netting Data

Bat capture data was analyzed using chi-square tests and diversity indices. Chi-square analysis, where $\chi^2 = \sum [(O - E)^2 / E]$, where O is the observed frequency and E is the expected frequency, was used to test for statistically significant differences between the proportion of males and females captured and among species captured. For comparison between sexes, the null hypothesis was that there are equal numbers of males and females in the bat population, so the expected value is one-half of the total capture of adult bats. For comparison among species captured, the null hypothesis was that species were represented equally in the sample.

The species diversity index of MacArthur (1972), similar to the reciprocal of the Simpson (1949) index, was used, where Diversity = $I/\sum P_i^2$, where P_i is the proportion of bats belonging to species *i*. The value of this index starts with 1 as the lowest possible figure, which would represent a community containing only one species. The higher the value, the greater the diversity. The maximum value is the number of species in the sample (species richness).

Simpson's Evenness Index, where Evenness = $(I \;/\; \sum P_i^2) \;/\; D_{max}$ (i.e., MacArthur Index/Species richness), gives a measure of the relative abundance of the different species making up the richness of an area. Maximum diversity for any level of richness is achieved when there is an equal distribution of individuals among species, so this value can range from 0 to 100 percent.

3.7 Weather and Temperature

Weather conditions were monitored during mist netting to ensure compliance with USFWS mist netting guidelines (Table 2). Conditions recorded include temperature, wind speed and direction, precipitation (not applicable during this survey), and percent cloud cover. A standard digital thermometer was used to record temperature, wind speed was determined by use of the Beaufort wind scale, and cloud cover was estimated. Appendix C contains completed weather data.

Temperatures in the study area were within acceptable limits of the USFWS guidelines (Figure 3). Survey temperatures ranged from 15.8° to 31.9° Celsius (60.4° to 89.4° F) during mist netting conducted 12 to 30 July 2011. Netting was discontinued due to precipitation on 22 and 23 July—data from these partial net nights are included below.

Figure 3. Weather data on the proposed Republic Wind Farm in Seneca and Sandusky Counties, Ohio.

3.8 Telemetry Studies

Telemetry studies were initiated on one Indiana and nine Big Brown bats per ODNR protocol (ODNR 2008) and a study plan approved by USFWS and ODNR. The Indiana bat was tracked to its nocturnal foraging area and roost trees. Big Brown bats were tracked to their day roosts only. Provided land owner access could be obtained, each roost was counted a minimum of three days including at least one when the radio-tagged bat was present. When it became clear that multiple sites would produce large numbers of big brown bats, ESI obtained verbal agreement from J. Norris of ODNR to withhold radio-tagging bats until the second night at the site. This decision was reached in an effort to comply with both the intent of guidelines and to reserve some radio-tags for use on other species in case a qualifying number of captures occurred. In these cases, the first juvenile or reproductive female that was captured was tagged.

3.8.1 Transmitter Attachment

After morphometric data were collected, one Indiana bat and nine big brown bats were fitted with 0.25- to 0.35-gram radio-transmitters (Blackburn Transmitters®, Nacogdoches, Texas or LB2 Holohil Systems Ltd Transmitters®, Ontario, Canada). Radio-tagged bats were assigned names corresponding to their transmitter frequency.

Each transmitter had a unique frequency allowing for bats to be tracked individually and independently of one another. Transmitters were activated and tested before attachment to bats. Fur was trimmed from a small interscapular area, and the transmitter was attached with non-toxic TORBOT® liquid bonding cement (Torbot Group, Inc., Cranston, Rhode Island). This latex adhesive degrades over time and the transmitter eventually falls off the bat. Transmitter weight, weight of the bat before and after transmitter attachment, and holding time were recorded on the Bat Transmitter Data Sheets, included in Appendix C.

3.8.2 Tracking

Radio-tagged bats were tracked by ground telemetry to locate roost trees and foraging areas. Biologists used Communication Specialist, Inc.® (Orange, California) R-1000 Telemetry Receivers, Wildlife Materials, Inc.® (Murphysboro, Illinois) TRX-2000S PLL Synthesized Tracking Receivers, hand-held three-element and five element Yagi directional antennas (Wildlife Materials or Titley Electronics). Tracking was completed on foot and in vehicles. Yagi directional antennas were used to estimate the direction of a signal relative to the tracker.

3.8.3 Roosts

On days subsequent to radio-transmitter attachment, radio receivers attached to Yagi antennas were used during daylight hours to locate roosts. Once a roost was located, data were collected for that tree and surrounding habitat and recorded on Roost Tree Data Sheets (Appendix C). Roost data focused primarily on characteristics of the roost tree including roost tree species, tree size (dbh), height of roosting site on the tree, percent of exfoliating bark, presence of roosting features, other indications of current bat use (guano, vocalizations), etc. General habitat characteristics near each roost were also evaluated, including species composition, canopy closure, slope, distance to water, and distance to flight corridors. Each roost was documented with a sketch, photographs, and GPS coordinates. Roost nomenclature was based on the first radio-tagged bat to use the roost. Consistent with bat names, roost names were based on transmitter frequencies.

Emergence counts were completed to determine the number of bats emerging from each roost. Emergence counts were completed visually while sitting near or under each roost tree. Bats were tallied only if emerging from a roost, not merely flying in the vicinity. Beginning at sunset, counts lasted approximately 1 to 1.5 hours or until bats finished emerging and/or darkness precluded accurate counting. In accordance with ODNR protocol, emergence counts were conducted on at least 3 occasions including the day when the radio-tagged bat was present. Potential maternity roosts were counted 5 times if land-owner permission could be obtained. Direction of bat emergence (as feasible) and other behavior were also noted on the Roost Tree Emergence Data Sheets (Appendix C).

3.8.4 Nocturnal Telemetry

Nocturnal telemetry data were collected for only the Indiana bat. Fixed telemetry stations were established immediately adjacent to portions of the Project area. Stations were chosen using a combination of experience and anticipation in an effort to determine the bats' use of available habitat. Use of available high spots on the terrain maximized coverage. Mobile telemetry, conducted from a vehicle, was used to follow the signal from a radio-tagged bat concurrent with fixed station telemetry. Mobile telemetry was employed to acquire general locations of certain bats when triangulation was not possible. At least three fixed telemetry stations were monitored at any given time, in an attempt to achieve triangulation at each reading. GPS coordinates for fixed telemetry stations were recorded on Garmin® (Olathe, Kansas) GPS 12 hand-held GPS units. Telemetry readings were synchronized using clocks on the GPS units.

Beginning at sunset, radio-tracking was conducted for at least 3 hours. Three or four biologists simultaneously participated in telemetry in an effort to obtain triangulation on each bat. Biologists simultaneously recorded azimuths at 5-minute intervals for all bats within receiver range. Two-way radios were used to synchronize readings and relay information. Timing of azimuth readings and locations of fixed telemetry stations varied among nights of the survey, depending on where and when certain bats were present. Appendix C contains Telemetry Data Sheets.

3.8.4.1 Foraging and Activity Area Data Analyses

Locate III was used to convert field data (i.e. azimuths taken from known points) into a likely location. Internally, the software measures the total angular error between observed bearings and all potential locations. The location with the lowest angular is thus deemed to be the most likely location. Theoretically, this can be thought of as a three dimensional regression.

Using this information, foraging and activity areas were calculated for the Indiana bat using Home Range Tools (Rodgers et al. 2007) for ArcGIS® (ESRI Corporation, Redlands, California) and Animal Space Use (Horne and Garton 2007). Foraging area was defined as the area each bat actively foraged or traveled after emerging from a diurnal roost; therefore, calculations only included nocturnal telemetry locations. Activity area was defined as the area used by each bat for all life requisites during a specified period, including: foraging, traveling, periods of inactivity (roosts), etc. Calculations for activity area included nocturnal telemetry locations and diurnal roosts.

Fixed kernel techniques (95%) were employed to calculate the foraging and activity areas. All home range estimates are artificial constructs and have their limitations (Boulanger and White 1990). Kernel analysis was used because it is considered one of the most robust of the probabilistic techniques for calculating home ranges

(Worton 1989). Kernel methods generally do not underestimate home range at small sample size, are least affected by sample size (Worton 1989), and require no unrealistic assumptions about the utilization distribution (Worton 1989). Fixed kernel methods with cross validation produce the most accurate estimates of simulated home ranges (Worton 1995, Seaman and Powell 1996). However, estimated distributions can vary greatly depending on which method is used to select the smoothing parameter (or bandwidth). Worton (1995) suggested that choosing the appropriate level of smoothing is the most important factor when using the kernel method for home-range analysis. If sample sizes are less than 50, likelihood cross validation (CVh) is proven to be the best method to calculate the smoothing parameter (Horne and Garton 2006). The software Animal Space Use 1.1, developed by Horne and Garton (2007) was used to calculate the smoothing parameter. Home Range Tools for ArcGIS® (Rodgers et al. 2007) was used to produce 95 percent fixed kernel home ranges.

4.0 Results

4.1 Survey Objectives

The main survey objective, to determine the presence or probable absence of Indiana bats or other species of concern, was met. One Indiana bat was captured and transmittered to determine habitat use. Nine net nights produced greater than 15 reproductive big brown bats, and thus radio telemetry was conducted on nine big brown bats to determine the location of their maternity colony(s). The bat community was characterized through the capture of 907 bats of eight species at 25 net sites.

4.2 Habitat Characterization of Net Sites

Table 5 summarizes habitat characteristics at each net site. The majority of sites were positioned across forest openings in woodlots and adjacent to crop and pasture land. Nets at sites 15 and 21 were placed across streams. Shagbark hickory (*Carya ovata*) and white oak (*Quercus alba*) were the most commonly encountered dominant tree species. Maples, including red maple (*Acer rubrum*) and sugar maple (*Acer saccharum*) were the most common subdominant species. Canopy closure was predominantly closed (56%; $n = 14$) with moderate closure at 36 percent of sites ($n = 9$). Sites 5 and 7 were characterized as open. Roost tree potential for Indiana bats was low at 44 percent of sites ($n = 11$), moderate at 44 percent of sites, and high at 12 percent of sites ($n = 3$; Sites 5, 7, and 12). Appendix C provides habitat description data sheets and Appendix D provides representative photographs of net sites.

Table 5. Habitat characteristics at mist net survey sites on the proposed Republic Wind Farm in Seneca and Sandusky Counties, Ohio, 2011.

Site	Water Source		Tree Species				Clutter		Roost Tree		Habitat	Herb.
	Name	Dis-tance (m)	Dominant Canopy	Subdominant Canopy	Subcanopy	Canopy Closure	Rating	Com-position	Potential	Composition	Type	Cover
2	Unnamed pond	10	*Acer rubrum, Carya ovata, Quercus palustris*	*Acer rubrum, Quercus palustris, Fagus grandifolia*		M	C	Branches & Saplings	L	None	YL, FE, W, C/PL, DL/P	M
3	Unnamed stream	500	*Carya ovata, Quercus alba*	*Carya ovata*	*Acer saccharum*	M	M	Saplings	L	Lrg trees	MU, FE,W,C/P L	M
4	Unnamed stream	400	*Quercus rubra, Juglans nigra*	*Juglans nigra*		M	M	Saplings	M	Lrg trees	MU, FE, W, C/PL	M
5	Unnamed creek	0	*Platanus occidentalis, Populus deltoides*	*Fraxinus pennsylvanica, Ulmus americana, Tilia americana, Juglans nigra, Acer saccharum, Aesculus glabra*	*Acer negundo*	O	M	Branches	H	Lrg trees & snags	ML, C/PL S/R	M
7	Unnamed pond	20	*none*	*Prunus serotina, Acer saccharum, Juglans nigra, Celtis occidentalis, Fraxinus pennsylvanica, Populus deltoides*	*Ulmus rubra, Ulmus americana, Juglans nigra*	O	M	Saplings	H	Snags	W, OF, C/PL DL/P	M
8	Unnamed pond	50	*Carya ovata, Acer rubrum, Quercus palustris*	*Acer rubrum, Fagus grandifolia, Carya ovata*	*none*	C	M	Branches & Saplings	L	Lrg trees	YU, W, S/R DL/P	M
9	Unnamed creek		*Tilia americana, Acer sp.*	*Carya ovata*	*none*	M	O	Branches	L		W, OF, lawn	M
10	Unnamed stream	0	*Acer saccharinum, Juglans nigra*	*Ulmus rubra*	*Ulmus rubra*	C	M	Saplings	L	Lrg trees	ML, S/R	M

Site	Water Source		Tree Species				Clutter		Roost Tree		Habitat	Herb.
	Name	Dis-tance (m)	Dominant Canopy	Subdominant Canopy	Subcanopy	Canopy Closure	Rating	Com-position	Potential	Composition	Type	Cover
11	Albright Ditch	500	*Acer saccharum, Ulmus americana, Prunus serotina, Juglans nigra*	*Acer saccharum, Ulmus americana*	*Acer saccharum*	M	M	Branches	M	Lrg trees & snags	W, C/PL,	D
12	Unnamed vernal pool	0	*Acer rubrum, Carya ovata*	*Acer rubrum, Carya ovata*	*none*	M	M	Branches & Saplings	H	Lrg trees & snags	YL, FE, W, C/PL, VP	M
14	Unnamed stream	500	*Quercus alba, Carya ovata*	*Prunus serotina*	*Prunus serotina*	C	M	Saplings	M	Lrg trees & snags	MU, FE, W, S/PL	M
15	Unnamed creek	15	*Juglans nigra*	*Acer saccharinum*	*Acer negundo*	M	M	Saplings	L	Lrg trees	ML, FE, W, OF, C/PL S/R	D
16	private pond (Reed, Mary)	250	*Ulmus americana, Acer saccharinum*	*Fraxinus pennsylvanica, Juglans nigra, Carya ovata, Ulmus americana, Acer saccharinum*	*Juglans nigra, Ulmus americana, Carya ovata*	M	O	Branches	M	Lrg trees & snags	W, OF, C/PL, DL/P	S
20	Unnamed stream	0	*Populus deltoides*	*Prunus serotina, Juglans nigra, Acer saccharinum*	*Fraxinus americana, Juglans nigra, Malus coronaria*	C	C	Shrubs & Saplings	M	Lrg trees & snags	W, OF, C/PL, S/R,	D
21	Unnamed stream	0	*Acer negundo, Acer rubrum, Acer saccharum*	*Acer negundo, Acer rubrum, Acer saccharum*	*Acer rubrum, Acer saccharum*	C	C	Branches & Saplings	L	Lrg trees	YL, FE, W, C/PL S/R	D
22	Unnamed pond	450	*Acer rubrum, Acer saccharum, Quercus palustris, Quercus alba, Tilia americana, Fagus grandifolia*	*Quercus palustris, Tilia americana, Fraxinus pennsylvanica, Ulmus rubra, Acer saccharum*	*Quercus palustris, Acer rubrum, Sassafras albidum*	C	M	Branches	M	Lrg trees & snags	W, OF, C/PL	M
23	Unnamed stream	10	*Acer saccharum, Carya ovata, Quercus alba*	*Acer saccharum, Prunus serotina, Acer rubrum*	*Acer saccharum, Acer rubrum*	C	C	Branches & Saplings	L	Lrg trees & snags	YL, FE, W, C/PL, S/R	D

Site	Water Source		Tree Species			Canopy Closure	Clutter		Roost Tree		Habitat	Herb.
	Name	Dis-tance (m)	Dominant Canopy	Subdominant Canopy	Subcanopy		Rating	Com-position	Potential	Composition	Type	Cover
24	Unnamed ditch	400	*Quercus palustris, Quercus alba, Fraxinus pennsylvanica*	*Carya ovata, Acer rubrum, Acer saccharum*	*Carpinus caroliniana, Crataegus sp.*	M	O	Branches	L	Lrg trees	W, C/PL	M
26	Unnamed stream	50	*Quercus alba, Acer rubrum*	*Acer rubrum, Acer saccharum, Fraxinus pennsylvanica*		C	M	Branches & Saplings	L	Lrg trees & snags	ML, FE, W, C/PL, S/R	
27	Unnamed pond	5	*Quercus bicolor, Fraxinus pennsylvanica, Quercus palustris*	*Fraxinus pennsylvanica, Quercus palustris, Acer saccharinum*	*Acer saccharinum, Fraxinus pennsylvanica*	C			M	Lrg trees & snags	W, C/PL, DL/P, OF	D
30	Unnamed stream	300	*Quercus rubra, Acer rubrum, Carya ovata*	*Acer rubrum, Tilia americana, Quercus rubra*	*Acer rubrum, Acer saccharum*	C	M	Shrubs & Saplings	M	Lrg trees	YL, FE, C/PL	M
31	Unnamed pond	500	*Carya ovata, Acer rubrum*	*Carya ovata, Acer rubrum*	*Acer rubrum, Fagus grandifolia*	C	C	Branches & Saplings	M	Lrg trees	YL, FE, W, C/PL	M
32	Unnamed stream	300	*Quercus alba, Quercus rubra*	*Prunus serotina*	*Ulmus americana, Acer saccharum*	C	M	Saplings	L	Lrg trees & snags	MU, FE, W, C/PL	M
33	Unnamed perennial stream	0	*Acer saccharum, Quercus alba, Juglans nigra*	*Acer saccharum, Carya cordiformis, Prunus, serotina, Tilia americana*	*Asimina triloba, Acer saccharum, Ostrya virginiana*	C	M	Saplings	M	Lrg trees & snags	MU, VP	M
34	Unnamed pond	150	*Quercus alba, Quercus rubra, Carya ovata*	*Carya ovata, Tilia americana, Ulmus americana*	*Ulmus americana, Acer saccharum, Acer rubrum*	C	M	Saplings	M	Lrg trees & snags	MU	M

NOTE: Numbers are not sequential because some pre-selected sites were not netted due to land-owner access or were deemed unsuitable following field visit by permitted bat biologists.

