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PUBLIC SERVICE COMMISSION OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

Forward Wind Project – Volume 1

Final Environmental Impact Statement

Docket 9300-CE-100

PUBLIC SERVICE COMMISSION OF WISCONSIN

DEPARTMENT OF NATURAL RESOURCES

Forward Wind Project

Public Service Commission of Wisconsin
610 North Whitney Way
P.O. Box 7854
Madison, Wisconsin 53707-7854
Phone (608) 266-5481 • Fax (608) 266-3957 • TTY (608) 267-1479
E-mail: pcsrecs@psc.state.wi.us
Home Page: http://psc.wi.gov

Wisconsin Department of Natural Resources
101 South Webster Street
P.O. Box 7921
Madison, Wisconsin 53707-7921
Phone (608) 266-2621 • Fax (608) 267-3579 • TTY (608) 267-6897
E-mail: steven.ugoretz@dnr.state.wi.us
Home Page: http://dnr.wi.gov

This final Environmental Impact Statement for the proposed Forward Wind Project is progress towards compliance with the Public Service Commission's requirement under Wis. Stat. § 1.11 and Wis. Adm. Code § PSC 4.30. It also is progress toward compliance with the Department of Natural Resources requirements under Wis. Admin. Code § NR 150.22.

By: Kathleen J. Zuelsdorff   Date: May 12, '05

Kathleen J. Zuelsdorff
WEPA Coordinator
Public Service Commission of Wisconsin

Questions about information provided in this final Environmental Impact Statement should be directed to:

Kathleen Zuelsdorff (environmental) Public Service Commission (608) 266-2730 kathleen.zuelsdorff@psc.state.wi.us	or	Jim Lepinski (engineering) Public Service Commission (608) 266-0478 jim.lepinski@psc.state.wi.us

Steven M. Ugoretz
Department of Natural Resources
(608) 266-6673
steven.ugoretz@dnr.state.wi.us

To the Reader:

The Public Service Commission of Wisconsin (PSC or Commission) is an independent regulatory agency that receives its authority and responsibilities from the State Legislature. Its authority and responsibilities include regulatory oversight over certain electric generation projects. The project discussed within this Environmental Impact Statement (EIS) requires Commission approval before the applicant may begin construction.

This final EIS was prepared jointly by Commission and DNR staff. The purpose of this final EIS is to provide the decision makers, the public, and other stakeholders with an analysis of the social and environmental impacts that could result from construction of the proposed wind farm and its associated facilities. This document fulfills part of the requirements of the Wisconsin Environmental Policy Act (WEPA), Wis. Stat. § 1.11. WEPA requires state agencies to consider environmental factors when making major decisions.

The Commission will hold a public hearing in the project area on June 21, 2005. All persons on the mailing list for the project will be notified of the date, time, and location of the public hearing. The notice will also explain the format for submitting written testimony in lieu of oral testimony. Individuals are encouraged to testify at the hearing or in writing. At this time, a technical hearing on the project is scheduled to be held in Madison on June 20, 2005.

If you have questions about the hearing or regulatory process, you should contact:

Jim Lepinski
(Docket Coordinator)
Public Service Commission
P.O. Box 7854
Madison, WI 53707-7854
(608) 266-0478
jim.lepinski@psc.state.wi.us

Please use the PSC docket number 9300-CE-100 on all e-mail and correspondence.

At this time, the Commission decision on the proposed project is expected in mid summer, 2005. The Commission decision on the merits of this project will be based on the record of the public and technical hearings. The final EIS and testimony from the public hearing will be included in the hearing record.

Specific questions on the final EIS should be addressed to:

Kathleen Zuelsdorff
Public Service Commission
(608) 266-2730
kathleen.zuelsdorff@psc.state.wi.us

Steven Ugoretz
Dept. of Natural Resources
(608) 266-6673
steven.ugoretz@dnr.state.wi.us

Table of Contents

List of Tables

List of Figures

Contributors and Reviewers

CONTRIBUTORS

Public Service Commission

William Fannucchi
Paul Helgeson
Jim Lepinski
Donald Neumeyer
Richard Reines
Kenneth Rineer
Marilyn Weiss
Kathleen Zuelsdorff

Department of Natural Resources

Sarah Carter
James Congden
Shari Koslowsky
David Redell
Steven Ugoretz

REVIEWERS

Scot Cullen, PSC
Jim Lepinski, PSC
Jacquelin Madsen, PSC
Robert Norcross, PSC
Randel Pilo, PSC
Kenneth Rineer, PSC
Daniel Sage, PSC
Jana Thompson, PSC
Steven Ugoretz, DNR
Kathleen Zuelsdorff, PSC

Executive Summary

Forward Energy's Proposal

Forward Energy LLC (Forward), a subsidiary of Invenergy Wind LLC (Invenergy), is proposing to build a 200 megawatt (MW) wind turbine facility in southern Fond du Lac and northern Dodge Counties. The new wind generating facility is referred to as the Forward project.

On September 29, 2004, Forward submitted an application to the Public Service Commission of Wisconsin (PSC) for a Certificate of Public Convenience and Necessity (CPCN), under Wis. Stat § 196.491(3) and Wis. Admin. Code PSC § 111.53, for authority to construct and operate a 200 MW wind turbine facility. The proposed facilities include: approximately 133 General Electric 1.5 MW SLE turbines; access roads to the turbines; an underground and overhead 34,500 volt (34.5 kV) cable system to collect the power produced at each turbine; and a new substation for interconnecting the generation facilities to the existing electric transmission system. An operations and maintenance (O&M) building would also be built near the new substation.

The turbines, access roads, and the underground and overhead electric cable systems would be constructed on private property under the terms of easement agreements with individual property owners. These easements would allow the facilities to be built and operated for a period of 25 years, with an option to extend the easement an additional 20 years. Forward would purchase the property on which the new 34.5/138 kV substation would be located.

Project Area

The project area consists of approximately 32,400 acres of predominately agricultural land in the townships of Byron and Oakfield in Fond du Lac County and the townships of Lomira and LeRoy in Dodge County. The communities of Brownsville, South Byron, Knowles, and LeRoy lie within the project area. The village of Lomira is adjacent to the southeastern boundary of the project area and the city of Oakfield is adjacent to the northwest boundary of the project area.

The entire project area is on the top of the Niagara cuesta, an upland landform with a short, steep descent (the Niagara Escarpment) on one side, and a long, gentle slope on the other. The Horicon Marsh is directly west of the Escarpment. The majority of the project area, over 96 percent, is currently farm land in tilled crops and hay. Small blocks of forest and fencerow trees are present throughout the area. Some rural residential development is also occurring.

Description of Facilities

The wind turbines proposed for this project are General Electric Wind Energy 1.5 MW turbines (GE 1.5 SLE) mounted on 262-foot tubular steel towers. The GE 1.5 SLE is an upwind, horizontal-axis turbine with a 1.5 MW generator and a rotor diameter of 271 feet. It is designed to operate between 10 and 20 revolutions per minute (rpm). A nacelle would sit on top of the tower and enclose the operating components of the wind turbine. Three blades approximately 135 feet in length would be connected to the nacelle. Wind passing over the turbine blades causes the low speed shaft to rotate between 10 and 20 rpm, depending on wind speed. The total height of the wind turbines from the ground to the blade tip would be up to 398 feet.

The foundations for each tower would be designed based on site-specific soil and geotechnical conditions. Based on the conditions at each site, the foundation would either be a deep foundation or spread foot foundation.

Each turbine generator would produce three-phase electricity at 670 volts that would be converted to 34.5 kV by a pad-mounted transformer at the base of each tower. The underground collector system consists of three shielded cables connecting each turbine either to the overhead collection system or directly to the substation. The underground collection cables would be converted to overhead lines at three transition areas. The overhead system would carry the electrical power to a new 34.5/138 kV substation. The substation would connect to an existing 138 kV line, owned by American Transmission Company (ATC), that runs north to south through the project area between the South Fond du Lac and Butternut Substations.

POWER CONTRACTS

Forward has negotiated contracts with several Wisconsin utilities for purchase of the power that would be generated by the Forward project. As of April 2005, contracts have been negotiated and executed with Wisconsin Public Service Corporation (WPSC) (70 MW), Madison Gas and Electric Company (MGE) (40 MW), Wisconsin Public Power Inc. (WPPI) (40 MW), and Alliant Energy Corporation (Alliant) (50 MW).

PRODUCTION TAX CREDIT

The federal Production Tax Credit (PTC) for wind generation is an important factor when considering the relative cost of wind generation. For 2005, the credit is 1.8 cents per kilowatt hour (kWh). The current law applies only to wind and biomass facilities that become operational before December 31, 2005.

Environmental Effects of the Forward Project

With the exception of potential impacts on avian and bat resources, the proposed Forward project would have few serious effects on natural resources. No turbines would be placed in or near wetlands and the applicant has committed to boring the 34.5 kV underground electric collector system under any wetlands or streams in its path. A few of the access roads to turbine sites cross Gill or Kummel Creek and a permit from the Department of Natural Resources would be needed to construct these roads if those turbine sites are used.

Unlike most power plants that combust fossil fuels to generate electricity, the proposed wind project would not emit air pollutants, require water for cooling purposes, or require wastewater to be discharged from the plant. Thus, the major impacts associated with decreased air quality, water consumption, thermal pollution, and ash landfills would be avoided.

Some of the potential impacts on the natural and human environment that could occur due to the construction and operation of the proposed Forward project are discussed below.

GEOLOGY AND GROUNDWATER

The Niagara dolomite bedrock that covers much of the project area lies very close to the soil surface. According to information from the U.S. Geological Survey (USGS), the depth to bedrock in the proposed project area appears to range from zero to 50 feet. About 53 turbines are sited at locations where the depth to bedrock from the surface may be five feet or less. A special foundation called a "spread footer" would be used to anchor these turbines.

Because of the karst geology, there is a concern regarding the potential for surface water to enter the bedrock and contaminate local aquifers during construction of the proposed turbines. Surface runoff into any cracks or fissures that might occur could be avoided if berms were built to divert surface flow away from open construction sites. Similar concerns would arise when the concrete bases for the wind turbine towers were removed at the end of their useful life. It would be necessary to seal the foundation sites and divert surface water away from the sites after the tower foundations were removed. Forward has stated that it would take precautions during installation and removal of the foundations to prevent or minimize water movement into the groundwater.

To prevent or minimize cracking of bedrock caused by pressure and vibrations during installation of the rock anchors, Forward has developed a construction plan and process to avoid groundwater contamination that establishes the existing condition of the rock and determines the best method for minimizing mechanical fractures. There would be no blasting or hammering on the bedrock.[1] Forward would also consider using fast setting cements, epoxies, and friction anchors for fastening bolts to the rock.

[1] In Dodge County blasting is prohibited without notification of property owners within 1,500 ft , according to its ordinance and the CUP issued to Forward. It would likely be prohibited in the CUPs from the towns of Oakfield and Byron as well.

There is also a potential for groundwater contamination from fuel spills during construction. Precautions would be taken by Forward to avoid fuel spills during construction and turbine removal.

BIRDS

The western-most wind turbine sites for the proposed Forward project are approximately 1.2 miles east of Horicon Marsh, an internationally important resource used by hundreds of thousands of birds annually. It is this project's proximity to Horicon Marsh that raises most of the avian impact concerns.

The combination of marshes, farm land, and small woodlots in the project region provides nesting, foraging and resting habitat for a greater diversity and abundance of birds than might be expected in other inland agricultural landscapes. This raises the question of whether a wind farm which might cause bird mortality or bird -displacement is compatible with an area that provides habitat for populations of protected and rare birds, and very high numbers of common birds.

Forward conducted bird surveys in the project area for 12 days in the spring and 33 days in the fall of 2004. The surveys consisted of driving surveys in an eastern and western sampling area plus 30-minute point counts at one location in each of the two sampling areas. Data recorded from these surveys included time, day, location of sightings, species, number, habitat, bird behavior, height (if flying), and direction of flight.

The agencies have concluded that the study methodology used by Forward in its 2004 studies was less rigorous than other Wisconsin wind farm avian studies, and the practices recommended by the Wisconsin Department of Natural Resources (DNR), U.S. Fish and Wildlife Service (USFWS), and the National Wind Coordinating Committee (NWCC)[2]. The differences included: 1) defining a study area that excluded the western-most project area where bird abundance is the greatest; 2) study timing that missed peak migrations of specific bird groups; 3) collecting data for only two seasons, too short a duration to identify variations in populations; 4) lack of assessment of the potential impacts to rare birds; and 5) minimal data collected on passerines, including the largest category of Wisconsin passerines, night-migrating songbirds. Finally, the Forward 2004 bird surveys did not address the importance of Horicon Marsh's effect on bird use within the project area.

Forward worked with the DNR and the PSC early in 2005 to define field studies for the spring and summer of 2005. The study design incorporated comments from USFWS via discussions with the DNR. While this 2005 Forward study will not replace a thorough multi-year study, it will provide additional information regarding: 1) how changes in bird abundance and diversity relate to distance from Horicon Marsh; 2) presence and use of the project area by rare birds; and 3) raptor use of the project area. These surveys began during the preparation of this final EIS. Therefore, no 2005 bird survey results are included in this document.

In 2004, a total of 89 bird species were identified during the Forward point counts and road surveys, which is slightly less than that observed by other bird studies conducted in the region. Waterfowl (primarily Canada geese) and passerines were the dominant bird groups recorded in the study. The

[2] The NWCC is a U.S. consensus-based collaborative formed in 1994. NWCC members include representatives from electric utilities and support organizations, state legislatures, state utility commissions, consumer advocacy offices, wind equipment suppliers and developers, green power marketers, environmental organizations, agriculture and economic development organizations, and state and federal agencies. (http://www.nationalwind.org/)

Forward 2004 bird study identified a total of 12 rare bird species, including two bald eagles (state special concern/ federally listed as threatened), and one each of great egret (state threatened), red-shouldered hawk (state threatened), and peregrine falcon (state endangered). The remaining eight are state special concern species with no protected status under the Federal or Wisconsin Endangered Species Act. Data from other nearby bird studies strongly suggest that Forward underestimated the presence of rare bird species within the project area.

Based on the Natural Heritage Inventory (NHI) data base, a total of 45 federal and state-listed threatened or endangered bird species and state special concern species could be present in or near the project area. The Forward project could pose some level of risk to species listed under the Endangered Species Act (ESA) or protected by the Migratory Bird Treaty Act (MBTA), both of which prohibit the take of specified species. The 2005 Forward surveys should provide additional information on rare bird use within the project area, but it may not be available in time to be considered for the PSC's final decision.

One of the most sensitive rare birds in the project area is the whooping crane. The Wisconsin experimental population consists of only 36 whooping cranes, which currently migrate along a well-defined corridor between Florida and Wisconsin. Whooping cranes have been recently observed foraging and flying over the project area (Meyers, pers. comm.[3]). The loss of one whooping crane could significantly impact the ability to reestablish these very rare birds. There is also a possibility that construction and operation of a wind farm close to Horicon Marsh could deter the reintroduction of additional wild whooping cranes in the region.

The 2004 Forward data seems to confirm a relationship between bird abundance and distance from the Horicon Marsh. There were significantly more birds for most bird groups in the western study area than in the eastern study area. This trend most likely continues beyond the western study area, into the area where the western-most turbines are proposed, which was not studied by Forward. Forward did not acknowledge this relationship or its potential effect when it redesigned the project in late 2004 and placed 23 more turbines within five miles of Horicon Marsh. The type of data that Forward will collect in its 2005 study should address this issue.

Bird fatality rates at other wind farms studied in the U.S. indicate that both migratory and resident birds sometimes collide with wind turbines. The avian mortality rates at operating wind farms range from less than one bird per turbine per year to just under 8 per turbine per year. Mortality rates vary for particular bird groups. The larger studies, such as those completed at Buffalo Ridge in Minnesota and Foot Creek Rim in Wyoming, concluded that the number of bird fatalities were insignificant for common species. Although the bird fatality numbers are low, the areas studied are not as heavily used by birds as the Forward project area which might increase the possibility of single large-scale mortality events, especially for nocturnal migrants. In addition, these studies do not address the susceptibility of rare bird species to collisions with wind turbines, with regard to the effect that small numbers of fatalities may have on species with declining populations.

The bird groups that appear to have the highest mortality risk from wind farms include raptors, small birds, and some large birds. Though Canada geese were the most observed bird species in the project area, they are not known to be susceptible to colliding with turbines, and any mortality due to the project would probably not affect their population dynamics.

[3] Patti Meyers, Horicon National Wildlife Refuge Manager, USFWS

Raptors are believed to be more vulnerable to wind turbine collision mortality than other types of birds. Regional observations indicate that hawks fly between 50 feet to a few hundred feet above the ground, within the blade-swept height of the proposed Forward turbines. In the project area, the Forward bird survey observed three raptor species that are listed as state or federally threatened or endangered and three species of special concern.

Research shows small birds experience the greatest number of casualties at some wind projects. Between 34 and 59 percent of the bird fatalities at wind farms were nocturnal migrants. However, the fatality rates compared to the overall population of migrating birds is relatively low.

The farmland in the project area is part of a very important feeding area for sandhill cranes, with some flocks consisting of 100 to 300 birds. Forward observed only 10 sandhill cranes in the spring, whereas in fall 6,845 cranes were observed. More sandhill cranes were observed in the western study area than in the eastern study area. Sandhill cranes are relatively weak flyers and may be more vulnerable to collisions with wind turbines. Because no wind turbines are currently located in areas with the same level of crane use as the project area, risk to these birds from the proposed project is unknown.

The proximity of the Forward project area to Horicon Marsh makes this project different from those projects where bird studies were conducted in comparable agriculture areas. It is critical to consider this in assessing the risk to birds because migrant or resident birds are observed to commonly move east beyond Horicon Marsh and the Niagara Escarpment.

Some avian mortality can be expected because of the sheer abundance of birds, and their documented flight, as they move within the project area and between the marshes, at heights that would be within the blade-swept area of the proposed turbines. Because of the factors discussed above, bird mortality from this proposed project could be higher than projected by Forward for rare bird species, nocturnal migrants, and raptors or other large birds.

BATS

The impacts of wind turbines on bat populations are not well documented. Significant data gaps were identified during a technical workshop hosted by Bat Conservation International (BCI) in 2004. Studies clearly show that bat mortalities occur, sometimes in high numbers, in association with wind turbines at some locations.

The Neda Mine is an abandoned iron ore mine located approximately 10 miles south of the project area. Neda is the largest hibernaculum for bats in the Midwest, accommodating thousands of bats. The most recent estimate of the total number of overwintering bats at Neda is between 143,000 and 146,000. Four species of cave-dwelling bats that inhabit Neda are likely found in the project area: little brown, eastern pipistrelle (state special concern), big brown, and northern long-eared bat (state special concern). Three tree bat species also likely occur in the project area: the silver-haired, hoary, and the Eastern red bat.

For its risk assessment of bat impacts, Forward relied entirely on a literature search, and did not conduct any field surveys. It did not provide site-specific information on bat occurrences or behavior in the project area. Studies at wind power sites in Wisconsin and other states have documented collision mortality of seven bat species known to occur in Wisconsin, including the two state species of special concern, northern long-eared bat and eastern pipistrelle.

Operational impacts on bats of the Forward project can be classified into two categories: 1) displacement/disturbance impacts; and 2) collision impacts. The maximum bat mortality per turbine per year for Midwestern wind projects ranges from 2 at Buffalo Ridge (Minnesota) to 4 at Kewaunee County (Wisconsin), with a potential high of approximately 10 at Top of Iowa (Iowa)[4]. Fatalities from collisions with turbines appear to be greater for bats than for birds. Existing studies imply that adult, fall migrating, tree bats might be at greatest risk of mortality from the Forward project. Due to the low reproductive rates of bats and that wind turbine fatalities are primarily adults, bat mortalities from wind turbines may have a disproportionate impact on the reproductive populations of bat species.

Furthermore, because the regional populations of the bats that occur in the project area have never been quantified, it is not possible to draw any conclusions about the extent and magnitude or significance of impacts to those populations, or determine whether the viability of local populations may be affected. While bat species, other than the Indiana bat, are not protected in Wisconsin, these uncertainties increase the level of concern for bat conservation groups and state and federal regulatory agencies.

LAND USE COMPATIBILITY

It appears that the Forward project would, in general, be compatible with existing land uses. The land use plans for the affected villages, towns and counties, are primarily focused on preserving existing farm land and natural resources, while managing and attracting new residential and commercial growth.

The proposed project would remove very little farm land from crop production and would allow continued agricultural use of the properties on which the turbines are sited. In addition, Forward avoided siting turbines within the sections of land surrounding most of the municipalities in the project area to provide a buffer and to allow for continued growth of the local communities. The village of Brownsville has expressed concerns that the buffer may not be large enough to accommodate future growth and that the turbines could interfere with emergency services communications. Dodge County recently approved several amendments to a portion of its zoning ordinance that regulates wind energy projects. The modifications would enable the Forward project to proceed as planned. The Dodge County Planning and Development Committee granted a Conditional Use Permit for the Forward project on April 26, 2005 which contains two provisions that place restrictions on the location of turbines with respect to the flight paths for private airstrips and the eastern boundary of the Horicon Marsh National Wildlife Refuge. Forward has filed an appeal with the Dodge County Board of Adjustments to have those two conditions removed. A hearing on the appeal is scheduled for May 19, 2005, in the Dodge County Administration Building in Juneau, Wisconsin.

AGRICULTURAL IMPACTS AND SOIL COMPACTION

The turbines, access roads, and collection system would be mostly compatible with the existing farm operations on properties where they are located. Little farm land would be taken out of crop production since many turbines would be located near field edges and existing farm lanes. Easement payments and crop compensation would add to many local farm incomes and possibly increase farm profitability

[4] The number of 10 bats/turbine/year has not been published or verified yet. The information comes from a personal communication with the principle investigator, Dr. Rolf Koford.

overall. Increased farm profitability could increase the likelihood that the farms in the area would be able to continue operating into the future, reducing the rate of farm land loss in Wisconsin.

Most of the concern with regard to soils relates to the potential for compaction and erosion. Soil grading or compaction could cause increased soil erosion and loss of fertility and crop yield. Soil erosion can also clog or contaminate surface water in local streams, as it already has in the area to some extent.

Heavy cranes, used for turbine component unloading and turbine construction, could cause soil compaction as they move across the landscape, along a string of turbine sites. After construction, in locations where the crane path was not converted to permanent access road, the following activities would be used to bring the fields back to their pre-construction condition:

- The gravel and pit run material would be removed.
- The underlying soil would be removed or "decompacted" with a chisel plow, subsoiler, and disk as needed until pre-construction soil densities were achieved.
- The topsoil would be returned to the area at the same depth that was present prior to construction.

A soil erosion and sediment control plan would be developed by Forward and utilized during construction of the project.

There is a also a potential for adverse impacts to some farms that are producing vegetables for local food processing businesses if the aerial application of pesticides is no longer possible due to aviation safety issues. Any necessary pesticide applications would be made using ground sprayers. These applications could result in slightly lower vegetable yields if crop damage occurs from use of this equipment. The potential for pesticide drift would likely be lower if ground sprayers are used.

ROAD CONDITIONS AND TRAFFIC CONGESTION

The project area contains federal, state, county, and town roads. USH 41, a limited-access, four-lane highway is along the eastern edge of the project area. This road is heavily used by traffic traveling between the Milwaukee or Chicago areas and points north, including Fond du Lac, the Fox Valley cities, Green Bay and Door County. Other roads in the project area include:

- STH 175, which runs north-south in the eastern portion of the project area;
- STH 49, which runs east-west through the north central portion of the project area
- STH 28 and 67 from the south and southwest; and
- Numerous county and town roads that transect the project area.

Because of Quad Graphics in the eastern part of the project area, canning companies to the north and south, the Michels construction company complex in Brownsville, numerous stone and gravel operations, and farms in the area, many of the state, county, and town roads currently carry a substantial amount of truck traffic.

During construction, vehicle traffic would include both worker trips and equipment or supply delivery trips. The construction workers would likely utilize a variety of routes to travel to work and would likely not concentrate traffic on any specific road. Up to 500 worker trips might occur on a daily basis and the number could be higher if workers travel between turbine sites during the workday.

All construction materials and equipment would be delivered by truck, including concrete and gravel, trenching machinery, and other construction needs. Construction vehicles would make multiple trips to the project area daily, especially those vehicles that provide materials such as concrete. In addition, the large parts for the wind turbines would also be delivered to each turbine site by truck. These trucks would be designed and configured specifically for the dimensions and weights of the tower or blade parts to be hauled, and for the specific haul routes that would be used. Trucks for the nacelle, blades, or tower sections could range from 112 to 159 feet long and those carrying the nacelle or hub assembly could be classified as wide loads. Eight transport trucks would be needed to deliver the major turbine parts to each site.

Forward has stated its intention to work with the local communities to coordinate traffic flow and to limit construction traffic to “normal” working hours, except in the event of emergencies. Forward has also stated that it would repair any road surfaces that are damaged by construction-related vehicles.

AIRPORTS AND AIRSTRIPS

Several public use airports surround the project area; the nearest is the Fond du Lac County Airport. Based on Federal Aviation Administration (FAA) regulations, the project does not appear to be a concern for the public use airports. There are also six existing private airports operating in or very near the project area. Pilots could have difficulty using these small airstrips if they are located in the midst of or near the proposed wind turbines.

Concerns related to private airstrips and the pilots that would use them include the potential for collisions with turbines and the air turbulence created by the rotating blades. These potential impacts could affect flight patterns, landing and take-off safety, and the need for the airstrips to be modified or redirected for safety reasons. Many of the private airstrips are used for recreational flying; others are used for business purposes or by aerial applicators who are under contract with local vegetable processing companies. Some of the private airstrips are used by the attendees of the Experimental Aircraft Association (EAA) annual event as emergency runways.

Potential impacts could be reduced or avoided by maintaining appropriate clearance distances between the proposed turbines and the existing runways of private airstrips. Several different criteria for determining clearance distances are described in Section 5.4.5. The alternatives discussed include, among others, the application of FAA Part 77 clearances for public airports and the distance required for the turbulence caused by rotating turbine blades to dissipate. Implementing one or more of these criteria could eliminate many of the proposed turbine sites from use or require that they be relocated. For private airstrips, none of the clearance distance alternatives are mandatory.

Wis. Stat. § 60.61(2)(f) and Wis. Stat. § 59.69(4)(g), gives townships and counties, respectively, the authority to protect privately-owned airports.

NOISE

Wind turbine noise is typically produced by either mechanical or aerodynamic sources. The GE turbine proposed for this project uses a fiberglass nacelle lined with sound-insulating foam which reduces acoustic emissions from the turbine.

Consultants hired by the applicant used a three-dimensional acoustical model to predict noise level changes associated with the proposed project. Estimated turbine sound power levels were obtained from the turbine manufacturer. The analysis indicates that the proposed plant could increase the noise levels at some locations. In cases where residences are near multiple turbine locations and where the ambient sound environment is relatively quiet, there may be perceptible changes to the ambient noise environment caused by turbine operation. However, in most cases, estimated increases to the ambient noise environment are expected to be very small, ranging from 0 to 4 decibels, which would be barely noticeable.

Low frequency noise levels could seem greater to nearby residents. Estimated increases range from 0 to 26 decibels. Although sound levels from the wind turbines tend to be somewhat higher in the low frequency range, it is also true that the overall sound levels appear to be relatively low.

SHADOW FLICKER

As wind turbine blades rotate, they cast a shadow upon the ground and objects below. A strobe effect can occur where the shadow of the rotating blades cause rapid changes in light intensity in the area of the shadow. Shadow flicker occurs when rotating wind turbine blades cast shadows on a sensitive receptor. Forward used a computer model, WindPRO Version 2.4.0.63, to evaluate the likelihood of shadow flicker in the areas around the turbines. This model is capable of predicting the likelihood of shadow flicker effects in the area of the proposed wind turbine installations.

The areas most likely to experience shadow flicker are those to the east and the west of the turbine tower locations. However, the number of hours per year during which shadow flicker could occur lessens as distance from the turbine increases, even for residences that are located east and west of the turbine locations.

BROADCAST AND COMMUNICATIONS INTERFERENCES

Microwave

Wind turbines can interfere with microwave paths by blocking or partially blocking the line-of-sight path between microwave transmitters and receivers. Comsearch, a communications consultant, identified nine microwave paths that intersect the project area. Of the 162 potential turbine sites, four would potentially cause interference with microwave communications. Because federal law does not permit interference with registered or licensed microwave pathways, Forward plans to reposition these sites to avoid any interference.

Television

Wind turbines also can block or cause unwanted reflections of broadcast signals. For some residents, television reception could be affected by "ghosting". Forward has committed to resolve television interference problems by improving the antenna, changing the antenna location, or installing relays to re-transmit and boost the affected signal. Installing satellite television is also another option. Television reception issues would be dealt with on a case-by-case basis by working with any affected residents to identify the best solution.

Cellular and two-way radio

There is no convincing evidence that wind turbines interfere with individual cell phones or two-way radio. In some areas cell phone antennae have been installed on the turbine towers.

Wireless Internet

A customer may have reception problems with broadband wireless Internet service if they are very close to a wind turbine that is also in line with the local area antenna. This may be resolved in a similar manner as the television issue.

Some new wireless Internet providers that are not registered with the Federal Communications Commission (FCC) may be at risk. Non-FCC registered service providers may want to provide some additional information about their microwave network to the Forward project staff to minimize potential interference with their backhaul paths.

SHARED REVENUE AND EMPLOYMENT

If the Forward project is approved and constructed, the towns of Byron, Oakfield, Lomira, and LeRoy and the counties of Dodge and Fond du Lac would receive annual shared revenue payments based on the number of wind turbines in their jurisdiction. For each of the 1.5 MW turbines constructed, shared revenue distributions would total $6,000. The township would receive $2,500 per wind turbine and the county would receive $3,500. Forward has applied for approval to construct 200 MW of wind power (133 turbines). It provided 162 turbine sites in its application in order to provide some site alternatives for Commission consideration. Because the final locations of the 133 sites is not known at this time, Table ES-1 below shows the maximum amount of shared revenue distributions that the municipalities and counties would receive if the maximum number of wind turbines in any particular municipality were constructed.

Table ES-1 Projected maximum shared revenue payments

Location	Maximum Wind Turbines	Maximum MW	Maximum Annual Shared Revenue Payments
Townships			
LeRoy	73	110	$ 182,500
Lomira	13	20	$ 32,500
Byron	41	62	$ 102,500
Oakfield	35	53	$ 87,500
Counties			
Dodge	86	129	$ 301,000
Fond du Lac	76	114	$ 266,000

The communities would also benefit through the addition of jobs in the area during construction and operation of the facilities. Between 200 and 250 construction workers would be required during peak construction periods. Skilled construction workers would include electricians, laborers, engineers, carpenters, cement finishers, iron workers, construction management, and operating staff. Local communities would also benefit directly from the purchase of goods and services for the Forward construction project and indirectly from meal and lodging expenditures made by project crews and construction workers.

Approximately six to ten full-time staff would be required for the operation of the Forward wind project. These employees would likely be technicians with electrical, mechanical, and instrument capabilities. The addition of six to ten permanent jobs in the region would be an economic benefit.

AESTHETICS

At the present time, the dominant visual environment in the project area consists of a rural landscape comprised of fields of row crops and pasture, small woodlots, farmhouses, barns, and other outbuildings. This landscape is generally visually pleasing; its gently rolling topography, farm fields, and scattered woodlots are a typical sight in the state of Wisconsin and other portions of the Midwest. The area's proximity to several unique natural features such as the Niagara Escarpment and the Horicon Marsh enhance its aesthetic appeal.

While the Forward project would enable farming to continue as the primary land use, it would significantly change the existing visual landscape in southern Fond du Lac County and northern Dodge County. Because of the size of the turbines and the design of the proposed turbine layout, many people would see the turbines as they reside in, travel through, or visit the project area during daylight hours. The sleek white or gray turbines would contrast with the rolling hills, crop land, and barns. After dark, a number of the turbines would likely support red flashing lights that would be visible against the night sky. Exactly how these visual qualities of the project would affect aesthetic perceptions of the area would be a personal matter based on individual experiences, knowledge, and feelings.

CHAPTER

1

Chapter 1 – Project Overview and Regulatory Requirements

1.1 DESCRIPTION OF THE PROPOSED PROJECT

1.1.1 Proposed wind turbine facilities

Forward Energy LLC (Forward), a subsidiary of Invenergy Wind LLC (Invenergy), is proposing to build a 200 megawatt (MW) wind turbine facility in southern Fond du Lac and northern Dodge Counties. The new wind generating facility will be referred to as the Forward project.

On September 29, 2004, Forward submitted an application to the Public Service Commission of Wisconsin (PSC) for a Certificate of Public Convenience and Necessity (CPCN), under Wis. Stat § 196.491(3) and Wis. Admin. Code PSC § 111.53, for authority to construct and operate a 200 MW wind turbine facility.

Generating and dispatching 200 MW of wind power would require the construction and installation of approximately 133 General Electric 1.5 MW SLE turbines, access roads to the turbines, an underground 34.5 kilovolt (kV) cable system to collect the power produced at each turbine, a section of overhead 34.5 kV cable line, and a new substation for interconnecting to the existing electric transmission system. An operations and maintenance (O&M) building housing a supervisory control and data acquisition (SCADA) system for monitoring turbine operation would also be built near the new substation.

The turbines, which would be up to 398 feet tall, the access roads, the underground electric cable system, and the 34.5 kV overhead cable line would be constructed on private property under the terms of easement agreements with individual property owners. Forward would purchase the property on which the new 34.5/138 kV substation and O&M building would be located.

1.1.2 Proposed sites

The project area for the new Forward project consists of approximately 32,400 acres of predominately agricultural land in the townships of Byron and Oakfield in Fond du Lac County and the townships of Lomira and LeRoy in Dodge County. The communities of Brownsville, South Byron, Knowles, and LeRoy lie within the project area. The village of Lomira is adjacent to the southeastern boundary of the project area and the city of Oakfield is adjacent to the northwest boundary of the project area.

In general, the project area is bounded by County Road F on the north, Centerline Road on the west, US Highway 41 on the east, Elm Road on the southwest and County Trunk Highway H on the southeast. Horicon National Wildlife Refuge is located within two miles of the western project area boundary.

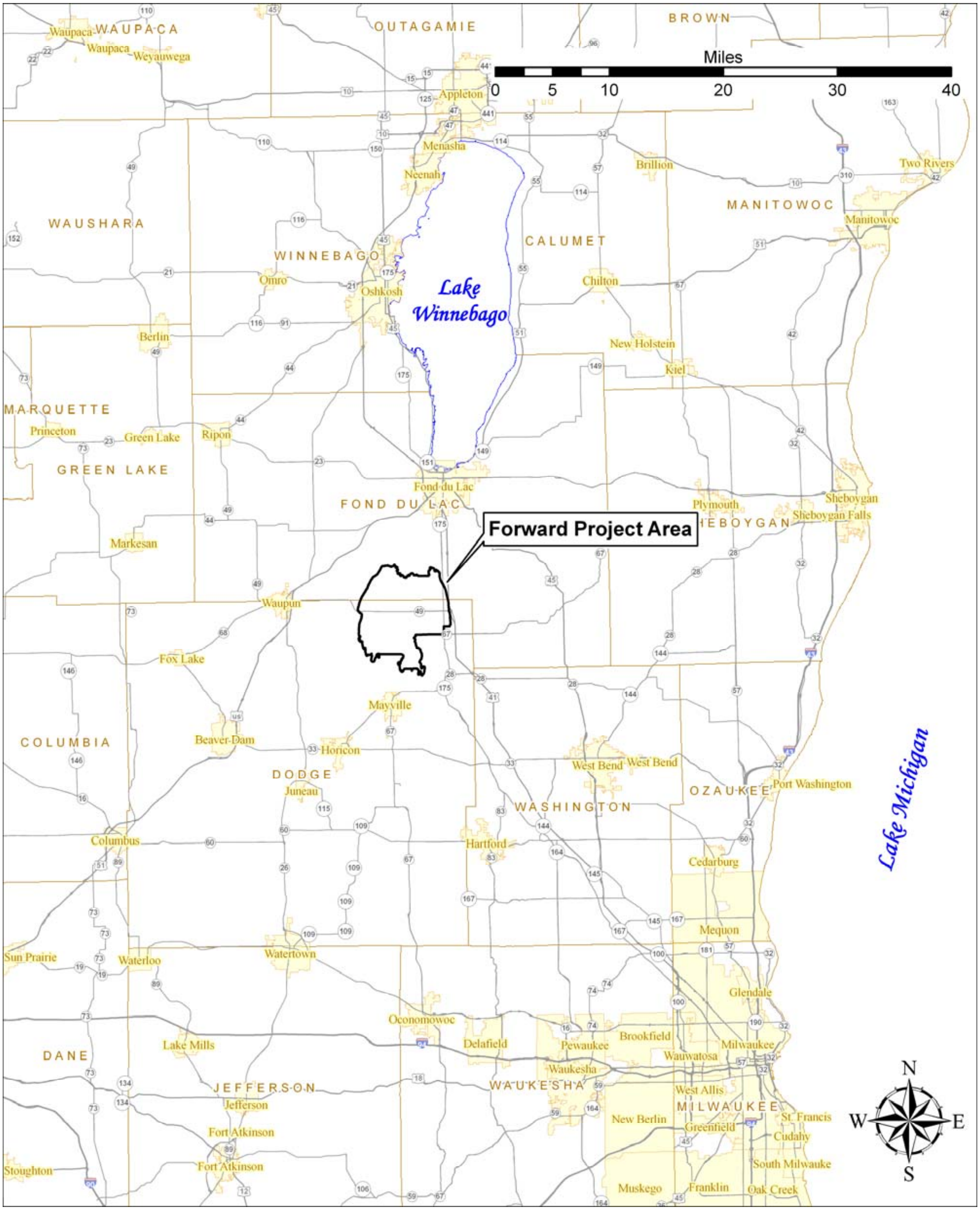
The applicant has identified a total of 162 proposed turbine sites. If approved, turbines would be constructed at 133 of these sites.

According to the applicant, the project area and individual turbines were sited based on wind characteristics, engineering considerations, landowner negotiations, and a number of other criteria. More detailed information regarding selection of the project area and siting of individual turbines is included in Section 3.2. Figure 1-1 is a map of the project area, showing it within a regional context. The proposed turbine sites within the project area (as of 4/4/04) are shown in Figure Vol. 2-1A and Vol. 2-1B. Forward states that it is continuing discussions with landowners to optimize the specific location of turbine sites, access roads, and collection systems to minimize crop loss and utilize existing farm roads.

1.1.3 Transmission interconnection facilities

The power generated at each wind turbine would be converted to 34.5 kV by a transformer located at the base of each turbine. An underground cable system would collect the output from linear "strings" of turbines and transfer the power onto an overhead 34.5 kV line that would run east-to-west through the project area to a new 34.5/138 kV substation. The new substation would be located adjacent to an existing 138 kV transmission line that runs in a north-south direction through the eastern portion of the project area. This existing 138 kV transmission line, which runs between the South Fond du Lac and Butternut Substations, is owned by American Transmission Company (ATC). While Forward would construct the substation and own most of the equipment, a portion of the new substation equipment would also be owned and operated by ATC. The transmission interconnection facilities are described in Chapter 6.

Figure 1-1 Project location map



1.1.4 Ownership and operation of generation and transmission facilities

Forward would build and own the foundations, the turbines, the electric cable collector system, the overhead 34.5 kV line, the O&M building, the SCADA system, and a portion of the new substation in which the power would be converted to 138 kV. The applicant may retain the services of a third party to provide some of the maintenance for the turbines and related equipment.

Some of the transformation equipment in the new 34.5/138 kV substation would be owned and operated by ATC.

1.1.5 Power contracts

The applicant has negotiated contracts with several Wisconsin utilities for purchase of the power that would be generated by the Forward project. As of April 2005, contracts have been negotiated with Wisconsin Public Service Corporation (WPSC) (70 MW), Madison Gas and Electric Company (MGE) (40 MW), Wisconsin Public Power Inc. (WPPI) (40 MW), and Alliant Energy Cooperation (Alliant) (50 MW).[5] The terms and conditions of these contracts cannot be publicly disclosed.

1.1.6 Expected life of plant

The turbines would be available for operation 24 hours a day, seven days a week, unless a turbine is shut down for maintenance. Actual operation of the turbines would be determined by the wind speed.

The wind turbines are designed to have a lifespan in excess of 20 years. Wind turbines are certified by agencies such as Underwriter's Laboratories. Certifications provide that the wind turbine has a design life of at least 20 years for a specified wind regime. The wind regime considers factors such as weather extremes, average wind speed, wind gusts, and turbulence intensity. Forward anticipates the project to have a 30-year life.

1.1.7 Decommissioning of plant

The applicant has stated that when the useful life of the wind turbines has ended, the landscape and land use would be restored to pre-project conditions. The applicant states that all agreements with landowners hosting turbines include provisions for removing foundations (aboveground and belowground to a depth of four feet), turbines, and any other Forward project structures from the property. The disturbed areas would be restored to a condition reasonably similar to their original condition. Reclamation would include leveling, terracing, mulching, seeding, and other necessary steps to prevent soil erosion. A Dodge County ordinance and Conditional Use Permit (CUP) also require the project owner to remove the facilities and restore the land. Funds, in the form of a bank letter of credit, must be provided to secure this obligation. Decommissioning is discussed in more detail in Chapter 5, Section 5.4.

[5] Wisconsin Public Power Inc. is a statewide power company owned by 37 municipalities that operate electric utilities.

1.2 REGULATORY BACKGROUND

1.2.1 Wisconsin Energy Priorities Statute

One of the goals listed in Wis. Stat. § 1.12, the State Energy Policy, is that to the extent that it is cost-effective and technically feasible, all new installed capacity for electric generation in the state shall be based on renewable energy resources. Wis. Stat. § 1.12(4) creates a priority list of preferred methods for meeting future electricity demands. Energy conservation is ranked first. Noncombustible renewables (wind, solar, and hydro) are the second preference and combustible renewables, such as the various forms of biomass, are the third preference. Therefore, Commission decisions regarding new electric generating capacity must consider the use of renewable resources as a higher priority than the use of fossil fuels to the extent that it is cost-effective and technically feasible.

Based on the Energy Priorities list, the proposed Forward wind project would be a positive step toward meeting the goals of the State Energy Policy as outlined in Wis. Stat. §1.12. A more detailed discussion of the Energies Priorities list is found in Section 3.1.2.

1.2.2 Wisconsin's Renewable Portfolio Standard (RPS)

As part of 1999 Act 9, the Wisconsin state legislature established an additional incentive for renewable energy development. That incentive is a Renewable Portfolio Standard (RPS), outlined in Wis. Stat. § 196.378(2), that became effective on January 1, 2001. It requires each Wisconsin electric provider (investor owned utilities (IOUs), municipal utilities, and electric cooperatives) to obtain an increasing portion of the electricity that it sells to its retail customers or members from renewable resources. The standard increases from 0.5 percent in 2001, to 2.2 percent in 2011. In 2003 electric providers participating in the program averaged 1.6 percent of their retail sales from renewable resources. The RPS requirement for 2005 is 1.2 percent for each electric provider. Wisconsin is one of 22 states with a minimum renewable energy requirement.

1.2.3 The Governor's Task Force on Energy Efficiency and Renewables

On September 30, 2003, Governor Doyle created the Task Force on Energy Efficiency and Renewables (Task Force). The Task Force was made up of representatives from Wisconsin's energy and manufacturing industries, the environmental community, and legislators. The final report of the Task Force, released in October 2004, included a number of recommendations for improving energy efficiency and increasing the use of renewable energy sources in both the public and private sector. The Task Force unanimously agreed to the following changes to the current RPS:

1. Change Wis. Stat. § 196.378 in the following way:
   a. Establish a statewide renewable standard of 10 percent of the total retail electric sales from renewable sources by 2015.
   b. Require each electric provider to increase renewable resources by 0.5 percent per year, over levels for 2004, to a total of 6 percent by 2015.
   c. Define qualifying renewable generation as all existing renewable facilities including all hydropower from facilities less than 60 MW.
   d. Grant tradable renewable credits (RRCs) with a four-year life to renewable facilities placed in service after January 1, 2004.

2. Electric providers submit implementation plans as a part of the Strategic Energy Assessment (SEA) proceedings.[6]
3. Electric providers that meet the new RPS be deemed in compliance with the Energy Priorities Law.

1.2.4 Federal Production Tax Credit

The federal Production Tax Credit (PTC) for wind generation is an important factor when considering the relative cost of wind generation. The PTC, which has been renewed several times since taking effect on January 1, 1994, provides for a tax credit of 1.5 cents per kilowatt-hour (kWh), plus an inflation adjustment for the first ten years of production from a qualifying wind power facility. The inflation adder is periodically adjusted by the federal Internal Revenue Service. For 2005, the tax credit is 1.8 cents per kWh. The current law applies only to wind and biomass facilities that become operational before December 31, 2005.

1.3 REGULATORY PROCESS

1.3.1 General requirements

Anyone proposing to build a power plant of 100 MW or more in Wisconsin must obtain approval from the PSC in the form of a CPCN before construction can begin. The Commission makes the final decisions about whether a power plant is built and where it is sited. The Commission consists of three members, appointed by the governor and approved by the Senate for six-year terms.

Project developers must file a detailed CPCN construction application with the PSC. Once the PSC deems an application complete under Wis. Stat. § 196.491(3), it must complete the review process within 180 days. Court approval is needed to extend the review time to a maximum of 360 days. If the PSC does not obtain a court extension or issue a final decision within this time period, the project is automatically approved as proposed by the applicant.

1.3.2 DNR permitting authority

The Wisconsin Department of Natural Resources (DNR) Office of Energy is responsible for reviewing and issuing any water management permits and approvals needed to construct and operate the facilities proposed by the applicant. For most fossil-fueled generation plants, a number of DNR permits and approvals are required, including an air pollution control permit and water supply and discharge approvals. Wind generation projects generally would not require major approvals from DNR because no air pollutants are emitted and no water is needed for plant operation or discharged from the plant. Erosion control and stormwater runoff during construction are issues that would be addressed through a DNR general permit. A letter indicating that the general permit covers the proposed project activities must be issued by DNR prior to the start of construction. Forward would develop erosion control and stormwater runoff plans for the construction sites as part of its Best Management Practices (BMP).

[6] The SEA is a biennial process in which the PSC evaluates the adequacy and reliability of Wisconsin's electrical supply for the next seven years.

1.3.3 WEPA requirements

The Wisconsin Environmental Policy Act (WEPA), Wis. Stat. § 1.11, requires all state agencies to consider the environmental impacts of major actions that could significantly affect the quality of the human environment. For projects that require approvals from both the DNR and PSC, a joint Environmental Impact Statement (EIS) is prepared, with the PSC functioning as the lead agency. The EIS describes the proposed project, discusses possible alternatives to the proposed action, and evaluates the project impacts on the natural and human environment.

The EIS process has several stages: a scoping period during which the state solicits issues and concerns to be covered in the EIS; preparation and circulation of a draft EIS; a 45-day comment period on the draft EIS; preparation of a final EIS based on the comments received; and a public hearing on the final EIS in the project area.

As part of agency scoping (issue identification) responsibilities under Wis. Admin. Code § PSC 4.30(2) and NR 150.21(3), the lead agency solicits comments from any person interested in the proposed action. The PSC also distributes copies of the project application to local clerks and libraries for inspection by the public. Public information meetings, sponsored by the applicant or the regulatory agencies, may be held in the project area. At these meetings, the public can learn more about the project, the applicant can improve its application, and the PSC and DNR staff can learn more about local concerns and interests before beginning to prepare the draft EIS.

The purpose of an EIS is to inform the Commissioners and the public of the potential effects of the proposed project. After the draft EIS is issued, there is a public comment period of 45 days. After the final EIS is issued, there is at least a 30-day review period to allow individuals to read the final EIS and prepare for the public hearing. The Commission provides notice to the public and holds a public hearing in the project area. This hearing is an opportunity for the public to make their views known to the Commissioners.

1.4 APPLICATION AND PROJECT DEVELOPMENT PROCESS

1.4.1 Pre-application activities

Prior to filing its initial application on September 29, 2004, Forward contacted staff at the PSC and the DNR Office of Energy to discuss the proposed project and the scope and level of detailed information that would be required to complete a regulatory review of the proposal. Two meetings were held - one in late May and another in August, 2004.

At these meetings, Forward informed the state agencies that it had been in contact with the US Fish and Wildlife Service (USFWS) at Horicon National Wildlife Refuge and DNR staff at the Horicon Marsh State Wildlife Area, a state-owned and managed property south of the National Wildlife Refuge. The applicant also stated that it had hired a biological consultant to conduct an avian and bat risk assessment and field studies for the purpose of evaluating the potential impacts to avian resources. Forward informed the state agencies that it had conducted a number of public meetings in the project area and that the public response to the project was very positive.

Contact between Forward and the USFWS consisted of two letters sent by the applicant's consultants in May 2004 and a written response from the federal agency dated July 16, 2004, that provided input on federally listed species within or near the project area and turbine siting guidelines and recommendations.

Forward submitted an engineering plan, as required under Wis. Stat. 196.491(3)(a)3, to the DNR Office of Energy on June 10, 2004. See Section 1.4.3 for a discussion about the DNR permits that may be needed.

1.4.2 CPCN application for the Forward project

On September 29, 2004, Forward filed a CPCN application for authority to construct a 200 megawatt (MW) wind generating facility in a project area approximately 32,400 acres in size on rural land in southern Fond du Lac and northern Dodge Counties. The project was assigned PSC docket number 9300-CE-100. The application included information on the proposed wind turbine facility and the interconnection facilities needed to collect and dispatch the power generated by the turbines. There are no plans to upgrade lines or add new lines to the existing electric transmission system outside of the project area.

After Forward provided additional information and updated materials, based on continuing landowner negotiations, the PSC found the application to be complete on January 18, 2005. The 180-day statutory review period ends on July 16, 2005. The PSC distributed copies of the consolidated application (an integrated document containing the original project application plus the updated materials) to local clerks and county libraries in the project area.

The Commission issued a public notification about the project to interested and affected persons on October 15, 2004. The notification letter explained the PSC's regulatory review process, solicited comments and questions about the proposed project, and announced a public scoping meeting, which was held on November 4, 2004, in the project area.

A Notice of Proceeding and Prehearing Conference was mailed on January 24, 2005. A prehearing conference was held on February 8, 2005, to identify persons who will actively participate as parties in the case and issues to be covered by testimony. To date, E4 Inc., Quad Graphics, RENEW Wisconsin, WPPI, Clean Wisconsin, the Horicon Marsh System Advocates (HMSA), and the four affected townships have requested and been granted full party status. Issues that will be considered to be relevant subjects for testimony include all of the topics covered under Wis. Stat. § 196.491(3)(d) and the adequacy of the EIS.

A second prehearing conference was held on March 14, 2005. The dates for pre-filing testimony (by parties in the case) and the hearing were set. The technical hearing which will include testimony by the applicant, other intervenors, and the regulatory staff will take place in Madison on June 20, 2005. The public hearing, in Brownsville, will take place on June 21, 2005.

1.4.3 DNR permits and approvals

The applicant has indicated that few, if any, DNR permits should be needed for the proposed project. Forward has stated that no turbines would be sited in wetlands or floodplains and that it intends to bore the 34.5 kV electric cable collector system under any wetlands located in its path. Access roads to turbine sites would be constructed to avoid wetland impacts, however, several access roads would cross Kummel Creek or Gill Creek. Potential DNR permits needed for the Forward project are listed in Table 1-2 near the end of this chapter, and described in the appropriate sections of this EIS. If it is determined at a later date that additional permits or approvals are needed, Forward would have to apply for these permits. The results of this EIS process would meet the requirements of the Wisconsin Environmental Policy Act (WEPA) with respect to those permits.

1.4.4 EIS process

Under Wis. Admin. Code § PSC 4.10, a proposal for a 200 MW wind generation facility requires preparation of an environmental assessment (EA). The purpose of an EA is to determine whether a project would have significant effects on the human environment. If such a determination is made, then an EIS is required before making the final agency decision. However, based on pre-application consultation with the project applicants and consideration of the scope and potential impacts of the proposed project, the Commission determined that it would proceed directly with the preparation of an EIS for the Forward project.

This EIS, jointly prepared by the PSC and DNR, describes the proposed project, discusses possible alternatives to the proposed action, and evaluates the project impacts on the natural and human environment. In this case, the PSC is the state review agency, and DNR is assisting with the development of the EIS because of its responsibility for managing the wildlife resources of the state. Because Forward is not a regulated utility, the need and cost for the project are not issues that can be considered by the Commission in its final decision (Wis. Stat. 196.491(3)(d)2. and 3.).

A 45-day public comment period followed the issuance of the draft EIS. The comments received were used to prepare this final EIS. The PSC will hold a public hearing in the project area at least 30 days after the final EIS is issued. A notice specifying the time, date, and location of the hearing will be sent to persons and entities on the project mailing list.

After the hearing is over and transcripts of the hearing record are reviewed, the three Commissioners will meet to make a decision to approve, modify, or reject the proposed project based on information presented at the hearing. That meeting will be open to public observation. If the project is approved, the Commission will approve or modify the proposal and add any conditions it determines necessary to be included in the construction order. After the Commission's decision is made, an order to the applicants will be prepared and issued.

1.4.5 Public participation opportunities

1.4.5.1 Forward's activities

Forward discussed its proposed project at open community meetings in 2003 at the following locations: the Town Board of LeRoy (once); the Town Board of Lomira (once); the Town Board of Byron (twice); and the Town Board of Oakfield (once). Each meeting was publicly noticed and open to the public.

In the spring of 2004, Forward held two meetings at the Brownsville Community Building. Attendance at each meeting was more than 125 people. An open house meeting was also conducted on December 14, 2004 at the Brownsville Community Building. Invitations to this meeting were sent to 2,000 local residents. Another open house is planned for May 2005.

1.4.5.2 During the regulatory scoping process

Shortly after Forward filed its initial project application, the PSC and DNR co-hosted a public information and scoping meeting with afternoon and evening sessions on November 4, 2004, at the Community Center in the village of Brownsville. A press release was issued, and direct mail invitations were made to everyone on the project mailing list. This list included all landowners within the project area and members of the public who had contacted the PSC about the project. Approximately 100 persons participated in the afternoon session, and about 130 people attended the session in the evening. Many issues and questions were raised at the scoping meeting, especially by property owners living in denser residential settings who had not previously been contacted by Forward.

1.4.5.3 During the EIS process

A 45-day comment period followed the issuance of the draft EIS. PSC and DNR staff sponsored another public meeting in the project area on April 7, 2005, to solicit comments on the draft EIS. Both the afternoon and evening sessions were well attended. All comments were considered in preparing the final EIS. Appendix E summarizes the comments received and the major changes that were made in the final EIS.

1.4.5.4 During the hearing process

The final EIS has been distributed to everyone that received a draft EIS and to all other interested or affected persons who requested a copy. A 30-day review period for the final EIS will be followed by a public hearing on the EIS and the CPCN application. A Notice of Hearing, mailed to all interested persons and parties, will identify the date, time and location of the public hearing. It will also explain a format for submitting written testimony in lieu of appearing at the hearing. Members of the public are encouraged to testify orally or in writing. All testimony will become part of the hearing record on which the Commissioners base their final decisions about the project. The Commission meeting where final decisions are made will be open to public observation.

1.5 FEDERAL INTERESTS

Several federal government agencies also have regulatory interests in this project that they will act on directly or will delegate to state agencies. These interests can be varied, depending on the sites and the type of facilities proposed. Table 1-1 indicates the federal agencies involved in this project to date.

Under Section 106 of the National Historic Preservation Act (Section 106), the Wisconsin Historical Society (WHS) must be consulted by the lead federal agency, if the agency determines the project is an undertaking as defined in 36 CFR 800.16(y). The agency is responsible for initiating consultation with any Native American peoples that might have an interest in the area affected by the project and any other individuals that might be affected by impacts to historical or archaeological properties that are listed or eligible for listing on the National Register of Historic Places (NRHP). The agency must also consider Traditional Cultural Properties (TCP) when determining impacts. If an adverse effect is determined, treatment of the area of potential affect would be the subject of a memorandum of agreement among all the interested parties.

The requirements of Section 106, when invoked early in a project review at the Commission, supersede the requirements of the corresponding state law on historic preservation. If Section 106 is invoked, it could cover all facets of this project, including the collector circuit, and access road routes that are required by the proposed plant. Discussions of historical and archeological considerations are in Section 4.6.1 of this final EIS under the heading "Protection of archeological or historic sites listed by the state." The results of any negotiations or agreement under Section 106 are not incorporated into this final EIS. It is possible that they could occur after the project received PSC approval. If no historic properties were potentially affected, a Section 106 process could be completed before a CPCN was issued.

Table 1-1 Federal government agencies involved in the project

Agency	Interest or Permit	Contact
Federal Aviation Administration	Reviewing heights of proposed facilities; assessing impacts on aviation and clearance standards; and requiring facility alterations as needed	Fred Souchet Great Lakes Regional Office (847)294-7458
Bureau of Indian Affairs and local tribe authorities	Cultural and archeological resources review, if applicable	Terrance Virden Midwest Regional Office (202) 208-3710
U.S. Fish and Wildlife Service	Migratory Bird Treaty Act review	Janet Smith Green Bay Field Office (920)886-1717
	Endangered Species Act review	Janet Smith Green Bay Field Office (920)886-1717

1.6 STATE INTERESTS

In addition to the approval interests of the PSC, several other state agencies may have approval authority over plans, designs, or specific components of the proposed generating facility and auxiliary equipment. The necessary state approvals and permits for the project are outlined in Table 1-2.

Table 1-2 State government agencies involved in the project

Agency	Interest or Permit	Contact
Public Service Commission of Wisconsin	Wis. Stat. § 196.491 - Certificate of Public Convenience and Necessity for construction of a large generating facility	Jim Lepinski (608) 266-0478
Department of Natural Resources	Wis. Stat. § 29.604 Endangered resource clearance for various land disturbance activities	Shari Koslowsky Office of Energy (608) 261-4382
	Wis. Stat. ch. 283 - Wisconsin Pollution Discharge Elimination System permit (stormwater management)	Fond du Lac Co. Jennifer Huffman (920) 832-1803 Dodge Co. Jim Bertolacini (608) 275-3201
	Wis. Stat. Chapter 30 permit to place structures below the high water mark	Office of Energy (608) 267-2770
Wisconsin Historical Society	Wis. Stat. § 44.40 protection of WHS-listed historical properties	Chip Harry L. Brown (608) 264-6508
Wisconsin Department of Transportation	Wis. Stat. § 114.135 High structure permit for the turbines	Gary Dikkers (608) 267-5018

1.7 LOCAL INTERESTS

Local approvals and permits are also needed for the proposed project. There are two counties involved, Dodge County and Fond du Lac County. The governments in the two counties are following their respective approval and permitting processes. Dodge County approaches permitting from the county level, while Fond du Lac County does not have county-wide zoning and instead handles approvals and permits at the town level.

Dodge County requires two levels of permitting. The first is a CUP for the entire Forward project. Forward submitted an application to the county for a CUP, which normally covers all aspects of the project, including erosion control, setbacks, tower heights, road use, and other factors. The Dodge County Planning and Development Committee granted a CUP for the Forward project on April 26, 2005. A description of the CUP is included in Section 5.4.1, and a copy of the permit is in Appendix D. After completion of the Conditional Use process, the county would require a Land Use Permit for each turbine. These permits could be obtained by Forward any time between the approval of the Conditional Use Permit and the time of installation for that turbine. The Conditional Use Permit and the Land Use Permit would be in effect for the life of the project. The Land Use permit would expire if substantial construction has not begun within six months, or if a six-month extension was not obtained.

The towns of LeRoy and Lomira in Dodge County are covered by the Dodge County permit. The village of Brownsville, which is located in the midst of proposed turbine sites in Dodge County, does not have any turbine sites within its jurisdiction or its extraterritorial zoning region. However, Brownsville, like other Dodge County communities, participates in the Dodge County process.

Dodge County's zoning ordinances include a special section devoted to wind energy systems, the Wind Energy System Overlay District. It has recently modified the Overlay District in order to accommodate more modern wind energy projects, such as the Forward project, without requiring a separate process for variances under the county Board of Adjustment. The Overlay District and its recent modifications are discussed in Section 5.4.2.

Fond du Lac County is not currently considering a Conditional Use Permit or other permit at the county level. The permitting required for the Forward project would be considered by the two towns involved with the project, the town of Oakfield and the town of Byron. The four towns involved with the project (including the towns of LeRoy and Lomira in Dodge County) have been working together. Forward has waited for Dodge County to approve a permit before applying for Conditional Use Permits in the towns of Oakfield and Byron. Each Fond du Lac town will be reviewing the Dodge County Conditional Use Permit and evaluating it in order to approve, reject, or modify the permit for its own purpose and need. As with the Dodge County Conditional Use Permit, the Oakfield and Byron town Conditional Use or Special Use permits would cover all aspects of the Forward project that are applicable under each town's zoning, land use plans, and other requirements.

Table 1-3 indicates the approvals considered necessary for construction of the Forward project.

Table 1-3 Local government permits for the project

Agency	Interest or Permit	Contact
Dodge County	Conditional Use Permit for the project as a whole.	David Carpenter (920) 386-3700
	Land Use Permit for each turbine, at the time of installation	
Fond du Lac County, Town of Byron	Conditional Use or Special Use Permit	Francis Ferguson (920) 922-1268
Fond du Lac County, Town of Oakfield	Conditional Use or Special Use Permit	Edward Smith (920) 583-3690

CHAPTER
2

Chapter 2 – Engineering

2.1 TECHNICAL DESCRIPTION OF FACILITIES

2.1.1 Wind turbines

The wind turbines proposed for this project are General Electric Wind Energy 1.5 MW turbines (GE 1.5 SLE) with a total height of approximately 121 meters (m). Figure 2-1 provides a diagram of a typical wind turbine. The GE 1.5 SLE is an upwind, horizontal-axis turbine with a 1.5 MW generator and a rotor diameter of 82.5 m. It is designed to operate between 10 and 20 revolutions per minute (rpm). Rotor speed is regulated by a combination of blade pitch angle adjustment and generator/converter torque control. The rotor spins in a clock-wise direction under normal operating conditions when viewed from an upwind location.

Turbine tower

Each wind turbine nacelle would be mounted on an 80 m tubular, steel plate tower. The towers are manufactured and shipped in three sections. A lockable maintenance door is located at the base of each wind turbine tower. Access to the nacelle and turbine components is via a ladder with a fall arresting safety system on the inside of the tower. The outer portion of the tower is smooth and does not have any components or systems attached to it.

Nacelle

The nacelle is the part of the wind turbine that sits on top of the tower and encloses the operating components of the wind turbine. The components include a gear box, low and high-speed shafts, generator, controller, pitch system, brakes and yaw system. Figure 2-2 is a diagram of a nacelle and its components.

Gearbox

The gearbox is essentially a speed increaser between the low-speed and high-speed shafts. Wind passing over the turbine blades causes the low speed shaft to rotate between 10 and 20 rpm depending on wind speed. The gearbox steps up the rotational speed to the high speed shaft which transfers the power to the generator. In order to reduce vibration and noise, the gearbox is attached to the nacelle bedplate with elastomeric elements.

Generator

The GE 1.5 SLE uses an induction generator with wound rotor and slip rings. A variable frequency power converter, tied to the generator rotor, allows the generator to operate between 870 rpm and 1,600 rpm. The generator is cooled by an air-to-air heat exchanger. Built-in temperature sensors signal the controller when to shut the generator down in case of overheating or prevent it from starting when the temperature is too low. Like the gearbox, the generator is isolated from the bedplate by elastomeric material to reduce vibration and noise.

Figure 2-1 Diagram of typical wind turbine

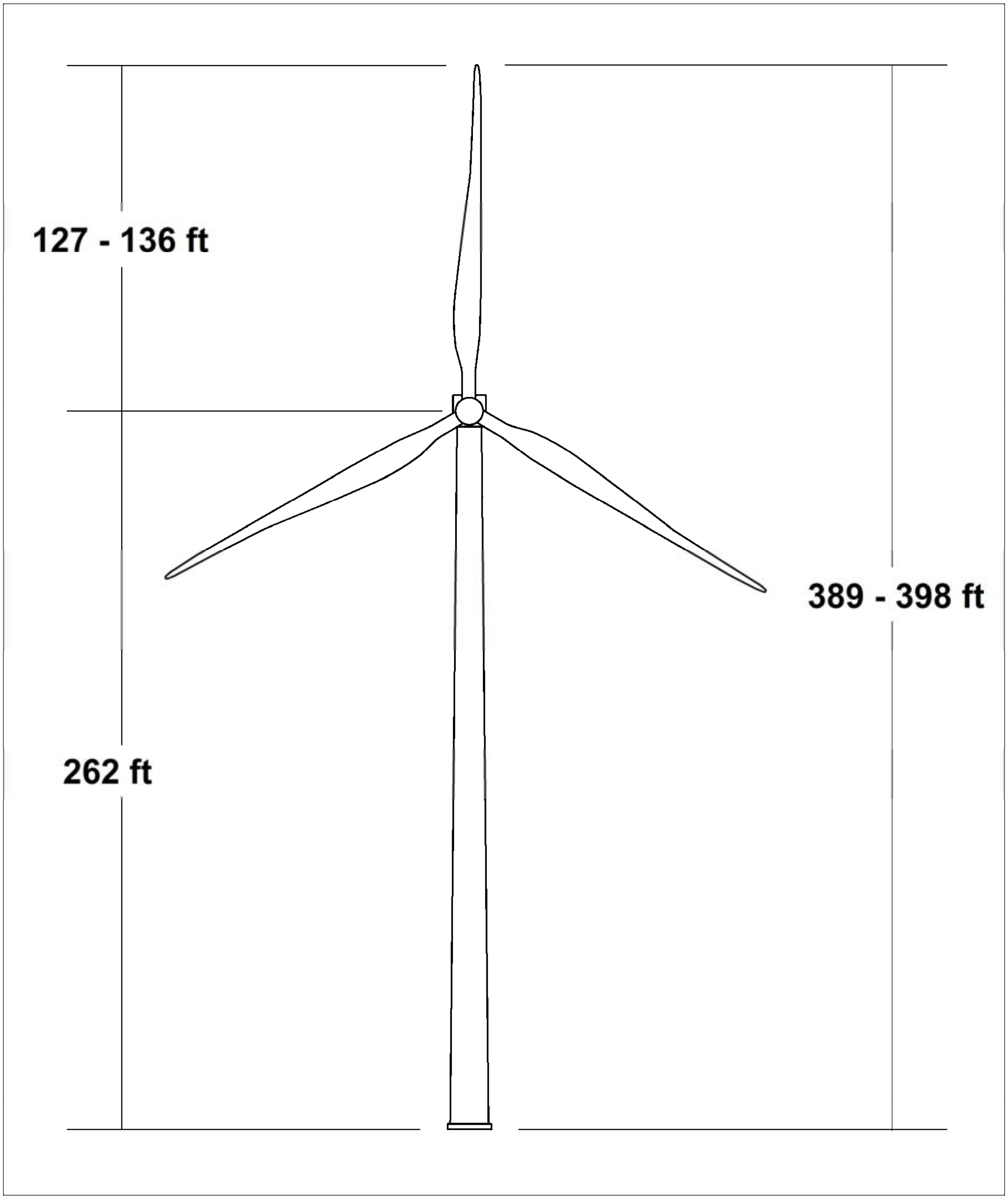
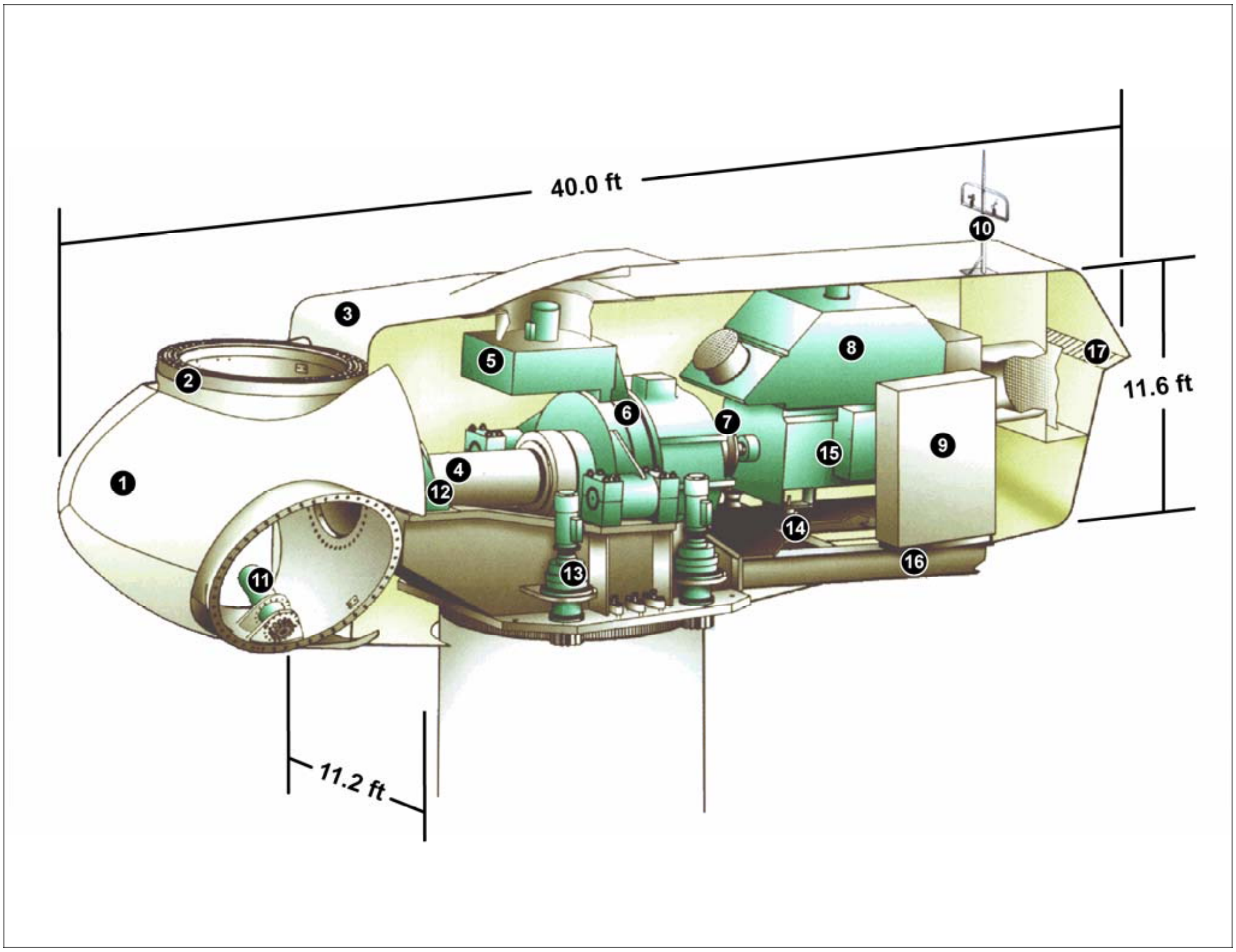


Figure 2-2 Nacelle dimensions and components



1	Spinner	10	Lightning Rod, Anemometer, Wind Vane
2	Rotor Hub	11	Pitch Drive
3	Nacelle	12	Bearing Bracket
4	Rotor Shaft	13	Yaw Drive
5	Oil Cooler	14	Elastomeric Mountings
6	Gear Box	15	Generator
7	Coupling	16	Main Frame
8	Heat Exchanger	17	Ventilation
9	Control Panel		

Pitch System

The pitch system located within the hub adjusts the angle of the blades to maximize efficiency. Full blade pitch angle range is approximately 90 degrees, with the zero degree position being with the airfoil chord line flat to the prevailing wind. The blades, pitched to a full feather pitch angle of approximately 90 degrees, accomplishes aerodynamic braking of the rotor. This causes the blades to “spill” the wind, thus limiting rotor speed.

Under partial load, the blade pitch angle is held constant and the rotor speed is controlled by the generator/converter control system. Once the rated wind speed is reached, the rotor blades operate in a "servo" mode, where turbine power output and rotor speed are controlled by varying the blade pitch angle in combination with the generator/torque converter/speed control system.

When wind speeds are above those rated for the GE 1.5 SLE turbines, the blades would be pitched to feather (non-power). They would be allowed to rotate freely in this condition at very low rpm (less than 3). The generator would still be physically connected but would be off-line. This combination would result in the least stress to the system. When an emergency stop is necessary, such as if the connection to the electric grid is lost, a mechanical braking system consisting of calipers is applied on the high speed side of the gear box. This brake mechanism would also be used when the machinery is being serviced.

Yaw System

The yaw system consists of four yaw drives that turn the nacelle on top of the tower. The turbine controller averages wind direction signals from a wind vane mounted on top of the nacelle. Based on the input, the yaw system rotates the nacelle, hub and blades into the direction of the wind. The yaw system includes brakes that can lock the turbine out of the wind when necessary.

Control System

The wind turbine can be controlled automatically or manually from inside the nacelle or from a personal computer located in a control box at the bottom of the tower. It can also be controlled remotely using a SCADA System.

2.1.2 Turbine spacing

A wind turbine creates a wake in which the wind moves at a slower velocity behind the turbine for a certain distance. This wake can impact the capacity of a downwind turbine to capture the best available wind velocity and produce the maximum amount of electricity. The wind turbines are, therefore, spaced far enough apart to minimize the wake that is experienced by the downwind turbines, considering the predominant wind directions. The wind turbines associated with the Forward project would typically be sited approximately 1,200 to 2,000 feet apart. This turbulence factor is discussed in greater detail in Section 5.3.4.5.

2.1.3 Foundations

The foundations for each tower would be designed based on site-specific soil and geotechnical conditions. Based on the conditions at each site, the foundation would either be a deep foundation or spread footer. A typical deep foundation would be placed on an area approximately 7.6 by 7.6 meters (25 by 25 feet) in size. A typical spread footer would have a similar footprint at grade, but may spread out below grade to as much as 15 by 15 meters (50 by 50 feet) in size. Figures 2-3 and 2-4 provide diagrams of typical deep foundations and spread footer foundations, respectively.

Figure 2-3 Diagram of a typical deep foundation for turbine towers

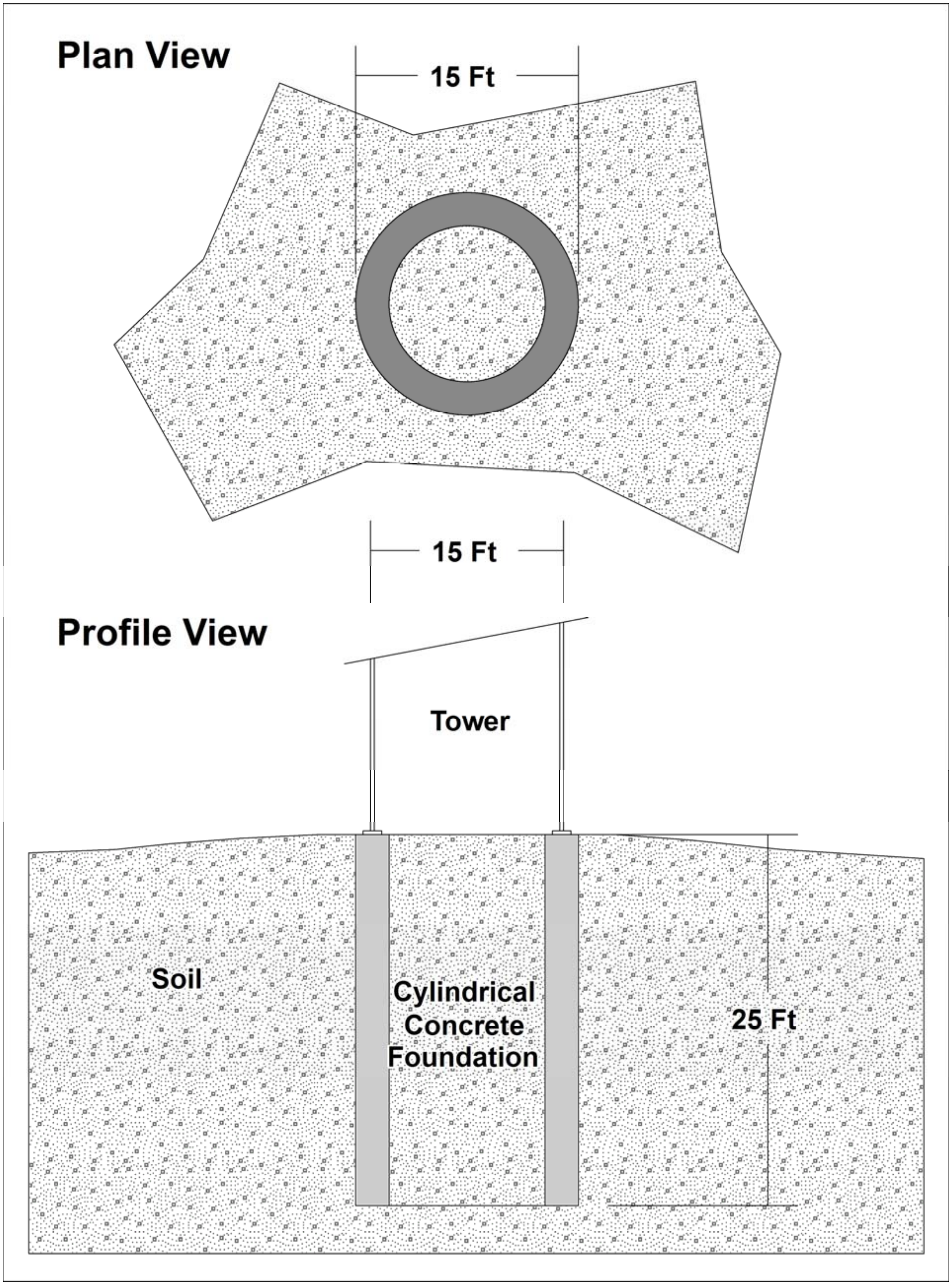
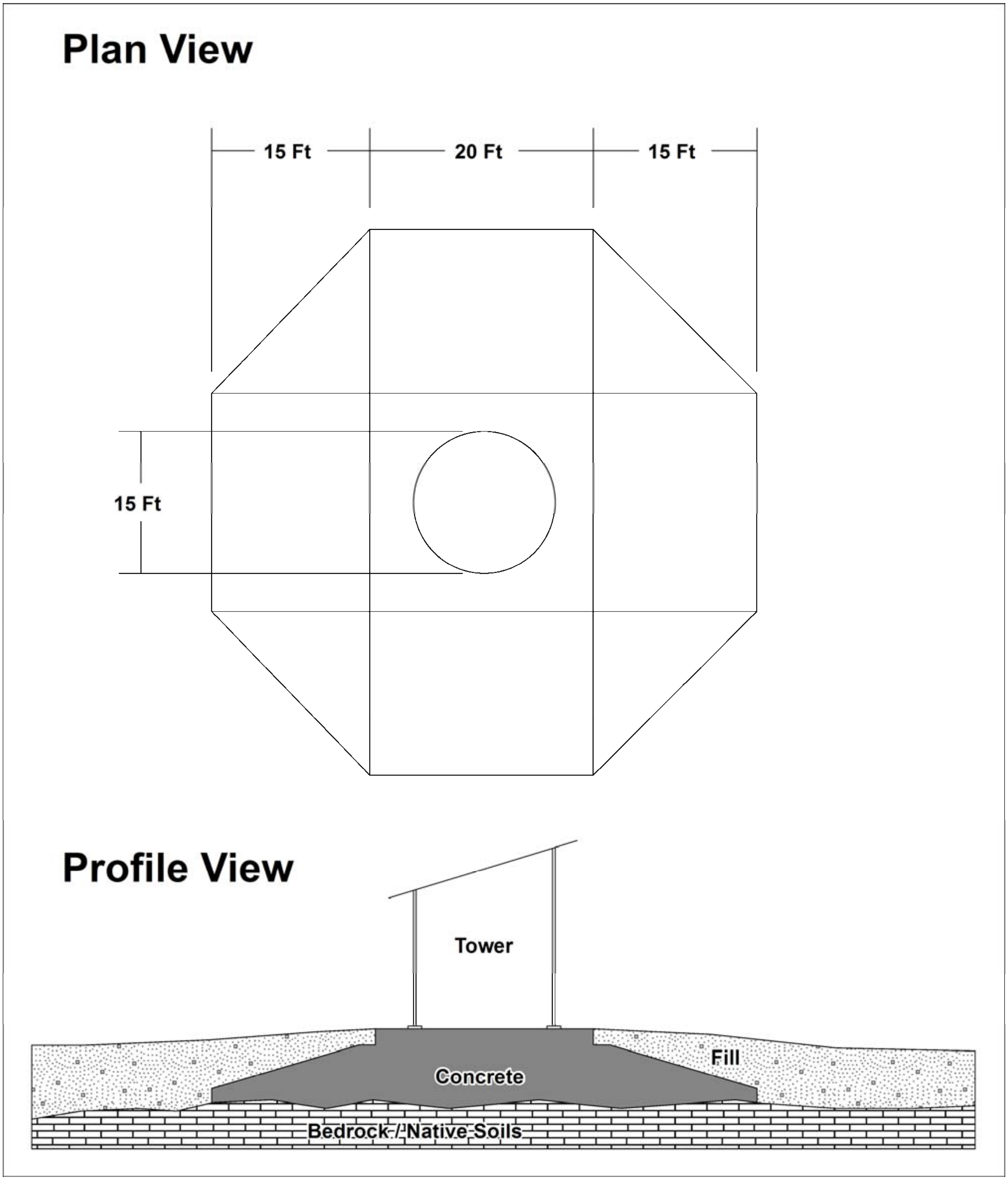


Figure 2-4 Diagram of a typical spread footer foundation for turbine towers



2.1.4 Underground/overhead collector system

Each turbine generator produces 3-phase electricity at 670 volts, which is stepped up to 34,500 volts (34.5 kV) by a pad-mounted transformer at the base of each tower. The underground collector system consists of three shielded cables connecting each turbine either to the overhead collection system or directly to the substation. Within the project area there would be three pole-mounted risers (Figure 2-5) to connect the underground collection cables to the overhead system. The overhead collector system (also at 34.5 kV) would carry the electrical power to the Forward 34.5/138 kV substation where the Forward project is proposed to interconnect with the regional electric transmission system. An illustration of a typical 34.5 kV overhead collector line in shown in Figure 2-6. For greater detail on the collector system and its environmental impact see Sections 6.5.2 and 6.5.3.

