

**Final Study Plan
Investigations of Bat Activity and Bat Species Richness
Cedar Ridge Wind Farm
Fond du Lac County, Wisconsin**

Wisconsin Power and Light Company (WPL) proposes to construct, install, and place in operation the Cedar Ridge Wind Farm. The facility will produce up to approximately 98 megawatt (MW), and includes related interconnection and ancillary facilities on approximately 7,808 acres. The site is located approximately ten miles south of the city of Fond du Lac, in the towns of Eden and Empire in Fond du Lac County, in southeastern Wisconsin (Figure 1).

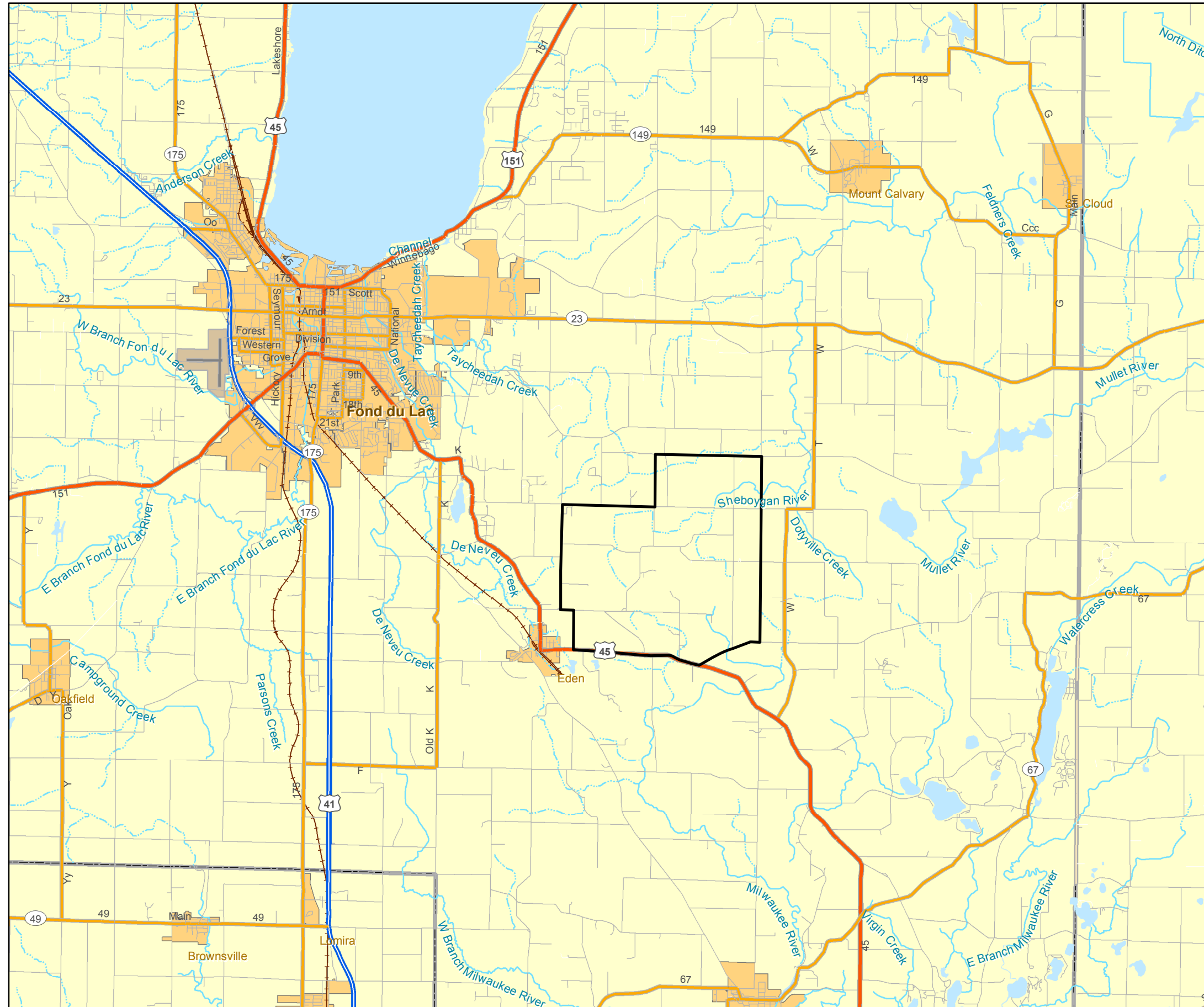
Current plans call for emplacement of 41 wind turbines. The exact make/model of turbine has not yet been determined. The turbines will utilize a horizontal axis, three-bladed rotor, and nacelle, mounted on a tubular steel tower. Based on the turbines under consideration, the maximum values for turbine/tower characteristics are as follows: blade length is 46.7 m, rotor swept area is 7,238 m², hub height is 80 m, and rotor speed is 9.6 to 15.5 rpm. The rotor swept area will extend from 33.3 m above ground level to 126.7 m agl.