Tree Species: Ohio buckeye (*Aesculus glabra*), box elder (*Acer negundo*), red maple (*Acer rubrum*), silver maple (*Acer saccharinum*), sugar maple (*Acer saccharum*), maple species (Acer sp.), tall pawpaw (*Asimina triloba*), ironwood (*Carpinus caroliniana*), bitternut hickory (*Carya cordiformis*), shagbark hickory (*Carya ovata*), American hackberry (*Celtis occidentalis*), hawthorn (*Crataegus* spp.), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), green ash (*Fraxinus pennsylvanica*), black walnut (*Juglans nigra*), sweet crabapple (*Malus coronaria*), hop hornbeam (*Ostrya virginiana*), sycamore (*Platanus occidentalis*), eastern cottonwood (*Populus deltoides*), black cherry (*Prunus serotina*), white oak (*Quercus alba*), swamp white oak (*Quercus bicolor*), pin oak (*Quercus palustris*), northern red oak (*Quercus rubra*), sassafras (*Sassafras albidum*), American basswood (*Tilia americana*), American elm (*Ulmus americana*), slippery elm (*Ulmus rubra*).

Canopy Closure/Subcanopy Clutter: O = Open; M = Moderate; C = Closed

Roost Potential Rating: H = High; M = Moderate; L = Low

Habitat Type: MU = Mature Upland Forest; ML = Mature Lowland Forest, Young Lowland Forest; FE = Forest Edge; W = Woodlot; OF = Old Field; C/PL = Crop/Pasture Land; S/R = Stream/River; VL = Vernal Pool; DL/P = Deepwater Lake/Pond

Herb (Herbaceous) Cover: S = Sparse; M = Moderate; D = Dense

4.3 Bat Capture

A total of 907 bats representing 8 species was captured over 200 net nights during the mist net survey, including 650 big brown bats (*Eptesicus fuscus*), 95 northern bats (*Myotis septentrionalis*), 82 eastern red bats (*Lasiurus borealis*), 52 little brown bats (*Myotis lucifugus*), 16 hoary bats (*Lasiurus cinereus*), 9 tri-colored bats (*Perimyotis subflavus*), 2 evening bats (*Nycticeius humeralis*) and 1 Indiana bat (*Myotis sodalis*) (Table 6, Figure 4).

Table 6. Total Bat Capture on the proposed Republic Wind Farm in Seneca and Sandusky Counties, Ohio, 2011.

Bat Species	Adult Male	Adult Female[1]				Juvenile		Escape[2]	Total
		P	L	PL	NR	Male	Female		
Big brown bat	153		32	199	4	140	105	17	**650**
Eastern red bat	7		1	15	4	17	34	4	**82**
Hoary Bat				1	1	6	8		**16**
Little brown bat	12		1	14	1	15	8	1	**52**
Northern bat	17		6	32		16	22	2	**95**
Indiana bat				1					**1**
Evening Bat							1	1	**2**
Tri-colored bat	2			1		4	2		**9**
Total	191	0	40	263	10	198	180	25	**907**

[1]P = pregnant; L = lactating; PL = Post lactating; NR = non-reproductive
[2] Escape = escaped from net or hand before all sex, age, and reproductive data were collected

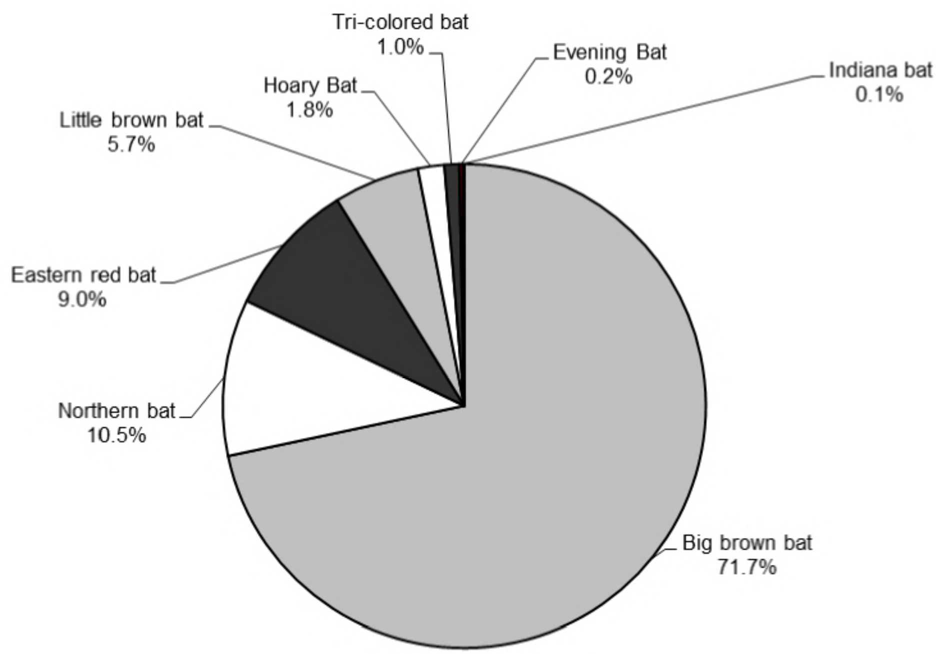
4.3.1 Species Diversity

The hypothesis of species evenness (relative abundance among species) was rejected (df = 7, χ^2 = 2985.35; P < 0.001); that is, the proportion of species captured was not similar among species (Figure 4). Big brown bats accounted for 72 percent of the sample. The Simpson's Evenness Index suggested low species equitability (ED = 0.233). The MacArthur Diversity Index (1/ED) was 1.9, so the equivalent of 1.9 of 8 total species was equally represented in the sample.

4.3.2 Occurrence by Sex and Age

Seventeen big brown bats, four eastern red bats, two northern bats, one little brown bat and one evening bat escaped before sex or age were determined (Table 6). Of the remaining 882 bats, 57 percent were adults (n = 504), and 43 percent were juveniles (n = 378). Of the adults, 62 percent (n = 313) were females and 38 percent were males (n = 191). Adult males and females were not represented equally in the sample (df = 1, χ^2 = 29.53, P < 0.001). Ninety-seven percent (n = 303) of adult females captured were reproductive, with 87 percent (n = 263) post lactating and 13 percent (n = 40) lactating. Evidence of reproduction was found for all the species captured (Table 5).

Figure 4. Percent bat captures by species on the proposed Republic Wind Farm in Seneca and Sandusky Counties, Ohio, 2011.



4.3.3 Bat Capture by Net Site

The mean number of bats captured per site was 36 (n = 25, SD = 20.5; Median = 34). Eighty-seven bats were captured at Site 30 followed by 70 bats at Site 26, 64 bats at Site 32 and 62 bats at Site 14. Site 31 had the least number of captures with 8 bats. The mean number of species captured per site was 3.9 (n = 25, SD = 0.97; Median = 4). Species richness was highest at Sites 5, 7, 8, 10, 14, 16, 21 and 30 where five of the eight species were captured. The Indiana bat was captured at Site 16 and the two evening bats were captured at Site 12.

4.4 Indiana Bat Capture and Telemetry

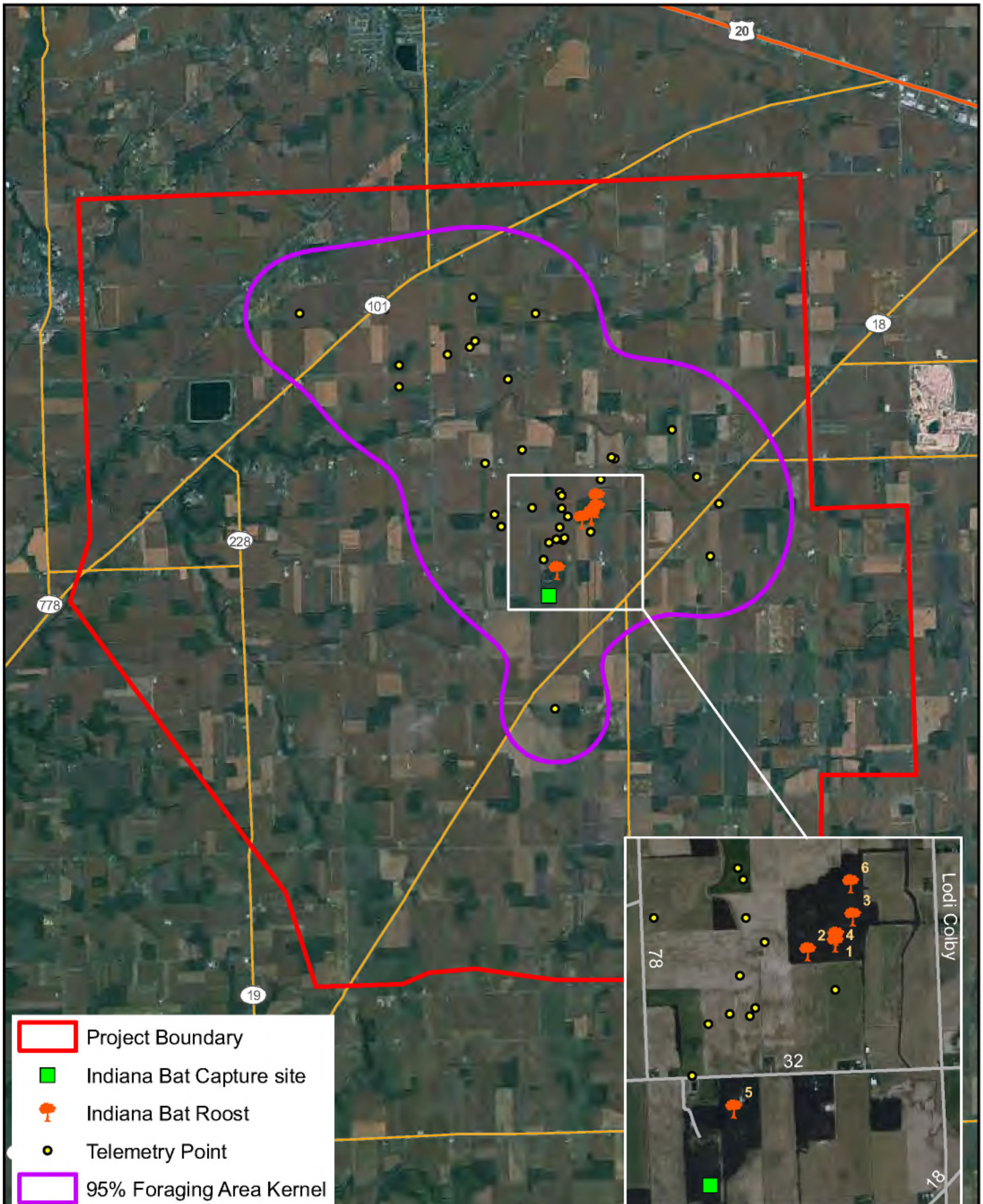
4.4.1 Details of Capture

The only Indiana bat captured or radio-tagged tagged on the proposed Republic Wind Farm during the 2011 survey was an post-lactating adult female captured at 2120 hrs at site 16 (Tables 7 and 8; Appendices C and D) the night of 24 July 2011. It was caught in a 6-meter (19.68 ft) wide by 6.2-meter (20.34 ft) high mist net placed within a small woodland opening. The woodland has multiple small ephemeral wetlands and is regularly burned for brush control (the landowner indicated it was last burned in 2009). Due to burning, the understory is open and multiple sizes and ages of dead trees are present. USFWS and ODNR were informally notified by phone on 25 July and received formal notification (including roost location) on 26 July.

4.4.2 Roosting Ecology

The bat was fitted with a 0.35-gram transmitter (172.219 MHz) and released at the capture site. At time of release, the bat was alert and active and flew away after being placed on a tree near the capture site. Over the next six days, the bat was tracked to six different roost trees (Tables 7 and 8; Figure 5). All roost trees were live shagbark hickories (*Carya ovata*). The night of 30 July, the radio-tag remained in the tree following emergence, indicating it had been shed by the bat.

All roosts were counted on three nights, with the exception of roost 218-5, which was counted once due to restricted access. As many as seven bats were observed exiting any one roost, and that happened on two nights (30 July from 218-RT 3 and 2 August from 218-RT 6). On 30 July 3 bats including 218 were also counted exiting 218-RT 6.



N W E S

Figure 5. Capture site, roosts, and foraging habitat of an Indiana bat on the proposed Republic Wind Energy Facility in Seneca and Sandusky counties, Ohio, summer 2011.

Project No. 340

0 1850 3700 Meters

Base Map: ESRI Aerial Imagery

ESI ENVIRONMENTAL SOLUTIONS & INNOVATIONS, INC.

Table 7. Summary data for roost trees used by Indiana bat 218 on the proposed Republic Wind Farm, summer 2011.

Roost	Tree Species	Tree Status	DBH (cm)	Exfoliating Bark (%)	% Canopy Closure	Tree Height (m)	Roost Height (m)
218-RT1	*Carya ovata*	Live	25	30	40	22	10
218-RT2	*Carya ovata*	Live	30	40	5	40	30
218-RT3	*Carya ovata*	Live	25	30	75	40	20
218-RT4	*Carya ovata*	Live	30	30	30	40	20
218-RT5	*Carya ovata*	Live	40	40	25	40	35
218-RT6	*Carya ovata*	Live	20	30	75	30	15

Table 8. Summary of emergence counts for roost trees used by Indiana bat 218 on the proposed Republic Wind Farm, summer 2011.

	Roost Number						
Date of Count	218-1	218-2	218-3	218-4	218-5	218-6	Total
25 July	4[1]						4
26 July	4	1[1,2]					5
27 July		0	1[1,2]				1
28 July				4[1]			4
29 July	1		2	1	1[1]		5
30 July			7	0		3[1]	10
31 July		0				0	0
2 August						7	7

[1]Bat 218 present in roost
[2]Point of emergence obscured by vegetation thus this is a minimal count

4.4.3 Nocturnal Behavior

Data on nocturnal behavior was collected on for five days (25-29 July) (Figure 6, Table 9). Most foraging activity occurred in an area located between State Highways 101 and 18. This foraging area was entirely contained within the project boundary and included approximately a quarter (27.8%) of the Project area. Habitat use at all scales was dominated by cultivated crops (Figure 7, Table 9). The majority of triangulated data points fell within cultivated fields (28 of 34 points, 82.3 %). Similar dominance of agricultural lands was observed at the scales of both the 95 percent foraging area (87.7% cultivated) and the 95 percent activity area (87.6% cultivated) despite inclusion of the roosts in the later metric.