Figure 2-5 Riser structure for converting the 34.5 kV electric collector system from underground to overhead

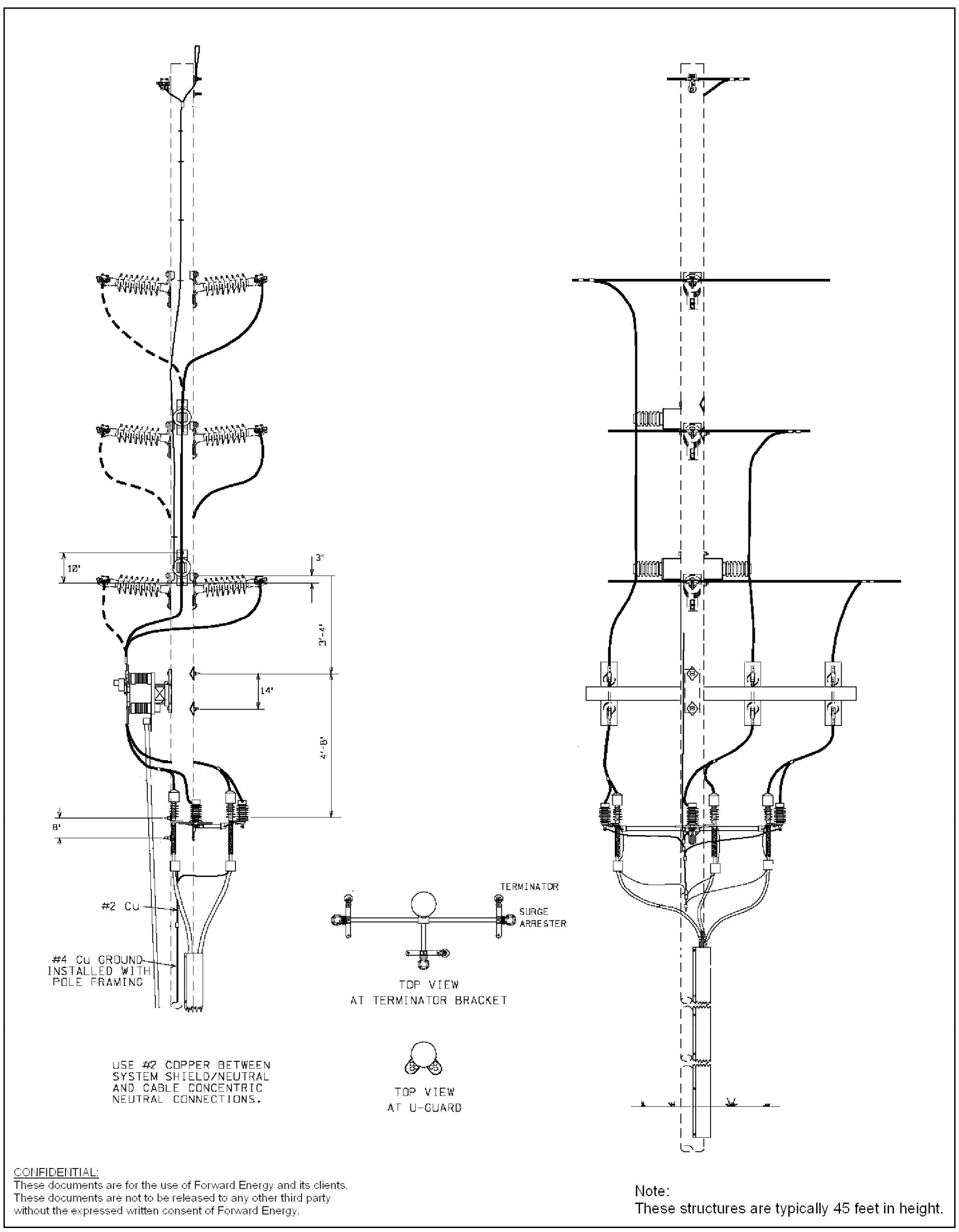


Figure 2-6 Construction of a typical 34.5 kV overhead collector line

2.2 PROPOSED CONSTRUCTION ACTIVITIES

2.2.1 Road construction and clearing

One of the first steps in the construction process would be site clearing and building gravel access roads to connect each turbine site to existing town and county roads. The width of the gravel access roads would be approximately 15 feet for the primary travel path, but may need to be as wide as 35 to 40 feet during the construction phase, to allow for passage of the large cranes needed to erect the turbines. All access roads would be restored to the 15-foot width after construction was completed.

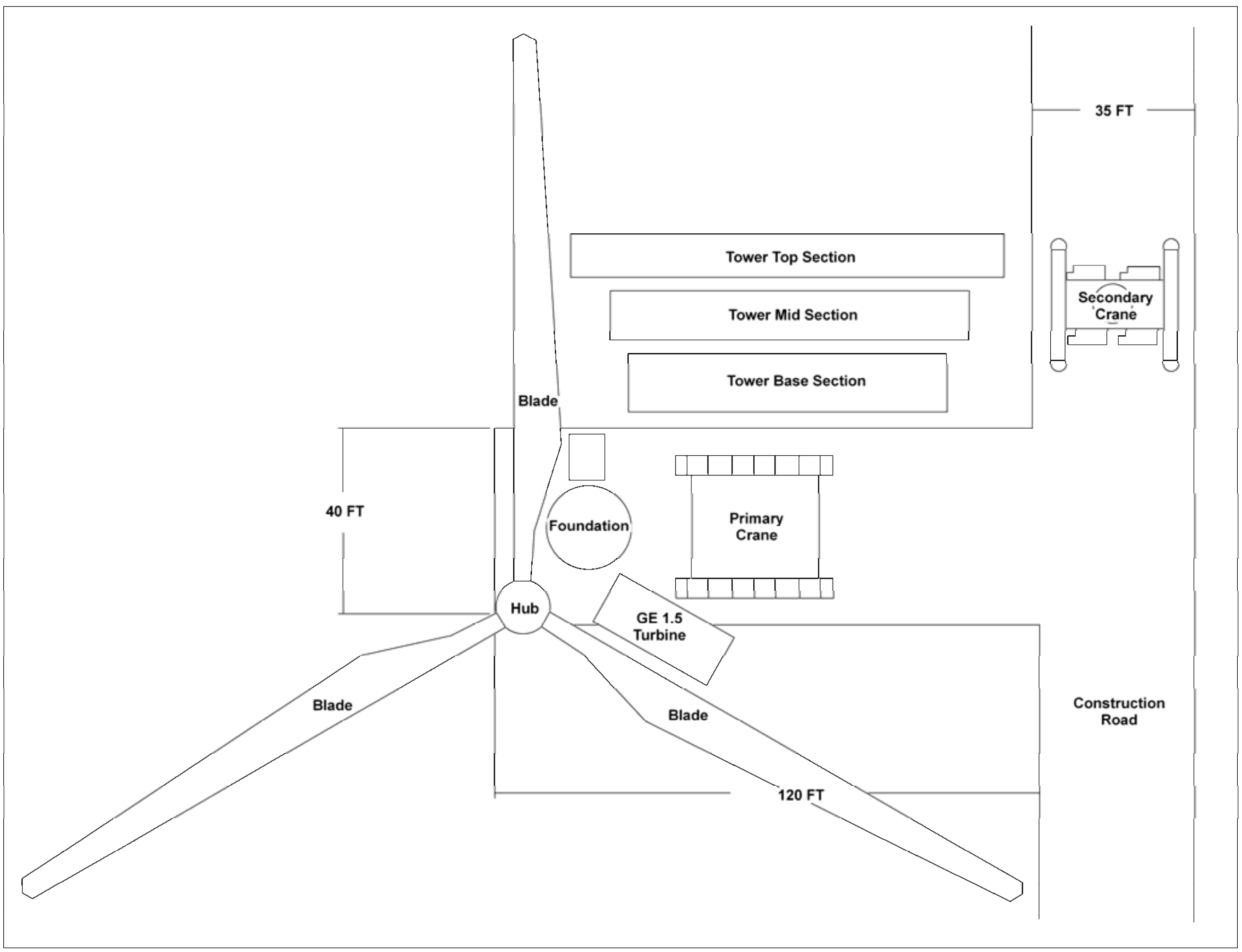
2.2.2 Foundation installation

The turbine foundation would be designed based on site-specific soil and geotechnical conditions. Based on the conditions at each site, the foundation would either be a "deep" foundation or a "spreader foot" foundation. A typical deep foundation would have a footprint of approximately 7.6 by 7.6 meters (25 by 25 feet). Typical spread footer foundations would have a similar footprint at grade, but may spread out below grade to as much as 15 by 15 meters (approximately 50 by 50 feet) in size. A more detailed description of foundation installation and the potential effects on local geology can be found in Section 4.1.

2.2.3 Tower and turbine installation

Each turbine site would typically have a laydown area and crane pad area to facilitate construction. The laydown area is required to place the components, including the nacelle, hub, and three blade assembly and tower sections near the foundation. The crane pad is a compacted area of approximately 40 to 60 feet where the crane would rest while lifting the turbine tower sections, the nacelle, blades and other equipment needed to assemble the wind turbine. Compaction of the ground on the crane pad is necessary so that the ground does not settle causing the crane to become unstable. The laydown and crane pad areas would be restored to their original condition upon completion of construction. The exact dimensions of these areas would be finalized as part of the final design of the project. The size of the laydown and crane pad areas would be determined by delivery sequence of the components, the type of cranes to be used, and construction sequence used by the contractor. For example, some contractors install the blades to the hub and lift the entire assembly; others install the hub to the nacelle and then lift each blade individually. A typical laydown area containing turbine components is shown in Figure 2-7.

Figure 2-7 Laydown area containing turbine components



The primary lift crane used to erect a 78- to 80-meter tower wind turbine is in the 400- to 500-ton size range. The heights for a typical configuration would be a 200-foot main boom and a 120-foot luffing jib. Crane models that might be used are the Manitowoc 2250, Demag CC2000 and the LR1400.

Below is a description of a typical construction sequence after the crane pad has been prepared, the foundation has been set, and the concrete has cured.

Off-loading

The turbine components would be off-loaded from the delivery vehicles with a smaller crane and staged near the foundation in locations of appropriate proximity for the primary lift crane to be able to make the reach to pick up and set the components in place. The smaller crane would off-load the hub and blades, and would assemble the blades to the hub to complete the hub and three-blade assembly. Off-loading could take one to three days depending on the frequency of component delivery.

Tower base

The components to be located in the base of the tower may consist of the controller cabinet, switchgear, and Federal Aviation Administration (FAA) lighting panel. These components would be set on the foundation. The base tower section would then be set over these components on the anchor bolts of the foundation. Setting the base tower section involves setting the shim packs and leveling the tower section prior to tightening the anchor bolts and grouting the tower section to the foundation. The grout typically requires a 24- to 48-hour cure period prior to installing the remaining components. Setting the tower base could take one to two days to complete.

Turbine installation

The remaining erection sequence would begin once the primary crane arrived on the site, and could take one to two days to install the remaining components. The primary lift crane would set the second and third sections of the tower, which are bolted together. The nacelle would then be set on top of the tower. Once the nacelle is set, the hub and blade assembly would be lifted and secured in place. Upon completing the installation, the primary lift crane would move to the next turbine location.

Once the turbine is installed, the remaining work is internal to the tower and nacelle. It includes completing all electrical and mechanical connections. This is typically followed by an electrical and mechanical systems checkout.

2.2.4 Connection to underground collection systems

The next phase of construction would be installation of the underground electric collection system cables and communication lines to interconnect all the turbine generators to the substation and operations building. These lines would be installed in one continuous operation using a trenching machine. Once all systems were interconnected, each turbine would be started up and tested.

The final construction phase would be reclamation and decompaction of all the land under temporary roads and crane pads. All areas not needed for future operations would be restored to agricultural use. These activities are described in greater detail in Section 4.3.2.

2.3 PLANT OPERATING CHARACTERISTICS

2.3.1 Plant operating schedule

The proposed wind generating facilities would operate whenever wind velocities are within the operating range of the turbines. Generally, the turbines require a minimum wind speed of about seven mph to begin generating electricity. If wind speeds exceed about 45 mph, the turbines utilize a blade pitch system to cut out of operation. The blade pitch system would reduce the amount of wind that the blade catches by rotating the blades at their base, thereby stopping the turbine from operating.

2.3.2 Plant capacity factor

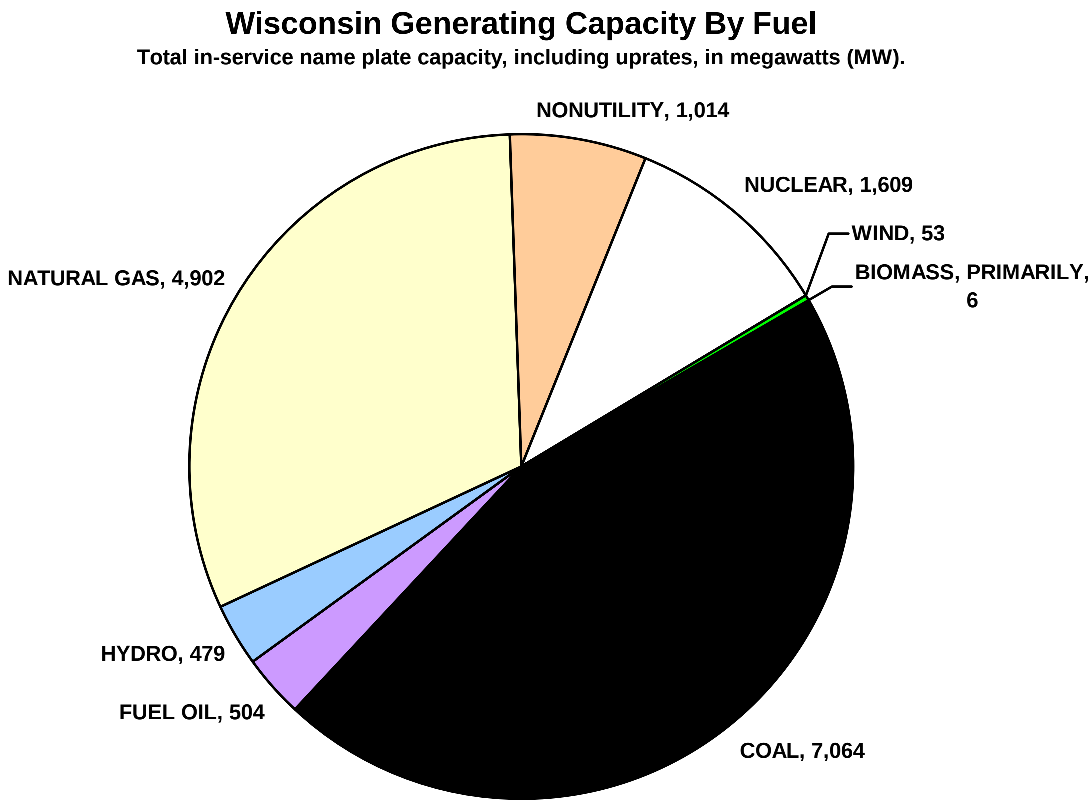
Annual capacity factor for electric generating plants is calculated by dividing the actual energy produced by the facility by the total possible energy produced per year. Forward states that the proposed facility is expected to operate at an annual capacity factor of 30 to 40 percent. The plant would not generate at rated capacity all of the time because wind velocities are not always sufficient to do so. Also, there would be some production time lost when the units are taken out of service for maintenance.

2.3.3 Possible energy produced and existing Wisconsin generating capacity

The name plate generating capacity of the proposed project is 200 MW, which is the product of 133 turbines multiplied by 1.5 MW per turbine. If all of the turbines generate electricity at their rated capacity for one continuous hour, the installation would deliver 200 MWh or 200,000 kWh of energy into the electric system for that hour. If the turbines generate at their rated capacity for an entire month, they would produce approximately 144,000,000 kWh. However, if the plant operates at a typical capacity factor of 35 percent, the facility would produce approximately 50,400,000 kWh during the month. At the average residential consumption of 700 kWh per month, the proposed facilities would produce enough electrical energy to power 72,000 residential customers in a typical month.

During periods when the proposed wind facilities are not generating, the demand for electricity would be met by power produced by using other fuels. The existing in-service electric generating capacity located in Wisconsin is shown by fuel in Figure 2-8. The generating capacity shown as non-utility is owned by entities such as paper mills and other businesses, and includes plants using many different fuels. The non-utility capacity is shown separately because the power generated by those non-utility power plants would be needed if they did not exist, and would likely be produced by utility-owned generation.

Figure 2-8 Wisconsin in-service generating capacity by fuel, known capacity owned by utilities, cooperatives, merchants and non-utilities



2.3.4 Relative cost of energy from wind power

Four Wisconsin utilities, WEPCO, WPSC, WPPI, and Alliant have contracted to purchase energy from Forward. The actual prices in their contracts are confidential. However, recent purchase power agreements for wind power with Wisconsin utilities have ranged from $.035 to $.055 per kWh, or $35 to $55 per MWh, depending on the wind resource and other variables. These prices net out the federal production tax credit (1.8 cents per kW, at the time) claimed by the generation owner.

Cost of energy from some other forms of renewable energy are:

- Photovoltaic systems costs range from $4,500 to $8,500 per kW; energy costs are $250 to $540 per MWh.
- Landfill gas systems cost approximately $1,500 per kW; energy costs are $25 to $45 per MWh.
- Hydroelectric – cost of energy for existing facilities averages $6.60 per MWh.

Table 2-1 shows the energy costs for some traditional generation sources. The costs in the table are from the Final Environmental Impact Statement, printed in July 2004, for the WPSC Weston Unit 4 Power Plant.

Table 2-1 Typical production costs of various forms of generation per MWh

	Capital	Fuel	O&M	Total Production Costs
Existing Nuclear	$2.49	$5.51	$15.53	$23.53
Existing Coal	$10.72	$10.74	$3.17	$24.63
Combustion Turbines	$54.55	$60.50	$7.18	$122.23
Advanced Coal (Weston 4)	$22.75	$10.74	$5.11	$38.60
Natural Gas CC (Port Wash)	$16.81	$33.25	$2.56	$52.62

Recent price increases for both coal and natural gas have pushed production costs even higher for these forms of generation. According to the Energy Information Administration of U.S. Department of Energy, the total cost of electricity from a new coal plant is now $42.30 per kWh.

2.4 PROPOSED CONSTRUCTION SCHEDULE

Typically, construction of a single turbine foundation can take approximately five days. When the foundation is completed, erection of the turbine can be expected to take two to three days. Depending upon the construction sequence at the project area, delivery of equipment and materials and contractor preference, there could be a time lag between foundation completion and turbine assembly.

The schedule submitted by Forward shows 24 weeks for construction of the entire project and another two months following that before commercial operation begins. The applicant's stated goal is to have the project on-line by December 31, 2005. This may be difficult given that construction can not begin until the Commission approves the project and issues a CPCN.

2.5 EASEMENT AGREEMENTS WITH LANDOWNERS

2.5.1 The basic easement agreement

To build and operate the wind turbines and related facilities on private land, Forward must obtain agreements in the form of contracts with the landowners. Forward would not purchase (via fee simple) the land on which a facility would be located; rather, it would rent the land under an "easement" agreement. An easement contract can secure a site or route for a facility for the duration of its operating life.

Forward has obtained easements from landowners for nearly all of the proposed turbine sites, the access roads, the underground collection system, the overhead collector line, and the transfer points from underground collection to overhead (see Section 6.5). These easements would allow the facilities to be built and operated for a period of 25 years, with an option to extend the easement an additional 10 years. For some land parcels, easements would be required for all of these items, and for some parcels easements would be required for only one or more depending on their position along the turbine string. The site for the substation, where the interconnection would be made and power would be transferred to the ATC electric transmission system, would be purchased by Forward, rather than leased via an easement.

Forward has used a single easement agreement form to cover all of the facilities that would be constructed as part of the project. The basic agreement form is considered by Forward to be proprietary with the company and cannot be shared. However, there are certain important aspects of the easement contracts that can be discussed and should be disclosed in a document such as this EIS. These aspects are discussed in the following sections.

2.5.2 Payments to landowners

There are three main components to the payments that would be made by Forward to landowners for the privilege and right to build and operate the project facilities.

First, there is an "annual rental payment," which is really an option payment, to secure the property needed for the facilities and their construction. This fixed annual payment would be paid by Forward to the landowner for up to five years and would cover property as agreed to by Forward and the landowner in the easement negotiations.

Second, there would be an annual "operating fee," which would replace the option payment. The company expects to install its facilities within five years of signing the easement contract. Once the facilities were installed, the option payment would be discontinued and would be replaced by the operating payment. The operating payment would be a fixed annual amount with a compounded escalator applied through the term of the agreement, that is, over the 30 to 50 years of the project's expected life.

Third, landowners, whose property is farmed, would also be compensated specifically for the loss of crops during construction activities and turbine operation. (Most, if not all of the contracted turbine hosts own farms. Potential farm impacts of the project are discussed in Section 5.5, "Agricultural Impacts.") Because the facilities would take up some land, this payment would annually address opportunity costs to the farmer for crops destroyed or not grown on that land. The payment would be based on the actual acreage covered by the various Forward facilities and the construction or repair work, and on a county average yield of that crop, including cultivated crops, hay, or pasture. The computed yield would be multiplied by a "Posted County Price." The county yield and county price would be determined by the farm service agency that services the property.

This payment would also cover additional crop losses that might result from the need for major turbine repair, such as a blade replacement. For example, if the repair requires widening of the access road for cranes or trucks and an expanded work area for equipment and laydown space during the repairs, a farmer would receive additional money that year to compensate for the additional acreage taken out of production.

Another type of payment would be related to the specific case in which a farm, where the Forward facilities would be located, is on Conservation Reserve Program (CRP) land. The landowner would be reimbursed for the amount that the owner would have received from the federal government for having this land enrolled in the program, plus penalties and interest assessed by the U.S. Department of Agriculture (USDA) as a result of the construction or occupation of the land by the wind facilities. At this time, no turbines for the proposed project would be located on CRP land.

According to the basic easement form, all of the easement payments would be provided semi-annually, per turbine, and would be without regard to the selected type of turbine, the capacity of the turbine, or the energy produced.

2.5.3 Final easement clarifications

The easement initially would cover the entire parcel and would provide Forward with the ability to site the turbine and collector circuit anywhere on the property covered by the easement. The landowners would have approval rights for the final location of facilities on their property. In addition, the easement agreement does provide for the landowner to restrict certain portions of their property from wind project development. According to Forward, landowners have included restrictions and maps in special attached exhibits to the easement contracts.

On the first year anniversary of the contract, if the landowner requested, the company would terminate the easement for property not utilized by wind power facilities. The company would map or survey the area used for the turbines, transformers, and access roads and return the remainder of the land to the owner with an amendment to the easement agreement that describes the change. The owner would still have to allow access in the future, though, for repair or maintenance activities that encroached on property outside of the existing access road or turbine foundation. The company would notify the owner of the need for the work space, and the crop compensation for that year (see Section 2.5.2 above) would reflect the increased acreage.

When facility installation was complete, a typical turbine foundation, the pad mounted transformer, and the access road would occupy an area of about 0.5 acre, at the most. The electricity collector circuit(s) would consist of three buried cables plus a communication cable, in a 48-inch deep trench about nine to 12 inches wide. The access road would be about 15 feet wide.

2.5.4 Taxes

Because the agreement is for an easement and not a fee simple purchase, the owner of the land would continue to pay taxes on the land as he or she did before the project. The company would pay the taxes or any other governmental charges or assessments that resulted from the turbines' presence or operation.

2.5.5 Impact mitigation

There are provisions in the easement agreement for Forward to reduce impacts or compensate the landowner for certain adverse impacts that might occur during construction or operation. For instance, if a landowner had suggestions or concerns about potential impacts, the company would agree to consider, in good faith, the suggestions or concerns and locate and operate the facilities in such a way that would reasonably minimize impacts. Forward would agree to keep the facilities in good working order and repair for the term of the agreement. Forward would replace fences with gates where fence maintenance was requested and maintain the gates while allowing the landowners access through the gates.

According to the agreements with each host landowner, upon termination of the easement, Forward would remove any foundations, aboveground and belowground (to a depth of four feet below grade) and remove other structures from the property. The areas disturbed would be restored to a condition reasonably similar to their original condition. Reclamation of the land could include, as required, leveling, terracing, mulching and other necessary steps to prevent soil erosion. See Section 4.3.

The basic easement form also states that the company would carry broad, comprehensive insurance coverage and includes protections for the landowner against liability for physical damage to property or injury to people resulting from wind facility construction or operation. It protects both the landowner and the company from potential hazardous materials violations that might incur. It also protects the owner from financial or regulatory problems that might occur with the company. It protects the company from direct or indirect interference by the landowner, in its right to construct and operate the wind turbines. The key agreements, in this respect, are that the landowner would control the land and have a right to protect it, while the company would have the right to operate, maintain, repair and protect its facilities.

Forward's contractors would need to construct the facilities in a very short time, about six months after starting. Parcel by parcel, they would quickly assemble each of the wind turbines and interconnection equipment and also complete the trenching and the building of access roads. In any specific area, construction could be completed in three to four months. Because of this short time frame, most potential social impacts related to construction activities would be expected to be limited and short-lived.

2.5.6 Removal of the facilities

As mentioned above, Forward, at the end or termination of the easement agreement, would be responsible for the removal of the aboveground facilities and the belowground facilities (to a depth of four feet below grade) from the property. The company would also be responsible for restoring the property to a condition reasonably similar to its original condition, including soil erosion control and crop yield restoration, if appropriate. Discussions about how Forward proposes do this are in Section 4.3.

A general sequence of removal of a single turbine would include the following steps:

1. Decommission the turbine.
2. Disconnect electrical and mechanical systems.
3. Disconnect electric cable from the generator in the nacelle and the switchgear at the base.
4. Disconnect and lower the three blades.
5. Remove the nacelle and hub from the top of the tower.
6. Disassemble the tower sections.
7. Remove the equipment from the base of the tower.
8. Remove the base tower section, including grouting and anchor bolts.
9. Remove the concrete foundation.
10. Excavate the turbine foundation.
11. Clear the turbine area and restore it to a condition reasonably similar to the original condition.

If, for some reason, Forward were to fail to remove the facilities within twelve months after the termination of the easement (or over a longer period if the landowners have agreed to it), the landowners would be allowed to have the facilities removed. If the landowners arranged for the removal themselves, the company would be obligated to reimburse the landowners for "reasonable and documented costs of removal and restoration" that the landowners incurred.

The recently-revised Dodge County Wind Energy System Overlay District, in the Dodge County Land Use Code,[7] supports this easement condition, requiring the wind company to remove turbines the county considers abandoned and to provide the county a bank letter of credit to secure its removal

[7] Section 4.11.3(H) of the Dodge County Land Use Code

obligations. This requirement is, in turn, reinforced by the CUP granted in April 2005 for this project. (A copy of the CUP is in Appendix D of this EIS.) Removal of the facilities and restoration of the land must be done to a depth of four feet below grade to the satisfaction of the county land use administrator.

The towns of Byron and Oakfield in Fond du Lac County are expected to include the same requirements in their CUP.

CHAPTER

3

Chapter 3 – Alternatives

3.1 NO ACTION

Taking no action on this application by denying the application would result in no change in the number of power plants in the state. The Wisconsin utilities that Forward has contracted with to receive power would have to identify other power sources and negotiate new power purchase agreements to meet their electric demand and comply with their obligations under the RPS legislation (Wis. Stat. § 196.378(2)).

Taking no action on this application by not making a final PSC decision within the statutorily-mandated timeline would result in a CPCN automatically granted, as proposed, to the applicant under Wis. Stat. § 196.491(3)(g). Forward would then have the option of constructing enough turbines to produce 200 MW of capacity at any of the turbine sites it has proposed. The project would still be subject to any DNR permitting requirements that apply to construction and operation of the facilities.

3.2 TECHNOLOGY ALTERNATIVES

The applicant, Forward LLC, is a subsidiary of Invenergy LLC (Invenergy). Invenergy is a developer, owner, and operator of wind generating facilities. It is an independent power producer, and the Forward project, if constructed, would be a wholesale merchant plant. Under Wis. Stat. § 196.491(3)(d)3, the Commission may not consider alternative sources of supply or engineering or economic factors if the application is for a wholesale merchant plant. Thus, for this application, the technology proposed, the turbine design selected, and the cost of construction and operation would not be considerations in the Commission's final decision.

3.2.1 Energy priorities

Wis. Stat. § 196.025 states: "To the extent cost-effective, technically feasible and environmentally sound, the Commission shall implement the priorities under s. 1.12(4) in making all energy-related decisions." Wis. Stat. § 1.12(4) creates the following priorities:

> (4) In meeting energy demands, the policy of the state is that, to the extent cost-effective and technically feasible, options be considered based on the following priorities, in the order listed:
> a) Energy conservation and efficiency.
> b) Noncombustible renewable resources.
> c) Combustible renewable energy resources.

d) Nonrenewable combustible energy resources in the order listed:
   1. Natural gas.
   2. Oil or coal with a sulfur content of less than 1 percent.
   3. All other carbon-based fuels.

Because the applicant is a non-utility generator, it does not have an obligation to provide electric service to Wisconsin retail customers and similarly it does not have the ability to implement energy conservation or energy efficiency programs in this state, in lieu of building the Forward project. The proposed Forward wind generating facility would be powered by a noncombustible renewable resource and thus the proposed project supports the goals of the energy priorities statute.

The four Wisconsin utilities that have negotiated contracts with Forward to purchase the power generated by the project are striving to meet their obligations under Wis. Stat. § 196.378(2).

3.3 SITE ALTERNATIVES

3.3.1 General area selection process

Forward states that it used a three-tiered siting process to identify the most favorable area for the Forward project. A description of the information and criteria used at each level of siting are described below.

3.3.1.1 State level

At the state level, using data collected from meteorological towers, Forward evaluated which regions across the state had the wind resources necessary to develop this type of project. Data from these towers generally includes wind speed and direction, temperature, dew point, and other valuable meteorological information.

Based on the tower data collected by Global Energy Concepts, LLC and reported for the years of 1997 to 2001, the region around Eden, Wisconsin was identified as having a strong wind resource with excellent exposure to prevailing winds from the west and southwest. The Eden tower site, which is located approximately 10 miles northeast of Forward's project area recorded an annual average wind speed of 6.9 meters per second at 60 meters above the ground elevation.

Forward reviewed topographic maps and other available data to determine areas near the Eden site that might have a similar wind resource and identified an area that had similar topography as that found at the Eden test site. Additional testing and evaluations were then undertaken on that area.

3.3.1.2 Regional level

The second tier of evaluation included installation of two meteorological towers in the identified area that were also designed to monitor wind speed, direction, temperature, dew point, etc. Based on the data collected from these two towers[8] over a period of about 1.3 years, Forward confirmed that the wind resource in its proposed project area was nearly identical to that at the Eden site.

[8] This data was filed confidentially at the Public Service Commission on October 27, 2004.

Another aspect of a second tier evaluation was to determine if specific criteria could be met within the region. The key criteria were sufficient land availability for a large wind project, engineering and design, environmental compatibility, and community support and acceptance. Specifically, Forward evaluated the following:

- Availability of land and compatibility with existing land uses;
- Topographic elevations;
- Wind turbine engineering and design parameters (including feasible turbine layouts);
- Location of existing substations and transmission lines suitable for interconnection;
- Community and landowner support and acceptance of the project; and
- Preliminary review of environmentally sensitive areas, such as parks, wetlands, water bodies, habitats, etc.

During the second tier evaluation, brownfield sites were also reviewed to determine if sites of adequate size were available for the development of the Forward project. Only eight of the 60 brownfield sites located within the state are outside of the city of Milwaukee. Only three of the remaining eight sites are located in the southeast portion of the state (Whitewater, Mukwonago, and Germantown) where viable wind resources are available. One of the project area criteria is the availability of significant tracts of cleared land. None of the three brownfield locations were considered a feasible option because they did not meet this requirement.

According to Forward, the second tier evaluations identified an area of land that appeared suitable for further development of the project. Forward drew the following conclusions about the area studied during the tier two evaluation:

- Significant tracts of cleared land are available within the region.
- A specific area of the region is above an elevation of 1,050 feet providing added wind resource availability.
- The terrain and geography of the area was suitable for the engineering and design of a wind farm.
- The project area is located near an existing electric transmission line suitable for interconnection.
- A community and landowner outreach program conducted to determine the level of community support and acceptance of the project in the proposed area showed strong community support and acceptance for the project.
- A preliminary environmental review to determine sensitive environmental resources in the project area showed that adverse impacts to the environment seemed to be avoidable or unlikely.

3.3.1.3 Project area level

Once the Project Area was identified based on the second tier study, Forward states that it continued to collect data, refine placement of the wind turbines based on engineering and design parameters. A sophisticated mapping program utilizing land use, meteorological data, wind turbine engineering and design parameters, and other project siting criteria identified preferred locations for the wind turbines. It also states that community and landowner meetings to inform the public were conducted.

Specific areas of analysis for the tier three evaluation included the following:

- Average annual wind speed
- Land use and zoning
- Site topography
- Geology
- Soils
- Existing vegetative communities
- Threatened and endangered species
- Wildlife
- Birds
- Bats
- Archaeological and historical resources
- Surface water resources
- Wetlands
- Floodplains
- Projected noise measurements
- Aviation
- Environmental mitigation
- Community resources
- Recreation and publicly owned lands
- Demographics
- Community services
- Local government infrastructure
- Benefits to the community
- Transportation infrastructure
- Public outreach

Figures Vol. 2-1A and 2-1B show the areas excluded from potential turbine development within the Forward project area based on the results of the tier three evaluation. These areas have been excluded for various reasons. The western edge of the project area was designated as an exclusion area because of its proximity to the Horicon Marsh and National Wildlife Refuge and also because of the sensitive biological features of the Niagara Escarpment and the unique plant and animal resources it supports. The villages of Brownsville, LeRoy, South Byron, Knowles, and Lomira and surrounding sections of land were excluded for the purpose of enabling growth and expansion of those communities. Other smaller areas were excluded because of inappropriate topography or proximity to wetlands, creeks, or springs.

3.3.2 Turbine siting process

3.3.2.1 Consideration of alternative sites

WEPA, Wis. Stat. § 1.11, and the Power Plant Siting Law, Wis. Stat. § 196.491(3)(d)3. require the Commission to consider alternative sites when determining whether to approve, modify, or deny an application for a CPCN for a large generating facility. To ensure that the Commission has sufficient information to comply with this requirement, an applicant for a large generating facility must provide detailed information for two or more sites in its application and it must have control (through ownership or an option to purchase) over the sites that it has proposed, so as to ensure that they are viable sites for construction.

Large-scale wind energy projects are somewhat different than most large generating facilities in that they involve two "levels" of siting. First, there is the "project site or area" within which all of the proposed turbines will be placed. For a project exceeding 100 MW, the size of this area would likely be thousands of acres. In the case of the Forward project, the project area is approximately 32,400 acres. It is not feasible to require an applicant to own or purchase a project site of this size.

In addition to the project site, there are numerous "turbine sites" on which individual turbines would be installed. Because the turbine sites are generally leased, rather than purchased, the project applicant must go through the process of negotiating individual easements with landowners for these turbine sites and other project-related facilities, such as the access roads and the electric collector system. These easement agreements must be forged before a CPCN application can be submitted, so that the regulatory review can consider the impacts at specific turbine sites, in addition to impacts across the entire project area. For a project exceeding 100 MW, this entails finding 70 or more suitable turbine sites (assuming a 1.5 MW turbine capacity) within a project area and negotiating dozens of easement agreements prior to submitting a CPCN application.

Commission staff have determined that requiring an applicant to identify two or more "project sites" and negotiate all of the easement agreements necessary to construct a wind farm of 100 MW or greater at each site, is not reasonable. The approach used by Forward to supply alternative sites for consideration as required by WEPA and Wis. Stat. § 196.491(3)(d)3 is described below.

For this application, Forward provided detailed information regarding its project site selection process. It has described and explained the information and criteria it used to select the project area proposed and to delimit its boundaries. With respect to turbine sites, Forward has proposed locations for and negotiated easements for 162 turbines. If the Commission approves the Forward project, the applicant would be limited to installing 133 turbines (totaling 199.5 MW, assuming a 1.5 MW turbine capacity). The 29 "extra" turbine locations provide the Commission with alternative sites to consider when making its final decisions on the project. Different turbine sites may have different potential effects on landowners, aviation safety, avian resources, broadcast and telecommunications interference, aesthetics, and agricultural use. Based on information provided in the final EIS and the hearing record, the Commission will be required to weigh these potential effects and make decisions about which turbine sites are reasonable.

3.3.2.2 Setbacks and other considerations

In determining possible locations for 133 turbines, Forward considered many factors, including, but not limited to: noise, aesthetics, local community growth, wetlands and floodplains, sensitive habitats, and access. It also considered engineering and cost issues, such as air turbulence, prevailing wind direction, existing microwave paths, and overall length of the collector cable system. Some of these turbine siting considerations are discussed below in more detail.

In its decisions regarding appropriate setbacks to minimize impacts, Forward considered the Dodge County Ordinance and the draft Model Wind Ordinance for Wisconsin Towns and Counties. Forward used guidance from both of these documents to arrive at the setbacks it used in siting turbines for the Forward project. The basic setback criteria used to initially locate the proposed turbine sites included:

- Setback from property boundaries and roads - 1.1 times the height of the turbines or approximately 450 feet.
- Setback from non-participating residence - 1,000 feet or a 50 dB noise threshold.
- Setback from participating residence - 450 feet (with landowner approval).

While these distances differ slightly from the setbacks required by provisions in the Dodge County Land Use Code, they provided a starting point for Forward's initial siting work.

Forward has worked extensively with landowners that have agreed to "host" one or more turbines on their property and continues to do so. In these negotiations, Forward's interest in optimizing turbine efficiency and minimizing array losses (see air turbulence section below) is balanced with the landowner's interest in maximizing use of the land and minimizing potential impacts such as noise, aesthetics, and loss of farmland.

To date, the easement agreements that have been signed give the landowner the right to choose the final location for the turbine foundation and tower, the access road and the underground collector system. Where conflicting land use or property line issues arise, Forward has stated its intent to resolve the issue to the satisfaction of both parties.

Draft Model Wind Ordinance for Wisconsin

In an effort to promote renewable energy in the state, 1997 Wisconsin Act 204 required each of the four eastern Wisconsin investor-owned utilities WP&L, WEPCO, WPSC, and MGE, to build or contract for an aggregate total of 50 MW of new renewable resource generating capacity within Wisconsin.

Because many wind energy projects fall below the threshold for projects requiring regulatory approval, this initiative required the utilities to begin discussions with Wisconsin communities to gain permission and public acceptance related to constructing new wind facilities. To aid local town and county governments with siting new wind farm facilities, a Wisconsin Windpower Siting Collaborative was formed. Members of the collaborative included: regulatory agencies such as the PSC, DNR and the Department of Administration's Division of Energy; electric utilities; representatives of private industry; and local governments.

In addition, legislation was enacted that allows municipalities to impose health and safety related restrictions on the construction and operation of wind farms, but prohibits them from enacting or imposing regulations that increase the cost of a wind farm, decrease its efficiency, or that completely bars the installation of a system.

The Wind Siting Collaborative developed a model wind ordinance that could be used by towns and county governments faced with siting utility-scale wind turbines. Some counties, including Dodge County, moved quickly to establish guidance and requirements for wind development. Comments are currently being solicited on the draft model ordinance. Factors addressed in the model ordinance include visual appearance, setbacks, noise, minimum ground clearance, signal interference, and safety. The Draft Model Wind Ordinance for Wisconsin is provided in Appendix D.

The Dodge County Ordinance

Chapter 4 of The Dodge County Land Use Code includes provisions for regulating Wind Energy Systems (WES) by establishing an Overlay District for WES designed to minimize impacts on natural resources and land use in the county while protecting the wind resource for WES owners. The ordinance includes several mandatory setbacks designed to minimize potential impacts, as well as other restrictions on WES facilities (see Section 5.4.2). Some of these siting and operational restrictions are:

- Setbacks related to property boundaries;
- Setbacks related to distances from residences, churches, schools, and hospitals;
- Noise levels;
- The total height of the turbines;
- The color of the turbines;
- Mitigation of radio and television interference; and
- Landscaping of substation facilities

Turbulence effects

The efficiency and potential output of a wind turbine depends on its ability to receive a clear fetch of wind. Maximizing air flow and wind speed is important. Obviously, placement of the turbines to maximize these factors is an objective in the turbine siting process. There are two ways in which turbulence can affect the siting of wind turbines. First, the height and location of nearby objects such as wind rows of trees or large structures can cause turbulence as the wind flows past. These objects can affect the flow of air causing it to deflect, change direction and lose speed. A shorter turbine sited too close to these kinds of objects would not operate very efficiently. Utility-scale wind turbine towers are usually tall enough to avoid turbulence caused by objects close to the ground.

When wind turbines extract energy from the wind, they change the air flow behind the turbine. This is called a downwind wake. The air flow in the wake is more turbulent and its forward velocity is reduced. As the wake moves away from turbine's rotor, it expands into the atmosphere and diminishes. Eventually, normal wind flow is restored by mixing the unaffected wind flows around the wake with the wake.

If a downwind turbine is sited too close (i.e. within the downwind wake), the energy produced by that turbine will be less, because the wind's strength is reduced. This reduction in energy is called wake loss. In addition to lowering energy production, the turbulent air in the wake imposes more wear and tear on the wind turbine by increasing mechanical stress in the blades and rotating mechanisms.[9]

The chaotic air flow in turbulence dissipates over distance in relationship to the rotor diameter of the turbine. The effects of wake are significantly diminished at a distance of six to eight rotor diameters. The diameter of the rotor on the proposed Forward turbines is approximately 271 feet. Thus, the optimal distance between downwind turbines for maximizing wind speed and flow would be about 2,000 feet or more.

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[9] Minnesota Environmental Quality Board's Findings of Fact, Conclusions, and Order Authorizing Exceptions to Buffer Setback and Amending Restrictions on Turbine Spacing. Site Permit No. O1-10-LWECS-NE

Of course, other costs and considerations, such as installation of access roads and the cable collector system, landowner willingness, and required setbacks, must also be taken into account when making the final determinations related to turbine siting.

CHAPTER

4

Chapter 4 – Natural Environment, Potential Impacts, and Mitigation Measures

4.1 GEOLOGY

4.1.1 Existing environment

The proposed Forward wind turbine project would be located east of the Niagara Escarpment which, geologically, is a "cuesta," an upland landform with a short, steep descent (an "escarpment"), on one side and a long, gentle slope on the other. The escarpment includes a layer of bedrock, specifically Niagara dolomite, which is relatively resistant to erosion and stands up in relief as a prominent line of bluffs. A soft, impermeable layer of Maquoketa shale lies beneath the Niagara dolomite. It erodes quickly where it is exposed, causing the dolomite to continually break off and form a new cliff face. It is in part because of this relatively soft shale layer that Horicon Marsh was later formed by glacial events to the west.

In Wisconsin, the escarpment runs roughly northeast to southwest, from Door County south to northern Waukesha and Milwaukee Counties. Locally, it is often called "the ledge." It becomes less prominent in relief as one travels southward from the Fond du Lac area. The escarpment is located on the eastern edge of Horicon Marsh and visually extends south to the town of Iron Ridge, about 10 miles south of the Forward project area. Further south, it is buried by glacial deposits and disappears as a surface feature. To the north of Horicon Marsh, it extends into the town of Oakfield and continues along the eastern shore of Lake Winnebago to Green Bay and Door County.

The cuesta on which the project is proposed appears to have a karst-like surface on the Niagara dolomite bedrock. A karst is a rock-based landform resulting from the solubility of the bedrock. Solution features in the bedrock allow organic matter to accumulate along the escarpment or water to flow in the cuesta's valleys and to increase the size and number of sink holes, fractures, and other openings. Glacial drift up to 100 feet thick overlies parts of the cuesta, filling many old river valleys, sink holes, and other highly weathered and fractured geologic features.

According to information from the U.S. Geological Survey (USGS), the depth to bedrock in the proposed project area appears to range from zero to 50 feet. As a particular example, the depth to bedrock, as indicated in the Brownsville water utility well logs for DNR, is about 20 feet.

There are eleven rock quarries and gravel pits within the project area and a 0.5-mile buffer around it.

4.1.2 Potential impacts of Forward activities

Forward has indicated that the final anchor method for each turbine tower would be determined as the rock depth, rock characteristics, and the foundation design requirements are clarified. Borings taken at each wind turbine site prior to construction would determine the geotechnical conditions and the depth to bedrock at each location. Depending on the depth to bedrock and site-specific geotechnical conditions, each turbine would be installed using one of two techniques: a “deep” foundation or a “spread footer” or “mat” foundation. These are illustrated in Figures 2-3 and 2-4.

In the case of the deep foundation design, where the bedrock is more deeply buried, the turbine tower foundation would be anchored directly into the bedrock with a system of “rock anchors.” Rock anchors are commonly used in construction. A rock anchor system might involve drilling bolts down into the rock or drilling holes and then using some material such as grout to fasten the anchor system in the hole.

In the case of the mat foundation, where the bedrock is closer to the surface, the bedrock would be excavated to create an appropriate foundation directly on the bedrock for the spread footer base, as shown in Figure 2-4. The bedrock in the project area is expected to be fragmented and mostly able to be excavated without blasting. While some of the quarries operating in the area blast to mine the rock, they often can use fork lifts and backhoes to break up the rock without blasting. (The recently amended Dodge County Land Use Code restricts blasting related to construction of the project facilities without numerous notifications. See Section 5.4.2.)

Table 4-1 Proposed turbines in locations where the bedrock is potentially five feet or less from the surface

Turbine 4	Turbine 50	Turbine 83	Turbine 125
Turbine 6	Turbine 56	Turbine 84	Turbine 128
Turbine 12	Turbine 57	Turbine 85	Turbine 129
Turbine 21	Turbine 58	Turbine 86	Turbine 130
Turbine 24	Turbine 59	Turbine 91	Turbine 131
Turbine 25	Turbine 60	Turbine 93	Turbine 133
Turbine 26	Turbine 63	Turbine 101	Turbine 135
Turbine 31	Turbine 70	Turbine 102	Turbine 136
Turbine 32	Turbine 71	Turbine 103	Turbine 139
Turbine 36	Turbine 72	Turbine 111	Turbine 143
Turbine 39	Turbine 73	Turbine 117	Turbine 146
Turbine 43	Turbine 74	Turbine 120	Turbine 147
Turbine 49	Turbine 78	Turbine 124	Turbine 159
			Turbine 162

Table 4-1 lists the turbines that Forward has identified at locations where the depth to bedrock from the surface is potentially five feet or less. There are 53 turbines sited at such locations. The five-foot depth is projected as the threshold for towers that might need to be installed into the bedrock using the spread footer or mat design. About half of the turbines listed in Table 4-1 are in the western four strings of turbines located nearer to the Escarpment, and largely in the town of LeRoy in Dodge County. Others are mostly in the northern parts of the project area, north of Brownsville. See Figures Vol. 2-1A and Vol. 2-1B.

Local concerns have been expressed about the potential for drilling and other bedrock work to lead to movement of soils and surface contaminants into the groundwater. Numerous wells in the area have had to be redrilled because of groundwater contamination due to other causes. Further discussion about these concerns and ways to reduce risks related to groundwater contamination are located in Section 4.4.2.

To prevent or minimize water movement into the groundwater as a result of the installation of rock anchors, Forward would use rotary boring with a tricone bit combined with air pressure forced down the bore hole to remove the chips and cuttings, instead of a water or mud rotary boring. With this method, there would be no water used in the process that could enter the bedrock or groundwater. Pressure grouting would be applied after installation of the rock anchors has been completed.

To prevent or minimize cracking of bedrock caused by pressure and vibrations during installation of the rock anchors, Forward has indicated that it would use rotary installation alone or rotary borings with a tricone bit, as opposed to a rotary installation combined with a hammering or concussion process.

The eleven active rock quarries and gravel pits in the project area are not expected to affect the project; nor is the project expected to affect any operations in the quarries and gravel pits.

4.2 TOPOGRAPHY

4.2.1 Existing environment

The general topography of the Forward wind project area is gently rolling with elevations ranging from about 900 feet to 1,132 feet above mean sea level (msl). Most of the turbines would be above 1,050 feet msl. The project would be located partly in Fond du Lac County and partly in Dodge County, and both counties are in what is known as the "eastern lowland and ridge" geographical region. The entire project area is on the gently sloping side, or top, of the Niagara cuesta. The steeper part of the cuesta, the Niagara Escarpment ridge, is located beyond the western edge of the project area. Directly west of the Escarpment lies Horicon Marsh.

Atop the cuesta, the Forward project area is on a plateau that contains shallow valleys. The eastern and western portions of the project area are on ridges, slightly higher than the valley that separates them. Three creek systems drain the project area, as discussed below in Section 4.4.

4.2.2 Potential impacts of Forward activities

The area topography would be affected very little by the project. Some grading would be necessary to level foundation areas for the wind turbine bases. There would be small local changes as soil was graded for construction, but overall, no significant change to project area topography would be expected from grading activities or any other project activities.

Local topography might influence how the project is perceived, however, by influencing the visibility of some turbines that would be located on slightly higher ground. Potential impacts to the visual landscape and potential mitigating influences or mitigation techniques are discussed in Section 5.10.

4.3 SOILS

4.3.1 Existing environment

In Dodge County, soil surveys[10] show three main soil associations within the Forward project area: Theresa-Lamartine-Hochheim, St. Charles-LeRoy-Lomira, and Houghton-Pella. In the Fond Du Lac County portion of the project area, there are two soil associations: Lomira-Virgil and Beecher-Elliott. Characteristics of each of the soil associations in Dodge and Fond du Lac Counties are summarized in Table 4-2.

Table 4-2 Characteristics of each of the soil associations in Dodge and Fond du Lac Counties

Soil Association	Topography	Drainage	Physical Appearance	Source Material
Houghton-Pella	nearly level	poorly drained to very poorly drained	deep, organic, with silty subsoil	decomposed sedges and reeds or in silty material and glacial drift
St. Charles-LeRoy-Lomira	nearly level to steep	moderately well drained to well drained	deep, with silty and loamy subsoil	loess and glacial till
Theresa-Lamartine-Hochheim	nearly level to steep	well drained and somewhat poorly drained	deep, with silty and loamy subsoil	loess and glacial till
Lomira-Virgil	low ridges and knobs separating nearly level uplands and depressions	well drained and somewhat poorly drained	moderately permeable	calcareous loam till
Theresa-Pella-Lamartine	uplands gently sloping to level lowlands	well drained to poorly drained	moderately permeable	calcareous loam and sandy loam till
Beecher-Elliot	lowlands	somewhat poorly drained	silty and clayey, moderately permeable	moderately alkaline shale and till that has a high shale content

Except for the organic lowland soils, the soils of the project area are all derived from glacial till and have large percentages of clays and silts. While their ability to drain water varies, they are all capable of holding water. In general, the soils in the project area are fertile and good for farming. The main farming concerns are controlling erosion and maintaining good soil tilth. Good tilth means that the soil is loose enough for good plant root growth.

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[10] Soils in each county in Wisconsin are described and mapped in separate publications issued by the United States Department of Agriculture (USDA) and the Soil Conservation Service (SCS).

4.3.2 Potential impacts of Forward activities

A soil erosion and sediment control plan will be developed by Forward and utilized during construction of the project. If mitigation is required for soils in the area, the soil erosion and sediment control plan would be used for guidance. In addition, geotechnical borings obtained at or near each turbine site would help determine the stability of soils for the turbine base. If a soil is well drained, fuel or other spills and leaching could result in groundwater contamination, unless the ground is too compacted to let water percolate. Forward has indicated that it would take precautions during construction to avoid fuel spillages onto soil surfaces.

Most of the concern with regard to soils relates to the potential for compaction. The soils at construction sites and along access roads are susceptible to compaction from the passing of construction equipment. Soil moisture is a critical factor in soil compaction potential. A dry soil has friction between the soil particles and is less likely to become compacted. Water acts as a lubricant between soil particles, making them more subject to compaction. Also, a predominance of smaller particles in clays and silts results in more water holding capacity and more compaction potential.

Soils in the project area are of interest because they are integral to the success of farming in the area. The potential impacts on area agriculture from the project are discussed in Section 5.5. As a result of construction, the chemical or physical properties of the area soils could result in changes in soil structure and decreased crop yields. Increased soil erosion during precipitation events could result from soil grading or compaction. Erosion from a farm field can result in a loss of potential fertility and crop yield. Soil erosion can also clog or contaminate surface water in local streams, as it already has in the area to some extent. Compaction alters soil tilth and the soil's ability to be penetrated by farm equipment or plant roots.

While there could be impacts to soils from compaction, erosion, or spills leaching into groundwater, Forward has indicated that it would adhere to Best Management Practices (BMPs) during construction to avoid or minimize these impacts.

In order to provide stable soil conditions for the heavy cranes that would be used in construction, soils in areas where the cranes would be used at each turbine location and along paths where the cranes would move from turbine to turbine would be prepared and intentionally compacted using the method described below.

The heavy cranes that would move across the landscape, along a string of turbine construction sites, could compact the farm soils severely. During construction of the strings of turbine towers, each crane pad and path would be developed as described below:

1. Depending on soil tests, the topsoil would be removed, most likely to a depth of plus or minus twelve inches.
2. The area for the crane path and pad would be tested to determine the existing soil density and level of compaction to a depth of about 24 to 36 inches. Test methods would include one or more of the following ASTM International measurement standards.
    a. Split spoon method
    b. Dynamic cone penetrometer for granular soils
    c. Static cone penetrometer for cohesive soils
3. After proof rolling, the area would be compacted to a 95 percent standard proctor.
4. A geotextile fabric would be laid into the path or pad.

5. About six inches of "pit run material" would be deposited and compacted.
6. About six inches of gravel would be laid over the pit run material and compacted to 95 percent standard proctor.

Additional sub-soil compaction could occur on the crane pads and crane paths due to the weight of the crane itself. After construction, in locations where the crane path was not to become the permanent access road, the following activities would be used to bring the fields back to their pre-construction condition:

1. The gravel and pit run material would be removed.
2. The compaction and soil density would be tested again.
3. The soil in place would be removed or "decompacted" in 12-inch lifts with a chisel plow, subsoiler, and disk as needed until the pre-construction soil densities were met. Subsoilers can reach a depth of 28 to 30 inches.
4. The topsoil would be returned to the area at the same depth that was present prior to construction.

About one-third of the proposed turbines and the crane access roads would be placed in fence lines or existing field lanes. This placement could reduce the need for relieving compaction. At another third of the proposed turbine sites, the crane path would become the permanent access road. No decompaction would be needed at these sites.

Where decompaction was needed but did not yield the desired result, the "Crop Compensation" section of the easement agreement would continue to be honored (see Section 2.5 of this EIS on the easement agreement). This would allow reimbursement to the farmer for decreased yields due to unsuccessful decompaction efforts. Under these circumstances, the Crop Compensation section of the easement agreement could be in effect throughout every year of the agreement, rather than only during construction.

4.4 WATER RESOURCES

4.4.1 Surface waters

4.4.1.1 Streams and surface waters

The Forward project area is located within the Upper Fox and Upper Rock DNR Water Management Units (WMU). Table 4-3 lists the tributaries to the Fox and Rock Rivers that lie within the project area. The streams are also shown on the map in Figure Vol. 2-3.

Some of the waters in Table 4-3 are listed in the DNR's proposed Impaired Waters List for 2004[11] under Section 303(d) of the Clean Water Act. Gill Creek and Irish Creek in the south, the Horicon Marsh in the west, and Kummel Creek in the north and east, are described as having degraded habitat because of pollution by excess sediment from non-point sources. The Horicon Marsh is listed as a "low" priority impaired water, while the streams are listed as "medium" priority situations. All the streams in the project area appear to be affected by nonpoint sources of pollution, particularly bank erosion due to cattle grazing and sedimentation from farm tillage practices.

[11] http://dnr.wi.gov/org/water/wm/wqs/303d/2004ProposedList/Proposed_2004_303_List.pdf

Table 4-3 Tributaries to the Fox and Rock Rivers that lie within the proposed Forward project area

Tributaries	Water Management Unit
Lake Michigan Basin (Upper Fox WMU)	
Campground Creek	Upper Fox
Mississippi River Basin (Upper Rock WMU)	
Fink Creek	Upper Rock
Gill Creek	Upper Rock
Horicon Marsh	Upper Rock
Irish Creek	Upper Rock
Kummel Creek	Upper Rock

Campground Creek, north of the proposed project, and Fink Creek, south of the proposed project, are not listed as Impaired Waters. In fact, Campground Creek is classified a Class II trout stream for about three miles from its headwaters.

Gill Creek and Irish Creek, at the south end of the proposed project area, are part of a U.S. Natural Resource Conservation Service (NRCS) Environmental Quality Incentives Project. The DNR and the Dodge County Land Conservation Department (LCD) are working with the NRCS and area farmers to install conservation measures as needed, including stream bank buffers, conservation tillage, and nutrient management plans. Ponds constructed in the headwater springs of Gill and Irish Creeks have resulted in warming of the water, and the water quality of both continues to be degraded by nonpoint sources of water pollution. Several conservation easements have been signed in an effort to improve water quality.

The DNR is also currently conducting EPA-required Total Maximum Daily Load (TMDL) studies on these two streams and on Kummel Creek to develop water quality restoration plans to address the impaired waters classifications. Gill Creek and Irish Creek have been monitored by the DNR for water quality concerns where high levels of nitrates, phosphorus, and sediment were observed. Despite their current status, both streams were once cold water fisheries and are now considered potential Class II trout streams. There are few trout streams in the entire Upper Rock River basin at this time.

Horicon Marsh has been designated as a "Wetland of International Importance." The most severe problem affecting the waters of the Marsh at this time is siltation resulting from soil erosion from agricultural lands in the surrounding watersheds. Other issues include purple loosestrife infestation and a high in-flow of nutrients from surrounding farms, pastures, and barnyards. The East Branch of the Rock River is the primary source of water for part of Horicon Marsh and is also the main source of sediment loading. Sediment carried by the tributaries of the East Branch flows into the East Branch and thereby into the Horicon Marsh.

Kummel Creek begins just northwest of the village of Brownsville, and flows into the East Branch of the Rock River 16 miles downstream at Theresa Marsh. Sediment and silt deposition is severe in pool areas of this stream. Portions of the creek have been channelized, and other portions are intermittent.

4.4.1.2 Potential impacts of the project on streams or surface waters

Although some of Forward's project facilities would cross streams or wetlands, these actions are not expected to have adverse affects on any of the described streams directly. Forward avoided affecting most of the surface water in its project design. It also has stated its intention to bore the underground electric collector system cables under surface streams during installation in order to avoid stream impacts. If streams or surface waters were crossed by trenching underground cables, Wis. Stat. ch. 30

permits from the DNR would be required. The electric collection system is discussed in detail in Chapter 6.

A Chapter 30 permit would be required where access roads cross streams as well. Seven access road crossings have been identified, as listed in Table 4-4 below. The company expects to expand some farm lanes to help create access roads to turbines. Seven access roads would cross either Kummel Creek or Gill Creek, probably using the same type of bridging as the existing farm lane. Erosion of soil into the creek would need to be prevented during these construction activities. Access roads are also discussed in Section 2.5 and Section 4.1.

Table 4-4 identifies streams in the project area that would be crossed by project facilities, such as the collector circuits, transmission lines, and access roads.

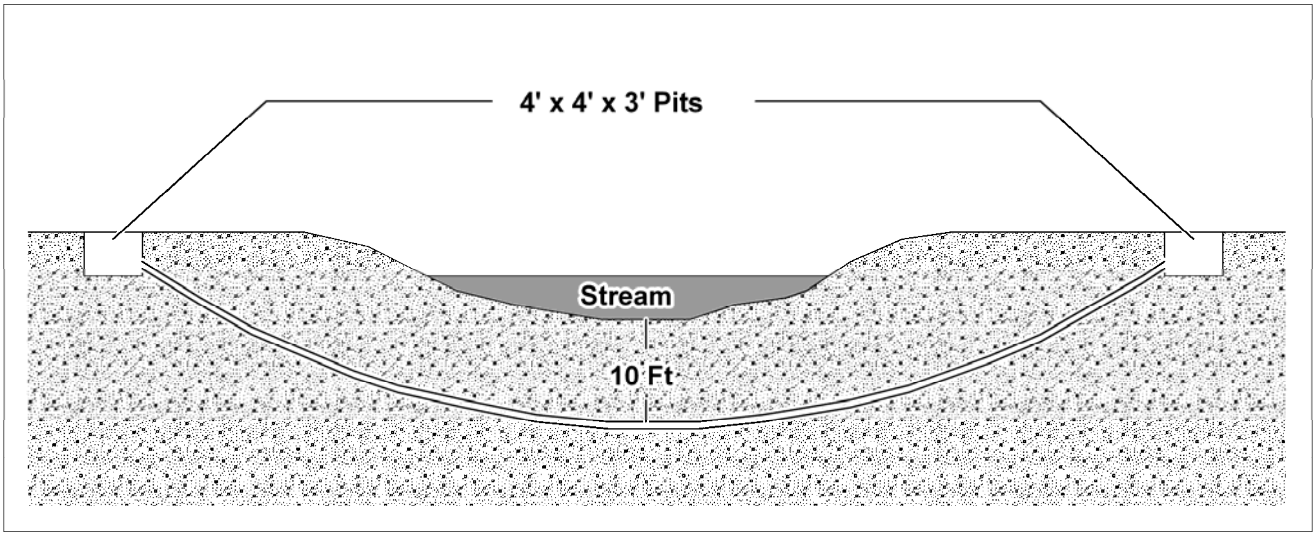
Table 4-4 Surface waters crossed by Forward project facilities

Surface Water	Location			Location Where Crossing Would Occur
	Town	Range	Section	
Underground 34.5 kV collection system				
Kummel Creek	14N	16E	26	Between Turbines 7 and 8
Kummel Creek	14N	16E	36	Between Turbines 88 and 89
Kummel Creek	14N	17E	31	Between Turbines 114 and 115
Kummel Creek	14N	17E	31	Between Turbine 87 and eastern Transition Point
Kummel Creek	14N	17E	31	Between Turbines 87 and 161
Kummel Creek	14N	17E	28, 33	Between Turbines 78 and 80
Kummel Creek	14N	17E	32, 33	Between Turbines 76 and 97
Gill Creek	13N	16E	11	Between Turbines 56 and 57
Gill Creek	13N	16E	14	Between Turbines 59 and 61
Above ground 34.5 kV collector line				
Kummel Creek	14N	16E	36	About ½ mile east of western transition point
Kummel Creek	14N	17E	32	About 1 mile east of eastern transition point
Kummel Creek	14N	17E	32, 33	Where overhead line angles from west to north, about 1 3/4 mile from eastern transition point
Access roads				
Kummel Creek	14N	16E	26	Access to Turbines 7, 5, and 4 from Breakneck Road
Kummel Creek	14N	16E	25	Access to Turbines 13 and 15 from CTH YY
Kummel Creek	14N	16E	36	Access to Turbine 89 from Turbine 88 and overhead 34.5 kV line ROW, and perhaps Mill Pond Road
Kummel Creek	14N	17E	31	Access to Turbine 87 from CTH Y
Gill Creek	13N	16E	11	Access to Turbine 56 from Zangl Road
Gill Creek	13N	16E	14	Access to Turbine 61 from CTH YY
Gill Creek	13N	16E	14	Access to Turbine 59 from Turbine 61 and CTH YY

Table 4-4 shows that, as proposed, the 34.5 kV underground collection system lines would cross Kummel Creek in seven places and Gill Creek in three places. These crossings would all be installed by direct underground boring once the crossing location was precisely established. A directional bore would be done by excavating a pit on each side of the stream at the crossing and drilling beneath the stream from one pit to the other. The dimensions of a typical pit would be four feet by four feet by three feet in depth. The depth of the bore would be 10 feet below the stream bottom. A typical boring beneath a stream is illustrated in Figure 4-1.

Sedimentation from construction disturbance at and between the tower sites would not likely be a significant problem if an appropriate construction storm water and erosion control plan was effectively followed. Forward has indicated that it would prepare a Stormwater Pollution Prevention Plan (SWPPP) for the project, to reduce the discharge of pollutants in stormwater runoff and prevent further degradation of the streams. During construction of deep anchored towers, dewatering of the foundation hole might be necessary. Appropriate disposal of this water would be needed to avoid sediment transport to surface waters or wetlands.

Figure 4-1 Diagram of typical directional bore under a stream for an underground power line



The 34.5 kV overhead line would cross Kummel Creek in three places. Power line poles would not be placed in Kummel Creek. The company has also indicated that no vehicles or other equipment would be moved through the creek or on its banks. Therefore, adverse impacts to the creek would not be expected.

4.4.1.3 Wetlands

The Wisconsin Wetland Inventory database shows that there are approximately 495 acres of wetlands in the project area. The Forward project has been designed to avoid area wetlands as much as possible. Effects of the turbines on wetland vegetation or wildlife are discussed in later sections in this chapter, Sections 4.7 through 4.12. This section addresses potential direct construction impacts on wetlands in the project area.

The nearest wetlands to any turbine locations or collection system or access road routes are shown in Figure Vol. 2-3. These wetlands are:

- A small isolated wetland north of Turbines 3 and 5 in Section 26 of the town of Oakfield in Fond du Lac County.
- A larger wetland west of Turbines 8 and 11 that spans Breakneck Road in Sections 26 and 35 of the town of Oakfield in Fond du Lac County.
- A smaller wetland south of the eastern junction-riser station and CTH Y in Section 31 of the town of Byron in Fond du Lac County.

- A very small wetland, about 100 feet by 300 feet, associated with the Grande Cheese Company in Section 12 of the town of LeRoy in Dodge County. This wetland would be crossed by the collection system cables between Turbines 139 and 28. The wetland appears to be an artifact of the cheese company's design or operation.
- A wetland around Gill Creek between Turbines 56 and 57, which would be crossed by the collection system, and smaller patches west of those turbines, in Section 11 of the town of LeRoy in Dodge County.
- Downstream from Turbines 57 and 52 along Gill Creek in Section 13 of the town of LeRoy in Dodge County. This wetland is midway between two sets of turbines; the other set is Turbines 55, 145, and 54 to the east in the same section.

All, except for the small wetland on the Grande Cheese property, are generally separated from turbines by farm fields. (It should be kept in mind that the underground 34.5 collection systems shown in Figure Vol. 2-3 would not necessarily be installed in straight lines as depicted, or even follow the exact route shown. The collection system routes would be determined as the project developed if it is approved, with the most acceptable routes being negotiated with the hosting landowners.)

Farther to the south, there are additional wetlands along Gill Creek in the town of LeRoy. Some are within a half mile of turbine sites in Sections 13 and 14, and some are farther downstream in Section 24, beyond the southernmost turbine sites. All of the Gill Creek wetlands except the one between Turbines 57 and 52 are separated from turbine sites by cropped fields.

There are also wetlands along Kummel Creek north of Brownsville, about 0.5 mile west of turbine sites in the town of Lomira in Dodge County, and more extensive wetlands south of Brownsville along the creek, within 0.75 to 0.5 mile of turbine sites in Sections 9 and 16.

A larger wetland in Fond du Lac County, north of the project area, is associated with Campground Creek, which feeds the Upper Fox River system to the north (see Table 4-3 and Section 4.4.1.1). Tributaries of this stream and its associated wetland flow northward from near the northern-most proposed turbine sites and some of the collection system lines. They are generally separated from turbines by farm fields. However, collection systems between Turbines 9 and 113 and between Turbines 108 and 116 would be very close to the headwaters of unnamed tributaries to Campground Creek and its wetlands. The access road projected for Turbine 116 in Section 24 of the town of Oakfield would be routed adjacent to a wooded stream path that is a tributary to the same system. At these locations, it would be important to control soil erosion adequately during project construction.

The largest and most important wetland for consideration in evaluating the impacts of the Forward project would be the Horicon Marsh, west of the project area. Effects on the Marsh are also discussed above in the section on streams and surface waters. Potential impacts to the birds that use the Marsh are discussed in Sections 4.7, 4.8, and 4.11, later in this chapter. Horicon Marsh would not be directly affected by the construction of any turbines, collection system facilities, or access roads. However, if soil erosion or construction spills are not controlled adequately, it is possible that sediment, nutrients, or contaminants could enter the Marsh by way of connecting tributary streams. Forward intends to control the effects of soil erosion and construction spills by using construction industry BMPs.

4.4.2 Groundwater

4.4.2.1 Existing environment

In Fond du Lac County, the depth to bedrock in the project area varies from less than five feet to greater than 75 feet. The average depth listed on well construction reports is about 18 feet. The depth to the seasonal high water table ranges from about five feet to about one foot at discharge areas along streams, to over 100 feet below ground surface on hills. In January 2005, soil borings at some Fond du Lac County locations found that bedrock was present at about 11 to 14 feet, but groundwater was not encountered. In general, the groundwater appears to flow in a southwesterly direction, but there is local variation.

In Dodge County, in the project area, the depth to bedrock appears to be over five feet, and the average depth of the water table as reported on well construction reports is over 50 feet. In general, as in Fond du Lac County, the groundwater appears to flow southwesterly, but with local variation.

The DNR has special well casing requirements in some nearby areas. Within the Forward project area, for example, there are well casing requirements in parts of the town of LeRoy, where the casing must be installed to the base of the Maquoketa Shale layer (see Section 4.1.1).

4.4.2.2 Potential impacts

Because of the karst geology of the area, there would be a potential for creating numerous conduits for surface water to enter the fractured bedrock and contaminate local aquifers during construction of many of the proposed turbines. There is also a potential for groundwater contamination from fuel spills after incidental cracking of bedrock. Potential impacts to bedrock and proposed methods of minimizing bedrock impacts are also discussed in Section 4.1, "Geology."

Construction of the turbines would pose some risks to local aquifers. The primary risk would not necessarily be the risk of fracturing bedrock during tower base excavation or anchor bolt installation. More likely, it would be related to existing fractures that were exposed by the excavation. Karst features are known to exist in several places in the Forward project area. A number of proposed turbine sites are located in regions of known karst features. Before construction could begin in or near these places, planning would have to take into account the possibility of a crack being exposed. If a large rainfall occurs over an open crack, the rainwater could move through the crack to a well located at a considerable distance, in a short period of time.

If excavation reveals fractures or cracks in the bedrock, the cracks could be covered with landscape fabric or similar materials, and berms could be built to divert rainwater away from them. These practices could help Forward avoid the potential for water to be channeled into the exposed bedrock.

The same concerns would arise when wind turbine towers were removed. To prevent or minimize impacts on groundwater, Forward would have to seal the foundation sites and divert surface water away from the sites after the tower foundations were removed. Concerns related to groundwater contamination were expressed at public meetings and in comments on the draft EIS. The ultimate concern relates to well contamination or failure, which could result in great inconveniences and expense for landowners.

Forward has indicated that, regardless of existing features in the bedrock, it does not expect its construction activities to increase the risk of surface water or run-off causing contamination of private drinking water wells. Forward maintains that there is no legitimate reason to provide financial protection to well owners.

Following is a description of Forward's pre-construction plan and process to avoid groundwater contamination:

Many well construction reports from the area indicate "broken lime rock" for the first 5-10 feet before competent rock is encountered. To determine the extent of fractures in the bedrock prior to the beginning of construction, Forward is proposing that rock cores be obtained at each turbine site where the foundation may extend into bedrock. The core would establish the existing condition of the rock and help determine the best method for minimizing mechanical fractures during installation of the foundation and rock anchors. Forward would likely core the rock with a method ("NX size core barrel using potable water") that typically provides good quality cores without inducing mechanical fractures. If a rock quality determination (RQD) indicates sound, competent rock, general construction techniques would be applied. If the RQD shows moderate to poor condition rock, special techniques (such as the air rotary with a tricone bit) would be used to minimize the fractures. Forward would also consider using fast setting cements, epoxies, and friction anchors for fastening the bolts to the rock; it would need to work with the DNR to determine the appropriate materials. Soil borings would be filled with 3/8-inch bentonite chips. No additives would be used.

Excavations would be designed for a particular depth and, if the bedrock were weathered and broken into cobble-sized pieces and gravel, the weathered bedrock would be removed and the footings of the structure would be placed on a recompacted gravel pad leveled directly on the solid bedrock. There would be no drilling, blasting, or hammering on the bedrock.[12] Once installation was complete, the foundation would be backfilled with native soil and compacted so that it was elevated and less permeable than the surface soils of the surrounding farm fields. Thus, rain water would run away from the structure and into the fields before percolating. Berms and plastic sheeting might be used during the construction process to reinforce this. These techniques are among the BMPs discussed to avoid the potential impacts related to well failure or contamination.

Precautions would also be taken by Forward to avoid fuel spillage during construction.

Members of the public have also expressed concern about the underground cabling that would connect the turbines and its effects on local bedrock and groundwater (see Section 6.5.2 on cabling installation and impacts). Forward has responded that the underground cable would not be installed in bedrock. If possible, any weathered bedrock would be removed, and the cable would be placed on a gravel base in a utility trench with recompacted natural soils placed above it to limit the infiltration of surface water. Cabling would be designed to be placed at or above the depth of competent bedrock. There would be no blasting or hammering.

If a situation occurs where bedrock is in the path of the cable and, for safety reasons, the cable must be placed below the surface of competent bedrock, a trench for the cable would be cut with a rotary saw to minimize the risk of fracturing the bedrock, which would likely be limestone. The cable would be laid within the trench cut, and the trench cut would be backfilled with bentonite or a bentonite slurry mixture. The remaining soil portion of the trench would be backfilled with compacted natural soils as described above.

[12] In Dodge County blasting is prohibited without notification of property owners within 1,500 ft, according to its ordinance and the CUP issued to Forward. It may be prohibited in the CUPs from the towns of Oakfield and Byron as well.

4.4.3 Avoidance of water consumption and thermal pollution

A positive aspect of the proposed wind project is that it would provide power without the consumption of water. Since the Forward project would not use water for steam production or cooling purposes, no cooling tower evaporation or operational wastewater discharge would occur. Thus, impacts to water resources in Wisconsin would be avoided to the extent that the Forward wind project provides electricity that would otherwise be generated by combustion of fossil fuels.

For comparison, the water consumption rates for two power plants recently approved in Wisconsin (the WPSC Weston 4 Generating Plant[13] and the Fox Energy combined-cycle plant[14]) are discussed below. (The Port Washington natural gas-fired plant[15] was approved after the Fox Energy plant, but it will use once-through cooling, with water drawn from Lake Michigan and discharged back into the lake at a slightly higher temperature, rather a consumptive water cooling method.) The Weston 4 coal plant and the Fox Energy natural gas-fired plant withdraw water from a surface water body and use evaporative cooling towers rather than discharging the water back to the water body. In each case, the water consumption is typical for any power plant in the state that burns fossil fuel.

The energy purchased from Forward would not need to be produced by another utility source. In many cases, the other utility source would be an intermediate-load, cycling plant, that likely would be a coal-fired plant with lower efficiency than that of Weston 4 or Fox Energy.

With the wind turbines in operation, Forward is planning to offer 200 MW at a 32 percent capacity factor. Thus, annually, the amount of electricity available that would require no water consumption would be:

(200 MW) x (8,760 hours per year) x (32 percent[16]) = 560,640 MWh per year

In contrast, 560,640 MWh per year from the new Weston 4 coal plant would require the consumption of 310,050,000 gallons of water per year drawn from the Wisconsin River and mostly evaporated into the atmosphere as part of the cooling process. For natural gas, 560,640 MWh of electricity from the new Fox Energy combined-cycle plant would require the consumption of 376,680,000 gallons of water per year, drawn from the Heart of the Valley Metropolitan Sewage District treatment plant and evaporated into the atmosphere. Small amounts of wastewater discharge would go into the Wisconsin River and the Fox River. The water consumption required by these two plants operating at a similar level of power output as the Forward project provides a rough idea of the amount of water consumption avoided by utilizing the power produced by Forward.

Water use for the Port Washington power plant, while not consumptive in the same manner, would require the cycling (withdrawal, warming, and discharge) of 47.8 billion gallons of water per year for cooling purposes. While the cycled water is not "lost" from the water body, the warm water discharge can result in thermal pollution that impacts fish and aquatic invertebrates.

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[13] Described in the Final Environmental Impact Statement for the WPSC Weston Unit 4 Power Plant, Public Service Commission of Wisconsin and Wisconsin Department of Natural Resources, July 2004.
[14] Described in the Fox Energy Generation Project Final Environmental Impact Statement, Public Service Commission of Wisconsin and Wisconsin Department of Natural Resources, August 2002.
[15] Described in the Environmental Assessment for the WEPCO Port Washington Generating Station, Public Service Commission of Wisconsin, March 2004.
[16] Forward's predicted capacity factor.

Forward expects to operate the turbines for 30 years, providing 560,640 MW each year that would not require the consumption of, or thermal pollution into, any state surface or ground waters.

4.5 AIR QUALITY AND SOLID WASTE

This section focuses on four aspects of potential air quality impacts.

- The avoidance of air pollution emissions from an operating wind energy plant.
- The existing air environment.
- The potential for air quality impacts during construction.
- The potential for air turbulence in the wake of the turbine rotors which, while not a pollution issue, is of concern in terms of the physical effects of the movement of the air around the turbines.

This section also describes the solid waste that would be avoided by an operating wind energy plant.

4.5.1 Air emissions avoided by using wind energy

The physical impacts of the Forward wind project are expected to be fairly localized. This is in contrast to some impacts of coal or natural gas-fired power plants, which are more regional or possibly global in scale. Air quality impacts, for example, have a much wider area of effect. Adverse air quality impacts would be avoided to the extent that the Forward wind project provides electricity that would otherwise be generated by combustion of fossil fuels.

The proposed wind project would generate electric power from turbines moved by naturally-blowing wind. It would supply electric demand without the added air pollutants associated with power generated by burning fossil fuels. More common coal-fired, oil-fired, or natural gas-fired generators use combustion to drive turbine-generators with either hot air or steam, producing air pollutant emissions that have adverse impacts on health, welfare, and the environment. In addition, coal (or other solid fuel) handling requires particulate controls. Liquid and gaseous fuels also can vaporize and escape into the surrounding air. For the proposed Forward project, all of these impact risks would be avoided.

Federal and state laws exist to reduce air pollution to levels that research has shown would protect the majority of individuals and reduce overall impacts to ecosystems. The implementation of these laws begins with the setting of air quality standards, which can be used to describe the existing air environment in the project area. The EPA currently sets National Ambient Air Quality Standards (NAAQS) to regulate the emissions of six "criteria" air pollutants:

- carbon monoxide (CO)
- nitrogen oxide (NO_2)
- ozone (O_3)
- lead (Pb)
- particulates (PM_{10} and $PM_{2.5}$)
- sulfur dioxide (SO_2)

CO, NO_2, and SO_2 are common products of combustion of fossil fuels, such as coal. Pb was commonly a product of combustion of gasoline in vehicles before its use as a gasoline additive was discontinued. Particulates can be emitted by combustion, created by chemical processes in the atmosphere after emission and, in coarser forms, as dust stirred up during the construction process. SO_2 and nitrogen oxides (NO_x) can combine to form fine particulates. They can also combine with moisture in the atmosphere and return to the earth as acid precipitation. NO_x and volatile organic compounds (VOC) can combine in sunlight to form ozone (O_3).