Aerial photographs dating to 1941 indicate the project site has been used for agriculture, with some rural residential and recreational use. Current agricultural uses include dairy farming, and corn and alfalfa farming. Small patches of forest, generally less than 5 to 10 acres, are present within the farmed areas (Figure 2). Landcover within the project area is generally representative of the entire county; only 6 percent of Fond Du Lac County was forested in 2004 (WDNR, Division of Forestry). Project implementation will only minimally affect the existing land cover.

Project Impact on Land Cover

Land Use	Project Area (acres)	Construction (acres)	Operation (acres)
Agricultural/Vacant/Open space	5,443	340	69
Water	40	0	0
Woodlands	824	33	10
Wetlands	716	8	0
CRP lands	342	6	0.1
Old fields	7	6	0.1
Other	436	12	6
Total	7,808	405	85

No bat hibernacula are known to exist in or near the project area, nor does the area appear to possess unique or otherwise high quality summer or winter habitat for any of the seven species of bats known to occur in Wisconsin.

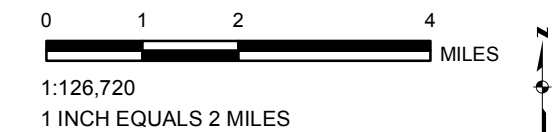


LEGEND

- LIMITED ACCESS HIGHWAY
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- MINOR ROAD
- RAMP
- PERENNIAL STREAM
- INTERMITTENT STREAM
- RAILROADS
- RUNWAY
- AIRPORT AREA
- CITY OR VILLAGE
- COUNTY BOUNDARY
- PROJECT BOUNDARY







NOTES:

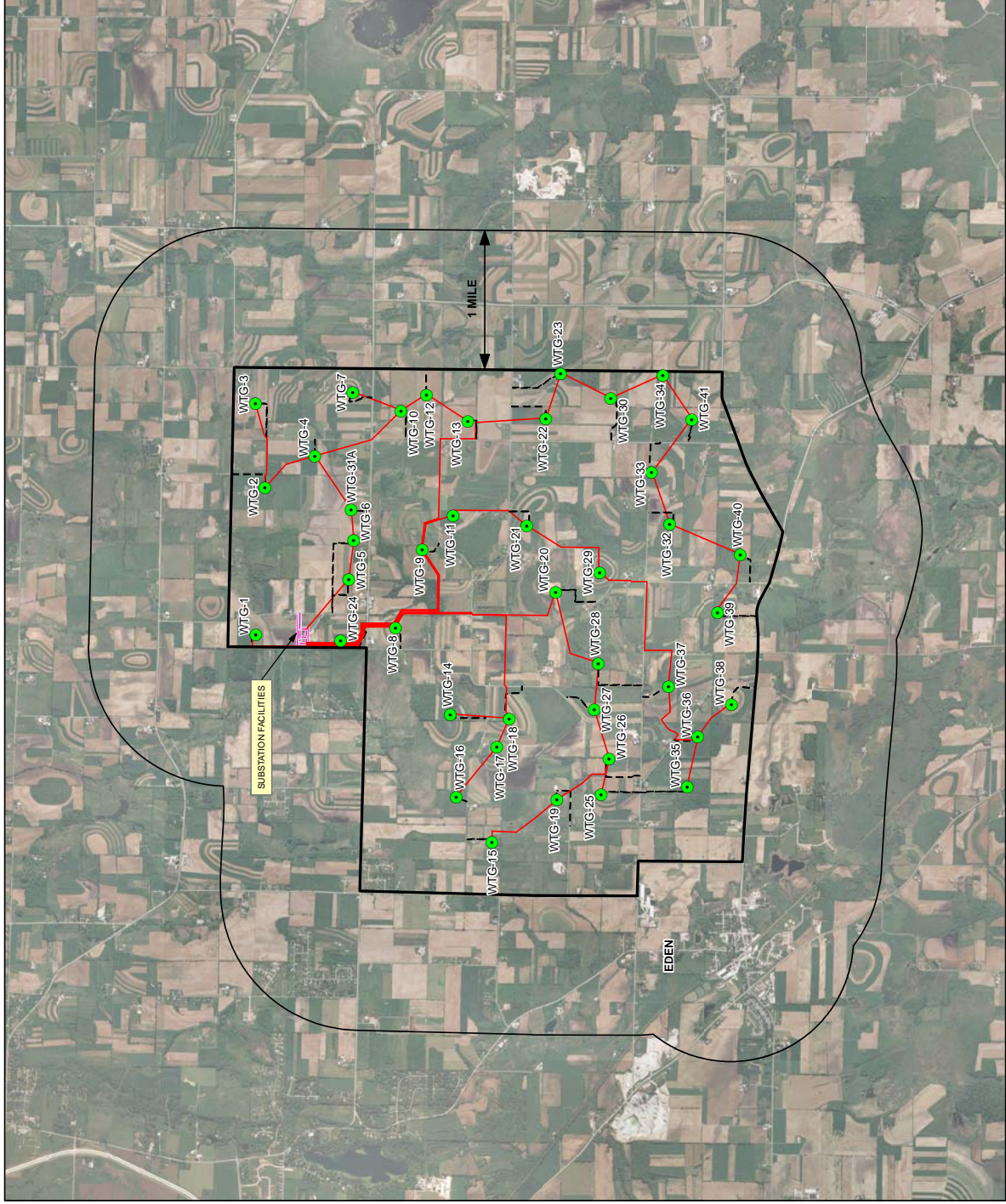
1. DATA FROM ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE.



PROJECT:		CEDAR RIDGE WIND FARM CEDAR RIDGE FOND DU LAC COUNTY, WISCONSIN	
SHEET TITLE: PROJECT LOCATION MAP			
DRAWN BY: MCKEEFRY J	SCALE: AS NOTED	PROJ. NO.: 00-07246.02	
CHECKED BY: JCK		FILE NO.: 72460213.mxd	
APPROVED BY: DAW	DATE PRINTED: 8/11/2006	FIGURE 1	
DATE: AUGUST 2006			
		744 Heartland Trail Madison, WI 53717 - 1934 P.O. Box 8923 Madison, WI 53708 - 8923 Phone: 608-831-4444 Fax: 608-831-3021	

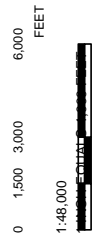
**WTG-3
LEGEND**


-  PROPOSED WIND TURBINE GENERATOR AND NUMBER
-  PROPOSED SUBSTATION
-  PROPOSED ELECTRIC COLLECTOR CABLES
-  PROPOSED CRANE ROUTES (TO BE DETERMINED)
-  PROJECT FROM PROJECT BOUNDARY WITH EXCEPTION OF EDEN
- 



NOTES:

1. AERIAL IMAGERY FROM US DEPARTMENT OF AGRICULTURE NATIONAL AGRICULTURAL IMAGERY PROGRAM (2005).



PROJECT:		CEDAR RIDGE WIND FARM CEDAR RIDGE FOND DU LAC COUNTY, WISCONSIN	
SHEET TITLE: AERIAL ORTHOPHOTO			
DRAWN BY:	MCKEERRY, J	SCALE:	AS NOTED
CHECKED BY:	JCK	FILE NO.:	7246207.mxd
APPROVED BY:	DAM	DATE PRINTED:	8/11/2006
DATE:	AUGUST 2006	FIGURE 9	
			