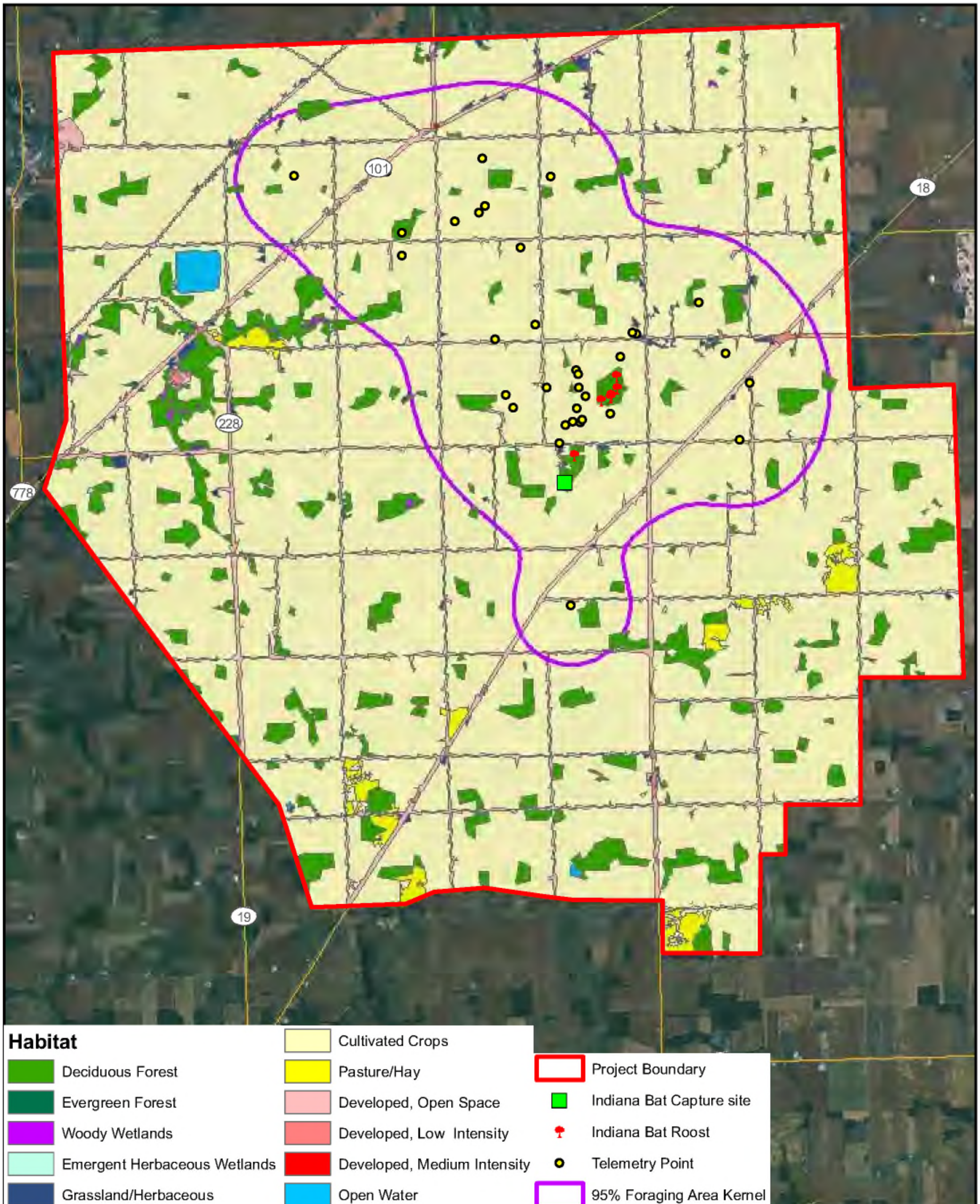


Figure 6. Habitat used by foraging Indiana bat on the on the proposed Republic Wind Energy Facility in Seneca and Sandusky counties, Ohio, summer 2011.

Project No. 340

Base Map: ESRI Aerial Imagery

ENVIRONMENTAL SOLUTIONS & INNOVATIONS, INC.

Table 9. Summary data for roost trees used by Indiana bat 218 on the proposed Republic Wind Farm, summer 2011.

Habitat Type	Raw Data Points	95% Foraging Area (Ac)	95% Activity Area (Ac)	Total Project Boundary (Ac)
Open Water				114.30
Developed, Open Space	4	624.46	552.72	2089.58
Developed, Low Intensity		33.29	30.69	135.15
Developed, Medium Intensity		2.63	2.63	7.33
Deciduous Forest	1	633.07	577.39	2976.94
Evergreen Forest				1.93
Grassland/Herbaceous	1	60.39	53.92	200.35
Pasture/Hay				423.16
Cultivated Crops	28	9672.37	8589.22	33617.96
Woody Wetlands				29.90
Emergent Herbaceous Wetlands				10.28
Total	34	11026.21	9806.57	39606.88

4.5 Big Brown Bat Telemetry

Following ODNR guidelines, ESI biologists radio-tagged a total of nine big brown bats from 9 net sites whose conditions indicated recent reproduction (Table 10). Seven of these bats were successfully tracked to roosts (Table 11, Figure 7) in anthropogenic structures including five barns, one garage, and one house. No tagged bats changed roosts, and no roosts were shared by tagged bats. Because each roost was occupied by multiple untagged bats (range 15-218) it is likely that each roost is occupied by a separate colony. Locations of radio-tagged big brown bat captures and roost trees are illustrated in Figure 7. Appendix D contains representative photographs of the captured big brown bats. Details of telemetry effort for each bat are described in the following sections.

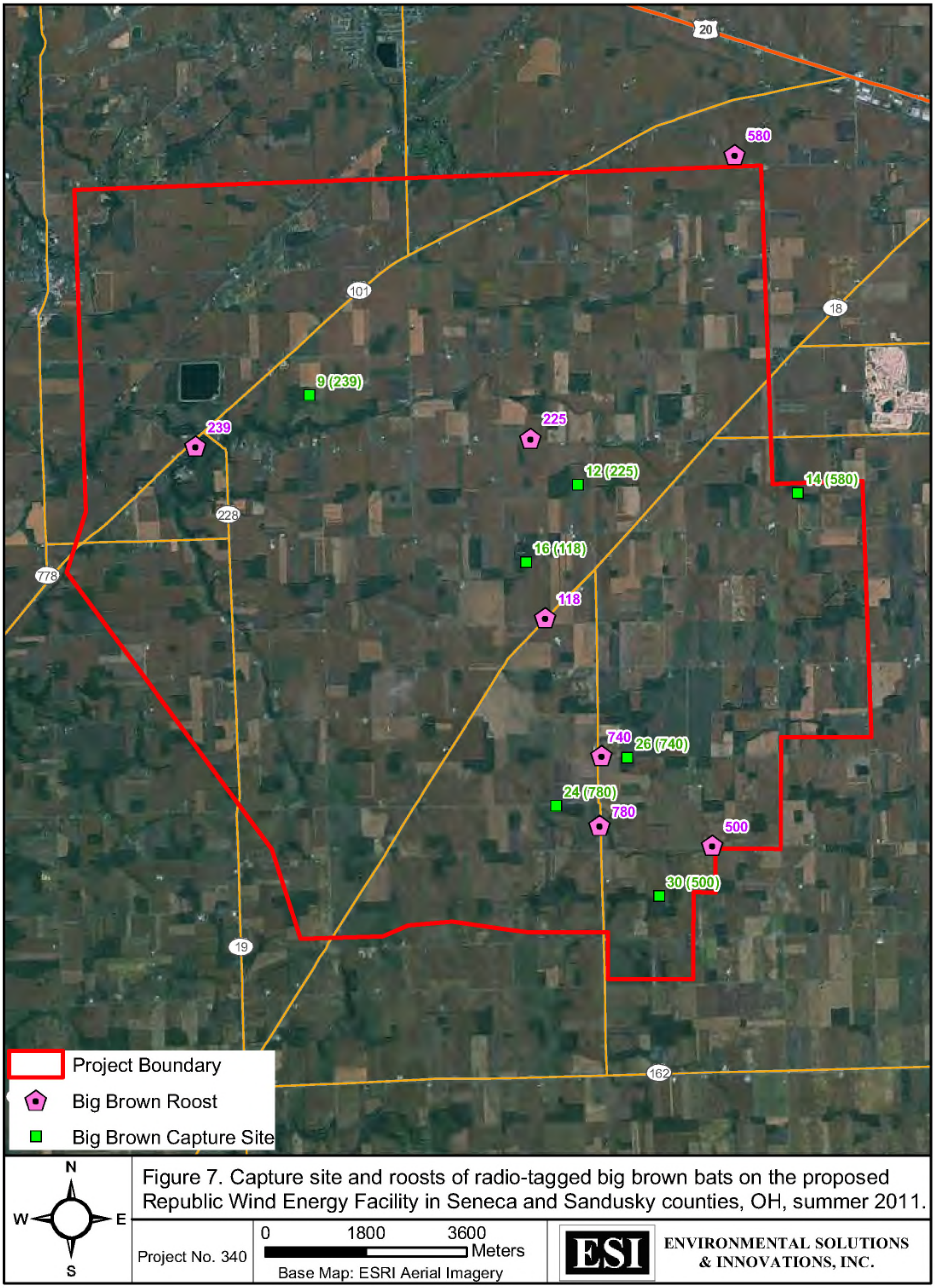


Figure 7. Capture site and roosts of radio-tagged big brown bats on the proposed Republic Wind Energy Facility in Seneca and Sandusky counties, OH, summer 2011.

Project No. 340

0 1800 3600 Meters

Base Map: ESRI Aerial Imagery

ESI ENVIRONMENTAL SOLUTIONS & INNOVATIONS, INC.

Table 10. Big brown bats radio-tagged on the proposed Republic Wind Farm, summer 2011.

Bat Number	Date Captured (2010)	Transmitter Frequency	Site Name	Sex	Age	Reproductive Condition
740	15 July	172.740	26	F	Ad	PL
780	18 July	172.780	24	F	Jv	NR
239	20 July	172.239	9	F	Jv	NR
118	22 July	172.118	16	F	Ad	L
500	24 July	172.500	30	F	Jv	NR
580	24 July	172.580	14	F	Jv	NR
122	27 July	172.122	4	M	Jv	NR
225	30 July	172.225	12	F	Ad	PL
950	30 July	172.950	32	F	Jv	NR

F=female, M=male, Ad=adult, Jv= juvenile, L = lactating, PL=postlactating, NR=not reproductive

Table 11. Roosts used by big brown bats radio-tagged on the proposed Republic Wind Farm, summer 2011.

Bat Number	Roost Number	Type Structure	First Day Occupied	Last Day Occupied	Maximum Bats
740	740-1	Barn	16 July	29 July	44
780	7 80-1	Garage	19 July	24 July	218
239	239-1	House	21 July		No Counts
118	118-1	Barn	23 July	28 July	117
500	500-1	Barn	25 July	29 July	23
580	580-1	Barn	25 July	2 August	15
122	Not located				
225	225-1	Barn	31 July	5 August	173
950	Not located				

4.5.1 Bat 740

The first big brown bat tagged during the 2011 season was an post-lactating adult female captured at 2300 hrs on 15 July at Site 26 (Tables 10, 11, and 12, Appendices C and D). It was caught in a 6-meter (19.6 ft) wide by 6-meter (19.6 ft) high mist net set across an ATV trail south of TR126 and east of CR27. The surrounding habitat consisted of cropland surrounding a large woodlot.

The bat was fitted with a 0.35-gram transmitter (172.740 MHz) and hand-released at the capture site. At time of release, the bat was alert and active and flew away. The next morning, the bat was tracked to an old barn to the northwest of the capture site. Emergence counts were conducted at this site over the next 5 days and revealed a maternity colony containing at least 44 bats.

Table 12. Emergence data for big brown bat 740 on the proposed Republic Wind Farm, July and August 2011.

Roost Number	Date Counted	#Bats[1]	First Emergence	Last Emergence	Notes
740-1	16 July	44	2128	2149	Bat 740 emerged at 2143
740-1	17 July	34	2130	2252	Bat 740 emerged at 2136
740-1	18 July	35	2115	2141	Bat 740 emerged at 2131
740-1	19 July	40	2128	2151	Bat 740 emerged at 2147
740-1	29 July	42	2127	2148	Bat 740 emerged at 2146

[1]Number of bats counted emerging from the roost. This number flucuates because some bats move between roosts.

4.5.2 Bat 780

The second big brown bat tagged during the 2011 season was a juvenile female captured at 2150 hrs on 18 July at Site 24 (Tables 10, 11, and 13, Appendix C). It was caught in a 9-meter (29.5 ft) wide by 9.2-meter (30.1 ft) high mist net set across an ATV trail south of CR38. The surrounding habitat consisted of a mature mesic woodlot with an open understory, a few shrubs and large trees present.

The bat was fitted with a 0.35-gram transmitter (172.780 MHz) and hand-released at the capture site. At time of release, the bat was alert and active and flew away. The next morning, the bat was tracked to a dilapidated detached brick garage to the east of the capture site. Emergence counts were conducted at this site for 5 days and revealed a maternity colony containing at least 218 bats.

Table 13. Emergence data for big brown bat 780 on the proposed Republic Wind Farm, July and August 2011.

Roost Number	Date Counted	#Bats	First Emergence	Last Emergence	Notes
780-1	19 July	73	2130	2144	Bat 780 emerged at 2140
780-1	20 July	93	2110	2136	Bat 780 emerged at 2135
780-1	21 July	190	2116	2148	Bat 780 emerged at 2125 Added second observer
780-1	22 July	218	2114	2146	Added second observer
780-1	23 July				No count
780-1	24 July	150	2100	2136	Transmitter off bat

[1]Number of bats counted emerging from the roost. This number flucuates because some bats move between roosts.

4.5.3 Bat 239

The third big brown bat tagged during the 2011 season was a juvenile female captured at 2145 hrs on 20 July at Site 9 (Tables 10 and 11, Appendices C and D). It was caught in a 9-meter (29.5 ft) wide by 9-meter (29.5 ft) high mist net set across a forested access road west of CR179. The surrounding habitat consisted of a moderately open canopy closure in a mature mesic woodlot.

The bat was fitted with a 0.25-gram transmitter (172.239 MHz) and hand-released at the capture site. At time of release, the bat was alert and active and flew away. The next morning, the bat was tracked to a house southwest of the capture site. Despite repeated efforts, ESI was unable to make contact with the home owners and thus conducted no emergence counts. During efforts to obtain permission to conduct emergence counts, biologists noted extensive amounts of guano splattered beneath the probable entrance to the roost. This observation is consistent with occupancy by multiple bats.

4.5.4 Bat 118

The fourth big brown bat tagged during the 2011 season was a lactating adult female captured at 0000 hrs on the night of 24 July at Site 16 (Tables 10, 11, and 14, Appendices C and D). It was caught in a 6-meter (19.6 ft) wide by 6.2-meter (20.3 ft) high mist net set in an opening in a woodlot that is burned every 5 to 10 years to control brush. The most recent burning appeared to be approximately 2 or more years ago. The woodlot contained several ephemeral wetlands and was adjacent to a soybean field.

The bat was fitted with a 0.25-gram transmitter (172.118 MHz) and hand-released at the capture site. At time of release, the bat was alert and active and flew away. The next morning, the bat was tracked south of the capture site to a wooden barn that appeared to be approximately 80-100 years old. Emergence counts were conducted at this site for 5 days and revealed a maternity colony containing at least 117 bats.

Table 14. Emergence data for big brown bat 118 on the proposed Republic Wind Farm, July and August 2011.