In addition, fossil fuel combustion processes can emit pollutants classified as "hazardous air pollutants" (HAPs) such as inorganic solids (like arsenic), inorganic acid-gases (like hydrochloric acid), organic compounds (like formaldehyde), or metallic compounds (like compounds of mercury). They also emit "greenhouse gases" (GHGs), such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), which contribute to global warming and climate change. Methane is also a component of natural gas, which can be released in the course of production, transport, and use of that compound.

Except for dust, due to earth moving and emissions from diesel-powered construction equipment, these various pollution emissions would not occur in the Forward wind energy project.

For comparison, one could examine the air pollutant emissions for natural gas and coal-fired plants in the state. As discussed in Section 4.4, the most advanced coal and natural gas technologies that have been approved in Wisconsin to date are: 1) the supercritical pulverized coal plant approved for the WPSC Weston Generating Plant,[17] and 2) the natural gas-fired combined cycle plant approved for the WEPCO Port Washington plant.[18] In each case, the air pollutant emissions would be as low as for any power plant in Wisconsin that burns coal or natural gas. If a utility were to purchase energy from Forward, that amount of energy would not need to be produced by another utility source. In many cases, the other utility source would be an intermediate, cycling plant, coal-fired and operating at a lower efficiency than those at Weston 4 or Port Washington.

As described in Section 4.4.3 above, Forward is planning to produce 560,640 MWh per year for 30 years. In comparison, 560,640 MWh per year from the new Weston 4 coal plant or the new Port Washington combined-cycle plant would result in the air pollutant emissions shown in Table 4-4b. The air pollutants emitted by these two plants at a similar level of power output as the Forward project provides a rough idea of the amount of air pollutant emissions avoided by utilizing the power produced by Forward.[19]

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[17] Described in the Final Environmental Impact Statement for the WPSC Weston Unit 4 Power Plant, Public Service Commission of Wisconsin and Wisconsin Department of Natural Resources, July 2004.
[18] Described in Port Washington Generation Project Environmental Assessment, Public Service Commission of Wisconsin, March 2004
[19] The comparison is made using 15 percent of the output of Weston Unit 4 and 34 percent of the output of Port Washington. This translates into 15 and 34 percent of their air pollutant emissions. Weston Unit 4 is rated at about 500 MW with an 85 percent capacity factor, and Port Washington is rated at 545 MW with a 35 percent capacity factor.

Table 4-4b Contrast of potential annual emissions in tons per year (tpy) for 560,640 MWh produced by the Weston Unit 4 coal plant, the Port Washington combined-cycle plant, and the proposed Forward project

Pollutant	Weston 4[20]	Port Washington[21]	Forward Wind
PM_{10}	529.2	98.3	0
CO	3,421	147.4	0
NO_x	1,613	130.0	0
SO_2	2,266	3.74	0
Total Suspended Particulates (TSP)	535	**	0
VOC	85.0	13.8	0
Lead (Pb)	0.59	**	0
H_2SO_4	113.3	5.7	0
Mercury (Hg)	0.039	**	0
Beryllium (Be)	0.029	**	0

** Not a notable amount

In addition, there would be a few hazardous air pollutants or toxics, such as benzene, arsenic, and cyanide that would be emitted by coal-fired or natural gas plants. These emissions would not occur from operation of the Forward project.

Concerns about global climate change have focused an interest on the emission of greenhouse gases. Greenhouse gases in the atmosphere trap heat and help keep the planet warm enough for life to survive. Some scientists conclude that increasing greenhouse gas concentrations are contributing to global warming and climate changes that will have catastrophic effects on many forms of life. CO_2 is the major component of "greenhouse gas," and the combustion of fossil fuels contributes a substantial amount of CO_2 to the atmosphere. For comparison purposes, the output from the new Weston 4 Unit that would be equivalent to the Forward project would be expected to produce about 615,000 tons of CO_2 per year. The equivalent output from a new unit of the Port Washington plant would be expected to produce about 231,200 tons of CO_2 per year. Operation of the Forward project would not produce any CO_2 emissions at all.

4.5.2 Existing air environment

The existing air environment in the region of the project is documented in monitoring and emissions data from the DNR air management offices and through the "attainment" status of the counties in the project area, namely Fond du Lac and Dodge Counties.

Dodge County and Fond du Lac County are both currently classified as in "attainment" for all the criteria pollutant NAAQS. "Attainment" means that the levels of the criteria pollutants in the local atmosphere are below the EPA's standard levels. In the context of federal "Clean Air" laws, the air in the proposed project area is considered relatively clean. As of December 2004, no "Potential for Significant Deterioration" study baselines for PM_{10}, NO_x, or SO_2 have been set for Dodge County. In Fond du Lac County, baselines were set for PM_{10}, NO_x, and SO_2, in March 1991, as a result of the

[20] Weston EIS, Table 6-5, page 134
[21] Port Washington EA, page 26

construction of the natural gas-fired South Fond du Lac combustion turbine power plant owned by WP&L.

In an attainment area, the term "major" means "emission of any air contaminant at a rate equal to or greater than 100 tons per year." DNR has indicated that there are no "major" air pollutant sources in Fond du Lac County. In Dodge County, Quad Graphics, Incorporated (Quad Graphics), at the eastern edge of the proposed Forward project area, is classified as a major source for "Reactive Organic Gases" (ROG). While some ROGs may contribute to the creation of O_3, Dodge County remains an attainment area.

Regarding hazardous air pollutants (HAPs) in an attainment area, a major source of HAPs would be defined as an emitter of any individual HAP at greater than or equal to 10 tons per year or any combination of emitted HAPs that are greater than or equal to 25 tons per year. There are no significant sources of HAPs in Fond du Lac County. In Dodge County, Quad Graphics surpasses the individual federal HAP threshold and is considered a major source for emissions of toluene and methyl ethyl ketone. However, the levels of these two compounds in the air raise no particular air quality concern in the county.

4.5.3 Potential impacts from construction activities

Because the two counties are in attainment, there are no special DNR air pollution restrictions that would be imposed for construction of the Forward project.

During project construction, air emissions resulting from site preparation activities could include fugitive dust generated by construction equipment moving over the ground, wind-blown fugitive dust, and fuel combustion emissions of trucks and construction equipment. Particulates would likely constitute the majority of the air emissions during the construction phase. Most of the total suspended particulates would be fugitive dust emissions from grading activities and from excavation, hauling, loading, and dumping of soil or rock material. Minor emissions of SO_2, NO_x, and CO would come from mobile equipment exhausts. Fugitive dust emissions during project construction would be regulated under Wis. Admin. Code § DNR 415.04.

The company has indicated that dust from construction activities and truck traffic would be controlled using standard construction practices like watering of exposed surfaces, covering of disturbed areas, or reduced speed limits on the site. It anticipates that emissions during the construction phase would be generally limited to the project area and would be similar to the construction of other kinds of business structures, such as office buildings. The project "area" includes many individual turbine construction "sites" where construction dust impacts of this kind would occur.

After construction was completed and operations began, the fugitive dust related to vehicular traffic would be reduced because all traffic between turbines would be along graveled access roads, and traffic would only consist of routine maintenance and repairs.

4.5.4 Odors

Except for isolated smells of diesel exhaust from construction equipment or trucks, no objectionable odors are expected as a result of construction or operation.

4.5.5 Solid waste

The project is not expected to generate solid waste from the electricity production process. The Forward project would avoid the impacts of ash and flue gas desulfurization ("scrubber") waste production that coal-fired plants produce. It would also avoid the smaller amounts of solid waste produced at natural gas-fired plants as part of the water intake purification processes.

As in Sections 4.4 and 4.5, contrasts might best be illustrated using the recently approved Weston Unit 4 coal-fired power plant. The generation by Weston Unit 4 equivalent to the MWh produced by the Forward project (see Section 4.4.3, "Water Consumption") would be expected to result in about 2,956.5 tons of bottom ash per year. It would also result in about 16,381.2 tons of fly ash, plus scrubber waste. While the bottom ash is reusable and marketable, the fly ash/scrubber waste mix has no current re-use potential and must be landfilled. In contrast, operation of the Forward turbines would produce no ash of any kind and would require no scrubbers or landfill space.

There would be office waste and some maintenance waste that would be transported and disposed of by a licensed waste hauler.

After construction, Forward has indicated that cleanup and restoration procedures would be initiated as soon as possible. Any remaining trash or debris would be properly handled and removed. Final cleanup would likely involve a series of steps, including off-site waste material disposal and equipment removal.

4.6 CULTURAL RESOURCES

4.6.1 Protection of archeological or historic sites listed by the state

In accordance with Wis. Stat. § 44.40, the Wisconsin Archaeological and Historic Resources Database (WisAHRD) of the Wisconsin Historical Society (WHS) has been reviewed to determine if there is a potential for the project to affect known and listed archeological, historic, or cultural places.

Several listed archeological resources are located in the Forward project area. Of those listed for the area, three archeological sites, two in Fond du Lac County and one in Dodge County, could potentially be affected by installation of the project facilities, particularly by the underground electricity collection cables between certain turbine towers. The listed sites are: an Early Woodland campsite/village site; an Unknown Prehistoric campsite/village site; and an Unknown Prehistoric petroform, or arrangement of stones.

All three of the above-noted sites have been determined, by the WHS, to be important and must be protected. It is likely that a qualified archeologist would need to be involved to locate the outer boundaries of the listed sites so that the paths selected for the underground collection cables in the vicinity are routed to avoid the sites.

4.6.2 Protection related to federal law and Wisconsin Indian tribes

If the project included a federal permit, grant, or loan, Section 106 of the National Historic Preservation Act would apply, and the company would need to work with the federal agency involved to examine the project area for archeological or historic resources, determine the eligibility of the resource for the National Register of Historic Places, and make an agreement on how to avoid or mitigate impacts. There is no such federal interest for this particular project.

The project application also included consultation letters to the federal Bureau of Indian Affairs (BIA) Midwest Regional Office and to federally recognized American Indian Tribes and Tribal Historic Preservation Offices (THPOs) in Wisconsin to determine the potential effect of the proposed project on Native American tribes or reservations. No tribes or THPOs indicated that the project would have any impact on known or potential Native American archeological or cultural sites.

4.6.3 Potential construction impacts

The absence of historic resources in a particular area does not necessarily mean that no historic or archeological materials are present. It is possible that the area in which the proposed project would be located has not been systematically surveyed for archeological or historic resources. It is also possible that the WisAHRD database search failed to retrieve all records associated with the area. Archeological materials could be encountered during construction.

If archeological or historic material was encountered during the construction of any part of this project, construction would have to stop and the applicant would have to consult the WHS for direction. All construction of the wind turbines and associated facilities (buried cables, roads, transformer pads, overhead line poles, and substation) near the archeological material encountered, would have to stop until a resolution was reached with the WHS.

Forward has stated its intention to develop an "Unanticipated Finds Plan" that would be kept onsite during construction activities and that would include contact information for individuals in the preservation and burials offices at the WHS. If unanticipated archaeological or cultural resources were discovered during construction of the project, Forward states that it would stop work immediately and contact the WHS for further direction.

4.7 REGIONAL ENVIRONMENTAL RESOURCES

The project area is primarily uplands that is intensively used for agricultural purposes. While it contains a few navigable waterways, wetlands and remnant forest patches, the region surrounding the Forward project area supports numerous unique and protected land features, including a diverse array of high-quality habitats (Figure Vol. 2-4). Other lands have been identified by state and federal programs for bird habitat restoration and protection. The convergence of these habitats in one region attracts large quantities of wildlife, both common and unique. Tables 4-5 and 4-6 list the significant state and federal properties in the region and their approximate distance from the nearest proposed Forward wind turbines.

Table 4-5 State natural resources in project region

DNR State Properties	Township	County	Size (acres)	Approx. Distance and Direction from Nearest Proposed Turbine
Horicon Marsh State Wildlife Area	Burnett, Williamstown	Dodge	11,091	4 miles southwest
Fourmile and Cotton Island Rookeries	Williamstown	Dodge	15	6.5 miles southwest
Oakfield Ledge	Oakfield	Fond du Lac	208	.25 miles northwest
Mayville Ledge State Natural Area and Rookery	Williamstown, Hubbard	Dodge	60	8.5 miles south
Neda Mine State Natural Area Bat Hibernaculum	Hubbard	Dodge	N/A	10.5 miles south
Theresa State Wildlife Area	Lomira, Theresa, Wayne, Addison	Dodge	5,499	3.5 miles southeast
Eldorado State Wildlife Area	Eldorado, Lamartine	Fond du Lac	6,371	8.5 miles north
Mullet Creek State Wildlife Area	Forest	Fond du Lac	2,177	14 miles northeast
Kettle Moraine State Forest	various	Dodge, Fond du Lac	221	12 miles east
Other DNR-Managed Properties* w/in 10 miles of Project Boundary	various	Dodge, Fond du Lac	Approx. 4,390	<10 miles

* Other DNR-managed areas include Fisheries Management, Natural Areas, and Park

Table 4-6 Federal natural resources in project region

Federal Properties	Township	County	size (acres)	Approx. Distance and Direction from Nearest Proposed Turbine
Horicon National Wildlife Refuge	Chester, Burnett, LeRoy, Oakfield, Waupun	Dodge, Fond du Lac	21,417	1.5 miles west
Breakneck, 2 parcels (Waterfowl Production Area)	Oakfield	Fond du Lac	238	1 mile northwest
Oakfield (Waterfowl Production Area)	Oakfield	Fond du Lac	314	3 miles northwest
Lamartine (Waterfowl Production Area)	Lamartine	Fond du Lac	204	5 miles northwest
Pieper (Waterfowl Production Area)	Burnett	Dodge	81	7.5 miles southwest
Trenton (Waterfowl Production Area)	Trenton	Dodge	374	10 miles west
Robbins Shorebirds (Waterfowl Production Area)	Trenton	Dodge	123	13 miles southwest

Directly west of the Forward project area is the Niagara Escarpment. This rock ledge is part of a huge geographic feature that extends across much of eastern North America. It is an important geologic, ecologic, historic, economic, cultural, and recreational resource for Wisconsin. In the project region, the top of the Escarpment rises approximately 300 feet above the lowlands to the west and hugs the eastern edge of Horicon Marsh (see Section 4.1, "Geology"). Within the Escarpment are the Oakfield Ledge along the northwest edge of the project boundary, and the Mayville Ledge and the Neda Mine, to the south. These portions of the Escarpment are known to harbor many rare species and important natural communities found in few places elsewhere in the world. Red cedar trees that are only eight inches in diameter but almost 300 years old have been recovered from the ledge. Nine snail species, which were thought to have disappeared from northeastern Wisconsin at the end of the last Ice Age, have been found living on the shaded Niagara Escarpment cliffs and talus slopes. These snails live in perhaps as few as 50 other sites on earth. The abandoned Neda Mine has become home to more than 100,000 hibernating bats and is a summer roost for migrating bats (see Section 4.12, "Bat Resources").

The Forward project area lies between Horicon Marsh to the west and Theresa Marsh to the east. These low lying areas and adjacent uplands support large bird populations. The Horicon Marsh has been recognized internationally as an "Important Bird Area." The Important Bird Areas program is a global initiative to protect essential habitat for all birds. In 1991, the Horicon Marsh was dedicated as a "Wetland of International Importance" under the Ramsar Convention of the United Nations. Horicon Marsh is one of only 21 sites designated as such in the U.S. These designations indicate the international resolve to protect the birds and their habitat. The Horicon Marsh at the headwaters of the Rock River is 14 miles long and three to five miles wide. At 32,000 acres (50 square miles), it is the largest freshwater cattail marsh in the U.S. The northern two-thirds of the Marsh are managed by the USFWS (Horicon National Wildlife Refuge). DNR manages the remaining acres (Horicon Marsh State Wildlife Area).

Up to 200,000 Canada geese gather on the Marsh on a peak day in fall and approximately one million migrate through the area during the entire fall season. Horicon Marsh provides critical habitat for ducks, cranes, egrets, herons, marsh birds, and shorebirds as well as several endangered and threatened species. Some 267 species of birds have been sighted using the Marsh, many of which use the surrounding uplands for feeding and migratory rest stops. More redhead ducks nest there than anywhere else east of the Mississippi River. The rookeries in the region support large colonies of great blue herons, great egrets, black-crowned night herons, and double-crested cormorants. The most notable of the rookeries is the Fourmile and Cotton Island rookery in Horicon Marsh. There are three established rookeries within seven miles of the project area.

Surrounding the Horicon Marsh are smaller parcels of federally-protected Waterfowl Production Areas (WPAs) and state-protected Glacial Habitat Restoration Areas (GHRAs). They are part of 530,000 acres designated by DNR in Columbia, Dodge, Fond du Lac, and Winnebago Counties for the establishment of restored wetlands and native grass prairies. Combined with croplands, these areas provide all of the elements necessary for the proliferation of waterfowl, wild pheasants, and non-game songbirds. The project boundary for the GHRA program includes the western half of the Forward project area and extends north and west of Horicon Marsh.

Several land features provide migratory corridors in and out of the Horicon Marsh for a variety of birds. Important water bodies and marshes include Lake Winnebago (approx. 9 miles north), Eldorado State Wildlife Area (approx. 8 miles north), Mullet Creek State Wildlife Area (approx. 14 miles northeast), Beaver Dam Lake (approx. 13.5 miles southwest), Green Lake (approx. 21 miles northwest), Fox Lake (approx. 16 miles west), Rush Lake (approx. 21 miles northwest), Rock River and Sinissippi Lake complex (approx. 12 miles south), and finally Lake Michigan (approx. 33 miles east). These water bodies, in addition to the 221 acres of Kettle Moraine State Forest (approx. 11.5 miles east), provide significant habitat for bird stopovers and birds migrating through the area (Figures Vol. 2-4 and 2-5).

The habitat resources and wildlife this region supports are unique in the Midwest. It is the combination of geology, hydrology, and vegetation that attracts the large numbers of resident and migrating birds, in addition to providing habitat for endangered and threatened species. The project area is located in the midst of this landscape.

4.8 THREATENED OR ENDANGERED SPECIES, AND SPECIES OF SPECIAL CONCERN

The proposed Forward project area is primarily agricultural with small remnants of forest, and a few creeks with emergent vegetation. Along the northwest edge of the project area boundary is a portion of the Niagara Escarpment that provides very specific habitat for several protected species. A review of the DNR Natural History Inventory (NHI) indicates that six snails and one protected plant have been observed in this selective environment. The only endangered species was the Midwest Pleistocene vertigo (*Vertigo hubrichti*), a snail. The remaining snails are listed as species of special concern and include the thin-lipped vallonia (*Vallonia perspective*), Iowa Pleistocene vertigo (*Vertigo iowaensis*), honey vertigo (*Vertigo tridentate*), and the land snails *Catinella gelida* and *Succinea baker*. The rock whitlow grass (*Draba arabisans*) is a special concern plant that was documented in 2000.

These protected species prefer the cool limestone talus slopes and cliffs of the Niagara Escarpment. Based on information in its application, Forward has not proposed constructing any turbines along the Niagara Escarpment cliffs. It is unlikely that the proposed project would have any impact on these species, provided no construction activities occur within 100 feet of the Escarpment and proper erosion control is implemented around any ground disturbing activities that are upslope from the Escarpment.

As part of its application, Forward conducted a bird survey during the spring and fall of 2004. During this survey, observations of several protected birds were recorded. Observations of a peregrine falcon (*Falco peregrinus)*, a state endangered species, and a red-shouldered hawk (*Buteo lineatus)* and a great egret (*Ardea alba*), both state threatened species, were documented. Also observed were eight species of special concern: the American wigeon (*Anas americana*), Bonaparte's gull (*Larus philadelphia*), bald eagle (*Haliaeetus leucocephalis*), great blue heron *(Ardea herodias*), northern goshawk (*Accipiter gentiles*), northern harrier (*Circus cyaneus*), pine siskin (*Carduelis pinus*), and the Tennessee warbler *(Vermivora peregrine*). In addition, the NHI database indicates that two additional protected birds have been observed in the nearby Horicon Marsh: the Forster's tern (*Sterna forsteri*), a state endangered species, and the black-crowned night heron (*Nycticorax nycticorax*), a state species of special concern.

After an absence of over 100 years, whooping cranes from the experimental flock established in Wisconsin have been observed foraging and flying over the project area. The re-establishment of the whooping crane is of international importance with a draft U.S./Canadian recovery plan completed in January 2005. Whooping cranes are discussed in detail in Section 4.11.3.2.

Although the project area does not provide significant habitat potential for the majority of these bird species, the project area's proximity to and its central location between such large, high-quality natural resource areas as the Horicon Marsh, the Theresa Marsh, and the Niagara Escarpment have attracted many protected species. More details regarding minimizing impacts to resident and migratory birds in the project area are discussed in subsequent sections of this EIS.

The DNR review for endangered resources included two additional plants, the prairie milkweed (*Asclepias sullivantii*) and the small white lady's slipper (*Cypripedium candidum*), both state threatened species, and the Blanchard's cricket frog (*Acris crepitans blanchardi*), a state endangered species. However, these plants and the frog were observed more than one mile from the project boundary and prefer habitats that are not present in the project area.

Additionally, two bat species of special concern have ranges that include the project area and use the Neda Mine (approximately 10 miles south of the project area) for hibernation. The two species are the northern long-eared bat (*Myotis septentrionalis*) and the eastern pipistrelle (*Pipistrellus subflavis*).

With the possible exception of potential impacts to birds (Section 4.11) and bats (Section 4.12), the applicant's analysis, as reviewed and verified by the state agencies, concludes that construction of the Forward project would not affect threatened or endangered species, or species of special concern.

4.9 VEGETATION

The project area consists primarily of tilled agricultural fields (corn, alfalfa, hay). Almost 97 percent of the project area is in agriculture (45 percent in pasture/hay, 51 percent row crops, and <1 percent small grains). The remainder of the project area consists of small tracts of recently tilled fallow fields, tree rows, forest patches, residential lawns with landscaped plantings, and emergent wetlands.

4.9.1. Existing vegetation

4.9.1.1. Woodlots

Scattered throughout the project area are small mature woodlots, the largest approximately 69 acres in size. Additionally, trees can be found along fence rows and along some streams. Species of trees found in the project area include oaks (*Quercus* spp.), hickory (*Carya* sp.), sugar maple (*Acer saccharum*), black cherry (*Prunus serotina*), box elder (*Acer negundo*), white ash (*Fraxinus americana*), aspen (*Populus* sp.), cottonwood (*Populus deltoides*), and some elms (*Ulmus* spp.). Willows (*Salix* spp.) are present in some low-lying areas around waterways. There are some small pine plantations with white pine (*Pinus strobus*), balsam fir (*Abies balsamea*) and spruce (*Picea* spp.). Smaller trees/woody shrubs in the project area include staghorn sumac (*Rhus typhina*) and red-osier dogwood (*Cornus stolonifera*). In residential areas, introduced landscape trees and shrubs can be observed.

4.9.1.2 Wetlands

Dodge and Fond du Lac Counties had extensive wetlands prior to European settlement. Stream straightening, ditching and field drainage have significantly reduced the wetland acreage in both counties. The existing wetlands in the project area are isolated pockets of wetlands located in low-lying areas and adjacent to streams which support primarily emergent vegetation. Many of these smaller wetlands are farmed during dry years. Reed canary grass (*Phalaris arundinacea*), a non-native invasive plant species, is dominant in many wetland areas. A detailed discussion of wetlands can be found in Section 4.4.

4.9.1.3. Grasslands

Several properties in the towns of Oakfield, Byron, and LeRoy are enrolled in state and federal programs designed to maintain and restore grasslands. The DNR GHRA promotes improvement of habitats for waterfowl, wild pheasants, and non-game songbird species. The goal of the USDA Conservation Reserve Program is to protect grasslands. Within the project area, approximately 280 acres of former crop land have been restored with native grasses and forbs.

4.9.2 Temporary construction impacts

The construction of the proposed turbine towers, electric cable collection system, substation, overhead 34.5 kV line, and gravel access roads would cause temporary and permanent impacts to agricultural properties. Property owners would be compensated for lost crop production. Lands temporarily disturbed by construction activities would be restored to their prior condition. Crop land compacted during construction would be decompacted. A more detailed discussion of agricultural impacts is found in Section 5.5.

Construction activities would consist of many small work sites. Each of the 133 turbine sites would have a laydown area and a crane pad. The crane pad is the area where the crane sits while assembling the wind turbine. The crane pad area would be cleared and graded for a radius of 130 feet with a compacted area of approximately 40 feet by 120 feet. In some instances, with permission of the property owner, the crane may travel across a field instead of along roads. The electric cable collection system that would connect the turbines would be installed using a trenching machine that would temporarily impact a path approximately eight feet wide. Where the collection system would cross waterways and wetlands, directional boring would require an additional 60 foot by 60 foot work space at both the entry and exit position of the bore.

The proposed project is not expected to impact any wetlands.

The spreading of oak wilt, a fungal disease of oaks in Wisconsin that usually results in tree death, is a concern if construction activities occur between April 15 and July 1. Oaks that sustain damage to limbs or roots during this time period are more susceptible to the disease.

Construction activities create the potential for introduction or spread of invasive species. Some invasive species of particular concern are wild parsnip (*Pastinaca sativa*), garlic mustard (*Alliaria petiolata*), purple loosestrife (*Lythrum salicaria*), buckthorn (*Rhamnus* sp.) and multiflora rose (*Rosa multiflora*). When construction moves from agricultural areas into areas adjacent to wetlands and woodlots, activities that might spread invasive plants should be avoided.

4.9.3 Permanent impacts

Approximately 50 to 90 acres of cropland, pasture, and fallow land would be permanently lost due to the proposed Forward project. Some trees may be lost due to turbine towers being located next to woodlots and routing of the collection system through fencerows. The proposed turbine sites located within or adjacent to woodlots which may require the removal of trees include turbines 7, 15, 23, 26, 37, 128, and 129. Additionally, Forward proposes a few access roads that pass through woodlots (between turbines 37 and 106, between 144 and Zangl Road, and between turbines 70 and 93). Approximately 6.25 acres of additional agricultural fields would be used for the substation and O&M building. The project is not expected to have significant impacts on existing woodlots, grasslands, or wetlands.

4.10 WILDLIFE (OTHER THAN BIRDS AND BATS)

The project area is primarily agricultural with small scattered woodlots that support a variety of common wildlife species. None of the habitat is so rare that it is critical to the continuation of the wildlife species present, with the exception of a portion of the Niagara Escarpment along the northwest boundary of the project area. This area provides unique habitat that supports several threatened and endangered species. However, no construction activities are proposed near this area.

Mammals that may be present in the majority of the project area include white-tailed deer, squirrels, rabbits, beavers, coyotes, foxes, raccoons, muskrats, skunks, opossums, woodchucks, mice, chipmunks, voles and other small mammals. Very little impact to wildlife, with the possible exception of birds and bats, is expected from the construction or operation of the proposed Forward project.

Because of the controversy regarding wind farms and their potential impacts to bird and bat populations, these species are discussed in detail in Sections 4.11 and 4.12, respectively. Threatened or endangered species, and species of special concern are discussed in Section 4.8.

4.11 BIRDS

4.11.1 Introduction

While wind power provides many environmental and social benefits, the potential for avian mortality and displacement from feeding and nesting habitat are major environmental concerns. Bird collisions with turbine blades and towers have been widely reported in this country and abroad. Avian mortality studies associated with wind turbines are ongoing in California and in other U.S. states, and in Europe. In the Midwest, mortality studies have been conducted in Minnesota, Illinois, Iowa, and Wisconsin. Mortality rates estimated from these studies vary, but are generally lower in the Midwest when compared to older installations in the west.

It is difficult to compare different types of studies from different types of wind farms. Different types, heights, and configurations of wind turbines may impact birds differently. Older, shorter turbines with higher rotation speeds, supported by guy wires or on metal lattice towers, appear to pose greater avian risks than newer turbines that are taller, have lower rotation speeds, and are supported on tubular towers. Bird impacts will also vary at different times of the year, from year to year, and in different locations due to meteorological factors that influence migration patterns, land use, and habitat resources. In addition, not all bird studies are designed with the same scientific rigor. These factors make it difficult to rely solely on the results from existing studies to predict the potential bird impacts from the Forward project.

A large part of the concern regarding the Forward project arises from its proximity to Horicon Marsh, which has been identified as a globally important bird area (Figure Vol. 2-4). In addition to Horicon Marsh, the project region contains various state and federal lands managed for the protection and proliferation of birds. This raises the question whether a wind farm that might cause bird mortality or bird avoidance is compatible with a region that provides habitat for rare birds and very high numbers of common birds. Agencies such as the USFWS and DNR, and groups such as the Friends of the Horicon National Wildlife Refuge, the Wisconsin Audubon Council, and the Citizens Natural Resources Association of Wisconsin have stated similar concerns.[22] Both the DNR and the USFWS have expressed support for properly sited and designed wind energy developments, but have concerns that the applicant has not adequately addressed potential impacts on birds in the project area in relation to Horicon Marsh.

[22] Comment letters by USFWS and DNR are included in Appendix B.

4.11.1.1 Sources of bird data for the project area

To determine the amount of risk associated with the proposed Forward project, the following sources of data were reviewed: the bird study submitted by Forward, Horicon Marsh Bird Club surveys, Christmas Bird Counts, migration data, waterfowl counts, endangered species surveys, May Day Counts, bird banding data, breeding bird surveys, marshland surveys, and consultation with expert state and federal ornithologists and wildlife managers. While the vast majority of the data on birds and bird use in this region of Wisconsin has focused on Horicon Marsh, many of the birds at Horicon Marsh utilize the surrounding uplands, including the project area, in their daily and seasonal activities. With the exception of the Forward bird survey, the only other study that has covered the project area was conducted by Howe and Atwater (1998) in 1996 and 1997. In addition to the Howe and Atwater study, bird studies conducted for other wind farms were reviewed (Table 4-7).

Table 4-7 Wind farms with major bird studies reviewed for this section

Wind Farm	Location	Number of Turbines	Height of Proposed Blade-Swept Areas (ft.)
Foot Creek Rim	Wyoming	69	62-203
Simpson Ridge	Wyoming	77	68-203
Stockbridge	Calumet County, Wisconsin	Not built	
Rosiere	Kewaunee County, Wisconsin	31	134-288
Buffalo Ridge	Minnesota	73 (phase I) 143 (phase II)	64-172 (phase I) 85-243 (phase II)
Mount Storm	West Virginia	Not built	
Top of Iowa	Worth County, Iowa	89	150-320
High Winds Energy Center	California	90	66-328

4.11.1.2 Factors affecting wind farm-caused avian mortality

Bird mortality rates at proposed wind farms can be related to the overall abundance of species that occur in the project area, the type and abundance of birds that spend time at altitudes that would bring them within the blade-swept area, and particular behaviors that might increase a species' chances for encountering turbine blades. Species that inhabit a project area in large numbers and for long periods of time may be more likely to be affected by the wind turbines. Rare bird species may not be frequent users of a project area but their population may be more sensitive to impacts if mortality numbers relate to a high percentage of the population. Some bird behaviors put a particular species at greater risk. For example, raptors focused on searching for prey may be more susceptible to striking or being struck by turbine blades than birds simply traveling through a project area. The visual acuity of some bird species that may not be sufficient to determine proximity to wind turbines at close range (Hodos *et al.* 2000; McIsaac 2000). Avian mortality may be the product of a small number of fatalities that occur over many days/nights at many structures, or a single large-scale event. Though large-scale events can be widely reported in the press, to date they have been mostly associated with tall structures, such as communication towers, and have not occurred at wind farms.

Another factor that may affect avian mortality is regional migration and movement patterns that result in large numbers of birds migrating through the project area and crossing between areas of significant natural resources. Because of the proximity of these natural resources to the project area, there are more birds and a greater variety of birds within this region than in other agricultural places in the Midwest. Migration in the project area is partially influenced by the Lake Michigan shoreline, which is a recognized major migratory pathway for raptors and Neotropical migrants, the latter of which migrate at night. The Lake Michigan shoreline is approximately 30 miles from the Forward project area. See

Section 4.7 for a discussion of the regional resources surrounding the project area. Figure Vol. 2-5 shows the general locations of migratory routes for herons and egrets, swans, raptors, and songbirds, as observed by ornithologists and wildlife experts.

In addition, DNR is actively attempting to enroll approximately 530,000 acres in Columbia, Dodge, Fond du Lac, and Winnebago counties as part of the Glacial Habitat Restoration Area (GHRA). The goal of this project is the restoration of grassland and wetlands habitat for the proliferation of waterfowl, wild pheasants, and non-game songbirds. The GHRA targeted lands include the western half of the Forward project area and acres of land to the north and west of the project area.

The habitat resources of this area are attractive to many types of birds for many different habitat uses. The combination of resources in the project region provides nesting, foraging, and resting habitat for a greater diversity and abundance of birds than would be expected in other inland agricultural landscapes in Wisconsin. At the very least, habitat use and bird movements within the project region are complex.

4.11.1.3 Regulations

Avian impacts that may result from the operation of the proposed Forward project are generally of two types: 1) mortality; and 2) loss or reduction in the quality of habitat. Both impacts are regulated to some extent by the following federal and state laws.

The **Federal Migratory Bird Treaty Act (MBTA)** is administered by the USFWS. The MBTA protects 836 species of birds and their parts (feathers, eggs, nests, etc.) from being killed, taken, transported, possessed, bought, sold, imported, or exported without a valid federal permit. The birds covered by this Act include a majority of the birds species found in Wisconsin, with the exception of resident game birds (*i.e.* pheasant, quail, grouse, etc.) and nonnative species such as the English sparrow, starling, mute swan, and pigeon.[23] Migratory game birds may be hunted only during the official hunting season and by licensed individuals.

The MBTA is a strict liability statute wherein proof of intent is not an element of violation. Wording is clear in that most actions that result in a "taking" or "possession" (permanent or temporary) of a protected species can be a violation.

The **Bald and Golden Eagle Protection Act** is another federal act that prohibits, except under certain specified conditions, the taking, possession, and commerce of bald and golden eagles.

The **Federal Endangered Species Act (ESA)** is administered by the USFWS. The ESA prohibits "take" of a federally listed threatened or endangered animal species. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct. Under the ESA, all federal agencies and cooperating states shall seek to conserve and recover federally listed species. The government may acquire land as necessary, develop protective regulations such as critical habitat designation, and cooperate with the states on inventory, conservation, and recovery efforts. In addition, no federal funds can be used on projects that would significantly damage the species. Any state projects that could affect a federally listed species and that are funded in whole or in part by federal funds also require consultation with the USFWS prior to any project activity. In order to take, transport, possess, process or sell any federally listed species, it is necessary to first obtain an endangered species permit from the USFWS.

[23] The list of birds protected under the MBTA can be found at http://migratorybirds.fws.gov/intrnltr/mbta/mbtandx.html.

The **National Wildlife Refuge System Administration Act**, as amended, serves as the basis for the National Wildlife Refuge System. The Act establishes a unifying mission for the Refuge System, a process for determining compatible uses of refuges, and a requirement for preparing comprehensive conservation plans. Two-thirds of the Horicon Marsh is a National Wildlife Refuge.

The **Wisconsin Endangered Species Act** (State Statute 29.604 & Administrative Rule NR 27) makes it illegal to take, transport, possess, process, or sell any wild animal that is included on the Wisconsin Endangered and Threatened Species List without a valid endangered or threatened species permit. Certain activities under specified conditions may be allowed with a DNR-issued endangered or threatened species permit.

Very few criminal or civil actions have been taken by the Department of Justice for violation of federal wildlife protection laws. To date, no criminal or civil actions have been taken against wind farm owners by the USFWS or the DNR due to avian mortality. However, a lawsuit was filed in 2003 by the Center for Biological Diversity against the owners and operators of the Altamont Pass Wind Resource Area (California) for failure to comply with federal and state wildlife protection laws. No decision on this case has yet been reached.

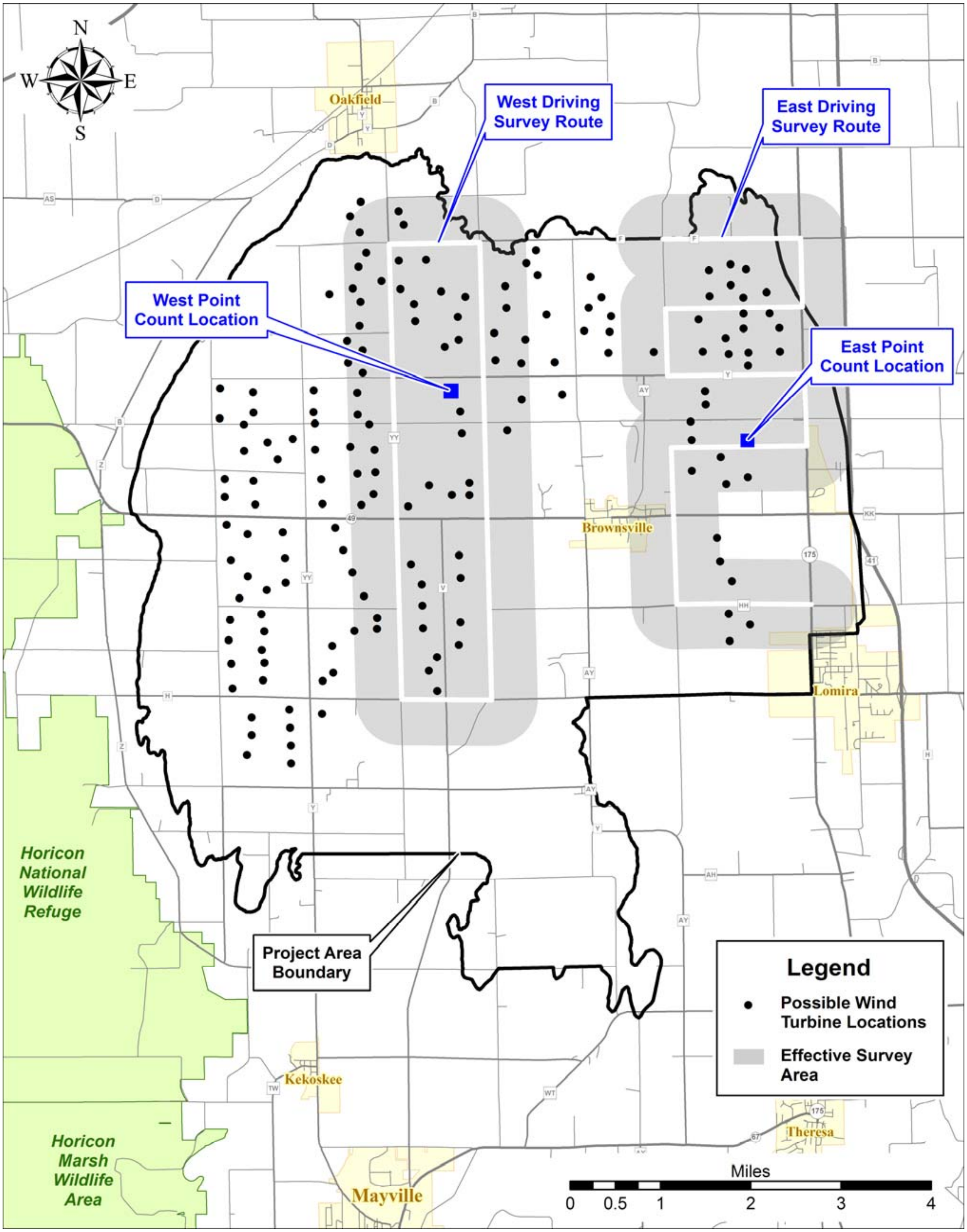
4.11.2 Forward's bird studies

4.11.2.1 2004 survey methodology

Forward conducted a field assessment on April 1-2, 2004, and two types of surveys on April 2-23 (spring) and October 2-November 24, 2004 (fall). The assessment included walking through parts of the project area and touring the project area by auto. The surveys consisted of driving surveys in an eastern and western sampling area plus 30-minute point counts at one location in each of the two sampling areas (Figure 4-2). Road survey observations were estimated to cover approximately one-half mile on each side of the road. Figure 4-2 shows the effective study area of the Forward surveys. Each field day consisted of a road survey and a 30-minute point count in each of the two sampling areas. The order in which the road surveys were conducted was reversed from day to day, as was the direction in which the surveys were driven. Information recorded on field data sheets included time, day, location of sightings, species, number, habitat, bird behavior, height (if flying), and direction of flight. The 2004 bird study methodology is included in Appendix C.

American robins, house sparrow, European starlings, mourning doves, and rock doves were excluded from the Forward bird study. Forward determined that these five species were so numerous in the project area that recording them would have taken time away from observing bird species that were more uncommon or of greater concern. European starlings, rock doves, and house sparrows are not protected by any conservation laws; however, the American robin and mourning dove are protected under the Migratory Bird Treaty Act. According to Forward, blackbirds were recorded because they were generally observed in large flocks which were easier to count, although they were not often distinguished by species.

Figure 4-2 The effective study area of the Forward 2004 bird survey



4.11.2.2 Inadequacies with the design of the Forward 2004 bird study

To provide a basis for evaluating the potential for avian impacts, the Forward 2004 study should have adequately characterized the diversity and abundance of birds and habitat use in the project area, concentrating on the influence Horicon Marsh has on the project area. The results of such a study would have provided information necessary for designing and locating a wind farm that minimizes impacts to birds. A review of the 2004 study reveals significant inadequacies in the study methodology, including:

- Failure to adequately define the survey goals and methodology to address risk to raptors, passerines (songbirds and small birds), and especially, rare species; the study is disproportionately focused on waterfowl;
- Failure to identify and study a reference area for post-construction monitoring;
- Failure to survey the western-most limit of the project area where bird use might be the highest due to proximity to Horicon Marsh;
- Failure to characterize the effects of Horicon Marsh and other resource areas on bird presence and use in the project area;
- Insufficient study period (number of years and seasons) and number of point count locations to account for natural variability;
- Road survey methodology is not sufficiently detailed for a project with turbine locations already selected;
- Survey dates did not capture peak migration periods for all bird groups;
- Rare species, nocturnal migrants, nesting, and prey populations were not adequately characterized;
- Questionable methodology for estimation of flight altitude; the height of the blade swept area used in the study is inconsistent with the proposed wind turbine design (shorter); and no analysis of flight behavior for passerines and other small birds;
- Timing of movements and behaviors of migrant and resident birds were not adequately addressed;
- Study did not incorporate recommendations provided by USFWS or DNR.[24]

The Forward 2004 bird study did not fully characterize bird use within the project area, missing some species and activity patterns, particularly those species that utilize the uplands nearer to Horicon Marsh. The observation points and driving surveys did not adequately address the western-most wind turbine sites. Allowing for observations of a half mile from the road, the western study area is approximately 1.5 mile east of the westernmost turbine (Figure 4-2). The westernmost point count location is approximately 2.5 miles east of the westernmost turbine.

The Forward methodology of road surveys and 30-minute long counts differs from the methodology used in other Wisconsin studies (Howe and Atwater 1998; Howe *et al.* 2002; Kaspar 1999 and 2000; PSC 1998). In these studies a combination of multiple point (short) counts and long counts were used because they more effectively capture bird use of an area. Also, it is doubtful that the variability of bird use in the project area was adequately represented with only two point count locations. The Forward survey period was relatively short. It did not cover summer and winter, multiple years, nor did it capture peak migratory period for many types of birds. The birds observed within the project area by Forward's avian study are shown in Appendix A, Table A-1. Table A-2 shows the peak migration periods for

[24] Comment letters by USFWS and Wisconsin DNR are included in Appendix B.

selected bird families or species occurring in the project area. Species with peak spring migration periods in mid-March or fall migration peaks in September would have been missed. To ensure that potential bird impacts to a globally important bird refuge are minimized, a study with more scientific rigor and adequate duration is needed.

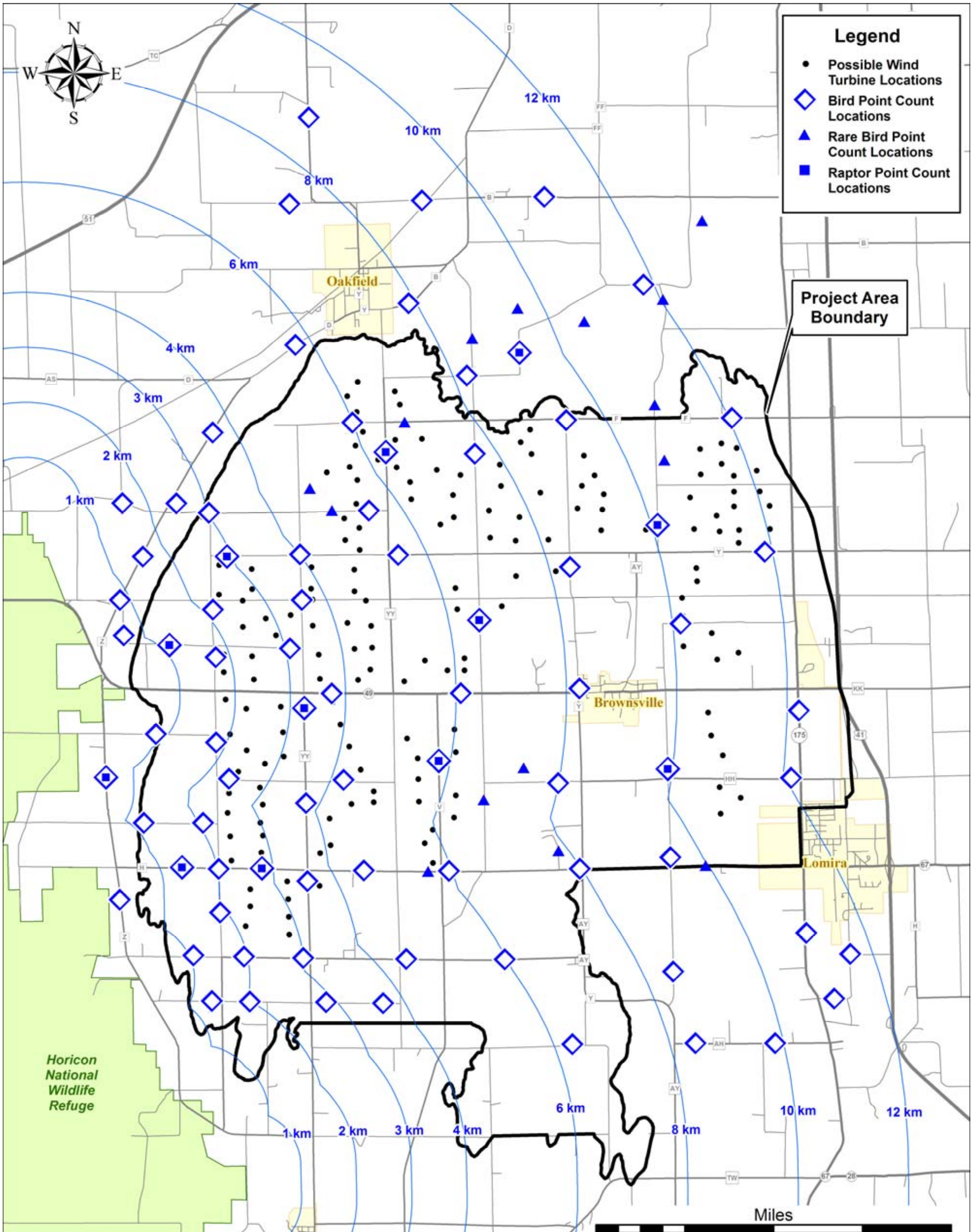
4.11.2.3 2005 survey methodology

Forward worked with the DNR and the PSC early this spring to define additional field studies for the spring and summer of 2005. Figure 4-2b shows the approximate locations of the new bird point counts, rare bird point counts, and raptor surveys. The study design incorporated comments from USFWS via discussions with the DNR. The surveys are scheduled from late March through the end of August. The Forward bird surveys just began during the writing of this final EIS, therefore no 2005 bird survey results are included in this document. Data from these surveys will add to the understanding of bird use of the project area and provide some of the necessary baseline studies for post-construction studies, should the project be approved. The major aspects of the 2005 studies are:

- Rare bird surveys;
- Short point counts at set distances from Horicon Marsh throughout the project area;
- Raptor surveys;
- Point count locations north and south of the project area that will be used as reference points; and
- Survey methodology that is more consistent with other studies completed at Horicon Marsh and other wind project sites.

The detailed Forward 2005 survey methodology is provided in Appendix C. While the study does not replace a thorough multi-year study, it will provide additional information regarding: 1) how changes in bird abundance and diversity relate to distance from the Marsh; 2) presence and use of the project area by rare birds; and 3) raptor use of the project area. The study will include all parts of the project area including the westernmost portion. In addition, the results may be used in "before–after" studies. Similar to the 2004 survey, the 2005 survey will not include a study of nocturnal migrants. This is because the state agencies and Forward could not agree on the methodology for such a study and the utility of the information for making project decisions.

Figure 4-2b The 2005 Forward bird survey point count locations



4.11.3 Project area rare bird species – endangered, threatened, and species of special concern

This section includes details for state and federally protected bird species and species of special concern that have or could be found in the project area. Other birds found in the project area are discussed in detail in Section 4.11.4.

Appendix A, Table A-3 lists 45 federal and state-listed threatened or endangered bird species and state special concern species that may be present in or near the project area. The last column of this table summarizes their occurrence in and use of habitats in Horicon Marsh and the project area. Data in the table were compiled from the National Audubon Society Christmas Bird Counts, a review of the USGS Breeding Bird Surveys, Wisconsin Breeding Bird Atlas, and the Wisconsin Important Bird Area studies. The reviewed Christmas Bird Counts (CBCs) included the counts for Randolph (20 miles west); Sheboygan (28 miles east-northeast); Stockbridge (25 miles north), and Horicon for the winters from 1993 through 2003. Each CBC area covers a 15-mile diameter circle, an area of about 177 square miles. Only the Horicon count includes the project area; however, the others represent the types and numbers of birds expected to be at or near the project area.

Few of the 45 birds listed in Table A-3 are likely to nest within the project area; rather, they use the project area for foraging, passing through during short-distance movement between habitat areas, or stopping over during long-distance migrations. All the birds on this list are relatively rare, meaning that their population numbers are declining or low.

Of the species listed in Table A-3, the Forward bird study observed a total of 12 rare[25] bird species in 2004. These species are identified in Table A-1 and shown in bold in Table A-3. This included two bald eagles (state special concern/federally listed as threatened), and one each of great egret (state threatened), red-shouldered hawk (state threatened), and peregrine falcon (state endangered). All of these birds were seen during the fall survey, but not during spring. The remaining eight are state special concern species with no protected status under the Federal or Wisconsin Endangered Species Acts. State special concern species are species about which some problem of abundance or distribution is suspected but not yet proven. The main purpose of this category is to focus attention on certain species before they become endangered or threatened.

A northern harrier (special concern species) observation by Forward was a territorial male, which may indicate that the species nests within the project area. Northern harriers prefer to nest in taller grasses and shrubs (greater than 2 feet), sometimes at the edge of wetlands. The northern harrier is observed frequently during the Horicon bird counts, although not every year. The Forward 2005 survey will attempt to determine if any northern harriers are nesting in the project area and delineate its territory.

The 12 rare species observations recorded during Forward's 2004 survey is lower than that observed by three other studies of proposed wind farms in nearby areas with similar habitats. At these three sites between 19 and 24 rare bird species were observed (Howe *et al.* 2002 and PSC 1998). These sites are similar to the Forward project area, with predominantly agricultural use and few areas of undisturbed habitat. Most of the rare species identified by these surveys were Neotropical migrants that prefer grasslands or open areas, which indicates that even these rare species will use habitat in disturbed areas, such as the project area.

[25] State or federally listed as threatened or endangered or state special concern species.

4.11.3.1 Bald eagle

Bald eagles are federally listed as threatened and state listed as a species of special concern. Bald eagles occasionally can be found in the project area and were observed during the Forward 2004 bird study. Bald eagles currently nest in Horicon Marsh and Lake Sinissippi. Lake Sinissippi is approximately five miles south of the Marsh. DNR staff and local birders have also sighted bald eagles foraging in the southwest corner of the project area. Because of the lack of wooded areas, cliffs, and large bodies of water, it is highly unlikely that bald eagles would nest within the project boundary. However, migrant and wintering eagles have been observed numerous times foraging on carrion in the uplands of the project area, particularly prior to ice-out on the Marsh in spring, when other food sources start to become available (Michael, pers. comm.[26]). The 2005 surveys should provide more information on habitat use by bald eagles within the project area.

4.11.3.2 Whooping crane

The recovery of the whooping crane is of international importance. The species currently exists in the wild at only three U.S. locations. In Wisconsin, the whooping crane is federally classified as an experimental population. Sandhill cranes are discussed in Section 4.11.4.6.4.

Since 2001, 36 whooping cranes have been reintroduced into central Wisconsin. They migrate along a well-defined corridor between Florida and Wisconsin. During the late summer and fall of 2002 and 2003, a female whooping crane was observed in the project area, one to two times per week (Meyers, pers. comm.[27]). She stayed at Horicon Marsh during the summer and flew east into the project area to forage with sandhill cranes. In 2004, she was less frequently observed in and around Horicon Marsh. A second crane was observed in the Marsh for a brief period during the summer of 2004. Whooping cranes are known to use the same type of spring and fall foraging habitat (upland agricultural areas) as sandhill cranes, but during the summer they tend to stay near wetlands and open water. This year (spring 2005), prior to the start of Forward's study, a total of eleven whooping cranes were observed flying over the project area. Members of this experimental crane population are being closely monitored for behavior and the potential for eventually nesting within the Marshes. Whooping cranes do not reach maturity (able to successfully breed) until they are four years old, which would be 2005 or 2006 for most of the experimental flock.

The whooping crane experimental population is a dynamic situation. The fact that sandhill cranes nest within Horicon Marsh and whooping cranes have been observed foraging and flying over the project area is encouraging in terms of the potential reestablishment of the species at Horicon Marsh. According to Meyers, it is too early to predict whether the reintroduction of whooping cranes in Horicon Marsh will be successful. If in the near future, members of the experimental flock become established at or near the Horicon Marsh, the project region would become the focus of intense international conservation and monitoring efforts for the species. Little is known about the whooping cranes' potential vulnerability to collision with wind turbines.

4.11.3.3 Herons and egrets

The Fourmile and Cotton Island Rookeries, located in the southern part of Horicon Marsh (Figure Vol. 2-4), once supported one of the few great egret (state threatened) rookeries in Wisconsin. In addition to the great egret, great blue heron (special concern species), black-crowned night heron (special concern species), and double-crested cormorant also nest there. In May 1998 a severe

[26] Larry Michael, President of the Horicon Marsh Bird Club
[27] Patti Meyers, Horicon National Wildlife Refuge Manager, USFWS

thunderstorm destroyed many of the nesting trees, displacing the colony. In 2004, great egrets have been seen in a newly established nesting colony in the Horicon National Wildlife Refuge, north of Hwy. 49 (Figure Vol. 2-4). This rookery, with an estimated total of 500 nests, includes black-crowned night herons, cattle egrets (special concern species), and even one or two pairs of snowy egrets (state endangered). Another heron rookery is located within the Mayville Ledge State Natural Area, south of the project area.

These birds depend on the abundant food sources of the Marsh and surrounding wetlands to build up reserves for nesting, growth of newly fledged young, and prior to autumn migration. During the fall of 2004, tremendous concentrations of egrets were observed in the impoundment in the northwest corner of Horicon Marsh. Up to 300 birds were in the area at one time and regular movements of these birds occurred between Horicon Marsh and the nearby smaller wetlands. Many of the birds in this inland region of the state are dependent on Horicon Marsh during the pre- and post-nesting period. Statewide over the past decade, there have been between five and 10 great egret rookeries. Only half of these rookeries are stable sites; one of these is in Horicon Marsh.

While great egrets and great blue herons are known to nest within Horicon Marsh, they do not confine their feeding to this area. Especially after nesting, these birds are commonly observed flying to smaller wetlands surrounding the Marsh and between the Horicon and Theresa Marshes, including those within the proposed project area. Studies conducted on the feeding distribution of herons and egrets along the Mississippi River (Thompson and Volkert, unpublished) indicate that these birds commonly fly up to 15 to 20 miles from their nesting sites to feed. Herons and egrets are rather weak flyers and tend to fly at heights of about 100 to 300 feet (Volkert, pers. comm.[28]), which would be within the height of the blade-swept area of the proposed Forward turbines. Though Forward, in 2004, observed only six herons and egrets (five of which were flying), four flew at heights less than 350 feet which is consistent with Volkert's observations.

4.11.3.4 Forster's tern and black-crowned night heron

Wisconsin's Natural Heritage Inventory (NHI) database indicated that Forster's tern (state endangered) and black-crowned night-heron (special concern species) occur near the project area. Both of these species nest at Horicon and have been observed moving between Horicon and Theresa Marshes, which are approximately seven miles apart. They may stop or forage within the project area, but because they require a combination of open water and cover, they are unlikely to nest there. Neither the Forster's tern nor the black-crowned night heron was observed in the project area during the 2004 Forward bird survey.

4.11.3.5 Greater prairie chicken

The greater prairie chicken is a state threatened species. The species is of concern to resource agencies when siting wind farms because it avoids tall structures such as wind turbines. As late as the early 1970s, this species was abundant in the uplands surrounding the Horicon Marsh (Gard 1972), including observations approximately two miles south of the Forward project area on land that is now part of the Horicon National Wildlife Refuge. At present, the proposed Forward project area could not support large numbers of these birds because it contains very little native grassland and existing fallow fields are usually dominated by weedy forbs that reduce habitat quality. The greater prairie chicken is considered an area-sensitive species that requires a minimum of approximately 2,500 acres of land of which 50 percent is grassland (Svedarsky et al. 2003). While there are grasslands in the project area enrolled in

[28] William Volkert, Natural Resources Educator and expert ornithologist at Horicon Marsh State Wildlife Area, Wisconsin DNR

both state and federal grassland preservation programs (see Section 4.9, "Vegetation"), they are significantly smaller than the requirements for this species.

4.11.3.6 Other rare waterfowl and shorebirds/waders

The project area is unlikely to provide suitable nesting habitat for most of the rare waterfowl and shorebirds/waders in Table A-3 because it is primarily agricultural. Grassland, fallow fields, wetlands and forested areas that provide ephemeral or perennial sources of water or inundated soil are patchy in the project area. Nearby Horicon and Theresa Marshes both provide suitable nesting habitats for the rare waterbird and shorebird species. It is likely that these birds would use the project area to forage.

4.11.3.7 Conclusions for rare species

Forward concludes that because only one or two individuals of federal and/or state listed species were identified within the project area in 2004, the risk of mortality is low and adverse effects are unlikely. However, by definition, listed species are present in low or variable numbers, or are observed in an area infrequently. Therefore, conclusions on presence and use should not be based on one season of general avian surveys. This is especially true when several of the species listed in Table A-3, like the great egret and red-shouldered hawk, are commonly or annually observed at Horicon Marsh. While abundance may increase the likelihood of impact for some species; it is not the only measure of risk. Concluding that the level of risk to rare species is low based on low numbers of observed individuals is not warranted, because even a small number of fatalities of a rare species may be significant for the population.

There may be adverse effects to federal and state listed threatened and endangered species because:

- Such species are present within the project area.
- They are observed at Horicon Marsh and flying between Horicon and Theresa Marshes, approximately seven miles apart.
- They may use the project area for foraging; fly within the blade-swept area while moving between resources areas; or ascend and descend through the blade-swept area during daily activities and migration stopovers.
- There is not enough information to rule out the possibility that rare raptors or small birds nest within the project area and may be more at risk.
- Loss of a listed species may have impacts to regional populations and legal repercussions.
- Whooping crane reintroduction efforts may become a concern in light of the fact that whooping cranes are currently using the project area for foraging and more may do so in the upcoming years.

The Forward 2004 surveys were not adequate to determine use of the project area by federal and state listed threatened or endangered species. The 2005 surveys should provide additional information on rare bird use within the project area, but may not be available in time to be considered for the PSC's final decision. At other sites deemed by Forward to be similar to this site, greater numbers of rare species were reported. This may indicate that the Forward surveys were not intensive enough to adequately characterize bird use of the project area.

In comments to the PSC, USFWS (Appendix B) stated that the Forward project could pose some level of risk to species listed under the Endangered Species Act (ESA) and the Migratory Bird Treaty Act (MBTA), both of which prohibit the taking of listed species. Under the federal and state ESA, if a "taking" is reasonably certain to occur, Forward should apply for an incidental take permit from the

USFWS or an incidental take authorization from the DNR. The federal permit requires the development of a Habitat Conservation Plan, among other things. No such permitting process for incidental take exists under the MBTA.

4.11.4 General bird use of project area

4.11.4.1 Project area bird abundance

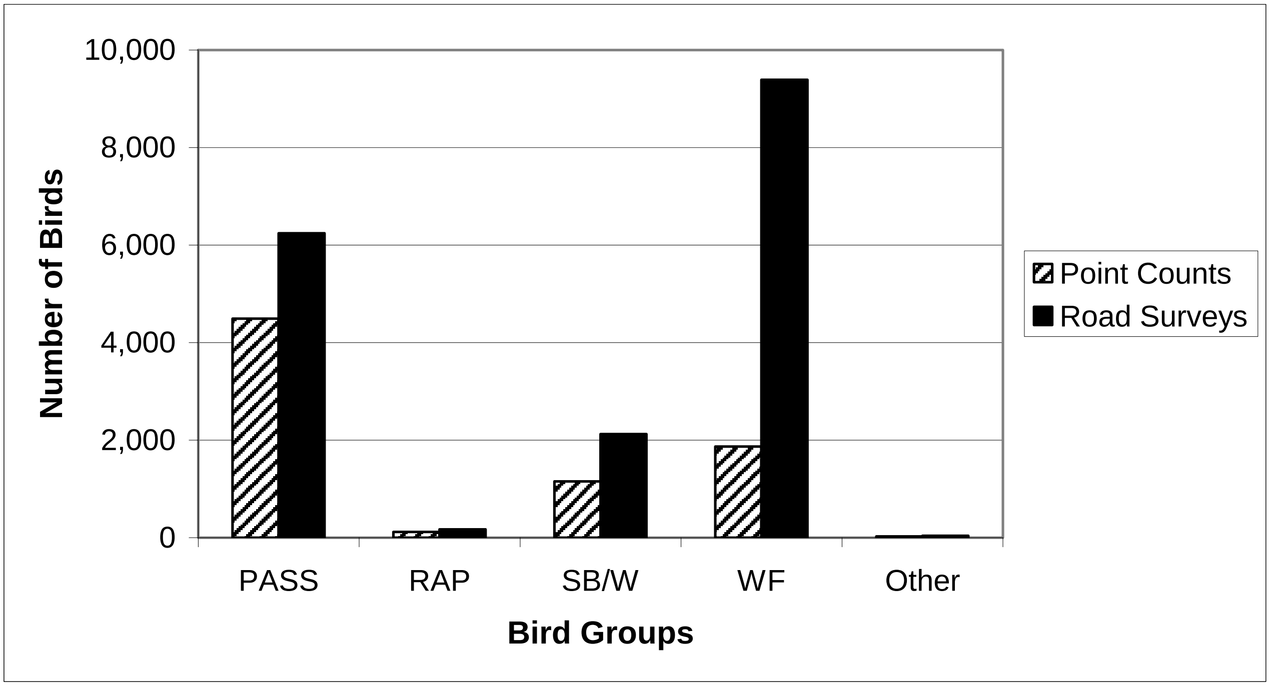
A total of 89 species of birds were observed during the Forward 2004 bird studies. A list of these birds is provided in Appendix A, Table A-1. Birds that are either state or federally protected are identified in Table A-3. The total number of species observed by Forward is comparable to the 98 bird species observed by Howe and Atwater (1998). The USFWS identifies some 267 bird species which have been observed within the Horicon National Wildlife Refuge.[29] Larry Michael, Horicon Marsh Bird Club president, observed 290 species within the Horicon Marsh in March 2004.[30] Not all of these species are confined to the marsh habitat, and many have been reported in settings similar to the project area.

The most abundant species observed during the Forward 2004 spring survey were the horned lark, Canada goose, common grackle, ring-billed gull, and red-winged blackbird. The most abundant species observed in the fall were the Canada goose, mixed blackbirds, ring-billed gull, mallard, and sandhill crane. This is mostly consistent with the abundant species identified in the Howe and Atwater study (1998). They found that the most abundant species were European starling and red-winged blackbird during all three seasons, and the Canada goose was the most abundant species in spring and fall. Some species like Lapland longspur and ring-billed gulls were infrequently observed, but relatively abundant during each observation. Similarly, Kaspar (1999 and 2000), who studied areas in nearby Calumet County, identified red-winged blackbird, common grackle, ring-billed gull, European starling, American crow, snow bunting, Canada goose, Lapland longspur, horned lark, rock dove and house sparrow as the most abundant bird species.

Figures 4-3 and 4-4 show an analysis of the bird groups observed by Forward in 2004. The observed bird species were grouped into passerines (song birds and small birds), raptors, shorebirds/waders, waterfowl, and other (woodpeckers, flickers, pheasants, and wild turkey). Table 4-8 contains the data for Figures 4-3 and 4-4. As shown in Figures 4-3 and 4-4, waterfowl and passerines are the predominant bird groups Forward observed in the project area. Note that in the spring point count, the dominant bird group was passerines, but in all other surveys by Forward, it was waterfowl, dominated by Canada geese. In almost all cases, more birds were observed during the road surveys than at the point count locations.

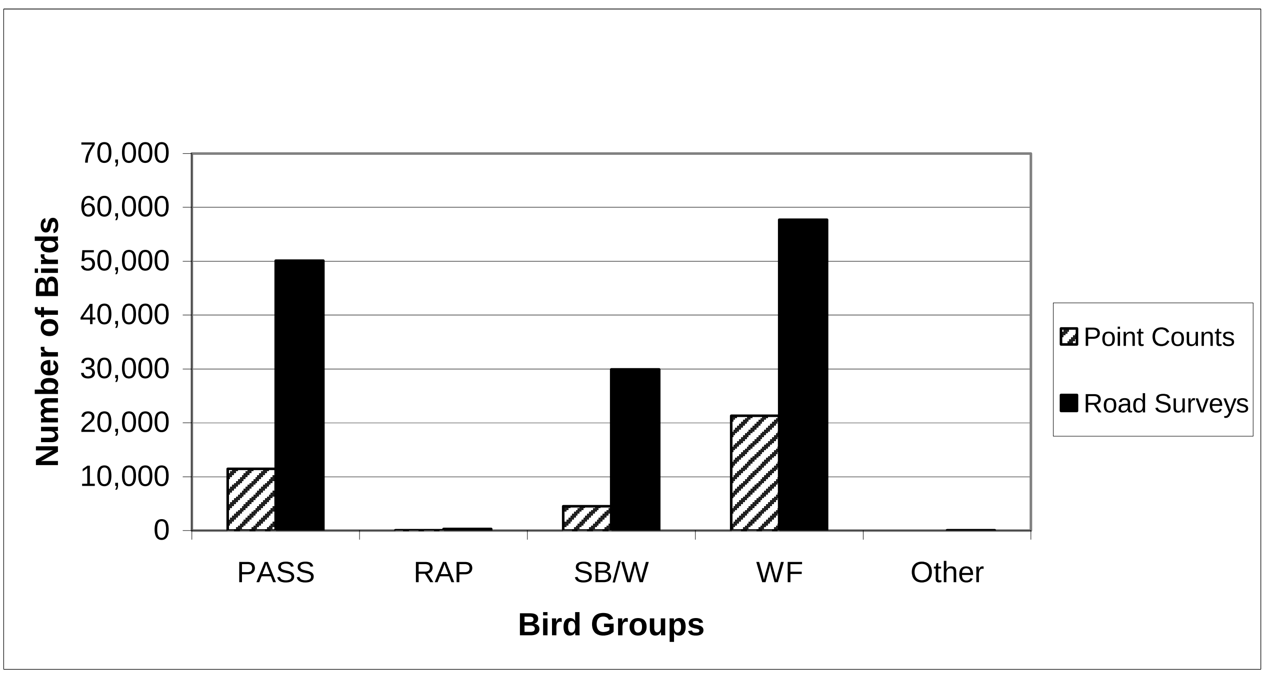
[29] http://midwest.fws.gov/horicon/textcklist.htm
[30] Checklist of Birds of Horicon Marsh 2004. Based on records and survey methods approved by the Wisconsin Society for Ornithology.

Figure 4-3 Number of birds in the project area observed by Forward (spring 2004)



PASS = passerines (songbirds, generally small birds), RAP = raptors (owls, hawks, kestrels, etc.), SB/W = shorebirds/waterbirds, WF = waterfowl

Figure 4-4 Number of birds in the project area observed by Forward (fall 2004)



PASS = passerines (songbirds, generally small birds), RAP = raptors (owls, hawks, kestrels, etc.), SB/W = shorebirds/waterbirds, WF = waterfowl

Table 4-8 Forward 2004 bird abundance totals by bird group

Bird Groups	Spring 2004				Fall 2004			
	Point Counts	Road Surveys	Total	Percentage of Spring Birds Observed	Point Counts	Road Surveys	Total	Percentage of Fall Birds Observed
Passerines	4,492	6,243	10,735	42	11,467	50,087	61,554	35
Raptors	119	168	287	1	74	271	345	0
Shorebirds/ Waders	1,154	2,126	3,280	13	4,506	29,908	34,414	20
Waterfowl	1,870	9,390	11,260	44	21,331	57,736	79,067	45
Other	23	41	64	0	14	81	95	0
Total	7,658	17,968	25,626	100	37,392	138,083	175,475	100

Abundance is one factor that may affect collision risk for a particular species, based on a simplified assumption that higher numbers mean higher mortality for that species. Relying solely on total abundance figures to determine collision risk can be misleading because abundance does not indicate the temporal usage of species recorded during the surveys. A species with a relative high abundance might actually occur infrequently but in large numbers during each occurrence. For example, the data from several of the studies show that species like Lapland longspur and snow buntings are not observed during all the counts, but are observed infrequently in large flocks. This observation suggests that collisions, for these groups of birds, are more likely to occur at certain times of the year or under certain conditions, rather than throughout the year. Knowledge of abundance and frequency throughout the year would provide a better indication as to whether observed mortality rates would be biologically significant.

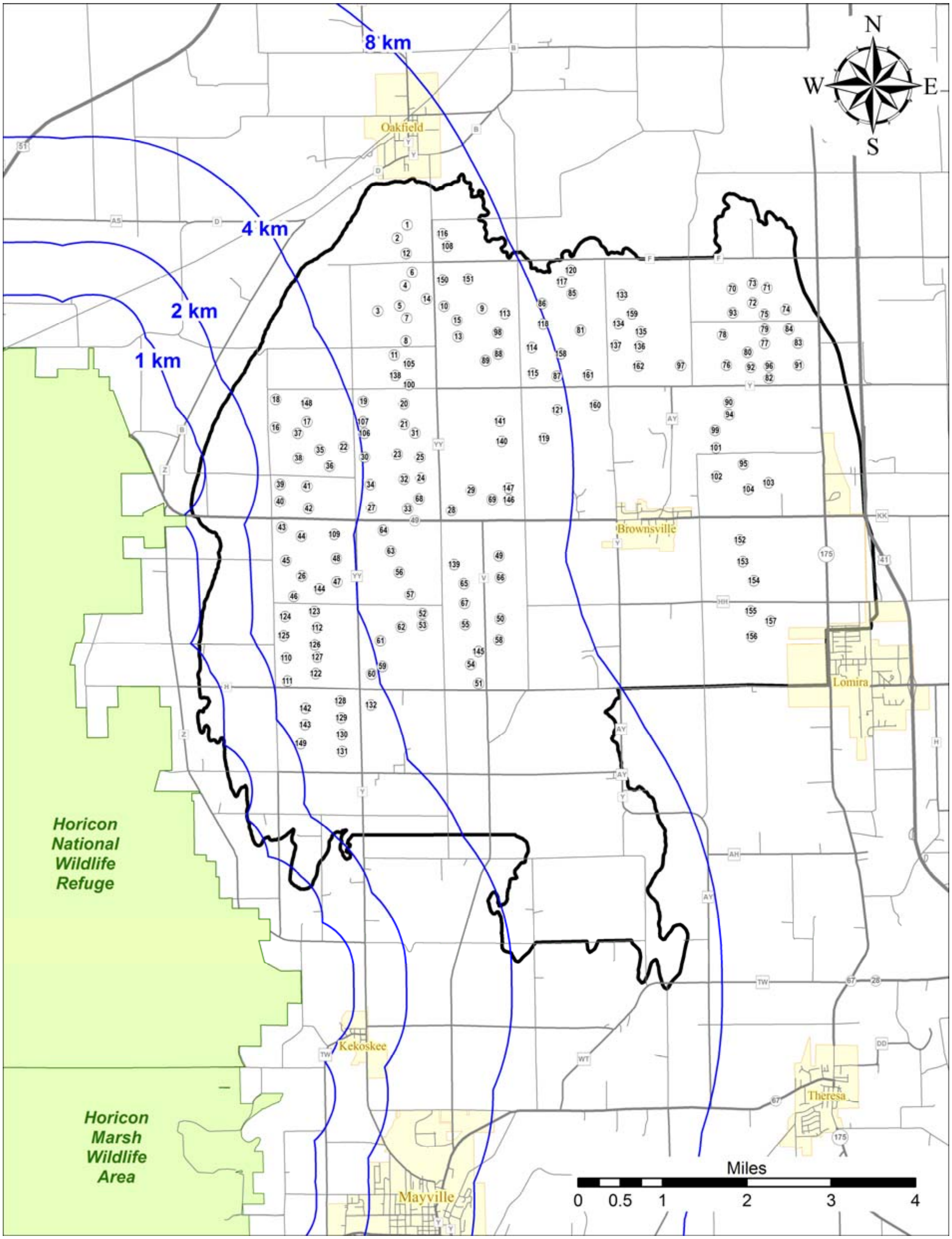
The species noted in Forward's survey were similar to those found at other locations, although fewer species were observed than at other comparable wind farm studies. Because the Forward survey was only completed during a portion of two seasons within one year, it is likely that the number of species using or migrating through the project area were underestimated compared to the other surveys.

4.11.4.2 Effect of distance from Horicon Marsh

The proximity of Horicon Marsh to the Forward project area makes this project different from those projects where bird studies were conducted at other comparable agricultural areas. Migrant or resident birds are observed to commonly move east beyond the Marsh boundary and the Niagara Escarpment. Of the 223 bird species regularly observed at Horicon Marsh, only 73 species are classified as waterfowl, shorebirds, or waders. The remaining 150 species fall into other bird groups, such as raptors and songbirds. Horicon Marsh provides resources for species with varying dependence on water. Some species remain close to the Marsh throughout the entire season, while many others use adjacent riparian and upland areas for part or all of their habitat requirements. Thus, a review of how the diversity and abundance of resources at Horicon Marsh influences the project area is of critical importance in assessing the risk to birds by the proposed wind turbines.

Howe and Atwater (1998) looked at the effect that distance from Horicon Marsh has on bird abundance. They looked at distances of 1, 2, 4, and 8 kilometers (km) (0.6, 1.2, 2.5, and 5 miles, respectively). These distances are shown in context of the Forward project area in Figure 4-5. Howe and Atwater found that the total numbers of each group of birds were affected by distance from the Marsh in the spring and fall, with no effect seen during the summer. The mean number of species also decreased from west to east, but only slightly during the spring and summer (differences of one or two species out of mean values around five). The relationship was not significant in the fall.

Figure 4-5 Distance of project area from Horicon Marsh

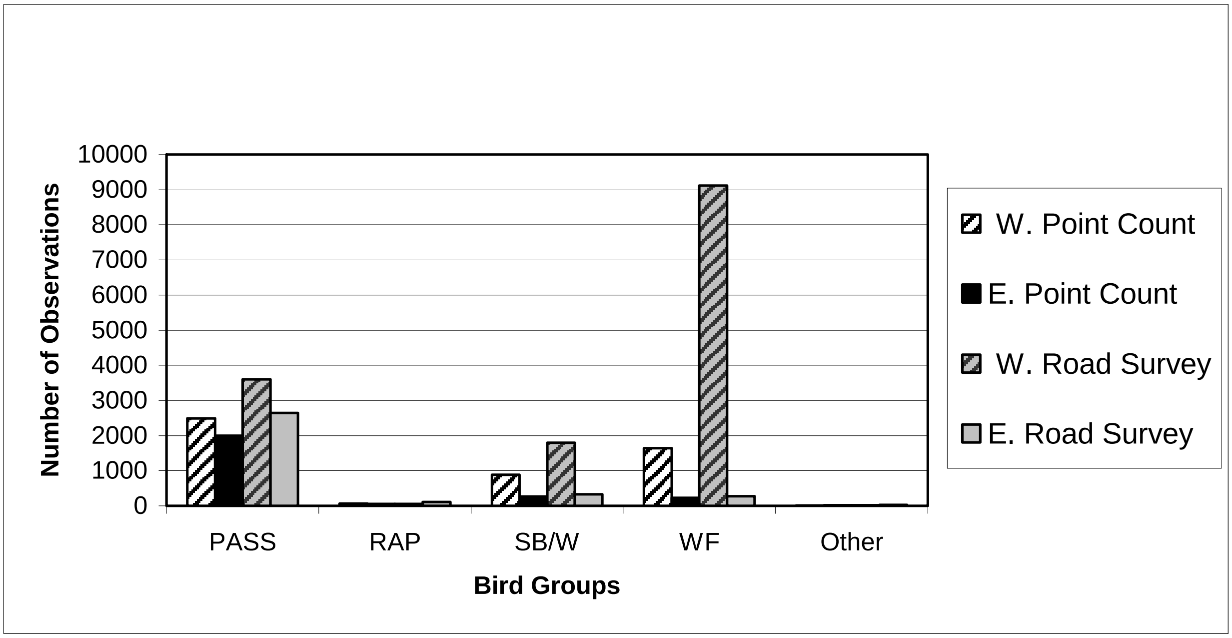


There are limitations in extrapolating the Howe and Atwater conclusions to the Forward project. The test for statistical significance of bird abundance versus distance from Horicon Marsh presented in the Howe and Atwater study looks at the entire relationship among all the distance intervals rather than between single intervals. The authors did not determine whether the change from 1 to 2 km or 2 to 4 km is significant, only that the entire relationship is significant. Statistical tests of significance aside, the data suggest that the greatest decrease in the number of birds in the spring (approximately 30 percent decrease) occurred between the 1 and 2 km interval, but a similar decrease also occurred between the 4 and 8 km interval. In the fall, the 1 to 2 km interval showed the largest decrease in bird abundance, approximately 40 percent. At the 8 km radius for both spring and fall, the median number of birds for each count was reduced by approximately half. Additionally, the Howe and Atwater analysis is based on data taken at distance intervals around the entire circumference of the Marsh. Only 23 of the 160 data points in the Howe and Atwater study area were within or adjacent to the project area. Even fewer data points were within the 1 to 2 km (0.6 -1.2 mi.) distance interval within the project area.

The 2004 Forward data indicate that the number of birds in all major groups, except raptors, decreased from the western to the eastern study area.[31] Data compiled for Figures 4-6 and 4-7 is presented in Appendix A, Tables A-4 and A-5. The point count locations are approximately 4 miles (6.4 km) and 7 miles (11.3 km) from Horicon Marsh. The western area road survey covered an area between 3 and 5 miles (4.8 and 8 km) from Horicon Marsh, whereas the eastern area road survey covered an area between 6 and 8.5 miles (9.7 and 13.7 km) from Horicon Marsh. Without looking at particular species, bird abundance did significantly drop over the distance of approximately three miles, from the western to the eastern study area. The percentage difference between the western and eastern study areas for all bird groups ranged between 77 and 39 percent (Appendix A, Tables A-4 and A-5). The most observed bird species in the study was the Canada goose (42 percent of all birds observed in both the spring and the fall). It was observed 69 percent more often in the western than in the eastern study area. No study was conducted west of the western study area. However because of the trend observed from both the Forward and the Howe and Atwater studies, it is reasonable to speculate that more birds would have been observed closer to Horicon Marsh.