<small>744 Newberry Trail Madison, WI 53717-1934 P.O. Box 8823 Madison, WI 53708-8823 Phone: 608.831.3444 Fax: 608.831.3821</small>			

Preconstruction studies to assess the potential for bat fatalities have been requested by the Wisconsin Department of Natural Resources and the U.S. Fish and Wildlife Service. The nature of these studies was discussed in a January 16, 2007 meeting attended by representatives of the WDNR, USFWS, Wisconsin Power and Light Company, The Wisconsin Public Service Commission, and BHE Environmental, Inc. Additional details regarding studies being requested by the DNR were described in a January 24, 2007 letter from Shari Koslowsky, WDNR to Pat Riley, Alliant-Wisconsin Power and Light Company, (attached). The DNR reviewed a draft version of this plan, and provided comments in an email dated March 1, 2007 from Shari Koslowsky to Pat Riley (Alliant).

The goals and objectives for the proposed investigation are as follows:

Goal 1: Characterize the species of bats which utilize the project area during the fall migratory period between July 15 and September 15, 2007.

Objective 1.1: Conduct mist net surveys at six sites within the project area between mid July and mid September.

Goal 2: Assess temporal and spatial patterns of bat activity within the project area between April 1 and October 31, 2007.

Objective 2.1: Assess bat activity at three elevations (approximately 2 m, 22 m, and 48 m above ground level) at three meteorological towers.

Objective 2.2: Characterize bat activity based upon number of calls and number of feeding buzzes.

Objective 2.3: Assess effects of elevation, season, temperature, wind speed, wind direction, and barometric pressure on bat activity

Objective 2.4: Assess effects of distance to nearest cover type edge, distance to nearest forest/tree line, and distance to nearest water

Goal 3: Where practicable, utilize assumptions and study design parameters similar in nature to those utilized in a similar study completed in 2005 in Dodge County, Wisconsin (Redell et al. 2006).

The data collection methods in this project are similar to portions of the collection methods in a Dodge County, Wisconsin study (Redell et al. 2006). In that study bat activity was found to be associated with bat species group, height (measured from three MET towers at 2 m, 22 m, and 48 m), wind speed, season, and temperature. The data collected from the Cedar Ridge site should allow for the testing of these same effects. Additionally the Cedar Ridge investigation will assess the effect of barometric pressure on bat activity. For comparison reasons, and provided all assumptions are valid, analytical methods similar to those employed in the Dodge County study will be utilized.

Data generated in this study may be useful in understanding bat fatalities at this and other wind energy facilities, especially when considered in light of post construction mortality data gathered at the Cedar Ridge site.

Evaluation of Species Richness - Mist Net Surveys

We propose to establish six mist net sites within the project area, in suitable habitat distributed in forested portions of the project area. Prior to the field survey, BHE will use topographic maps and/or aerial photos to identify potential mist net sites within the 7,808 acre project area. Mist net site locations will be selected in the field by a biologist experienced in capturing bats. Selection of mist net sites will be based upon forest conditions (e.g., tree density, canopy cover), presence and size of flowing streams, and presence of an open flyway. Accessibility of potential site by field vehicles will be considered. Netting over streams with riparian forest increases the probability of capturing bats due to the natural funneling action of the stream corridor. In addition to forested stream corridors, upland forest tracts within the project area will be surveyed. To the extent practicable, given the scarcity of suitable mist net sites and land access issues, we will locate three sites in riparian/lowland areas and three sites in upland forests.

Each site will consist of two stacked mist net sets spaced no less than 100 feet apart. Both nets will be deployed for four calendar nights. Each night, netting will begin at sunset and continue for at least five hours, resulting in a total of 40 net-hours at each site (2 nets x 5 hours x 4 nights), or a total combined survey effort of 240 net hours (6 sites x 2 nets x 5 hours x 4 nights). Nets will be monitored every 20 minutes.