Roost Number	Date Counted	#Bats	First Emergence	Last Emergence	Notes
118-1	24 July	87	2100	2135	Bat 118 emerged at 2115
118-1	25 July	73	2116	2136	Bat 118 emerged at 2120
118-1	26 July	75	2112	2129	Bat 118 emerged at 2125
118-1	27 July	117	2112	2130	Bat 118 emerged at 2116
118-1	28 July				No count
118-1	12 August	62	2045	2107	Transmitter off bat

[1]Number of bats counted emerging from the roost. This number flucuates because some bats move between roosts.

4.5.5 Bat 500

The fifth big brown bat tagged during the 2011 season was a juvenile female captured at 2200 hrs on 24 July at Site 30 (Tables 10, 11, and 15, Appendix C). It was caught in a 12-meter (39.3 ft) wide by 9-meter (29.5 ft) high mist net set across a forested logging trail.

The bat was fitted with a 0.35-gram transmitter (172.500 MHz) and hand-released at the capture site. At time of release, the bat was alert and active and flew away. The next morning, the bat was tracked to a barn northeast of the capture site. Emergence counts were conducted at this site for 5 days and revealed a maternity colony containing at least 15 bats.

Table 15. Emergence data for big brown bat 500 on the proposed Republic Wind Farm, July and August 2011.

Roost Number	Date Counted	#Bats	First Emergence	Last Emergence	Notes
500-1	25 July	14	2110	2126	Bat 500 emerged at 2122
500-1	26 July				No count
500-1	27 July				No count
500-1	28 July				No count
500-1	29 July				No count
500-1	17 August	23	2036	2052	Transmitter not heard
500-1	18 August	23	2036	2048	Transmitter not heard
500-1	22 August	23	2011	2057	Transmitter not heard
500-1	24 August	16	2022	2036	Transmitter not heard
500-1	26 August	22	2025	2038	Transmitter not heard

[1]Number of bats counted emerging from the roost. This number flucuates because some bats move between roosts.

4.5.6 Bat 580

The sixth big brown bat tagged during the 2011 season was an juvenile female captured at 0030 hrs on the night of 24 July at Site 14 (Tables 10, 11, and 16, Appendix C). It was caught in a 12-meter (39.3 ft) wide by 9-meter (29.5 ft) high mist net set across a forested farm drive between two crop fields.

The bat was fitted with a 0.35-gram transmitter (172.518 MHz) and hand-released at the capture site. At time of release, the bat was alert and active and flew away. The next morning, the bat was tracked to a barn north of the capture site. Emergence counts were conducted at this site for 5 days and revealed a maternity colony containing at least 15 bats. It is likely that this colony was larger in size than counts would estimate because colonies of big brown bat begin to break up in early August (Whitaker 1996, Duchamp et al. 2004).

Table 16. Emergence data for big brown bat 580 on the proposed Republic Wind Farm, July and August 2011.

Roost Number	Date Counted	#Bats	First Emergence	Last Emergence	Notes
580-1	29 July	14	2110	2126	Bat 500 emerged at 2122
580-1	30 July				No count
580-1	31 July				No count
580-1	1 August				No count
580-1	2 August				No count
580-1	8 August	14	2055	2105	Transmitter off bat
580-1	9 August	12	2051	2113	Transmitter off bat
580-1	10 August	15	2056	2106	Transmitter off bat
580-1	11 August	11	2050	2100	Transmitter off bat

[1]Number of bats counted emerging from the roost. This number flucuates because some bats move between roosts.

4.5.7 Bat 122

The seventh big brown bat tagged during the 2011 season was a juvenile male captured at 0140 hrs on the night of 27 July at Site 4 (Tables 10 and 11, Appendices C and D). It was caught in a 6-meter (19.6 ft) wide by 9-meter (29.5 ft) high mist net set across a forested trail leading to an open area.

The bat was fitted with a 0.35-gram transmitter (172.122 MHz) and hand-released at the capture site. At time of release, the bat was alert and active and flew away. Searches for this bat were continued for five days, but the bat was never encountered.

4.5.8 Bat 225

The eighth big brown bat tagged during the 2011 season was a post lactating female captured at 2200 h on 30 July at Site 12 (Tables 10, 11, and 17, Appendices C and D). It was caught in a 9-meter (29.5 ft) wide by 6-meter (19.7 ft) high mist net placed across a vernal pool in a woodlot surrounded by crop fields.

The bat was fitted with a 0.30-gram transmitter (172.225 MHz) and released by hand near the capture site at 2250 h. At time of release, the bat was alert and active and immediately flew away. Bat 225 was tracked to a roost in a barn northwest of the capture site. Emergence counts were conducted at this site for 5 days and revealed a maternity colony containing at least 173 bats.

Table 17. Emergence data for big brown bat 225 on the proposed Republic Wind Farm, July and August 2011.

Roost Number	Date Counted	#Bats	First Emergence	Last Emergence	Notes
225-1	31 July	36	2117	2125	Took time to locate exit point. Bat 225 emerged at 2125
225-1	1 August	121	2102	2126	Bat 225 emerged at 2109
225-1	2 August				No count
225-1	3 August	117	2105	2125	Bat 225 emerged at 2115
225-1	4 August	173	2102	2129	Bat 225 emerged at 2113
225-1	5 August	169	2056	2120	Bat 225 emerged at 2109

[1]Number of bats counted emerging from the roost. This number flucuates because some bats move between roosts.

4.5.9 Bat 950

The ninth and final big brown bat tagged during the 2011 season was a juvenile female captured at 2235 hrs on 30 July at Site 32 (Tables 10 and 11, Appendices C and D). It was caught in a 12-meter (39.3 ft) wide by 9-meter (29.5 ft) high mist net set across a forested trail at the edge of a woodlot. The surrounding habitat consisted of crop fields.

The bat was fitted with a 0.35-gram transmitter (172.950 MHz) and hand-released at the capture site. At time of release, the bat was alert and active and flew away. Searches for this bat were continued for five days, but the bat was never detected.

5.0 Discussion/Conclusion

This study had three major objectives. The first objective was to determine if any species of concern, at either the state or federal level, was present. The second was to determine if any colonies of common species were present and locate the roosts. The third was to provide an overview of the summer bat community. Mist netting efforts completed for this Project complied with guidelines set by the USFWS (as identified in the Indiana Bat Recovery Plan) for the federally endangered Indiana bat and the ODNR moderate intensity pre-construction monitoring of bats. All three objectives were met.

5.1 Presence of the Indiana Bat

The results of the current study indicate that a maternity colony of Indiana bats is present. This conclusion is based on the following data and is consistent with guidance in the draft recovery plan (USFWS 2007) for the species. First, the bat captured (218) was an adult female who had recently ceased lactation (i.e. her young was recently weaned). This is a time of year when large summer colonies of Indiana bats begin to change their behavior (Humphrey et al. 1977, Brack 1983, Kurta et al. 1993, Callahan et al. 1997, Kurta 2004, Sparks et al. 2008, Whitaker and Sparks 2008). During lactation, most bats are associated with one or more primary roosts, but as the young become more independent, bats begin to move into a much larger number of trees including both the important summer roosts and other nearby trees (Sparks et al. 2008). All roosts used by bat 218 were large, living shagbark hickories, and thus are most likely alternate roosts. The presence of five of six roosts within a single woodlot suggests that woodlot also contains a primary roost.

Interpretation of the foraging data must consider three factors. First, only a single bat was tracked. Second, this landscape is dominated by agriculture and other habitats occur as small isolated parcels within this larger matrix. Under these conditions, any telemetry error is likely to result in the data point being mapped within a cultivated field. Biologists in the field noted that bats spent much of their time moving along small wooded parcels (especially fencerows) that are small enough to not appear on the habitat map. Indiana bats are known to make extensive use of woodland throughout the range (Kiser and Elliott 1996, Kurta 2004, Murray and Kurta 2004, Sparks et al. 2004, Sparks et al. 2005, Watrous et al. 2006), but the small sample size prevented such an analysis.

5.2 Presence of Other Listed Species

No eastern small-footed or Rafinesque's big-eared bats were captured. However, there were 17 northern bats, 12 little brown bats, and two evening bats captured. Evidence of reproduction was found for all three species, which likely indicates that a maternity colony is present within the local area for these species as well. This is an important consideration because both northern and little brown bats have recently been petitioned for listing under ESA as threatened or endangered species (Kunz and Reichard 2010, The Center for Biological Diversity 2010). At present, the northern bat is undergoing a formal status review by the USFWS for consideration of addition to the federal list of threatened and endangered species. Similarly, the little brown bat is undergoing a 90-day evaluation by USFWS to determine if the species will receive a full status review.

Evening bats are not currently listed by ODNR partly because the species is uncommon enough that there is some question as to whether the species is a resident of the state. Recent data indicated that the species is much more common in neighboring areas of Indiana (Whitaker et al. 2007) than previously thought, and a maternity colony has been found in Michigan (Kurta et al. 2005). As such, there is reason to believe this species will also be listed at some point in Ohio.

5.3 Presence of Maternity Colonies of Common Species

The results of the current study also indicate that the Project area is home to a minimum of seven maternity colonies of the big brown bat. The presence of multiple colonies of big brown bats is typical of the Midwest (Cope et al. 1991, Whitaker 1996, Sparks et al. 1998, Duchamp et al. 2004, Whitaker et al. 2004, Brack and Duffey 2006). The species is locally abundant, associated with human activities during all parts of its life, and has a relatively high reproductive potential (Brack et al. 2010). Small numbers of big brown bat fatalities have been recorded at wind energy facilities (Kunz et al. 2007a, Kunz et al. 2007b, Arnett et al. 2008). Given the species abundance in the Project area and its habit of foraging in open areas (Duchamp et al. 2004), it is likely that some big brown bats could be killed at the facility. However, the robust local population, dispersal of these bats in multiple roosts, and relatively high reproductive potential makes it unlikely that this mortality would have population-level impacts.

5.4 Characterization of the Bat Community

The third objective of characterizing the bat community on the site was met. The bat community is typical for this area of Ohio and was dominated by big brown bat, which is associated with anthropogenic structures in all parts of its life history (Davis et al. 1968, Barbour and Davis 1969). Eleven species of bats are typically considered to occur in Ohio (Gottschang 1981, Belwood 1998, Brack et al. 2010). Published studies in the region are rare; however, Brack and Duffey (2006) reported capture of 6 of 11 Ohio bat species on the Ravenna Training and Logisitcs Site (RTLS), Portage and Trumbull counties, Ohio. The main differences between the current study and that of Brack and Duffey (2006) was the much higher local abundance of little brown bats at RTLS and the presence of the Indiana and evening bat in this study.

This study documented the presence of two migratory tree bats-- the eastern red and hoary bat. The silver-haired bat is not typically present in this region during summer, but is likely abundant during migration (Brack et al. 2010). Together, these migratory tree bats are the species most commonly killed at wind energy facilities (Kunz et al. 2007a, Kunz et al. 2007b, Arnett et al. 2008).

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APPENDIX A
SPECIES ECOLOGY

1.0 Ecology of Listed Species

1.1 Indiana Bat (*Myotis sodalis*)

1.1.1 Description

The Indiana bat is a medium-sized bat in the genus *Myotis*. The forearm length has a range of 35 to 41 millimeters (1.4 – 1.6 in). The head and body length ranges from 41 to 49 millimeters (1.6 – 1.9 in). Its appearance most closely resembles that of congeners little brown bat (*M. lucifugus*) and northern bat (*M. septentrionalis*). Indiana bats differ from similar *Myotis* species in that they have a distinctly keeled calcar (cartilage that extends from the ankle to support the tail membrane). Other minor differences include smaller and more delicate hind feet, shorter hairs on the feet that do not extend past the toenails, and a pink nose. The fur lacks luster, and the wing and ear membranes have a dull, flat coloration that does not contrast with the fur (USFWS 2007). Fur on the chest and belly is lighter than fur on the back, but is not as strongly contrasting as that of similar *Myotis* species. Overall color is slightly grayer, while the little brown bat and northern bat are browner. The skull has a crest and tends to be smaller, flatter, and narrower than that of the little brown bat (USFWS 2007) .

1.1.2 Status

The USFWS listed the Indiana bat as endangered on 11 March 1967. The most current range-wide estimate of the population is 387,835 individuals (USFWS 2010), which represents about half of the estimated population of 1960. Listing was based on long-term declines of winter populations across the range of the species, although population changes are best documented where the species was most abundant in Kentucky, Missouri, and Indiana (Brack et al. 1984, Johnson et al. 2002, Whitaker et al. 2002, Brack et al. 2003, Sparks et al. 2008), although such information is now being acquired in most states. It is probable that habitat loss during summer (USFWS 2007) and winter disturbances during hibernation (Johnson et al. 1998) both contributed to the overall decline of the species.

Federal Register Documents

41 FR 41914; 24 September 1976: Final Critical Habitat, Critical habitat-mammals

40 FR 58308 58312; 16 December 1975: Proposed Critical Habitat, Critical habitat-mammals

32 FR 4001; 11 March 1967: Final Listing, Endangered

The only official recovery plan for the species was completed on 14 October 1983. A revised draft was released in April 2007. Although widely used as a regulatory document, the 2007 version of the recovery plan has not been officially approved.

Critical habitat was designated on 24 September 1976, and includes 11 caves and 2 abandoned mines in Illinois, Indiana, Kentucky, Missouri, Tennessee, and West Virginia.

1.1.3 Regional Species Occurrence

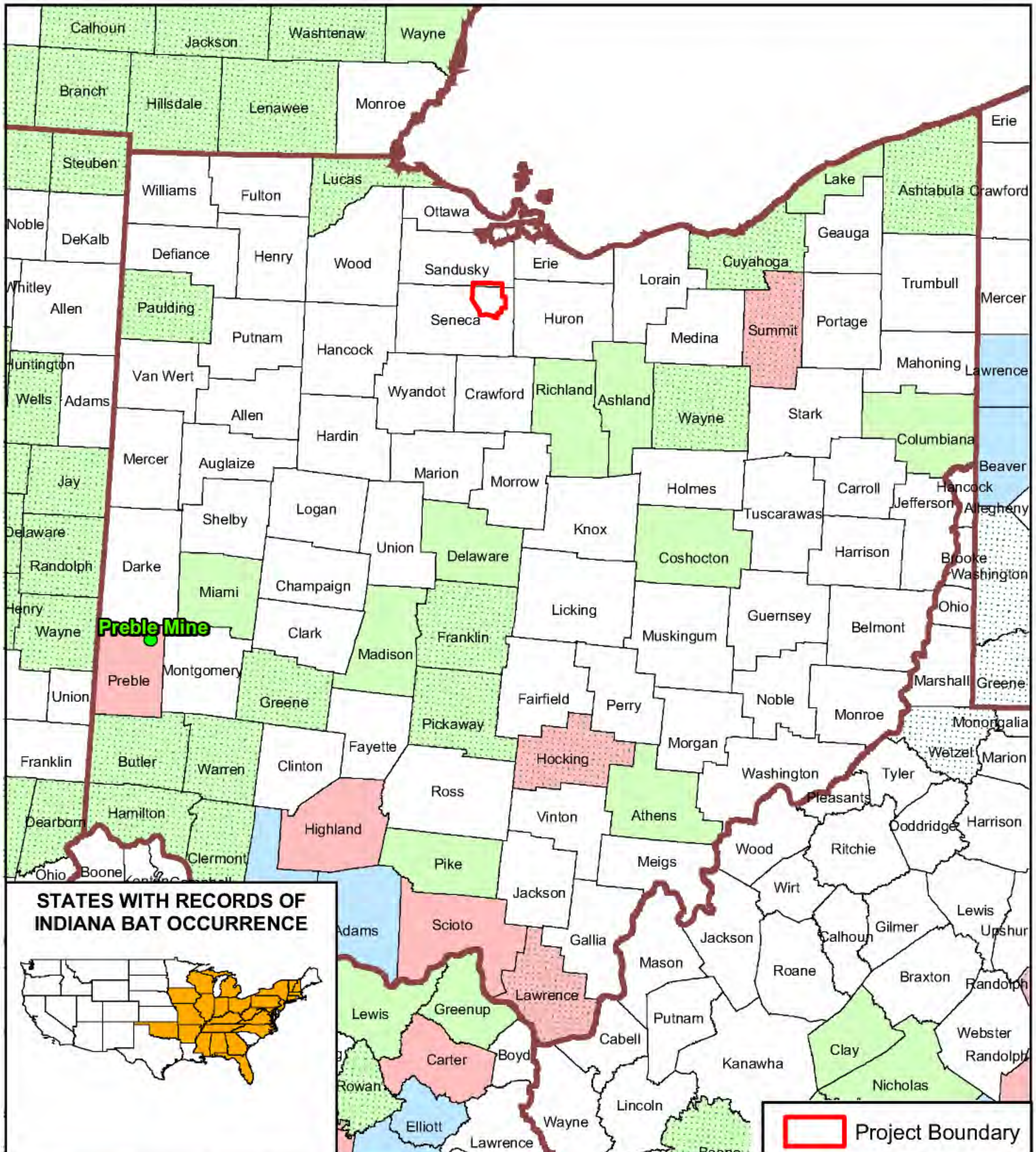
Neither Seneca nor Sandusky counties has records of the Indiana bat. The closest major hibernaculum is Lewisburg Mine, approximately 180 kilometers (112 mi) southwest of the Project in Preble County. The closest designated critical habitat for this species is Ray's Cave, approximately 385 kilometers (239 mi) southwest of the WRA in Greene County, Indiana. Prior to the survey, the closest counties with documented non-reproductive summer records were Richland and Ashland Counties (Figure 1). However, following completion of the study a reproductive Indiana bat was captured within 5 miles of the WRA (J. Norris, ODNR).