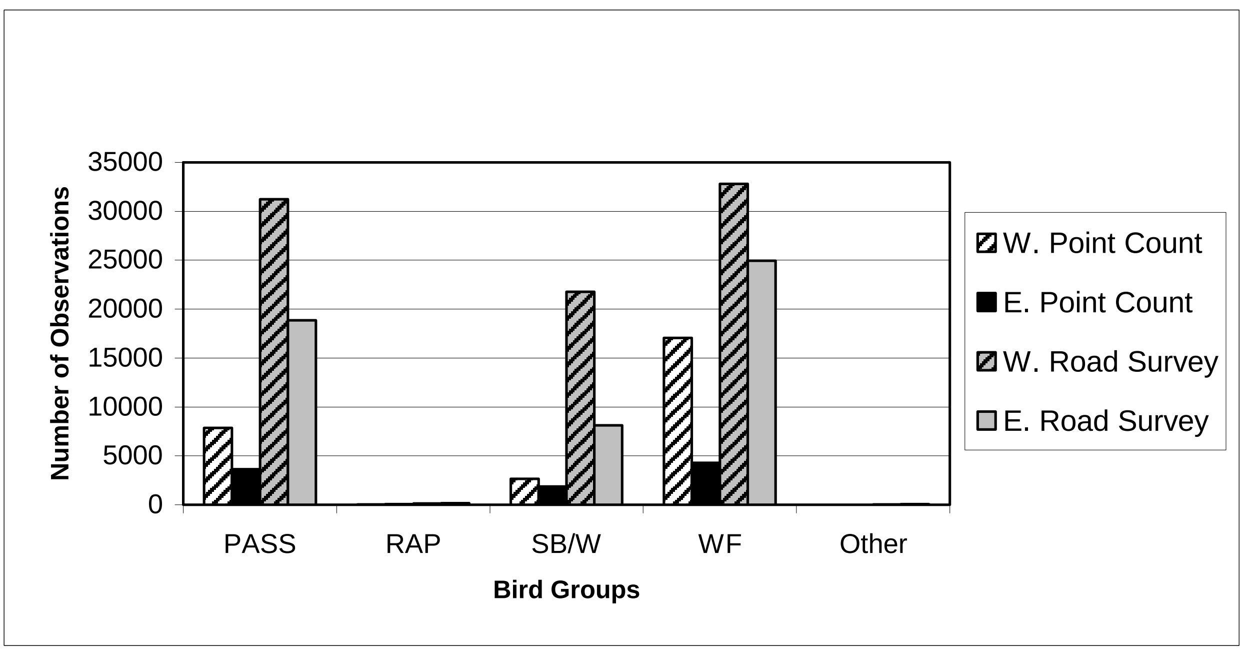
[31] A small number of bird species (woodpeckers, flickers, pheasants, and wild turkeys) included in the category of "other" also did not decrease from the west to the east survey areas.

Figure 4-6 Comparison of Forward survey results for the eastern and western portions of the bird study area (spring 2004)



PASS = passerines (songbirds, generally small birds), RAP = raptors (owls, hawks, kestrels, etc.), SB/W = shorebirds/waterbirds, WF = waterfowl

Figure 4-7 Comparison of Forward survey results for the eastern and western portions of the bird study area (fall 2004)



PASS = passerines (songbirds, generally small birds), RAP = raptors (owls, hawks, kestrels, etc.), SB/W = shorebirds/waterbirds, WF = waterfowl

Compared to the Howe and Atwater study, the Forward spring and fall data show two different patterns of change and the distance intervals are different. The results from both the Howe and Atwater study and the Forward bird surveys show that there is variability in the results depending on the timing of the studies and methodologies used. Furthermore, there may be important differences among bird groups or between rare birds and common species. Forward did not conduct this type of study in 2004 but will be addressing this issue in its 2005 study.

4.11.4.3 Flight heights

The altitude of bird flight can be a measure of risk, assuming that species which fly frequently in the blade-swept area may be at greater risk of collision. A review of bird behavior may also provide an indication of the relative frequency that these activities would place birds within the blade-swept area. Because high-quality habitat resources are located in the region, area birds migrate through the project area; move between the resource areas; and ascend and descend through the blade-swept area during daily activities and migration stopovers.

A literature review of the recorded bird flight heights in relation to wind turbines shows much variation in bird species and groups flying within different blade-swept areas. Even though these studies were designed for a particular proposed or existing wind farm, some commonalities can be drawn from the results of these studies.

4.11.4.3.1 Studies of bird flight heights

At the Foot Creek Rim site in Wyoming (also referred to as SeaWest Wind Farm), studies completed in 1995 and 1996 showed that 37.1 percent of all raptors and other large birds that were in flight, flew in the blade-swept area (62 to 203 feet), and 23.5 percent flew higher. However, 89.6 percent of passerines and other small birds flew below the blade-swept area (Johnson *et al.* 2000a). The surveys by Johnson *et al.* (2004a) at Foot Creek Rim and Simpson Ridge in Wyoming indicated that raptors had the highest proportion of flight heights within the blade-swept height (45 percent), compared to 15.2 percent of blackbirds, 10.3 percent of shorebirds, 8.8 percent of swallows, and 7.8 percent of thrushes.

Spring bird surveys were conducted at two proposed Wisconsin wind farm sites, Stockbridge in Calumet County and Rosiere in Kewaunee County (PSC 1998). At the Stockbridge site there were a total of 6,510 individual bird sightings representing 68 species recorded during spring long counts. Of the 68 species observed, only 18 were recorded as having flown at altitudes that would place birds within that wind farm's blade-swept area (134 to 288 feet). Ninety-six percent of all birds observed were either perched, on the ground, or flying above or below the blade-swept area. Table 4-9 lists the bird species that were observed flying at the proposed Stockbridge Site. Approximately 5 percent of sightings for these species involved flight at altitudes in or through the expected blade-swept area.

Table 4-9 Observations of bird species recorded within the blade-swept area of the Stockbridge Site (Calumet County, 1998)

Common Name	Number of Birds in Blade-Swept Area (134 to 288 ft.)	Total Number of Observations	Percentage of Birds within Blade-Swept Area	Percentage Flying in Blade-Swept Area versus Total Birds Observed
snow bunting	100	300	33.3	1.96
ring-billed gull	43	2,444	1.8	0.84
horned lark	28	107	26.2	0.55
red-tailed hawk	19	47	40.4	0.37
Canada goose	18	47	38.3	0.35
mallard	8	75	10.7	0.16
common grackle	6	163	3.7	0.12
Lapland longspur	4	654	0.6	0.08
turkey vulture	3	3	100.0	0.06
rock dove	3	77	3.9	0.06
red-winged blackbird	3	877	0.3	0.06
sandhill crane	2	44	4.5	0.04
killdeer	2	71	2.8	0.04
American crow	2	163	1.2	0.04
northern harrier	1	1	100.0	0.02
herring gull	1	1	100.0	0.02
great blue heron	1	5	20.0	0.02
tree swallow	1	34	2.9	0.02
TOTAL	245	5,113		4.8

Source: Public Service Commission of Wisconsin, 1998.

When looking only at species observed flying within the blade-swept area, the ring-billed gull, red-winged blackbird, Lapland longspur, and the snow bunting account for 84 percent of all bird flights recorded and 61 percent of the flights within the blade-swept area. The snow bunting (33 percent), horned lark (26 percent), red-tailed hawk (40 percent), and Canada goose (38 percent) may have a higher proportion of flights within the blade-swept area. This may mean that these species could be at greater risk of mortality than other species observed during the surveys. The limited amount of data collected during the long-count surveys for this project indicate that the vesper sparrow, eastern and western meadowlarks, purple martin, and the northern harrier tend to fly below 134 feet. These birds are not very common and represented only 1 percent of the total 21,396 recorded bird observations (short and long counts combined).

At the second proposed site, Rosiere located in Kewaunee County, a total of 15,209 individual bird sightings representing 83 species were recorded during the spring long-counts. Of the 83 species observed 35 were recorded as having flown within the blade-swept area (134 to 288 feet). Eighty-eight percent of all bird observations in this survey flew either above or below the blade-swept area (Table 4-10).

Table 4-10 Observations of bird species recorded within the blade-swept area of the Rosiere Site (Kewaunee County, 1998)

Common Name	Number of Birds in Blade-Swept Area (134 to 288 ft.)	Total Number of Observations	Percentage of Birds within Blade-Swept Area	Percentage Flying in Blade-Swept Area versus Total Birds Observed
ring-billed gull	876	3,872	22.6	6.26
Canada goose	304	6,159	4.9	2.17
Lapland longspur	243	845	28.8	1.74
red-winged blackbird	97	778	12.5	0.69
mallard	65	89	73.0	0.46
Bonaparte's gull	46	426	10.8	0.33
rock dove	36	220	16.4	0.26
American crow	15	223	6.7	0.11
herring gull	15	48	31.3	0.11
European starling	14	267	5.2	0.10
horned lark	14	359	3.9	0.10
purple martin	10	35	28.6	0.07
eastern bluebird	9	14	64.3	0.06
red-tailed hawk	9	50	18.0	0.06
turkey vulture	7	28	25.0	0.05
common raven	6	20	30.0	0.04
great blue heron	6	17	35.3	0.04
killdeer	6	91	6.6	0.04
sandhill crane	6	23	26.1	0.04
American robin	3	122	2.5	0.02
broad-winged hawk	3	23	13.0	0.02
lesser yellowlegs	3	3	100.0	0.02
northern harrier	3	30	10.0	0.02
common grackle	2	99	2.0	0.01
gray catbird	2	2	100.0	0.01
merlin	2	7	28.6	0.01
mourning dove	2	23	8.7	0.01
northern flicker	2	17	11.8	0.01
rough-legged hawk	2	3	66.7	0.01
sharp-shinned hawk	2	6	33.3	0.01
wood duck	2	2	100.0	0.01
common loon	1	7	14.3	0.01
common snipe	1	4	25.0	0.01
tree swallow	1	57	1.8	0.01
upland sandpiper	1	15	6.7	0.01
TOTAL	1,816	13,984		12.93

Source: Public Service Commission of Wisconsin, 1998.

When looking only at species with recorded flights within the blade-swept area, the ring-billed gull, red-winged blackbird, Lapland longspur, and the Canada goose account for 83 percent of all bird flights recorded and 84 percent of the flights within the blade-swept area. The data indicate that while overall numbers of flights within the blade-swept area may be low, some species are likely to be more at risk for collisions than others. For example, raptors show a relatively high proportion of flights within the blade-swept area as do the ring-billed gull, mallard, eastern bluebird, great blue heron, and the Lapland longspur. These species may be proportionately more vulnerable to mortality from striking turbine blades than other species in the study area. Some species, such as the Canada goose, show a relatively low proportion of flights within the blade-swept area. However, because they appear in the study area in relatively high numbers, abundance may be the most important factor in defining risk of wind turbine strikes for the Canada goose.

4.11.4.3.2 Risks associated with flight height

A turbine exposure index provides a means of comparing the flight height data from different wind farm sites. The exposure index is based on the average use, proportion of observations recorded as flying, and proportion of flight heights recorded within the blade-swept height of turbines. Appendix A, Table A-6 shows the exposure index for raptors and other large bird species at the Foot Creek Rim, Simpson Ridge, and Buffalo Ridge sites.

For all birds, the species with the highest exposure index at Foot Creek Rim were the golden eagle, American crow, red-tailed hawk, common raven, and black-billed magpie (Johnson *et al.* 2000a). The species with the highest turbine exposure index at Simpson Ridge were the golden eagle, American crow, ferruginous hawk, common raven, and ducks. For Buffalo Ridge, the species were Canada goose, snow goose, mallard, double-crested cormorant, and Franklin's gull (Johnson *et al.* 2000b; Strickland *et al.* 2000). However, at Buffalo Ridge, Minnesota, the species with the highest exposure index did not coincide with the species recovered from the site (Johnson *et al.* 2000b). The majority of the bird fatalities recovered at Buffalo Ridge, from 1999 to 2002, were small birds; approximately half were likely nocturnal migrants.

Regarding raptor fatalities, the information is mixed at Foot Creek Rim. There was high raptor use at the site. Only 5 percent of the observed raptors were American kestrels, but they accounted for 60 percent of all raptor fatalities. Other raptors like the golden eagle accounted for 40 percent of raptor observations, but had no fatalities (Young *et al.* 2003a). This does not necessarily mean that abundance and flight behavior are not effective measures of collision risk, but rather that many factors influence risk and the relative influence of each factor may vary from site to site.

4.11.4.3.3 Bird flight heights observed in the project area

Howe and Atwater (1998) recorded that within five miles of Horicon Marsh, birds generally flew higher during the fall than in the spring. Most birds were recorded below 98 feet, which is below the height of the Forward-proposed blade-swept area (127 feet). Species observed in the study area with flying heights averaging greater than 98 feet included the double-crested cormorant, rough-legged hawk, turkey vulture, and ring-billed gull. Many flocks of Canada geese, mallards, and sandhill cranes were observed at elevations of 164 feet or higher.

Forward based bird flight height estimates for their bird study on the heights of trees and houses and lengths of wingspans, and other objects in the general area. Flight heights were estimated for most of the birds observed using three height categories, less than 75 feet (below the blade-swept area), between 76 and 350 feet (within the blade-swept area), and greater than 350 feet (above the blade-swept area). However the actual blade-swept area for the Forward project is between 127 and 398 feet, reducing the usefulness of the data collected. Furthermore, flight height data was only analyzed for waterfowl, sandhill cranes, and raptors. Based on their flight height categories the following percentage of birds flew within the blade-swept area: approximately 20 percent of sandhill cranes observed, 30 percent of waterfowl (dominated by Canada geese), and more than half of the observed raptors (65 percent). No analysis was provided by Forward in the 2004 study for passerines (36 percent of all birds observed); other types of shorebirds/waders; or endangered, threatened, or otherwise protected species. Flight heights will be recorded and analyzed for all bird groups during Forward's 2005 study using the same methodology, but the height categories will be adjusted to the height of the blade-swept area for the turbines proposed for the Forward project.

4.11.4.4 Raptors

4.11.4.4.1 Raptor migration patterns

Raptor migration occurs throughout Wisconsin, including the Forward project area (Figure Vol. 2-5). Primary migration routes are the Lake Michigan and Lake Superior shorelines, and the Mississippi River. Experts in the field agree that the number of migrating hawks inland is variable. Raptor migration information is focused on the Lake Michigan shoreline because of the tendency for migrating raptors to be "drifted," by westerly winds, east from the Mississippi valley to the Lake Michigan shoreline, where some raptors continue along the shore rather than crossing the lake (Erdman, pers. comm.[32]). The extent to which migrating raptors drift east to the lake shoreline depends on the individual species, timing of weather systems, and the number of systems. Of the 100 or so individual red-tailed hawks color-marked at Little Suamico (on the west shore of Green Bay) every fall, only a few are observed again in the same year further south along the Lake Michigan shoreline, suggesting that some may continue their migration inland. Depending on the timing and number of cold fronts passing through Wisconsin in the fall, counts at the shoreline can vary significantly. Erdman points out that because of climatic and other environmental variables, 35,000 broad-wing hawks can be observed along the Lake Michigan shoreline one year and only 500 the next. The birds still migrate, but inland away from the shorelines.

Forward's avian risk assessment concluded that there is an absence of focused raptor migration pathways in inland southern Wisconsin. Forward describes hawk migration in the project area as small numbers occurring over a broad front, mostly at high altitudes except where topography such as water bodies or large continuous ridges concentrates the migrants (Heintzelman 1975, 1986; Kerlinger 1989). Forward considered the Niagara Escarpment as a topographic feature that is not prominent enough to attract migrating raptors because it is relatively low, broken, and not very distinct compared to the Appalachians or Rockies. It concluded that a small number of hawks migrate through the project area at altitudes greatly exceeding the proposed blade height. Forward's data indicated that raptors observed in 2004 flew at low altitudes and in varied directions, suggesting they were not actively migrating.

DNR biologists at Horicon Marsh have observed that the Niagara Escarpment provides deflected winds that are regularly used by turkey vultures during migration and throughout the summer. This particular use has not been quantified, but illustrates that the Marsh/Escarpment complex attracts raptors and is a habitat resource not present in other agricultural landscapes. Red-tailed, sharp-shinned, and Cooper's hawks demonstrate a regular seasonal movement along the eastern edge of Horicon Marsh, the Escarpment, and the uplands east of the Escarpment in the project area.

4.11.4.4.2 Raptor use of project area

Many raptors hunt in open landscapes such as the project area. Larry Michael, an experienced local birder (pers. comm.[33]), reports regular sightings of red-shouldered hawks (state threatened) moving

[32] Tom Erdman, curator of the Richter Museum at University of Wisconsin – Green Bay
[33] Larry Michael, President of the Horicon Marsh Bird Club

parallel to the Escarpment, and he commonly sights peregrine falcons within the project area as they hunt migrating plovers. He reports that bald eagles are commonly seen scavenging in the uplands within the project area early in the year. Broad-winged hawks are occasionally sighted in migration following the Niagara Escarpment, usually at altitudes of more than 500 feet. They are known to roost in the woodlots around the Escarpment during migratory stopovers. Rough-legged hawks, red-tailed hawks, northern harrier, and the American kestrel forage within the project area. Both red-tailed hawks and kestrels are among the raptors most frequently reported as killed at other wind farms.

Concerns about raptor impacts with wind turbines originate from early studies completed at older wind farms in California (Howell *et al.* 1991; Orloff *et al.* 1992). Hunting, migratory, or resident raptors can be susceptible to turbine collisions because they hunt within the height of the blade-swept area. Raptors often concentrate on their prey during hunting to the exclusion of hazards like wind turbines. Raptors can also become habituated to them, losing their wariness. Young raptors have been shown to be more vulnerable to turbine collisions than older, more experienced birds (Thelander *et al.* 2003).

Young *et al.* (2003b) also made interesting observations of attempts by raptors to avoid collisions with wind turbines at Foot Creek Rim. He noted that a golden eagle was observed climbing up and down as it passed over and between two turbines, and another turned back to its direction of origin. A prairie falcon was observed adjusting its height to fly below the turbine. Some dramatically altered their flight at the last minute to avoid being struck while pursuing prey. While these are qualitative observations, it may demonstrate that there are differences among raptor species in their flying characteristics and manner of avoiding turbines, but it also suggests that stress factors may eventually reduce their use of the area.

The 2004 Forward bird survey recorded 289 raptors in the spring and 346 in the fall. An estimate of the number of raptors observed per hour for the Forward survey, and the Howe *et al.* (2002) and Kaspar (1999 and 2000) studies, is presented in Table 4-11. The three surveys had similar rates of observation of common raptors, with red-tailed hawk being the most frequent.

Table 4-11 Comparison of counts per hour for selected raptors in Wisconsin studies

Common Name	Howe (1999-2001)		Kaspar (1999)		Forward Project (2004)	
	Total	Individuals/ hour	Total	Individuals/ hour	Total	Individuals/ hour
American kestrel	477	0.5	77	0.6	102	0.6
Cooper's hawk	27	0.0	14	0.1	18	0.1
red-tailed hawk	536	0.6	383	3.2	371	2.2
rough-legged hawk	63	0.1	12	0.1	4	0.0
sharp-shinned hawk	12	0.0	5	0.0	8	0.0
turkey vulture	111	0.1	66	0.5	56	0.3

Notes: The values presented in the table were estimated for this EIS. Total number of hours estimated: Howe = 900 during three years; Kaspar = 121 hours during spring/fall of 1999; Forward = 171 hours during spring/fall of 2004.

Kaspar survey for spring and fall, 1999 only. Howe survey excludes results from 1998 that were incorporated from a different survey and includes results from 1999 to 2001 for all seasons.

Forward concludes that raptor use is low in the proposed project site. Forward observed 2.2 red-tailed hawks per hour. At Foot Creek Rim during studies from 1998 to 2002 at the first phase project site (FCR I) with 69 turbines, observations of 1.3 to 2.4 raptors per hour were interpreted as moderate to high raptor use. Nonetheless, at this site the total number of raptor fatalities during the study period was 5 and the fatality rate was 0.03 raptor fatalities per turbine per year (Young *et al.*. 2003a). Likewise, no raptor mortalities were reported at the Kewaunee site during the study period, despite the higher proportion of raptors than other birds being found at the rotor-swept height (139 to 294 feet) (Howe *et al.* 2002).

Raptors are believed to be more vulnerable to wind turbine-related mortality than other types of birds. Erickson *et al.* (2001) looked at several sites and studies and found a good correlation of raptor area use with fatality risk. However, the correlation is not consistent when one separates the earlier California studies from more recent studies completed at Buffalo Ridge, Minnesota and Foot Creek Rim, Wyoming. This may indicate that newer turbines, which are taller, do not use guy wires or lattice towers, and have slower rotor speeds, may reduce the risk to raptors.

Observations from the Horicon CBCs indicate that the flight patterns of the hawks in this area often rely on wind currents, with birds flying from 50 feet to a few hundred feet above the ground, which is within the blade-swept area of the proposed turbines.

Studies at Foot Creek Rim indicated that the proportion of flights within the blade-swept height of the turbines (62 to 203 feet) was 42.8 percent for eagles, 36.6 percent for large falcons and 35.9 percent for buteos (red-shouldered, red-tailed, and rough-legged hawks) based on a minimum of 40 observations (Johnson *et al.* 2000a). Kaspar (2000 and 1999) noted the raptors spent more time within the blade-swept area of the wind turbines for Kewaunee County than any other group of birds. Howe *et al.* (2002) reported a higher proportion of raptors found within the blade-swept area (134 to 288 feet) relative to their proportion among the total number of birds.

Similar to the other studies, Forward found that a high percentage of raptors (65 percent) flew within or below the blade-swept area (75 to 350 feet), and 13 percent flew above this height. However, because the top of the Forward proposed blade-swept area is actually 389 to 398 feet and not 350 feet (assuming their field flight estimations were accurate), it is possible that more than 65 percent of the flying raptors actually flew within the blade-swept area. To the extent that the Forward study was not timed to fully characterize raptor migration and use during the 2004 season, collision risk for raptors may differ from that calculated by Forward.

4.11.4.4.3 Forward project implications for raptors

Conclusions about raptor migration through the project area are difficult to make beyond saying that it occurs in variable numbers lower than those along the Lake Michigan shoreline. Despite many years of observations at Horicon Marsh and in the surrounding uplands, there have been no studies quantifying raptor migration or its variability from year to year. Even winter raptor populations, recorded during the Horicon CBC, vary by several hundred percent. Although the Forward survey reported rates of raptor observation similar to other studies, one year of survey data does not provide sufficient information to characterize resident and migrant populations, which are cyclical and dependent on prey populations. The number of raptors hunting within an area is related to local prey populations, which vary over four-year cycles. Raptor-use surveys that occur in only one year have a three-in-four chance of missing peak raptor population years. But if raptors have several different types of prey, the peak prey population years could be much more irregular than one-in-four years.

Forward completed no nesting surveys or prey population estimates. From one incomplete year of survey data, Forward concluded that raptor use at the site is low and therefore, mortality would be biologically insignificant. However, raptors have been shown to be particularly vulnerable to wind turbines and are among those groups that frequently fly within the blade-swept areas of turbines (*i.e.*, at altitudes of a few hundred feet). There may be differences among raptor species with respect to their ability to avoid collisions such that the amount of raptor fatalities at the Forward site will be influenced by both abundance and behavior.

The range of raptor mortality in California was from 0.007 to 0.10 raptors/turbine/year. However, the California studies include data from older wind turbines which have higher bird mortality rates than the newer designed turbines, such as those proposed by Forward. Studies completed outside of California show a raptor mortality rate of 0.00 to 0.065 raptors/turbine/year (Erickson *et al.* 2003; Erickson *et al.* 2001; Howe *et al.* 2002; Young *et al.* 2003a;), which when applied to the 133 turbines at Forward, would be 0 to 9 raptors/year. Red-tailed hawks and American kestrels are most at risk because of their relative abundance in the Forward project area and their tendency to fly within the turbine's blade-swept area. The presence of at least five state-listed or protected raptor species in the Forward project area and the abundance and use of this bird group within the project area warrant a more thorough study by Forward.

4.11.4.5 Passerines

The category of passerines includes songbirds, perching birds, and other small birds. Migrating passerines and other small birds (most are nocturnal migrants), occur in very large numbers around Horicon Marsh (Volkert, per. comm.[34]). As many as one-third of the Neotropical migrant species that pass through Wisconsin are estimated to be in decline (Cutright 2005). In order to determine the degree of risk the Forward project would pose to these bird species, potential habitat in the project area, species abundance, flight heights, and their mortality rates at other wind projects were reviewed.

Passerines tend to spread over broad geographic areas while migrating over open country or farmland. Night migrating songbirds concentrate at stopover areas along the edges of large bodies of water (Diehl *et al.* 2003). Stopover areas are necessary to preserve populations of nocturnal migrants. The stopover areas must be well dispersed throughout the landscape to accommodate the needs of many different species or to accommodate birds during adverse weather conditions. However, the stopover areas are not restricted to areas with optimal habitat at the edge of water bodies, but include small patches with food resources or large areas with little food, but good protective cover. Potential grassland habitat for migrating passerines can be found in the project area on parcels eligible for or actively participating in the Conservation Reserve Program (CRP) and the GHRA. See "Vegetation," Section 4.9.1.3 for additional information on these parcels. There are no forested parcels in the project area large enough to attract large numbers of forest-nesting songbirds.

The Horicon and Theresa Marshes are areas where migrating passerines most likely congregate along with the larger woodlots and riparian areas adjacent to or near the marshes. Migrating passerines could also use the adjacent uplands in the project area. As the region becomes more developed and suitable habitat becomes more fragmented and scarce, both the marshes and surrounding habitat will become increasingly important for migrating passerines.

4.11.4.5.1 Passerine flight heights

In general, nocturnal migrants travel at higher altitudes than diurnal migrants. Of the nocturnal migrants, most shorebirds and waterfowl fly higher on average than do songbirds. Most birds tend to fly higher when crossing large bodies of water than when flying over land.

[34] William Volkert, Natural Resources Educator and expert ornithologist at Horicon Marsh State Wildlife Area, Wisconsin DNR

Some of the highest flight altitudes are attained by shorebirds and a few songbirds that make long-distance, non-stop flights over water. Most birds migrate within the following ranges of altitudes (in feet):

- Songbirds 500-6,000
- Shorebirds 1,000-13,000
- Waterfowl 200-4,000
- Raptors 700-4,000

Seventy-five percent of songbirds migrate between 500 and 2,000 feet.[35]

No nocturnal avian migration studies have been reported for Dodge or Fond du Lac Counties or specific to the project area. Along the Lake Michigan shoreline, passerine flocks have been observed on NOAA Doppler radar, mostly flying at an altitude of more than 500 feet (Idzikowski, pers. comm.[36]). While this altitude is well above the proposed Forward project blade-swept area, this does not prove whether or not they would fly at that height in the project area. Idzikowski noted that these birds may be at risk from wind farms when they become exhausted in migration and drop into the first suitable habitat, or when weather conditions compel birds to fly at lower altitudes.

An acoustical study was conducted for a wind project in Kewaunee County, about 75 miles northeast of the Forward project area. Howe *et al.* (2002) estimated flight altitudes of night migrating passerines based on acoustical time delays. More than 10,000 individuals of more than 35 migrating species were identified flying over the site. About 20 to 22 percent of birds recorded flew within or below the Kewaunee project blade-swept area (134 to 288 feet), which is within the Forward blade-swept area. Howe suggests that this should be interpreted carefully. Environmental factors may have interfered with the recordings, resulting in underestimates at the project location. Still, the study provided no evidence that the Kewaunee wind turbine sites experience unusually large numbers of migrant bird mortality.

Thirty-two percent of the passerines in flight observed by Young *et al.* (2004) at the proposed Mount Storm turbine site in West Virginia were flying between 75 and 345 feet. Some passerines such as vireos and nuthatches, flew more frequently in this elevation range. Flight elevations during nocturnal migration were highly variable with a mean altitude of 1,230 feet, well above wind farm turbine heights. However, at Buffalo Ridge, Johnson *et al.* (2000b) found that most passerines flew below 150 feet and sparrows, thrushes, finches and longspurs would infrequently fly above this elevation. This is similar to what Kaspar (2000 and 1999) found insofar as longspurs and larks would infrequently fly within the blade-swept area of turbines at the wind farm in Kewaunee County.

The index of relative exposure to turbines (Appendix A, Table A-7) was calculated for all species observed during passerine and small bird (PSB) surveys by Johnson *et al.* (2000a and 2000b). Based on this index, passerine and small bird species with the highest turbine exposure index at Foot Creek Rim, in order, are pine siskin, American goldfinch, cliff swallow, violet-green swallow,[37] and horned lark. On Simpson Ridge, species with the highest turbine exposure index are cliff swallow, violet-green swallow, horned lark, Brewer's blackbird, and Brewer's sparrow. At Buffalo Ridge (Johnson *et al.* 2000b) those

[35] Data obtained from the Smithsonian Migratory Bird Center website at http://nationalzoo.si.edu/ConservationAndScience/MigratoryBirds/Fact_Sheets.
[36] John Idzikowski, researcher at University of Wisconsin Milwaukee.
[37] Violet-green swallow is a western species only and not found in Wisconsin. The tree swallow is its eastern counterpart.

with the highest index overall for raptors and other large birds combined with passerine and small bird data were Lapland longspur, horned lark and red-winged blackbird.

Research shows small birds experience the greatest number of casualties at some wind projects. Of the bird fatalities at wind farms reviewed by Erickson *et al.* (2001), between 34 and 59 percent of the fatalities were nocturnal migrants. However, bird fatality studies of nocturnal migrants suggest that fatality numbers are relatively low compared to the overall population of migrating birds (Erickson *et al.* 2001). This underscores the need to understand how environmental conditions and behavior influence collision risk at each particular site, since the risk of collision is related to abundance, behavior, and other conditions such as weather.

4.11.4.5.2 Passerines in the project area

The number of passerines observed per hour was estimated for the Howe, Kaspar, and Forward studies to determine whether the different study methodologies produced comparable results. Appendix A, Table A-8 illustrates that despite attempts to account for similarities in the habitat at the three study sites, there is still variability in the species that were observed. Even though abundance of the various bird species among the three sites differs by orders of magnitude, relative patterns of high, medium and low abundance are recognizable.

In the Forward 2004 survey, passerines were the second most abundant group of birds identified and the most abundant group in the eastern study area during the spring, yet Forward provided little analysis regarding this group of birds. Forward estimates "modest" numbers of this bird group at the project site. However, comparisons to observation rates for passerines at other sites in Wisconsin indicate that some species that should have been present at the Forward site were not recorded and other common small birds were excluded from the field observations. Flight height of passerines was recorded in the field notes, but was not included in the risk analysis report. No studies of nocturnal migrants were completed, nor was risk to this group evaluated in the report. The Forward 2005 study will not provide additional information on nocturnal migrants because the state agencies and Forward could not agree on the methodology for such a study and the utility of information it would provide for making project-related decisions.

In looking at studies by Howe *et al.* (2002) in Wisconsin and elsewhere (Young *et al.* 2003a), it is likely that passerines could suffer the majority of fatalities at the site. Abundant species like European starling and Lapland longspur may suffer the majority of the fatalities, but less common species like Tennessee warbler (special concern species) could also be impacted. Applying Howe's fatality estimates for passerines, 133 passerines would be killed per year for the Forward wind farm, assuming that mortality is evenly distributed among all the turbines. Applying estimates from other sites outside of Wisconsin, the mortality numbers could double or triple.

Bird abundances at other sites are not subject to the influence of Horicon Marsh. Again, because the 2004 Forward survey did not include the westernmost part of the project area where bird abundance and diversity may have been the greatest, there are limitations in applying fatality estimates of passerines from other sites to the project area. For common birds, this inability to estimate fatalities would likely not have any biological consequence for the survival of these species, but this is not the case for rare species.

The displacement of passerines and other small birds from this area is not significant for common birds. Displacement could become significant for rare species in a cumulative context, combining the effects of all of the wind farms proposed and other land use changes in the region that reduce the region's suitability as bird habitat. However, the 2004 Forward study did not provide sufficient information on rare bird use within the project area to assess this potential impact. Results of the 2005 study may provide more information.

4.11.4.6 Shorebirds, waders, waterfowl, and waterbirds

Horicon Marsh is a major resting and feeding area for waterfowl, wading birds and shorebirds during the spring and fall migrations. The broader Horicon Marsh ecosystem region is also an important habitat resource for many less abundant and rare waterfowl and shorebirds. Therefore, any development with the potential to diminish the value of this habitat should be carefully evaluated.

Compared to the surrounding agricultural region, excluding Horicon and Theresa Marshes, the project area does not have unique land features and habitat resources for this category of birds. However, each year very large numbers of waterfowl, shorebirds, and waders move into and out of Horicon and the surrounding marshes to forage in nearby farm fields (including the proposed Forward project area). These birds move at low altitudes between resource areas.

Waterfowl observed during the Forward survey were flying to and from the Horicon Marsh area and moving between foraging sites. Flight direction for 51,629 waterfowl, about 93 percent of them Canada geese, was recorded during the Forward survey. The dominant direction of flight was toward the northeast, with a lesser number flying toward the east. Together these directions accounted for roughly one-half of all waterfowl directional observations. The next most common directions were to the southwest and west.

Waterfowl most often migrate at altitudes in excess of 500 to 1000 feet above ground, as detected by radar (Kerlinger and Moore 1989, Bellrose 1976). In the vicinity of Horicon and Theresa Marshes, ducks, geese, and other waterbirds must descend and ascend as they use these resource areas for stopovers, and as they fly in and out to forage. During these foraging flights, altitudes are not likely to exceed several hundred feet. According to Dick Hunt, retired waterfowl researcher at Horicon Marsh, geese fly from 100 to 500 feet high when feeding and commonly from 2,000 to 5,000 feet when migrating. Also, waterfowl move from field to field at altitudes in the range of 30 to 150 feet. This is comparable to findings from the Foot Creek Rim site in Wyoming where an estimated 42.8 percent of the waterbirds flew between 62 and 203 feet (Johnson *et al.* 2000a).

Other waterfowl, waders, and shorebirds such as grebes, loons, sandhill cranes, herons and egrets, also generally migrate above 500 feet but are observed at lower altitudes as they land and take off while using the Marsh and surrounding area.

Species that are primarily open water feeders, including grebes, loons, and diving ducks, are less likely to forage in upland areas in the project area. Sandhill cranes and some herons will forage in the wet patches within open fields and in wetland areas within the project area.

Erickson *et al.* (2002) found that two seasons of data provided moderately good predictions of use by waterfowl and waterbirds and three years of data provided good predictions. Correlations of seasonal use estimates with overall use estimates were highly variable, but best in spring and summer. Waterfowl and waterbird use at agricultural sites was greater than at natural habitat sites, but the added factor of edge or transitional habitat increased use even more. The highest waterfowl use existed at sites near waterbodies (*i.e.*, San Gorgonio, California and Buffalo Ridge, Minnesota). The authors estimated that, at least regarding Canada geese, the rate of fatalities relative to use was low.

4.11.4.6.1 Canada geese

Horicon Marsh hosts the largest migratory flock of Canada geese in the world. They are part of the Mississippi Valley Population (MVP) of Canada geese. The Marsh and surrounding area attract between 200,000 to 300,000 Canada geese on a peak day in fall. These birds attract hunters and bird watchers to the area due to their sheer numbers.

The fall migrant geese arrive on the Marsh around mid-September, and stay for four to eight weeks. The population peaks around late October to mid-November and declines by early to mid-December, as snow and ice cover the food supply and freeze open water resting areas. In most winters, some geese remain in east-central Wisconsin, with the population size and distribution dependent upon open water, snow depth and weather conditions.

In spring, Canada geese are at Horicon Marsh from late February or early March until mid-April. The Marsh and the surrounding uplands are even more important during the spring when they are used as a staging area (Wheeler and Vine 1999). This results in approximately 29 million goose-use days (the number of geese multiplied by the number of days when geese are present) each spring prior to departure for the nesting grounds. During stopovers at Horicon and Theresa Marshes, the geese make daily foraging flights into farm fields surrounding the project to feed on corn and other crop residues.

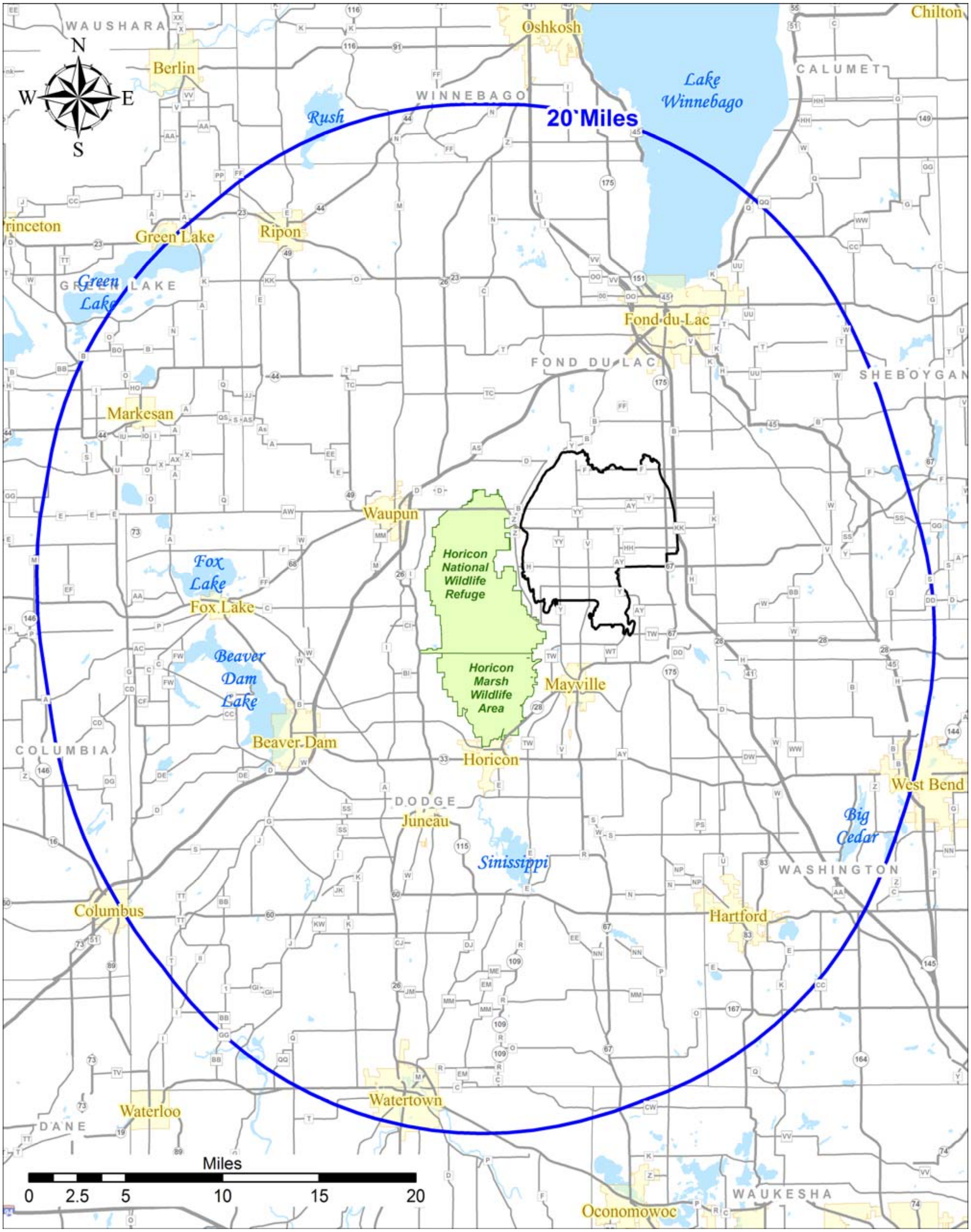
The Canada geese that use the Horicon area are of special concern to wildlife experts as well as amateur bird watchers who see these population levels as a successful outcome of wildlife management. Wildlife managers see the geese as a shared resource that is managed regionally, with cooperation from the Canadian government, USFWS, Wisconsin DNR, and conservation agencies in surrounding states.

Canada geese were among the most abundant birds observed in the project area by both Howe and Atwater and Forward. While Howe and Atwater (1998) only studied the area within five miles of Horicon Marsh, DNR experts estimate the feeding area used by the waterfowl may extend up to 20 miles from Horicon Marsh (Figure 4-8). Howe and Atwater noted that the altitude of birds flying through the observation areas in the spring and fall was most often in the 20-50 m. (66-164 feet) range.

Canada geese accounted for more than 90 percent of all waterfowl observed by Forward during the 2004 spring and fall surveys, in both the road surveys and the point counts. Forward observed 10,963 Canada geese in the spring and 74,508 in the fall. However, the peak of the spring migration occurred in mid-March,[38] before the 2004 Forward bird study began. Still, there is a good historical record of Canada goose populations at Horicon Marsh as well as observations regarding their use within the project area in the 2004 study. Based on recommendations from the PSC and the DNR, Forward agreed not to count Canada geese in its 2005 bird surveys because their large numbers may distract from accurate counts and observations of other bird species.

[38] This is based on USFWS monitoring at Horicon Marsh where they recorded a peak of 22,827 Canada geese on March 16, 2004.

Figure 4-8 Horicon Marsh area of influence on waterfowl



4.11.4.6.2 Ducks

The project area is not an important waterfowl nesting habitat, though mallards do rely to a high degree on the waste grain in the fields for forage (Gatti and Coblenz, pers. comm.[39] [40]). Gatti has typically seen flocks of 50 ducks foraging within this area, occasionally numbering up to 2,000. Mallards commonly fly out of Horicon Marsh in late fall. Single flocks numbering 500 to 2,000 mallards have frequently been observed at the Marsh. On several occasions, from 1998 through 2002, 20,000 to 25,000 mallards have been observed leaving Horicon Marsh within a 30-minute period to feed in the nearby uplands (Volkert, pers. comm.[41]). During the 2004 study, Forward observed only 130 mallards in the spring and 4,265 in the fall.

4.11.4.6.3 Swans

Tundra swans commonly stop over at Horicon Marsh during migration. According to Volkert,[42] flocks tend to fly at relatively higher altitudes of 500 feet or more. Forward recorded 81 observations of tundra swans during its survey in 2004. Howe *et al.* (2002) recorded 621 tundra swans during surveys from 1998 to 2002 at the Kewaunee County site. During surveys in Calumet County, Kaspar recorded only one occurrence of 42 tundra swans during surveys in spring, summer and autumn of 1998 and 1999.

Trumpeter swans (state endangered) were released into Horicon Marsh as part of the state re-introduction program. However, these birds did not return to Horicon Marsh in the subsequent year. With the continued increase of the population (in 2004, there were 70 successful nesting pairs in Wisconsin), it is expected that these birds will eventually re-establish themselves at Horicon Marsh. In the spring of 2004 a pair of sub-adults was sighted on the Marsh and flying at low altitudes to the east.

4.11.4.6.4 Sandhill cranes

The farmland in the project area is a very important feeding area for sandhill cranes. Coblenz reported that most flocks consist of 20 to 50 cranes flying into the farmland to feed. Michael[43] and Volkert[44] (pers. comm.) have each observed flocks consisting of 100 to 300 birds standing in surrounding fields on numerous occasions. Most of these flocks are found within about 3 miles from the federal refuge boundary, in particular, the area from the western edge of the Niagara Escarpment east to County Highway YY.

In spring, only 10 sandhill cranes were observed on road surveys and point counts, whereas in fall 6,845 cranes were observed. This translates to 0.3 cranes observed per hour in spring versus 51.9 cranes per hour in autumn. Sandhill cranes observed during the Forward survey tended to be flying northeast and north about one-half of the time, suggesting that they were moving outward from Horicon Marsh into and through the Forward project area. There was not a strong tendency for these birds to fly back toward the Marsh.

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[39] Ron Gatti, waterfowl research biologist, DNR
[40] Jim Coblenz, local hunting guide and bird observer
[41] William Volkert, Natural Resources Educator and expert ornithologist at Horicon Marsh State Wildlife Area, Wisconsin DNR
[42] Ibid.
[43] Larry Michael, President of the Horicon Marsh Bird Club
[44] William Volkert, Natural Resources Educator and expert ornithologist at Horicon Marsh State Wildlife Area, Wisconsin DNR

Similar to the Forward survey, the sandhill crane was also among the most frequently observed and most abundant bird observed by Howe and Atwater. Howe and Atwater (1998) observed 218, ranking them as the 13th, 19th, and 11th most frequently recorded species during the spring, summer and autumn around Horicon. They noted that approximately 12 percent of the sandhill cranes were observed flying at 30 m (98 feet) or greater. Howe (2002) recorded 175 sandhill cranes from 1999 to 2002 at the Kewaunee County site. During surveys in Calumet County in spring and autumn of 1998 and 1999, Kaspar observed over 70 cranes. Sandhill crane use of the project area may be greater than at other locations with similar land use cited by Forward. Sandhill cranes are relatively weak flyers compared to ducks and geese and may be more vulnerable to strikes with the turbines than waterfowl, due to their flight habits. However, there is little data in the literature or from Forward to resolve this uncertainty.

4.11.4.6.5 Shorebirds

Shorebirds, including sandpipers and plovers, are unlikely to land at the project area in large numbers during either spring or fall. These birds generally migrate at night at high altitudes, usually exceeding 500 feet above ground level (Kerlinger and Moore 1989). These species are likely to rest in the project area in small numbers, and are likely to be dispersed over a large geographic area. There is little habitat in the project area that would attract large numbers of shorebirds. It is likely, however, that they will be found in larger numbers at the Horicon and Theresa Marshes where they will be attracted to shallow water, mudflats, and wet meadow habitats.

Most shorebirds rely on shallow water and mudflats as stop-over habitat for feeding and resting during their long migrations (Matteson and Volkert 2002; Volkert and Matteson 2001). However, several species of shorebirds, particularly the American golden plover and black-bellied plover (both of which have been commonly observed in the Horicon area during migration), as well as American pipits rely more on upland habitats for feeding and resting. Among the best places around Horicon Marsh to observe these birds are the uplands in the proposed project area, especially the farmland along Centerline Road (Volkert and Michael, pers. comm.[45] [46]). Flocks commonly number 20 to 30 birds with some larger flocks of 75 to 100 golden plovers.

As with other shorebirds, terns stop over in fairly large numbers at the Horicon and Theresa Marshes during spring and fall migration. These birds are attracted to the open waters of these wildlife areas and are not likely to be seen in large numbers in the project area.

The Forward survey identified 141 American golden plovers and 1 black-bellied plover in the fall. Howe and Atwater (1998) identified 148 black-bellied plovers during 1997 and 1998 surveys around Horicon Marsh, but did not list golden plovers among the commonly observed birds. Howe *et al.* (2002) recorded 60 golden plovers and 11 black-bellied plovers from 1998 to 2001 at the Kewaunee County wind farm.

4.11.4.6.6 Conclusions for shorebirds, waders, waterfowl, and waterbirds

Shorebirds, waterfowl, waterbirds, and waders forage within the Forward project area in numbers that are higher than in other agricultural areas of Wisconsin. This is due to the site's proximity to Horicon and Theresa Marshes. Hundreds of thousands of these birds pass through Horicon Marsh each year.

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[45] William Volkert, Natural Resources Educator and expert ornithologist at Horicon Marsh State Wildlife Area, Wisconsin DNR
[46] Larry Michael, President of the Horicon Marsh Bird Club

It is reasonable to assume that the Forward project could cause some mortality to this group of birds simply because of their sheer abundance in the region and that they may fly within the blade-swept area as they move through the area. Existing studies suggest that mortality numbers will be low, but none of the other wind farm study sites match all of the conditions of the Forward project area. The large numbers of turbines located between marshes and in the upland feeding areas could result in higher mortality numbers for this bird group than those recorded at other wind farms.

The potential loss of foraging habitat may be more of a concern for these abundant water-dependent species than mortality. The large populations residing in and stopping over at Horicon Marsh are heavily dependent on the adjacent agricultural fields for food. Documented avoidance of wind turbine sites varies by bird species. It may range from a few hundred feet, as estimated at Buffalo Ridge, up to a mile, as estimated for an offshore ocean site (Johnson *et al.* 2000b; Leddy *et al.* 1999; Tulp *et al.* 2000). Avoidance of the project area by these birds could result in the loss of tens of thousands of acres of foraging habitat. While a loss of this magnitude is unlikely to occur, this effect has not been well-studied at existing wind farms, nor is there information from Horicon Marsh that could be used to estimate this impact or the additional pressure it could place on other upland foraging sites.

4.11.4.7 Winter resident birds

The presence of wintering birds within or adjacent to the Forward project area depends on the availability of food, which is affected by harvest conditions and snow cover, the persistence of open water for some species, and weather conditions in general.

CBCs provide the best information on raptors and other winter bird populations in the Horicon Marsh area. CBCs are conducted by volunteers in December or early January of each year. The number of bird species and individuals that are recorded may depend on the number of people participating and the number of hours per count (approximately from sunrise to an hour after sunset).

The count circle for the Horicon Marsh CBC is located at the Main Ditch and Main Dike at the Marsh and covers a standard 15-mile diameter. The northeast corner of the Horicon Marsh CBC covers a large portion of the western half of the Forward project area. Counts of raptors are of birds sighted on the uplands surrounding the Marsh, consisting primarily of rough-legged hawks, red-tailed hawks, and American kestrels. Northern harriers were sighted about equally in upland and wetland habitats. Bald eagles were primarily sighted on Horicon Marsh, although they commonly hunt the uplands in the project area.

Table 4-12 is a summary of hawk observations from the Horicon CBC conducted from 1976 to 2004. The complete table is located in Appendix A, Table A-9. Volkert has participated in this count for the past 25 years. In compiling the data for Table A-9, extra care was taken to avoid double-counting.

Table 4-12 Summary of common raptor counts from Horicon Christmas bird counts (1976-2004)

Results of Raptor Counts	Number of Observations (Year)			
	Red-tailed hawk	Rough-legged hawk	Northern harrier	American kestrel
Low	1 (1978)	0 (1978)	0 (1980, 1985, 1996)	0 (1978)
High	67 (2004)	28 (1999)	24 (2004)	30 (2002)
Average	22.9	10.2	7.5	11.2

*Source: William Volkert, Wisconsin DNR

Winter raptor populations are quite variable depending on prey availability and snow cover. Data for the 2004 CBC reflects the higher rodent populations that year. In several recent CBC counts (1988, 1994, 1998, 1999 and 2002), populations were very high and red-tailed and rough-legged hawks comprised from 50 to 75 individuals. During the 1994 count, 9 hawks were identified on a single 20-acre field in the northeast corner of the count area, in the project area. All of the species in Table 4-12 and Appendix A, Table A-9 use either open farmland/grassland, brushland, or forest edge habitats. The greatest proportion of these birds was in the quadrant covering the proposed project area.

The open farmland within the project area also provides ideal habitat for Lapland longspurs, snow buntings and horned larks. These birds can be difficult to detect, except as large flocks over the open landscape. Both longspurs and snow buntings travel in modest to relatively large flocks during the winter season. The CBC data indicate that a high count for these bird species and in this area is 275 longspurs and 480 snow buntings. Volkert has sighted flocks of longspurs and snow buntings as large as 500 to 700 birds in the southern portion of the proposed project area. All three species were common or abundant during Forward's fall survey (1,525 Lapland longspurs, 117 snow buntings, and 191 horned larks). Horned larks were frequently observed and abundant in the Howe and Atwater survey. Lapland longspurs were infrequently seen, but present as large flocks (*i.e.*, infrequently observed, but abundant). Howe and Atwater observed that Lapland longspurs and snow buntings typically flew close to the ground, as flocks at altitudes of 98 to 295 feet which overlaps the proposed Forward blade-swept area. This is similar to observations made by Volkert.

4.11.4.8 Summary of bird presence and use in the project area

The western-most turbine of the proposed Forward project is located approximately 1.2 miles east of Horicon Marsh, an internationally important marsh. The project area provides some edge habitat and a variety of foraging and prey resources for many species known to occur at the Marsh. Another indicator of the area's potential value to wildlife is that the site overlaps with or is adjacent to lands that are eligible for or enrolled in the Conservation Reserve Program and Glacial Habitat Restoration Areas (Figure Vol. 2-4).

Other wind farm sites have characteristics similar to the Forward site:

- Top of Iowa wind farm in western Worth County Iowa is located among three wildlife management areas;
- Buffalo Ridge is located in southwestern Minnesota along a topographical ridge with some adjacent waterbodies and wetlands;
- Montezuma Hills wind farms in California are near Suisun Marsh, a large wetland located along the Pacific Flyway;
- Kewaunee County wind farm is located in a primarily agricultural setting between Green Bay and the Lake Michigan shoreline.

However, the proximity of the Horicon Marsh to the Forward project area and the site's location between Horicon and Theresa Marshes could result in very different ecological, temporal and spatial avian use patterns.

Bird surveys conducted by Forward in 2004, as well as other local and regional surveys of locations with similar habitat characteristics, were used to estimate bird populations and use at the proposed project area. Forward observed a total of 89 species during spring and fall surveys in 2004, including four state or federally listed threatened or endangered species and eight state species of special concern. Given the number of species observed at Horicon Marsh and elsewhere in the region and the duration, methodology and extent of the 2004 surveys conducted by Forward, it is likely that the presence and use of rare bird species within the project area were underestimated. Based on USFWS and DNR records and observations, as well as those of birders and birding organizations, another 33 threatened, endangered, or special concern species may use the area for hunting, foraging, resting and migratory stopovers. The 2005 study includes surveys for rare bird species in a subset of habitats where rare species are most likely to occur and where property access can be obtained.

Suitable nesting habitat is relatively scarce within the project area because of the fragmented or disturbed nature of its woodlands, wetlands, and open areas. While the project area may not support dense nesting populations of any bird group or species, species such as killdeer, mourning dove, horned lark, and vesper sparrows are regular breeders in Midwestern cropland However, Forward completed no nesting surveys of the project area to define the extent of breeding or nesting behavior. Nesting behavior will be recorded in the 2005 Forward study.

Both the Howe and Atwater and Forward surveys demonstrate that bird numbers decrease with distance from Horicon Marsh. The results from these studies suggest that the decrease varies depending on the season and bird group. Although the Howe and Atwater study shows the largest decrease between 1 and 2 km (0.6 and 1.2 miles) both in the spring and fall, a similar decrease is also noted in the spring between 4 and 8 km (2.5 and 5 miles). In both studies, numbers of birds decrease by approximately 50 percent at more than 6 miles from the Marsh. Neither study provides conclusive results that should be used as the sole basis for siting wind turbines. The 2005 Forward study has been designed to better define this Horicon Marsh distance effect.

Flight altitude is a factor in assessing collision risk. It is based on the assumption that species that spend more time flying within the blade-swept height are more at risk and that detection and avoidance of the blades is about even for all birds. Because the site is heavily used by birds during migratory stopovers, evaluating flight behavior becomes more complicated by factors that affect flight height including birds, ascending or descending during diurnal or nocturnal migration, moving from one local stopover to another, or carrying out resident activities such as hunting or nesting. Forward found that approximately 65 percent of raptors flew either at the lower edge of the blade-swept area or within the zone estimated at 75 to 350 feet, and 13 percent flew above this height. Similar observations for raptors were documented in Calumet County (Kaspar 2000 and 1999) and at Foot Creek Rim in Wyoming (Johnson *et al.* 2000a). While the blade-swept area of the turbines in these studies was lower, it mostly overlaps the blade-swept area of the proposed Forward turbines. Canada geese and sandhill cranes were also observed, primarily at lower altitudes rather than migratory altitudes, as they moved from one feeding/resting site to another. The Forward survey did not evaluate the flight altitude of other species or bird groups, such as passerines and other small birds (American robin, horned lark, Lapland longspur, pine siskin, snow bunting). These were identified by Kaspar (2000 and 1999), Johnson *et al.* (2000a and 2000b) and PSC (1998) as having a higher proportion of flights within the blade-swept area, and are also present within the proposed project area. Flight altitude of all bird groups will be recorded and analyzed in the 2005 Forward study.

Even though Horicon Marsh is a strong influence on the diversity and abundance of birds within the project area, it is difficult to assess the magnitude of this influence based on the Forward survey, *i.e.*, whether groups of birds or species are more abundant or more frequently present within the project area compared to other agricultural landscapes. This is because other studies used different methodologies and durations for their surveys and the Forward study was not designed to make this comparison. In addition, the Forward survey area did not include the westernmost portion of the project area, which has the greatest number and diversity of birds. Observations from local birders and

DNR experts suggest that the timing of the Forward survey and its methodology caused Forward to underestimate the diversity, occurrence, and abundance of birds at the Forward project area.

Forward's observation rates of common raptors were similar to two other studies in Wisconsin counties (Calumet and Kewaunee). Because of the cyclical nature of prey populations and the timing of Forward's surveys (resident or migrating birds), Forward's conclusions on raptor use of the project area may not be accurate.

Observation rates of passerines and other small birds were relatively variable when compared to two other studies, and some species that should be present were not identified. Most of Wisconsin's songbirds are nocturnal migrants, which were not considered in the Forward survey. Given the duration of the study, and the focus on waterfowl and flocking species, absence of some passerine species from the survey may not indicate absence from the site.

Pre-construction studies should define the bird species present at a site, their abundance, the frequency of observation, diurnal versus nocturnal activity, flight height, flight direction, habitat use, and habitat resources such as prey availability. An effort should be made to identify rare species that may be present because of their sensitivity to disturbance and mortality.

Information is typically gathered over multiple seasons and years, and may include a project site and a reference site for future post-construction studies in the form of a before-after, control-impact (BACI) design study. By collecting data at both the project and reference site, before and after construction, changes in an impact indicator (*e.g.*, abundance or mortality) due to the project may be distinguished from other factors that may cause the same change in space or time (Anderson *et al.* 1999). All of this information is important because it supports predictions of avian collision risk or other impacts such as displacement, as indicated in the USFWS interim guidance on wind turbine siting (Erickson *et al.* 2001; Anderson *et al.* 1999; USFWS 2003). The USFWS interim guidance is based on the assumption that multiple sites will be evaluated and the results will be used to select the final site for development. Anderson *et al.* (1999) also identified similar data that should be collected in order to evaluate the different sites.

The impact gradient (IG) methodology may be substituted or used in conjunction with the BACI design. Whereas the BACI design can identify whether a change is due to the project or some other factor, the IG methodology may be used to analyze the relationship between the impact indicator and distance from the hypothesized impact source (Anderson *et al.* 1999). This assumes that there is a gradient of response and that other factors influencing the gradient (covariates) can also be measured. Some indicators like mortality may not show a gradient whereas abundance or nesting success will. One also has to recognize the influence of overlapping and variable gradients depending on the number and spacing of turbines. This design was applied in Buffalo Ridge to study avoidance of turbines by grassland birds (Leddy *et al.* 1999).

The 2005 Forward study provides elements of both the BACI and the IG design. Elements of the IG design will be used to determine the impact of Horicon Marsh on bird abundance and diversity. After construction, both Horicon Marsh and the turbine area can be studied to determine if there is a gradient response for these same indicators.

The detail or magnitude of the information that is needed depends on the phase of the project, insofar as site selection generally warrants a less detailed, comprehensive approach than studies for project design and turbine siting. At the time of the 2004 Forward study, the project was in the project feasibility and design phase. One location had been selected, and the study was supposed to address specific project impacts. As such, the site-specific information gathered by Forward to assess avian risk does not include some of the important information cited above and is not adequate to resolve all of the critical issues for this phase of the project.

Because of the project's proximity to Horicon Marsh, bird use within and around the project area, and the lack of site-specific information addressing Horicon Marsh's effect on bird use within the project area, it is not possible to estimate or rule out potentially significant impacts to rare bird species, as well as either direct or cumulative impacts to raptors, nocturnal migrants, and waterfowl or waterbirds flying within the blade-swept area.

4.11.5 Avian impacts from wind turbines

It is not currently known how the many factors that contribute to avian risk and mortality from wind turbines interact with one another. Hence, two studies with seemingly similar conditions may yield different results. The following factors can be grouped into categories:

- Environmental factors include topography, climate, land use and land use patterns, and distribution and quality of habitat resources for nesting, foraging, and resting. These factors may affect avian impacts on different spatial and temporal scales.
- Biological factors address how birds fly, see, or navigate through their surroundings. This includes aspects of their life history such as courting, nesting, and migration that affect how high birds fly, their strength, how much time they spend within the blade-swept area of the turbine, and whether they are able to recognize and avoid wind turbines.
- Project related factors include the number, location, distribution, and orientation of turbines on the landscape; their height, size, form, rotational speed, color, lighting, and placement of related structures. These factors may make turbines more or less hazardous to birds.

Like most biological issues, there are always more questions than answers. This is especially true in the case of wind turbine impacts, because while the amount of research from which to draw conclusions continues to grow, it still does not address the full range of environmental and biological variables. Because no two sites are alike, site-specific studies are very important. The USFWS, Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines (2003), says, "…each proposed development site is unique and requires detailed, individual evaluation."

4.11.5.1 Bird fatality rates

A summary of what is known about avian risks from wind farms has been published by the National Wind Coordinating Committee (NWCC)[47] and includes the following (NWCC 2004):

- Both migratory and resident birds sometimes collide with wind turbines.
- Some species, such as raptors, appear to be at a higher risk for collisions with wind turbines (Table 4-13 and 4-14).

[47] The NWCC is a U.S. consensus-based collaborative formed in 1994. NWCC members include representatives from electric utilities and support organizations, state legislatures, state utility commissions, consumer advocacy offices, wind equipment suppliers and developers, green power marketers, environmental organizations, agriculture and economic development organizations, and state and federal agencies. (http://www.nationalwind.org/)

- A pre-construction site evaluation can help to evaluate whether wind power development at a site is likely to cause avian impacts at levels of concern.
- Most reported fatality estimates for operating wind projects are based on an extrapolation of the number of fatalities actually observed and then corrected for sources of error, scavenging, or other field bias. Careful assessment of these correction factors is critical to determining the validity of the study's conclusions.
- There have been no documented large fatality events of songbirds at wind projects. The two largest reported events include 14 spring migrant songbirds found at two adjacent turbines in Minnesota (Buffalo Ridge) on one night and approximately 30 spring migrant songbirds at a floodlit substation and nearby turbines in West Virginia (Mountaineer) on a foggy night. Large scale fatality events in the ornithological literature generally refer to single, one-night collision events involving hundreds to thousands of birds at a single structure, such as a tall communication tower. These events are distinct from cumulative fatalities, which are the sum of fatalities that occur over longer intervals and may be related to many structures. Most mortality studies try to quantify cumulative fatalities.

Tables 4-13 and 4-14 demonstrate the range of mortality rates found at wind farms throughout the U.S. These numbers represent totals for all avian species (Table 4-13) and the subset of all raptor species (Table 4-14). Although the numbers are low, those who study the issue are still not sure whether the studies have adequately characterized the full range of risk factors or the biological importance of the results. For example, only a few studies have looked at impacts to a specific rare species. There are limitations to the ability to predict risk and mortality, as the NWCC fact sheet (2004) states:

- It is not yet clear whether larger or smaller wind turbines cause equivalent bird collision fatalities based on blade-swept area (or blade tip velocity).
- Based on the location of bird mortality relative to turbines without lighting or with different types of lighting, flashing red lights do not strongly influence bird mortality. However, questions still remain about the impact of facility lighting on night migrating and other nocturnally flying birds and whether other variables may increase or decrease the effect of lighting. Other unanswered questions relate to the ability of some birds to see turbine blades from a distance and change their direction.
- The full impact of wind turbines on resident and migrating songbirds is not clear. Songbird impacts must be considered for each wind development.
- The impact of weather events on bird deaths needs to be considered.
- The following areas are currently being researched: avian vision, hearing, other issues that may yield information on reducing risk, differences between early and modern wind turbines, and studies of nocturnal migrants especially along ridge tops.

Table 4-13 Bird fatality rates at U.S. wind farms[1, 2]

U.S. Region	Number of Studies	Rotor Diameter		# Birds/Turbine/Yr.		
		Min. (m/ft)	Max. (m/ft)	Avg.	Min.	Max.
Northwest	4	47 / 154	65 / 213	1.9	0.6	3.6
Rocky Mts.	2	42 / 138	44 / 144	1.5	1.5	1.5
Upper Midwest[3]	4	33 / 108	48 / 157	2.7	1.0	4.5
East	2	47 / 154	72 / 236	4.3	4.0	7.7

Source: NWCC 2004

1 Based on studies of wind projects that were conducted for a minimum of three seasons (spring, summer and fall), and where scavenging and searcher efficiency biases were incorporated into the estimates. Per-turbine estimates are weighted by number of turbines at projects studied.
2 The authors of this table are only aware of two California studies that reported estimates for all birds apparently adjusted for scavenging and searcher efficiency. One estimate was 2.3 birds/turbine at San Gorgonio, where nearly all of the wind turbines studied were small (65-200 kW), and methods for scavenging and searcher efficiency adjustments are unknown.

Table 4-14 Raptor fatality rates at U.S. wind farms[1]

U.S. Region	Number of Studies	Rotor Diameter		# Raptors/Turbine/Yr.		
		Min. (m/ft)	Max. (m/ft)	Avg.	Min.	Max.
Northwest	4	47 / 154	65 / 213	0.05	0.00	0.07
Rocky Mts.	2	42 / 138	44 / 144	0.03	0.03	0.04
Upper Midwest	4	33 / 108	48 / 157	0.00	0.00	0.01
East	2	47 / 154	72 / 236	0.02	0.00	0.02
California[2]	3	15 / 49	33 / 108	0.15	0.01	0.24

Source: NWCC 2004
1 Based on studies of wind projects that were conducted for a minimum of three seasons (spring, summer and fall). Per-turbine estimates are weighted by number of turbines at projects studied.
2 Data at older turbines in California; based on most recent publication from Altamont, and older studies at Montezuma Hills and San Gorgonio, where methods are less understood.

4.11.5.2 Summary of avian impact studies

The applicants referenced the results of three avian mortality studies to support a conclusion that avian mortality rates would not be significant at the Forward wind farm. Following is a summary of the Buffalo Ridge Wind Farm Study in Minnesota, the Top of Iowa Study in Iowa, and the High Winds Energy Center Study (Suisun Marsh) in California. The results of these three studies must be put into context in order to determine if it is appropriate to apply them to the Forward project.

Of note, the USFWS has stated its concerns regarding Forward's reliance on and comparison to these and other studies referenced in this document. The USFWS guidelines (2003) recommend that the different sites used for determining potential risks to wildlife be within the same wind resource area and therefore exhibit similar vegetation, climate, topography, agricultural development, and other environmental conditions. The sites used by Forward, for comparison, are not within the same wind resource area.

4.11.5.2.1 Buffalo Ridge Wind Farm Study

The Buffalo Ridge Wind Farm is located in southwestern Minnesota. Initiated in 1994 with 73 turbines, there are currently over 400 turbines, the tallest of which is 243 feet. The farm covers approximately 32,000 acres. Projections are up to 1,000 turbines producing over 800 MW. In the course of developing the three phases of the Buffalo Ridge Wind Farm, BACI studies (including radar monitoring of nocturnal migrants and selection of a permanent reference area along the ridge) and mortality studies have been completed at this site over a four-year period. Buffalo Ridge, as the name implies, is a northwest-southeast glacial moraine ridge at 1,653 to 1,830 feet above sea level. The majority of the study area at Buffalo Ridge is composed of cropland and pasture, with fragments of wetlands and forest. A few lakes are one mile from some portions of the study areas. Bird counts indicated that while waterfowl and waterbirds were among the most abundant bird groups in the study area as a whole, total numbers were lower than at the Forward project area for some of the individual study areas. Although Buffalo Ridge may be similar to the Forward project area, it does not replicate the influence of marsh habitat and open water found at Horicon and Theresa Marshes.

The study found that the wind farm does reduce use of the site by some groups and species of birds in close proximity to the turbines (≤ 300 feet). The area of reduced use was larger for certain avian groups during some seasons and some bird groups were not affected. Reduced use might mean a reduced potential for collision, but it also means a loss of habitat. Displacement effects could be especially important for rare species present within the Forward project area or in a cumulative context for more common species.

At Buffalo Ridge, 11 bird groups (including waterbirds, raptors, upland game birds, and some passerines) exhibited lower than expected use of the area during some time period, nine groups exhibited no change, and four groups exhibited a higher than expected use of the wind farm area. However, warblers, vireos, longspurs, and larks also exhibited a greater than expected use of the area during other time periods. It is important to note that even though cropland had the least amount of avian use, there was a significant relationship between the level of use and the cropland's proximity to woodlots, wetlands, or fencerows. The study did not specify a minimum woodlot size or distance for this relationship. Considering the effect of displacement on birds within the Forward project area, the proximity of turbines to habitat resources must be considered, even if the resources are small patches of wetlands, woodlots, or fencerows.

Bird groups most often observed flying within the blade-swept area (from 58.5 to 212 feet, depending on the turbine) were waterbirds, waterfowl, longspurs, raptors, and corvids. There were no significant differences in flight height as a function of habitat or presence or absence of turbines. From March 15 to November 15, 1996-1999, the wind facility was associated with 55 avian fatalities of at least 31 bird species. The avian fatalities comprised of 76.4 percent passerines (mostly warblers), 9.1 percent waterfowl, 5.5 percent waterbirds, 5.5 percent upland game birds, 1.8 percent raptors, and 1.8 percent shorebirds. Among the three study areas and study years, corrected mortality rates ranged from 0.5 to 4.45 birds/turbine/year compared to 0.83 to 1.81 birds per search in the reference area.[48] Seventy-three percent of all fatalities were found outside the breeding season. Most of the fatalities were likely nocturnal migrants (warblers and sparrows made up 45.4 percent of all fatalities), that may have been flying lower due to bad weather (Johnson *et al.* 2000b). Based on the periodic searches of the study, the time of mortality for these migrating birds (day or night), could only be estimated. FAA lighting on turbines (i.e., red flashing lights) was not highly related to avian mortality.

At Buffalo Ridge in the spring and fall, there was a low correlation between exposure indexes of bird species (Appendix A, Tables A-6 and A-7) and fatality rates. This could have been because the exposure

[48] Recovered bird mortalities are underestimated and do not include birds lost to scavengers (other animals that eat the carcasses) or simply birds that are missed during searches. Therefore, mortality studies must include additional tests to quantify these two sources of error and adjust mortality numbers upward, often up to one order of magnitude.

index was based on diurnal, not nocturnal bird activities. Diurnal risk may differ substantially from nocturnal migrating bird risks. This is supported by the observation that the majority of bird fatalities at Buffalo Ridge were nocturnal migrants. However, there was a correlation between the exposure indexes of species and turbine fatalities during the summer breeding season.

The authors of the Buffalo Ridge study conclude that compared to several other wind farms in the U.S., avian mortality appears to be low at Buffalo Ridge and primarily involves nocturnal migrants. Mortality of resident breeding birds appears very low and primarily involves common species that would not experience any population consequences within the Buffalo Ridge wind resource area. Based on the estimated number of birds that migrate through Buffalo Ridge each year, the number of wind facility related avian fatalities at Buffalo Ridge is likely inconsequential from a population standpoint.

4.11.5.2.2 Top of Iowa Study

Another cited study is the Top of Iowa Wind project located in Worth County in north-central Iowa, 100 miles north of Des Moines (PSC Ref. #26265). Because of its location between three large state-owned wildlife management areas (WMA), consisting of complexes of wetland, grassland, and forest habitat, the area has high bird use, particularly waterfowl. In addition to hosting birds migrating along the Mississippi Flyway during spring and fall, the three large WMAs provide attractive habitat for many breeding wetland and grassland birds. Prior to construction of the wind farm, migrant and resident birds moved freely among the three sites. At the end of 2001, 89 turbines were in operation, standing 320 feet tall at the blade tip, and spread across 5,280 acres.

A 2004 progress report, submitted by the applicant contained the methodology and preliminary results of the Top of Iowa 2003 bird mortality study. Between April and December 2003, total adjusted mortality (adjusted for the proportion of the plot searched, searcher bias, and scavenging) was estimated at 10.79 birds for the 26 turbines researched. According to Koford, principle investigator for the study (pers. comm.[49]), the total number of turbine collision-induced bird fatalities for the 2003 study period has been revised to approximately 35 or 0.39 birds per turbine. Koford also stated that the preliminary mortality estimates for the period between March 24 and December 15, 2004 are even higher, at approximately 80 birds. A published report containing the complete analysis of the 2003 and 2004 data is expected to be available later this year.

In light of the fact that a complete study has not been released for this site, few findings can be concluded from this research, much less applied to the Forward project. In addition, the three WMAs together are less than 6,000 acres compared to the 32,000 acres of Horicon Marsh. For the Top of Iowa study, there is currently no published list of bird species, bird abundance data, or rare bird data. The Top of Iowa mortality results are of significant interest for wind projects proposed for the Midwest, though without more information, their applicability to the Forward project at this time is questionable.

4.11.5.2.3 High Winds Energy Center Study (Suisun Marsh)

Forward identifies the High Winds Energy Center adjacent to the Suisun Marsh along the Sacramento River in California as a relevant example that risk to waterfowl from the Forward project would be insignificant. The project supports 90 turbines with a total height of approximately 328 feet; 27 of which are equipped with FAA red flashing obstruction lights. The High Winds project is located among

[49] Dr. Rolf Koford, faculty at the Department of Natural Resource Ecology and Management of Iowa State University and assistant unit leader of the Iowa Cooperative Fish and Wildlife Research Unit

the rolling Montezuma Hills. The data from the first year of a three-year fatality study has not been released for public use, so little is known beyond what has been supplied by Forward in its application.

The relevance of the High Winds fatality study to the Forward project area is its proximity to one of the largest migration and winter waterfowl concentration areas along the West Coast. The wind resource area and turbines are located just north of the Sacramento River and east of the Suisun Marsh. The Suisun Marsh consists of approximately 84,000 acres of waterfowl habitat. The Marsh is a primary migration stopover and wintering area for ducks, geese, and other waterbirds in the Pacific Flyway. Older, smaller turbines are within about 0.5 mile of the Marsh and River, whereas the High Winds turbines are slightly more than two miles from the Suisun Marsh and about one mile from the Sacramento River. The area is mostly grassland with a small amount of grain fields rather than row crops.

Forward reports that the fatality list for the High Winds project demonstrates that modern and older wind turbines do not necessarily pose a significant risk to waterfowl and other waterbirds. Despite the presence of more than one million ducks and geese during winter and migration seasons, as well as many thousands of other waterbirds at the Suisun Marsh, no waterfowl fatalities were documented by searchers working in the one year period between mid-2003 and mid-2004. The number of recovered carcasses was small; four waterbird fatalities were reported including one American coot, one common moorhen, one Virginia rail, and one sora. Adjusted mortality rates were not publicly available and were not provided by Forward; nor were any interpretations applied to other bird groups.

Of the three wind farms studies cited by the applicant, this project probably provides the best comparison for the Forward project. However, patterns of bird movement in relation to habitat resources must also be considered when comparing results from this study to the Forward project area. The distribution of resources within Suisun Marsh and along the Sacramento River encourages waterbirds to forage primarily within these wet areas rather than among the wind turbines in the adjacent uplands. The birds fly out of the river valley and marsh, continuing their long-distance migrations. By the time they pass over the wind farm, they may already be at long-distance migration altitudes, well above the wind turbines. At Horicon Marsh, although the Forward turbines would be located east of the Escarpment, the project area is heavily used for foraging and frequently crossed by birds in their daily movements. Birds feeding in or near the Forward project area often fly at lower altitudes than birds flying over the High Winds Project from the Suisun Marsh.

An earlier avian mortality study was conducted at the 237 smaller, older turbines at Montezuma Hills. These older turbines are closer to the Suisun Marsh and Sacramento River than the High Winds turbines. However, waterbirds, waterfowl, and shorebirds still comprised the smallest percentage of fatalities, similar to the High Winds study (Howell and Noone 1992; Howell 1997). Results of the Montezuma Hills study indicate that diurnal raptors, owls, and passerines composed the greatest portion of avian fatalities. The adjusted mortality rates for raptors were 0.048/turbine/year. There were no passerine fatalities in this study (Howell and Noone 1992).

The results of the High Winds and Montezuma Hills studies demonstrate that at these sites waterfowl are not highly susceptible to colliding with wind turbines. However, despite the site's potential similarities to Horicon Marsh where waterfowl is concerned, Forward submitted no information regarding whether the mortality results for raptors from this site should also be applied to the Forward project. Additionally, pre-construction bird use of the study areas, direction and height of flight of waterfowl and waterbirds relative to the location of the turbines, and other relevant information were also not submitted by the applicant for comparison with the Forward project area.

Caution is warranted when applying the results of the Montezuma Hills/Suisun Marsh studies to the Forward project because similarities and differences between the two sites have not been fully identified and evaluated.

4.11.5.2.4 Other fatality studies

Four other studies prominent in the current literature on avian mortality at wind farms are the Foot Creek Rim study from Wyoming, Mount Storm Project in West Virginia, the Nine Canyon Study in Washington (both available at http://www.west-nc.com/wind_reports.php), and the Kewaunee County study completed by Howe *et al.* (2002). Howe estimated 1.29 bird fatalities/turbine/year occurred at the Kewaunee County site. By comparison, the other three studies recorded from 1.16 to 3.59 fatalities/turbine/year (Erickson *et al.* 2003; Johnson *et al;* 2000a; Young *et al.* 2003a).

Fatality rates of birds vary among sites and likely depend on several factors including the amount of bird use, vegetation, and other physical and biological characteristics of the specific wind plant and surrounding area. By the end of 2003, there were approximately 12,000 turbines operating in the U.S., with about 4,700 turbines located outside of California. Fatality estimates for 12 projects outside of California average 2.3 bird fatalities per turbine per year (Tables 4-13 and 4-14).

4.11.6 Conclusion

The project area is very close to several important wildlife resource areas. Because of the influence of these resource areas, the project area cannot be studied as an independent ecological unit but must be placed in context with the region. Issues regarding birds include bird mortality and avoidance of the project area.

Avoidance of wind turbine sites varies by bird species and may range from a few hundred feet up to a mile. According to NWCC (2004), some studies have documented decreased densities of birds closer to wind turbines and roads. This is borne out by observations of avoidance behavior by grassland songbirds and other birds. Avoidance of the project area by certain species of birds could result in the loss of tens of thousands of foraging habitat acres. This effect has not been well-studied at existing wind farms and research is currently ongoing in an effort to quantify the potential distance of avoidance.

The adjusted mortality rates at operating wind farms range from less than one bird per turbine to just under eight per turbine. Mortality rates are less for particular bird groups. Most of these studies associate risk of bird fatalities to overall bird abundance, number of flights within the blade-swept area, behavior, or visual ability. However, estimating collision risk is very difficult, in part because of the low number of fatalities. The studies do not explain why a particular fatality occurred, nor do they examine the complex interactions among risk factors. Complex interactions, which if more fully understood, would help predict situations that might increase or reduce the risk to birds. The larger bird mortality studies, such as those completed at Buffalo Ridge (Minnesota) or Foot Creek Rim (Wyoming), concluded that the number of bird fatalities were insignificant, at least for common species. None of the studies discussed in this section addressed single large-scale events as opposed to average mortality measured over the course of a year. This is especially significant for nocturnal migrants in light of large-scale events that have occurred at other types of tall facilities. Neither the existing literature nor the data submitted by the applicant contain enough information about bird interactions with wind turbines in different environments to predict the full range of typical and infrequent mortality events. Also absent from most studies is an evaluation of the susceptibility of rare bird species to collisions with wind turbines and the effect that small numbers of fatalities may have on species whose populations are already at risk. To address these particular concerns in the Forward project area, site-specific information must be generated.

The importance of site-specific information is critical, even in light of the studies cited in this document. Understanding the significant differences between projects and locations allows better evaluation of the resulting data and proper application of the results to other sites. The important differences between the Forward project area and the other sites with studies have been discussed (*e.g.*, the project's proximity to Horicon Marsh, birds flying at low altitudes to move between foraging areas, etc.).

Among various study designs, the BACI design is considered optimal by authorities in the field (DNR, USFWS, and the NWCC). With the exception of the earliest studies of wind farms in California and the 2004 Forward bird study, the BACI study design has been used at all major wind farm projects cited in this document. Other designs such as Impact Reference or Impact Gradient designs have been used when pre-construction information is lacking, or in the latter case, when the response to the source of impact is exhibited as a gradient, such as for bird displacement studies. The lack of an adequate pre-construction study for the Forward project would limit the usefulness of data collected from a post-construction mortality study.

Inadequacies in the 2004 Forward bird study could have been avoided had Forward worked with the regulatory agencies (PSC, DNR, USFWS) earlier in the project design, and more closely, to define the goals and methodology for the studies prior to initiating them. This is markedly different from soliciting agency concerns. While the USFWS and DNR did make study methodology recommendations (Appendix B), the spring surveys were already underway and few of their recommendations were incorporated into Forward's 2004 bird studies. However, Forward has incorporated most of the state's recommendations in the design of its 2005 bird study (Appendix C).

The 2004 Forward study was too general for this stage of the project and where there are specific concerns about avian impacts. Furthermore, Forward did not study the westernmost portion of the project area, which would likely be impacted the most by the proposed wind turbines. The closest proposed Forward wind turbine is 1.2 miles from Horicon Marsh. Based on limited data regarding the effect of distance from the Marsh on bird abundance and diversity, and incomplete data from its own surveys, Forward concluded that operating a wind farm so close to Horicon Marsh would not have biologically significant impacts.

In addition, while Forward frequently cites the relationship between bird abundance and distance from Horicon Marsh in its risk assessment (submitted as part of the CPCN application), on December 2, 2004 it redesigned the project to include 16 more turbines 2 to 4 km (1.2 to 2.5 mi.) from Horicon Marsh and seven more turbines between 4 and 8 km (2.5 to 5 mi) from the Marsh. This change resulted in the placement of 70 percent of the proposed turbines within 5 miles of Horicon Marsh, compared to 58 percent, prior to December 2, 2004. Based on the results of Forward's own study and the fact that it had no data for the westernmost portion of the project area, Forward has not yet provided evidence that this change would minimize impacts to birds in the region.