Mist nets will be constructed of black nylon with a mesh of approximately 1.5 inches. Mist nets will extend approximately from water or ground level to tree canopy and will be bounded to the extent practicable by foliage on the sides. One net set may be 15 - 30 feet tall and 18 - 60 feet wide, depending on dimensions of the survey site. Net width and height will be adjusted for the fullest possible coverage of the flight corridor at each site. To the extent possible, mist nets will be placed greater than 150 feet away from disturbance by vehicle and/or human traffic. Netting will occur only if the following weather conditions are met:

- Minimal or no precipitation,
- Temperature > 10°C (50 °F),
- Wind speed still to calm, and
- Cloud cover; or moon less than half full if net site is not shaded by the forest canopy.

Bats will be live-caught in mist nets and released unharmed near the point of capture. Species, capture location, age, gender, reproductive condition, right forearm length, and weight of bats captured during the survey will be recorded. Habitat near each mist net site will be characterized, and weather conditions during the survey will be recorded.

Assessment of Temporal and Spatial Patterns of Bat Activity - Acoustic Surveys

We propose to record ultrasound using broadband acoustic detectors (Anabat II zero-crossing ultrasonic detectors and CF-ZCAIM storage units) between approximately April 1 and October 31, 2007. Detectors will be programmed to record from at least 30 min prior to civil sunset to 30 min after civil sunrise each day.

Recorders will be mounted on three meteorological towers within the project area. Two of these towers are 50 m in height, one tower is 60 meter in height. At each of the three towers we will record calls from 2 m, 22 m, and 48 m heights. The 2 m, 22 m, and 48 m heights were selected to correspond to heights of detectors used in another study in Wisconsin. Detectors at 48 m will be at rotor swept height.

Tower	Tower Location	Tower Height	Proposed Height of Ultrasound Detector		
			2 m	22 m	48 m
WRAP Tower 408	Northeast portion of project area near WTG 4	60 m	X	X	X
Alliant Tower 803	Central portion of project area near WTG 21	50 m	X	X	x
Alliant Tower 810	Southwest portion of project area near WTG 25	50 m	X	X	x

Microphones will be protected in weather resistant structures (EME Systems), and will be connected via cables to CF-ZCAIM storage units mounted at ground level. The direction in which each microphone points will be selected randomly. Microphones will be positioned so the dominant acceptance angle is 45 degrees above the horizon. Pre-amp drivers will be utilized with each microphone to prevent signal loss. We will download data from the ZCAIM storage units periodically throughout the study. The duration of periods between downloads will be determined in part based upon the storage capacity of the units.

We will utilize “number of bat passes per hour per sampling unit” to generate an index characterizing bat activity. Bat passes will be a series of two or more consecutive echolocation calls having less than one second between the calls. Bat calls will be identified to two species groups. Activity will be further characterized with the enumeration of feeding buzzes per hour per sampling unit.

Group	Average Minimum Call Frequency	Species in Wisconsin
High frequency	≥ 35 kHz	Little brown bat, northern long-eared bat, Eastern pipistrelle, eastern red bat
Low frequency	< 35 kHz	Hoary bat, silver-haired bat, big brown bat

Prior investigations have detected a potential correlation between wind speed and bat mortality (Arnett et al. 2005), and found that bat activity was affected by temperature and wind speed (Redell et al. 2006). We will acquire meteorological data being collected at each of the three towers in the Cedar Ridge project area to evaluate the effect of meteorological conditions, specifically wind speed, wind direction, temperature, and barometric pressure on bat activity. We will also evaluate the effect of three habitat variables upon bat activity:

- Distance to forest edge or tree line
- Distance to the nearest water source
- Distance to the nearest cover type edge.

Literature Cited

Arnett, E., W. Erickson, J. Kerns, and J. Horn. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia. Unpublished report submitted to Bats and Wind Energy Cooperative.

Redell, D., E. Arnett, J. Hayes, and M. Huso. 2006. Patterns of pre-construction bat activity determined using acoustic monitoring at a proposed wind facility in south-central Wisconsin. Unpublished report.