1.1.4 Ecology

The Indiana bat is a "tree bat" in summer and a "cave bat" in winter. There are four ecologically distinct components of the annual life cycle: winter hibernation, spring staging and autumn swarming, spring and autumn migration, and the summer season of reproduction. The U.S. Fish & Wildlife Service Recovery Plan (2007) provides a description of the life history. Figure 2 provides an annual chronology of seasonal activities.

1.1.4.1 Summer Roosting Ecology

The summer range of the Indiana bat is large and includes much of the eastern deciduous forestlands between the Appalachian Mountains and Midwest prairies (Figure 3). Distribution throughout the range is not uniform and summer occurrences are more frequent in southern Iowa and Michigan, northern Missouri, Illinois, and Indiana. Greater tree densities do not equate to more bats (Brack et al. 2002).



County with Record of Indiana Bat Hibernacula Occurrence	County with Record of Indiana Bat Other Summer (Nonreproductive) Occurrence	State Boundary	
County with Record of Indiana Bat Summer Maternity Occurrence	County with Record of Indiana Bat Hibernacula and Other Summer (Nonreproductive) Occurrences	County Boundary	

Figure 1. Counties near the project area with hibernacula, summer maternity, and other summer (non-reproductive) records for the Indiana bat (*Myotis sodalis*).

Project No.340

Sources: USFWS, Indiana Bat Revised Recovery Plan, Agency Draft, 2007. Updated October 2010

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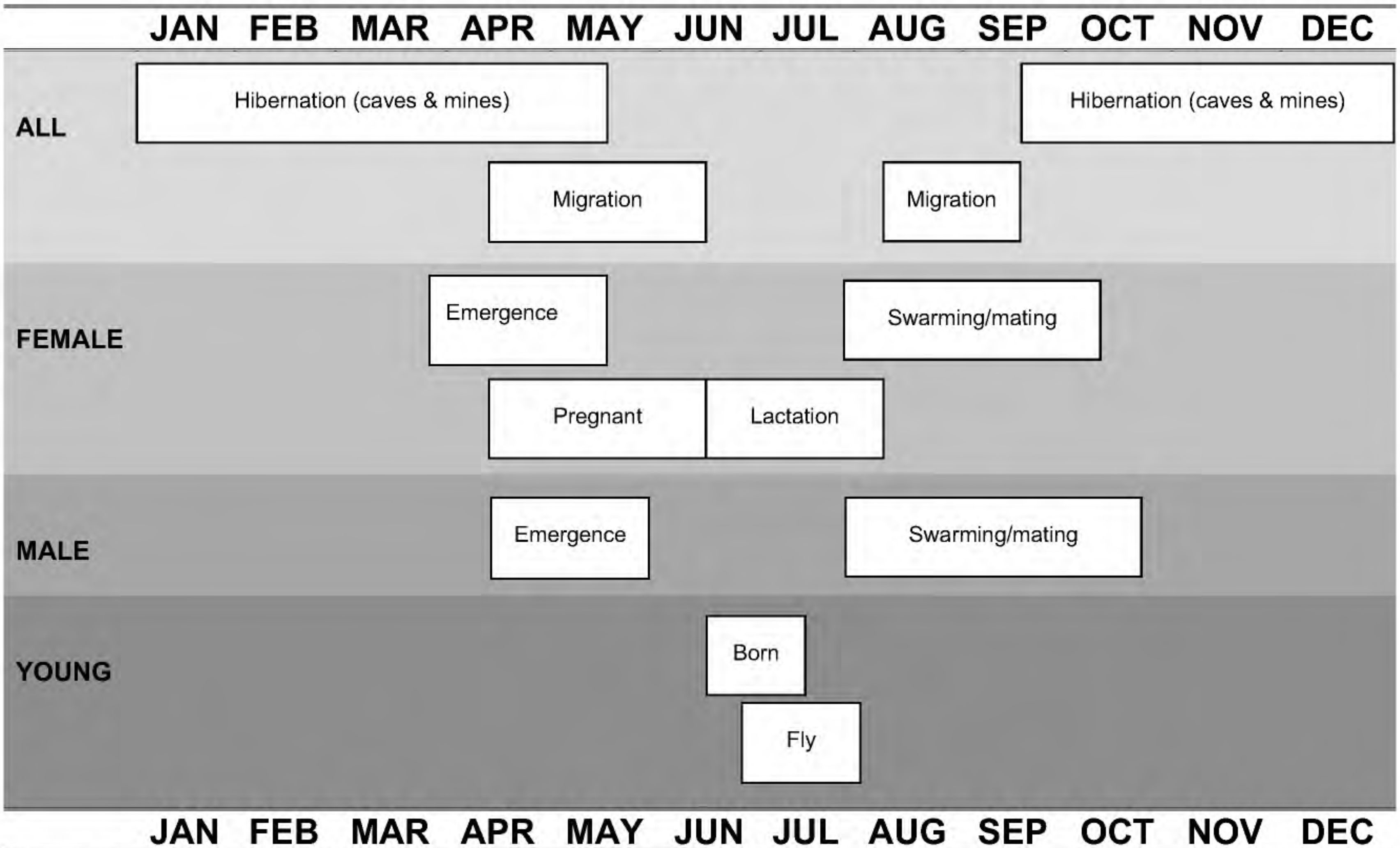

Figure 2. Seasonal chronology of Indiana bat activities.

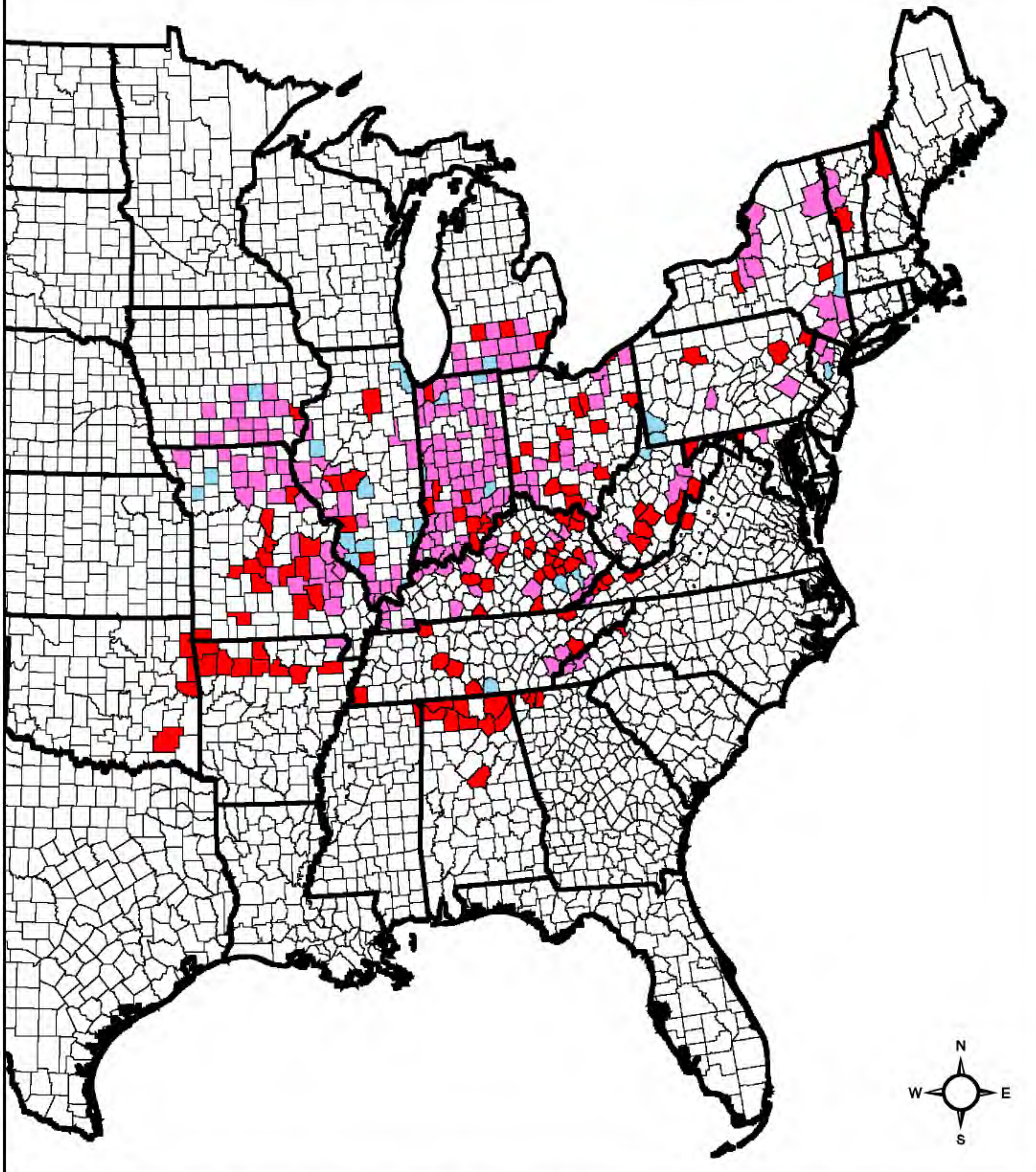

Figure 3. Rangewide distribution of the Indiana bat during summer, showing counties with reproductive (adult female and/or young-of-the-year) and non-reproductive records.

County with Record of Indiana Bat Reproductive Occurrence	County with Record of Indiana Bat Summer Non-Reproductive Occurrence	County with Record of Indiana Bat Reproductive and Summer Non-Reproductive Occurrence

Project No. 340	Sources: USFWS, Indiana Bat Revised Recovery Plan, Agency Draft, 2007. Updated: October 2010	ESI ENVIRONMENTAL SOLUTIONS & INNOVATIONS, INC.

Cooler summer temperatures associated with latitude or altitude likely affect reproductive success and the summer distribution of the species (Brack et al. 2002).

1.1.4.1.1 Males

Some males remain near hibernacula throughout summer while others migrate varying distances (Whitaker and Brack 2002). Males can be caught at hibernacula on most nights during summer (Brack 1983, Brack and LaVal 1985), although there may be a large turnover of individuals between nights (Brack 1983).

Structurally, woodland roosts used by males are similar to those used by maternity colonies (Kiser and Elliott 1996, Schultes and Elliott 2002, Brack and Whitaker 2004, Brack et al. 2004). These trees are smaller (Kurta 2004), perhaps because males are often solitary or form small groups and thus need less space or because males may have different thermal requirements than females. Males appear somewhat nomadic; over time, the number of roosts and the size of an area used increases. Activity areas encompass roads of all sizes, from trails to interstate highways. Roosts have also been located near roads of all sizes (Kiser and Elliott 1996, Schultes and Elliott 2002, Brack et al. 2004), including adjacent to an interstate highway (Sparks et al. 1998, Brack et al. 2004, Whitaker and Sparks 2008, Sparks et al. 2009).

1.1.4.1.2 Females and Maternity Colonies

When female Indiana bats emerge from hibernation, they migrate to maternity colonies that may be located up to several hundred miles from the hibernacula (Kurta and Murray 2002, Winhold and Kurta 2006). Females form nursery colonies under exfoliating bark of dead, dying, and living trees in a variety of habitat types, including uplands and riparian habitats. A wide variety of tree species (Kurta 2004), occasionally including pines (Britzke et al. 2003), are used as nursery colonies indicating that it is tree form, not species that is important for roosts (Kurta 2004). Because many roosts are in dead or dying trees, they are often ephemeral. Roost trees may be habitable for one to several years, depending on the species and condition of the tree (Callahan et al. 1997, Kurta 2004, Whitaker and Sparks 2008). Indiana bats exhibit strong site fidelity to summer roosting and foraging areas(Kurta and Murray 2002, Kurta et al. 2002, Sparks et al. 2004, Whitaker et al. 2004, Winhold et al. 2005, Whitaker and Sparks 2008, Sparks et al. 2009).

A maternity colony typically consists of 25 to 325 adult females. Nursery colonies often use several roost trees (Kurta et al. 1993, Foster and Kurta 1999, Kurta and Murray 2002, Whitaker and Sparks 2008), moving among roosts within a season. Most members of a colony coalesce into one or a few roost trees about the time of parturition, the action or process of giving birth to offspring. Once young are volant, capable of flying, the bats spend less time in these major roosts and more time in minor roosts—often roosting alone under the bark of live trees. Roosts that contain large numbers of bats (more than 20 bats) are often called primary roosts, while secondary roosts hold fewer bats. Primary roost trees are often greater than 46 centimeters (18 in) dbh and secondary roost trees are often greater than 23 centimeters (9 in) dbh (Gardner et al. 1991, Callahan et al. 1997, Kurta et al. 2002, Miller et al. 2002, Carter 2003). Numerous suitable roosts may be needed to support a single nursery colony, possibly about 45 stems per hectare (20/acre) (Gardner et al. 1991, Miller et al. 2002, Carter 2003).

Roost trees often have 10 hours of solar exposure per day, with 20 to 80 percent canopy closure (Humphrey et al. 1977, Gardner et al. 1991, Kurta et al. 1993, Kurta et al. 1996, Kurta et al. 2002, Carter 2003), but the need for solar exposure may vary with latitude. Although Indiana bats typically roost under the exfoliating bark of dead and dying trees, they have also been found roosting in a variety of cracks and hollows in trees (L. C. Watkins in Humphrey et al. 1977, Kurta et al. 1993, Kurta et al. 2002), (Butchkoski and Hassinger 2002, Kurta 2004), utility poles (ESI 2004, Hendricks et al. 2004), buildings (Butchkoski and Hassinger 2002, V. Brack Unpublished data, A. C. Hicks Personal communication), and bat boxes (Butchkoski and Hassinger 2002, Carter 2002, Butchkoski 2005, Ritzi et al. 2005, Whitaker et al. 2006). The colony of bats near the Indianapolis Airport have used a combination of both natural roosts (trees) and batboxes every year since 2003 (Sparks et al. 2008).