It is unrealistic to expect that no avian mortality will occur at a wind facility. However, if the 2004 Forward surveys had been well-planned and executed with appropriate methodology, the ability to estimate potential impacts and recommend measures to reduce impacts would have been greatly improved, but it still would not have eliminated all the uncertainty regarding avian impacts at this site. The goal for any wind project should be to site, design, and operate the facilities so as to minimize collisions and habitat displacement to levels that would not result in threats to the viability of a species either directly or because of cumulative effects.

With information available from other wind farm studies and the limited 2004 Forward surveys, there is potential for this project to impact state- or federally-protected and other rare bird species. At least 12 state or federally listed threatened or endangered species or state special concern species are present on the site. Nocturnal migrants and some species of raptors or other larger bird species could also be at higher risk because of their flight behavior.

As stated previously in this EIS, the pre-construction bird studies completed by Forward in 2004 could not have fully characterized the potential impacts to birds in the region. These studies did not include the westernmost project area, did not quantify the distance relationship between the Horicon Marsh and the project area in relation to bird use, did not analyze the potential impacts specific to rare bird species, did not include any raptor nesting and prey species studies, and did not cover the peak migration period for all bird groups.

The DNR, PSC, and Forward worked together to develop a 2005 study plan to address many of the inadequacies cited above, particularly those related to understanding the effect of distance from Horicon Marsh on bird abundance, diversity, behavior, and use of the site by rare bird species and raptors (Appendix C). While it is a positive outcome that additional pre-construction studies are being completed, the results of these studies are not available for this document and may not be available for a Commission decision made within the 180-day statutory timeline.

Regardless of the results of the 2005 study, the following mitigation strategies could be implemented to verify that impacts to the bird populations are minimized by the proposed project:

- To ensure that long-term impacts to rare birds are minimized, construction at proposed turbine sites closest to Horicon Marsh should be restricted.
- As a condition of Commission approval, post-construction mortality and bird use surveys should be carried out for multiple years after construction and periodically thereafter. Survey methodology should be submitted for review and approval by PSC and DNR and be consistent with the methodology used at other large wind turbine sites and with the guidelines provided by the NWCC (1999) or similar peer organizations. The surveys should include not only bird mortality data, but also additional breeding, nesting, foraging, and flight behavior of bird species in the Forward project area. Post-construction studies should be consistent with the BACI design that was established in the 2005 study as well as elements of the IG design suitable for understanding response gradients for bird displacement. Periodic reports should be submitted to the PSC and DNR.
- Prior to conducting post-construction studies, Forward should obtain a permit from the USFWS authorizing possession under the MBTA of any carcass of migratory birds collected.
- The USFWS or DNR should be notified if a state or federally protected species is accidentally killed in the project area in order to determine if an Incidental Take Authorization is required under the Wisconsin Endangered Species Act or under the Federal Endangered Species Act.
- Forward should work with the PSC and the DNR to develop a plan to characterize the flight height, direction and general abundance of nocturnal migrants in the project area, utilizing existing radar information or other approaches, and to identify and monitor meteorological conditions and migratory behavior of nocturnal migrants that may result in

mortality events. If such events occur, Forward should work with the DNR and the PSC to identify the significance of such events and potential measures to avoid, minimize or mitigate their effects.

- Some turbine blades could be painted or coated with ultraviolet paint to evaluate whether this improves visibility to birds and avoidance.
- Night lighting on all project-related structures should be minimized to the maximum extent possible allowed by FAA and local ordinances.

Based on the results of post-construction studies or significant bird mortalities, enforcement of federal or state wildlife or endangered species laws may result in operational restrictions to coincide with weather, migratory events, or other environmental factors that increase the likelihood of bird mortality as regulated under those laws.

Well-designed and executed post-construction studies do not prevent bird fatalities. However, the one relationship that is apparent in the Howe and Atwater study, the 2004 Forward study, and that which is being studied in the 2005 Forward study is that bird abundance decreases with distance from Horicon Marsh. In lieu of more detailed information on the nature of this relationship, increasing the distance between the turbines and Horicon Marsh is one of the best measures to minimize the risk to common and rare bird species.

Due to the international significance of Horicon Marsh and the surrounding environmental resources, it would be prudent to have a setback from the Marsh greater than the 1.2 miles, proposed by Forward. This recommendation is not without precedent. Setbacks have been used for other utilities in order to minimize potential impacts to wildlife.[50] If significant bird mortalities occurred at Forward once the facility was operating, the prominence of the Horicon Marsh could result in much negative local and international press. In addition, the applicant could be prosecuted for violating federal or state laws. If enforcement actions result in operating restrictions to reduce the potential for bird collisions, there could be monetary impacts to the applicant that might prevent it from fulfilling its contracts.

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[50] In the addendum to the Environmental Impact Report for the Butternut to Auburn Transmission line (prepared for Wisconsin Electric by CH2M Hill) the following was concluded, "At the recommendation of the Department of Natural Resources, the New and Former Preferred Routes have been located farther from Theresa Marsh State Wildlife Area. This will reduce the potential of geese, great blue herons, great egrets and other migratory waterfowl with low flight trajectory or wide wing spans from colliding with the proposed transmission line."

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4.12 BATS

Until relatively recently, bat mortalities at wind farms were assumed to be minor in comparison with bird mortalities. Recent data strongly suggests that a greater level of concern is warranted. In the Midwest, bat mortality studies of Buffalo Ridge (Minnesota), the Top of Iowa Wind Farm (Iowa), and Kewaunee County wind projects (Wisconsin), showed greater mortalities for bats than for birds. In addition, high numbers of bat fatalities have occurred at two eastern wind power projects – Mountaineer Wind Farm, West Virginia and Meyersdale, Pennsylvania. The unexpectedly high levels of bat mortalities at these two eastern sites have increased conservation concerns by bat experts and wildlife agencies, as well as in the wind industry. Scientific research is beginning to focus on how the behavior and abundance of different species are affected by wind facilities (BCI 2004a). This is occurring at the same time that more wind projects than ever are being proposed and constructed.

The DNR and the USFWS are charged with protecting state and federally listed endangered, threatened, and candidate species for listing. In Wisconsin there are two bat species of special concern and potentially one federally listed endangered bat species (see Table 4-15). The state pays close attention to actions that may affect special concern species because they are species about which some problem of abundance or distribution is suspected but not yet proven. This category exists to focus attention on certain species before they become endangered or threatened.

Bat species have low reproductive rates making bat populations more sensitive to losses than other species, so each additional source of mortality to bats may have a greater effect on the viability of regional populations, or have cumulative effects on migratory populations. This increases the level of concern for state and federal conservation agencies.

Foraging bat populations provide important ecological and financial benefits because they consume vast numbers of pests and are the primary predators of night flying insects. The major food sources for bats include lacewings, cockroaches, gnats, and mosquitoes. A single little brown bat can catch hundreds of mosquito-sized insects in an hour and between 3,000 and 7,000 mosquitoes in a night. A typical colony of big brown bats can protect local farmers from costly attacks of 18 million root-worms each summer.

The Forward application included a Phase I Bat Risk Assessment, which was primarily a literature search. The applicant did not complete any pre-construction bat surveys of the project area as part of its assessment. Such surveys would have provided site-specific information on bat occurrences or behavior.

4.12.1 Occurrence of bats in the state

Seven species of bats are known to occur in Wisconsin and one additional species may be present. Table 4-15 lists the bat species, their protection status, and their roosting habitats. In Wisconsin, two bat species are listed as state species of special concern (northern long eared and eastern pipistrelle). Indiana bats are federally listed as endangered and are a state species of special concern. Except for the Indiana bat and the eastern pipistrelle, the range of the six other bat species includes all of Wisconsin, the Great Lakes region, and parts of Canada. The eastern pipistrelle has a range that includes the central and western portions of Wisconsin, but not much of the northeastern portion of the state. In the Midwest, the northern limit of the Indiana bat is generally considered to be northern Illinois and southern Michigan. There is one record of the Indiana bat in Wisconsin, a 1954 observation in southwestern Wisconsin reported in the DNR Natural Heritage Inventory (NHI). Recently, Indiana bats have been reported, but not verified, near the location of the previous siting. Bat identification in the field is difficult and comprehensive bat surveys have not been conducted in Wisconsin, thus the occurrence of bats in the state is not fully known.

Table 4-15 Bat species found in Wisconsin

Common Name	Scientific Name	Status	Roosting Habitat	Neda Mine Presence
Big brown bat	*Eptesicus fuscus*	None	Cave	Yes
Little brown bat	*Myotis lucifugus*	None	Cave	Yes
Northern long-eared bat	*Myotis septentrionalis*	State special concern	Cave	Yes
Eastern pipistrelle	*Pipistrellus subflavus*	State special concern	Cave	Yes
Indiana bat	*Myotis sodalis*	Federally endangered/ state special concern	Cave	No
Eastern red bat	*Lasiurus borealis*	None	Tree	No
Hoary bat	*Lasiurus cinereus*	None	Tree	No
Silver-haired bat	*Lasionycteris noctivagans*	None	Tree	No

4.12.2 Relevant aspects of bat biology

4.12.2.1 Cave bats

Bats can be grouped as either tree bats or cave bats depending on their strategy for overwintering. Hibernating cave bats generally congregate in large hibernacula such as caves or abandoned mines. Four of the state's cave bats (Table 4-15) are known to hibernate in Wisconsin. Little brown bats congregate to hibernate for the winter, and then in the spring disperse up to 210 miles. Males are usually solitary during the summer, roosting in tree hollows, under awnings, or behind shutters. Females form maternity colonies in the summer, often in structures such as barns, houses, and churches, or in trees beneath loose bark or in cavities. Little brown bats tend to forage near water. Northern long-eared bats also hibernate in caves or abandoned mines, but are thought to stay closer to their hibernaculum throughout the summer. Similar to the little brown bat, males are often solitary in summer while females congregate in maternity colonies. Northern long-eared bats prefer cavities in trees or under loose bark for summer roosts and tend to forage in forested areas. Big brown bats generally hibernate in caves or mines, but may also use buildings. Big brown bats are most abundant in areas dominated by farmland. Males are often solitary in summer while females form maternity colonies. Big brown bats specialize in feeding on beetles, including many crop pests. Eastern pipistrelles are the first species to enter hibernation in the fall and the last to leave the hibernaculum in the spring. As with other cave bat species present in Wisconsin, males roost alone or in small groups in the summer, but females may form maternity colonies. Roosting sites include barns and possibly hollow trees. Eastern pipistrelles forage over streams and ponds and at the forest-field edge, but avoid dense forests.

4.12.2.2 Tree bats

Tree bats in Wisconsin (Table 4-15) are generally solitary and do not congregate for hibernation. They are more difficult to study and, in general, less is known about tree bats than about cave bats. Tree bats do not regularly use caves or mines as hibernacula (Wilson 1997, Nowak 1994). These species are generally migratory in Wisconsin, arriving in early spring and leaving for more southerly locations by late fall.

During the spring and fall active period, silver-haired bats prefer to roost in trees and both males and females are generally solitary. Silver-haired bats often forage over woodland ponds or streams or in small forest clearings. Eastern red bats are also a solitary species, roosting in trees. They tend to forage along forest-field edges, over streams with some vegetative cover, and around lights. Hoary bats are most common in rural areas and small towns in Wisconsin. Similar to silver-haired and eastern red bats, hoary bats are solitary and roost in a variety of trees. They tend to forage over large canopied streams, along forest edges, and around lights.

4.12.2.3 Population biology

All bats have a low reproductive rate, most species generally produce a single young each year (sometimes two for silver-haired, hoary, and eastern pipistrelles, 2-3 for red bats). Mating occurs in the fall, but fertilization is delayed until the spring, and the young are born in early summer. Natural and human-influenced causes of mortality include killing by exterminators, inadequate fat storage to survive winter hibernation, environmental toxicants, loss or disturbance of habitat, collisions with manmade structures and predation by raptors, owls, feral cats, raccoons and snakes. Bats are relatively long-lived mammals. Some species of bats may live over 30 years (little brown bats), although a more typical lifespan is on the order of 5 to 15 years.

4.12.3 Habitat resources and use in the project region

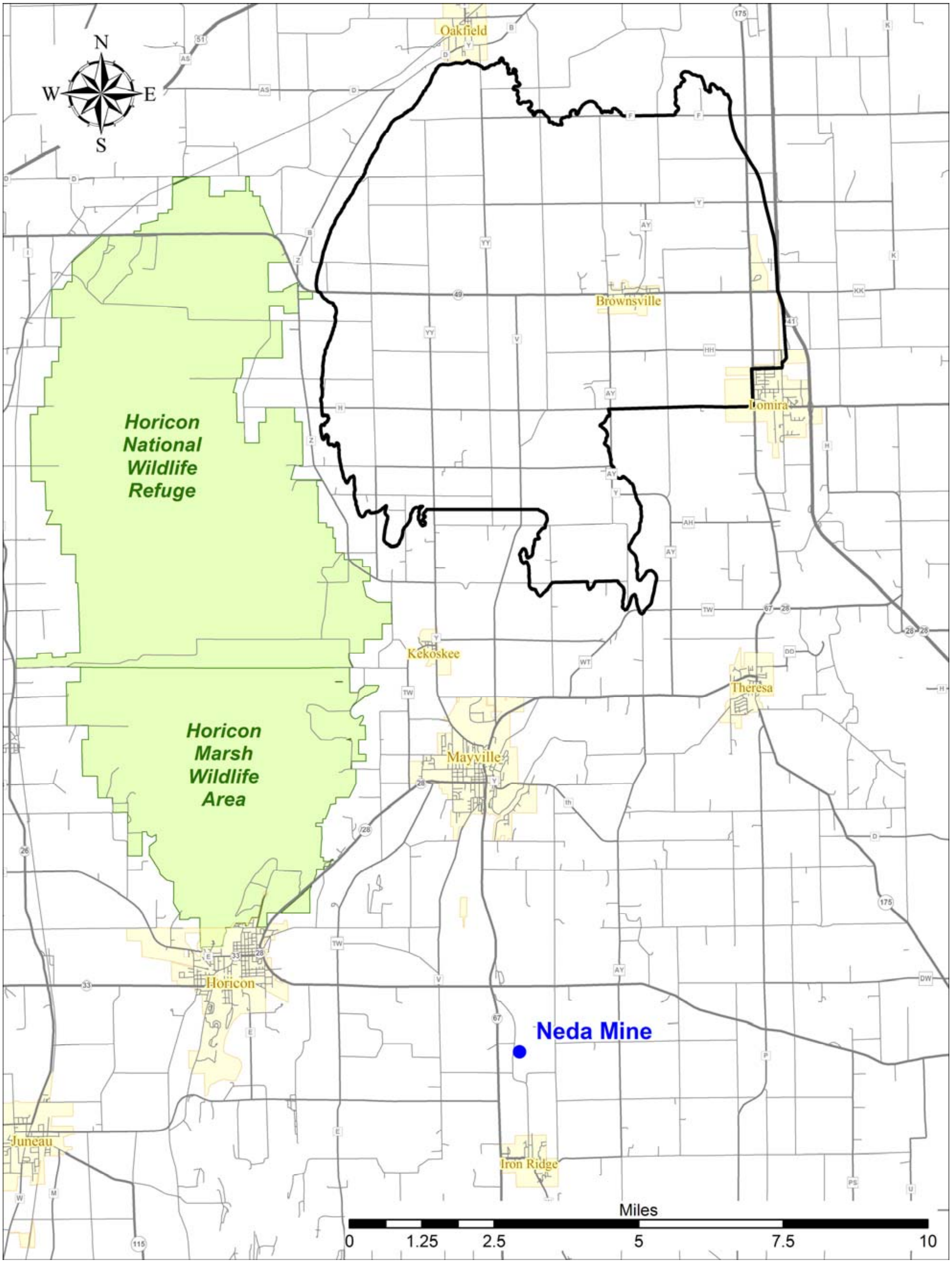
All seven species of bats commonly found in Wisconsin are likely to be present at some time in the Forward project area. The closest concentration of cave-dwelling bat species to the project area is the regionally important Neda Mine (Neda). It is an abandoned iron ore mine, located approximately 10 miles south of the project area (Figure 4-9). Neda is one of the largest hibernaculae for bats in the Midwest. The property is owned by the University of Wisconsin (UW) and managed by the UW-Milwaukee Field Station with assistance from various agencies. Table 4-15 identifies those species known to be present at Neda.

Four species of bats inhabit Neda: little brown bat, eastern pipistrelle (state special concern), big brown bat, and northern long-eared bat (state special concern). Most bats hibernating at the mine are little brown bats, with smaller numbers of the other three species present. Small numbers of big brown bats are year round residents at Neda. Neda provides cave-like habitat to thousands of bats. The most recent estimate of the total number of overwintering bats in the hibernaculum is between 143,000 and 146,000 bats[51] (Redell 2005).

Horicon Marsh, and to a lesser extent Theresa Marsh, are large and regionally important wetlands that may provide important foraging areas during the summer and for species of bats overwintering at Neda. The Forward project's proximity to these important bat resources leads the conservation agencies to conclude that, without studies to prove otherwise, the project area is likely to have greater bat abundance than in other areas of east-central Wisconsin. The closest Forward project turbines are proposed approximately 1.2 miles east of Horicon Marsh, 3.3 miles north of Theresa Marsh, and 10 miles north of the Neda Mine (Figures 4-9 and Vol. 2-4).

[51] Other reports estimate up to 500,000 bats, but these are very qualitative estimates that are based on internal surveys, which would be difficult to undertake given the number of cracks and crevices throughout the four miles of tunnels for bats to crawl in undetected by the observer. As such, these estimates do not have an error associated with them. The bat population estimate was made at the exits of Neda Mine in 2002 using a calibrated electronic beam break system with statistics applied to get the census estimate as well as the error term. The census estimate yielded a result of 143,000 to 146,000 bats.

Figure 4-9 Location of Neda Mine



The presence of Neda and nearby large wetland areas suggest that bat use (foraging, roosting, etc.), dispersal, and migration in the proposed project area may be higher than in other areas of similar land use patterns and vegetation in southeastern Wisconsin. Bats are likely to forage where insect densities are greatest: near forest edges, tree lines, and wet areas such as marshes and open water (Johnson *et al.* 2002). These areas all exist in the project area. Of the 162 turbine sites proposed by Forward, 71 or 44 percent are located near potential bat foraging features such as forest edges, tree lines, or vegetated patches.

The distances that bats travel from summer roosts for foraging, and the area that they cover, may vary depending on the species, colony size, and habitat resources. During the summer months, bats may forage over an area of tens to thousands of acres during a single night. Hoary bats usually leave their roosts soon after dusk, having two foraging peaks, one in early evening and another an hour before sunrise. They sometimes make round trips of up to 24 miles on the first foraging flight of the night then make several shorter trips, returning to the day roost about an hour before sunrise.[52] A Washington study of little brown bats documented foraging 6 to 9 miles from the roost.[53] The northern long-eared bat, studied in West Virginia, had an average home range of approximately 320 acres.[54] The home range of five eastern red bats varied from 311 to 2,171 acres, with an average area of 1,120 acres (Menzel *et al.* 2003). The home range area of eastern pipistrelles has been documented at up to 977 acres with an average foraging distance of 3,730 feet (Menzel *et al.* 2003). One study of large brown bats documented a home range of 7,181 acres and a foraging distance of 2.7 miles (Menzel *et al.* 2003).

Little is known about how bat behavior changes with the seasons (between summer and fall). In the fall, the patterns of bat movements and resource use may change as hibernation approaches and bats need to accumulate fat reserves. When bats aggregate prior to hibernation, they may prefer to forage over the marshes close to the hibernaculum which have a greater density of food resources. The location of the project area roughly within a triangle bounded by Horicon Marsh, Theresa Marsh, and the hibernaculum at Neda mine, strongly suggests that the project area may be an important travel zone between these three natural resources. In absence of more data, conservation dictates this more conservative assumption.

The nearby Niagara Escarpment may be an important migration corridor for the three tree bat species not found at Neda. Migration corridors and foraging routes for flying species can vary for many reasons. Within the region, bats may fly directly from the mine or other roosting area to nearby marshes without spending time in the project area, or bats may criss-cross along linear features in the project area in a single night of foraging.

Based on the findings at other wind farms where foraging bats were found at altitudes higher than previously expected, elevation may not be the primary factor controlling bat occurrences or activity. Because bats may use landscape features for navigation and foraging (Redell 2005), the relationship between the altitude of man-made structures, landscape features, and prey distribution is important. Biologists are just beginning to use radar and other technologies to gather information on bat foraging and migration height.

McCracken (1996) estimated that while the Mexican free-tailed bat (*Tadarida brasiliensis*) in Texas may migrate at heights up to 10,000 feet, the majority of these bats fly between 600 to 3,500 feet. Other

[52] http://www.batcon.org/discover/species/lcinere.html
[53] http://bats.capitollake.com/2005_Myotis_Olympia_Poster.pdf
[54] http://www.nrac.wvu.edu/rm493-591/fall2000/students/owen/index.html

groups of bats may migrate a few hundred feet above the ground (Johnson and Strickland 2003; Altringham 1996). Conversely, foraging bats may fly at heights ranging from a few feet to a few hundred feet (Menzel et al. 2003; Erickson *et al.* 2002). No Wisconsin studies document bat migration height and, in general, nothing is known about the circumstances that may compel bats to fly higher or lower either during migration or foraging.

When bats forage, they are flying at the approximate height of their prey at the tree line or above the water. Erickson *et al.* (2002) concluded that bats generally forage at relatively low altitudes, below the wind turbine blades, and that most bats are able to avoid wind turbines. However, the report also points out that there are several recorded observations of bats foraging at heights that would likely bring them into the blade-swept area of turbines. For example, the eastern red bat is known to fly at altitudes of 300 to 600 feet during evening foraging (Erickson *et al.* 2002).

In addition to using the project area for foraging and migrating, structures such as barns may provide ideal summer roosting conditions for large colonies of cave bats. The small forested areas within the project area are suitable for some bat species to raise young. Little brown bats and big brown bats may also roost in man-made structures during the daytime. Small populations of tree bats, the eastern red, hoary, and silver-haired, are likely to be present in the project area during the summer season. Larger numbers of these bat species are more likely to be present during southbound (April-May) and northbound (late July-October) migrations.

4.12.3.1 Wintering/hibernating bats in the project region

The year-round temperature inside Wisconsin caves and mines ranges from 40ºF to the mid-50's°F. This makes these locations ideal for bat hibernation, which can last up to six or seven months. Large caves and mines, such as Neda, provide a range of temperature and humidity that allows bats to balance their water and energy needs by moving to different locations within the hibernaculum during the winter.

Of the estimated 143,000 bats that hibernate in Neda, the little brown bat is the most numerous, accounting for 80 to 90 percent of the bats. Eastern pipistrelle, big brown, and northern long-eared bats are numerous but account for a small proportion of the total bats (Rupprecht 1980). Bats begin to emerge from the mine in April and disperse in all directions (David Redell, pers. comm.[55]). The relative order of directions of greatest spring migration from the mine are to the south (36%), the northeast (17%), the southeast (15%) and the north (14%), with lesser percentages in the other directions (Redell 2005). With the exception of big brown bats, the other three species that inhabit the mine are thought to move tens to hundreds of miles in all directions during the spring and summer, and return from mid- to late July through late October.

Bat use of the landscape during the fall migration is presently unknown. Further study is needed before any conclusions can be drawn about bat numbers and distribution in the project area during fall migration. However, as noted at the beginning of this section, because bats need to build fat reserves prior to the onset of hibernation they may concentrate foraging in the project region during this period.

4.12.3.2 Bat migration

Bats migrate along natural and artificial linear features, including transmission lines, but may also avoid or cross over such features (Johnson and Strickland 2004). Very few bat studies have addressed details

[55] David Redell, Wisconsin DNR bat researcher.

related to migration, such as daily and seasonal timing, height, speed, orientation and navigation, whether bats make stopovers to "refuel," sociality of species, etc. It is also not known whether all bat species use echolocation during migration, whether they minimize or stop use of echolocation to save energy, and whether this could affect wind farm caused bat mortalities.

Most of the bat species known to occur in Wisconsin migrate. Tree-dwelling bats (eastern red, silver-haired, and hoary bats) seem to migrate farther than do the cave-dwellers. The reason for the longer migration distance of these species is related to thermo-regulation and food sources. These bat species are not known to hibernate and survive at far northerly latitudes. Instead, they must migrate far enough south to reach areas where they are not unduly stressed. A recent study (Mormann *et al.* 2004) found that eastern red bats will temporarily enter hibernation in the leaf litter beneath the cover of snow on the forest floor until conditions change. It is not known if these species winter in large or small numbers in Wisconsin, or whether they only migrate through the state.

The tree bats are known to regularly migrate hundreds of miles during spring as well as during late summer and early fall. Hoary bats have the most northerly distribution of Wisconsin bats being found as far north as the Northwest Territories of Canada, and are likely to have the longest migrations of Wisconsin bats. Silver-haired bats extend into central Ontario and also undertake significant migrations. Red bats reach their northern limit in northern Wisconsin.

Even though most cave bats do not commonly migrate as far as tree bats, some pipistrelles may migrate hundreds of miles. Little brown and northern long-eared bats may migrate distances of only a few miles to more than 100 miles from their hibernaculum. Big brown bats disperse or migrate the shortest distances of all species in Wisconsin; rarely more than 20 miles from the hibernaculum.

In Wisconsin, bats become active in April and May and disperse and or migrate during this time period. Most female bats give birth and raise young from late May through July, depending on the species physiology and environmental conditions. In summer, most species spend the day behind or on the bark of trees, in cavities, roosting on tree branches, in structures, or even in caves and crevices. Fall migration for most species occurs from late July through October. Big brown bats remain active later in autumn and may sometimes be active away from caves in November and December. Their hibernation is the shortest of all the bat species in Wisconsin.

Spring studies conducted at Neda have shown that the change in directional airflow movement through the mine (the chimney effect) is the strongest seasonal cue associated with the onset of spring migration (Redell 2005). By monitoring this condition at the mine, it may be possible to predict nights of peak bat emergence in the spring. It has not been determined what event(s) predict or trigger the onset of fall bat migration.

4.12.4 Construction impacts

As discussed in detail in Section 2.4, construction would be expected to occur during the fall and winter of 2005. Its limited duration, and general limitation to daylight hours, reduce the likelihood that increases in noise or dust would have an effect on bats foraging or migrating through the proposed project area.

4.12.5 Operational impacts

4.12.5.1 Bat mortality studies at wind farms in the U.S.

Erickson *et al.* (2002) reviewed bat mortalities prior to 2001 at five sites across the U.S. This information was updated by the National Wind Coordinating Committee (NWCC) in 2004 and is shown in Table 4-16. Information in Table 4-16 has been adjusted for scavenging (bat carcasses eaten or removed by other animals) and observer and detection biases (bats missed during searches). For comparison, the rotor diameter for the Forward project wind turbines could be up to 271 feet.

Table 4-16 Bat fatality rates adjusted for detection biases[1]

Region[2]	Number of Studies	Rotor Diameter Feet (meters)		Number of Bat Fatalities/ Turbine/Year[3]		
		Min.	Max.	Avg.	Min.	Max.
Northwest	4	154 (47)	213 (65)	1.2	0.7	3.2
Rocky Mts.	2	138 (42)	144 (44)	1.2	1.0	1.3
Upper Midwest	4	108 (33)	157 (48)	1.7	0.1	4.3
East[4]	2	154 (47)	236 (72)	46.3	28.5	47.5
Total	12	108 (33)	236 (72)	3.4	0.1	47.5

Source: NWCC 2004

1 Studies were conducted for a minimum of three seasons (spring, summer and fall). Scavenging and searcher efficiency biases were incorporated into the estimates, although most bias trials used birds to represent bats in the trials. Per turbine estimates are weighted by number of turbines at projects studied.

2 A few bat fatalities have been reported at older projects in California, but no estimates have been made.

3 Per turbine estimates are weighted by number of turbines at projects studied.

4 Improved estimates expected in winter 2004/2005 from intensive fall 2004 studies at two sites, i.e., Mountaineer, WV and Meyersdale, PA.

Regional fatality numbers (Table 4-16) range from an average of 1.2 bats/turbine/year in the northwest and Rocky Mountain regions to an average of 46.3 bats/turbine/year in the east (NWCC 2004). Many factors, including turbine characteristics and ecological settings, differed among these locations. It should be noted that the wind turbines at all these sites were shorter and had smaller blade-swept areas than those proposed for the Forward project. Species composition of fatalities also varied among locations. The most commonly reported bat fatalities at wind power facilities in the U.S. are eastern red and hoary bats which are tree bats. Smaller numbers of silver-haired bat (tree bat) and the eastern pipistrelle (cave bat) mortalities have been reported.

Bat mortalities in Table 4-16 were recorded from May through November. Approximately 90 percent of bat mortalities occur during the fall period, from mid-July through mid-September. The bat mortalities peak in August, with more than 50 percent occurring then. Of the 616 bat carcasses found in these studies, the vast majority were tree bat species: 62 percent hoary bats, 17 percent eastern red bats, and 7 percent silver-haired bats (Erickson *et al.* 2002). For four of the studies in Table 4-16 completed prior to 2001, tree bats in the genus *Lasiurus* (eastern red bat and hoary bat) represented 85 percent (122 of 143) of the dead bats collected, with 86 percent[56] occurring between late August and

[56] Note that the numbers and percentages by species are based on recovered bats without being corrected for scavenging and searcher and detection biases.

early October[57] (Osborn et al. 1996; Puzen pers. comm.[58]). Smaller numbers of cave bat fatalities were recovered: 3 percent big brown bats, 3 percent little brown bats, and 2 percent eastern pipistrelles. The seasonal timing of mortalities suggests that most collisions occur during the fall migration period (Erickson *et al.* 2002).

At Buffalo Mountain Wind Farm in Tennessee, located on a mountaintop in a deciduous forest, bat mortalities as high as 10 per turbine per year were recorded, with no adjustment for scavenging or observer detection biases. Mortality estimates that do not incorporate correction factors for area, scavenging, observer detection biases and other sampling biases, underestimate the true number of mortalities. Appropriate correction factors can increase total estimates by at least one order of magnitude (e.g., Foot Creek Rim, Young 2003a). The differences between these settings, in regard to conditions leading to mortality, have not been established.

A number of assumptions regarding the causes of bat mortality have been disproved in recent studies. Because some bat species may spend considerable time foraging near lights, it was suggested that lighted turbines might have higher collision rates than unlighted turbines. However, data from the Buffalo Ridge, Minnesota wind project did not support this hypothesis (Johnson *et al.* 2002). There was also speculation that higher mortalities in the fall might represent increased numbers of less experienced juveniles; however, the two studies in which bat carcasses have been aged have shown most carcasses to be adults. (At Buffalo Ridge, 68 percent of bat fatalities were adults. Johnson *et al.* 2002).

The following are the mortality results from four specific studies. However, the limited scientific understanding of bat behavior for different bat species limits our ability to extrapolate known mortality events to different bat species or to other sites. Moreover, there is not a commonly-applied protocol for studying bat mortality.

<u>Mountaineer Wind Energy Project, West Virginia and Meyersdale, Pennsylvania</u>

The highest number of bat fatalities represented in Table 4-16 is 47.5 bats/turbine/year recorded at the 44-turbine Mountaineer Wind Energy Project in West Virginia and a 20-turbine site in Meyersdale, Pennsylvania The mortalities included approximately 2,092 bats of seven species from August to October, 2003. All the species that are known to occur in Wisconsin also occur at these sites, except for the eastern red bat. These results prompted follow-up radar and infrared studies carried out in cooperation with the USFWS. Data generated in 2004 at Mountaineer were similar to the 2003 results, but have not yet been published (Kerlinger pers. comm.[59]). At this time, researchers do not fully understand how these mortality events relate to bat behavior or environmental factors. While this site shows that negative impacts can occur that were not anticipated prior to construction, it is important to note that the vegetative cover and topography (mountainous ridges with forest and scrub/shrub vegetation) at the Mountaineer and Meyersdale sites are not present in the Forward project area.

[57] Whether the studies referred to in this citation were also included in the summary in Table 4-16 is not certain, but likely, given the date and the fact that bat studies at wind farms are not numerous.
[58] Shawn C. Puzen, environmental analyst, Wisconsin Public Service Corporation
[59] Paul Kerlinger, Ph.D., Curry & Kerlinger, LLC

Nine Canyon Wind Power Project, Washington

Bat mortality information is also available from the Nine Canyon Wind Power Project in Washington (Erickson *et al.* 2003). The Nine Canyon site is located among wheat fields, grazed shrub-steppe, and CRP grasslands. The project consists of 37 turbines arranged in three strings. Each turbine is 91 m (299 ft) tall, with a rotor diameter of 62 m (203 ft). During the one year study, 74 percent of the total number of dead bats (n=27) were found between August 5 and October 24, and 24 percent were found during May, June and early July. Mortality consisted of two species of tree bats: hoary bats (56 percent) and silver-haired bats (44 percent). Adjusted for searcher efficiency and carcass scavenger rates, bat mortality from this study was estimated at 3.21 bats/turbine/year.

Top of Iowa, Iowa

The Top of Iowa Wind project is located in north-central Iowa. The 89 turbines are located in a primarily agricultural area with three nearby wetlands. Preliminary results from a 2004 progress report (PSC Ref. #26265) indicated that the total adjusted mortality (adjusted for the proportion of the plot searched, searcher bias and scavenging) for the period between April and December 2003 was 167.23 bats for the 26 turbines researched or approximately 6.4 bats per turbine. According to Koford, principal investigator for the study (pers. comm.[60]), the number of collision-induced bat fatalities for the 2003 study period estimated for the entire wind farm has been revised to 526 ± 193 or approximately 5.9 bats per turbine. Koford has also stated that the preliminary mortality estimates for the period between March 24 and December 15, 2004 may be even higher, at 905 ± 265 or approximately 10 bats per turbine. Almost all mortality occurred during the fall migration. This data has not been published or peer-reviewed. Koford stated that these preliminary results will most likely be further revised downward with additional analysis. However, these numbers of bat fatalities are higher than values reported for any other Midwestern site and are cause for concern. A published report containing the complete analysis of the 2003 and 2004 data is expected to be available later this year.

Buffalo Ridge, Minnesota

Wind farms in agricultural areas with less optimal bat foraging habitat like Buffalo Ridge in Minnesota have bat mortality much lower than those recorded at the Mountaineer and Meyersdale sites. At each of the three development areas at Buffalo Ridge, bat mortality was 0.3, 1.8 , and 2.0 bats/turbine during the study period of 1996 to 1999 (Johnson *et al.* 2000).[61] Bat mortalities at Buffalo Ridge, increased from 0.07 to 2.32 as more turbines were added to the facility. Unlike the Forward project area, the Buffalo Ridge wind farm is not near large marsh areas or a bat hibernaculum, which could potentially increase bat activity in the area and therefore increase the risk of bat mortalities.

At Buffalo Ridge in 2001, one bat mortality was estimated to occur for every 70 bat passes and the mean number of bat passes at turbines without mortality was not significantly different from the mean number of passes at turbines with mortality. This suggests that bat activity is not correlated with collision mortality. It is more likely that the strength of the correlation depends on the presence or absence of other factors, including specific species characteristics and habitat conditions.

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[60] Dr. Rolf Koford, faculty at the Department of Natural Resource Ecology and Management of Iowa State University and assistant unit leader of the Iowa Cooperative Fish and Wildlife Research Unit

[61] The fatality searches were carried out from March 15th to November 15th during 1999 at the Phase 1 and 3 areas and during 1998 and 1999 at the Phase 2 area

4.12.5.2 Bat mortality studies at existing wind farms in Wisconsin

Studies at wind power facilities in Wisconsin have documented collision mortality of all seven bat species known to occur in Wisconsin, including the two state species of special concern, northern long-eared bat and eastern pipistrelle.

The Kewaunee County wind project is the closest facility to the Forward project area at which bat mortality studies have been conducted (Howe *et al.* 2002). Located approximately 100 miles northeast of the current project site, the site consists primarily of crop land in a setting of dairy farms and rural homes. Extensive lowland forests are within 1.2 miles of the wind farm. The project consists of 31 turbines, each 288 feet tall with a blade-swept height range of 134-288 feet.

The adjusted bat mortality rates from this study totaled 4.26 bats/turbine/year (Howe et al. 2002). Most of the mortalities were found during the months of July, August (peak), and September, although some were also found during May in each of the two study years. The recovered bats were mostly tree bats: hoary bats (35 percent), eastern red bats (38 percent), silver-haired bats (18 percent), little brown bats and possibly northern long-eared bats (8 percent), and big brown bats (1 percent).

Bat mortality rates for the Kewaunee County studies may have been underestimated because objects used to represent bat carcasses in searcher efficiency trials (pieces of white PVC tubing) were a poor simulation of small dark brown or black bat carcasses in terms of visibility, and vegetation was lower making targets easier to find during the searcher efficiency trials than in the fall, when most of the bat mortalities occurred.

Although most of the mortality at the Kewaunee Project was comprised of tree bats, that may be because these species were more locally abundant without a nearby hibernaculum. Also, the recovery of the majority of bat species coincided with their migratory period.

4.12.5.3 Potential impacts of the Forward project on bats

Operational impacts on bats of the Forward project can be classified into two categories: 1) displacement/disturbance impacts; and 2) collision impacts. Assessing bat presence, abundance, and behavior in the project area, throughout the year is the most reliable method of determining the project's potential impacts on bats. Forward's application only provided a very general evaluation of the project area and a literature search. No pre-construction bat study was conducted.

Projecting potential impacts based on results from other studies can be misleading without accounting for the influences of many important factors, including, topography, vegetation, land use, weather patterns, turbine design and layout, bat presence, relative abundance, and use of the landscape. Those studies most informative for the Forward project would be those with environmental factors, design attributes, and bat population characteristics most similar to the Forward project area.

Based on the information presented in this discussion, the following observations can be made:

- Bats are impacted by wind turbines.
- Fatalities from collisions with turbines appear to be greater for bats than for birds.
- All bat species known to be present in Wisconsin and likely to be present within the project area are vulnerable to collisions, tree bats as well as cave bats; though less is known about tree bats and mortality studies indicate that they may be at greater risk from wind turbines.

- Bat mortalities from wind turbines may have a disproportionate impact on the reproductive populations of bat species because bats have low reproductive rates and wind turbine fatalities are primarily adults.
- Bat fatalities caused by collision with wind turbines occur primarily during the fall migration.
- Disruption of foraging patterns within the project area may cause indirect impacts if bats do not store enough fat prior to hibernation.
- One of the largest bat hibernacula in the U.S. is located 10 miles from the project area. This distance is within the summer home range and pre-hibernation foraging range of the bat species that hibernate at Neda Mine.
- With limited locations that have conditions suitable for bats to hibernate, Neda is a winter home for many summer colonies of bats from throughout the Great Lakes region.
- Several large wetlands surrounding the project area are likely to provide a large number of bats with feeding opportunities for fat building in the fall.
- The Forward project area occupies an area that may be a movement path between the Neda hibernaculum and important feeding areas or migration routes for bats.

The lack of information, from either the applicant or other reliable sources, on bat presence, abundance, and behavior in the project area is a substantial weakness in the data. This information would be needed to develop a reliable quantitative assessment of potential impacts to bats from the project.

4.12.6 Conclusions

The impacts of utility structures on bat populations are not well documented. Moreover, existing projects do not provide a sufficient range of mortality scenarios from which to draw scientifically valid conclusions for future wind projects. Significant data gaps were identified during a technical workshop hosted by Bat Conservation International (BCI) in 2004 (BCI 2004b). What is clear is that wind turbine-induced bat mortalities occur, sometimes in high numbers, and that bat fatalities are most likely to be greater than bird fatalities. However the reasons for these mortalities have not been fully studied.

Approximately 445 wind turbines exist or are proposed for construction along the Niagara Escarpment (including the Forward project). Each is likely to contribute to the total mortality of bats in this region. Assuming full development by the end of the decade, bat mortality from wind turbines in this region could total thousands of bats per year. Because bats have very low natural mortality and reproductive rates, and because a large portion of carcasses recovered from mortality studies are adults, wind farms may have a disproportionate impact on the reproductive populations of various bat species.

Without good data, the increasing number of wind turbines is of particular concern because the facilities might have unknown and largely irreversible effects on this group of mammals. Unlike birds, there is very little existing baseline information on bat populations, distribution, and movement in Wisconsin. Regional populations of the seven species of bats that occur in the project area have never been quantified. This makes the extrapolation of bat mortality studies from one wind farm to another difficult. Too little is known about the potential impacts to bats from wind turbines to rely exclusively on information from studies at other locations, much less to conclude with confidence that the Forward project would have no biologically significant impacts.

The complete lack of site-specific bat information makes it necessary to review bat mortality results at other sites. The maximum bat mortality per turbine per year for Midwestern wind projects ranges from 2 at Buffalo Ridge (Minnesota) to 4 at Kewaunee County (Wisconsin), with a potential high of approximately 10 at Top of Iowa (Iowa)[62]. At Kewaunee County, the majority of bat mortalities involved fall migrating, tree bats. While all of these Midwestern sites are located in agriculturally-dominated landscapes, none is located both adjacent to extensive wetlands and near a hibernaculum (Neda Mine). The proximity of bat resources to the Forward project and the fact that the project area is within the summer home range and pre-hibernation foraging range of cave bats that use the Neda Mine, suggest that bat mortality at the Forward project area could exceed that at other Midwestern sites.

In comparison, the Mountaineer Wind Energy Center in West Virginia is located within 10 miles of two bat hibernacula, but within a very different landscape than the project area. It had the highest bat mortalities recorded to-date (47.5 bats/turbine/year), but the mortality data showed that cave bats were a smaller percentage of the fatalities than tree bats. All three of the Wisconsin bats that are listed as state species of special concern are cave bats. Allowing that very few bat studies have been conducted to date and that little is known about bat activity and migration in this region, these studies imply that adult, fall migrating, tree bats might be at greatest risk of mortality from the Forward project.

Having identified the population of bats that might be at greatest risk from the Forward project does not predict the mortality rate that could occur at this site, or whether the resulting bat mortality would have a significant biological impact on specific bat species. There are important differences between the Forward project area landscape and turbine dimensions and those at other sites studied for bat mortality. Sites located near bat hibernacula have different environmental features than the project area which might affect bat impacts in different ways. Wind farms with mortality studies in the Midwest have fewer or smaller turbines compared to those proposed for Forward (133 turbines, each approximately 398 feet tall, with a maximum rotor diameter of 271 feet), which may also cause different bat impacts than those observed at other locations. And while the actual number of bat fatalities at different sites can be compared, there are no established protocols for bat mortality studies and not all studies apply the same bias adjustments.

Finally, without knowing the historical populations of bat species in an area, it is difficult to determine the significance of post-construction mortality rates. The purpose of a pre-construction study is to assess the extent to which bats may be displaced from an area or have their life-cycle activities disturbed because of operating wind turbines. A pre-construction study could create population estimates for evaluating the significance of post-construction mortality impacts. Comment letters received from the USFWS specifically questioned how Forward could conclude that the project would pose no significant impacts to bats without a pre-construction study (Appendix B). Relying solely on post-construction mortality studies has direct implications on the effectiveness of these studies, and the potential cost of mitigating impacts.

4.12.7 Recommendations

The location of the Forward project poses a unique situation. Given the number of wind turbines proposed for the Niagara Escarpment region, and the potential for cumulative, irreversible impacts to existing bat populations, a detailed assessment of potential impacts is necessary to provide useful, meaningful information. Both DNR and the PSC recognize that there is very little baseline information

[62] The number of 10 bats/turbine/year has not been published or verified yet. The information comes from a personal communication with the principle investigator, Dr. Rolf Koford.

about bat distribution, diversity, and movement throughout the state. Further, this information is critical to evaluating the potential impacts of wind energy and other construction projects to the state's bat populations. This is one reason that DNR is in the process of developing a plan to study the state's bat populations, and is assembling a combination of public and private funding sources. It would be advantageous for Forward to participate, either monetarily or with site-specific field studies, in this cooperative state-wide research.

Comparing results from pre-construction and post-construction surveys (BACI study design) is a more reliable approach for assessing actual bat impacts and gaining insight into potential impacts at new sites. It is also possible to use an impact gradient (IG) approach where displacement is measured along a transect going away from a turbine. In considering whether the Forward project might be delayed until pre-construction studies could be completed, several factors need to be considered. First, the lack of regional bat data means that any pre-construction study would need to be lengthier than one completed for birds, where much is already known about species behavior, abundance, and movement. Second, while birds can be visually identified in the field with relatively simple technology, bat studies require the use of several different technologies, some of which are highly technical in nature (*e.g.*, mist net surveys, radar, infrared or acoustic). These technologies are generally complementary, with each providing a different piece of information about bat numbers and usage. This means that an effective pre-construction bat study for this project would delay it for several years and cost hundreds of thousands of dollars. On the other hand, the lack of a pre-construction study limits the set of options for reducing impacts after the project has been built, and may result in additional unanticipated costs.

Ideally, Forward would have worked with the regulatory and resource management agencies to complete *both* pre-construction and post-construction studies of bat habitat use, movement, behavior and mortality within the project area. Given the timing of the review process, only post-construction studies would be possible unless the Commission delays its approval of the project.

If undertaken, the Forward post-construction study should be conducted for two to three years with periodic follow-up studies during the spring, summer, and fall; and within the project area and at a reference (control) site outside of the project area. More emphasis must be placed on the data obtained from a suitable reference site; especially, for understanding bat displacement issues. Post-construction monitoring programs provide important information on the number of bat mortalities due to collision with turbines. Mortality information must be adjusted to reflect the bias and errors discussed previously. Presenting only observed mortalities without adjustments for these biases could produce a substantially inaccurate mortality estimate.

If adequate post-construction studies reveal significant bat mortality, additional studies would be needed to address mitigation measures to repel or draw bats away from turbines or reasonable operating restrictions for some or all turbines during periods of highest bat risk. The additional studies and the potential for operating restrictions have financial implications for project owners.

Given the previous discussion, the following mitigation strategies could be implemented to verify that impacts to bat populations are minimized by the proposed project:

- As a condition of Commission approval, post-construction mortality and bat use surveys should be carried out for two to three years after construction, and periodically thereafter (the duration and intervals could be finalized through negotiations between Forward and the agencies). Survey methodology should be submitted for review and approval by PSC and DNR and be consistent with the most current guidance from the Bats and Wind

Energy Cooperative (BWEC) and Bat Conservation International (BCI).[63] Input from the USFWS should also be solicited and applied. Periodic reports should be submitted to the PSC and DNR.

- The USFWS or DNR would be notified if a federally protected species is accidentally killed in the project area in order to determine if consultation is required under the Federal Endangered Species Act.
- Forward should participate in the DNR state-wide bat study in order to define regional bat populations and relate data collected near the Neda Mine with bat movements and impacts in the project area.

With respect to siting and design recommendations, minimizing lighting of the turbines and the substation (to the extent allowed by the FAA) may also be protective for bats. None of the recommendations provided in the draft USFWS turbine siting guidance, which are primarily based on what is known about birds, would be incompatible with bat behavior.

It is important to establish an adaptive management approach based on the results of the post-construction monitoring and other relevant studies. As new information becomes available on potential impacts to bats in the Forward project area, project operations should be reevaluated to avoid or minimize those impacts. While there is not enough experience to determine what types of mitigation measures are appropriate for reducing bat mortalities at wind farms or individual turbines, some theories are currently being considered for testing.

Preliminary anecdotal evidence suggests that bats are more likely to collide with operating rather than stationary turbines. Studies at the Mountaineer site provided some support for this in that a single non-operating turbine had no fatalities. It may be possible to create a predictive model that would determine nights of high bat activity and risk. One possible mitigation method would be to idle turbines off on nights during peak bat activity when environmental conditions forecast high mortality events. As more information about bat behavior is gained and other measures are proven successful in reducing bat mortality, shut-offs could be for shorter durations and less frequency.

Other possible mitigation measures being considered include acoustic-based deterrents. These deterrents might either alter the sound produced by the turbines themselves or emit a sound to alert bats to the danger posed by the turbines or repel the bats away from the turbine area altogether. Alternatively, mitigation measures could be designed to compensate for impacts that cannot reasonably be avoided such as the creation of bat roosting and foraging habitat away from turbine sites.

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[63] The BWEC has published recommendations for improved bat fatality search protocols due to the higher bat mortality rates recorded at eastern wind farms (Mountaineer and Meyersdale).

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CHAPTER

5

Chapter 5 – Social Environment and Community Impacts

5.1 AFFECTED MUNICIPALITIES

The proposed Forward wind project would be located in an area straddling the towns of Byron and Oakfield in Fond du Lac County and the towns of Lomira and LeRoy in Dodge County as illustrated in Figure Vol. 2-1A and 2-1B. The village of Brownsville, Dodge County, lies in the midst of the project area. The village of Lomira, Dodge County, is at the southeast edge of the project area, and the village of Oakfield, Fond du Lac County, lies at the northwest edge. The villages of Kekoskee and Theresa, Dodge County, lie two to four miles beyond the southern reaches of the project area, respectively. The city of Mayville is further to the south, and the city of Fond du Lac lies several miles to the north. No properties within these cities or villages would host turbines. All of the turbines would be located in the surrounding rural areas as shown in Figure Vol. 2-1A and 2-1B.

The area proposed for the project is mostly farmed. There are also, as discussed in Section 5.2, a growing number of exurban housing developments, unrelated to farming, in the area. Several quarry and stone operations are also present in the area. There are six private airports whose flight paths are within or adjacent to the project area. Details on the existing land use and land use plans are discussed in later sections of this chapter.

A new substation to interconnect the Forward project with the existing electric transmission system would be located on agricultural land in the town of Byron, T14 N-R17 E, Fond du Lac County, in the southeast quarter of the southeast quarter of Section 28.

5.2 PROJECT AREA CHARACTERISTICS

5.2.1 Demographics

Table 5-1 summarizes the characteristics of the community in the area of the proposed project. Demographics of residents in the project area, based on the 2000 U.S. Census, are compared with the demographics of Fond du Lac and Dodge Counties, Wisconsin. Census Tract 419 includes residents in the Fond du Lac County portion of the project area, and Census Tracts 9601 and 9602 include residents in the Dodge County portion of the project area.

Table 5-1 Demographic characteristics of the Forward project area, based on 2000 U.S. Census data

Criteria	U.S.	Wisconsin	Fond du Lac County	Dodge County	Census Tract 419	Census Tract 9601	Census Tract 9602
General Demographics							
Total Population	281,421,906	5,363,675	97,296	85,897	6,797	5,955	3,297
Percent White	75.1	88.9	96.2	95.3	98.5	98.2	98.5
Percent African American	12.3	5.7	0.9	2.5	0.1	0.2	0.1
Percent All Other	12.6	5.4	2.9	2.2	1.4	1.6	1.4
Economic Characteristics							
Percent Employed	59.7	65.8	67.6	64.3	73.4	72.4	71.6
Percent Unemployed	3.7	3.2	3.0	2.2	2.7	2.0	1.4
Median Household Income	$41,994	$43,791	$45,578	$45,190	$50,149	$49,632	$52,246
Percent Families Below Poverty Level	9.2	5.6	3.5	3.7	2.8	2.6	3.4
Housing Characteristics							
Median Value of Owner Occupied Units	$119,600	$112,200	$101,000	$105,800	$124,300	$117,700	$110,700

As indicated in Table 5-1, the demographics of the communities in the proposed Forward project area show a mostly white population, with a generally higher rate of employment and annual income than in the state, nation, or in either county. The value of owner-occupied homes in the project area is similar to the average value in Wisconsin and the U.S and above the average value in either county. Because the percentage of residents in the vicinity of the proposed project represented by non-white races or relatively low annual incomes is very small, it is apparent that the proposed project would not disproportionately or unfairly affect residents of minority races or low incomes.

The townships and sections in which Forward's wind turbines would be located are listed in Table 5-2.

Table 5-2 Townships and sections where Forward turbines are proposed to be located

Township	Town	Range	Sections
Oakfield	14	16	23, 24, 25, 26, 34, 35, 36
Byron	14	17	27, 28, 29, 30, 31, 32, 33, 34
LeRoy	13	16	1, 2, 3, 10, 11, 12, 13, 14, 15, 22, 23
Lomira	13	17	4, 6, 9, 16

5.2.2 Population trends

There have been changes in the area population since the year 2000, but it does not appear that the changes are substantial. While the vast majority of the land in the project area of the proposed project is farm land, there is a growing community of non-farm rural homes on smaller parcels of land. The growing exurban population in the area does not appear to represent a notable change in the racial or economic character of the local demographic, except that farming, as an occupation, may be declining.

5.2.3 Potential impacts of Forward project

Differences or changes in the area may relate more to farm versus non-farm culture rather than to differences in income or race. It appears that the Forward project could benefit farmers who are willing to have turbines located on their property. As discussed in Sections 2.5 and 5.5, the farms that host wind turbines would receive easement settlements and annual payments. According to Forward, placing turbines on farm land so as to interfere as little as possible with the farm operations is addressed in the easement agreements by allowing the host landowners to approve all final turbine locations. The easements are for 25 years, with options to extend them for another 10 years. The annual compensation for hosting the turbines, provided for in the easement agreements, could mean an increase in farm profitability that allows the land to remain in farming, which is consistent with the future land use goals of the local municipalities described in Section 5.4.

5.3 LAND USE

5.3.1 Historic and existing land use

5.3.1.1 Historic land use

The land in the area of the proposed project has been in agriculture since European settlement of the area occurred in the 1800s. The parcels where the turbines are proposed to be sited have historically been farm land.

5.3.1.2 Existing land uses

The majority of the project area is currently farm land in tilled crops and hay. As discussed in Section 4.9, there are some forested areas and fencerow trees throughout the area. There is also an increasing amount of rural residential housing in the area. Figure Vol. 2-21 shows the land classifications within the project area, and Table 5-3 provides acreages for each land use or land cover.

The largest amount of land in the project area, about 31,312 acres or 97 percent of the total project area, is dedicated for row crops, small grains, or for hay. Beyond the farm fields, the next greatest acreage of land is committed to deciduous woodlands (about 2 percent). Residences account for about 85 acres total at this time, or about 0.26 percent of the project area land. Therefore, most if not all of the directly affected land in the project area is farm land.

Forward has indicated that its easement negotiation process allows landowners to select the precise sites on their farms for one or more turbines. This has resulted in a proposed turbine layout in which, at least, 65 percent of the turbines sited in farm fields are located at or near field edges or other boundaries between different land uses or land covers. The potential impacts of this type of location are discussed in Section 5.5.

Table 5-3 Land use in the project area

Land Use	Acreage	Percent of Project Area
Open Water	5.1	0.02
Low Intensity Residential	64.5	0.20
High Intensity Residential	20.9	0.06
Commercial/Industrial/Transportation	9.3	0.03
Bare Rock/Sand/Clay	2.4	< 0.01
Quarries/Strip Mines/Gravel Pits	80.5	0.25
Deciduous Forest	702.2	2.17
Evergreen Forest	8.5	0.03
Grasslands/Herbaceous	46.5	0.14
Pasture/Hay	14,740.5	45.48
Row Crops	16,553.9	51.07
Small Grains	17.8	0.05
Urban/Recreational Grasses	2.7	< 0.01
Wooded Wetlands	139.0	0.43
Emergent Herbaceous Wetlands	18.4	0.06
Total	32,412.2	100.00

5.3.2 Publicly-owned lands

There are several important publicly-owned lands near the proposed project area. These are mainly wetlands and wildlife areas that are managed by the DNR or the USFWS. The Horicon Marsh represents the greatest acreage and area of potential concern. Public wetlands and wildlife refuges near the project area are discussed in Section 4.7, "Regional State and Federal Lands."

There are also many, small, publicly-owned parcels inside or near the mapped project area. These parcels, all of which are very small, are related to village, township, or local DOT functions. USH 41 is close to proposed turbine locations in the northeastern portion of the project area. Lands owned by the villages of Brownsville and Lomira and by the state would not host turbines, although turbines could be within a mile of some of these properties. While no direct impacts are expected on these lands, as discussed in Section 5.4.4, the village of Brownsville has concerns related to its plans for residential growth. In a letter to the Commission,[64] the village requests that all turbines be relocated so as to be at least 1.5 miles from the village of Brownsville corporate limits, and that an independent study be conducted to determine if the turbines adversely affect radio or microwave transmissions which would limit the municipalities' abilities to process 911 emergency calls and other emergency communications.

Table 5-4 provides a list of the publicly-owned lands that are located in township sections where wind turbine sites are proposed.

[64] January 6, 2005 letter to the Commission from Harold Johnson, Village President, Village of Brownsville, County of Dodge, State of Wisconsin.

Table 5-4 Publicly-owned lands located in sections where turbine sites are proposed

Town	Range	Section	Place	Controlling Agency	Acres
13N	16E	22	Between Centerline Road and CTH YY	Dodge County	<1
13N	16E	22	Between Centerline Road and CTH YY	Town of LeRoy	4
14N	16E	23	Along escarpment south of village of Oakfield	DNR	100
14N	16E	26	Intersection of Breakneck and Highland Roads, west of Turbine No. 3	DNR	80

The small acreages in Section 22 would not be affected directly by nearby turbines. The larger acreages to the north, toward the village of Oakfield, support trees or wetlands that DNR is trying to protect. The parcels in Section 23 of the town of Oakfield are part of an exclusion area designated by Forward in which no turbines would be located.

Maps in Forward's CPCN application show an access road across the DNR parcel in the western 1/2 of the southwest 1/4 of Section 26, T14N R16E, from Highland Road east to Turbine 3. This land is zoned Prime Agricultural land, and it also appears to be the headwaters area for Kummel Creek. The parcel is currently in grasses, and DNR manages it as wildlife habitat under the GHRA program. Forward has indicated that it is not planning to route an access road across this DNR land but is instead negotiating a different route for an access road that would approach Turbine 3 from the Turbine 5 site to the east.

Two other public properties are of particular interest in this case. Both are discussed in more detail in Section 4.7, "Regional State and Federal Lands." They are the Horicon National Wildlife Refuge and State Wildlife Area and the Wild Goose State Recreation Trail.

The Horicon National Wildlife Refuge is located west and southwest of the project area. The Refuge itself covers approximately 21,000 acres and makes up the northern two-thirds of the Horicon Marsh. This portion of the marsh is managed by the USFWS. The southern one-third of the Horicon Marsh is administered by the DNR and is known as the Horicon Marsh State Wildlife Area. The State Wildlife Area covers approximately 11,000 acres. The marsh as a whole is the largest freshwater cattail marsh in the United States. Congress established the Horicon National Wildlife Refuge in July 1941 for the protection and conservation of migratory birds.

Although no turbines are proposed to be located on state or federal marsh land, the installation of the wind farm on uplands east of the marsh may have impacts on marsh resources that need to be considered. The potential impacts on local bird populations and bird migrations are discussed in Section 4.11. The Horicon Marsh and the waters that feed it are discussed briefly in Section 4.4.

The Wild Goose State Recreation Trail is located northwest of the project area along an old railroad right-of-way. While owned by DNR, the trail is maintained and operated by Fond du Lac and Dodge Counties. It is used for bicycle riding, hiking, and snowmobiling. The trail and its uses are not expected to be directly affected by the construction or operation of the Forward wind farm. However, several turbines may be visible from some sections of the trail.

5.3.3 Recreation

Recreation in and around the Forward project area, which includes enjoyment of natural landscapes or hunting, mostly revolves around the nearby marshes and wildlife habitats. The project applicant has indicated that it would not expect any restrictions on hunting waterfowl, small game, or deer to be applied in the project area.

Boat landings are operated on the Horicon, Theresa, and other area marshes. Off-road snowmobile trails are established throughout each county for winter use. The majority of the snowmobile trails cross private lands, where the use of the land is donated or covered by a special easement. The Horicon Marsh Parkway encircles the Horicon Marsh and thus runs close to the western edge of the Forward project area.

In Fond du Lac County, recreation interests in the towns of Oakfield and Byron focus on the Horicon National Wildlife Refuge and the Wild Goose State Recreational Trail, both of which are outside the proposed project area. There is one town-owned recreational area in the town of Oakfield. It is located along CTH B, north of the project area. There are conservation easements on several privately-owned lands, related to the Glacial Habitat Project, and some state-owned land that are also used as wildlife habitat. One county-owned parcel exists in the town of Byron, well north of the project area. Only the state-owned lands are open to the public for hiking, nature study, hunting, or trapping.

Dodge County has prepared a recreation plan[65] that proposes recreation improvements through the year 2020. In addition to the state and national wildlife areas and boat landings associated with the Horicon Marsh and other marshes and wildlife conservancies, parks and playgrounds in the county consist mainly of municipally-owned and privately-owned properties. Planned park improvements and land acquisitions are detailed in this plan. Aside from improvements to parks in Brownsville, no acquisitions or park improvements appear to be planned for the towns of LeRoy or Lomira.

Recreation in both counties has been increasing over recent years and is expected to increase more in the future. Lifestyles in this region of Wisconsin are changing so that more leisure time may become available. The area population is getting older overall, with potentially greater mobility and finances to spend on recreational activities. In addition, the tourist use of the area continues to grow, largely for the purpose of experiencing the marshes and wildlife. Finally, the increasing number of residences in the area could require more focus on developing parks and recreational facilities and also preserving open space. As recreation facilities and activities develop or increase, the Forward project would probably not be an obstacle to park development.

Depending on one's point of view, the Forward project may or may not interfere with the enjoyment of natural landscapes and wildlife. The project itself could draw tourists, partly because it would appeal to the growing interest in renewable energy, and partly because the 398-foot turbine towers with 135-foot blades could present a dramatic change to the traditional, rural Wisconsin landscape. (See Section 5.10, "Visual Resources and Aesthetics," for a more detailed consideration of the appearances of the turbines in this locality.) It has also been proposed that, while there would likely be an initial "curiosity factor" that would draw tourists to see the turbines, that curiosity factor could dissipate. Several comments on the draft EIS suggested that tourism related to the Horicon Marsh could decrease if there is an alteration in bird activities (displacement or mortality; see Sections 4.7 through 4.11). This could change the local tourism economy, with local stores and services experiencing reduced business.

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[65] Dodge County, Wisconsin. "Park, Outdoor Recreation and Open Space Plan - 2003."

5.3.4 Airports and airstrips

Potential impacts on area airports and airstrips are of some concern for proposed wind farm projects. Six public use airports are located within twenty miles of the project area. The nearest is the Fond du Lac County Airport (FDL), seven miles to the north. There are also six existing private airports operating in or near the project area. Being located in the midst of or near the proposed wind turbines could pose some problems for pilots using these airstrips, including aerial applicators that are under contract to local vegetable growers. See Section 5.5.

5.3.4.1 Reporting requirements for high structures

Federal Aviation Regulations regarding obstructions to navigable airspace (14 CFR 77, or "FAA Part 77") require notification to the FAA Administrator of any proposed construction "of facilities more than 200 feet in height above the ground level at its site (Section 77.13(a)(1))." The turbines proposed for the Forward project have a maximum height of 398 feet, exceeding the FAA notice threshold of 200 feet. The landscape is gently rolling, so there would be slight variations in the above sea level elevations of different wind turbines. In addition, construction of the wind turbines would require the installation and movement of cranes that would extend to the turbine hub height or beyond. The primary lift crane used to erect the towers would be in the 400- to 500-ton size range. The crane height would typically have a 200-foot main boom and a 120-foot luffing jib.[66] Forward has stated its intention to notify the FAA regarding exact facility heights and latitude and longitude coordinates at least 30 days before it begins construction. The FAA cannot complete the required aeronautical studies and issue the final determinations until Forward submits the heights and coordinates of each turbine. FAA-required lighting of the turbine towers is discussed in Section 5.10.

The FAA recently drafted a new set of recommendations for lighting wind farms that could require fewer lights than needed under its current policy. The new lighting recommendations would likely reduce the visibility of wind farms at night for those living in the surrounding areas. The proposed new standards suggest red or white synchronized flashing strobe lights, one half-mile apart at the most, around the perimeter of the wind farm. In the recommendations, the FAA has determined that neither daytime lighting nor dual lighting of turbines that are part of wind farms would be necessary.

The proposed project area is very spread out and contains several existing or established airfields (see Section 5.3.4.3 below). It is unclear how the new FAA lighting recommendations might consider airstrips or airfields within a project area. The applicant has stated its intent to seek the minimal lighting proposed by the new FAA standards for wind farms, including lights one-half mile apart around the perimeter of the proposed project. If the project is approved, the FAA will make the final marking and lighting determinations as part of their aeronautical study once Forward submits the final tower heights and locations.

5.3.4.2 Public use airports

Six civil airports open for public use have been identified within a 20-mile radius outside of the Forward project area boundary. Table 5-5 identifies these airports.

Each public use airport, with the exception of Hahn Sky Ranch, is paved and has an officially published instrument approach procedure.

[66] Crane models that might be used would be the Manitowoc 2250, the Demag CC2000, or the LR1400.

Table 5-5 Public airports within 20 miles of Forward project area

Airport Name	Location	Runway Length (Ft.)	Approximate Distance From Project Area
Fond Du Lac County Airport	Fond Du Lac	5,900	7 miles north
Dodge County Airport	Juneau	5,000	11 miles southwest
Hahn Sky Ranch	West Bend	2,900	11 miles southeast
Hartford Municipal Airport	Hartford	3,000	14 miles southeast
West Bend Municipal Airport	West Bend	4,400	19 miles southeast
Wittman Regional Airport	Oshkosh	8,000	20 miles north

For public use airports, FAA 77.13 requires notifying the FAA Administrator of any proposed structure whose height exceeds that of an imaginary surface extending 20,000 feet (about 3.8 miles) from the nearest public use airport runway at a slope of 100 feet horizontal to each one foot vertical (a 100:1 slope). If the structure is within 10,000 feet (about 1.9 miles) of an airport's runway and the airport's longest runway is no greater than 3,200 feet, the slope is reduced to 50 to 1 (Section 77.13(a)(1)(i)). The nearest public-use airport to the proposed wind farm area is the FDL, located approximately seven miles to the north of the proposed project area, just west of the city of Fond du Lac (greater than the 3.8 or 1.9 mile distance in the FAA regulation). Since the other identified public use airports are farther away from the project than the FDL, the project does not appear to be a concern for them under these FAA regulations.

Under Wis. Stat. § 114.135(7), the Wisconsin Department of Transportation (DOT) has certain responsibilities concerning new construction of high structures near airports. The DOT Bureau of Aeronautics (BOA) requires a permit for new structures that would extend to a height of more than 500 feet above the lowest terrain or water elevation within one statute mile of the location of the object, or above a height determined by the ratio of one foot vertical to 40 feet horizontal (a 40:1 slope) measured from the nearest public use airport within the state. For structures of less than 150 feet in height, no permit is required.

At this time, it appears that permits from the DOT would likely not be required, because of the gently rolling terrain and because it is unlikely any turbine would extend more than 500 feet above the lowest terrain elevation within one mile. The Fond du Lac County Airport (FDL) is the closest public use airport to the project area, and there would be no wind turbine structures or construction cranes exceeding a slope ratio of 40:1 to the nearest public use airport, FDL. There would also be no structures or cranes greater than 924 feet above the ground (considering the 40:1 slope for seven miles) less than the seven miles from the Fond du Lac County Airport. The turbine towers proposed for the northern-most edge of the project would be the closest to the Fond du Lac County Airport and the most likely to exceed the thresholds. The top of the blade of Turbine 73, which is at the highest proposed structure location (see Figure Vol. 2-1A) would be about 712 feet above the elevation of the Fond du Lac County Airport. This is less than the 924 feet computed using the 40:1 ratio and is not expected to require a permit.

5.3.4.3 Private airports

Several private airports are located or near the Forward project area. These are shown on the map in Figure Vol. 2-21 and are listed in Table 5-6. Forward believes that there is enough flexibility in the wind turbine siting process to accommodate the airport landowners' needs. If a host turbine landowner wanted a turbine placed in a location that would conflict with use of an airstrip, Forward would attempt to coordinate the siting with both landowners to allow for both uses. While turbine hosts appear to prefer locating the turbines in fence lines and existing lanes on their properties, airstrip owners have indicated that turbines must be located at safe distances from the approach and takeoff corridors for their airstrips. When siting turbines, Forward should consider these spatial needs to ensure that these functioning airstrips, which are part of the existing environment in the project area, remain open and safely useable.

Table 5-6 Private airports potentially affected by the Forward wind project

Owner	Approximate Airstrip Location
R. Baier	T14-R17E, S ½ of SE ¼ of Section 29; N ½ of NW ¼ of Section 32
W. Baier	T14N-R17E, SE ¼ of Section 17
Hjelle	T14N-R16E, E ½ of NE ¼ of Section 24
Mittelstadt	T13N-R16E, Section 1
Quad Graphics	T13N-R17E, SE ¼ of Section 3
Wunsch	T14N-R17E, E ½ of NE ¼ of Section 30

Potential impacts on the airstrips could relate to flight patterns, landing and take-off safety, and whether the airstrips would have to be modified or relocated for safety reasons after turbines were erected in the area. The airstrip owned by Quad Graphics is concrete, angling northwest to southeast, and could not be readily modified or redirected. The remaining airstrips have turf surfaces and thus may be more easily modified or redirected; however, any modification or redirection would be constrained by the size and location of the parcel of land on which it is located and by the financial resources of the airstrip owner.

Different airstrips are used for different functions. Mr. Robert Baier, a lifetime member of the Experimental Aircraft Association (EAA), has owned his private airstrip since about 1967. It is currently home for two planes, and possibly a third plane in the near future. Mr. Baier's son, Warren, owns an airstrip north of River Road, north of the Forward project area. The Mittelstadt runways are used not only by the Ralph Mittelstadt family, but also by aerial applicators that are under contract with local vegetable processing companies, as discussed in Section 5.5. The Mittelstadt runways have been stable and in place long enough that the EAA uses them regularly as emergency runways during its annual "Fly-In." Local residents have said that thousands of small aircraft fly over the area to go to the week-long Fly-In each year, and an emergency landing is made in the area nearly every year during that week. Two members of the Mittelstadt family are certified aircraft mechanics, and their airport is the home base for four airplanes. Mr. Arden Hjelle flies mostly in the summer. Mr. Larry Wunsch bought his land more recently in order to operate a private airport. His airstrip is now established and used.

Forward has raised some questions regarding private airstrips and zoning. Private airstrips are not specifically listed as permitted uses in A-1 agriculture zone lands for any of the municipal governments in the Forward project area. Dodge County has no mention of private airstrips in its code, nor do the codes for the towns of Oakfield and Byron. Still, the airstrips in the project area might be considered legally existing non-conforming uses. As an existing prior use that would be affected by the proposed wind turbine project, the potential impacts on private airstrips have been considered in this EIS.

Potential impacts could be reduced or avoided by maintaining appropriate clearance distances between the proposed turbines and the existing runways. Mr. R. Baier, an airstrip owner, is planning to host two turbines. His immediate neighbors would also host several additional turbines. In his easement with Forward, Mr. Baier negotiated a clearance of one mile out from each end of the runway, 600 feet if the turbines are 200 feet off of a direct line with the glide path, and approximately 400 feet directly offset from the center of the airstrip. He has indicated that these clearances should provide the safety cushion he needs to operate his airstrip. If they prove not to provide the safety needed, he has determined that users of his airstrip might be limited to calm days.

5.3.4.4 FAA Section 77.25 as a safety guideline

Several local airstrip owners and users, including the chief pilot for Quad Graphics and a local aerial pesticide applicator, have indicated that they would prefer that the airstrip clearances be similar to those required for public airports under federal law (40 CFR § 77.25.) BOA staff agrees that this would be safer. Even though the local airstrips are not public use airports, they are used by pilots who would be affected adversely by decreased runway safety. Clearances requested by Quad Graphics pilot and the BOA would have the dimensions for "visual approach" as described in FAA Section 77.25:

1. The approach surface slope would be 20:1 from each end of the runway. It would extend for about 5,000 feet from each end of the runway.
2. A horizontal surface would be set at 150 feet above the established runway elevation. Its radius around the entire runway would be 5,000 feet (about 0.95 miles).
3. A 20:1 slope conical surface would extend 4,000 feet (about 0.76 miles) beyond the 150-foot horizontal surface. The 20:1 slope would begin at the height of 150 feet.

FAA Part 77-type clearances around the private airstrips in the project area would not be within the enforcement jurisdiction of the FAA or the BOA, since their jurisdiction only applies to public use airports. Wis. Stat. § 60.61(2)(f) and Wis. Stat. § 59.69(4)(g), give townships and counties, respectively, the authority to protect privately-owned airports, but not without exercising the power of eminent domain. If the local governments were to proceed with protection of private airstrips, the BOA has indicated that the standards of FAA Part 77 would be a good guide for this purpose. Dane County, Wisconsin, for example, is in the process of enacting an ordinance that would protect privately owned airports with clearance patterns similar to those of FAA Part 77.[67] Dodge County, Fond du Lac County, and the towns in the proposed Forward project area have not initiated any procedures to develop ordinances to protect privately-owned airstrips. In fact, Dodge County has developed and recently amended its existing ordinance regarding wind energy systems, as described in Section 5.4.2, to allow Forward more liberty to work with landowners in determining where it may locate its turbines.

If FAA Part 77-type clearances were used around the private airstrips in the Forward project area, the wind turbine towers, at about 398 feet in height, could not be located within a 5,000 foot radius of a private airport runway, as illustrated in Figure 5-1.

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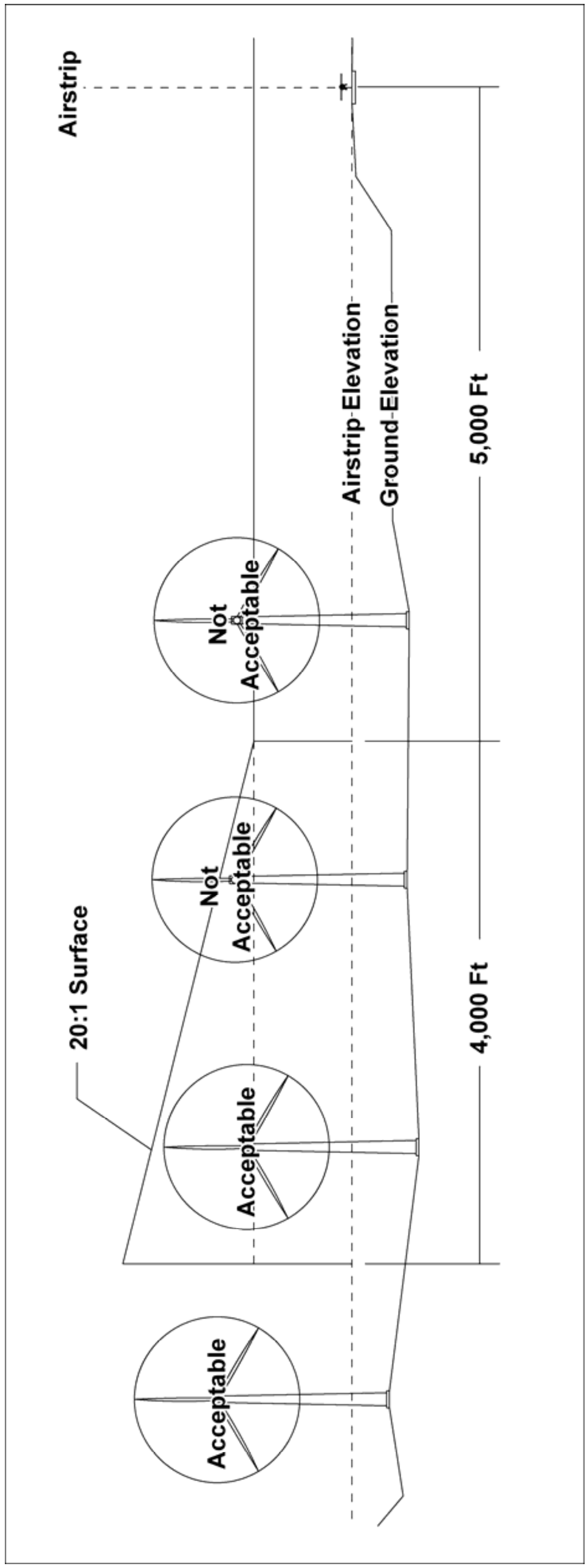
[67] The Dane County ordinance would protect privately owned airports (airstrips) that have submitted FAA Form 7480-1, "Notice of Landing Area Proposal" and that have subsequently received from the Wisconsin DOT a "Certificate of Airport Site Approval." It would prohibit:

- Towers and other structures greater than 150 feet in height above the established airport elevation within one mile of the runway.
- Structures greater than 200 feet above the airport within 1.5 miles of the runway.
- Structures greater than 250 feet above the airport within 2 miles of the runway.
- Structures greater than 300 feet above the airport within 2.5 miles of the runway.
- Structures greater than 350 feet above the airport within 3 miles of the runway.
- Structures greater than a surface increasing in height at a 20:1 slope for 3,000 feet from each end of the runway.

Figure 5-1 Diagram illustrating the application of FAA Part 77 clearance surfaces to private airports in the Forward project area and potential placement of wind turbine towers relative to those clearance surfaces



Using the proposed turbine locations and the potential impact radii mapped around the private airports as shown in Figure Vol. 2-22, turbines that could adversely affect the safety of existing private airports in the area can be identified (roughly). Table 5-7 lists the turbines that could be identified as potential safety hazards to the private airstrips in the project area. Utilizing the diagram in Figure 5-1, the compilation in Table 5-7 assumes that turbines located about half-way through the 4,000-foot 20:1 surface would be below the height limits under FAA Part 77. The accuracy of this list depends on the elevations of the land on which the turbines would be built relative to the elevations of the runways. It most likely underestimates the actual numbers of turbines that would exceed the 20:1 surface.

Table 5-7 Proposed turbines (by identification number) in relation to FAA Part 77 clearances around private airstrips in the area of the Forward project.

Private Airport	150-foot height limit within 5,000 feet		20:1 surface from 5,000 to 9,000 feet		20:1 surface from end of runway	
	Tower ID #	Total	Tower ID #	Total	Tower ID #	Total
R. Baier	97, 133*, 85*, 81*, 158*, 87*, 161*, 160*	8	90, 76, 92, 80, 78, 93, 72, 70, 120*, 117*, 118*, 114*, 115*, 121*, 119*, 99, 94	17	None	0
W. Baier	None	0	none	0	None	0
Hjelle	116, 108, 151, 120*	4	1, 2, 12, 6, 150, 9, 113*, 86*, 85*, 117*	10	None	0
Mittelstadt	31, 24, 29, 140, 141, 89, 105, 138, 100, 20, 21, 106, 34, 32, 68, 33, 69, 146, 147, 119*	23	121*, 115, 88, 98*, 13, 15, 7, 8, 11, 19, 107, 22, 36, 27, 64, 63, 139, 49	18	28, 25, 23, 30	1
Quad Graphics	103	1	95,104,152	3	None	0
Wunsch	120*, 117*, 85*, 133*, 86*, 118*, 81*, 158*, 137, 134, 136, 135, 169	13	113*, 98*, 114*, 115*, 87*, 160*, 162*	7	161*	1

* Turbines located within more than one airstrip's potential impact area

While the compilation in Table 5-7 is not based on actual measurements, it provides an estimate of the number and location of proposed turbines that would be likely to present safety concerns to existing private airports in the project area, if the clearances designated in FAA Part 77 are applied. It also illustrates the relatively high number of airports in the project area. Eighteen turbines appear to be within the potential impact area of more than one airstrip. The greatest potential for air safety impacts would appear to be around the Mittelstadt runways, where 42 turbines would rise above the FAA Part 77 height limits. The second greatest potential would appear to be around the R. Baier runway, where 25 proposed turbines would exceed those limits. Five turbines (28, 25, 23, 30, and 161) are actually proposed to be located on the 20:1 surface projection from the ends of runways, as illustrated in Figure Vol. 2-22. Four of those five turbines exceed surfaces from the Mittelstadt runways.

Forward, in its comments, indicated that it believes that consideration of the application of 40 CFR, Part 77 clearances to private airstrips is unreasonable because private airstrips do not have the rights and privileges of public airports under Part 77 or Wisconsin Statutes. Application of this clearance would substantially reduce the number of viable turbine sites.

5.3.4.5 Potential air turbulence

Concerns about air turbulence were raised by the local public, particularly among private airstrip owners and local flyers. A wind turbine and tower would produce turbulence in the wind that passes around and through it, especially when the blades were rotating.

Turbulence is relatively chaotic air flow characterized by low momentum diffusion, high momentum convection, and pressure and velocity variation with time. The momentum of the disturbed flowing air (the product of the mass of the air being moved and its velocity) would be conserved around an object that created the turbulence. Flow that is not turbulent is called laminar flow. Flow of a fluid, like air, over a simple smooth object, such as a sphere, at very low speeds, would be laminar or smooth, and the drag would be relatively low. As the speed of the air flow increased, at some point, the transition would be made to turbulent flow, where there would be a large increase in drag and often the creation of vortices (spiral motions within limited areas) behind the object. The same transition to increasingly turbulent flow would occur by gradually increasing the size of the object or decreasing the viscosity of the fluid (in this case, air).

The Wisconsin DOT Bureau of Aeronautics (BOA) has determined a rule-of-thumb for wind energy facilities with respect to potential air turbulence wake effects for downwind turbines. This rule-of-thumb is based on the distance needed for the turbulence to dissipate. It takes about six to eight rotor diameters for the turbulence to die down to the point where it won't affect the next downwind turbine. With a blade length of up to 135.3 feet, which is planned for the Forward turbines, the rotor diameter would be up to 271 feet. Thus, a distance of about 2,166 feet would be needed to clear the air turbulence caused by the rotating turbine blade. See Section 2.1.2 on turbine spacing for the Forward project.

While the turbulence factor is an important consideration in spacing turbines for optimal operating efficiency, it is also a concern for those operating aircraft within and near the project area. Locating turbines no closer than 2,166 feet to an airport's or airstrip's traffic pattern would keep turbulence effects to a minimum. Public use airport and private airstrip traffic patterns and potential impacts are discussed in Section 5.3.4.

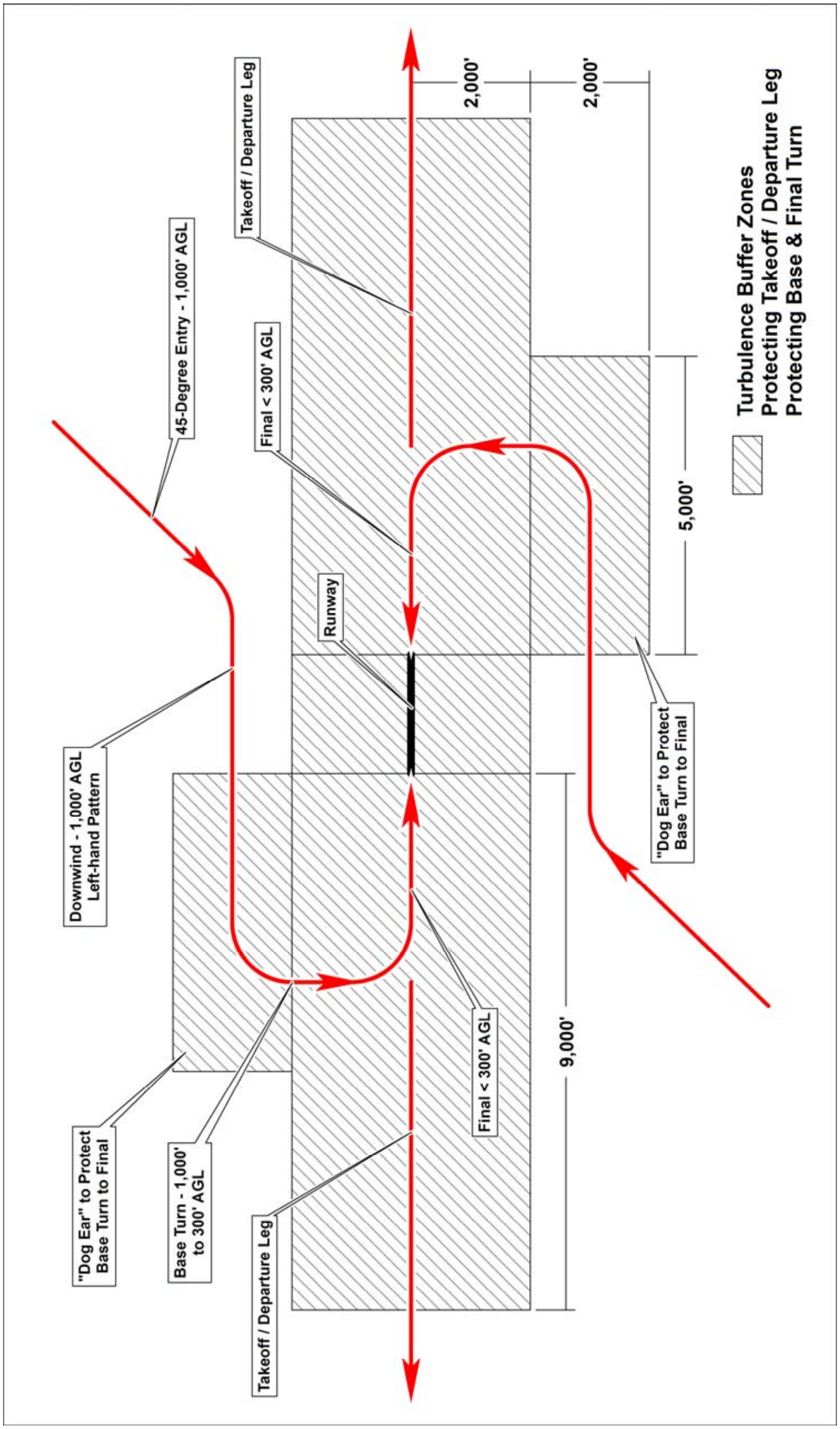
5.3.4.6 Turbulence buffer zone

Although the FAA surfaces are federal requirements that are not mandatory for private airstrips, and are not state or local requirements, there is still a need to consider the safety of pilots that use existing local airstrips. For this purpose, the BOA has diagrammed areas that it would recommend be clear of turbines to avoid impacts on local aircraft due to air turbulence caused by the rotating turbine blades.

As described earlier, with a blade length of 135.3 feet and a rotor diameter of about 271 feet, a distance of approximately 2,000 feet would be needed to allow wake turbulence and rotor tip vortices to dissipate to the point where the turbulence from one turbine would not affect downstream turbines. While this is a turbine-to-turbine calculation, it is reasonable to assume that about the same distance would be needed to ensure that turbulence downstream of a turbine would not affect general aviation (GA) aircraft present in the traffic patterns at the private airstrips in and near the Forward project area. GA aircraft are much lighter than commercial airliners, have low wing loadings (an aircraft's total weight divided by the area of its wings), and are susceptible to turbulence in their traffic pattern and at landing air speeds. GA aircraft can be easily upset by turbulence. An upset while in the traffic pattern and low to the ground would allow a GA pilot little time to safely recover the aircraft. Therefore, the DOT BOA recommends a "turbulence buffer zone" (TBZ) around the private airstrips to reduce the possibility of downstream turbulence having an adverse effect on GA aircraft while in their landing traffic patterns, or after takeoff and during climb out.

The recommended TBZ for a typical runway is diagrammed in Figure 5-1b. It extends for 9,000 feet from the runway thresholds, and 2,000 feet to either side of the runway centerline. This allows the aircraft to climb to 450 feet above ground level (AGL) at a climb gradient of 20:1. (450 feet AGL should be sufficient to put an airplane above the turbulence level generated by the turbines.) The TBZ also provides for a 5,000-foot by 4,000-foot box, which maintains the buffer zone during the base leg and final turn of the standard landing pattern as aircraft descend from 1,000 feet above the ground, through the level of the wind turbines and their turbulence.

Figure 5-1b Diagram of a turbulence buffer zone (TBZ) for a generic runway (with left-hand traffic to both runway ends)



The recommended TBZs for the airstrips in the area of the Forward project are shown in Figure Vol. 2-23. The proposed turbines that would be located within the TBZs are identified in Table 5-8.

Table 5-8 Forward's proposed turbines (by identification number) within the TBZs for each private airstrip in the area of the Forward project

Private Airport	Tower ID #	Total
R. Baier	87*, 121, 133*, 134, 135, 136, 137*, 158*, 159, 160*, 161*, 162	12
W. Baier	None	0
Hjelle	9, 88, 89, 98, 108, 113, 114*, 116, 150*, 151*	10
Mittelstadt	10 11, 13, 14, 15, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36,, 37, 38, 41, 65, 67, 68, 69, 100, 105, 106, 119, 138, 139, 140, 146, 147, 150*, 151*	39
Quad Graphics	82, 83, 91, 92, 96	5
Wunsch	81, 85, 86, 87*, 114*, 115, 117, 118, 120 , 133*, 134*, 137*, 158*, 160*, 161*	15

* Turbines located within more than one airstrip's potential impact area

According to Figure Vol. 2-23 and Table 5-8, pilots using the Mittelstadt runways could potentially be affected by the most turbines. The potential turbulence impacts on existing runways would be avoided to the extent that the turbine sites identified in Table 5-8 were relocated.

5.3.4.7 Other potential obstacles for planes in the area

The proposed overhead 34.5 kV collection line that would run east-west along CTH Y could present a possible obstacle to low-flying planes in the area. The proposed location for the line is just north of the Mittelstadt airport's north-south runway. At 45 feet in height, it is not tall enough to warrant relocation of either the line or the runway. The line would not affect any airstrip under existing regulations. Forward has indicated that it would place markers on the line so that it would be visible to pilots using that runway. (If the Mittelstadts use their airport at night, the poles could also be lighted).

There are other potential obstacles in the area that could affect air traffic patterns. These obstacles are already being taken into account by pilots in the area. The Mittelstadt's use of their runways must consider an existing 69 kV electric transmission line that presently runs past the east end of the east-west Mittelstadt runway and a cell tower at the northeast end of the property near CTH Y that has had an effect on runway traffic patterns. Similarly, there is a woodland at the north end of the Hjelle airstrip that pilots must address during landing and/or take off.

5.3.5 Schools, hospitals, daycare facilities, and residences

The most vulnerable members of the population are generally the young, the old, and the infirm. The concerns of these population groups related to electricity generation often focus on air emissions related to fossil-fuel combustion, coal handling, or natural gas safety. None of these concerns apply to the Forward project. However, other health-related concerns have been expressed regarding shadow flicker, low-frequency noise, and other potential impacts. These concerns are covered in Sections 5.7, "Noise," and 5.9, "Health and Safety."

Table 5-9 lists the schools and daycares located in the area of the proposed Forward project. There are no hospitals or nursing homes located in this area.

Table 5-9 Schools and daycares and in the Forward project area

Name	Address	Nearest turbine	Distance to nearest turbine (feet)
Schools			
St. Paul's Lutheran School	Highland Avenue, Brownsville	102	5,359
Lomira Elementary School	4th Street, Lomira	157	5,136
Lomira Junior High School	4th Street, Lomira	157	5,136
Lomira High School	4th Street, Lomira	157	5,136
Consolidated Catholic School	Milwaukee Street, Lomira	157	4,642
St. John's Evangelical Lutheran School	Water Street, Lomira	157	7,288
Reynolds Elementary School	Oak Street, Oakfield	1	4,095
Oakfield High School	Church Street, Oakfield	1	6,931
Oakfield Junior High School	White Street, Oakfield	1	5,833
St Luke's Lutheran School	2nd Street, Oakfield	1	4,414
Daycares			
Mary Linsmeier Schools	Church Street, Lomira	157	5,290
Oakfield Community Child Care Center	Church Street, Oakfield	1	6,860

As listed in Table 5-9, the turbines nearest to schools or daycares would be Turbines 102, 157, and 1. These turbines would also to be the closest to nearby villages. Turbine 102 would be the closest turbine to Brownsville. Turbine 157 would be the closest turbine to Lomira, and Turbine 1 would be the closest turbine to Oakfield. All of the schools are located at least 0.75 mile from the nearest turbine site, and both daycare facilities are located at least one mile from the nearest turbine site. The proposed turbines would not have direct adverse impacts on any of the schools or daycares listed in Table 5-9.

A discussion of sensitive communities might also include a discussion about the local residences in the project area. Many residences in the project area are not located on parcels that would host turbines, however, many would have turbines located nearby. Although the area is zoned largely Prime Agricultural, there are many exurban, non-farm, rural residences in the area, and the number of these dwellings is increasing.

Residences in the Forward project area can be identified to some extent on the background aerial photography in Figure Vol. 2-2A and Vol. 2-2B. Those figures show the turbine locations with a 1,194-foot radii and a 398-foot radii around the turbines. These distances relate to the requirements of the Dodge County Wind Energy Overlay District[68], which is described in Section 5.4.2. The 1,194-foot radius represents the "setback" distance that a turbine must be from an occupied structure.[69] The 398-foot radius represents the distance that a turbine must be set back from property lines.[70] Ideally, the 1,194 radius would have been placed around each occupied residence to determine which turbines fall

[68] Section 4.11.1 of the Dodge County Land Use Code
[69]The recently revised Dodge County wind ordinance says that the setback from residences must be no less than three times the total turbine tower height (3 x 398 feet = 1,194 feet unless a lesser setback is agreed to by the residence owner.
[70] The revised ordinance also says that the setback from property lines must be one tower height (398 feet) unless the appropriate easement is secured from the adjacent property owner, or unless other acceptable mitigation is approved by Dodge County.

within the setback buffer area. However, the aerial photos and information provided in the application did not differentiate between occupied and unoccupied structures. Additionally, property boundaries could not be readily identified from an aerial photo. The purpose of these figures is to aid persons with local knowledge of the area in determining if the proposed turbine sites are in compliance with the required setbacks. Ultimately, Forward is responsible for complying with Section 4.11.1 of the Dodge County Land Use Code.

Also, Figures Vol. 2-2A and 2-2B show the radii in Fond du Lac County as well as Dodge County. At this time, there is no corresponding ordinance in Fond du Lac County that would require such setbacks. The towns of Byron and Oakfield in Fond du Lac County are expecting an application from Forward for a Conditional Use Permit. It is possible that a CUP issued by these towns would be based, to some extent, on the Dodge County ordinance.

Figures Vol. 2-2A and Vol. 2-2B reveal that there may be some turbine sites that are within 1,194 feet of a home. It is difficult to discern on the maps whether such a residence is the home of a landowner who has agreed to host a turbine or an adjacent landowner. A number of turbine sites also appear to be within the 398-foot setback from property lines. Some of the homes and property lines in question are in Fond du Lac County, which currently has no ordinance requiring setbacks. A discussion of Fond du Lac County developments can be found in Section 5.4.

5.4 ZONING AND LOCAL ORDINANCES

In Wis. Stat. § 196.491(3)(i), the power plant siting law indicates that, if a project such as the Forward wind energy project has been granted a CPCN by the Commission, and if that project is precluded or inhibited by a local ordinance, "the installation and utilization of the facility may nevertheless proceed." This means that a local body such as a county or town may not stop or hinder a project by local ordinance if the project developer has received a CPCN from the Commission.

However, before the Commission can grant a CPCN, it must determine that the proposed project "will not unreasonably interfere with the orderly land use and development plans for the area involved." Thus, the CPCN application review must include an examination of relevant zoning and land use and local plans for the future in order to aid the Commission in making this determination.

The subsections below discuss local zoning and official land use plans, how they apply to the project, and how compatible the project is with these development tools.

5.4.1 Existing zoning in the project area

5.4.1.1 Local authority

As discussed earlier, the Forward project area is located within portions of Fond du Lac and Dodge Counties, in the towns of Oakfield, Byron, LeRoy, and Lomira. The land in the project area is primarily zoned as either General Agriculture (A-1) or Prime Agricultural (A-2). A map identifying the existing zoning of the Forward project area is provided as Figure Vol. 2-24.

In Figure Vol. 2-24, it can be seen that every proposed turbine site and every turbine access road is located on land zoned as Prime Agricultural land. The relationships between the proposed project and local agriculture are discussed in Section 5.5, "Agricultural Resources." The electric collection system would apparently also be entirely in Prime Agricultural land, except for the connection between

Turbines 139 and 28 east of Dairy Road, which would cross land zoned Industrial. The Industrial land is owned and operated by the Grande Cheese Company.

Fond Du Lac County does not have a zoning ordinance. All zoning issues are handled at the town level. Within Fond du Lac County, the town of Byron is currently updating its zoning maps. They are expected to be completed in 2005. At a meeting of the Byron town board in February 2005, the Board was asked by the public to hold a special meeting in the near future to answer questions about the Forward project and to prepare to make decisions about the plant. The town of Oakfield has a zoning ordinance dated March 13, 2000. Each of the zoning designations within the town allows for "Special Uses." The Forward project qualifies as a special use. The village of Oakfield also has zoning, but it is located entirely outside the Forward project area.

In Dodge County, the municipalities in the project area that have zoning ordinances include the county, the village of Brownsville, and the village of Lomira. The village of Brownsville adopted its zoning ordinance in 1978, and it is currently being updated. Currently, all zoning issues in Dodge County are being handled by the county. A discussion of Dodge County's process related to the Forward Project is found in Section 5.4.2.

Noise is often a subject of local zoning and ordinances. Noise is discussed in Section 5.7. Fond Du Lac County does not have established limits on industrial noise emissions. Dodge County regulations prohibit all activities or operations that exceed maximum permitted sound levels at the property line of the receiving premises.

5.4.1.2 Authority over wind energy systems

There are limitations on local authorities described in Wis. Stat. § 66.0401(1), which says that no county, city, town, or village may place any restrictions on the installation or use of a wind energy system unless the restriction satisfies one of the following conditions:

1. It serves to preserve or protect the public health or safety.
2. It does not significantly increase the cost of the system or significantly decrease its efficiency.
3. It allows for an alternative system of comparable cost and efficiency.

Thus, in order for a local authority to place restrictions on the Forward project, it must have evidence showing a risk to public health or safety. Forward has applied a for Conditional Use Permit from Dodge County and the two towns in Fond du Lac County, while reserving its rights under Wis. Stat. §§ 66.0401 and 196.491(3)(i).

Dodge County also has created a "Wind Energy System Overlay District"[71] in its Land Use Code to "promote the health, safety, property value, aesthetics, and general welfare of the County."[72] The Overlay District ordinance is discussed in Section 5.4.2, and a copy of it is in Appendix D.

5.4.1.3 Conditional use permits

An electric generation or transmission project in an area zoned Industrial or Prime Agricultural is subject to a conditional use permit in Dodge County.

71 Section 4.11 of the Dodge County Land Use Code
72 Section 4.11.1(A) of the Dodge County Land Use Code

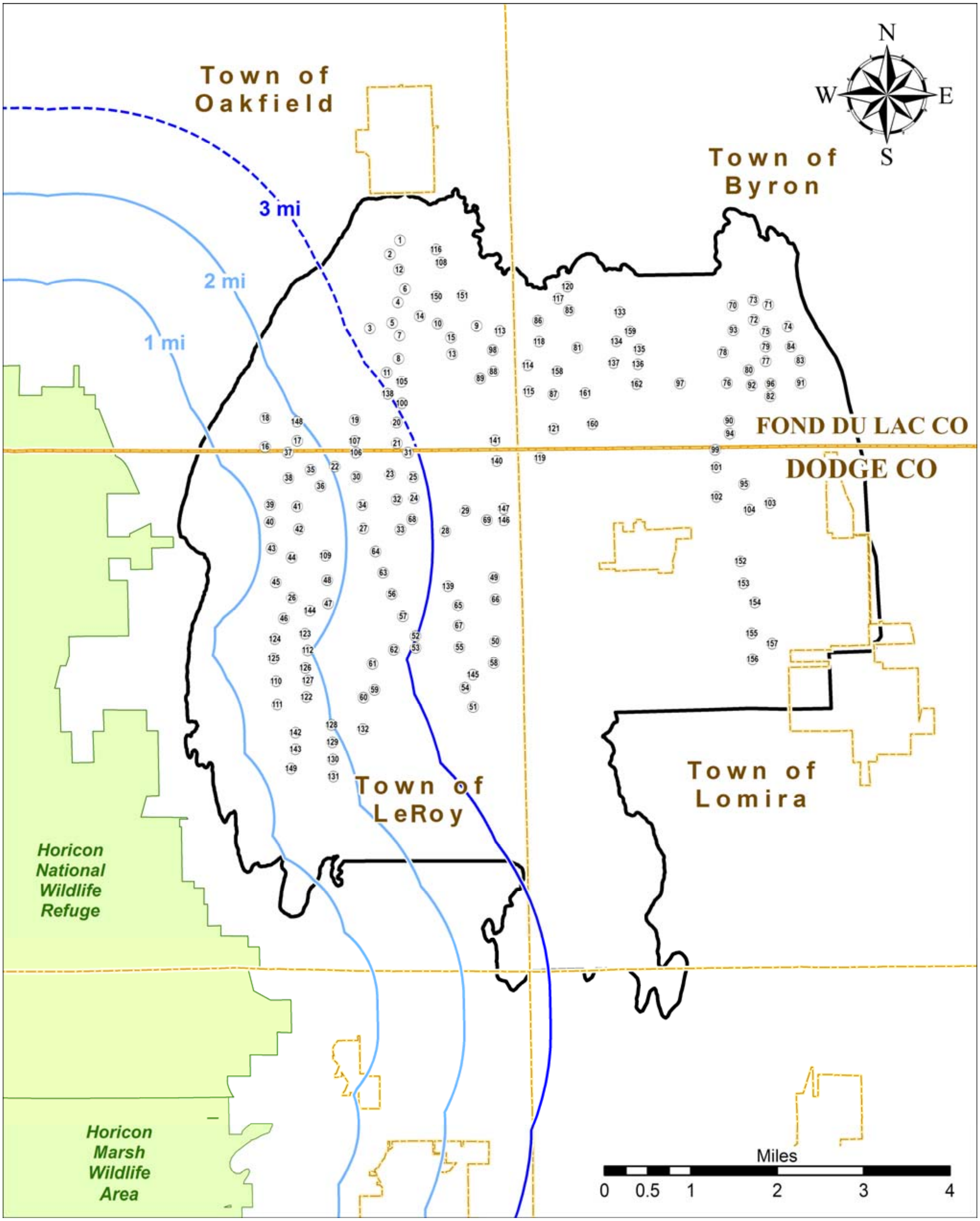
Forward received its CUP from Dodge County on April 25, 2005. A copy of the CUP is in Appendix D. This permit included 31 conditions, most of which were the subject of negotiations between the company and the county and also between the company and the four towns in the project area.[73] Many of the conditions are also delineated in the county wind ordinance. However, two new provisions were added to the Dodge County CUP, as Conditions 9 and 28:

> 9. "Each WES Facility shall be sited in accordance with FFA Rules, Part 77, regarding unobstructed flight paths for existing and private airstrips;"
>
> 28. "No WES Facilities shall be sited within three (3) miles of the eastern boundary of the Horicon Marsh National Wildlife Area;"

As shown in Figures 5-1c and Vol. 2-22, application of these two conditions would remove all but a few of the proposed turbine locations from the project.[74] After receiving the CUP, Forward filed an appeal with the Dodge County Board of Adjustments to have those two conditions removed. A hearing on the appeal is scheduled for May 19, 2005, in the Dodge County Administration Building in Juneau, Wisconsin.

[73] The conditions include protections against excessive noise, road damage, blasting without permission, groundwater contamination, and other concerns, plus a requirement for a letter of credit, cash or the equivalent to be held in trust in favor of the county to pay for facilities removal if needed.
[74] A discussion of the FAA surfaces in relation to private airstrips is discussed in Section 5.4.4.4 of this EIS. A discussion of how Horicon Marsh may affect bird presence and use is discussed in Section 4.11.4.2.

Figure 5-1c Three-mile buffer from Horicon Marsh proposed by Dodge County CUP on April 25, 2005



Forward intends to file for a CUP from the towns of Oakfield and Byron in Fond du Lac County in the near future. The towns have been working cooperatively while reviewing the project in their respective jurisdictions and have made arrangements with Dodge County to consider its CUP when making decisions for their towns. However, the preliminary draft permit for each town does not, at this time, include the two conditions listed above. The permit process in each town is expected to conclude by the time of the PSC hearing on this docket.

5.4.2 Local wind energy system ordinances

Several Wisconsin counties have adopted wind siting ordinances to regulate the installation of "Wind Energy Systems" (WES). Of the two counties impacted by the Forward project, only Dodge County has specifically addressed WES in its ordinances. To date, neither Fond du Lac County nor the towns of Oakfield or Byron have addressed wind power in their ordinances.

Chapter 4 of the Land Use Code of Dodge County regulates WES. The Code establishes an overlay district "to promote the health, safety, property value, aesthetics and general welfare of the County." It encourages location of WES facilities in non-residential areas, areas that will have minimal impact on natural resources, in a way to minimize adverse visual impact, and protect WES owners from interference with the wind resource. Dodge County's ordinance was amended on April 19, 2005, to accommodate technology changes in the wind energy industry and address some concerns identified by landowners within the Forward project area. A copy of the amended ordinance is in Appendix D. Some of the requirements of the ordinance include:

- Facilities shall be painted a neutral color that blends in with the natural setting.
- Facilities shall not be artificially lighted except as required by the FAA.
- Facilities shall not be used to display advertising except identification of manufacturer or operator.
- The total height of each WES shall not exceed 500 feet.
- Setback from a property line shall be equal to total height of WES unless appropriate easements are secured from adjacent property owners.
- Setback from a residence, school, hospital or church shall be at least three (3) times total height of WES, except that a lesser setback may apply to a residence where agreed to by the residence owner. The agreement between the residence owner and the WES operator shall be a recorded document with the Dodge County Register of deeds.
- Facilities must comply with the general county noise ordinance unless a waiver is obtained from neighboring landowners.
- The Applicant must mitigate any interference with radio or television signals caused by WES.
- WES maintenance facilities and substations shall be landscaped in such a way that the facilities are screened from view by adjacent landowners.
- Dodge County and the owner of the WES facility shall enter into an agreement under which the owner of such WES facility agrees to provide to the county a bank letter of credit to the Land Use Administrator to secure its obligations under this Subsection, 4.11.3(H)(1). The agreement shall be kept in effect by the initial owner and all subsequent owners of the WES facility until the Land Use Administrator has certified that the removal and restoration requirements and obligations have been met.

- Any WES that does not produce energy for a continuous period of one year shall be removed and the site reclaimed to a depth of four feet. If the project owner does not perform this reclamation, Dodge County will be able to draw upon the Letter of Credit described above.

5.4.3 Land use plans

Fond Du Lac County does not have a land use plan. Within Fond du Lac County, the town of Byron is currently completing a Comprehensive Plan. The Byron land use plan is expected to be available around May 2005. The town and village of Oakfield have an "Oakfield Area Joint Land Use Plan," prepared by the East Central Wisconsin Regional Planning Commission.

Both towns that encompass the Forward project area in Fond du Lac County have been in agricultural use for many years. As the farm population declines, the town of Oakfield has become attractive to residents wishing to be close to employment and shopping opportunities but also desiring a relatively rural lifestyle. The town's proximity to the city of Fond du Lac and USH 151, a major state artery, affords residents those opportunities. Because USH 41 passes through the town of Byron, a similar dynamic has occurred. Despite expected population decreases over the coming years, both townships expect to experience housing development pressures.

In its plan, the town of Oakfield indicates that residents are interested in attracting moderate to high quality residential development, but are also concerned with preserving the best farmland for agricultural production and protecting the environmental and aesthetic quality of the Niagara Escarpment and other important natural features. The Plan recommendations appear to follow these interests and concerns. The Forward project area is planned to remain in agriculture, except where public conservancy lands are present. A general concern is that industrial uses, while welcome, must not conflict with existing development or result in future land use conflicts. Spot zoning for new industry would not be allowed.

The town of Byron Plan is expected to include many of the same visions and objectives expressed by the town of Oakfield, particularly with regard to the preservation of natural areas and existing farms.

In Dodge County, both towns that encompass the Forward project area are mainly in agricultural use; both have important natural areas to protect. The town of LeRoy has an individual land use plan. Although the town of Lomira does not have a plan at this time, the village of Lomira does. The village of Brownsville is currently working on a 30-year comprehensive growth plan. The town and village plans would be elements of Dodge County's Development Plan. Currently, all land use and zoning issues are being handled by Dodge County.

The town of LeRoy's "Year 2020 Land Use Plan," issued in 2000, describes a vision of development that is planned and controlled in order to "protect the integrity of the LeRoy environment and the farmers' right to farm." Even residential development would be directed away from prime farmland and farming operations and towards existing concentrated development areas like the hamlets of LeRoy and Farmersville. Like Oakfield, LeRoy would regulate subdivisions, lot sizes, and other uses of farmland or woodland. Aesthetic considerations would be important. Industrial or residential developments would have to fit within the character of the area in terms of their site design, building character, scale, and long-term economic feasibility. Public infrastructure or utilities should be located and constructed to prevent negative impacts on agriculture such as limiting or interfering with access to fields or the effectiveness or efficiency of the farmer and farm equipment. Electric lines serving new development are preferred to be underground.

The village of Lomira's "Comprehensive Plan," issued in 1989, includes a policy for decision-makers to provide adequate alternative sites for residential, commercial, and industrial development but to preserve farmlands wherever possible. Its concerns include the area northwest of the village where the southeastern string of proposed turbine sites would be located.

The Dodge County "Comprehensive Plan," issued in 1999, complements its local community plans and includes goals, objectives, and policies similar to those of LeRoy and Lomira, regarding the need to protect environmental landscapes and resources as well as prime agricultural lands, and to promote residential development in areas where the infrastructure necessary to residential development exists. The county also issued an "Agricultural Preservation Plan," in 2002, which addresses farmland and farmland preservation specifically.

5.4.4 Compatibility of project with local land use and future developments

5.4.4.1 Compatibility with existing land use

Of the roughly 32,400 acres in the Forward project area, about 11,000 acres (about 34 percent) have been dedicated to turbine easements with over 60 landowners. If each turbine site uses about 0.5 acre, and 133 turbine sites were approved and used, the total acreage dedicated to the project would be about 65 acres (about 0.2 percent of the 32,400 acres).

It appears that the Forward project would, in general, be compatible with existing land uses. Some concerns or possible exceptions to that compatibility are described in other sections of the EIS.

The existing land use patterns in the Forward project area are illustrated in Figure Vol. 2-21. This figure illustrates that the proposed turbine sites for the Forward project would all be located on what is currently cropland, hay land, or pasture. Some are close to woodlands, wetlands, or streams. All of the access roads also would be on farm fields but, as discussed in Section 4.4, some would have to cross streams. Except for the portion between Turbines 139 and 28, which crosses wooded land owned by the Grande Cheese Factory, the underground electric collection system is also on open farmland. This cable collector system would also have to cross several wetlands and streams. The overhead collection system would run across farm land adjacent to CTH Y, and would pass near homes and a woodland north of CTH Y near the proposed substation.

Even though most natural resources in the area would not be directly impacted, there are concerns about compatibility of the project area with the Horicon Marsh and impacts to the avian resources it attracts.

As discussed in Section 5.5, "Agricultural Impacts," the turbines, access roads, and collection system would be mostly compatible with the existing farm operations on properties where they are located. Many of the turbine sites are located near field edges and existing farm lanes. Easement payments and crop compensation would add to many local farm incomes and possibly increase farm profitability overall. Increased farm profitability could increase the likelihood that the farms in the area would be able to continue operating into the future, reducing the rate of the farmland losses in this state.

Conversely, the discussion in Section 5.5 indicates that there is a potential for adverse impacts to some farms that are producing vegetables for local food processing businesses if pesticides need to be applied using ground equipment. Local aerial pesticide applicators have indicated that they would not be able to fly in the project area once the turbines were erected. Ground applications could result in a slight loss of vegetable yield due to crop damage by the equipment. Farms using aerial sprayers to protect soybeans against Asian soybean rust would also have to convert to ground applications of fungicides. It is not known at this time whether significant impacts to farm profitability would result among farms not hosting turbines.

Later sections of this chapter explore potential impacts of the Forward project on other current uses of the area, including economic issues, traffic, health and safety, and aesthetic issues.

5.4.4.2 Compatibility with future plans

The Forward project also appears, in general, to be compatible with most of the future plans for the area, as they are discussed in the land use plans issued by the various municipalities.

In the village and town of Oakfield's joint land use plan, there is no mention of the potential for wind power projects to be located in the town. There is, however, a clearly stated concern that future industrial uses should not conflict with existing development or result in future land use conflicts. Section 5.4.4.1 mentions potential conflicts that exist between the turbines and existing residential, industrial, or agricultural land uses. Oakfield's plans emphasize control of residential and industrial development so that agricultural and conservancy type land uses are supported. Spot zoning would not be desirable, but such zoning changes would not be needed for the Forward project.

Oakfield also has indicated its concern for the protection of the landscape and resources associated with the Niagara Escarpment. Turbines would not be located on the edge of the Escarpment, and thus, these resources should not be affected.

Concerns have been expressed by the DNR and others about surface water leaking through the karst bedrock during or after construction (see Section 4.4). Some of the northeastern-most turbines would be installed on bedrock that is within five feet of the ground surface.

The town of LeRoy plan focuses on similar protections and includes a policy that decision-makers try to avoid having industrial or utility developments limit or interfere with access to fields or the effectiveness or efficiency of the farmer and farm equipment. The placement of the turbines would not appear to affect the efficiency of ground level farm operations because many of them are located along field edges and other land use boundaries.

Part of the town of Lomira is covered by the village of Lomira's land use plans. This part includes the area where the southeastern string of turbine sites would be. The policy of preserving farmlands wherever possible would not be adversely affected by the Forward project.

Dodge County's specific "Agricultural Preservation Plan," adopted in 2002, describes how farmland preservation in the county has fared and how it will be addressed in the future. Farmland is by far the largest of the county's land uses. The plan reinforces the county's effort to manage urban, industrial, and residential growth by locating them in areas with existing or easily expandable support services. The Forward project's potential impacts on local agriculture, both positive and negative, have been discussed in this EIS in several places. Overall, the project appears compatible with preserving farms and farmland in Dodge County.

5.4.4.3 Compatibility with Brownsville operations and plans

The village of Brownsville has expressed strong concerns about the potential incompatibility of the project with the village's Smart Growth plan as it is being prepared. It also expects that the project could limit physical expansion through annexation and could reduce the desire of people to locate in Brownsville, thus affecting village growth over the long term. Brownsville has also expressed concerns about adverse effects of the project on property values and on public safety radio systems and the ability of the village to respond to emergencies. The village offers the following suggestions to the Commission in its considerations:

1. Relocate turbine tower sites so that the towers would be at least one and one-half mile from the village corporate limits.
2. Require Forward to participate in the development of a "property value protection plan" with an existing negotiating committee including the towns of Lomira and LeRoy, the village of Brownsville, and the Dodge County Planning and Development Department.
3. Require an independent study be done on potential effects of the project on radio and microwave transmission, and in turn on "911" emergency calls and other emergency communications.
4. Require an investigation of television and radio wave disruption potential.

5.5 AGRICULTURAL IMPACTS

5.5.1 Existing environment

Existing vegetation in the Forward project area consists primarily of tilled agricultural fields in corn or alfalfa, tilled acreage for corn, beans, or peas for local processors, small tracts of old field or fallow field, fence rows of trees, forest patches, mowed lawn grasses and landscaped areas, irregularly mowed grassy areas, and mostly emergent wetlands. As discussed in the previous section of this chapter, agricultural cropland is, by far, the current predominant land use in the area. This characterization is illustrated in Figure Vol. 2-21, and also in aerial photos used as background in other figures in the EIS.

Different farms in the Forward project area concentrate on different mixes of products. Dodge County is the state's leading county in the production of green peas and sweet corn for processing, and corn for silage. Dodge County also ranks fourth in the state for total number of cattle and calves, and fifth for hogs and pigs. Fond Du Lac County is one of the leading dairy counties of the state. Farms in the project area, in both counties, produce milk, beef, pork, corn, soybeans, hay, or processing vegetables.

5.5.2 Potential impacts

A general advantage of wind energy is that the turbines generally do not interfere with the use of the remaining land for cropping or cattle grazing. The proposed project would allow for continued agricultural use of the land by the farming community. In addition, the landowners participating in the project could receive a sustained financial benefit while the turbines were present, providing them with additional income to support their current agricultural and farming practices. Overall, development and operation of the turbines would result in a small portion of farmland being taken permanently out of production. With the exception of aerial spray applications, the project is not likely to adversely affect current farming and agricultural practices. The subject of aerial spray applications is discussed below in Section 5.5.2.6.

In particular, potential impacts on farmed land caused by the Forward wind project would be both negative and positive. They could include:

- Cropland acreage permanently (or for the life of the Forward project) lost to production due to occupation by the turbines, transformer pads, or access roads;
- Crop losses from land temporarily occupied by the company during construction;
- Increased farm income or profitability for local farmers due to payments made by the company for placing and operating turbines on farm lands;
- Damage to field drainage systems and drain tiles during construction;
- Compaction and other damage to the soils during construction;
- Contamination of groundwater as a result of fractures or openings in the bedrock during or after construction or in the future after the facilities are removed; and/or
- Safety issues related to aerial spraying that could result in increased time and effort for farm operators or decreased yields due to the need to spray for pests or fungal diseases using ground equipment.

In general, Forward has agreed to mitigate these potential impacts, mostly through monetary compensation. Damage to drainage systems and crop loss during construction and as a result of land occupied by the wind facilities would be compensated by Forward as part of the easement agreement (see Section 2.5, "Agreements with Landowners.") Potential impacts related to growing vegetables for processing would be considered in landowners' decisions as they negotiate contracts with Forward. Vegetable growers that do not host turbines could be adversely affected without compensation.

The potential impacts are discussed in more detail below.

5.5.2.1 Farm land removed from production

Section 2.5 of this EIS discusses, in general, the easement agreements and owner impacts that would exist if the Forward project is approved. In most cases, the amount of farm land taken out of service would be 0.5 acre or less for each wind turbine, including the acreage for the access road. Land adjacent to the base of the wind turbine tower or the access road would be allowed to remain agricultural, meaning that cropping or grazing could continue right up to where the facilities are located.

Although the four townships in which the project area is located have over 1,000 acres of land in the CRP, no Forward turbines are currently proposed to be located on CRP land. Although nearly the entire project area, including almost every turbine site, is zoned Prime Agricultural (see Section 5.4.1, "Zoning"), there would be no turbines located on property enrolled in the Farmland Preservation Program. If turbines were sited on property in the Farmland Preservation Program, the landowner would have to reapply for certification.

Not every turbine on farm land would require a new access road. Forward has identified existing lanes on many landowners' properties that could be utilized for access roads to the wind turbines. This has reduced the number of potential new access roads needed.

5.5.2.2 Compensation for agricultural losses

With regard to agriculture, Forward would compensate the farm owner for crops lost during construction, crops that would have grown on land proposed to be occupied by wind turbine facilities in future years, damages to drainage systems if they occur, and losses in Conservation Reserve Program (CRP) payments if the turbine facilities are located on CRP land.

Crop compensation payments would be calculated by multiplying the damaged or displaced acreage by the county average price and by the county average yield for each particular crop.

While the crop compensation payments would have a relatively slight effect on farms that would host turbines, the annual rental payments and the subsequent annual operating fee would provide additional farm income, similar to that from a cash crop, potentially improving farm profitability and thus the potential for keeping the remainder of the farm in agriculture. Unlike cash crop income, the income from the turbines would not be subjected to periods of low crop prices or low crop yields. The calculation method for crop compensation is meant to prevent the turbine payments from being less than the income that would have been received from growing crops on the same land. The rental and operating payments would be fixed.

Some comments have suggested that payments to farmers could have the opposite effect, and that rather than preserving farming in the community, the payments could provide enough income to allow a farmer to stop actively farming. Alternatively, the payments may be enough to allow farmer to decide not to subdivide the land for additional homes. The organization Dairy Farmers of America has indicated that hosting the wind turbines would be one kind of investment that could help to stabilize the local economy when agricultural prices are insufficient.[75]

Farmers that are renting farm fields for cropping or pasture would not be compensated for the loss of their access to the land. Because Forward's legal contract relationship is with the landowner, crop compensation payments would be made directly to the landowner and not to the farm operator who was renting. Landowners could take this into account when renewing their rental agreements with farm operators. Like the landowners' easement agreements, the rental agreements between landowners and farm operators are contracts between private individuals.

Essentially, renters would probably still have access to the same amount and type of land they had been renting, with the exception of the land area (up to 0.5 acre) removed by placement of the turbine facilities.

5.5.2.3 Damage to drainage systems

Because of high ground and recurring ledge rock at varying depths, there appears to be little need for field tile in the project area. Forward indicates that it has encountered five landowners that have drainage tile in their agricultural fields. The primary method for drainage in the area appears to be temporary surface waterways that carry water away during the spring and occasionally during a heavy summer rain.

Forward has worked with landowners to collect information about drainage tile locations, drainage swales, and related features. The company has indicated its intention to identify and minimize any potential impacts to drain tiles. If tile locations were determined prior to construction activities, the company would flag the drain tile location and take measures to minimize interference to the extent practicable. If broken, the tiling would need to be repaired to maintain the integrity of the field drainage system. Forward and their contractors would be responsible for all repairs. All drain tiles that are damaged during trenching or digging would be located on a map and recorded using GPS coordinates. The size and type of tile also would be recorded. All damaged tile would be removed. Existing grades and tile alignment would be maintained. After completion of the project, logs documenting all drain tiles that were repaired would be given to Forward by the contractor.

[75] Letter from William Averbeck, Dairy Farmers of America, received March 2, 2005

5.5.2.4 Soil erosion and compaction

Erosion from a farm field can result in a loss of potential fertility and crop yield. Erosion of soil can also clog or contaminate surface water in local streams. A soil erosion and sediment control plan would be developed by Forward and utilized during construction of the project. The erosion control measures used would be in accordance with applicable state and local soil and erosion control plan guidelines. If mitigation is required for soils in the area, the soil erosion and sediment control plan would be used for guidance. As shown in Appendix D, Condition 2 of the Dodge County CUP for the project says that no grading or construction is allowed to occur before the county approves the company's submitted erosion control plan.

With heavy equipment like trucks and cranes operating in a field, most of the concern about soils relates to the potential for compaction. Compaction can lead to increased soil erosion during precipitation events and can limit soil penetration by roots or farm implements. The compaction would have to be remedied before the land could provide yields similar to those during pre-construction conditions. A detailed description of Forward's planned methods of reducing and remedying compaction on farm land is discussed in detail in Section 4.3.

5.5.2.5 Groundwater contamination

DNR has expressed a concern that installation or removal of the wind turbine towers in the karst geological landscape of the proposed project area could increase the possibility for surface water and contaminants to enter the local groundwater. In a farm situation, manure, nutrients, or pesticides could enter the groundwater with surface or storm waters along new channels in the rock created by installation or removal of turbine towers or indirectly through cracks that developed while these operations were happening. In a worst case scenario, these chemicals could contaminate local wells and water supplies. DNR would work with Forward to ensure, to the extent possible, that such an incident would not occur. Groundwater contamination and mitigation strategies are discussed in greater detail in Chapter 4.

5.5.2.6 Aerial pesticide applications

Many farmers in the project area rely, in part, on aerial applications of pesticides for their crops. Two vegetable processing companies, Seneca Foods Corporation and Lakeside Foods, contract for thousands of acres on local farms to grow corn, beans, or peas for processing. Corn requires spray applications for earworm and corn borer. Lately, Asian soybean rust has appeared in Wisconsin, affecting green beans as well (also peas, but they are harvested before the rust develops). Some local growers also use aerial spray applications on soybeans. Application of these spray products is done most reliably and inexpensively by airplane or helicopter.

The spraying service that operates over most of the project area, Reabe Spraying Service, Inc., in Waupun, has indicated that, for flight safety reasons, its pilots would not be able to spray for pests or disease in the area where the wind turbines would be located. Discussions about flight safety and local private airports are in Section 5.3.4. Potential problems would include both direct obstructions to flight and problems with turbulence. The pilots sometimes use the Mittelstadt private airport (see Section 5.3.4) as a local base of operations. There would be turbines all around the Mittelstadt property. Fixed wing aircraft make their turns to pass across a field at altitudes that would be within the blade swept area.

Helicopters could be used, with their ability to move slower across the fields and perform tighter turns. Because aerial applications generally must be made when the wind speed is light in order to reduce the chance of pesticide drift, it is possible that the wind turbines would not be operating or would be operating at a reduced speed. However, helicopter applications are more expensive, and the concern about turbulence and obstacles still exists. Based on current information, aerial applications would likely cease in the area of the Forward project turbines.

The two food companies that employ aerial sprayers in the area have not expressed an opinion about the proposed Forward project. If aerial application is not possible, the spraying could be done by ground rigs. Ground applications could be more precise than aerial applications, providing better coverage of the pesticides. However, ground applications take significantly more time to cover each field and thus are more expensive. Another potential problem would be soil compaction if the applications are done when the ground is wet.

Ground equipment also would need space to turn around for passes across the field. If crops were run over or damaged, a loss in yield could occur. However, vegetable growers who would host wind turbines have indicated that these losses are something that they would take into account when negotiating a contract. Of course, growers that are not turbine hosts would not have contracts or be eligible for compensation.

Growers plant seed provided by the vegetable processing companies and are responsible for fertilization and weed control. The companies provide growers with the pesticides for earworm, corn borer, and rust control. The companies pay on a tonnage basis for the crop they receive, and if yields are lower, the grower could receive less money. Weed sprays (herbicides) are always applied by ground rigs, so ground application patterns in fields could already be established, and any potential crop damage could happen during weed control work. Additional crop damage would only occur if an insecticide or fungicide applicator did not follow the existing ground application pattern.

Both of the vegetable processing companies have indicated that they have continued to contract with local growers knowing that the Forward wind project might be built during the growing season. They also have indicated that they intend to continue to contract for vegetable crops in the project area in future years and would depend on ground applications in situations where they cannot depend on aerial spraying. Both companies appear to value the number of growers and acreage they have under contract, and have stated that they would not terminate contracts with growers if the Forward project was installed.

Reabe Spraying Service has indicated that it might lose business and spraying contracts in the area if the turbines were installed. However, the company serves growers and canners in a much wider area, including farms west of the Horicon Marsh.

5.5.3 Restoration of agricultural land

After the wind turbines were erected, the land surrounding each turbine would be restored to its previous use. Cleanup and restoration procedures would be initiated as soon as possible after construction activities. Final cleanup would typically involve a series of steps, including equipment removal and off-site disposal of waste material. The access roads would be maintained at a width of about 15 feet. The majority of other roads, road shoulders, crane travel paths, crane pads, and laydown areas would be restored so that their original use could occur. The methods proposed by Forward for remedying soil compaction are described in the “Soils” discussion in Section 4.3.

After construction, all disturbed areas would be finish graded and any remaining trash or debris would be properly disposed of. The sites would be protected during and after construction by the implementation of appropriate erosion control measures, including site-specific contouring, reseeding, or other measures agreed to with the landowners. Areas surrounding each wind turbine that were used during construction would revert to the original land use after construction.

When a turbine is at the end of its useful life and needs to be removed, the company would be required to restore the land on which the turbine and its related facilities were located. The recently revised Dodge County Wind Energy System Overlay District ordinance, discussed in Section 5.4.2, includes a requirement that the owner of the wind energy system restore the land from which the facility is removed to a depth of four feet below grade.

5.6 LOCAL ECONOMICS

The Forward project would have temporary and permanent impacts on the local economy of townships in the project area.

5.6.1 Temporary economic impacts during construction

Construction of the Forward wind turbines would require an average of 150 construction workers over a six-month period. During peak construction periods, between 200 and 250 construction workers would be required. Skilled construction workers would include electricians, laborers, engineers, carpenters, cement finishers, iron workers, construction management, and operating staff. Depending upon the availability of qualified persons, construction workers could be from regional sources.

Local communities would benefit from the purchase of goods and services for the Forward construction project and the addition of temporary construction jobs. Indirectly, the community would benefit from purchases made by project crews and construction workers during the construction phase.

Multiple trips of large construction vehicles as described in Section 5.8 could damage local roads in and around the project area. Forward has stated that they have discussed the use of local roads with local officials. Prior to the start of construction, the applicant should work with the townships to reach an agreement for repair and/or reimbursement for any road or infrastructure damage created by the construction of this project.

5.6.2 Permanent economic impacts during operation

5.6.2.1 Potential positive economic impacts

Permanent local economic benefits would include the addition of employed Forward personnel, shared revenue payments to the local counties and municipalities, and the additional income received by property owners that host turbines.

Approximately six to ten full-time staff would be required for the operation of the Forward wind project. Types of required employees include technicians with electrical, mechanical, and instrument capabilities. The addition of six to ten permanent jobs in the region would be an economic benefit.

Forward does not anticipate that the construction or operation of the Forward Energy Center would require any additional emergency personnel (police, fire, ambulance) from either the counties or local communities.

Shared revenue dollars are paid during the operating life of the wind farm. This money would substantially increase the existing budgets of the counties and townships in the project area and improve their capacity to provide new or increased services for their communities. It could, especially, benefit the township of LeRoy, where over one-fourth of the land within the township is federally-owned (Horicon National Wildlife Refuge) and pays no local property taxes. Details of the shared revenue program are discussed below in Section 5.6.3.

The wind farm may also attract tourists interested in viewing such a large-scale, renewable energy system. These tourists would spend some money within the project area.

Finally, the local economy would be improved by the money paid to property owners that host a wind turbine or provide a facility-related access. Negotiated turbine easement contracts are not publicly disclosed, but are likely in the range of $4,000 to $5,000 dollars annually. Payments would continue for the operating life of the facility. Forward would also reimburse land owners for any profits lost due to land taken out of production. This influx of money into the local economy would be a benefit.

5.6.2.2 Negative economic impacts

The potential negative impacts to the regional economy from the Forward project are not as well quantified as the potential positive impacts. One of the potential negative impacts relates to residential property values. This subject is reviewed in detail in Section 5.6.4.

Another potential negative local economic impact involves safety issues connected with the operation of local airstrips, including concerns about the potential reduced ability of aerial applications for farm fields (see Section 5.3.4).

Lastly, the proposed project could impact the amount of recreational dollars spent in the project area. Because the project area is located adjacent to Horicon Marsh and between Horicon and Theresa Marsh, it is an area of significant bird activity. The huge number of birds attracts over 500,000 people to the area who spend more than $5 million dollars annually in the region while bird watching, hunting, or trapping. While the operation of wind turbines would not restrict the use of the area for hunting, the turbines could diminish bird use of the area. This in turn could reduce the number of visitors to the region for hunting. Furthermore, because some of the turbines would be visible from Horicon Marsh (Figure Vol. 2-13), the public perception of the Marsh as a globally important natural environment could be altered, further reducing the number of visitors who come to bird watch. These potential unintended consequences of the proposed Forward project could reduce the number of visitors and the recreational dollars spent in the region.

5.6.3 Shared revenue

One part of the state of Wisconsin's shared revenue program distributes money to municipal and county governments for land used by public utilities. Public utilities are exempt from local taxation. The money from shared revenue is paid out to compensate local governments for costs they incur in providing services to the public utility.

Shared revenue payments are tied to the MW capacity of power plants. If the power plant is located in a city or village, the municipality receives an annual payment equal to two-thirds of the plant's MW capacity multiplied by $2,000. The county receives an annual payment equal to one-third the plant's capacity multiplied by $2,000. The two-third\one-third relationship is reversed if the power plant is built in a town (rather than a city or village). The total dollar amount distributed can not annually exceed the municipality's population multiplied by $300 or the county's population multiplied by $100. Shared revenue payments are not distributed during construction; the payments begin after the plant is operational. The payments would continue at the same level until the facility is decommissioned.

In addition to the base payment described above, municipalities and counties can qualify for more than one of the following incentive payments:

- $600 annually multiplied by the plant's MW capacity to both the municipality and county for a non-nuclear plant that is built on or adjacent to an existing power plant site, a former plant site, or a brownfield site;
- $600 annually multiplied by the plant's MW capacity to both the municipality and county for a baseload plant that has a capacity of at least 50 MW;
- $1,000 annually multiplied by the plant's MW capacity to both the municipality and county for a plant that derives energy from an alternative energy source and the plant has a capacity of at least one MW; or
- $1,000 annually multiplied by the plant's MW capacity to both the municipality and county for a cogeneration plant that has a capacity of at least one MW.

If the Forward project is approved and constructed, the towns of Byron, Oakfield, Lomira, and LeRoy and the counties of Dodge and Fond du Lac would receive annual shared revenue payments based on the number and location of the wind turbines. Each of the wind turbines proposed by Forward has a capacity of 1.5 MW. For each turbine constructed, shared revenue distributions would total $6,000. The township would receive $2,500 per wind turbine and the county would receive $3,500. Forward's application shows 162 wind turbine sites which includes 29 alternate sites. It proposes to construct 133 wind turbines. Table 5-10 shows the maximum amount of shared revenue distributions that the municipalities and counties would receive if the maximum number of wind turbines in any particular municipality were constructed.

Table 5-10 Projected maximum shared revenue payments (if 162 wind turbines are constructed)

Location	Maximum Wind Turbines	Maximum MW	Maximum Annual Shared Revenue Payments
Townships			
LeRoy	73	110	$ 182,500
Lomira	13	20	$ 32,500
Byron	41	62	$ 102,500
Oakfield	35	53	$ 87,500
Counties			
Dodge	86	129	$ 301,000
Fond du Lac	76	114	$ 266,000

5.6.4 Property values

The impact of power plants on property values has been the subject of discussion for many years. Although few studies have actually been conducted, there has been significant debate regarding the real and perceived impacts and costs associated with electric generation plants and the effect of a plant on local property values. A similar set of issues surround wind farms, though again, there are few scientific studies. The problem is further complicated by the design of wind farms, which are usually dispersed over a large area. Because of this, there can be vast differences in the aesthetic effect of the turbines across the view shed and thus differences in the potential impacts for different property owners.

Additionally, the perceived impacts of wind farms may differ: 1) depending on whether an individual is a property owner hosting one or more wind turbines or a property owner that lives adjacent to a wind turbine; 2) whether an individual has direct views of one or more nearby turbines or their views of the turbines are partially blocked by topography or trees, and; 3) whether an individual's primary use of their land is agricultural or residential. Determining the impact on property values can be further complicated by the fact that many property transfers conducted in rural areas are between family members (rather than at "arm's length") and may not be at fair market value. A study of property values that includes these kinds of property transfers might not accurately reflect adverse impacts related to the wind farm.

5.6.4.1 Literature review

There have been numerous studies analyzing public opinions towards wind power in the U.S., Europe, Australia, and New Zealand. However, anecdotal surveys and public attitudes cannot be used to assess impacts on property values. Other studies, such as the one completed for the Phoenix Economic Development Group,[76] interviewed tax assessors about the effect of turbines on real estate prices. This method of study is highly subjective and has no controls for other factors that may affect property values.

In 1996, the Institute of Local Government Studies in Denmark[77] compared the prices of homes near wind turbines with the prices of homes further away. They concluded that homes near a single wind turbine averaged DKK 16,200 ($2,314 U.S.) less in value and homes located near parks of 12 wind turbines averaged DKK 94,000 ($13,429 U.S.) less in value. However the study did not identify what constituted homes, "close" versus those "far away."

The Renewable Energy Policy Project (REPP) studied property value sales data near ten large wind projects scattered throughout the U.S.[78] As part of the study, REPP combined the data from the two Kewaunee County wind farms in Wisconsin. The analysis looked at smoothed time trends in property sales price in three ways: (1) differences between the view shed and a comparison area (a control area without a wind farm) over a period covering several years before and after the wind project developments; (2) sales price trends for properties within the view shed before the wind development compared to after the development; and, (3) sales price trends for the view shed properties compared to the comparison area after the wind development. The results of the study showed little evidence of adverse impacts by the wind farms on local property values.

The methodology and the results of the REPP study were critiqued and the data reanalyzed in 2004 by the Energy Center of Wisconsin on behalf of the State of Wisconsin, Department of Administration[79] (DOA). The REPP study flaws identified in the DOA report included the definition of "view shed". REPP defined view-shed as a five-mile radius surrounding the outermost wind turbines in a wind farm. The study did not take into account that properties closest to the wind turbines may be subject to

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[76] ECONorthwest, "Economic Impacts of Wind Power in Kittitas County, A report to the Phoenix Economic Development Group, November 2002.
[77] Munksgaard, J. and A. Larsen, "Social Assessment of Wind Power", The Institute of Local Government Studies (AKF), Copenhagen, Denmark, 1996. (Available electronically at www.akf.dk/eng/wind.htm)
[78] Sterzinger, G., F. Beck, D. Kostiuk, "The Effect of Wind Development on Local Property Values", Renewable Energy Policy Project, Washington D.C., 2003. (Available electronically at www.repp.org)
[79] State of Wisconsin, Dept. of Admin., Div. of Energy, "A Study of Wind Energy Development in Wisconsin", Energy Center of Wisconsin, 2004. (Available electronically at www.ecw.org)

greater impacts than those one or more miles away from the turbines. Additionally, no actual determination was made whether those in the REPP-defined "view shed" actually had a direct view of the wind turbines. REPP researchers did attempt to interview tax assessors and other local authorities to get an estimate of the proportion of properties within the view shed that had views of the development. This method resulted in incomplete information for the study areas and was never field-checked for accuracy. And finally, the study used a simple regression of a smoothed average sales price against a variable of time and did not determine the statistical uncertainty of increased average sales prices.

In the DOA report, the REPP study was supplemented with information from Kewaunee and Iowa counties, site visits were conducted to determine the true view sheds, and property transfers that were not at arms' length were removed from the study. Surprisingly, 70 percent of all property sales in Kewaunee County were not arms' length transactions. Also, only 28 percent of the REPP "view-shed" properties actually had a view of the wind turbines. The conclusion was that there were too few properties to support a statistical analysis of the REPP data. Additionally, the REPP study did not distinguish between agricultural properties and residential properties which would likely be affected to a greater extent.

5.6.4.2 Conclusions from property value studies

Based on the existing literature, it is difficult to draw specific conclusions about the potential impacts of the Forward project on property values. However, it is reasonable to expect that the value of agricultural lands that host wind turbines would increase due to the guaranteed annual source of income. It is also reasonable to expect that residential properties located adjacent to properties hosting wind turbines could be adversely impacted. The issue of residential property values in this area is a significant issue because the area is slowly changing from agriculturally-dominated to more residential. While satellite data shows that over 96 percent of the project area is farmland, a visual assessment reveals a growing number of residential properties. Since the early 1990s, these counties have seen a gradual decrease in the number of acres in farmland and the total number of farms.[80] Currently, in both Dodge and Fond du Lac counties, land has more value per acre when converted to other uses than under agricultural use.[81] For example, in the 1990's the total value of properties in the town of LeRoy was equally split between agricultural land (30.3 percent) and residential properties (30.2 percent). By 1998, the value of property in the town of LeRoy was 44 percent residential land uses.[82] In the town of Oakfield, approximately 10 to 20 percent of acres taxed as agriculture were lost between 1990 and 1997.[83]

Recent aerial photos of the project area show the continued construction of new homes in clusters among the farms. Not only is there new construction of residences in the area, but property owners are continuing to expand and improve their existing homes. For non-agricultural properties, the value of the property is likely related to the esthetics of living in a rural setting. This has been borne out by the comments from property owners in the project area who have described the importance they place on living near the Horicon Marsh and the view of wildlife it affords. If property values and assessed values were to decrease as a result of the Forward project, the amount of property tax paid to local governments would also decrease.

[80] USDA, Wisconsin Agricultural Statistics Service.
[81] Dodge County Agricultural Preservation Plan, 2002.
[82] Town of LeRoy Land Use Plan, 2000.
[83] The East Central Wisconsin Regional Comprehensive Plan 2030.

The existence of numerous wind turbines could impact the aesthetics that these non-host residents value and result in reduced property values or a lengthier market time. Possible remedies to mitigate the potential impacts on property values include use of manmade and natural screening, sufficient turbine setbacks from adjacent residences, a property value protection plan, and/or financial provisions to ensure turbine removal and site restoration at the end of facility life or when the easement is terminated.

The use of visual screening such as trees would most likely not be effective in blocking out the proposed turbines from nearby adjacent residences due to the height of the proposed turbines. Visual screening may be more effective for residences at a greater distance from turbines and could lessen those property value impacts.

In its application, Forward agrees to not site turbines closer than 1,000 feet from any occupied residence and 450 feet from any property line, road, or utility; however, these setbacks may be subject to agreements with property owners. The issue of setbacks is also addressed in the recently revised Dodge County Land Use Code (revised April 19, 2005). Dodge County requires a setback of three times the total height of the wind turbine (1,194 feet for Forward turbines) from the nearest residence, unless a lesser setback is agreed to by the residence owner, and a setback equal to the total height of the wind turbine (398 feet for Forward turbines) from the nearest property line, unless appropriate easements are secured (see Appendix D). Currently, both of the towns in Fond du Lac County (Byron and Oakfield) have no zoning ordinances requiring setbacks for wind turbines. A review of the proposed turbine locations in both Dodge and Fond du Lac counties (Figures Vol. 2-2A and 2-2B), indicate a number of turbines are potentially closer than 398 feet to the nearest property boundary and some of the turbines may be closer than 1,194 feet to a residence. If the project is approved by the PSC, maps clearly showing adjacent property lines and residential buildings in relation to the turbine site should be posted in public locations. In this manner, non-host property owners could verify that these setbacks are maintained.

Another method that could mitigate potential impacts to non-host residences is a property value protection plan. This type of a plan provides property owners with certain assurance, that they will receive "fair market value" for their eligible properties upon sale. Since 1997, this type of agreement has been successfully implemented between the Onyx Glacier Ridge Landfill and the town of Williamstown, city of Mayville, and Dodge County. Fair market value is determined by a state-licensed appraiser. The plan identifies the properties covered by the agreement, the party responsible for paying for the property appraisals, and how affected property owners are compensated. The PSC generally does not interfere in negotiations between an applicant and municipalities, however, nothing would prevent Forward from entering into a property value protection plan agreement with the townships whose properties may be impacted by the project.

Finally, both the property values of host and non-host properties would be equally affected if the proposed turbines would fall into disrepair or not be removed in a timely or appropriate manner when easements are terminated, at the end of the life of the facility. The sample easement contract supplied by Forward did not include any details on financial responsibility for facility removal. The revised Dodge County Land Use Code (Appendix D) specifies that the owner of the wind turbines would be financially responsible for removing the turbines to a depth of four feet below grade and restoring the property when the county considers the turbines abandoned. In addition, both the Dodge County Land Use Code and Dodge County Conditional Use Permit (CUP) require a letter of credit or other financial equivalent to guarantee's the applicant's removal obligations. The Dodge County CUP requires Forward to keep the wind farm in good repair and operating condition. While these local Dodge County requirements would be effective in mitigating some potential property value impacts, there are concerns regarding whether the amount set aside for facility removals and land restoration is sufficient. Currently, neither the towns of Byron nor Oakfield have similar land use code provisions.

5.7 NOISE

5.7.1 Background and terminology

Everyday sounds are comprised of sound waves of many different frequencies. The frequency of a sound wave is measured in Hertz (Hz), with one Hz equal to one sound wave cycle per second. Sound levels are measured with a device called a sound level meter in units known as decibels (dB).

Even though the frequency range of human hearing is generally accepted to be between 20 to 20,000 Hz, the human ear is not equally sensitive to sounds through that entire range. Accordingly, when sound level measurements are taken, it is customary to use weighting systems in conjunction with the sound level meter to approximate the frequency sensitivity of human hearing. Three internationally standardized weighting characteristic curves exist for sound measurements: characteristic A for sound levels below about 55 dB, characteristic B for sound levels between about 55 and 85 dB, and characteristic C for sound levels above about 85 dB. When sound levels are measured using a weighting characteristic, the measurements are designated by adding the characteristic curve letter after the abbreviation for decibels, such as 58 dBA.

Sound levels above 140 dBA can cause immediate damage to hearing. At the other end of the spectrum, normal breathing generates a sound of about 10 dBA while a soft whisper registers at around 30 dBA. Normal conversation would be about 60 dBA at a distance of three feet. People are exposed to a wide variety of noise levels in their living environment. Typical ambient noise in an urban environment can range from 58 dBA for a quiet urban environment to as much as 72 dBA or more for very noisy urban neighborhoods. For small towns and quiet suburbs, ambient noise environments typically range from 47 to 53 dBA. Rural areas are even quieter, with noise levels during the daytime hours of around 45 dBA. In the workplace, a medium-sized office would exhibit, on average, a noise environment of around 63 dBA. Inside a typical residence, daytime noise levels can vary from 40 to 45 dBA with no television or radio playing, to between 50 and 70 dBA while listening to television or stereo music.[84] [85]

5.7.2 Noise measurements

The existing noise environment at the proposed sites and anticipated noise from the proposed facilities have been analyzed in terms of A-weighted (dBA) and C-weighted (dBC) sound scales. Also, an examination of the variation among frequency bands from 20 Hz to 8,000 Hz was made. The dBA scale enables an estimate of the noise that people would hear. The dBC scale enables an estimate of low-frequency noise that people might hear or feel. The frequency band analyses might reveal whether certain types of noise are prominent and need to be controlled in certain ways.

In order to determine the likely impact of a new noise source it is important to understand how new sources of sound add to the ambient environment. Noise level scales (as measured in decibels, (dB)) are logarithmic rather than linear. This means that the decibel levels emitted by two different noise sources

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[84] Environmental Protection Agency. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.
[85] Talbott, E.O. and G. F Craun, 1995. Introduction to Environmental Epidemiology. Lewis Publishers.

cannot simply be arithmetically added together to determine the combined effect of those noise sources. As a generally accepted rule of thumb, two noise sources emitting sound at the same dB level would have a combined noise impact of 3 dB greater than either source alone. The same rule can be applied to weighted sound levels.

As a point of reference, sound experts generally agree that the human ear can detect changes in dBA roughly as follows:

- A change of 3 dBA or less is barely perceptible.
- A change of 5 dBA is perceptible.
- A change of 10 dBA is perceived as either twice or half as loud.

Noise also decreases with distance from the source. Assuming there are no obstructions between the noise source and receptor, the noise from a single point source decreases by approximately 6 dBA for every doubling of the distance. For a noise source that is a continuous line, such as a highway, the noise levels will generally decrease by about 3 dBA with a doubling of the distance from the source. In addition to distance, noise levels can be affected by intervening structures or objects such as buildings, trees, and shrubs.

5.7.3 Applicable local ordinances

The Fond Du Lac County Code does not have a specific noise ordinance. Section 38-173 of the code addresses only nuisance noise and does not establish specific decibel limits on industrial activities or construction. Dodge County, however, does have land use codes addressing noise and wind development. Chapter 8.5.3 of the Dodge County Land Use Code sets the maximum sound levels permitted at the property line of the receiving premises. Residential limits are set at 55dBA during the day and 50dBA at night (See Table 5-11).

Table 5-11 Dodge County land use code

Source of Sound and Time	Premises Receiving Sound/Sound Level Decibel - db(A)		
	Residential	Commercial/Industrial	Industrial
Residential (Day)	55	60	60
Residential (Night)	50	50	50
Commercial/Industrial (Day)	55	60	65
Commercial/Industrial (Night)	50	50	55
Industrial (Day)	55	60	70
Industrial (Night)	50	50	60
Note: Night is defined as the hours between 10:00 p.m. and 7:00 a.m.			

Chapter 4.11 of the Dodge County Land Use Code specifically limits noise from a wind energy facility to the limits shown in Table 5-11. However, Chapter 4.11.3(D) provides for a waiver process if a wind facility exceeds the county's noise limits. The waiver requires written consent from affected landowners to allow noise levels to exceed code limits at the property line. The waiver may also be extended to succeeding landowners by recording a permanent noise impact easement with the County Register of Deeds.

5.7.4 Existing noise environment

After consultation with PSC staff and in accordance with the PSC's Noise Assessment Measurement Protocol, an ambient noise level survey was conducted in the project area on July 27 and 28, 2004. Sound level measurements were collected to establish background sound levels prior to construction and operation of the proposed project. Sound level readings were recorded over 10 minute periods during morning (6–8 a.m.), midday (12 noon–2 p.m.), evening (6–8 p.m.) and late night hours (10 p.m.–12 midnight) at six locations or Measurement Points designated as MP1- MP6, (see Figure 5- 2).

Percentile octave band (Ln) unweighted sound levels were measured, in addition to A-Weighted and C-Weighted decibel levels. Observations of predominant noise sources and weather conditions were also noted.

Weather conditions during the surveys were favorable for noise studies. Temperatures ranged from 65 to 85 °F and wind speeds averaged between 0 and 6 mph. Ambient noise sources during the survey included noise from natural sources such as rustling vegetation, birds and insects. Sources of man-made noise in the ambient environment included occasional aircraft flyovers, trains, and road noise from local roads, and USH 41 and STH 49 and 175. Table 5-12 shows some of the ambient sound measurements taken during the ambient sound study. The table lists the L_{eq} (equivalent continuous sound level-a measure of average sound level during the measurement period) reported in both dBA and dBC, and the L_{10} and L_{90} (sound levels exceeded 10 percent and 90 percent of the time during the measurement period) all reported in dBA.

Table 5-12 Ambient sound measurements within the Forward project boundary – measurements were taken on July 27 and 28, 2004

Measurement Point	Time	L_{eq} (dBA)	L_{eq} (dBC)	L_{10} (dBA)	L_{90} (dBA)
MP1	6-8 a.m.	40	50	43	33
MP1	Noon-2 p.m.	35	49	37	28
MP1	6-8 p.m.	42	51	45	32
MP1	10 p.m.-12 a.m..	51	54	42	29
MP2	6-8 a.m.	44	50	40	33
MP2	Noon-2 p.m.	56	59	48	27
MP2	6-8 p.m.	56	61	52	38
MP2	10 p.m.-12 a.m.	56	58	48	30
MP3	6-8 a.m.	59	63	57	38
MP3	Noon-2 p.m.	47	50	36	27
MP3	6-8 p.m.	55	61	52	36
MP3	10 p.m.-12 a.m.	39	31	33	28
MP4	6-8 a.m.	41	53	43	32
MP4	Noon-2 p.m.	54	57	48	33
MP4	6-8 p.m.	53	58	51	39
MP4	10 p.m.-12 a.m.	28	41	30	25
MP5	6-8 a.m.	71	74	75	54
MP5	Noon-2 p.m.	68	73	69	42
MP5	6-8 p.m.	70	74	74	47
MP5	10 p.m.-12 a.m.	62	66	62	46

Measurement Point	Time	L_{eq} (dBA)	L_{eq} (dBC)	L_{10} (dBA)	L_{90} (dBA)
MP6	6-8 a.m.	65	68	68	40
MP6	Noon-2 p.m.	60	63	56	35
MP6	6-8 p.m.	68	73	68	43
MP6	10 p.m.-12 a.m.	55	57	46	33

The L_{90} background noise levels ranged from about 25 to 54 dBA (see Table 5-12). Background ambient sound levels, as represented by L_{90} measurements, appear to be strongly influenced by local traffic, particularly for MP5 and MP6. The equivalent continuous sound level (L_{eq}) for MP 1 – MP4 measured between 28 and 59 dBA, while the L_{eq} for MP5 and MP6 varied from 55 and 71 dBA. Overall the ambient noise levels at MP5 and MP6 were higher than at the other MPs. The ambient noise levels appear to be somewhat lower towards the western side of the project area. In general, MP 1 through 4 are located in relatively quiet surroundings. When using the C weighting, the L_{eq} ranged from 31 to 74 dBC. The higher dBC levels, particularly at MP5 and MP6, indicate a relatively high component of low frequency sounds in the ambient environment. Traffic noise is a primary source of low frequency sound in the area, particularly in areas near major highways.

5.7.5 Construction noise impacts

Construction noise would come from a series of intermittent sources, most of which would be diesel engine drive systems that power most construction equipment. Because of the unique nature of a wind project, the construction phase would be spread over a large area rather than confined to a relatively small, fenced-in plant site. Construction noise impacts would vary significantly with time, stage of construction and turbine location. Construction of access roads, foundation excavation and construction, and equipment deliveries are likely to be the loudest sources of construction noise. Some examples of noise levels produced by typical construction equipment are listed in Table 5-13. Construction would occur primarily during daytime hours, so there would be little or no construction noise impacts at night.

The noise from construction operations might be compared with the L_{10} statistic from the ambient sound measurements shown in Table 5-12. This statistical parameter is intended to quantify the sound level that is exceeded 10 percent of the time and is an indication of the maximum noise levels reached in the ambient environment. As with other parameters, the highest L_{10} measurements are associated with MP5 and MP6. In this case, sources for L_{10} are most likely from traffic noise. In other areas, L_{10} values are relatively low. Regardless of location, L_{10} ambient noise levels are well below the maximum noise levels produced by typical construction equipment listed in Table 5-13. It should be noted that the decibel levels reported in Table 5-13 are for a distance of only 50 feet. Disturbance related to construction will depend on how close the receptor is to the construction site. During construction, there could be a significant increase in the ambient noise environment at locations near construction sites. This impact would, however, be short-term and would occur primarily during the daytime.

Table 5-13 Estimated maximum noise levels for typical construction equipment.

Construction Equipment	Maximum Noise Level (dBA) Typical Range = 50 Feet from Source
Blasting	93-94
Dozer (250-700 horsepower)	85-90
Front end loader (6-15 cubic yards)	86-90
Trucks (200-400 horsepower)	84-87
Grader (13-16 foot blade)	83-86
Shovels (2-5 cubic yards)	82-86
Portable generators (50-200 kW)	81-87
Derrick crane (11-20 tons)	82-83
Mobile cranes (11-20 tons)	82-83
Concrete pumps (3-150 cubic yards)	78-84
Tractor (3/4 to 2 cubic yards)	77-82

The noise from construction operations might be compared with the L_{10} statistic from the ambient sound measurements shown in Table 5-12. This statistical parameter is intended to quantify the sound level that is exceeded 10 percent of the time and is an indication of the maximum noise levels reached in the ambient environment. As with other parameters, the highest L_{10} measurements are associated with MP5 and MP6. In this case, sources for L_{10} are most likely from traffic noise. In other areas, L_{10} values are relatively low. Regardless of location, L_{10} ambient noise levels are well below the maximum noise levels produced by typical construction equipment listed in Table 5-13. It should be noted that the decibel levels reported in Table 5-13 are for a distance of only 50 feet. Disturbance related to construction will depend on how close the receptor is to the construction site. During construction, there could be a significant increase in the ambient noise environment at locations near construction sites. This impact would, however, be short-term and would occur primarily during the daytime.

5.7.6 Operation impacts and mitigation

5.7.6.1 Wind turbine noise

Wind turbine noise is typically produced by either mechanical or aerodynamic sources. Mechanical noise is created by bearings, gear housings, cooling fans, yaw drives, and the generator itself. The tower and nacelles may also conduct or transmit mechanical noise. Methods for reducing mechanical noise in wind turbines include: using low-speed cooling fans, special finishing of gear teeth, adding baffles and acoustic insulation to the nacelle, and using vibration isolators and soft mounts for major components. The GE turbine proposed for this project uses a fiberglass nacelle lined with sound-insulating foam which reduces acoustic emissions from the turbine. In addition, elastomeric mountings are also used in the GE turbine for both the generator and gearbox. Elastomeric mountings reduce vibration and noise amplifications caused by sounding-board effects.

Aerodynamic noise is created when the turbine blades cut through the air. Noise generated by wind turbines depends on the wind speed and the design of the turbine. Over the years, improvements in technology and turbine design have reduced overall noise levels around turbines. By using upwind turbines (turbine blades face into the wind), reducing the rotational speed of the turbine blades, and incorporating pitch control on turbine blades, the overall noise profile of a turbine can be reduced. As an example, low-frequency impulsive noise from wind turbines has, in the past, been a subject of some concern. Impulsive sounds are often perceived as being more annoying than sounds that are more constant in terms of frequency and duration. Low-frequency impulsive sound is found primarily in downwind turbine designs. Downwind turbines face in the direction the wind is blowing. This means that the wind encounters the turbine blades only after passing by the turbine structure itself. The turbine structure causes turbulence which results in short duration load fluctuations on the turbine blades, resulting in acoustic pulses or thumps.[86] In this case, the applicants propose to use an upwind turbine design that incorporates pitch-controlled blades. The turbine design would also have a relatively low blade rotation speed of between 10 and 20 rpm.

5.7.6.2 Estimated noise impact of project

Consultants hired by the applicant have used a three-dimensional acoustical model to predict noise level changes associated with the proposed project.[87] The noise impacts are approximate and would change depending on the final location of the turbines. Estimated turbine sound power levels were obtained from the turbine manufacturer. Figure 5-3 shows the sound level contours of the turbines as they relate to the current locations for turbines provided by the applicant. The sound level contours include only the noise from the proposed turbines and do not include existing ambient sound levels.

[86] Hubbard, H. H. and K. P. Shepherd. 1990. Wind Turbine Acoustics. NASA Technical Paper 3057. 46pp.
[87] Acoustic modeling software SoundPLAN Version 6.2 was used by Consultants.

Figure 5-2 Noise measurement points for the Forward project and range of expected increases in sound levels

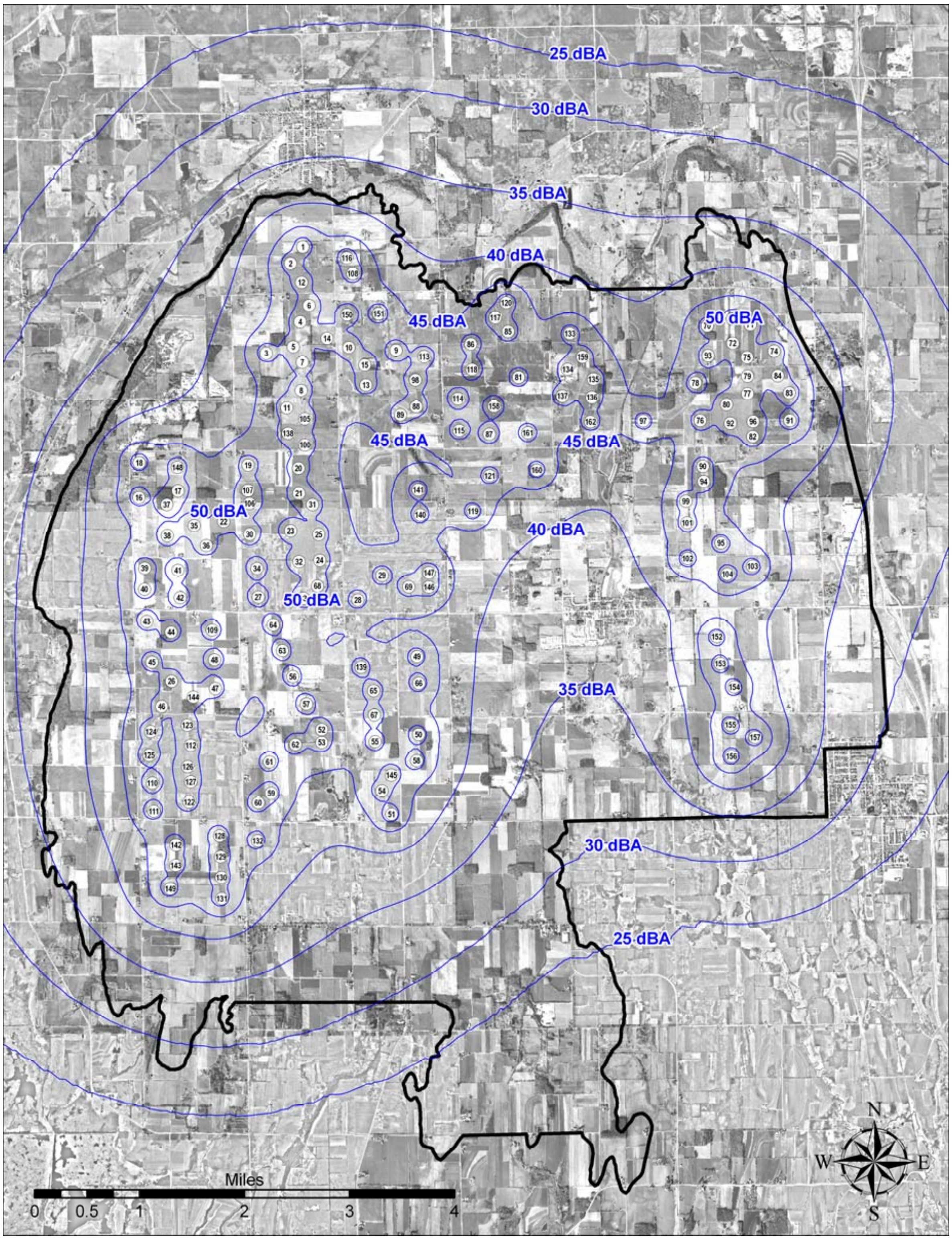
The estimated noise emissions for the proposed power plant have been compared to the existing ambient noise environment. An analysis was conducted to estimate the changes in the ambient noise level around the proposed turbines. Table 5-14 shows the measured ambient L_{eq} in both dBA and dBC and the expected increase in noise levels at each measurement point.