Females are pregnant when they arrive at maternity roosts. Females produce one young per year, typical for the genus *Myotis* (Asdell 1964, Hayssen et al. 1993). Parturition typically occurs between late June and early July. Lactating females have been caught 11 June to 29 July in Indiana, 26 June to 22 July in Iowa, and 11 June to 6 July in Missouri (Humphrey et al. 1977, LaVal and LaVal 1980, Brack 1983, Clark et al. 1987). Juveniles become volant between early July and early August. Reproductive phenology is likely dependent upon seasonal temperatures and the thermal character of the roost (Humphrey et al. 1977, Kurta et al. 1996). Like many microchiropterans, Indiana bats are thermal conformists (Stones and Wiebers 1967), with prenatal, neonatal, and juvenile development temperature dependent (Racey 1982). Cooler summer temperatures associated with latitude or altitude likely affect reproductive success and therefore the summer distribution of the species (Brack et al. 2002).

1.1.4.2 Food Habits and Foraging Ecology

Like many other species of microchiropterans, the Indiana bat often uses travel corridors that consist of open flyways such as streams, woodland trails, small infrequently used roads, and possibly utility corridors, regardless of suitability for foraging or roosting (Brown and Brack 2003). Members of maternity colonies forage in a variety of woodland settings, including upland and floodplain forest (Humphrey et al. 1977, Brack 1983, Gardner et al. 1991). Foraging activity is concentrated above and around foliage surfaces, such as over the canopy in upland and riparian woods, around crowns of individual or widely spaced trees, and along edges. They forage less frequently over old fields, and occasionally over bushes in open pastures. Forest edges, small openings, and woodlands with patchy trees provide more foraging opportunities than dense woodlands. Most species of woodland bats forage prominently along edges, less in openings, and least within forests (Grindal 1996). Openings also provide a better supply of insects than do wooded areas (Tibbels and Kurta 2003).

1.1.5 Causes of Past/Current Decline

Long-term, detailed documentation of population changes of Indiana bats are lacking in most areas. Summer habitat degradation (USFWS 2007), pesticides, and winter disturbance (Johnson et al. 1998) are believed to have contributed to an overall decline. Beginning in 2006, bats (including Indiana bats) hibernating in mines near Albany, New York were observed with fungal disease that is now known as white nose syndrome (WNS), which has been responsible for dramatic declines in bats throughout the northeast (Blehert et al. 2008; 2009).

Populations of hibernating bats in the northeastern United States have been dying in record numbers, and the specific cause of the deaths is unknown. However, this crisis is directly associated with WNS, named for a white fungus evident on the muzzles and wings of affected bats (Meteyer et al. 2009). This affliction was first documented at four sites in eastern New York in the winter of 2006-2007 (Blehert et al. 2008; 2009). Since then, WNS has rapidly spread to multiple sites throughout the northeast and has begun to spread into the Southeast and Midwest. Researchers associate WNS with a newly identified fungus (*Geomyces destructans*) that thrives in the cold and humid conditions characteristic of the caves and mines used by bats (Gargas et al. 2009). Bats apparently have a reduced immune responses while hibernating (Carey et al. 2003), which may predispose them to infection by *G. destructans*. Biologists and/or cavers have documented WNS in bat hibernacula in New Hampshire, Vermont, New York, Massachusetts, Connecticut, New Jersey, Pennsylvania, West Virginia, Virginia, Maryland, Delaware, Tennessee, and the Canadian provinces of Ontario and Quebec. We recently documented its presence in Indiana and it has been reported from both Ohio and Kentucky. The disease can lead to severe wing damage (Reichard and Kunz 2009) which can be used as a "red flag" for infected individuals, although the majority of bats within an infected area have only slightly damaged or undamaged wings (Francl et al. 2011). By combining sensitive molecular techniques (Lorch et al. 2010) with field observations of damaged wings, the fungal agent of WNS has now been documented in Missouri and Oklahoma.

The Indiana bat uses a variety of wooded summer habitats, from large tracts of woodlands to riparian strips and woodlots on a man-dominated landscape. Summer habitat losses include tree removal or land clearing for a variety of land use practices. Removal of standing dead trees, especially during summer months, is potentially harmful. Removal of riparian forest along streams and ditches also degrades summer habitat. Loss of wooded lands can lead to increased forest fragmentation, and a compounding of adverse effects. In many portions of their core range, Indiana bats utilize savanna-like habitats, with large trees, an open canopy, and an uncluttered understory. However, suppression of fire and removal of dominant grazing herbivores, combined with frequent tree harvest, has often produced wooded lands of smaller trees with a closed canopy and a cluttered understory, which may have affected the quality of maternity habitat (USFWS 2007). Similarly, urbanization removes potential foraging habitat and bats may not cross developed areas to access otherwise suitable foraging habitat (Sparks et al. 2005).

1.2 Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*)

1.2.1 Description

Rafinesque's big-eared bat is a medium-sized bat, approximately 102 millimeters (4 in) in length with a wingspread of about 280 millimeters (11 in). The Virginia big-eared bat (*Corynorhinus townsendii virginianus*), a federally listed sub-species also has large, conspicuous ears but several characteristics separate the two. The Rafinesque's big-eared bat has grayish-brown fur on the upperparts, a whitish belly, and long toe hairs that extend noticeably beyond the tips of the toes. The Virginia big-eared bat has medium brown upperparts, a buff belly color, and very short toe hairs. Both species of big-eared bats have two large lumps (glands) on the upper surface of the snout, accounting for the alternative name, 'lump-nosed' bat.

1.2.2 Status

Rafinesque's big-eared bat is a federal species of management concern and is listed in Ohio as a species of concern. The Rafinesque's big-eared bat is rare in Ohio, known only from Adams County, in extreme south central Ohio (http://www.mammalsociety.org/mammals-ohio).

1.2.3 Ecology

This is a bat of forested regions. Hibernation in the north and in mountainous regions most often occurs in caves or similar sites; small caves are selected, and the bats stay near the entrance (often within 30 meters) and are thought to move about in winter (Handley 1959, Barbour and Davis 1969). In Kentucky, shallow caves or rock shelters in sandstone formations of the Cumberland Plateau often are used. Rafinesque's big-eared bats are also known to use abandoned mines year-round (Belwood and Waugh 1991). Many are found hibernating singly, but clusters of up to about 100 individuals have been found on rare occasions. From spring through fall, the species is most often found in sandstone rock shelters along cliff lines and in small caves, but abandoned buildings are frequently used in some areas (http://www.biology.eku.edu/bats/rafbat.html).

Summer roosts often are in hollow trees, occasionally under loose bark, or in abandoned buildings in or near wooded areas. Nursery colonies are rare in caves, but are known to occur in Kentucky and Tennessee (Barbour and Davis 1969). There are records of roosts under bridges and even in a cistern. Maternity colonies consist of from a few to several dozen females and are found in roosts from May through August or September (http://www.biology.eku.edu/bats/rafbat.html). Pups are typically born in late May and early June, and they are volant by mid-July. Male bats may roost singly or in small clusters, often at different sites than females and young. Rafinesque's big-eared bats are thought to forage in forests and along forest edges, preying mostly on moths, which they frequently eat at roost sites. A collection of moth wings on the ground often indicates the species' use of a sheltered place as a roost site (http://www.biology.eku.edu/bats/rafbat.html). Hurst and Lacki (1997) noted that the diet of these bats primarily consisted of lepidopterans. Big-eared bats primarily relied on gleaning near the cave, but at least occasionally captured moths in flight (Lacki and Ladeur 2001).

1.3 Eastern Small-footed Bat (*Myotis leibii*)

1.3.1 Description

The small-footed bat is one of the eastern United States smallest bats averaging 8.9 centimeters (3.5 in) long, with a 3.8-centimeter (1.5-in) tail. Although it generally similar to the little brown bat (*Myotis lucifugus*), it differs from that species in having a dark face and wing membranes that contrast with the fur, smaller feed (less than 8 millimeters [.3 in]) and a strongly keeled calcar (Best and Jennings 1997).

1.3.2 Status

The eastern small-footed bat is not a listed species, protected under ESA, although USFWS has been petitioned to list the species as a result of the emergence of WNS (The Center for Biological Diversity 2010), and after their 90-day review of the petition are completing a Status Assessment to determine whether or not to recommend listing. In Ohio, the eastern small-footed bat is considered the rarest bat in the state and is listed as a species of concern (http://www.dnr.state.oh.us/wildlife/Home/resources/mgtplans/specofconcern/tabid/6007/Default.aspx). In May 2011, for the first time in more than 100 years the species was identified in Ohio, roosting in Castalia Quarry MetroPark.

The range of the eastern small-footed bat, extends from northern New England through New York, south along the Appalachian Mountains to North Carolina and westward through Tennessee and northern Georgia, Alabama and Mississippi with disjunct populations occurring in cliffs along the Ohio River and in the Ozarks (Whitaker and Hamilton 1998). Despite its wide distribution, the species is rarely encountered in sufficient numbers for meaningful interpretation of seasonal reproductive cycles, habitat use, food habits, or even seasonal changes in morphometric data.

1.3.3 Ecology

The small-footed bat is considered a "hearty" species that enters hibernation late in autumn and emerges early in spring and is thought to hibernate at cold temperatures (Best and Jennings 1997). Throughout the range, most winter observations have been of individuals using open areas of caves and mines (Mohr 1936, Gunier and Elder 1972, Best and Jennings 1997, Veilleux 2007), but these observations are probably not typical of areas most used. Observations of bats hibernating beneath stones and rocks on floors of caves (Davis 1955, Krutzsch 1966) as well as the capture by trapping sites a railroad tunnel where the bats were not observed during visual surveys in Maryland (Johnson and Gates 2008), all suggest the species may typically hibernate in a variety of narrow rock crevices.

The mating behavior of the eastern small-footed bat is frequently assumed to be similar to that of better-known congeners, such as the Indiana bat and little brown bat, with autumn swarming at caves and mines providing an opportunity to mate (Humphrey and Cope 1976, Cope and Humphrey 1977, LaVal and LaVal 1980, McDaniel et al. 1982). During autumn studies in Wise County, Virginia, eastern small-footed bats came to caves and mines, generally after feeding, rather than emerging from them, emphasizing the importance of caves and mines in the social behavior of the species (V. Brack, Pers. Comm.). The mass of bats in autumn, prior to hibernation, was about 44 percent greater than the mass of bats in spring, after hibernation. Bats captured during swarming in West Virginia fed on 7 orders of insects although moths (Lepidoptera) and flies (Diptera) were predominant (Johnson and Gates 2007). In southern New Hampshire the summer diet (May through September) included insects belonging to eight orders, spiders (Araneae), unidentified arthropods and vegetation (Moosman et al. 2007). Moths (Lepidoptera), trueflies (Diptera), and beetles (Coleoptera) composed most of the diet. Diet of adult males contained significantly fewer beetles than that of juveniles, but diet was similar between other demographic groups and across time. The Presence of spiders and crickets (Gryllidae) in the diet suggested gleaning.

Bats captured during spring emergence from a Maryland railroad tunnel made short (less than 2 km) migrations to summer grounds (Johnson and Gates 2008). These bats selected summer roosts amongst slopes covered with shale and occasional trees, and appeared to roost randomly amongst the rock. Although few published accounts are available, the species is considered a specialist in using rocky areas (Best and Jennings 1997). The following comments are based on a review of the limited available published data (Best and Jennings 1997, Erdle and Hobson 2001, Johnson and Gates 2008, Johnson et al. 2009, PGC 2010), discussions with a biologist with the largest unpublished study (J. P. Veilleux, personal communication), observations of ESI biologists on capture sites and roosts discovered via radio-telemetry, and the known roosting biology of other eastern bats (Barclay and Kurta 2007). Ideal summer habitats for this species are large expanses of rock that provide the bats with a variety of thermal conditions. Such conditions are naturally found in rock fields, tallus slopes, and cliff lines. Suitable anthropogenic habits are known to include high walls and mine tailings, and rip-rapped dams, but also likely include road cuts. Reproductive females likely select roosts with significant solar exposure that allow for more rapid development of the young. Other bats likely select more shaded and thus cooler roosts that allow bats to use daily torpor to save energy. As such, occasional individuals may also occupy smaller rock outcroppings even if isolated.

Other aspects of summer ecology consist primarily of anecdotal observations (Best and Jennings 1997). By late June, most adult females are lactating, although pregnant individuals can still be found. About 30 percent of females captured are not reproductively active, which suggests females do not mate the first year. A similar rate of capture of reproductive females and adult males during summer suggests males and females use the habitat similarly, and maternity colonies, if present, are small. Flight is slow (Davis et al. 1965, Barbour and Davis 1969, van Zyll de Jong 1984), which suggests the species may extensively glean prey items from surface structures.

2.0 Additional Species that May be Listed During the Life of the Project

2.1 Northern Long-eared Bat (*Myotis septentrionalis*)

2.1.1 Natural History

The northern long-eared bat ranges from the northern border of Florida north and west to Saskatchewan and east to Labrador. In Ohio, it ranges in forested areas throughout the state (Brack et al. 2010). Maternity colonies are typically found in hollow trees and under bark although they sometimes use bat-houses, and buildings (Sparks 2003, Whitaker et al. 2004). Colonies are usually smaller than other species of *Myotis* and occupy small territories (D. W. Sparks Unpublished Data). Northern long-eared bats hibernate in crevices and fissures in caves and mines (Whitaker and Rissler 1992), and probably such structures as highway cuts. The Lewisburg Limestone Mine is home to approximately 100 of these bats in winter (Brack 2007). Unpublished studies in suburban Indianapolis and along the Wabash River near Terre Haute indicate this species forages almost exclusively in forested areas within 1 kilometer (0.6 mi) of the roost (D. W. Sparks, Unpublished). The species forages on a variety of insects including flies, moths, beetles, and is noteworthy for its consumption of spiders (Brack and Whitaker 2001).

2.2 Little Brown Bat (*Myotis lucifugus*)

2.2.1 Natural History

The little brown bat ranges from the edge of the Coastal Plain north to Alaska and may dominate bat communities where scattered buildings (potential roosts) occur in a matrix dominated by natural or agricultural landscapes. The species is commonly captured in Ohio (Brack and Duffey 2006) and likely occurs throughout the state (Brack et al. 2010), including the Project Area. However, White-Nose Syndrome has impacted the little brown bat more than any other species. The species may no longer be the most common species and likely will continue to decline. Maternity colonies are typically found in buildings, bridges, bat-houses, and under the bark of trees (Barclay and Cash 1985, Cope et al. 1991). Near large colonies, this species may dominate the local bat community. Most little brown bats hibernate in caves and mines (Whitaker et al. 2002, Whitaker et al. 2003). Nearly 20,000 use nearby Preble Mine as a hibernaculum (Brack 2007). Recent declines may be due to White-Nose Syndrome. Little brown bats have not been extensively radio-tracked to study foraging areas. A single bat captured near Indianapolis flew to a roost approximately 6 kilometers (3.7 mi) from its point of capture (Whitaker et al. 2004). This species makes extensive use of riparian zones and wetlands for foraging (Brack 2009). The species forages on a variety of insects including flies, moths, beetles, and flying ants (Whitaker et al. 2007).

2.3 Evening Bat (Nycticeius humeralis)

2.3.1 Natural History

The evening bat ranges from central Nebraska east to the Atlantic Ocean and south to the Gulf of Mexico. In Ohio, this bat is uncommon and is known from only three counties (Medina, Harrison, and Pickaway) (Brack et al. 2010). During the summer mist net survey two juvenile female bats were captured. These two bats are the first recorded occurrence in Seneca County. Since both individuals were juveniles and this species has a remarkably short foraging range with virtually all bats foraging in woodlots and over agricultural fields within 4 kilometers (2.5 mi) of the roost, it is very likely a maternity colony is located close to the capture site (Duchamp et al. 2004). Maternity colonies may occur in buildings (Whitaker and Gummer 2003); however, most roosts now occur in hollow trees, and several hundred bats may cram into a woodpecker hole (Duchamp et al. 2004). In Indiana, the species occurs in the bottomlands of major streams (Whitaker and Gummer 2003). The evening bat is highly sensitive to development as a result of their small foraging range. The species forages heavily on spotted cucumber beetles, other beetles, green stink bugs, and moths (Whitaker and Clem 1992).

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APPENDIX B
STUDY PLAN AND ASSOCIATED CORRESPONDENCE

ESI

STUDY PLAN

MIST NET SURVEYS OF SUMMER BATS ON THE REPUBLIC WIND ENERGY PROJECT RESOURCE AREA SENECA AND SANDUSKY COUNTIES, OHIO

20 June 2011

Submitted to:

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1.0 Introduction and Project Description

Republic Wind Energy, LLC (Republic), a Nordex affiliated company, is proposing to construct a commercial wind energy facility within a wind resource area consisting of approximately 16,028 hectares (39,607 ac) in Seneca and Sandusky Counties, Ohio. The project area is referred to as the Republic Wind Energy Project (Project). On behalf of Republic, Tetra Tech EC, Inc. (Tetra Tech) contracted Environmental Solutions & Innovations, Inc. (ESI) to perform a summer mist net survey for summer bats on the Project site.

The Project straddles the Seneca/Sandusky county line, just east of the town of Green Springs in Sandusky County, Ohio (Figure 1) and covers part of the Fremont East, Clyde, Watson, and Fireside USGS 1/24000 Quadrangles. Indiana bats are found in the state of Ohio during summer, and are known to hibernate in caves and mines within the state and in neighboring states of Indiana and Kentucky. The closest major hibernaculum is Preble Mine approximately 196.34 kilometers (122 mi) southwest of the Project in Preble County. The closest designated critical habitat for this species is Ray's Cave approximately 402.34 kilometers (250 mi) southwest of the Project in Greene County, Indiana. The closest county with documented maternity records is Lucas County to the northwest (Figure 2).

Based on previous agency coordination, Ohio Department of Natural Resources (ODNR) indicated that the Project met the need for a moderate monitoring and that sampling would require 25 mist-net sites. Field studies will be carried out under ESI's current Federal Fish and Wildlife Permit #TE02373A-1 and ODNR Wildlife Animal Permit-Scientific Collection # 14-70.

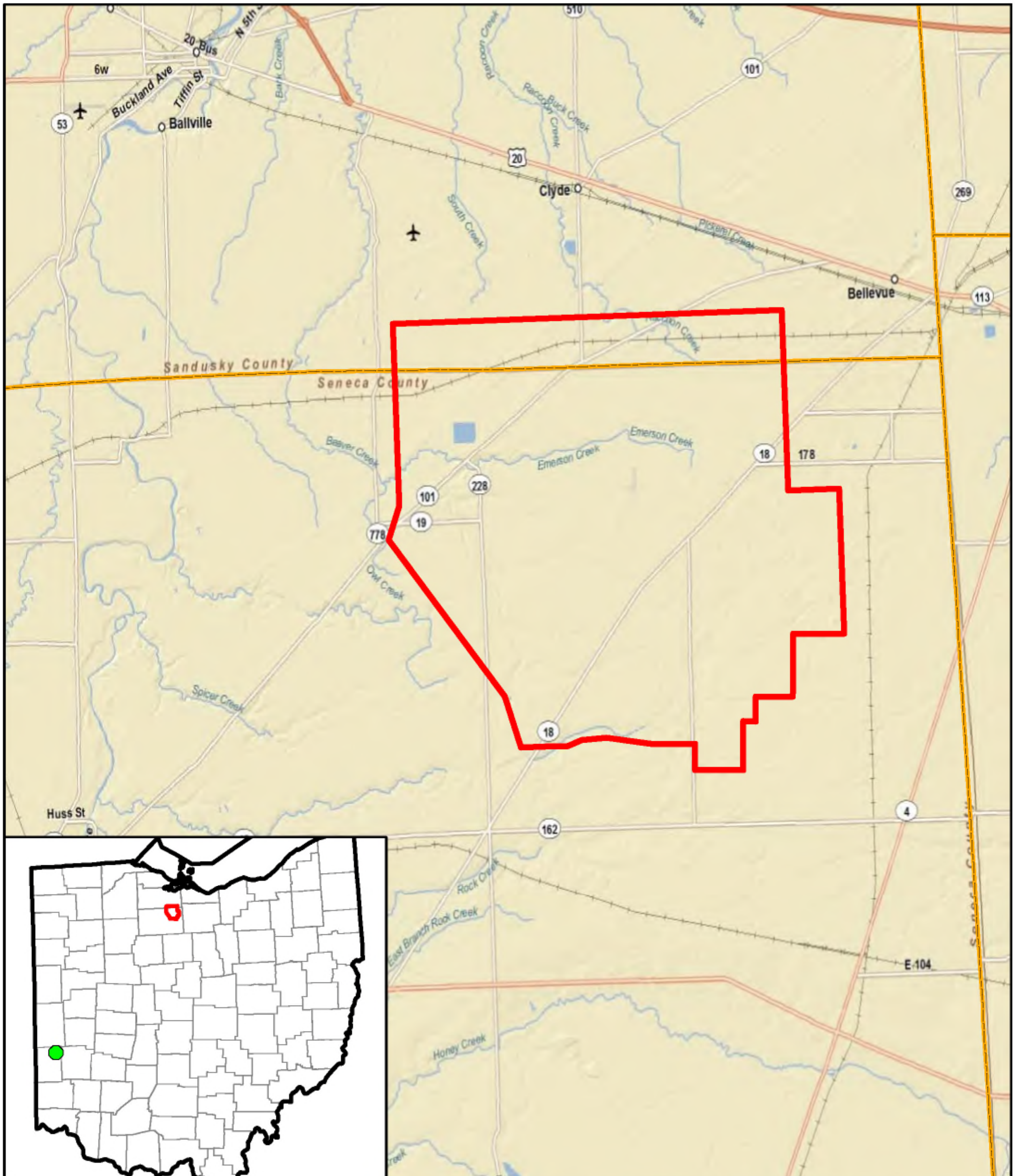

Figure 1. Location of the Project area in Seneca and Sandusky Counties, Ohio and relation of the Project to a Priority 2 hibernaculum in Preble County.

Project No. 340

0 3450 6900 Meters

Base Map: ESRI Street Map

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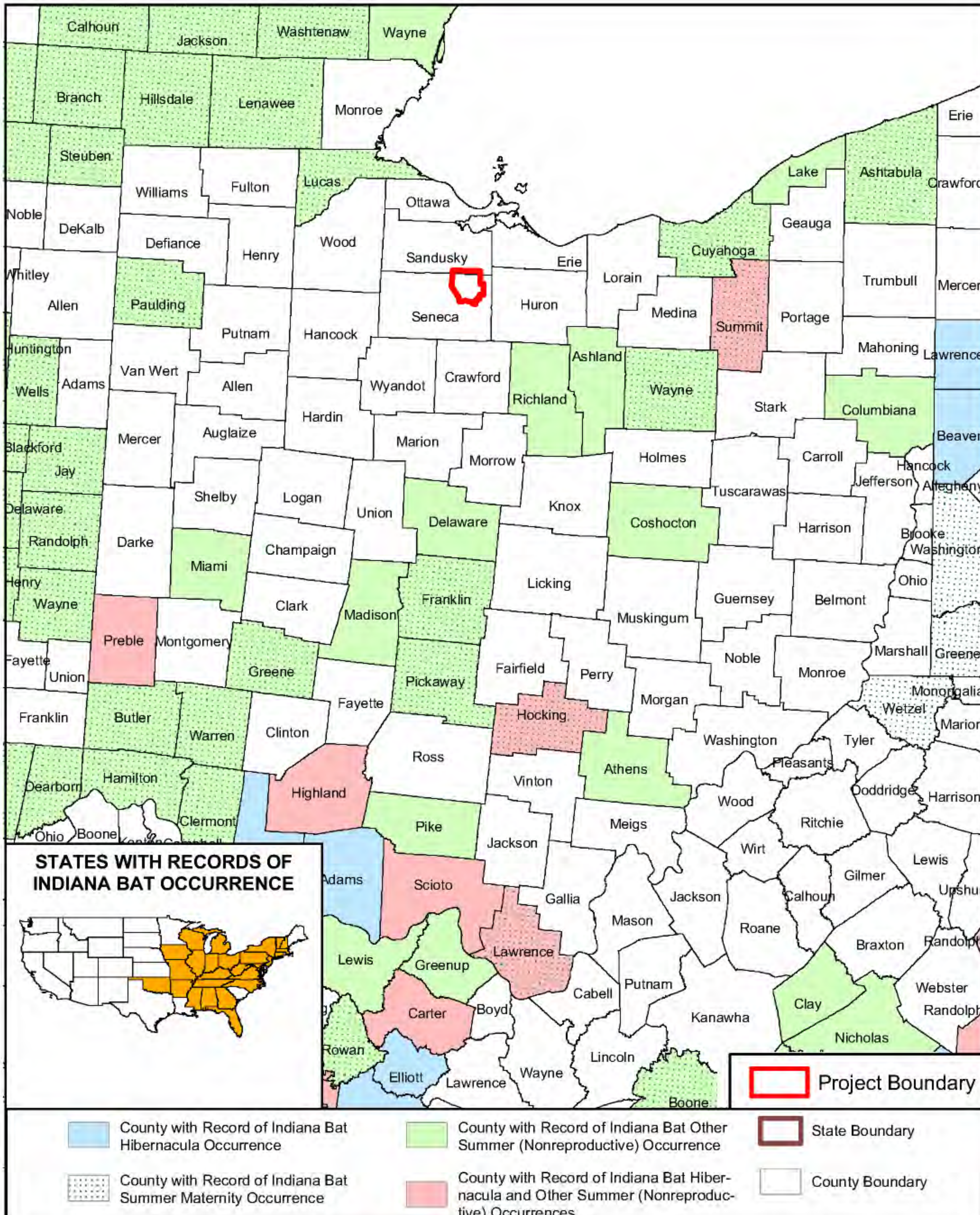

Figure 2. Counties near the project area with hibernacula, summer maternity, and other summer (non-reproductive) records for the Indiana bat (*Myotis sodalis*).

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Sources: USFWS, Indiana Bat Revised Recovery Plan, Agency Draft, 2007. Updated October 2010

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2.0 Methods

2.1 Mist Netting

Sampling efforts will follow guidelines provided by the Indiana Bat Recovery Team in the 2007 Indiana Bat Draft Recovery Plan (First Revision) (Table 1) as supplemented by guidance provided in ODNR's On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio (Table 2).

2.1.1 Level of Effort

In prior correspondence, ODNR requested that 25 sites be sampled for bats based on the amount of forest contained in the Project area (Figure 3).

Table 1. USFWS Indiana Bat Mist Net Survey Guidelines

NETTING GUIDELINES

1. Netting Season: 15 May to 15 August, when Indiana bats occupy summer habitat.
2. Equipment (Mist Nets): constructed of the finest, lowest visibility mesh commercially available – monofilament or black polyester – with the mesh size approximately 38 millimeter (approximately 1.5 in).
3. Net Placement: mist nets extend approximately from water or ground level to tree canopy and are bounded by foliage on the sides. Net width and height are adjusted for the fullest coverage of the flight corridor at each site. A "typical" net set consists of three (or more) nets "stacked" on top of one another; width may vary up to 20 meters (60 ft).
4. Net Site Spacing:
   - Streams – one net site per 1 kilometer (0.6 mi)
   - Land Tracts – two net sites per 1 square kilometer (246 ac) of forested habitat
5. Minimum Level of Effort Per Net Site:
   - Two net locations (sets) per net site, with locations (sets) at least 30 meters (100 ft) apart
   - Two (calendar) nights of netting
   - At least four net–nights (1 net–night = 1 net set deployed for 1 night); typically, two net sets are deployed at one site for two nights, resulting in four net-nights
   - Sample Period: begin at dusk and net for 5 hours (approximately 0200h)
   - Nets are monitored at approximately 10-minute intervals
   - No disturbance near the nets between checks
6. Weather Conditions: net only if the following weather conditions are met:
   - No precipitation
   - Temperature $\geq$ 10° Celsius (50° F)
   - No strong winds

Source: U.S. Fish and Wildlife Service, 2007

Table 2. ODNR Moderate Monitoring Mist Net Survey Guidelines for Proposed Commercial Wind Facilities

ODNR MODERATE MONITORING NETTING GUIDELINES

1. Netting Season: 15 June to 31 July.
2. Net Placement:
    - Nets are placed on pulley systems that allow at least two standard nets to be "stacked" on top of each other and with one set of poles allowing 3 nets to be stacked and reach 7.5 meters from the substrate.
    - Proposed net sites are to be inspected by ODNR personnel prior to beginning sampling efforts.
3. Net Site Spacing: Land Tracts – two net sites per 1 square kilometer (246 ac) of forested habitat
4. Minimum Level of Effort Per Net Site:
    - Four net locations (sets) per net site, with all locations (sets) within at least 100 meters (30 ft) of each other
    - Two non-consecutive (calendar) nights of netting
    - At least eight net–nights (1 net–night = 1 net set deployed for 1 night);
    - Sample Period: begin at dusk and net for 5 hours (approximately 0200 h)
    - Photos of all species captured
5. Marking of Bats:
    - Small dots of nontoxic, water-soluble paint applied to one forearm of all bats to temporarily identify recaptures.
    - Indiana and Rafinesque's Big-Eared bats banded with bands provided by ODNR
    - Eastern Small-Footed Bats are not banded due to risk of injury

Source: Ohio Department of Natural Resources 2009

2.1.2 Net Placement

Mist nets are set to maximize coverage of flight paths used by Indiana bats along suitable travel corridors, foraging areas, and/or drinking areas. Riparian corridors are often used for travel or foraging by Indiana bats; however, upland corridors (e.g., trails or logging roads) also provide suitable sites. In upland areas, net sites in the vicinity of road ruts holding water have resulted in Indiana bat captures in many portions of the range.

Using GIS, ESI's biologist identified 30 potential sites (Figure 3) for sampling. This includes 8 sites beyond the required 25 to address potential issues related to property access and to address sites with unsuitable characteristics that may not be detected using remote sensing techniques. The 30 sites are distributed throughout the Project area and were placed so to maximize bat capture. Preferred sites include:

1. Riparian corridors along streams that connect larger woodlands, which could be used by foraging or roosting bats
2. Wooded upland corridors (roadways, fencerows) that connect larger woodlands, which could be used by foraging or roosting bats
3. Upland corridors including trails and utility rights-of-ways through larger woodlands that bats use for commuting and foraging
4. Choke points entering and exiting high potential foraging grounds (such as small fields or wetlands)
5. Areas identified as suitable using a model of habitat suitability (Weber and Sparks In Litt).

These potential sites are general locations. Once in the field, qualified bat biologist will select the exact netting locations and net orientation so to maximize bat capture. Extra sites have been pre-selected to allow field biologist maximum flexibility to select high quality net sites, and in the expectation that some preferred sites will be on inaccessible parcels. Because netting efforts can be easily impacted by environmental factors such as changes in vegetation or water level, the actual location and orientation of each net set is determined in the field by a qualified bat biologist.

Given that ESI was not directly involved in the negotiation of net sites, and that ODNR has, on other sites, agreed to lower the sampling effort in exchange for the inclusion of other techniques. ESI requests concurrence from USFWS and ODNR that this survey effort will be accepted as a presence, probable absence survey for the Indiana bat.