Table 5-14 Projected noise impact at sensitive receptors in the Forward project area

Measurement Point	Time	Measured Ambient (L_{eq}, dBA)	Projected Increase in Ambient (dBA)	Measured Ambient (L_{eq}, dBC))	Projected Increase in Ambient (dBC)
MP1	6-8 a.m.	40	11	50	16
MP1	Noon-2 p.m.	35	16	49	17
MP1	6-8 p.m.	42	10	51	15
MP1	10 p.m.-12 a.m.	51	3	54	12
MP2	6-8 a.m.	44	4	50	12
MP2	Noon-2 p.m.	56	0	59	5
MP2	6-8 p.m.	56	0	61	4
MP2	10 p.m.-12 a.m.	56	0	58	5
MP3	6-8 a.m.	59	0	63	1
MP3	Noon-2 p.m.	47	1	50	8
MP3	6-8 p.m.	55	0	61	2
MP3	10 p.m.-12 a.m.	39	4	31	26
MP4	6-8 a.m.	41	9	53	12
MP4	Noon-2 p.m.	54	1	57	8
MP4	6-8 p.m.	53	2	58	7
MP4	10 p.m.-12 a.m.	28	21	41	23
MP5	6-8 a.m.	71	0	74	0
MP5	Noon-2 p.m.	68	0	73	0
MP5	6-8 p.m.	70	0	74	0
MP5	10 p.m.-12 a.m.	62	0	66	0
MP6	6-8 a.m.	65	0	68	2
MP6	Noon-2 p.m.	60	1	63	5
MP6	6-8 p.m.	68	0	73	1
MP6	10 p.m.-12 a.m.	55	2	57	10

The analysis indicates that the proposed plant could increase the noise levels at some locations. In cases where residences are near multiple turbine locations and where the ambient sound environment is relatively quiet, there may be perceptible changes to the ambient noise environment caused by turbine operation. At four of the ambient measurement points (MP 2, 3, 5, and 6), estimated increases to the ambient noise environment are expected to be very small, ranging from 0 to 4 dBA (see Table 5-14) As discussed in Section 5.7.2, increases of 1 to 4 dB would be barely noticeable. At MP 1 and 4, there is a potential for turbine noise to be noticeable. However, ambient dBA levels vary throughout the day. Accordingly, noise effects from nearby turbines may occur only periodically, depending on the level of ambient noise present. Low frequency sounds from 31.5 to 500 Hz tend to dominate the sound spectrum produced by the turbines. In terms of dBC measurements, the low frequency impacts could appear higher to nearby residents. Increases in dBC range from 0 to 26 dBC with potentially noticeable increases at MP 1, 2, 3, 4, and 6. It should be acknowledged that ambient low frequency measurements at all MPs are also higher than their corresponding dBA measurements.

Figure 5-3 Estimated sound levels from wind turbines in dBA for the Forward project



Even though the sound levels created by the wind turbines tend to be somewhat higher in the low frequency range, it is also true that the estimated overall sound levels are relatively low. For example, at a distance of 100 feet, a typical turbine produces sound levels of 53 dBA and 67 dBC. When the distance is increased to 1,000 feet, the sound levels drop to 42 dBA and 57 dBC. The dBA levels at these distances would be generally equivalent to the noise levels found in most quiet residential suburbs. Even where the estimated noise impact is highest (MP4) the contribution from the turbine is only 49 dBA and 64 dBC.

In general, the noise produced by wind turbines tends to be less noticeable than the noise produced by other industrial facilities. Frequently, ambient sounds, including natural sounds, tend to mask turbine noise. For example, as wind speeds increase, ambient sound levels from natural sources affected by the wind tend to rise as well. At the same time, the noise produced by the turbines would tend to remain relatively constant.

Noise impacts associated with wind turbine facilities are difficult to assess because of the scattered nature of turbine placements. In addition, perceived impacts largely depend on the distance to and number of nearby turbines, the sensitivity of the receptors, wind speed and direction, time of year, the type of structures or vegetation existing in the intervening space between turbines and receptor, and turbine design.

Wisconsin has limited experience with wind turbine facilities. However, some residents living near a utility operated wind farm located in northern Kewaunee County have complained about noise. That facility uses Vestas V47, 660 kW turbines. They are mounted on 65-meter (213 feet) towers and have a blade diameter of 47 meters (152 feet). The Kewaunee turbines are an older turbine design that uses a fixed rotational speed of about 28 rpm. Commission staff visited the site but was unable to collect noise measurements from that site for analysis in the final EIS due to low wind conditions.

Over the years, modern turbine designs have reduced noise emissions from turbines. The turbines proposed by the applicant would be an upwind design with insulated nacelle, isolation mounts, blade pitch control, and relatively slow blade rotation (10 to 20 rpm). All these factors tend to reduce turbine noise. In addition, maintaining a large setback distance (1,000 feet or more) from residences would tend to further limit noise impacts.

5.8 ROADS AND RAILROADS

The project developer has stated that there would be no railroad transport of materials, parts, or equipment. Therefore, this section focuses on the potential impacts on local roads.

5.8.1 Existing road network

The federal, state, county, and town roads in the project area are illustrated in the various map figures, particularly Figure Vol. 2-1A and 2-1B. The closest limited-access, four-lane highway is USH 41 along the eastern edge of the project area. This road is part of the connection between the Milwaukee area and points north, such as to Fond du Lac, the Fox Valley cities, and Green Bay. Other major roads in the area include:

- STH 175, which runs north-south in the eastern portion of the project area;
- STH 49, which runs east-west through the north central portion of the project area ;
- STH 28 and 67 from the south and southwest; and
- Numerous county and town roads that transect the project area.

Because of Quad Graphics in the southeast part of the project area, canning companies in the north and south, the Michels construction company complex in Brownsville, numerous stone and gravel operations, and abundant farms in the area, many of the state, county, and town roads carry a substantial amount of truck traffic.

5.8.2 Potential construction traffic related to the project

Traffic associated with construction activity would include both worker trips and equipment or supply delivery trips.

5.8.2.1 Worker trips and personal vehicles

Worker trips would involve construction employees traveling to and from the job site. The primary impact on traffic would be from these worker trips or construction employee vehicles. The project location would result in construction workers likely coming from a variety of surrounding areas including Fond du Lac (from the north), Waupun (from the west), Beaver Dam (from the southwest), Mayville (from the south), and West Bend (from the southeast). Construction workers could also be driving from major metropolitan areas such as Sheboygan (from the northeast), Milwaukee (from the southeast), or Madison (from the southwest). Some workers may also come from other, smaller communities in or near the project area, such as Lomira, Brownsville and Oakfield.

The construction workers would likely utilize a variety of routes, meaning that traffic would not concentrate on any specific road.

The average number of construction workers in the project area at any one time is expected to be around 150 workers. This would result in approximately 300 worker automobile trips (arriving and departing). However, during peak periods of construction, as many as 250 workers might be present. Therefore, up to 500 worker trips could occur on a daily basis. This number would be higher if workers travel between turbine sites during the workday.

5.8.2.2 Construction equipment, parts, and supplies

The second type of traffic associated with construction activities would involve trips by trucks delivering construction material, equipment, and supplies. All construction materials, bulk materials, and equipment would be delivered by truck, including concrete and gravel, trenching machinery, and other construction needs. Construction vehicles would make multiple trips to the project area daily, especially those vehicles that provide materials such as concrete.

The large parts for the wind turbines would also be delivered to each turbine site by truck. Sources of turbine parts from GE could include fabrication plants in the province of Quebec, the states of Louisiana, North Dakota, or Utah, or possibly Korea or China. Parts from Korea or China would enter the U.S. at a port in the state of Washington. All major turbine parts (nacelles, blades, hub assemblies, tower pieces) are expected to be transported by Lone Star Transportation, Incorporated (Lone Star), of Fort Worth, Texas, which is GE's typical transport contractor. The wind turbine supplier is responsible for delivering the parts and equipment, and GE has been transporting these major turbine parts by truck for many years.

The truck configurations would be designed and assembled specifically for the dimensions and weights of the tower or blade parts to be hauled, and for the specific haul routes that would be used. Figures 5-4 and 5-5 illustrate types of truck configurations that could transport blades, nacelles, hub assemblies, and tower sections over public roads. Trucks for the nacelle or hub assembly would be classified as wide loads. Trucks for the nacelle, blades, or tower sections could range from 112 to 159 feet long. The truck configurations would be different depending on whether the transport was coming from the eastern U.S. or the western U.S. Figure 5-5 illustrates the configuration for the turbine tower sections.

Figure 5-4 Truck configurations for transporting the nacelle, hub, turbine blades, and tower top

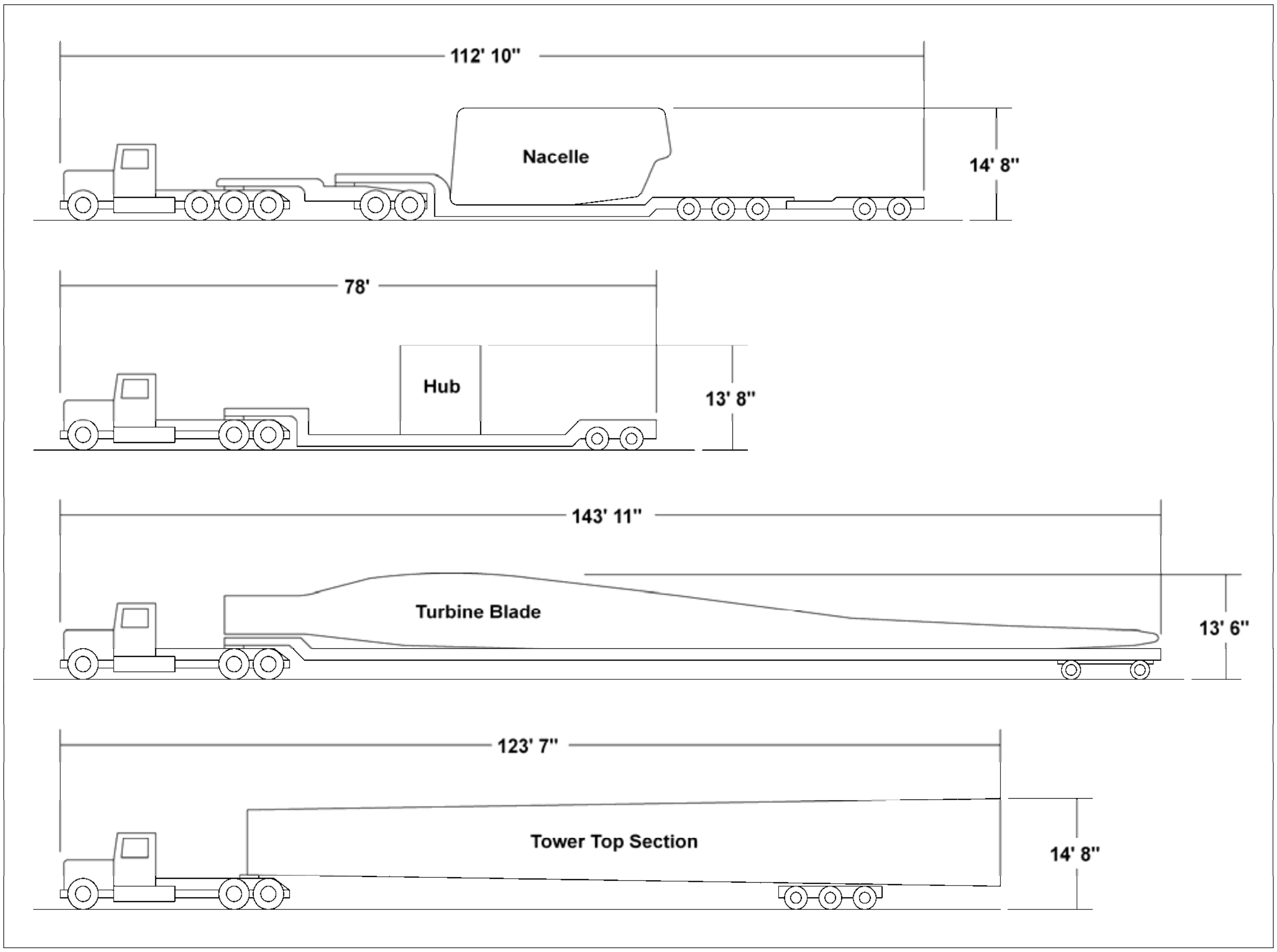
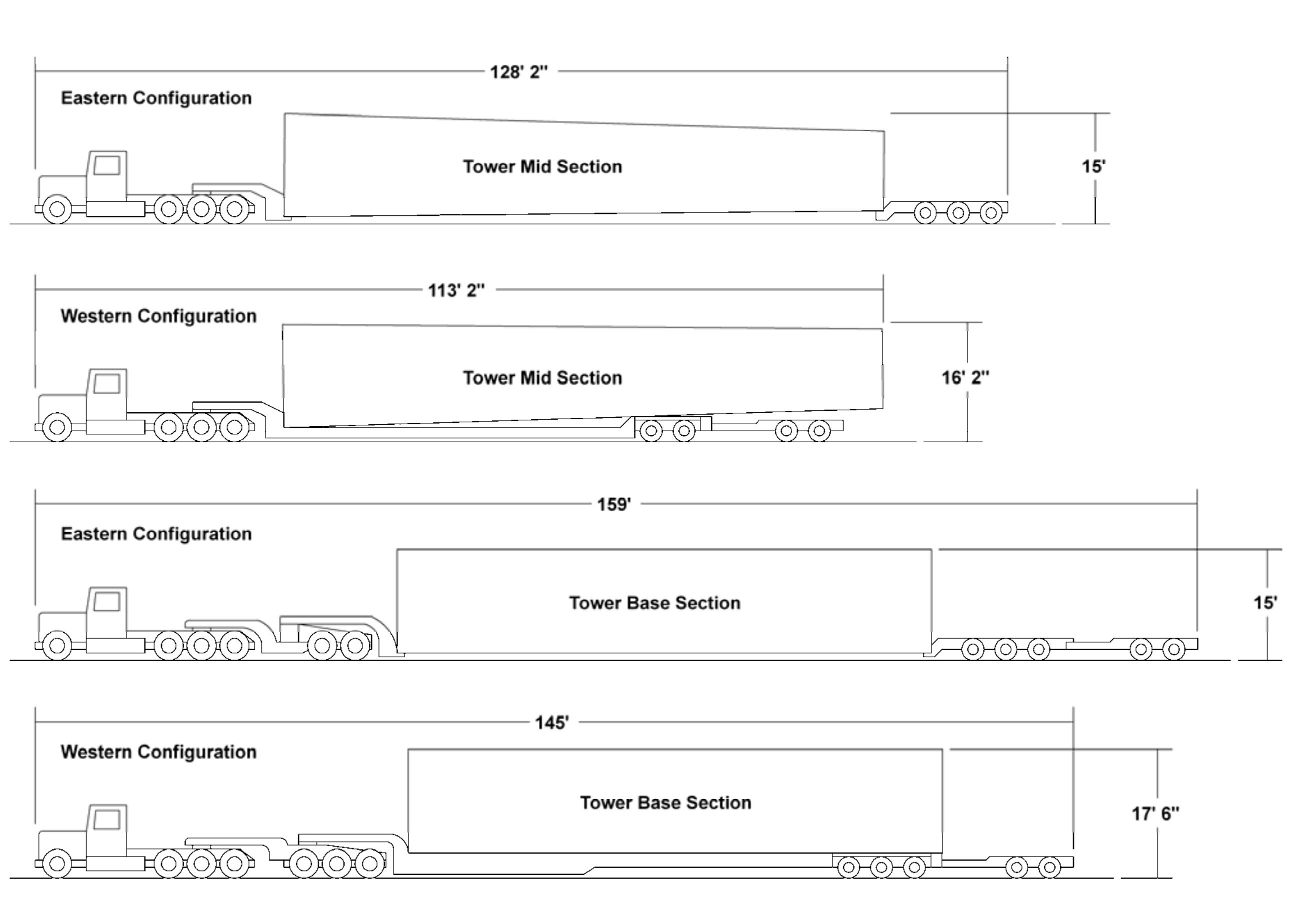


Figure 5-5 Truck configurations for transporting tower mid sections and base sections, depending on eastern versus western road use needs



One likely transport route from the point of manufacture would enter the project area from USH 41. The USH 41 exits in the project area are STH 67 and STH 49. Either would be utilized, depending on the specific load and final destination. Once in the project area, the routing of loads to the smaller roads accessing the turbine sites would be coordinated with the local officials. After exiting at USH 41 onto STH 49, the first north-south path would be STH 175. CTH H, CTH HH, West Byron Road, and CTH F connect to this road. Additional north to south roads that are expected to be utilized would include Center Road, Oaklane Road, Mill Pond Road, Dairy Road, CTH Y, and CTH YY. Smaller access roads would be created to move the loads to the turbine sites that do not have a direct access from a public road.

Looking at Figures 5-4 and 5-5, with three blades per turbine, each turbine site would receive eight transport trucks to deliver the major parts. To calculate the number of truck loads using each access road, the eight truck loads could be multiplied by the number of turbines proposed for each string. If, for example, there were four turbines in a string along one access road, such as the four off of Dairy Road in Dodge County, there could be 32 transport trucks bringing parts. (They could exit USH 41 onto STH 49 westward, through or around Brownsville, south onto Dairy Road and east onto the new access road to Turbines 139, 65, 67, and 55.) These transport trucks would be in addition to gravel trucks, cement trucks, cranes, and other construction vehicles necessary for installing each turbine and building the access road.

Forward has stated its intention to work with the local communities to coordinate traffic flow and to limit construction traffic to "normal" working hours, except in the event of emergencies. Coordination, as planned to date, is discussed in the next section.

5.8.3 Potential impacts on traffic and road conditions during construction

Heavy construction equipment, including mobile cranes, earth moving equipment, cement trucks, and dump trucks, would be delivered to the project area as described above.

The impacts on current traffic conditions during construction would be temporary, occurring only until all of the proposed facilities are installed. Levels of truck traffic in the area would vary depending on the phase of construction. Truck deliveries would typically be distributed evenly over a ten-hour delivery day. Construction traffic would utilize roadways that have enough capacity to handle the expected number and size of vehicles, but congestion could occur at certain times from vehicles entering and exiting the project area. Because the project area lies between a number of urban centers and includes several state highways, it is likely that trucks would approach the project area using the same roads as the construction worker traffic. This could reduce the likelihood of overuse on any single road.

The revised Wind Energy Systems Overlay District[88] in the Dodge County Land Use Code Dodge County specifies how to address the use of local roads. Prior to construction in the area, a mutually agreed-upon independent engineer would visually survey and document the conditions of the roads in the project area with local officials and Forward. After the completion of construction, another survey would be conducted and Forward would be responsible for the cost of making repairs to roads damaged as a result of construction. (See Section 5.4.2 for a discussion of the revised Dodge County land use code.) The code is reinforced by the recently passed Dodge County CUP, where Condition 27 specifies the same process. While the two towns in Fond du Lac have not yet issued a CUP, the same provision is expected to be included.

If required, a bond could also be posted by a hauler to assure that any road damage would be fixed. It might also be appropriate for the applicant to ensure that only licensed haulers are used and that a bond would be posted as needed.

Any necessary permits or approvals required to transport large or oversized equipment or materials to the project area would be obtained by the hauler, such as the transport company described above. According to Forward, Lone Star, the hauler for the turbine parts, would communicate the expected times of travel, load weights, and dimensions and make all arrangements with highway and road authorities.

Lone Star would be responsible for knowing and complying with the clearances and restrictions for all of the routes across the various states through which they would travel to reach the Forward project area. The haulers would be licensed. During this permitting process, the transportation company would work with the road permitting authority to select the final delivery route and address any clearance, weight, or time restriction issues that could affect the delivery. Trailer dimensions would be determined, including clearance from the ground, overhead clearance, side-to-side clearance, the method of fastening the equipment, and the trailer axle configuration.

[88] Section 4.11 of the Dodge County Land Use Code

Table 5-15 shows some of the weights, lengths, widths, and heights of the turbine part transport trucks and loads. The basic designs and numbers of axles in Figures 5-4 and 5-5 also illustrate how the companies might control the weight distribution of the turbine tower parts so that axle loads are kept below the thresholds allowed by various road authorities across the country. As discussed, delivery would also be coordinated with local officials. Depending on the time of day and how many trucks arrived at one time, police services might be required to assist in temporary traffic diversion during delivery of the large equipment to the site.

Table 5-15 Approximate dimensions of trucks transporting major turbine parts (as shown in Figures 5-4 and 5-5)

Part	Weight (lbs)	Length (ft)	Width (ft-in)	Height (ft-in)
Nacelle	197,000	113	11’6”	14’8”
Hub assembly	75,000	78	10’5”	13’8”
Blade	-	144	-	13’6”
Tower top section	64,710	124	-	14’6”
Tower mid-section - eastern configuration	80,668	128	-	15’0”
Tower mid-section - western configuration	80,668	113	-	16’2”
Tower base section - eastern configuration	123,607	159	-	15’0”
Tower base section - western configuration	123,607	145	-	17’6”

Forward has stated that it would take responsibility for needed repairs to local roads in the project area. Therefore, no permanent impacts or damage to the area roadways would be expected from the turbine part transports or from heavy construction equipment and delivery. With the exception of the addition of access roads on the properties hosting wind turbines, there would be no anticipated permanent changes to the condition of area roadways.

5.8.4 Potential impacts on traffic during plant operation

It is anticipated that the Forward wind project would employ approximately six to ten permanent employees, for one shift, five days a week. Currently operating facilities of similar capacity employ similar numbers of workers. A small number of vehicles would deliver supplies and equipment as needed.

5.9 HEALTH AND SAFETY

5.9.1 Shadow flicker

5.9.1.1 Description of shadow flicker

As wind turbine blades rotate, they cast a shadow upon the ground and objects below. A strobe effect can occur where the shadow of the rotating blades cause rapid changes in light intensity in the area of the shadow. Shadow flicker occurs when rotating wind turbine blades cast shadows on a sensitive receptor. These rapid changes in light intensity are troublesome when they affect a sensitive receptor, such as the windows of residences. Shadow flicker can occur if a turbine is located near a home and the home is in a position where the shadow of the moving blade is cast upon the residence. Obstacles such as trees or buildings between the wind turbine and a potential shadow flicker receptor can reduce or eliminate shadow flicker effects. Changes in elevation can either reduce or increase the effects.

No shadow flicker occurs when the turbine rotor and blades are not rotating, such as when winds are calm. Shadow flicker occurs only during hours of sunshine, as no discernable shadow is cast on overcast days. Because the wind turbine is designed to turn and face into the wind, shadow flicker is less pronounced when the wind direction is perpendicular to the direction of the wind turbine, as viewed from the receptor. By contrast, the shadow flicker is more pronounced during sunlight hours when the wind blows from a direction near parallel with a line between the wind turbine and the receptor.

The rate of changes in light intensity is a function of the rotational speed and the number of blades on the rotor. This rate, or "blade pass frequency," is measured in cycles per second, or hertz (Hz). Each complete change in light intensity, from the beginning of one shadow to the beginning of the next shadow, is considered one cycle.

Forward proposes to use wind turbines having three blades that are designed to operate at between 10 and 20 revolutions per minute (RPM). For this range of rotational speeds, the blade pass frequency would range from 0.5 to 1.0 cycles per second.

5.9.1.2 Potential for shadow flicker in the project area

Forward used a computer model, WindPRO Version 2.4.0.63, to evaluate the likelihood of shadow flicker in the areas around the turbines. This model is capable of predicting the likelihood of shadow flicker effects in the area of the proposed wind turbine installation. The prediction is based on the physical dimensions of the selected turbine, local topographical information, turbine location, local annual wind speed and direction data, the sun's path across the sky based on latitude and longitude, and the monthly average hours of sunshine. These model inputs are specific to the location in which the turbine installation is proposed.

Figure 5-6 shows the modeling results where 25, 50, and 100 hours per year of shadow flicker are likely for a typical turbine location. Note that almost the entire area that could experience shadow flicker up to 25 hours per year is within 1,000 feet of the proposed wind turbine location.

Figure 5-6 Likely hours per year of shadow flicker

The computer modeling predicts that potential receptors to the north or south of the wind turbines are not likely to receive shadow flicker, because the shadow is shorter in those directions. Receptors to the east and west of the turbine locations could experience shadow flicker in the morning and evening.

Figure 5-7 through 5-9 show traces of the rotating turbine blade shadows on three days: the winter solstice, equinox, and the summer solstice. For each shadow trace, the position of the shadow is shown at various times of day, from 30 minutes after sunrise to 30 minutes before sunset. The turbine is assumed to be oriented perpendicular to the sun, thereby casting the largest shadow. As the days of the year pass from the winter to summer, the shadow trace also moves from the winter solstice trace through the equinox trace to the summer trace.

Figure 5-7 Shadow traces at winter solstice (local solar time, 389-ft. turbine)

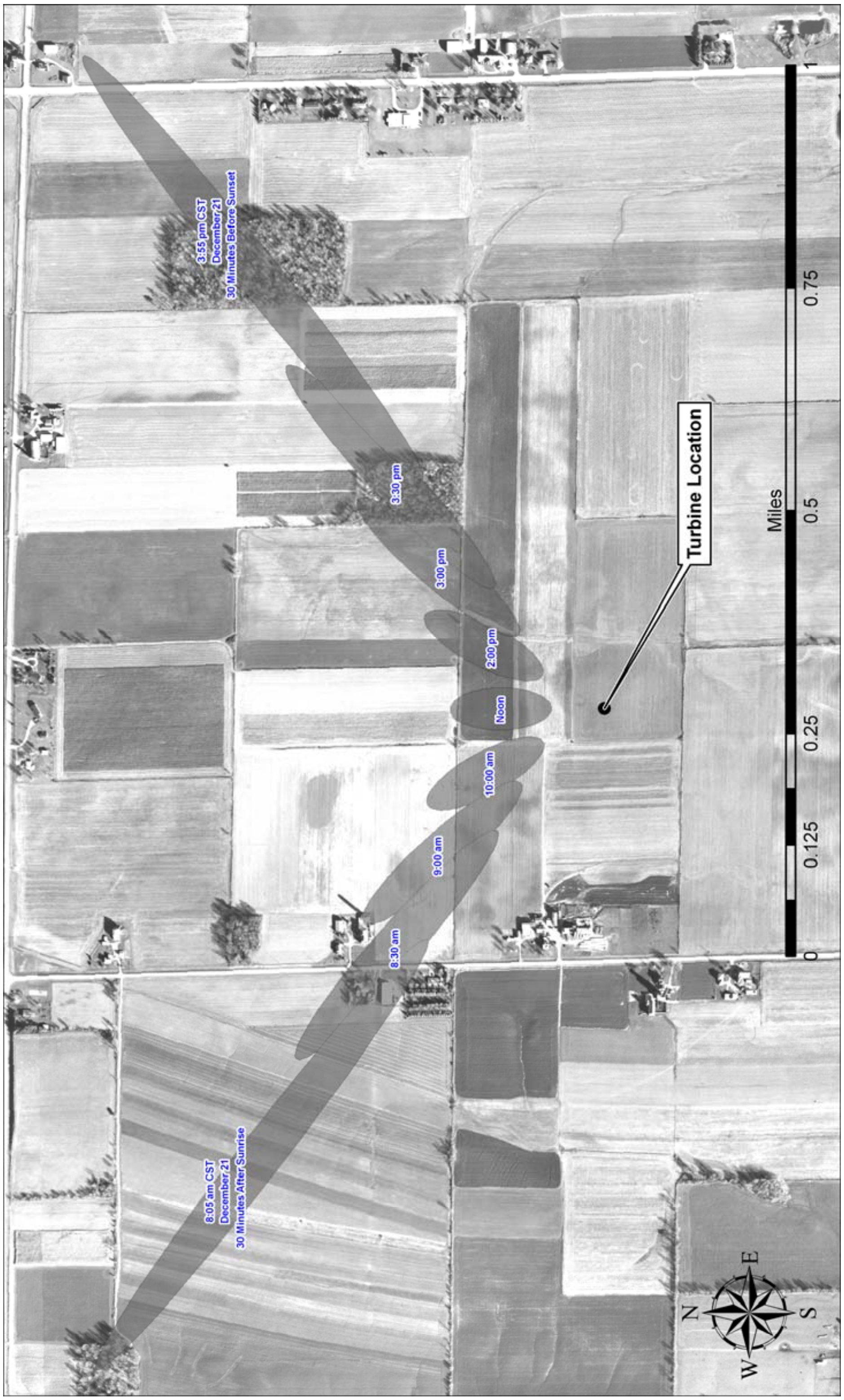


Figure 5-8 Shadow traces at equinox (local solar time, 389-ft. turbine)

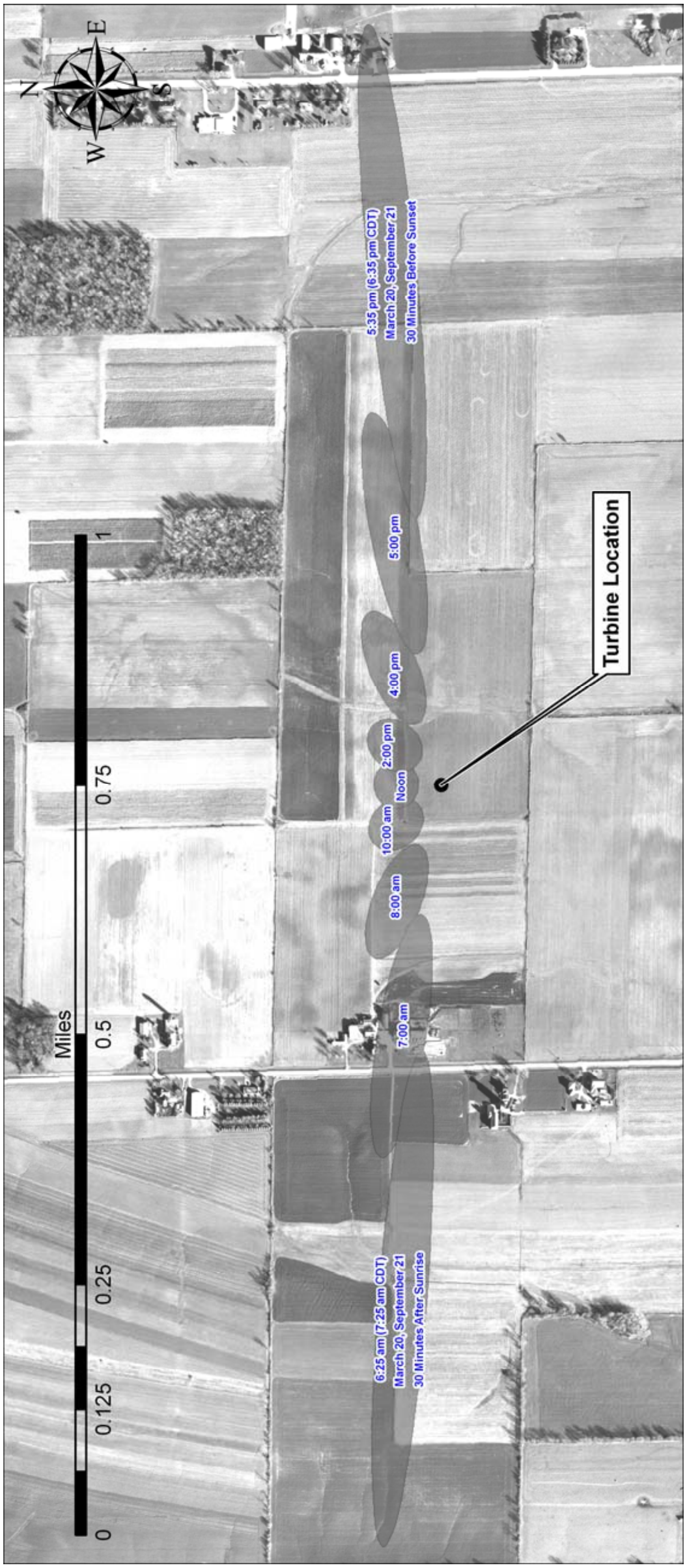
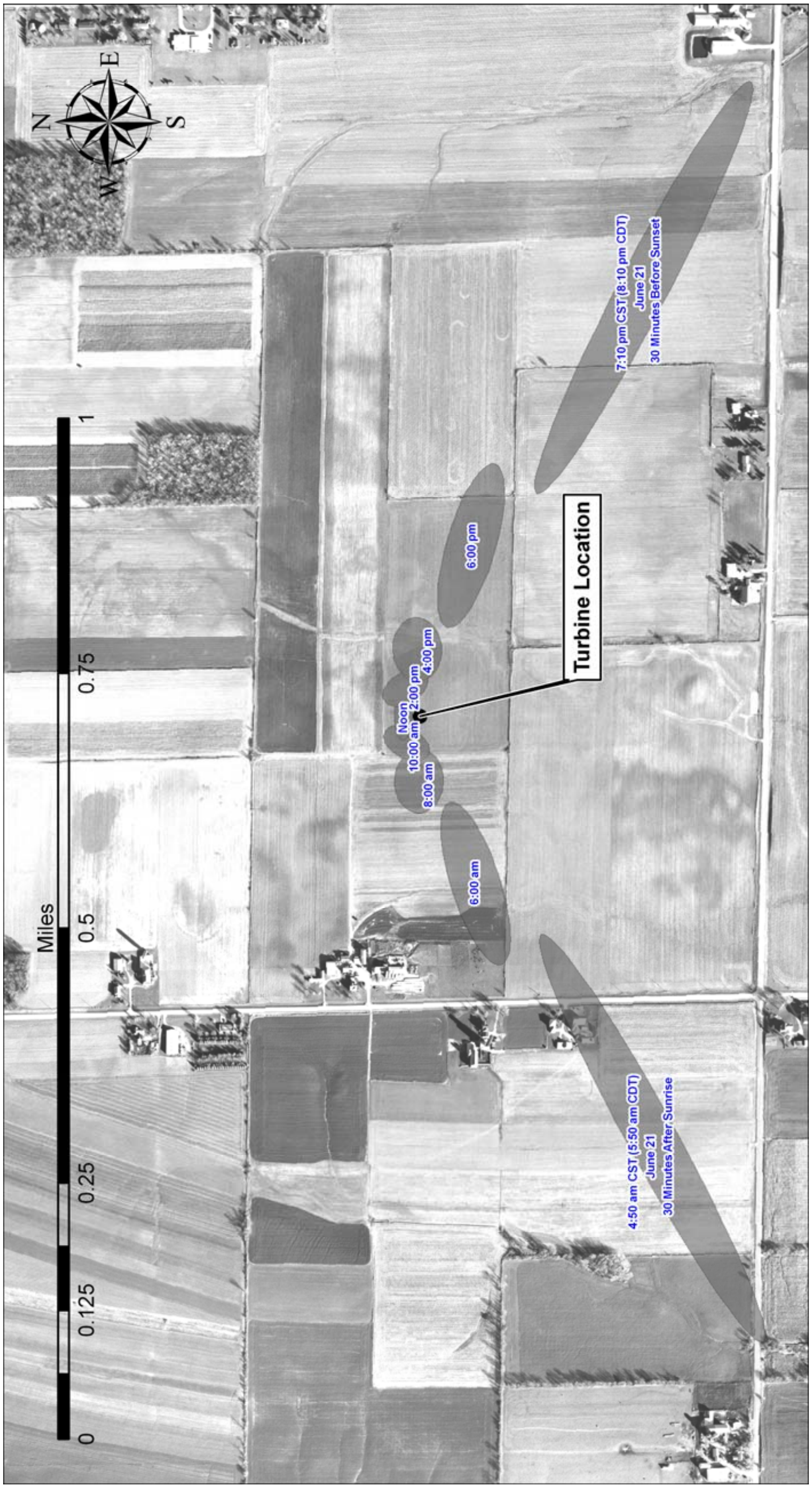


Figure 5-9 Shadow traces at summer solstice (local solar time, 389-ft. turbine)



Figures 5-7 through 5-9 also show that the areas most likely to experience shadow flicker occur to the east and the west of the turbine tower locations. However, the number of hours per year during which shadow flicker could occur lessens as distance from the turbine increases, even for residences that are located to the east and west of the turbine locations. There are three reasons why this is so:

- As the season passes from winter to summer, the shadow angles at sunrise and sunset move from north to south. Because this angle changes, a residence further from the turbine would most likely experience shadow flicker only during a few days per year.
- As the sun rises or sets, the turbine shadow length changes rapidly, so that a residence further way from the turbine location would experience shadow flicker for only a short time during the day.
- A discernable shadow forms or dissipates within 15 to 45 minutes of sunrise or sunset, depending on sky conditions.

5.9.1.3 Possible effects of shadow flicker

Shadow flicker from a wind turbine that falls upon a home may cause an annoyance to the residents. According to Forward's modeling, almost the entire area that could experience shadow flicker up to 25 hours per year is within 1,000 feet of the proposed wind turbines locations. Sensitive receptors that are greater than 1,000 feet from a wind turbine could experience shadow flicker for shorter periods, but most likely only for a few days per year as the sun's path changes with the seasons.

Epileptic seizures can sometimes be triggered by certain frequencies of flashing or flickering light sources. This is a fairly rare condition known as photosensitive epilepsy. The frequency of flicker that could trigger the epileptic seizure varies from patient to patient. Generally, literature on photosensitive epilepsy suggests that the frequency likely to trigger the seizure is between 5 Hz and 30 Hz. The literature suggests that while some epileptic patients are sensitive at higher frequencies, the triggering of photosensitive epileptic seizures by flicker below 5 Hz is uncommon.

5.9.2 Mechanical hazards

5.9.2.1 Blade throw

There are only two incidents of a utility-scale wind turbine blade breaking loose from its hub. One was due to a lightning strike and the other was caused by improper assembly. The turbine supplier, GE Wind, states that it has never lost a blade from an operating machine. A literature search conducted for a previous wind-project EIS indicates that no theoretical modeling has been performed on blade throw.

5.9.2.2 Ice throw

While most information regarding ice throws from wind turbines in the U.S. is anecdotal, a report by Durstewitz (2003)[89] provides some insight into the phenomenon of turbine icing in cold climates of Europe. Rime ice or glace ice can form on a wind turbine given the right combination of temperature and moisture. Rime ice will occur when objects such as trees or wind turbines are exposed to low temperatures in combination with fog. Depending on the duration of the ice conditions, significant amounts of rime ice can collect on the turbines and increase static and dynamic loads. Glace ice can occur when a warm front drifts above cold air. The falling rain can cool down to temperatures below the freezing point without actually freezing into solid ice. If the super-cooled rain hits the surface or

[89] Durstewitz, M.; On-site Cold Climate Problems- BOREAS VI; April 2003, Pyhatunturi, Finland.

objects with temperatures below 32 F, it will instantly turn to a layer of solid ice. Ice accretion can be collected by all parts of the turbine structure.

When rime ice or glace ice would occur, the turbine would shut down in one of two ways: either the blades would be unbalanced and the vibration sensor would stop the turbine; or the wind measuring instruments would freeze over and cause an automatic shutdown. The turbine would restart when the ice had been shed.

In the rare event of an ice throw, it is expected that there would be little danger to public safety because the setbacks typically required minimize noise and other impacts. No ice throw from turbines has ever been documented in Minnesota where hundreds of wind turbines have been installed in recent years. The only documented incident of ice damage was to a truck parked at the base of a wind machine.

5.9.3 Lightning protection and grounding

To protect the wind turbines from damage caused by lightning strikes and to provide grounding for electrical components of the wind turbine, an electrical grounding system would be installed at each turbine location. Parts of the grounding system would be built into the wind turbine blades, nacelle, and tower. In addition, a buried grounding system would be constructed as part of the wind turbine foundation pad. Design of the buried grounding system would consider local soil electrical conductivity conditions to ensure that electricity from lightning strikes would be dissipated into the ground. The design of the grounding system would also consider local electrical codes. A schematic of a typical turbine grounding system is included in Figure 5-10.

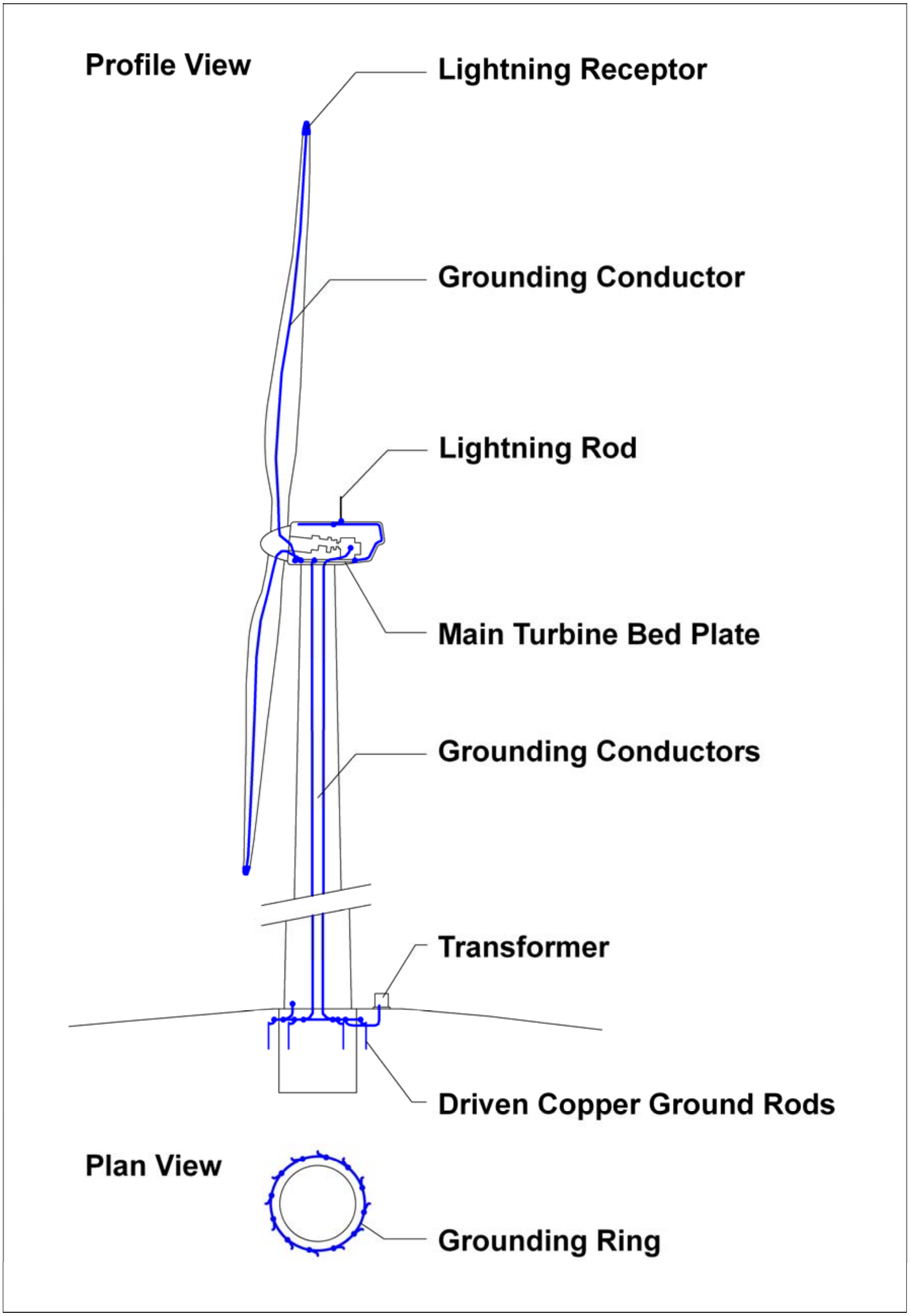
For the GE 1.5 wind turbines proposed for the Forward project, the wind turbine manufacturer would provide the lightning protection and grounding hardware from the blade tips to the base of the tower. The grounding ring and connections of the turbine and transformer to the grounding ring would be Forward's responsibility.

A lightning receptor would be built into each wind turbine blade tip, and would function similar to a lightning rod. The lightning receptor would be connected to the main turbine bed plate in the nacelle by a copper grounding conductor that would run the length of each blade. The electrical generator would be mounted on and electrically connected to the main turbine bed plate.

The nacelle would be fitted with a lightning rod, to protect it from direct lightning strikes. Like the blade tip lightning receptors, the nacelle lightning rod is connected to the main turbine bed plate by a copper grounding conductor. The main turbine bed plate would be connected by at least two copper conductors that would run down to the base of the turbine tower, where they would connect to the buried grounding ring. In addition, the steel turbine tower and the turbine transformer would be connected to the grounding ring.

The grounding ring would be constructed of a ring of buried copper conductor that would encircle the turbine foundation. The ring of copper conductor would be connected to copper grounding rods that would extend down into the soil. The number of ground rods would depend on soil conditions. If the soil conditions were such that electricity is easily conducted into the soil, fewer ground rods would be used. Conversely, if soil conditions did not readily allow for the flow of electricity off of the grounding ring, it would be necessary to use more copper ground rods.

Figure 5-10 Schematic of proposed wind turbine grounding system



The grounding system is usually constructed from 250 kCM bare copper wire and 8-foot long, 5/8-inch diameter rods driven into the ground. The conductor comprising the grounding ring would be installed at least 30 inches below ground level and approximately 18 inches from the tower foundation. Ground rods would be equally spaced along the grounding ring, approximately 24 inches from the grounding ring conductor. A 250 kCM ground conductor would be extended to the transformer.

5.9.4 Stray voltage

Stray voltage is a term used by the Commission to describe a physical phenomenon that may affect confined livestock. It is defined as a natural electrical phenomenon that can be found at low levels between two contact points in any animal confinement area where electricity is grounded.

Electrical systems – including farm systems and utility distribution systems – by code must be grounded to the earth to ensure continuous safety and reliability. Inevitably, some current flows through the earth at each point where the electrical system is grounded due to ever-present resistive materials, which cause a small voltage to develop. This voltage is called neutral-to-earth voltage (NEV). When a portion of this NEV is measured between two objects that may be simultaneously contacted by an animal, it is frequently called 'stray voltage.' This voltage arises solely from the distribution system. The electrical collection system for the Forward project would be totally independent of the local electric distribution system.

There is only one mechanism through which a transmission system can affect a distribution system. Transmission lines can induce voltages and currents on the distribution system through high electric and high magnetic fields if the systems are in close proximity. An extensive distance of underbuild distribution beneath a high-voltage transmission line could allow such an induction process to occur. The coupling between the two can be caused by the magnetic field that surrounds the transmission line conductors, or the high electric field occupying the space between them, or both. Proper arrangement of the lines' positions and relative topographies can be implemented in such a way that the inductive coupling of voltages and currents into the distribution neutral is minimized. No such installation is proposed for the Forward project.

5.9.5 Electromagnetic fields (EMF)

5.9.5.1 EMF basics

Concerns regarding exposure to EMF (electromagnetic or magnetic fields) are often raised during power plant and transmission line construction cases. Magnetic fields are created when an electric current flows through a conductor. Magnetic fields vary in intensity depending on how much electric current is flowing at any given time; the higher the electric current, the larger the magnetic field. The intensity of magnetic fields also decreases with distance from the source. Magnetic fields can be reduced by decreasing the current flow, increasing the distance from the source, or by bringing individual conductors closer together. Power lines and the structures that support them can be designed to reduce the resulting magnetic fields. This is accomplished by properly arranging the individual conductors so that their respective magnetic fields interact and partially cancel one another.

Magnetic fields occur whenever and wherever we use electricity. Common sources of magnetic fields include electric blankets, fluorescent lights, electric appliances (computers, microwaves, televisions, washing machines etc.), electric baseboard heating, and power lines. Because there are so many common sources of EMF, we are exposed to a wide variety of magnetic fields every day. Magnetic fields are measured or estimated in units of Gauss (G) or milligauss (mG) (a milligauss is equal to 1/1000th of a Gauss). Measurements of power line EMF are always reported in mG.

5.9.5.2 EMF and human health

Scientists have found only weak and inconsistent epidemiological associations between exposure to power-frequency EMF (the kind created by power lines) and human health. Several epidemiological studies have shown a statistical association between the risk of childhood leukemia and the kind of electric wires outside the home. However, many epidemiological studies have found no link to leukemia. Cellular studies and studies exposing test animals to EMF have shown no link between EMF and disease. Taken as a whole, the biological studies conducted over the last 25 years have not been able to establish a cause-and-effect relationship between exposure to EMF and human health effects. In addition, there have been no plausible biological mechanisms discovered to explain how exposure to power-frequency EMF might cause human disease.

For more information on EMF and human health you may wish to request the free publication entitled EMF – Electric & Magnetic Fields from the Public Service Commission of Wisconsin. This publication is also available on the PSCW web site at the following internet address: http://psc.wi.gov/consumer/brochure/ind_broch.htm

5.9.5.3 Sources of EMF for the Forward project

The primary source of EMF from this project would be the power lines used to connect the turbines to the new proposed substation located south of West Byron Road. Turbines would be electrically connected to one another in groups using a three-phase (three conductors) 34.5 kV buried power line. The buried cables would generally be located adjacent to the turbine access roads and would be placed in a trench between 30 and 40 inches deep. The final location for the buried cables has not yet been determined.

There are two possible wire configurations for buried cable being considered. One configuration, called a trefoil, would arrange the conductors very close together. This would result in the lowest EMF profile. An alternative configuration would space the conductors about one foot apart. Because of the greater physical separation between the individual conductors, this configuration would have generally higher EMF than the trefoil configuration. For both configurations, the individual conductors are relatively close to one another; accordingly, the resulting magnetic field intensity, while relatively high directly over the centerline, would decrease far more rapidly with distance from the line than it would for a typical overhead configuration. Over the centerline, the magnetic fields at ground level would be about 115 mG for the trefoil and about 673 mG using a 1-foot conductor separation. At 25 feet from the buried line the magnetic fields would decrease to 2mG and 11mG respectively (see Table 5-16).

An overhead double-circuit 34.5kV power line, approximately five miles in length, would serve to connect the majority of the turbines to the new substation. The line would be located along CTH Y, Oak Lane and across farm fields as described in Section 6.5.4 (see Figure Vol. 2-3). Under normal circumstances, with both circuits operating and the turbine farm at full output, EMF would be approximately 35 mG directly below the centerline, measured at waist height. At about 50 feet from the line, the magnetic field would decrease to about 6.7 mG (see Table 5-16). At a distance of 100 feet from the overhead power line the magnetic field produced by the line at full output would decrease by about 96 percent to approximately 1.4 mG.

Table 5-16 Calculated magnetic field levels for the 34.5 kV buried cables and overhead line

	Magnetic Fields - Buried Cable 34.5kV (at ground level)		Overhead Power Line 34.5kV (at 3 feet above ground)
Distance (ft)	**Trefoil (mG)**	**1-ft. Separation (mG)**	**(mG)**
0	115	673	35
5	30	215	
10	9	66	31
15	4	31	27
20	3	18	
25	2	11	19
50			6.7
100			1.4

The magnetic field estimates in Table 5-16 should be considered the absolute maximum field intensities that could be produced by the project's power lines. On most days the magnetic fields produce by the wind farm would actually be lower.

Magnetic field exposure from the wind turbines themselves and the pad-transformers located at the base of each tower would be very small to non-existent. These magnetic fields are produced by the complex windings or concentric wire arrays that constitute the primary electrical components of the transformers and generators. While magnetic fields near generators and transformers can be very high, those fields break down very quickly within a relatively short distance. Homes in the area should not experience changes in EMF levels as a direct result of the wind turbines and transformers.

5.9.6 Television, radio and telecommunications interference

This section assesses the potential for interference with various types of communication, including telecommunications and broadcast communication. The potential for interference was raised as a concern by private citizens living in the project area and by a number of municipal government offices that depend on radio and microwave communications for emergency notification.

5.9.6.1 Microwave paths

Wind turbines can interfere with microwave paths by blocking or partially blocking the line-of-sight path between microwave transmitters and receivers. Forward hired a communications consultant, a professional spectrum management firm named Comsearch, to identify microwave telecom systems that traverse the project area. Using WindPower GeoPlanner software, the firm made a geographical representation of registered fixed microwave paths in the 900 MHz to 40 GHz frequency band. Because microwave communication is a line-of-sight technology, potential interference of microwave telecom signals can be avoided by locating the wind turbines outside of the microwave communications profile. Comsearch calculated a Worst Case Fresnel Zone (WCFZ) for each of the microwave paths in the area. The middle of the path is where the widest (the worst case) Fresnel Zone appears. The affected paths were then overlaid on topographic base maps for the project area.

An updated report shows that nine microwave paths intersect the project area. Of the 162 potential turbine sites, four would potentially cause interference with microwave communications. Because Federal law does not permit interference with registered or licensed microwave pathways, Invenergy plans to reposition these sites outside the WCFZ to avoid any interference.

Some typical size relationships are provided below:

- Microwave antennae height is 30 meters plus and typically located on water towers, television towers, building roofs, and shared commercial towers.
- The initial antenna diameter is 2 meters.
- The width of the WCFZ for 950 MHz is about 50 meters.
- The width of the WCFZ for 2 GHz is about 30 meters.
- The width of the WCFZ for 6 GHz is about 17 meters.
- The width of the WCFZ for 18 GHz is about 6 meters.
- The width of the Forward project area is approximately 7 miles or 11,200 meters.

5.9.6.2 Television

Wind turbines also can block or cause unwanted reflections of broadcast signals. It is possible that the Forward project could affect television reception for some residents in the project area by introducing reflections or "ghosting" to the images they see.

The turbine towers are metal and would block all electromagnetic field signals at close range. The turbine blades, which are typically reinforced fiberglass with epoxy resins, would reflect electric fields and allow magnetic fields to pass through. The rotating blades can produce a reflected television video signal to an individual who has a personal television broadcast receiving antenna and is in relatively close proximity to a wind turbine that is in line with the signal from the over-the-air broadcast signal. Forward has committed to resolving television interference problems by improving the person's antenna, changing the antenna location, or installing relays to re-transmit and boost the affected signal. Installing satellite television is also another option. Television reception issues would be dealt with on a case-by-case basis by working with affected residents to identify the best solution.

Electromagnetic noise produced from wind turbines may be present on low VHF channels, if the receiver is closer than one-half mile to a wind generator.

5.9.6.3 Cellular and two-way radio

There is no convincing evidence that wind turbines interfere with individual cell phones or two-way radio. In fact, turbine maintenance personnel often use cell and radio equipment to perform their work. In some areas cell phone antennae have been installed on the turbine towers.

5.9.6.4 Wireless Internet

A recent development is a broadband wireless Internet service. This usually involves a 2 GHz antenna array sending and receiving signals from a local tower to a wide area of customers. The local tower would have a narrow microwave "backhaul" path to the office network connection point. The customer would have a small dish or panel antenna at the home or office to send and receive signals to the local tower. The home or office customer may have a reception issue if they are very close to a wind tower that is in line with the local area antenna. This may be resolved in a manner similar to the television issue.

Some of the new wireless Internet providers choose not to register with the FCC and they may be at risk. Non-FCC registered service providers may want to provide some additional information about their microwave network to the Forward project staff to minimize potential interference with their backhaul paths.

5.9.7 Potential electric distribution service interruptions

Existing electric distribution lines parallel many of the state and local roads in the project area. These lines could be obstacles to the movement of the cranes used for turbine tower installation. Distribution lines generally range from 20 to 50 feet above the ground. The smaller cranes needed to unload turbine components and the largest crane that would be used to lift turbine and blade sections in place are much taller. Arrangements with the electric distribution utility that provides service in the area could be necessary to in order to cross under these lines or to work with large equipment in the vicinity of the lines. Part of the proposed project area is in the distribution service territory of Wisconsin Power and Light Company (WP&L), and part is in the service area for Wisconsin Electric Power Company (WEPCO).

It is likely that some distribution lines temporarily would be taken out of service to allow for movement of the crane along the optimal access paths. The types of distribution lines that Forward might need to take out of service would be the smaller distribution lines that serve one or a few homes. Forward does not expect that any of the larger distribution lines would need to be taken out of service. Rather than disconnect the larger distribution lines that are responsible for providing service to larger numbers of homes and businesses, the boom of the crane would be lowered onto a trailer or disassembled for relocation at the next turbine site.

In the event that distribution service needs to be interrupted, Forward would consult with the local distribution company (either WP&L or WEPCO) and any residents who might temporarily lose electric power before the line would be taken out of service. The duration of the service outage would likely be a few hours, the time needed to allow the crane to pass. Forward would follow the local distribution utility's required procedures for disconnecting and reconnecting service.

5.10 VISUAL RESOURCES AND AESTHETICS

Concerns about aesthetics or changes in the local visual environment are commonly raised when new wind energy facilities are proposed. The size, scale and high-tech appearance of modern wind turbines can cause them to stand out against the backdrop of the rural open landscapes in which they are generally sited. Personal feelings about wind energy technology and the surrounding environment can also contribute to how wind energy facilities are visually perceived.

This section describes the existing visual environment within and around the Forward project area. It also discusses the potential physical changes in the existing visual environment that would result from construction of 133 turbines that would be up to 398 feet tall and located as shown on the proposed turbine siting map, Figure Vol. 2-1A and 2-1B. No qualitative assessment or conclusions are provided in this section. This is because many factors, as well as individual ideas and experiences, would determine how a wind energy facility such as the Forward project was aesthetically perceived.

This discussion on visual impacts is based on two visits to the project area in fall 2004, one visit in spring 2005, and on photo simulations provided by the applicants and citizens in the area. It was written with several basic assumptions in mind. These assumptions are listed below and discussed in the following sections.

- Different types of viewers may have different levels of visual sensitivity.
- The setting can influence the degree of visual impact.
- The viewing conditions can influence the degree of visual impact.

It should be acknowledged that no existing wind turbine project in Wisconsin is as large in scope as the Forward project, or has turbines as tall as those proposed by Forward.[90] In addition, many of the larger wind turbine projects that have been built in other Midwest states or regions of the U.S. have been constructed in areas with lower population densities than those found in the Forward project area. For these reasons, it was difficult to relate some of the visual analysis techniques and conclusions from other projects to the Forward project.

5.10.1 Current landscape views

The Forward project area encompasses approximately 32,400 acres of east-central Wisconsin. The topography within the project area is mostly gently rolling to flat. Two primary north/south ridges separated by a shallow valley are the prominent topographic features. The elevation on the eastern and western "ridges" varies from about 900 to 1,132 feet above mean sea level (MSL). Most of the proposed turbine sites are more than 1,050 feet above MSL. Scattered small woodlots and lines of fencerow trees are located throughout the project area.

While primarily rural in nature, the project area contains several villages supporting residential districts, commercial districts and industrial facilities. Brownsville, the largest community in the project area has a population of approximately 570. Two other communities, Oakfield and Lomira that abut the project area boundary, have populations of 1,000 and 2,300 respectively.

The primary land use is agriculture, with an average farm size of approximately 200 acres. Scattered among the farmsteads in the rural areas are small clusters of newer residences, many of them constructed within the past 10 to 15 years. In addition to the many county and town roads within the project area, a substantial amount of traffic passes through the area on STH 49 and along its eastern edge on STH 175 and USH 41. A state-owned bicycle trail, the Wild Goose Trail, which runs in a northeast to southwest direction just west of the Niagara Escarpment, passes within a mile of several proposed turbine sites near the community of Oakfield.

At the present time, whether passing through the project area or residing within its boundaries, the dominant visual environment consists of rural farmscapes comprised of fields of row crops and pasture, small woodlots, farmhouses, barns, and other outbuildings. The tallest features currently include silos, two transmission lines (a 69 kV line along CTH V and a 138 kV line near the eastern project area boundary), and several types of communication towers, including microwave towers and cell towers.

The overall landscape is visually pleasing; its gently rolling topography, farm fields, and scattered woodlots are a typical sight in the state of Wisconsin and other portions of the Midwest. While the area's proximity to several unique natural features such as the Niagara Escarpment and the Horicon Marsh enhance its aesthetic appeal, the area itself does not contain elements of exceptional scenic beauty. Some views of the existing landscape in the project area are shown in Figures Vol. 2-6 through Vol. 2-9.

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90 The combined Kewaunee/Rosier projects support a total of 31 turbines that are approximately 290 feet tall and the Montfort project has a total of 20 turbines that are 330 feet to the blade tip.

Figure Vol. 2-6, looking northeast from the intersection of Centerline Road and STH 49, is a common view showing a mix of row crops and small woodlots. Figure Vol. 2-7**,** looking north on CTH Y, shows the existing 138 kV transmission line ROW and adjacent cropland and woods. The proposed interconnection substation would be built north of the woodlot. The cluster of homes shown in Figure Vol. 2-8 is on the south of CTH Y across from the 138 kV transmission line. This photo illustrates a fairly typical mix of old and new homes. A microwave tower is in the background. Figure Vol. 2-9 is a view looking east on CTH Y from the intersection of Kinwood Road and CTH YY. A 300-foot tall cell tower is about one-half mile in the distance. The proposed ROW for the overhead 34.5 kV line would be parallel to the CTH YY on private property.

5.10.2 Potential visual impacts from the project

If the Forward wind project is approved and constructed, the presence of the turbine towers and blades would result in permanent changes in the visual environment. Many of the turbines, laid out in asymmetric strings along the ridge tops, would be visible for many miles. In addition, the construction activities associated with the wind generation project would add a new dimension to the rural landscape and temporarily alter the visual environment as trucks, heavy machinery, and construction workers enter the project area to install the turbines in a relatively short time-frame.

5.10.2.1 Potential visual impacts during construction

The number and size of trucks entering, traversing, and leaving the project area would increase substantially during the construction period. Because of the presence of the rock quarries and gravel operations in the northwest part of the project area, large dump trucks are a common sight. However, the number of trucks traveling area roads in order to provide gravel and other materials for the access roads would be much greater. Concrete trucks would also be a common sight during construction, as would the grading and trenching machinery that would be used to install the crane pads and underground 34.5 kV electric cable collector system. (Section 6.5.2 provides a detailed description of the underground collector system and how it would be installed.)

The trucks that would be used to deliver the turbine components, including tower sections, the nacelle, the hub assembly, and turbine blades, would be very large (see Section 5.8). Smaller cranes would be brought in to unload turbine components, while much larger cranes would be needed to complete the turbine installation. The primary lift crane used in the construction process would be in the 400- to 500-ton size range with a 220-foot tall main boom and a 120-foot luffing jib.

For the duration of the construction period, the rural landscape within the project area would take on a more industrial character as the heavier truck traffic moves about and the profile of backhoes, cranes, and tower components become a common sight.

5.10.2.2 Potential impacts during operation

The visibility and the aesthetic effects of a particular wind energy project will depend on many factors, including tower height and color, proximity to residences and roadways, local terrain, tree coverage in the area, and lighting requirements. Also, as mentioned above, the type of viewer and the viewing conditions can also influence how the turbines are perceived visually. Examples of how different types of viewers, different viewing conditions, and varying landscape settings can affect the visibility of the wind energy project are discussed below and illustrated in color photos and photo simulations in Volume 2.

Residents who live in close proximity to one or more turbines may perceive the turbines as an intrusion on the rural landscape. Conversely, someone who resides outside of the project area and is traveling past on a nearby roadway may find that the turbines provide interest or visual relief in an otherwise typical Wisconsin landscape. Differences in aesthetic perception may also be found within the project area. Landowners that host one or more turbines may view the turbines in a positive light because they are providing income and ensuring some level of financial stability; alternatively, landowners that live in close proximity to turbines sited on adjacent properties may feel a loss of control over their visual environment and a sense of helplessness to restore their former familiar surroundings. Because of the size of the structures, it would not be possible for adjacent landowners to easily mitigate the visual changes that would occur.

Although the closest turbines are nearly 1.5 miles from Horicon Marsh, the potential for turbines to be visible from the Marsh raises concerns regarding aesthetics and public perception about the Marsh's function as a bird and wildlife sanctuary. Regardless of the project's actual impacts on bird mortality, the sight of turbine strings on the eastern horizon could project an image that seems incongruous with the primary purpose and function of the combine Horicon Marsh State Wildlife Area and Horicon National Wildlife Refuge. Figure Vol. 2-13 is a photo simulation, provided by citizens in the project area and verified by PSC staff, showing a panoramic view looking east while traveling on STH 49 as it passes through the northern half of the Refuge.

Sky conditions can also affect the visibility of the turbines. An overcast sky can reduce the visibility and prominence of a group of turbines on the horizon, as compared to viewing them against a bright blue sky. This difference in contrast can be seen in the photo simulations provided by Forward, in which nearly all of the base photos were taken under mostly overcast conditions, versus some photos taken by Commission staff near the Montfort wind project in summer 2004 on a clear day. Figures Vol. 2-14 through Vol. 2-19 illustrate the visual differences related to sky conditions.

5.10.3 FAA lighting requirements

The visual effects of the turbines at dusk and after dark must also be considered. Under dusk conditions, when backlit, the turbines are quite prominent against the darkening sky (see Figure Vol. 2-20). After dark, although the outline of the turbine towers and blades may be indistinguishable against the night sky, some of the turbines would have flashing red lights mounted on the nacelles to ensure that they are visible to aircraft. These lighted structures would be very conspicuous in an otherwise dark night sky.

The final determination regarding the exact number and locations of the towers that would be lighted and the specific lighting design to be used would be made by the Federal Aviation Administration (FAA).[91] Forward has begun discussions with the FAA, but the exact location of all of the turbines must be submitted to the FAA before a final decision would be made. When the final location of all turbines is known, Forward would provide the latitude and longitude of each turbine and the FAA would decide the specific number of turbines that must be lighted and the type of lighting required.

Forward has stated that it would recommend the use of L864 flashing red lights with the shortest possible flash time and the longest possible duration between flashes. This recommendation is based on minimizing avian and aesthetic impacts. It also would recommend that only the turbines that comprise the outside perimeter of the project area be required to have lighting. This is typical of what the FAA

[91] The FAA determines warning light requirements for any structure over 200 feet.

has required at some other wind project locations.[92] However, because of the presence of the six private airstrips within the Forward project area, the lighting requirements may be more complex.

The American Wind Energy Association (AWEA) recently announced that the FAA may soon be ready to release a new set of recommendations for lighting wind farms that will require fewer lights. The Department of Energy's National Renewable Energy Laboratory (NREL) funded an FAA study to determine the most effective and efficient lighting techniques for wind projects. A central concept of the study was to treat wind energy projects as a single large obstruction, rather than as a number of individual hazards. The study evaluated existing wind farms with different lighting patterns from the air and attempted to determine which lighting configuration would allow a pilot to see the obstruction, understand it, and move around it. Initial findings indicate that:

- Lighting the perimeter of wind projects with simultaneously flashing lights is sufficient to indicate one large obstacle to pilots.
- No daytime lighting is needed.
- Only one light on a lit nacelle is needed (rather than dual lights).

The FAA study was prompted by the AWEA and the DOE in the hope that new lighting recommendations would make wind farms less visible at night and therefore, easier to site. However, until the new recommendations are published in a revised FAA Obstruction Lighting Circular, regional FAA Obstruction Hazard Analysts would continue to use existing guidance to determine lighting requirements.

5.10.4 Conclusion

In summary, the Forward wind energy project, consisting of approximately 133 turbines that are approximately 389 to 398 feet tall at the blade tip, would significantly change the existing visual landscape in southern Fond du Lac County and northern Dodge County. Due to the size of the individual structures and the design of the proposed turbine layout, many people would view the turbines as they reside in, travel through, or visit the project area during daylight hours. The sleek white or gray turbines would contrast with the rolling hills, crop land, and barns. After dark, a number of the turbines would likely support red flashing lights that will be visible against the night sky. Exactly how these visual qualities would affect aesthetic perceptions of the area is a personal matter based on individual experiences, knowledge, and feelings.

5.10.5 Mitigation of visual impacts

In recent literature, one of the most common methods cited for minimizing aesthetic impacts of wind farms is to select an appropriate design. Using turbines of the same size and type and spacing them uniformly generally results in the most visually acceptable project. Because of the need to efficiently collect the energy output from multiple turbines and transfer it to the local electric transmission or distribution grid, turbines are often placed in rows with a sufficient distance between turbines to maximize wind speed and flow through the blades. For smaller projects (25 turbines or less), this type of arrangement makes the group of turbines appear compact and organized; it defines them as a unit.

[92] At the Montfort wind project in Iowa County, Wisconsin, eight of 20 turbines are lighted. At the Buffalo Mountain Wind Farm in Tennessee, Forward indicates that only six of 15 towers have lights.

Larger formations of turbines (more than 25), while basically laid out in strings or rows, appear more asymmetrical and less compact. Projects as large as the proposed Forward wind project, that are sited in populated areas, can literally surround communities or clusters of homes, such that from a single observation point, turbines are visible in several directions.

As mentioned earlier in this section, mitigating the visual impact of an individual turbine or a cluster of turbines by attempting to install a visual screen is somewhat difficult due to their size and movement. The farther one is from a turbine or a string of turbines, the easier it would be to screen them from view by planting trees, especially conifers, or installing a fence, garage, or other structure.

CHAPTER

6

Chapter 6 – Generation Interconnection and Transmission Facilities

6.1 INTERCONNECTION REQUIREMENTS

The Commission requires that an applicant for a power generating facility submit an interconnection study as part of its application for a CPCN. The Midwest Independent System Operator (MISO), the entity that has ultimate responsibility for regional transmission planning and operation also requires such a study. To complete an interconnection study, an applicant must contact American Transmission Company (ATC) and provide detailed information about its proposed generating facility. The study, conducted by ATC, assesses the impact of interconnecting the proposed generating plant to the regional and statewide transmission grid. The study can identify transmission equipment and system upgrades needed to support the interconnection and any other upgrades needed to dispatch the power that would be generated to the entities that have signed purchase power agreements with the power plant developer.

The Final Interconnection Facility Study Report for 200 MW Wind Generation in Fond du Lac County, Wisconsin MISO # G368 (#379009-03), which was prepared for the MISO, was completed by the ATC on October 21, 2004 and posted to their website. The detailed report summarizes the impact of the 200 MW wind turbine generating plant on the existing electric transmission system in the Fond du Lac and Dodge County areas. All relevant MISO adopted National Electric Reliability Council (NERC) reliability criteria and the ATC contingency criteria were met for the analysis.

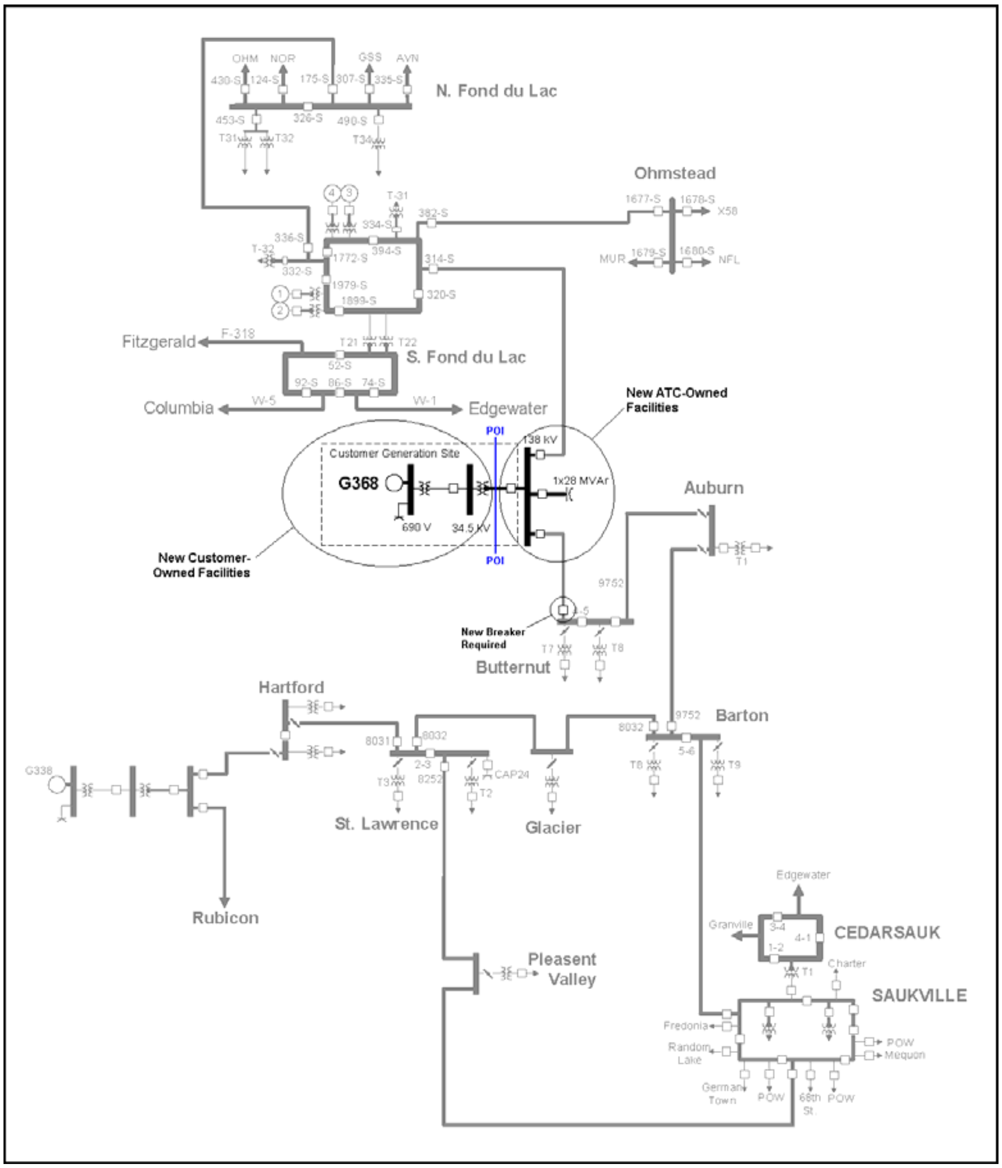
Transmission lines and substations provide the necessary support to deliver power to meet customer's load requirements. The transmission system must provide the four basic requirements listed below. These requirements are addressed by the studies that ATC completes for potential power plant developers:

Thermal Requirements – this defines the system capacity to not overheat and damage equipment or violate safety code clearances.
Voltage Levels – the system must maintain a proper range of transmission voltages during various load and generation levels, including under system contingencies.
System Stability – this defines the ability of the specific generator and other regional generators to stay synchronized with each other and not trip off line due to faults, power surges, etc.
Breaker Duty – this determines the ability of the circuit interruption equipment to remove faults from the system quickly and not allow equipment damage while maintaining system integrity.

Forward has selected the GE 1.5 MW unit with a low voltage "ride-through" feature for the project. This turbine selection would enable a substation with a 138 kV straight bus configuration to be placed on the existing 138 kV line (line 33542) between the South Fond du Lac and Butternut Substations. Figure 6-1 is a one line diagram of the system after the addition of the GE Wind 1.5 MW generator units.

The selection of the GE unit is critically linked to the required upgrades. No new distribution or transmission lines would be required, beyond the 34.5 kV underground and overhead collector circuits. However, the study found that the Forward project would not have the capability to continue operating if multiple primary faults occur due to the loss of a critical network line. Therefore, ATC would require that the wind generation units have better "ride through" characteristics to enable them to continue operating if low voltage situations arise. A detailed explanation of this potential problem and how it would be remedied is in the following section.

Figure 6-1 One line diagram of the area transmission system after the addition of the Forward wind project (shown as G368)



Forward would be responsible for the equipment on the "generator" side of the "Point Of Interconnection" to the ATC transmission system. This includes a high-side disconnect switch and circuit breaker, a substation transformer, and all of the 34.5 kV lines and apparatus. Relaying would be required at the substation to maintain appropriate system voltage whenever the wind turbines trip off-line. The 138 kV circuit breakers at the substation must be 3 cycles or faster.

Some operating restrictions for the wind generating facility have been identified due to multiple thermal constraints under some contingencies. These will be summarized later in this section.

Cost responsibilities for the required upgrades initially fall on the customer and not ATC. This practice avoids placing ATC at risk for generation investments made by others. The developer would be reimbursed by ATC after the generating plant successfully begins operation. Transmission costs are ultimately borne by the transmission customers.

6.2 GENERATION CHARACTERISTICS

The interconnection study has the maximum output of the Forward project rated at 200 MW. This would indicate that a maximum of 133 1.5 MW units can be operating at full capacity at any one time. Any additional capacity added in the area would require a new interconnection study.

The GE 1.5 MW turbine is a doubly-fed three-phase asynchronous induction generator. The three blade rotor has active individual blade pitch control, yaw control, and operates through a three-step planetary spur gear system. The variable speed control captures more energy and minimizes drive train loads, but does not provide 60-cycle power.

Asynchronous induction generators do not have a reactive power control system when compared to synchronous generators. Controlling the voltage and reactive power is accomplished in a different manner. The variable speed input is managed through a pulse-width modulated frequency converter. A unique dynamic power conversion system provides some reactive power to the grid and manages it in fractions of a second. This helps maintain transmission voltages inside design guidelines during system intact conditions and during contingencies. The general public is familiar with power (watt) losses. There are also var losses that must be compensated for through the use of other generators, capacitor banks, or other reactive devices.

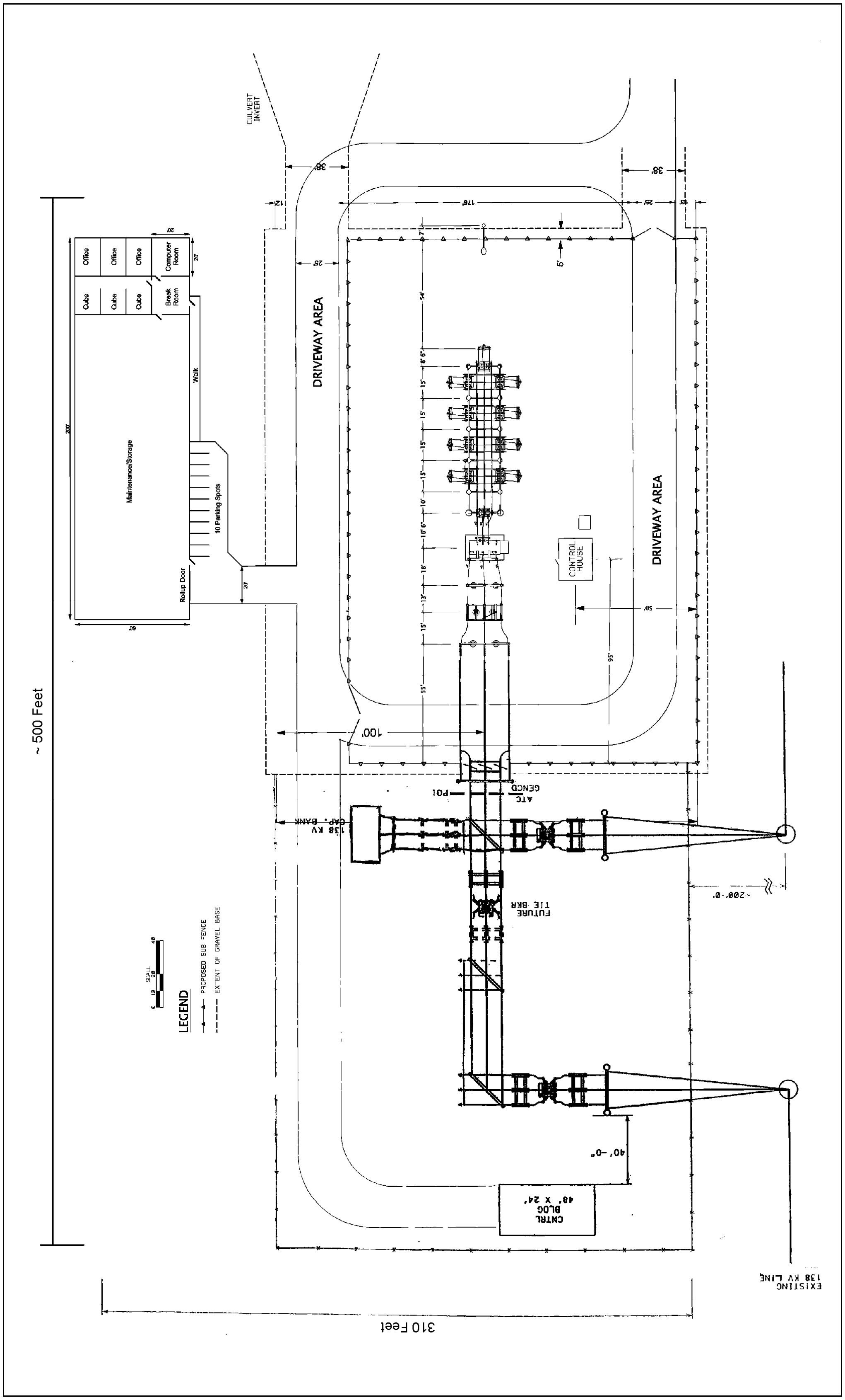
Many induction generators with wind turbines cannot stay synchronized with the transmission system during some normally expected transmission contingencies.

The generators selected for this project would have a special low voltage ride-through capability that would allow them to stay connected to the grid during short low voltage transient events.

Each unit generates 3 phase at 670 volts. Each generator's output would be stepped up to 34.5 kV with a transformer placed at the foot of each tower.

An electric "collector system" would bring the power to the substation. Each generator can function independently. No customer loads would be connected to the 34.5 kV collector systems. To minimize cable size, costs, and electrical losses, the underground system would be connected to a double-circuit 34.5 kV line. At the substation, the two overhead circuits and some of the easternmost underground collector cables would be joined. The power would then be stepped up, via a transformer, to 138 kV and connected to the transmission system. See Figures Vol. 2-1A and Vol. 2-1B, and Figure 6-2.