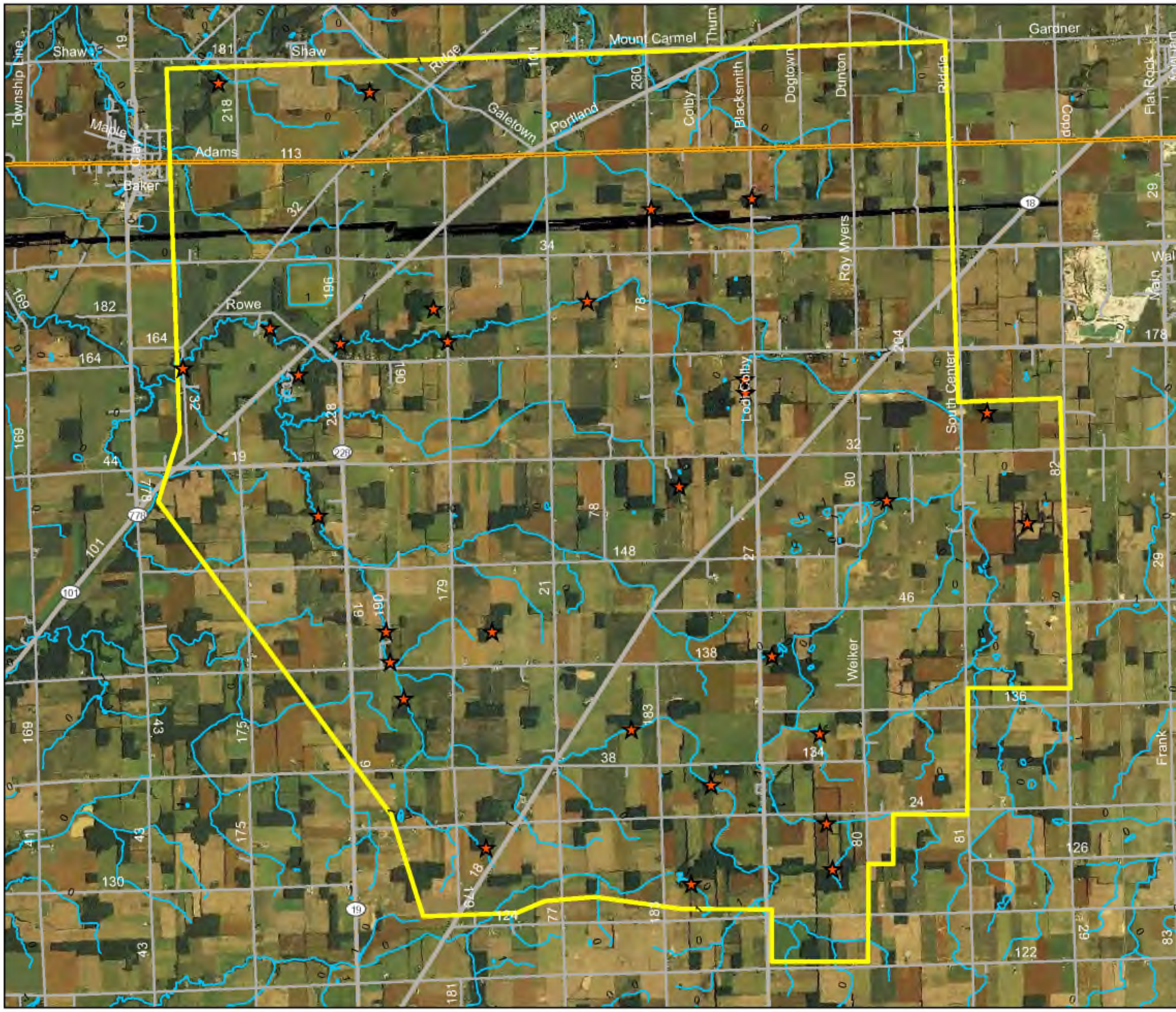

Figure 3. Potential mist netting sites within the Project area.

Source: http://gis1.oit.ohio.gov

Base Map: Ohio 2006 Aerial Imagery

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2.1.3 Bat Capture and Marking

Bats are live-caught in mist nets and released unharmed near the point of capture. Captured bats are identified to species, sex, age class, and reproductive condition. Weight and right forearm length of each individual are also recorded. Age is determined by examining the ephiphyseal-diaphyseal fusion of long bones in the wing. Reproductive condition of female bats is recorded as pregnant (based on gentle abdominal palpation), lactating, post lactating, or non-reproductive. Time and location/net site of captured bats is recorded. Indiana and Rafinesque's big-eared bats will be banded with bands provided by ODNR and processing is typically completed within 30 minutes of the time each bat is removed from the net.

In response to the current White Nose Syndrome (WNS) issue, ESI biologists will follow Bat Handling/Disinfection Protocol for Summer Bat Field Studies, developed by the USFWS and any subsequent updates issued by either ODNR or USFWS. ESI biologists will also categorize wing damage using the "Wing-Damage Index Used for Characterizing Wing Condition of Bats Affected by White-nose Syndrome" established by Jon Reichard in 2008.

2.1.4 Habitat Characterization

Concurrent with mist netting, habitat is described for each net site. The emphasis of this description is habitat form: size and relative abundance of large trees and snags that potentially serve as roost trees, canopy closure, understory clutter/openness, water availability, and flight corridors. Habitat form is emphasized because the Indiana bat roosts in a great many species of trees. Tree species composition is included in the assessment since it provides insight on edaphic conditions on site.

ESI's habitat characterization does more than emphasize species of large trees near the net. It identifies components of the canopy and subcanopy layers. As defined in the Indiana Bat Habitat Suitability Index Model, dominant trees are the large trees in the canopy (> 40 cm diameter at breast height [dbh]) that have the greatest likelihood of being used by maternity colonies of Indiana bats. ESI's habitat characterization identifies dominant and subdominant elements of the canopy. The amount of understory, or clutter, is also recorded, as many bat species, including the Indiana bat, tend to avoid areas of high clutter.

Each net site is documented with a sketch on the Net Site Habitat Description data sheet.

2.1.5 Weather and Temperature

Weather conditions will be monitored each night of survey to assure compliance with mist netting guidelines. Temperature, wind speed and direction, and percent cloud cover are recorded on an hourly basis. Netting will be discontinued during rain. A standard thermometer will be used to record temperature. Wind speed will be determined by use of the Beaufort wind scale, and cloud cover will be visually estimated. Weather data will be provided in an appendix to the final report.

2.2 Capture of Indiana Bats

2.2.1 Transmitter Attachment

After collecting morphometric data, up to four Indiana bats will be fitted with radio-transmitters. A maximum of three transmitters will be attached per net site, and as feasible, transmitters will be placed on females or juveniles in preference to males. Only one transmitter will be attached to an adult male bat. Transmitters are obtained from Holohil Systems Ltd., ®Wildlife Materials, Inc., ®Titley Electronics, PTY LTD, ®Blackburn Transmitters, or a similarly reputable vendor. Bat transmitters weigh from 0.20 to 0.68 gram; ESI typically uses 0.35-gram transmitters, favoring minimal impact to the bat over the additional tracking window associated with larger devices. Batteries on these 0.35-gram transmitters typically last from 7 to 14 days. Transmitters are activated and tested before attachment. A small interscapular area is trimmed of fur and the transmitter attached to this area with non-toxic surgical adhesive. The adhesive degrades over time (typically 1 to 4 weeks) and the transmitter falls off the bat. Biologists record the transmitter weight, weight of the bat before and after transmitter attachment, and holding time. Bats are released unharmed near the points of capture. Standardized data forms are used for transmitter attachment information.

ESI will notify USFWS, ODNR, and Republic of any Indiana bat captures by the next business day.

2.2.2 Diurnal Roost Telemetry

To locate roosting bats, ESI tracks radio-telemetry signals using either a ®Wildlife Materials TRX-2000S PLL Synthesized Tracking Receiver, an ®Advanced Telemetry Systems, Inc. Model R2000 Scanning Receiver, or a ®Titley Australis 26k receiver with three-element folding Yagi directional antennas manufactured by either ®Wildlife Materials, Inc. or ®Titley Electronics, PTY LTD. Receivers are not water resistant and will not be used during periods of rain.

Beginning the day after bat capture and transmitter attachment, ESI biologists use telemetry to locate each bat's diurnal roost. Roost trees are identified to species and dbh is measured. The approximate height at which the bat is roosting and general condition of the roost tree (dead, live, dying, % bark cover, etc.) is noted. A description of habitat near the roost tree is recorded. Occasionally, Indiana bats roost in man-made structures, most frequently bridges. Standardized data forms are used to characterize roost trees and assess associated habitat; the form also provides for assessment of man-made structures used as roosts. Roosts are photographed and flagged or marked in another acceptable manner for ease of future identification. Coordinates of each roost are recorded with a GPS unit. When feasible, distances among roost trees and other notable landscape features are determined.

Bats will be tracked for approximately six days after the date of capture or until the transmitter is shed or fails, whichever happens first. Emergence counts will be performed on each identified roost tree for three days. In situations where multiple bats are being tracked and each bat uses a new roost daily, it can quickly become financially and logistically infeasible to complete three days of emergence on all trees. In those situations, all trees will be watched for at least 1 day. Beyond that, ESI biologists will use their best judgment to select which trees receive further observation.

GPS location, tree species, dbh, and various other habitat characteristics will be recorded on ESI's Roost Habitat data sheets.

2.2.3 Nocturnal Telemetry

At night, for the life of the transmitter, the tagged bat will be followed to identify foraging and activity areas to determine the home range of the individual and collectively of all tagged bats from the same maternity colony. Telemetry readings are taken at approximately 5-minute intervals, simultaneously by three or four biologists so that triangulation can be used to ascertain the location of the bat. These data points are plotted on maps and used to construct "minimum convex polygons" or "kernels" depicting areas used by the bat(s). Within that area, habitat use versus availability can be used to determine whether bats are concentrating their activity in a specific area or habitat.

2.3 Capture and Telemetry of Eastern Small-footed or Rafinesque's Big-eared Bats

Although highly unlikely, ESI will radio-tag any and all eastern small-footed or Rafinesque's big-eared bats that are captured. The same techniques will be used to track these species as are outlined above for tracking Indiana bats to determine both their day roosts and home range.

2.4 Capture and Telemetry of Colonial Bats

Maternity colonies concentrate individuals in an area and thus increase the risk of death or injury if turbines are located nearby. If more than 15 reproductive females or juveniles of one of the more common colonial species (e.g., big brown, little brown, or northern bat) are captured within a night's trapping, radio telemetry will be used to locate the maternity colony. A maximum of 10 transmitters will be used to complete this task, and their use will be stratified across the project area.

Each roost that is located will be monitored at least five times at dusk, unless only one or no bats are observed on three consecutive emergence counts.

3.0 Timeline and Reporting

Mist net and surveys will be conducted between 20 June and 31 July 2011, and any associated radio-telemetry will be completed by 5 August 2011. ESI will prepare a detailed technical report that provides results and discussion of the mist net survey. Copies of field data sheets and an interpretation of those data will also be included. The report will also contain maps clearly identifying the Project area, mist net sites, and diurnal roost trees (if applicable). Representative photographs of net sites, all bat species captured, and roost trees will be included.

4.0 Request for Site-Specific Authorization to Proceed

Please consider this study plan a request for site-specific authorization to begin sampling throughout the proposed Project Area on 20 June 2011.

5.0 Personnel

A list of ESI staff that may be involved in field work for the Project follows. Other staff not listed here may also participate – resumes can be provided upon request; all individuals responsible for bat identification are listed on ESI's scientific collection permit(s).

1. Dr. Virgil Brack, Jr. – Principal Scientist
2. Dr. Dale W. Sparks – Project Manager
3. Mr. Adam Mann
4. Mr. Jason Duffey
5. Ms. Lisa Winhold
6. Ms. Erin (Pfeffer) Basiger
7. Dr. L. Michelle Gilley
8. Mr. Jack Basiger
9. Mr. David Jeffcott
10. Mr. Jared Helms
11. Mr. Nick Gikas
12. Dr. Justin Boyles

CORRESPONDENCE

From: Norris, Jennifer [mailto:Jennifer.Norris@dnr.state.oh.us]
Sent: Wednesday, July 27, 2011 1:27 PM
To: Megan_Seymour@fws.gov; Dale Sparks
Cc: Keith_Lott@fws.gov; Melanie_Cota@fws.gov; Angela_Boyer@fws.gov
Subject: RE: Republic Wind Project

Megan-

Capture site: 41 12' 25.2", -82 57' 10.3"

Roost 1: 41 13' 07.5", -82 56' 38.0"

Roost 2: 41 13' 06.1", -82 56' 44.6"

Both roost trees are shag bark hickory. Jack indicated ESI was still netting as well- they should be done netting by the end of the week.

Jennifer L. Norris
Wildlife Research Biologist
Olentangy Wildlife Research Station
ODNR, Division of Wildlife
8589 Horseshoe Road
Ashley, OH 43003
Tel: 740 747-2525 Ext: 26
Email: jennifer.norris@dnr.state.oh.us

-----Original Message-----
From: Megan_Seymour@fws.gov [mailto:Megan_Seymour@fws.gov]
Sent: Wednesday, July 27, 2011 1:21 PM
To: Dale Sparks
Cc: Norris, Jennifer; Keith_Lott@fws.gov; Melanie_Cota@fws.gov; Angela_Boyer@fws.gov
Subject: RE: Republic Wind Project

Dale,
Thank you for the notification. There was no map attached, so please provide that and the lat/long when you get a chance. We look forward to hearing more from you about this bat. Are you still netting? How many more sites/nights do you anticipate netting for?
Thanks again,
Megan

Dale Sparks <DSparks@environmentalsi.com>

Dale Sparks
<DSparks@environmentalsi.com>

07/26/2011 05:57 PM

To"Megan_Seymour@fws.gov" <Megan_Seymour@fws.gov>, "Jennifer.Norris@dnr.state.oh.us" <Jennifer.Norris@dnr.state.oh.us>

cc

SubjectRE: Republic Wind Project

Jennifer and Megan:

My field crew at republic captured and radio-tagged a post-lactating Indiana bat on Sunday night. They have located the bat to a woodlot located immediately to the West of the label for site 13 in the attached map.

I apologize for the late notice. I was on the road yesterday and had thought you had already been notified.

From: Megan_Seymour@fws.gov [Megan_Seymour@fws.gov]
Sent: Friday, July 08, 2011 12:43 PM
To: Virgil Brack
Cc: Dale Sparks; Funk, Jason (Jason.Funk@tetratech.com)
Subject: Re: Republic Wind Project

Virgil,
Thank you for providing this. When Angie receives requests for wind projects she always runs them by whoever has been coordinating on that project, so we did already see this proposal and agree that it was appropriate.
Sincerely,
Megan

[cid:1__=0ABBF254DFC843218f9e8a93df938690@fws.gov]Virgil Brack <VBrack@environmentalsi.com>

Virgil Brack <VBrack@environmentalsi.com>

06/30/2011 11:58 AM

To

"Megan Seymour (Megan_Seymour@fws.gov)" <Megan_Seymour@fws.gov>

cc

"Funk, Jason (Jason.Funk@tetratech.com)" <Jason.Funk@tetratech.com>, Dale Sparks <DSparks@environmentalsi.com>

Subject

Republic Wind Project

[cid:4 =0ABBF254DFC843218f9e8a93df938690@fws.gov]
Megan,

Attached please find the study plan for the Republic Wind Energy Project (Republic Wind Energy, LLC - a Nordex company), a proposed commercial wind energy facility consisting of approximately 16,028 hectares (39,607 ac) in Seneca and Sandusky Counties, Ohio. The Project straddles the Seneca/Sandusky county line, just east of the town of Green Springs in Sandusky County, Ohio and covers part of the Fremont East, Clyde, Watson, and Fireside USGS 1/24000 quadrangles.

ESI has been retained to complete sampling/netting for the chiropterofauna at the Project site, including the endangered Indiana bat. The study plan details sampling efforts that follow guidelines provided by the Indiana Bat Recovery Team in the 2007 Indiana Bat Draft Recovery Plan (First Revision) and guidance provided in ODNR's On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio. Based on previous coordination, ODNR indicated that the Project met the need for a moderate level of wildlife monitoring.

We are seeking your approval of the study plan. It was previously sent to Angela Boyer (USFWS) and Jennifer Norris (ODNR) and we received approval from both of tem, but you unfortunately and not keep in this loop. For that I apologize.

Thanks

Virgil

ESI has Moved. Our NEW ADDRESS is:

Environmental Solutions & Innovations, Inc.
4525 Este Avenue
Cincinnati, OH 45232

Virgil Brack, Jr., Ph.D., MBA
CEO and Principal Scientist
Office: 513-451-1777; Cell: 513-235-1076; Fax: 451-3321
[attachment "340 Republic Wind Study Plan 20 June 2011.pdf" deleted by Megan Seymour/R3/FWS/DOI]