Figure 6-2 Scale drawing of the proposed substation and O&M building



6.3 SYSTEM UPGRADES

6.3.1 System Upgrades required before start-up of the Forward project

The March 2004 update to ATC's 2003 10-Year Assessment lists the need for two capacitor banks in the area to maintain proper voltage performance. These banks must be in service before the operation of the Forward project and are listed in Table 6-1.

Table 6-1 System upgrades required prior to the start-up of the Forward project

Location	Equipment
Hartford	138 kV, 1 x 13.2 MVAR capacitor bank
Burlington	138 kV, 1 x 28 MVAR capacitor bank

6.3.2 Upgrades required after start-up of the Forward project

6.3.2.1 Voltage related

One 138 kV 28 MVAR capacitor bank is required at the substation to maintain the correct voltage performance with the new wind generation. The GE units must have the Low Voltage Ride Through (LVRT) Option installed.

6.3.2.2 Stability related

The circuit switcher at the Butternut Substation for the existing 138 kV line must be replaced with a 3-cycle circuit breaker. No other stability related upgrades are required for the addition of 200 MW of GE 1.5 turbines.

6.3.2.3 Breaker duty related

No upgrades are required and a study was not performed. The evaluation of the short-circuit violations after the addition of the Forward generation project was not required due to the fact that induction generators typically contribute significant short-circuit current only within the first 1 to 1.5 cycles after a fault.

6.3.2.4 Thermal overload related

The two South Fond du Lac 138/69 kV transformers were shown to have overloaded for single contingencies. The transformer ratings were recently reduced, but ATC will perform an upgrade of these units to full capability of 125/140 MVA summer normal/emergency. No optional thermal upgrades are provided.

Table 6-2 summarizes the required equipment and upgrades needed to operate the Forward project at full capacity.

Table 6-2 Required equipment and upgrades for the Forward project

Location	Equipment	Cost Estimate
Interconnection Point	GE 200 MW at 0.99 leading power factor	N/A
Each generator	GE Low Voltage Ride Through option	N/A
Proposed Substation	138 kV, 1 x 28 MVAR capacitor bank	$500,000
Proposed Substation	138 kV straight bus with 4 circuit breakers	$2,600,000
Butternut Substation	Replace circuit switcher on terminal of line 33542 with 3-cycle breaker	$350,000
	Total cost	$3,450,000

6.4 OPERATING RESTRICTIONS

The Forward project would be connected into a looped 138 kV transmission line, which would provide two power outlets. The area transmission system has limited capability to reliably carry the power output under "double contingency conditions." The interconnection study identified 13 prior outage elements (11 lines and two transformers) that could cause overloads if certain other lines or transformers go out of service. This is known as a double contingency situation. Several of the overloaded elements identified in the double contingency portion of the thermal analysis are not scheduled to be upgraded in ATC's 10-Year Assessment Report. Other elements are scheduled for upgrades that would alleviate some of the identified thermal overloads. Until the necessary upgrades are implemented to resolve the double contingency thermal violations, the Forward project would require restrictions on unit output as listed in Appendix D of the Final Interconnection Report.[93] This section of the Interconnection Study can be found in Appendix D of this final EIS.

6.5 ENVIRONMENTAL IMPACTS OF INTERCONNECTION FACILITIES

6.5.1 Substation

As discussed earlier in this chapter, the Forward project electrical system would consist of the wind tower generators, pad-mounted transformers at the base of the tubular towers, connected underground 34.5 kV electric cable systems, an overhead 34.5 kV electric line, and a substation for interconnection to the adjacent 138 kV transmission system owned and operated by ATC.

6.5.2 Underground collector system

As discussed earlier in this chapter, the 690 volt/34.5 kV transformer for each wind-powered generator would be mounted on a concrete pad adjacent to the base of the tower. The concrete pad for a pad-mounted transformer typically would be about five by five feet and would be approximately five feet from the base of the turbine tower. The exact distance from the tower base would be determined once the final tower foundation was installed. Most likely, the pad would be located near the tower access road and would be part of the area disturbed by construction of the tower and road.

[93] The final Interconnection Report is Appendix I in the Compendium of Supplemental Filing Information and the Application for the Forward Wind Energy Center

The 34.5 kV side of the transformer at the foot of the turbine tower would be connected to three underground collection system cables that would run underground to the overhead collection system. The overhead line would proceed directly to the proposed interconnection substation near the east end of the project area. The various collector circuits would be routed as shown in Figure Vol. 2-3.

The underground collection system lines are likely to run adjacent to access roads; however, the exact path of any particular collection line between turbine towers is not yet known. Some flexibility in routing the underground collection system lines is needed so that Forward can find the best place to bore under any streams, as necessary, or the best route to avoid disrupting crop growth during the construction season.

Three archeological sites listed with the WHS are potentially in the path of the collection lines. As discussed in the "Cultural Resources" Section 4.6, adverse impacts to archeological sites must be avoided. The need to protect these known archeological resources would affect how the line was routed at those locations. Other known archeological sites are also in the proposed project area, and if the collection line paths are altered from the lines represented in Figure Vol. 2-3, these sites would also need to be monitored.

Figure 6-3 Typical trenching machine for installing the underground electric cable system

A trenching machine would be used to install the underground collector cables, as illustrated in the photograph in Figure 6-3. This photograph also illustrates the general shape, depth, and width of the trench that would be created to bury the cables. The cables would be buried well below the plow depth in an agricultural field. The trenching machine would install the collection system in one continuous operation.

Each circuit (consisting of three cables) would require a trench about 12 inches wide. In places where multiple circuits run parallel to one another, four feet of separation between circuits may be required. For example, two parallel circuits would require a total of six feet of ROW (two 12-inch spaces plus four feet of separation). The construction ROW path would be about eight feet wide, to accommodate the trenching machine and a lead vehicle with the reel of cable. The trench installations would end at the junction "transfer places" described in Section 6.5.3 below.

There are places where two or more sets of cables might be installed parallel to each other, instead of being joined into one larger set of cables with greater ampacity, or ability to carry current.

In general, the underground collector cables would connect a series or "string" of turbines. As the collector system runs along the string of turbines and more energy inputs enter the collector system, the diameter of the cables would increase, as well as the cable ampacity (ability to carry current). The more turbine outputs collected, the greater the ampacity of the underground collector cables. At Turbine 19 the electric output from two lengthy strings of turbines would be joined. From that turbine to the westernmost proposed transfer point, it may be reasonable to have two parallel sets of three-cable systems.

Another likely place where two or more three-cable paths might be installed parallel to each other would be where the cables are converted from underground to overhead facilities. Near the westernmost transfer area, more than one riser structure (see Section 6.5.3 below) would probably be needed to handle the underground to overhead conversion from the five-plus strings of turbines. The three-cable (single circuit) underground collector systems from different strings could be joined to the overhead system at different riser poles. To achieve this, however, the cable circuits would have to run parallel along the overhead line for a short distance or angle toward the overhead line to get to the next available riser structure along the line in the transfer area. Similarly, at the next designated transfer area to the east, four strings of turbine cable collectors would come together. Also, it appears that more than one string of cable collectors would need to be routed directly into the substation in the eastern part of the project area.

Forward states that the number of sets of three cables that would run side by side in any situation would be determined during the detail design phase of the project. This would not occur until the project was approved and the 133 turbine locations were known. In general, the underground collection system routes would be determined by attempting to:

1. Minimize trenching and cable length.
2. Minimize crop disruption in consultation with the landowner.
3. Avoid stream and wetland crossings.
4. Utilize existing farm roads or access roads.

Forward has indicated that it is continuing to try to optimize or minimize environmental impacts of the electricity collection system by looking to see if there are better, overhead paths to follow. At this time, however, the system is planned as described and shown in Figure Vol. 2-3.

When installing the underground collection system, Forward intends to avoid impacts to wetlands and surface waters by directionally boring under such areas. For the borings, an additional 60 by 60 feet of extra work space would be required at the entry and exit positions of the bore. In this work space, the entry and exit pits would be excavated and the equipment necessary would be positioned for the excavations and for drilling and running the underground cable. A typical bore under a stream is described in Section 4.4, and an illustration of a typical bore can be found in Figure 4-1.

In areas where the bedrock is close to the surface, it would be excavated if it was weathered. Forward indicates that there would be no drilling, blasting, or hammering on the bedrock, so there should be no fracturing during installation of the lines. The cables would be placed on a gravel base in the utility trench with recompacted natural soils placed above to limit infiltration of surface water. They would not be installed directly in bedrock.

6.5.3 Junctions and risers – "transfer" locations

As discussed above, at certain points in the collection system the electricity generated by a group of towers would be aggregated at a junction of some kind. There are apparently three "transfer" locations where the 34.5 kV underground electrical collection systems would be brought aboveground on "risers" mounted on wood poles, and connected to the overhead 34.5 kV line. The proposed locations for these transfer points are along Kinwood Road and CTH Y, as shown on the map in Figure Vol. 2-1A, and at the new substation near the east end of the proposed project area. A transfer location could include several riser poles along the overhead 34.5 kV line route (see next section), separated by normal 34.5 kV line spans between poles.

Each riser pole would be about 45 feet in height. A diagram of a typical riser structure is shown in Figure 2.5.

Construction for each riser would involve auguring a hole for the wood pole and using a crane to set the pole in place. The remainder of the hole would be filled and compacted, and insulators would be installed on the pole. With the insulators in place, the underground collection wires would be brought out of the ground at the pole, installed through a metal tubular attachment on the riser pole, similar to Figure 2-5. On the upper portion of the pole, the cables would emerge from the tube, be attached to the insulators, and become part of the 34.5 kV overhead circuits that extend to the proposed substation.

Construction of the transfer point riser structures would require equipment such as a backhoe, a crane, a flatbed truck for material delivery, and crew trucks. The construction area would disturb an area approximately 50 by 50 feet (2,500 square feet). Laydown areas for parts would be within the overhead line construction ROW.

6.5.4 Overhead 34.5 kV line

The overhead 34.5 kV line would start where the underground collection system (described above in Section 6.5.2) was brought aboveground at the westernmost transfer location. The line would end in the new Forward project substation, described in Section 6.5.1. It would run generally from west to east for a distance of approximately five miles. The line would parallel Kinwood Road and CTH Y for about 3.33 miles, from the westernmost transfer location through the village of South Byron. The line would then jog northward along Hickory Road for about 0.76 mile. From that point, the line would run eastward for about 0.92 mile along West Byron Road to a point about 235 feet east of the existing ATC Butternut-South Fond du Lac 138 kV transmission line. From there, it would parallel the transmission line south for about 880 feet, underground, and enter the new substation. The location of the new 34.5 kV overhead collector line route is shown in Figure Vol. 2-1A.

The overhead line ROW width would typically be twenty feet for the permanent power line easement and up to thirty feet during construction to allow for passage of vehicles. Part of the ROW would probably overlap the road ROW along CTH Y, Hickory Road, and West Byron Road.

The method of construction and the final appearance of the overhead line would be similar to the 34.5 kV line shown in Figure 2-6. The standard poles for the 34.5 kV overhead line would be about 45 feet tall but would not have the riser equipment described in Section 6.5.3.

The proposed route for the line is along and across land designated for agricultural use. It would extend along or through about 24,300 feet (about 4.6 miles) of agricultural land in 38 parcels. Along Hickory Road, the line would pass through approximately 340 feet of woodland. The line would cross Kummel Creek or its tributaries in three places in Fond du Lac County, but the poles, construction equipment, and other materials would be kept out of the creek. The construction activities would be limited to areas on either side of the creek. No impacts on the creek or its tributaries would be expected. The line also would not appear to affect any wetlands or listed archeological sites. The line would pass by the northern end of the Mittelstadt north-south airstrip in Section 36 of the town of Oakfield in Fond du Lac County. Forward has stated that it would discuss aviation requirements with the airstrip owners and put aviation marking balls on the line, if necessary, depending on the distance between the line and the end of the runway.

The proposed right-of-way passes through the village of South Byron. Residents and the town government request that the line avoid the village or be placed underground. Forward has indicated that it is willing to work with the town of Byron and the neighboring landowners to find an alternative overhead route that goes north and east of South Byron and avoids the homes located along CTH Y in South Byron. The town of Oakfield has expressed a preference for an overhead line. Forward has also stated that if an overhead solution cannot be found, an underground line through the community of South Byron may be feasible.

An alternative overhead line route that avoids South Byron would affect additional farmland or woodland to the extent that a greater length of the line would be built off of road ROW.

If the line were placed underground along the same route as the proposed overhead line, certain impacts could be expected. The same sections of woodland and farmland would be affected. Construction activities would occur totally within road ROW except for a small stretch on private farmland where the route extends from West Byron Road to the proposed substation site on a privately-owned field. Forward already has an easement for that section of ROW from the landowner, who is also a turbine site host and the owner of the land where the proposed substation has been sited. There would be two stream crossings, at Kummel Creek and a tributary, where the method of crossing would need to be clarified with the DNR. Forward has indicated that standard erosion control measures for construction would be employed along the entire route. The four roads and 24 driveways along the route would be crossed by trenching and subsequent repair of the road surface.

Any power line carrying current would generate electric and magnetic fields (EMF). The EMF associated with the overhead 34.5 kV line and other collection and transmission facilities is discussed in detail in Section 5.9.5.

6.5.5 Substation and O&M facility

As described above, the Forward wind project would be connected to the regional electric transmission system through the existing ATC South Fond Du Lac-Butternut 138 kV line at a new 34.5/138 substation.

The proposed location for the substation is in Section 28 of the town of Byron, between CTH Y and West Byron Road. The access to the substation would be from West Byron Road to the north. Figure Vol. 2-1A shows the proposed location of the new substation adjacent to and west of the Butternut-South Fond du Lac 138 kV electric transmission line.

The graveled and fenced substation area would occupy about 90,000 square feet or about 2.07 acres. In order to make the interconnection, the existing transmission line would be re-oriented on new structures to bring it into and out of the fenced substation area. In addition, the proposed Forward O&M building, a ten-space parking area, and driveways to connect the facilities would be located next to the substation along the road. The environmental effects of the O&M facilities would be similar to those of the substation. Both would be located on what is now agricultural land, resulting in some permanent crop loss. Both facilities would be set back from the road and the new housing that has been developed along CTH Y. A woodland would block some of the view of the facilities from the south. Figure 6-2 is a diagram showing the dimensions of the substation and O&M facilities.

Construction of the substation and O&M facility would not adversely affect surface waters, wetlands, woodlands, or other vulnerable natural resources. A small woodlot located just south of the site would not be affected. Landscaping adjacent to the new substation fence could be planted to provide some screening of equipment as appropriate.

The new facilities would be constructed using standard construction techniques and equipment. Construction activities would include grading of the substation and O&M site, installation of the substation and O&M facility, connection to the collection circuit system and the existing transmission line, and testing. Construction debris would be segregated and collected in containers for off-site disposal or recycling. Appropriate soil erosion control measures would be used in areas of soil disturbance. The area adjacent to the substation would be returned to agricultural use after construction was complete.

The substation would be considered a small distribution substation. The EMF related to the substation facilities is discussed under "Health and Safety" in Section 5.9.5.

6.5.6 Related transmission upgrades

The Forward project would not require any new electric transmission lines to interconnect to the existing electric transmission system. It would be connected to the existing ATC Butternut - South Fond du Lac 138 kV line. ATC would construct and operate the new substation where the interconnection occurs.

ATC would also be responsible for any related transmission upgrades. At the existing Butternut, Hartford, and Burlington Substations, where some upgrades would be needed, all work would occur within the existing fenced areas. Existing access roads would be used to reach the fenced areas to perform the necessary upgrades.

CHAPTER

7

Chapter 7 – Cumulative Impacts

7.1 FORWARD PROJECT PROPOSAL

7.1.1 Potential effect on natural resources

The Forward project avoids any adverse effect on air quality and water resources (surface waters and wetlands), two important natural resources affected by most other generation projects. Also, few if any trees or woodlands would be affected at the turbine sites or during installation of the access roads and the underground electric collection system. Few, if any, effects on wildlife, other than birds and bats, should occur.

The actual long-term impacts that the project would have on bird and bat mortality and/or displacement have been a major issue of concern and discussion throughout the review of this project. These potential impacts are discussed in great detail from several perspectives in Sections 4.11 and 4.12. While bird mortality numbers from other wind farms in the Midwest are relatively low, these projects are not located in the middle of upland foraging areas directly adjacent to a wildlife refuge that offers the acreage and quality of resource habitat provided by Horicon Marsh. Of particular concern are some of the state or federal listed species, whose populations could be adversely affected by the loss of one or more birds. Conducting additional pre-construction studies that provide more detailed information about bird use in the area, restricting construction at proposed turbine sites closest to the Marsh, and minimizing night lighting requirements are some of the suggested remedies to lessen potential bird mortality. Similarly, while the project area itself does not appear to contain a concentration of streams, wetlands and woodlands that may support large numbers of bats, the presence of the Neda Mine ten miles to the south, the largest hibernaculum for bats in the Midwest, raises some concerns about bat movement through the project area. Higher mortality numbers from recent bat studies conducted at wind farms in the Midwest support this concern.

Finally, the potential for creating cracks in the upper bedrock during construction of the project and the further potential for seepage of surface water or other contaminants to enter these cracks and affect the groundwater aquifer is a serious concern. Forward has stated its intent to use construction techniques and other BMPs to avoid any possible impacts on the groundwater that could lead to problems with local wells.

7.1.2 Potential effects on the social environment and community resources

The Forward project appears to be consistent with the future land use plans of all of the affected and nearby communities. It would provide employment of several hundred workers, some of whom may be local, during the construction phase. Six to ten new permanent jobs would be created for operation of the plant. While adding employment and providing shared revenue to local communities, the project and the long-term leases with farm owners would likely help to preserve farmland and the current primary land use, which is farming. While slowing residential development in the project area, the project would likely have little impact on future industrial or commercial growth.

From a health and safety perspective, effects of the Forward proposal should be minimal. Although some complaints regarding noise were acknowledged at the Kewaunee wind farm, the turbines proposed by Forward would operate at slower speeds and be higher off the ground. Forward has stated its intent to mitigate or correct any interference problems that would occur related to communications or television reception. The Dodge County ordinance related to WES and the Conditional Use Permit would require restoration of and compensation for any area road damage caused by construction.

Although it is a major concern of a substantial number of landowners that are not hosting turbines, the effect of the Forward project on property values in the project area cannot be assessed or estimated at this time. Previous studies lacked the details and methodology that would make them useful tools for analysis. Some steps that could be taken to minimize possible adverse property value effects would be to maximize setbacks from non-host residences, implement a property protection plan (see Section 5.6.4), and ensure that the project owner removes the turbines when their operation is no longer economically viable.

Maximizing residential setbacks would also help reduce potential aesthetic impacts from residences. On a larger scale, as proposed, the project would substantially change the overall landscape in the area. This may reduce some residents use and enjoyment of their personal property, while resulting in personal satisfaction or financial benefit for others that view the project as a means of providing clean, renewable energy. Potential effects on local tourism, whether adverse or positive, short-term or long-term, are difficult to ascertain at this time.

While the project is mostly compatible with farming as a land use, the potential adverse effect of the turbines on safety with respect to use of six private airstrips in and near the project area is a serious impact that has not been resolved. These airstrips are currently used for both business and recreational purposes, and maintaining adequate clearances that do not restrict the use of these facilities is important. A discussion of several clearance thresholds and the impacts related to implementing these clearances is found in Section 5.3.4. Application of the most conservative threshold (from FAA Part 77 requirements for public airports) would eliminate a majority of the turbine sites proposed by Forward, resulting in an inability to honor the power contracts that have been negotiated. Similarly, implementation of the turbulence buffer zones, calculated and mapped by the BOA, would eliminate about half of the turbine sites from consideration. Finding a solution that would enable Forward to meet its contract obligations and satisfy the safety concerns of the private airstrip owners in the area is difficult.

In summary, because a wind farm of this size and scale has not been constructed in such a densely populated setting to date, it is difficult to determine the extent of its effects on some natural resources and the surrounding communities. However, the Forward project would definitely have an effect on the area. Alternatively, for Wisconsin utilities striving to meet the Renewable Portfolio Standards established by the legislature and improve air quality in the state, the Forward project provides a clear opportunity. In its final decision, the Commission, based on the record, must balance the potential adverse impacts against the project's potential benefits.

The sections below examine the regional effects of the Forward project in combination with other existing and proposed wind energy projects in the east central Wisconsin region.

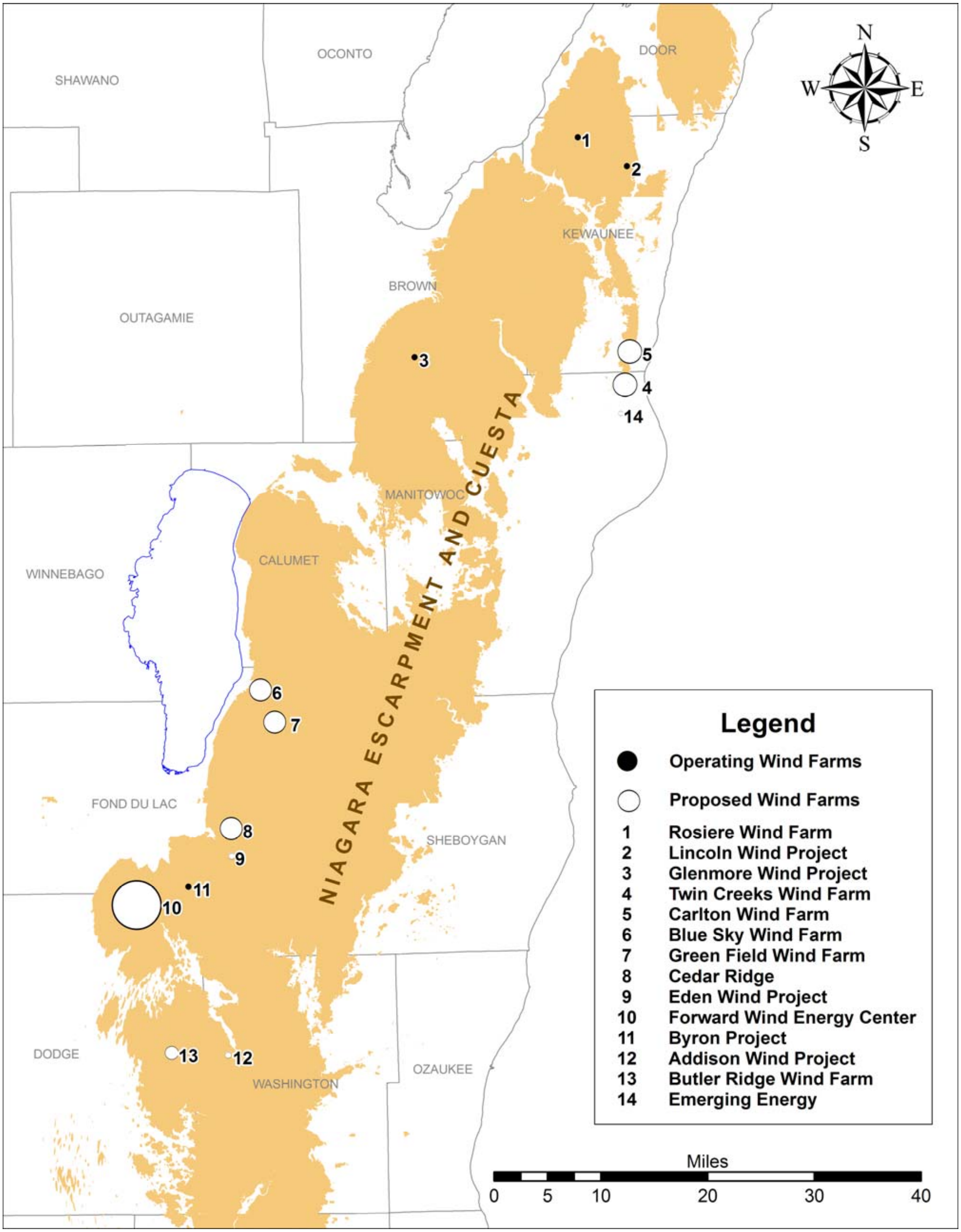
7.2 WIND PROJECTS PROPOSED AND COMPLETED IN THE REGION

Currently, along the Niagara Escarpment there are 35 wind turbines with a capacity of approximately 23 MW. However, through 2007, there are plans for construction of another 405 turbines (including the proposed Forward project) with a capacity of approximately 695 MW (see Figure 7-1). Table 7-1 lists all existing or proposed wind developments for the region.

Table 7-1 Existing and proposed utility-scale wind projects along the escarpment

Map ID	Wind Project	Town	County	Start Date	Number of Turbines	Capacity (MW)
1	Rosiere	Lincoln & Red River	Kewaunee	1999	17	11
2	Lincoln	Lincoln	Kewaunee	1999	14	9
3	Glenmore	Glenmore	Brown	1998	2	1
4	Twin Creeks	Two Creeks & Mishicot	Manitowoc	2006	49	98
5	Carlton	Carlton	Kewaunee	2007	49	98
6	Blue Sky	Calumet	Fond du Lac	2005	44	80
7	Green Field	Marshfield	Fond du Lac	2005	44	80
8	Cedar Ridge	Eden & Empire	Fond du Lac	2006	48	80
9	Eden	Eden	Fond du Lac	2005	2	3
10	Forward	Byron, LeRoy, Lomira, & Oakfield	Dodge & Fond du Lac	2005	133	200
11	Byron	Byron	Fond du Lac	1999	2	1
12	Addison	Addison	Washington	2005	1	2
13	Butler Ridge	Herman	Dodge	2005	33	54
14	Emerging Energy	Mishicot	Manitowoc	2006/2007	7	19.5

Figure 7-1 Existing and proposed utility-scale wind projects along the escarpment



The Forward project is the largest wind development proposed for the Niagara Escarpment. It has the largest number of turbines (up to 133 total) and the tallest turbines (389 feet to blade tip) than any project built to date in Wisconsin. The proposed Twin Creeks and Carlton wind farms are within one half-mile of each other and would have a combined total of 98 wind turbines in Kewaunee and Manitowoc Counties.

7.3 EFFECTS ON STATEWIDE ENERGY SUPPLY

If all wind power projects proposed for construction in Wisconsin by the end of 2005 are actually built, they would add a total of 419 MW of renewables capacity and 1,051,245 megawatt hours (MWh) energy from wind power annually. Currently wind power contributes approximately 107,400 MWh energy from 53 MW of wind capacity.

If other projects known to the Commission and being planned for construction in 2006 and 2007 are built, including some of the proposed projects on or along the Niagara Escarpment, as well as others in the southwestern and west-central regions of the state, the total wind capacity in place in the next 3-4 years could total as much as 961 MW with a projected annual energy production of 2,397,352 MWh or 3.5 percent of 2003 electric retail sales.

This would indicate that by 2008, wind power would contribute one-third to one-half of the 10 percent RPS requirement for 2015 proposed by the Governor's Task Force. In addition to more wind power, other technologies that could be used to make up the balance would include hydropower and biomass.

7.4 ANTICIPATED IMPACTS ON REGION AND AREA COMMUNITIES

The construction of the proposed Forward project and other proposed wind energy projects listed above would have a number of regional and local impacts in the east-central area of Wisconsin. Some of these potential benefits and adverse impacts are discussed below.

In an effort to comply with the Renewable Portfolio Standards recommended by the Governor's Task Force on Energy Efficiency and Renewables, the proposed wind energy projects listed in Table 7-1 and several others are likely to be developed over the next several years. In addition to a greater number of projects, there is trend toward larger projects involving more turbines and higher capacity turbines. These trends will likely heighten the public's awareness of wind energy in Wisconsin and promote more widespread discussion of some of the issues that have been raised in the Forward project, the first large-scale wind development project proposed in the state.

7.4.1 Air quality benefits

A primary reason for the promotion of renewable energy sources and the establishment of a Renewable Portfolio Standard for Wisconsin utilities is to improve air quality and reduce health impacts related to air pollutant emissions, including asthma, mercury poisoning, and lung cancer, among others. Because wind energy does not emit any particulates, criteria pollutants (e.g. CO, NO_x, SO_2) or hazardous air pollutants (e.g. ammonia, benzene, formaldehyde), it does not contribute to problems such as global warming, acid deposition, ozone depletion, or mercury accumulation in fish.

The construction of 695 MW of wind energy along the Escarpment could have a substantial effect on reducing air pollution levels and improving air quality in some regions of Wisconsin. If this same amount of energy was produced by burning fossil fuels, either through combustion of natural gas or burning coal, a large amount of air pollutants would be emitted, even with DNR-required Best Available Control Technology (BACT) installed. The amounts and types of air pollutants that would be offset by using wind energy are discussed below.

The proposed Calpine Fond du Lac Energy Center was approved by the PSC in 2003, but has not been built. This project included two natural gas-fired combustion turbines with heat recovery steam generators and steam turbines capable of producing 523 MW of power, about 175 MW less than the proposed wind projects listed in Table 7-1. The potential criteria pollutant emissions from the Calpine power plant are shown in Table 7-2.

Table 7-2 Potential emission of criteria pollutants from the Fond du Lac Energy Center

Criteria Pollutant	Total Potential Emissions (tons per year)
CO (carbon monoxide)	435.95
NO_x (nitrogen oxides)	266.67
VOC (volatile organic compounds)	72.91
SO_2 (sulfur dioxide)	40.50
H_2SO_4	9.23
PM/PM10 (particulate matter)	212.09

In addition, the selective catalytic reduction technology that is proposed to be installed to reduce the emissions of NO_x would result in the emissions of approximately 173 tons of ammonia per year.

The combustion of coal to produce energy would also result in emissions of the same types of pollutants, but at higher levels. Table 7-3 below shows the emissions proposed to be released by a 500 MW supercritical pulverized coal plant that was approved by the Commission and is currently under construction at the existing WPSC Weston Power Plant site in Rothschild, Wisconsin.

Table 7-3 Potential emission of criteria pollutants from the Weston Unit 4 Power Plant

Criteria Pollutant	Total Potential Emissions (tons per year)
CO (carbon monoxide)	3,421
NO_x (nitrogen oxides)	1,613
VOC (volatile organic compounds)	85.0
SO_2 (sulfur dioxide)	2,266
H_2SO_4	113.3
PM/PM10 (particulate matter)	529.2

In addition, the Weston Unit 4 Coal Plant is expected to emit 0.039 tons per year of mercury.

Thus, the air quality benefits that could be realized by construction of some or all of the proposed wind energy projects are substantial and would likely result in improvements in air quality for the Green Bay, Door County, and Fox Valley areas.

7.4.2 Water-related benefits

Water quantity and quality issues are becoming very important in many communities of Wisconsin. The depletion of local aquifers due to higher water demands has resulted in the need for some private well owners to drill deeper wells. In the east-central region of Wisconsin, problems related to high levels of radium, arsenic, and other contaminants have caused some communities to seek new water supply sources.

Other than a small amount of water needed for mixing concrete and other construction- related activities, as well as some potable water for drinking purposes, wind energy facilities have no need for large quantities of water during construction or operation. This is in strong contrast with the water needs of combined-cycle natural gas-fired power plants and coal-fired plants that rely on high-capacity wells or surface water.

For these power generation technologies, consumptive water use (water loss) from local aquifers or surface water bodies and thermal pollution of surface water bodies are often serious siting concerns. The water for cooling and make-up water for the Calpine Fond du Lac Energy Center would come from a new water intake in Lake Winnebago. Approximately 4.0 million gallons of water per day would be needed for operation of this natural gas-fired plant. Most of that water would be evaporated to the atmosphere through cooling towers rather than returned to Lake Winnebago.

Coal combustion technologies require significantly greater amounts of water. The approved Weston Unit 4 Plant would require approximately 6.0 million gallons of water per day or 2.17 billion gallons annually from the Wisconsin River. Of this total, 5.3 million gallons per day would be evaporated to the atmosphere. The proposed WEPCO Elm Road Generating Station, consisting of two supercritical pulverized coal units, would use once-through cooling in which the majority of the water used during the power generation process would be returned to Lake Michigan at a temperature higher than the ambient Lake water temperature. Each of the 612 MW units would cycle through about 7.00 million gallons of water per day.

Thus, it is clear see that one of the major benefits of wind power generation is that it has no water requirements for operation.

7.4.3 Land use compatibility

Due to the engineering and design requirements for wind generation, the projects are often sited in areas where the primary land use is agriculture. In general, wind farms are a very compatible use of farm land. On an acreage basis, very little land is removed from production and the negotiated easement agreements with farm operators that allow facilities to be sited on their land can provide some financial stability to a business that is subject to many risks. The presence of multiple wind projects in east-central Wisconsin could preserve agricultural land use in this area, if it results in slowing residential growth and suburban development in the rural landscape. For these reasons, it would be important when siting individual turbines, to provide an adequate buffer around communities within a project area. This buffer would allow growth to occur within established communities and provide land to attract new businesses.

It is also important to accurately identify existing land uses, such as private airstrips, which may need buffer distances in order to continue to operate safely.

7.4.4 Aesthetics

Construction of some or all of the proposed wind energy facilities listed in Table 7-1 could result in a major change in the overall visual appearance and aesthetic quality of east-central Wisconsin. As mentioned above, a potential benefit is that the long-term easement agreements associated with construction and operation of the wind turbines could help to preserve prime agricultural lands in the area and slow residential and commercial development. Ironically, while the presence of the turbines guarantees that the landscape remains open crop land or grassland, the presence of the turbines may result in a more "industrial" looking landscape. The large groupings of wind towers and spinning blades would contrast with the backdrop of barns, farmsteads and fields that currently dominate the area.

East-central Wisconsin, unlike some areas where large scale wind farms have been built, is fairly densely populated. The growing interest in siting and building wind turbine facilities in Wisconsin and the trend toward increasingly larger projects and taller turbines with higher capacities suggests that suitable methodologies for assessing the aesthetic impacts and determining effective visual impact mitigation strategies will be very important if wind energy is to gain public acceptance as part of the Wisconsin landscape.

7.5 ANTICIPATED IMPACTS ON WILDLIFE

The Niagara Escarpment is a topographic land feature that contributes to strong wind resources that make wind power projects feasible. As it continues northeast from the Horicon area toward Door County and Lake Michigan, the Escarpment also plays an important role in the migration routes of thousands of birds. In addition, heavy seasonal migrations of raptors and other songbirds are observed along the Lake Michigan shoreline. Several of the proposed wind projects listed in Table 7-1 would be located in or near these migratory corridors (see Figure Vol. 2-5).

While populations of more abundant bird species (geese, blackbirds) may not be adversely affected by these wind projects, it is difficult to predict how rare bird species and populations would be impacted by numerous wind farms located along one or more of the primary migratory corridors in the state. The cumulative wildlife impacts for the region may include significant bird and bat mortalities or impacts to rare bird species.

Siting of wind farms along the Niagara Escarpment should be based on appropriate pre-construction and post-construction studies to minimize the potential impacts to these wildlife species. Results of the studies should be reviewed and considered on a cumulative basis so that the impacts on the region as a whole can be more fully understood.

7.6 LONG-TERM MITIGATION STRATEGIES

The following strategies are suggested for minimizing or avoiding potential impacts of large-scale wind turbine projects. They would address many of the primary concerns that are raised by affected members of the public and local communities.

- Use a neutral gray finish on the turbines rather than white to minimize contrast against the sky, especially when viewed at close-range.

- Design avian and bat studies to incorporate and build on the body of knowledge that has resulted from previous studies. Consider the cumulative or regional impacts as appropriate.
- Utilize new FAA lighting recommendations that provide sufficient lighting for aviation safety but minimize night-time visual impacts.
- Provide a sufficient buffer around communities within and at the edge of a wind project area to allow residential and commercial growth.
- Identify local private airports and provide a sufficient buffer around them to ensure pilot safety.
- Hold the project developer responsible for decommissioning the facilities when the turbines are no longer viable and ensure that adequate funds for decommissioning are set aside within the first ten years of operation.
- Advise the local zoning authority, either the country or township, to adopt a wind siting ordinance. A statewide model ordinance is available from the Energy Division of DOA (www.doa.state.wi.us)
- Consider revising the existing regulatory review threshold so that any wind energy project greater than 20 MW would require state siting approval.

Acronyms

Abbreviation or Acronym	Definition
%	Percent
§	Section
Army Corps	U.S. Army Corps of Engineers
ATC	American Transmission Company
AWEA	American Wind Energy Association
BACI	Before-after-control-impact
BACT	Best available control technology
BCI	Bat Conservation International
BMP	Best management practices
BOA	Bureau of Aeronautics
CBC	Christmas bird counts
CC	Combined-cycle
CFR	Code of Federal Regulations
cfs	Cubic feet per second
ch.	Chapter
CO	Carbon monoxide
CO_2	Carbon dioxide
Commerce	Department of Commerce
Commission or PSC	Public Service Commission of Wisconsin
CPCN	Certificate of Public Convenience and Necessity
CRP	Conservation Reserve Program
CT	Combustion turbine
CTH	County trunk highway
cu. ft.	Cubic feet
dB	Decibels
dBA	Decibels A-weighted
dBC	Decibels C-weighted
DNR	Department of Natural Resources
DOA	Department of Administration
DOE	U.S. Department of Energy
DOT	Department of Transportation
DSM	Demand-side management
EA	Environmental Assessment
EAA	Experimental Aircraft Association
EIS	Environmental impact statement
EMF	Electromagnetic field
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FDL	Fond du Lac County Airport

Abbreviation or Acronym	Definition
Forward	Forward Energy LLC
FWS	U.S. Fish and Wildlife Service
G	Gauss
gal	Gallon
GE	General Electric
GHG	Greenhouse gas
GHRA	Glacial Habitat Restoration Area
GL	
GWh	Gigawatt hour
H_2SO_4	Sulfuric acid
HAP	Hazardous air pollutants
HMSA	Horicon Marsh System Advocates
hr.	Hour
Hz	Hertz
I-39	Interstate highway 39
IG	Impact gradient
Invenergy	Invenergy Wind LLC
IPP	Independent power producer
kV	Kilovolt – 1,000 volts
kW	Kilowatt
kWh	Kilowatt-hour
lbs.	Pounds
LCD	Dodge County Land Conservation Department
LDC	Local distribution company
LLC	Limited liability company
LVRT	Low Voltage Ride Through
MAIN	Mid-America Interconnected Network
MAPP	Mid-Continent Area Power Pool
MBTA	Migratory Bird Treaty Act
mG	Milligauss (equal to $1/1000^{th}$ of a gauss)
MGE	Madison Gas and Electric Company
MISO	Midwest Independent System Operator
MP	Measuring point
mph	Miles per hour
msl.	Mean sea level
MVA	Megavolt amperes
MW	Megawatt
MWh	Megawatt hour
N/A	Not available or not applicable
NAAQS	National Ambient Air Quality Standards
NERC	North American Electric Reliability Council
NEV	Neutral-to-earth voltage
NHI	Natural Heritage Inventory
NO_2	Nitrogen oxide
NO_x	Nitrogen oxides
NOI	Notice of Intent

Abbreviation or Acronym	Definition
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NREL	DOE's National Renewable Energy Laboratory
NSP	Northern States Power
NWCC	National Wind Coordinating Committee
O_3	Ozone
O&M	Operating and maintenance
ºC	Degrees Centigrade
ºF	Degrees Fahrenheit
Pb	Lead
PM	Particulate matter
PM_{10}	Particulate matter less than 10 microns in diameter
PM_{25}	Particulate matter less than 25 microns in diameter
PPA	Power purchase agreement
PSC or Commission	Public Service Commission
PSD	Prevention of significant deterioration
PTC	Production Tax Credit
REPP	Renewable Energy Policy Project
ROW	Right-of-way
RPM	Revolutions per minute
RPS	Wisconsin Renewable Portfolio Standard
RRC	Renewable credits
SCADA	Supervisory control and data acquisition
SEA	Strategic Energy Assessment
spp.	Species (plural)
STH	State trunk highway
SWPPP	Stormwater Pollution Prevention Plan
Task Force	Task Force on Energy Efficiency and Renewables
TCP	Traditional cultural properties
THPO	Tribal Historic Preservation Officer
TMDL	Total maximum daily load
tpy	Tons per year
UL	Underwriters' Laboratory
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USH	United States Highway
VOC	Volatile organic compounds
WCFZ	Worst Case Fresnel Zone
WEPA	Wisconsin Environmental Policy Act
WEPCO	Wisconsin Electric Power Company
WES	Wind Energy Systems
WHS	Wisconsin Historical Society
Wis. Admin. Code	Wisconsin Administrative Code
WisAHRD	Wisconsin Archaeological and Historic Resources Database
Wis. Stat.	Wisconsin Statutes

Abbreviation or Acronym	Definition
WMU	Water management units
WP&L	Wisconsin Power and Light Company
WPA	Waterfowl Production Areas
WPPI	Wisconsin Public Power Inc.
WPSC	Wisconsin Public Service Corporation

Appendix A

Table A-1 Birds observed within the project area by Forward (spring and fall, 2004)

Common Name	Order/Species Name	State Status	Federal Status
Doves	**Columbiformes**		
Eurasian collared dove	*Streptopelia decaocto*		
Ducks, Geese and Swans (Waterfowl)	**Anseriformes**		
American wigeon	*Anas americana*	Special Concern	MBTA
blue-winged teal	*Anas discors*		MBTA
Canada goose	*Branta canadensis*		MBTA
gadwall	*Anas strepera*		MBTA
green-winged teal	*Anas crecca*		MBTA
mallard	*Anas platyrhynchos*		MBTA
northern pintail	*Anas acuta*		MBTA
northern shoveler	*Anas clypeata*		MBTA
snow goose	*Chen caerulescens*		MBTA
tundra swan	*Cygnus columbianus*		MBTA
white-fronted goose	*Anser albifrons*		MBTA
wood duck	*Aix sponsa*		MBTA
Eagles, Kites, Falcons, and Hawks (Raptors)	**Falconiformes**		
American kestrel	*Falco sparverius*		MBTA
bald eagle	*Haliaeetus leucocephalus*	Special Concern	Threatened Bald and Golden Eagle Protection Act, MBTA
Cooper's hawk	*Accipiter cooperii*		MBTA
northern goshawk	*Accipiter gentilis*	Special Concern	MBTA
northern harrier	*Circus cyaneus*	Special Concern	MBTA
peregrine falcon	*Falco peregrinus*	Endangered	MBTA
red-shouldered hawk	*Buteo lineatus*	Threatened	MBTA
red-tailed hawk	*Buteo jamaicensis*		MBTA
rough-legged hawk	*Buteo lagopus*		MBTA
sharp-shinned hawk	*Accipiter striatus*		MBTA
Grouse, Turkey and Quail	**Galliformes**		
ring-necked pheasant	*Phasianus colchicus*		
wild turkey	*Meleagris gallopavo*		
Herons, Ibis, and New World Vultures (Waterfowl and Scavengers)	**Ciconiiformes**		
great blue heron	*Ardea herodias*	Special Concern	MBTA
great egret	*Ardea alba*	Threatened	MBTA
green heron	*Butorides virescens*		MBTA
turkey vulture	*Cathartes aura*)		MBTA

Common Name	Order/Species Name	State Status	Federal Status
Loons	**Gaviiformes**		
common loon	*Gavia immer*	Special Concern	MBTA
Perching Birds	**Passeriformes**		
American crow	*Corvus brachyrhynchos*		MBTA
American goldfinch	*Carduelis tristis*		MBTA
American pipit	*Anthus rubescens*		MBTA
barn swallow	*Hirundo rustica*		MBTA
black-capped chickadee	*Poecile atricapillus*		MBTA
blue jay	*Cyanocitta cristata*		MBTA
Brewer's blackbird	*Euphagus cyanocephalus*		MBTA
brown creeper	*Certhia americana*		MBTA
brown-headed cowbird	*Molothrus ater*		MBTA
chipping sparrow	*Spizella passerina*		MBTA
cliff swallow	*Petrochelidon pyrrhonota*		MBTA
common grackle	*Quiscalus quiscula*		MBTA
dark-eyed junco	*Junco hyemalis*		MBTA
eastern bluebird	*Sialia sialis*		MBTA
eastern meadowlark	*Sturnella magna*		MBTA
eastern phoebe	*Sayornis phoebe*		MBTA
golden-crowned kinglet	*Regulus satrapa*		MBTA
gray catbird	*Dumetella carolinensis*		MBTA
horned lark	*Eremophila alpestris*		MBTA
house finch	*Carpodacus mexicanus*		MBTA
Lapland longspur	*Calcarius lapponicus*		MBTA
Lincoln's sparrow	*Melospiza lincolnii*		MBTA
northern cardinal	*Cardinalis cardinalis*		MBTA
palm warbler	*Dendroica palmarum*		MBTA
pine siskin	*Carduelis pinus*	Special Concern	MBTA
purple finch	*Carpodacus purpureus*		MBTA
red-breasted nuthatch	*Sitta canadensis*		MBTA
red-winged blackbird	*Agelaius phoeniceus*		MBTA
ruby-crowned kinglet	*Regulus calendula*		MBTA
rusty blackbird	*Euphagus carolinus*		MBTA
savannah sparrow	*Passerculus sandwichensis*		MBTA
Smith's longspur	*Calcarius pictus*		MBTA
snow bunting	*Plectrophenax nivalis*		MBTA
song sparrow	*Melospiza melodia*		MBTA
swamp sparrow	*Melospiza georgiana*		MBTA
Tennessee warbler	*Vermivora peregrina*	Special Concern	MBTA
tree sparrow	*Spizella arborea*		MBTA
tree swallow	*Tachycineta bicolor*		MBTA
vesper sparrow	*Pooecetes gramineus*		MBTA
white-breasted nuthatch	*Sitta carolinensis*		MBTA
white-throated sparrow	*Zonotrichia albicollis*		MBTA
yellow-rumped warbler	*Dendroica coronata*		MBTA
Rails, Limpkin, Cranes	**Gruiformes**		
sandhill crane	*Grus canadensis*		MBTA

Common Name	Order/Species Name	State Status	Federal Status
Shorebirds	**Charadriiformes**		
American golden plover	*Pluvialis dominica*		MBTA
black-bellied plover	*Pluvialis squatarola*		MBTA
Bonaparte's gull	*Larus philadelphia*	Special Concern	MBTA
greater yellowlegs	*Tringa melanoleuca*		MBTA
herring gull	*Larus argentatus*		MBTA
killdeer	*Charadrius vociferus*		MBTA
lesser yellowlegs	*Tringa flavipes*		MBTA
pectoral sandpiper	*Calidris melanotos*		MBTA
ring-billed gull	*Larus delawarensis*		MBTA
Wilson's snipe	*Gallinago delicata*		
Tropical Birds, Boobies, Pelicans, Cormorants, Anhinga, and Frigatebirds (Waterfowl)	**Pelecaniformes**		
double-crested cormorant	*Phalacrocorax auritus*		MBTA
Woodpeckers	**Piciformes**		
downy woodpecker	*Picoides pubescens*		MBTA
hairy woodpecker	*Picoides villosus*		MBTA
northern flicker	*Colaptes auratus*		MBTA
red-bellied woodpecker	*Melanerpes carolinus*		MBTA
Total Species Recorded = 89			

American robin, mourning dove, rock dove, European starling and house sparrow were likely present in large numbers, but were not recorded during the survey. None of these species are considered rare.
MBTA = Migratory Bird Treaty Act.

Appendix A

Table A-2 Migration periods for selected bird families or species in the project area

Bird Group/Family	Spring Migration	Fall Migration
geese	begin early March, peak mid March to mid April from 1999-2003 peaks ranged from 3/17 to 3/27	begin mid-September, peak mid October to mid November from 1999-2003 peaks ranged from 10/4 to 11/19
mallard and most other waterbirds	begin early March, peak mid April from 1999-2003 peaks ranged from 4/10 to 4/24	begin late August, peak to late October from 1999-2003 peaks ranged from 8/2 to 11/5
American wigeon	begin mid to late March, peak mid to late April	begin late August, peak late September to early October
red-shouldered hawk	diffuse, early March to early April	most conspicuous throughout October
sharp-shinned hawk	mid March, peak mid to late April	begin late August, peak mid September to mid October
Cooper's hawk	begin mid March, peak mid to late April	no concentrated activity recorded, late August to mid October
double-crested cormorant	begin mid April, peak late April to early May	mid to late September
turkey vulture	early April, peak mid to late April	mid September to early October
eastern meadowlark	begin mid March, peak mid April	begin early to mid September, peak late September to early October
warblers	begin late April, peak mid-May	begin mid-August, peak mid-September
grosbeaks, finches, sparrows, buntings	begin late April to early May, depending on species, peak mid-May	mid- late-August, peak early- through late-September, depending on species
bobolink	begin late April, peak mid May	mid August, peak late August
dickcissel	late May, peak late May or early June	late August

Source: Wisconsin Society for Ornithology and USGS at http://www.npwrc.usgs.gov/resource/1998/stcroix/catharti.htm and USFWS Horicon Wildlife Refuge.

Appendix A

Table A-3 State or federally listed Threatened or Endangered Birds and Special Concern Species that occur or may occur in the project area

Common Name	Species Name	Status State/Federal[1]	Occurrence in or near Project Area
Acadian flycatcher[2]	*Empidonax virescens*	ST	Project area not suitable; heavily wooded areas preferred for nesting are absent, may occasionally occur in woodland fragments during migration.
American black duck[2,3]	*Anas rubripes*	SC	Uncommon at the marsh, but may join with mallards to feed in the surrounding uplands.
American white pelican	*Pelecanus erythrorhynchos*	SC	520 nesting pairs at Horicon Marsh in 2003. Recently returned to the Marsh after decades of absence. Birds primarily move from the Marsh, south and west, between water bodies. Not likely to forage in the project area.
American wigeon	***Anas americana***	**SC**	**Observed in project area during spring survey.**
bald eagle[2,3]	***Haliaeetus leucocephalus***	**SC/FT/PD**	**One pair nests at Horicon, another at L. Sinissippi to the south; eight to ten observed overwintering; early spring sighted foraging in upland fields as far as Centerline Rd and Bauer Rd.**
barn owl[2]	*Tyto alba*	SE	Rare occurrence, sighted in December 2004 at refuge headquarters; nesting and foraging habitat may occur within forest fragments within the project area, but the Project area is mostly to the north of this species' normal geographic range (Sibley 2000).
black-crowned night heron[2]	*Nycticorax nycticorax*	SC	Nests at Horicon, but more restricted to marsh than other herons; movement between Horicon and Theresa Marshes is common.
Bonaparte's gull[2]	***Larus philadelphia***	**SC**	**Common to abundant migrant over Horicon and may form large flocks (>1,000) in uplands in early spring; movements east-west among lakes.**
canvasback[2,3]	*Aythya valisineria*	SC	Uncommon migrant and rare nesting species.
Cape May warbler[2,3]	*Dendroica tigrina*	SC	Common migrant occurring in woodlots near marsh and Niagara Escarpment.
Caspian tern[2]	*Sterna caspia*	SE	Rare migrant through Horicon; occurrence in upland (Project area) unknown.
cerulean warbler[2]	*Dendroica cerulea*	ST	Declining in the state; small nesting population in northern kettle Moraine; occasionally sighted at Horicon during migration.

Common Name	Species Name	Status State/Federal[1]	Occurrence in or near Project Area
common goldeneye[2,3]	*Bucephala clangula*	SC	Common migrant restricted to feeding at the Horicon with movement between water bodies.
common loon[2,3]	***Gavia immer***	**SC**	**Uncommon migrant in the marsh.**
common merganser[2,3]	*Mergus merganser*	SC	Less common migrant restricted to feeding at Horicon with movement between water bodies
dickcissel[2,4]	*Spiza americana*	SC	More common in W. Wis.; sporadically found in grasslands surrounding Horicon as this species is eruptive in its nesting.
Forster's tern[4]	*Sterna forsteri*	SE	Regular nesting species at Horicon; movements generally restricted to marsh once nesting begins.
great blue heron[2,4]	***Ardea herodias***	**SC**	**Nests at Horicon and feeds in Project area.**
great egret[2,4,5]	***Ardea alba***	**ST**	**Marsh, wetland, open water, common nester in Horicon; on 8/12/04 USFWS surveyed 450 individuals with 8 nest sites at rookery N of Hwy 49; unlikely to nest, but forages within Project area.**
greater prairie-chicken[2]	*Tympanuchus cupido*	ST	Project area unsuitable, need large areas or fields of particular age and vegetation structure that occur north and west of Horicon (Zimmerman 1993).
Henslow's sparrow[2]	*Ammodramus henslowii*	ST	Summer records at Horicon; adjacent agricultural lands do not provide dense tall-grass component unless allowed to stand fallow.
lesser scaup[2,3]	*Aythya affinis*	SC	Common migrant generally restricted to the marsh, but flies to nearby water bodies.
loggerhead shrike	*Lanius ludovicianus*	SE	Rare in state; Project area unsuitable, need large areas or fields of particular age and vegetation structure (Zimmerman 1993).
merlin[5]	*Falco columbarius*	SC	Identified at Horicon Marsh by Howe and Atwater on two occasions during 1998 and 1999.
northern goshawk[2,3]	***Accipiter gentilis***	**SC**	**Rare to uncommon winter visitor at Horicon.**
northern harrier[2,3,4,6]	***Circus cyaneus***	**SC**	**Observed within project area; uncommon but known to nest in uplands surrounding Horicon; sighted equally in marsh as nearby uplands.**
orchard oriole[2,4]	*Icterus spurius*	SC	Increasing in S. Wis.; several recent sightings from Horicon and surrounding uplands incl. Hwy 49.

Common Name	Species Name	Status State/Federal[1]	Occurrence in or near Project Area
osprey[2]	*Pandion haliaetus*	ST	Uncommon migrant through Horicon, but mostly along Rock River; some summer sightings but no evidence of nesting; occasionally seen flying through adjacent uplands.
peregrine falcon[2,3]	***Falco peregrinus***	**SE**	**Usually overwinters near open water or urban areas where prey is more abundant; regular migrant at Horicon; sighted hunting in marsh and Project area.**
pine siskin[2,3]	***Carduelis pinus***	**SC**	**Uncommon winter resident not recorded every year.**
red-breasted merganser[2,3]	*Mergus serrator*	SC	Less common migrant restricted to feeding at Horicon with movement between water bodies.
redhead[2,3]	*Aythya americana*	SC	Horicon supports larges nesting population in eastern U.S.; generally restricted to the marsh with movement between nearby waterbodies especially during migration
red-headed woodpecker[2,3,4]	*Melanerpes erythrocephalus*	SC	Declining species, relatively rare but still known to nest, possibly in Project area.
red-necked grebe[2]	*Podiceps grisegena*	SE	One to three nests known at Horicon during 2002 to 2004; does not use surrounding upland habitat.
red-shouldered hawk[2]	***Buteo lineatus***	**ST**	**An uncommon, but annual migrant along Niagara escarpment.**
short-eared owl[3]	*Asio flammeus*	SC	May nest within project area, uncommon winter resident.
snowy egret[2]	*Egretta thula*	SE	Uncommon to rare at Horicon; occasionally feeds in adjacent wetlands; movement between Horicon and Theresa Marshes has been noted.
Tennessee warbler	***Vermivora peregrina***	**SC**	**Observed within project area during autumn survey.**
trumpeter swan[2,3]	*Cygnus buccinator*	SE[7]	Requires open water, unlikely to nest but may forage in project area, occasionally seen at Horicon.
upland sandpiper[2,7]	*Bartramia longicauda*	SC	Project area unsuitable, need large areas or fields of particular age and vegetation structure (Zimmerman 1993); not recorded at Horicon for many years.
western meadowlark[2,4,5]	*Sturnella neglecta*	SC	Declining in recent years and rare to Horicon, observed by Howe and Atwater (1999).
whooping crane[2]	*Grus americana*	SC/FE	Single female from experimental population moves between Horicon and Theresa Marshes and within Project area.[8]

Common Name	Species Name	Status State/Federal[1]	Occurrence in or near Project Area
yellow rail[2]	*Coturnicops noveboracensis*	ST	Rare migrant at Horicon, 8 to 12 individuals have been recorded during spring migration, but has not been adequately surveyed (difficult to detect).
yellow-billed cuckoo[2,4]	*Coccyzus americanus*	SC	Uncommon migrant and summer resident; found in woodland in and around Horicon.
yellow-crowned night-heron[2]	*Nyctanassa violacea*	ST	Rare southern visitor to Horicon; no upland sightings.

Species in bold type were observed during Forward's surveys in spring and autumn 2004.
[1]All species are fully protected under by the federal Migratory Bird Treaty Act (MBTA).
[2]Observations recorded by William Volkert, DNR, Larry Michael, President Horicon Marsh Bird Club, and Jim Coblenz, local birder who leads hunting teams around Horicon Marsh.
[3]Identified in Forward's survey report from a review of Audubon Christmas Bird Counts regionally proximate to the project area.
[4]Identified in USGS Breeding Bird Surveys within or near the project area as cited by in Forward's survey report.
[5]Howe and Atwater 1999.
[6]Identified in Wisconsin Breeding Bird Atlas, Lomira quad as cited in Forward's survey report.
FT: federally listed as threatened; FE: federally listed as endangered; ST: state listed as threatened; SE: state listed as endangered; SC: state special concern species; PD: proposed for delisting.
[7]If no indication is provided then the species is not federally listed, proposed for listing or a candidate for listing as threatened or endangered.
[8]Reintroduced birds are classified as experimental and are exempt from the Federal Endangered Species Act, but not the Migratory Bird Treaty Act (MBTA).

Appendix A

Table A-4 Forward 2004 spring bird survey results for the west and east survey areas

Bird Groups	Point Counts		Road Surveys	
	West	East	West	East
Passerines	2,493	1,999	3,598	2,645
Raptors	67	52	56	112
Shorebirds/ Waders	887	267	1,798	328
Waterfowl	1,639	231	9,117	273
Other	8	15	15	26
Total	**5,094**	**2,564**	**14,584**	**3,384**
Percentage Difference Between the Two Areas	**49.7**		**76.8**	

Table A-5 Forward 2004 fall bird survey results for the west and east survey areas

Bird Groups	Point Counts		Road Surveys	
	West	East	West	East
Passerines	7,843	3,624	31,225	18,862
Raptors	24	50	117	154
Shorebirds/ Waders	2,637	1,869	21,783	8,125
Waterfowl	17,052	4,279	32,797	24,939
Other	6	8	25	56
Total	**27,562**	**9,830**	**85,947**	**52,136**
Percentage Difference Between the Two Areas	**64.3**		**39.3**	

Appendix A

Table A-6 Raptors and other large bird species with highest turbine exposure index at three wind farm sites

	Foot Creek Rim		Simpson Ridge		Buffalo Ridge[1]	
Season	**Species**	**Exposure Index[2]**	**Species**	**Exposure Index**	**Species**	**Exposure Index**
Spring	golden eagle	0.142	golden eagle	0.062	Canada goose	0.847
	American crow	0.071	American crow	0.061	snow goose	0.552
	red-tailed hawk	0.059	ferruginous hawk	0.053	mallard	0.474
	common raven	0.057	common raven	0.045	Franklin's gull	0.381
	clack-billed magpie	0.035	Unidentified duck	0.032	double-crested cormorant	0.326
Summer	red-tailed hawk	0.201	Unidentified duck	0.259	Franklin's gull	0.301
	golden eagle	0.112	northern harrier	0.108	mallard	0.185
	American kestrel	0.108	American kestrel	0.080	American white pelican	0.111
	black-billed magpie	0.056	mallard	0.061	Swainson's hawk	0.102
	common raven	0.053	golden eagle	0.035	American crow	0.091
Fall	red-tailed hawk	0.226	Unidentified duck	0.106	Franklin's gull	4.173
	golden eagle	0.164	northern harrier	0.062	double- crested cormorant	0.975
	American crow	0.103	golden eagle	0.038	Canada goose	0.579
	common raven	0.089	American kestrel	0.032	mallard	0.324
	American kestrel	0.078	red-tailed hawk	0.026	ring-billed gull	0.315
Winter	golden eagle	0.079	golden eagle	0.047	ND	ND
	common raven	0.045	common raven	0.023	ND	ND
	rough-legged hawk	0.012	black-billed magpie	0.008	ND	ND
	black-billed magpie	0.008	bald eagle	0.007	ND	ND
	ferruginous hawk	0.005	rough-legged hawk	0.003	ND	ND

Source: Johnson et al. 2000a and 2000b

[1] Data provided for Turbine B at 26 to 74 m (85-243 ft).
[2] Exposure indices based on mean abundance adjusted for visibility bias, proportion of daily activity budget spent flying, and proportion of flight heights within blade-swept height of turbines.
ND = no data.

Appendix A

Table A-7 Passerine species with highest turbine exposure index[1] at three sites

Foote Creek Rim		Simpson Ridge		Buffalo Ridge[2]	
Species	Exposure Index	Species	Exposure Index	Species	Exposure Index
				Spring	
pine siskin	0.542	cliff swallow	0.189	Lapland longspur	0.295
American goldfinch	0.324	violet-green swallow	0.176	horned lark	0.190
cliff swallow	0.289	horned lark	0.074	red-winged blackbird	0.156
violet-green swallow	0.250	Brewer's blackbird	0.043	snow goose	0.056
horned lark	0.152	Brewer's sparrow	0.021	common grackle	0.051
Brewer's blackbird	0.095	pine siskin	0.014	unidentified blackbird	0.044
American robin	0.031	western meadowlark	0.007	Canada goose	0.040
tree swallow	0.016	mountain bluebird	0.006	common redpoll	0.039
mountain bluebird	0.012	American kestrel	0.005	greater white-fronted goose	0.031
Brewer's sparrow	0.008	American robin	0.005	mallard	0.030
				Summer	
				horned lark	0.103
				red-winged blackbird	0.082
				cliff swallow	0.061
				barn swallow	0.057
				common grackle	0.049
				European starling	0.044
				bobolink	0.028
				bank swallow	0.020
				unidentified blackbird	0.018
				killdeer	0.015
				Fall	
				horned lark	0.599
				Lapland longspur	0.452
				unidentified blackbird	0.180
				Franklin's gull	0.140
				European starling	0.132
				double-crested cormorant	0.127
				red-winged blackbird	0.094
				unidentified gull	0.050
				Canada goose	0.046
				barn swallow	0.040

Sources: Johnson *et al.* 2000a and 2000b

[1]Exposure indices based on mean abundance adjusted for visibility bias, proportion of daily activity budget spent flying, and proportion of flight heights within blade-swept height of turbines.

[2] Data provided for Turbine B at 26 to 74 m (85-243 ft).

Appendix A

Table A-8 Comparison of birds per hour for selected passerines and other small birds

Common Name	Howe (1999-2001)		Kaspar (1999)		Forward (2004)	
	Total	Individuals/ hour	Total	Individuals/ hour	Total	Individuals/ hour
bobolink	510	0.6	48	0.4	0	0.0
Brewer's blackbird	57	0.1	0	0.0	800	4.7
eastern bluebird	294	0.3	31	0.3	92	0.5
eastern meadowlark	737	0.8	51	0.4	16	0.1
eastern phoebe	38	0.0	13	0.1	4	0.0
hairy woodpecker	36	0.0	15	0.1	1	0.0
horned lark	2,137	2.4	1,411	11.7	3,000	17.5
killdeer	1,553	1.7	478	4.0	231	1.4
Lapland longspur	702	0.8	2,423	20.0	2,533	14.8
least flycatcher	16	0.0	5	0.0	0	0.0
lesser yellowlegs	25	0.0	0	0.0	12	0.1
purple martin	682	0.8	38	0.3	0	0.0
palm warbler	2	0.0	10	0.1	3	0.0
northern flicker	228	0.3	179	1.5	62	0.4
red-breasted nuthatch	1	0.0	2	0.0	2	0.0
savannah sparrow	4,705	5.2	818	6.8	71	0.4
snow bunting	1,037	1.2	1,234	10.2	117	0.7
Tennessee warbler	10	0.0	0	0.0	4	0.0
tree swallow	1,178	1.3	562	4.6	256	1.5
willow flycatcher	19	0.0	0	0.0	0	0.0
wood thrush	15	0.0	21	0.2	0	0.0

NOTES: The values presented in the table were estimated for this EIS. Total number of hours estimated: Howe = 900 during four years; Kaspar = 121 hours during spring/fall of one year; Forward = 171 hours during spring/fall of one year.

Kaspar survey includes spring and autumn 1999 only. Howe survey excludes results from 1998 that were incorporated from a different survey and includes results from 1999 to 2001 for all seasons.

Appendix A

Table A-9 Sightings of common hawks from Horicon Christmas bird counts (1976-2004)

Year	Red-tailed Hawk	Rough-legged Hawk	Northern Harrier	American Kestrel
1976	12	6	1	3
1977	12	6	3	3
1978	1	0	1	0
1979	14	11	3	2
1980	11	12	0	1
1981	11	18	5	5
1982	19	8	15	8
1983	5	3	2	2
1984	13	2	4	7
1985	11	4	0	6
1986	5	3	1	3
1987	8	9	3	12
1988	32	18	14	6
1989	32	5	13	8
1990	22	22	10	11
1991	24	11	4	9
1992	20	15	11	26
1993	17	11	7	27
1994	49	15	0	29
1995	26	6	3	13
1996	24	3	0	6
1997	22	15	8	13
1998	39	15	22	22
1999	47	28	17	16
2000	30	7	5	15
2001	30	5	17	11
2002	39	17	17	30
2004	67	10	24	20

Source: William Volkert, DNR

Appendix B

WISCONSIN DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Jim Doyle, Governor
Scott Hassett, Secretary

101 S. Webster St.
Box 7921
Madison, Wisconsin 53707-7921
Tel*ephone 608-266-2621
FAX 608-267-3579
TTY Access via relay - 711

November 16, 2004

Ms. Marilyn Weiss
Public Service Commission of Wisconsin
610 N. Whitney Way
Madison, WI 53707-7854

Subject: Forward Energy Wind Energy Center: PSC Docket 9300-CE-100

Dear Marilyn:

Consistent with the PSC/DNR Cooperative Agreement, I am writing to provide you with our comments about the completeness of Forward Wind's submittals relating to issues that should be evaluated in the Commission's Environmental Impact Statement (EIS) for this proposal. The Department has reviewed materials in the application and supporting responses describing the above-referenced project in regard to the potential for impacts on wildlife resources subject to DNR management responsibility.

The Department is responsible for managing the wildlife resources of the State to benefit the public, and to maintain the integrity of the ecosystems. We also manage hunting of waterfowl and upland game birds, many of which are likely to be present in the landscape in which this project is proposed. Further, studies in Wisconsin, and other states, have shown that wind farms have impacts on birds and bats in particular, that include direct mortality due to collision with wind facilities, and behavioral impacts such as exclusion from the area surrounding the turbines and disruption of the courting activities of certain species.

In order to provide enough information to prepare an EIS for this project, an appropriate level of characterization of the affected natural environment must be provided. We have reviewed the bird and bat studies prepared for Forward Wind, and note that they are primarily literature reviews, and include only limited characterization of the actual use of the project area by birds and bats (based primarily on one brief site visit in April, 2004). There is also limited description of the habitat resources in the area that tend to hold or direct the movements of wildlife species. This is especially true in the case of bats. A Phase 1 study, such as those submitted for birds and bats at this location, is a valuable planning tool in the early stages of designing a project such as this. It can identify areas that should be avoided based on high wildlife use, and those that should be studied further to evaluate whether they pose a collision risk, or may exclude birds from important habitat resources.

However, if only a Phase 1 study is submitted in support of this application, the reviewing agencies can only speculate on how accurately the distribution and variability of wildlife use has been characterized, and thus, how reliable are the conclusions of the study. The quotes from the reports by Dr. Kerlinger which I have included below support this conclusion.

As noted in those reports, a major bat hibernaculum, the Neda Mine, is located about 10 miles south of this facility. During certain periods of the spring and fall, hundreds of thousands of bats inhabit the vicinity of the mine. Recent reports of bat casualties in the Eastern U.S., demonstrate that there is reason to be concerned that large numbers of bat fatalities are possible. We suspect that large numbers of these bats may be using the landscape resources in a large area up and down the Niagara Escarpment for travel and feeding. Bat experts tell us that the bats tend to follow linear features, such as fencerow vegetation, moving cross-country to feed at sources of their insect prey. The characterization study submitted by Forward Wind lacks sufficient description of these resources to allow an evaluation of the risk to bats foraging in the area proposed for turbine installation.

In regard to birds, the Dr. Kerlinger's report makes the following statement: "Migration of waterfowl and other waterbirds over the Project area is likely to be greater than most other areas of Wisconsin because of the proximity of the site to the Horicon and Theresa Marshes. Large numbers of waterfowl migrate into and out of Horicon and Theresa Marsh and forage during migration in nearby farm fields. Use of the general area is likely to be high with ducks and geese regularly present around the Project area in spring and fall. This suggests some risk to these species that is discussed further in this assessment." Given the close proximity to Horicon Marsh of the southwestern turbines, the characterization of avian usage and risk is only given a superficial treatment in the application.

Dr. Kerlinger also states that at least 1 species of concern, Northern Harrier, may be nesting within the Project area boundary, suggesting that a spring survey be done to confirm nesting and delineate its territory. In addition, the Horicon and Theresa Marshes are both suitable habitats for some listed and rare species, which are listed in the appendices to the application. If the project is approved before this information has been gathered, there is a risk that the impacts to these species will not be adequately evaluated and addressed. The presence of an experimental flock of whooping cranes in Wisconsin also suggests a potential risk to that species, should a natural or human-introduced flock become established at Horicon Marsh. This potential risk should be evaluated based on information about utility structure interactions with whooping cranes and sandhill cranes.

The DNR recommends that the risks Dr. Kerlinger refers to should be characterized in greater detail, preferably based upon adequate monitoring of bird activity, especially flight patterns, over an adequate period of time (two years would be a reasonable duration, unless other site-specific data from reliable observations, such as the Audubon Society bird counts cited by Dr. Kerlinger, were adequate). Since the applicant's studies indicate that such data do not cover the site itself, we recommend that the application should adequately discuss the uncertainties related to bird use, and the potential for underestimating risks. DNR experts should be able to assist the PSC in this matter.

To further quote Dr. Kerlinger: "Population modeling of waterbird collision fatalities (e.g., population viability analyses) would provide an indication as to whether biologically significant risk is likely to occur to some of those species. Such models would examine the potential for significant declines of species based on realistic levels of collision fatalities derived from other wind power projects." The DNR endorses this approach to better characterize the risk posed by this facility. We hope that models currently available could be used to provide a timely answer to this question.

Ultimately, in the absence of more detailed site-specific observations, we feel that the most prudent course would be to redesign the layout of this facility to increase the set-back from the marsh edge by one or more additional miles. This would necessitate relocating some of the more south-westerly turbines, in effect shifting the facility footprint to the east. An alternative approach would be to phase the installation of the turbines from East to West. If appropriate monitoring of avian interactions demonstrates that substantial numbers of birds and bats are not being affected by the turbines, then more turbines could be installed further to the west within the project boundary (again coupled with adequate monitoring to confirm the actual level of risk). If the applicant wishes to propose additional measures to reduce wildlife risk, we would be happy to consider them.

A similar observation applies to use of the landscape by several species of bats. We have good data regarding the cave bat's seasonal use of the Neda Mine, but little data regarding their use of the surrounding landscape. This applies to both the seasonally large numbers of cave bats that hibernate in the mine, and the base level of landscape use during the breeding season by both cave bats and tree bats.

We do know that bats tend to follow wooded corridors in moving about the landscape. Therefore, an assessment of the degree of connectivity provided by fencerows, woodlots and other lines of cover would help to evaluate the risk to bats imposed by installing a substantial number of wind turbines in the area. DNR specialists would be available to work with Forward Wind's consultants to help design an adequate evaluation. The alternative would be to make a highly conservative assumption that the hundreds of thousands of bats using the hibernaculum are distributed randomly throughout the surrounding landscape. We recommend that the PSC consult with a bat expert to help flesh out this discussion. We should be able to work with you, as Bureau of Endangered Resources has recently hired a person with this expertise (Dave Redell).

There is also a related concern about the visual impact of the facility on persons viewing birds at the marsh. We recommend that the company prepare visual simulations of views from commonly-used observation points, especially in the northern quarter of the marsh (primarily the Federal refuge).

In summary, the DNR has concluded:

- The application does not provide sufficient information to evaluate the magnitude and significance of the project's impacts to wildlife
- Adequate site-specific monitoring information is needed to assess these impacts
- Qualitative and semi-quantitative information can be provided by local DNR and FWS experts
- DNR biologists are concerned that the western boundary of the project may be too close to Horicon Marsh, and better information is needed to resolve this concern
- The company should seriously consider increasing the setback from the Marsh, and/or phasing construction from East to West, coupled with adequate monitoring to verify wildlife impacts
- Other measures, such as operational restrictions, visual collision deterrents, and landscape management to redirect bird use, should also be evaluated
- Survey and monitoring plans should be developed consistent with the Draft USFWS Guidelines for wind facility siting, and reviewed by DNR and FWS biologists.

In closing, let me reiterate the DNR's intent to work in close cooperation with the Commission's staff to ensure that these issues are adequately disclosed in the EIS for this project. We will provide text for those sections consistent with the PSC/DNR Cooperative Agreement. However, this can only occur when the applicant has provided complete information, as indicated in PSC's WEPA regulations and the Power Plant Siting Law. If you wish to discuss this further, please feel free to call me at 266-6673.

Sincerely,

Steven Ugoretz
Office of Energy

Cc: Dave Siebert – OE/7
Shari Koslowski – OE/7
Russ Anderson – SCR – Fitchburg
Dave Redell – ER/6
Sumner Matteson – ER/6
Maureen Rowe – SCR – Fitchburg
Bill Volkert - Horicon

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Green Bay ES Field Office
2661 Scott Tower Drive
New Franken, Wisconsin 54229-9565
Telephone 920/866-1717
FAX 920/866-1710

November 18, 2004

Ms. Marilyn Weiss
Wisconsin Public Service Commission
610 North Whitney Way
Madison, Wisconsin 53707-7854

re: Forward Energy Wind Farm Project
PSC Docket No. 9300-CE-100
Fond du Lac and Dodge Counties,
Wisconsin

Dear Ms. Weiss,

Thank you for the opportunity to further review and comment on the Forward Energy Wind Farm Project, located in and around the Town of Brownsville, in Fond du Lac and Dodge Counties, Wisconsin. The U.S. Fish and Wildlife Service (Service) provided comments to Invenergy consultants Ms. Julie Spapperi of URS Corporation and Dr. Paul Kerlinger of Curry & Kerlinger, LLC, in a letter dated July 16, 2004, as a response to written requests for information on potential impacts to federally-listed threatened and endangered species. Other than information solicited in phone conversations with Ms. Spapperi and Dr. Kerlinger, we have not received any further information about the project from Invenergy or its representatives since letters dated May 14 and May 21, 2004, with general descriptions of project size (up to 100 megawatts (MW)), turbine height (up to 393 feet at top of rotor tip), project area (primarily agricultural), and project maps. Ms. Leakhena Au, of my staff, attended one of the public hearings held in Brownsville on November 4, 2004, and there learned of the currently proposed size and layout of the wind farm. We have also since downloaded the Phase I Avian Risk Assessment and Phase I Bat Risk Assessment included with the application. We would like to clarify and expand upon our previous comments in light of this additional information.

Project Size and Location

The siting of the majority of turbines as depicted in maps at the hearing did not coincide with a map provided by Dr. Kerlinger, or with verbal descriptions provided by Dr. Kerlinger or Ms. Spapperi. The map provided by Dr. Kerlinger showed the "Western Project Area" boundaries as: N boundary—approximately 1/3 mile north of Fond du Lac County Road F, E boundary—approximately 1/3 mile west of Oakline Road in Fond du Lac County and Dodge County Road Y/AY west of Brownsville, S boundary—approximately ½ mile south of Dodge County Road H, and W boundary—less than ¼ mile west of Dairy Road and County Road YY in Dodge County. The "Eastern Project Area" boundaries were: N boundary—Fond du Lac County Road F, E boundary—less than 1/8 mile west of Hwy 175, S boundary—approximately 1/3 mile south of Dodge County Road HH, W boundary—Center Drive in Dodge County, Hickory Road in Fond du Lac County.

When questioned about the discrepancy between the two maps in a conference call on August 16, 2004, Dr. Kerlinger stated that the larger area (the URS map) included properties under project control, but that turbines would only be located in the areas shown by the map he sent to this office. In a call on September 1, 2004, Ms. Spapperi stated that turbines were more likely to be located within the rectangles shown on Dr. Kerlinger's map, but that some turbines may be located outside of those areas. The Service did not receive any additional or updated project documents to review.

Our comments of July 16, 2004, were based upon the generalized information about project size and locations provided in the initial contact letters sent to us in May. We recommended that "no turbines be located within several miles of the Horicon Marsh and Horicon National Wildlife Refuge, or between the Marsh and known feeding areas for migratory waterbirds and waterfowl." The proposed project is approximately twice as large, both in megawatts and number of turbines, as was described in written correspondence. The potential size of the turbines has also been increased to a height that poses a disproportionately greater risk to migrating birds. Because of these reasons, the Service has even stronger concerns about impacts to migratory and resident birds that use the Horicon Marsh, whether for breeding, feeding, or stopover purposes. Service staff and its volunteers have observed waterfowl, songbirds, and shorebirds traveling at relatively low altitudes (within the range of the rotor swept area) over the edge of the Niagara Escarpment. We do not believe 1 to 2 miles from the escarpment edge is sufficient distance to minimize potential impacts to these birds. The Service strongly recommends that turbines be located no closer than 3, preferably 4 or more aerial/linear miles from the eastern boundary of Horicon Marsh and Horicon National Wildlife Refuge. This would preclude development of most proposed turbine sites located west of Fond du Lac County Road YY/Dairy Road and south of Breakneck Road. The Service also recommends that turbine height (at the maximum height of a rotor tip) be limited to 400-feet or lower within 4 miles of the Marsh.

Risks to Birds and Bats

The Phase I Avian and Bat Risk Assessments should be viewed as useful primarily in determining if further consideration of a site as a potential wind farm location is warranted. They are not adequate in delineating actual risk to resident and migratory birds and bats. It should be noted that the risk assessments are also based on the previous plans to locate turbines largely within the areas described above in paragraph two.

The Avian Risk Assessment acknowledges that the proximity of the site to Horicon and Theresa Marshes would likely lead to a greater than average mortality of waterfowl and waterbirds, but also states that "[s]tudies in Wisconsin (Howe et al. 2002) and Minnesota (Johnson et al. 2003 [note: should be cited as 2002]) at wind turbines suggest that very few ducks and geese ever collide with wind turbines, despite their presence at or near the turbines at both sites and the fact that these sites are in locations where there is significant migration of waterfowl (Bellrose 1976)". The application of findings at wind power plants in Kewaunee County, Wisconsin, and the Buffalo Ridge Plant in western Minnesota to potential mortality associated with this project may not be valid because both studies were conducted at wind farms with fewer and shorter (maximum height of rotor tip) turbines, and neither the Kewaunee or Buffalo Ridge projects are located near a national wildlife refuge, particularly one of international importance to migratory birds (please see our letter of July 16, 2004). To our knowledge, no large wind farms have been constructed so close to such a major concentration of birds with the United States. In addition, broad descriptions of waterfowl migration patterns published in 1976 may not be adequate to describe specific similarities or differences in waterfowl congregations or movements today.

With respect to Appendix III, we would like to clarify or correct some of the characterizations and descriptions of Service comments during the referenced conference call. Dr. Kerlinger incorrectly identifies the “rare” rail referred to in the call as a yellow rail. It is unclear where the incorrect information was obtained. In addition, Dr. Kerlinger requested that we discuss what level of mortality or risk would be acceptable to the Service. We reiterate that we cannot set an arbitrary level of acceptable mortality for migratory birds or other wildlife.

Mortality of migratory birds and threatened and endangered species should be avoided and minimized as much as possible. Measures to avoid and minimize must be taken before planning is completed and construction occurs. If mortality occurs despite these best efforts, all possible and reasonable post-construction actions (i.e., locking turbines immediately after severe weather fronts) should be taken to remedy the problem. Population viability modeling based on little or no empirical data is unacceptable as a tool to avoid and minimize avian (or bat) mortality. Indeed, because size and layout of wind farms, as well as species assemblages and population numbers, are very site-specific, viability modeling would have only marginal value for future wind farms.

In this instance, we believe it is necessary to conduct pre-construction movement studies of birds (and bats) during spring and fall migrations and during a portion of the summer using radar and infrared technology. This recommendation is further expanded in the *Project Recommendations* section of this letter. The Service also recommends that post-construction mortality studies be conducted, because we believe they are important as a means to document the actual impact of the proposed wind farm on wildlife, and to allow comparison of impacts from different types and sizes of wind farms to wildlife in different landscapes.

With regards to the Migratory Bird Treaty Act (MBTA), it is public law published within the United States Code readily available to any interested person. We can provide a copy of the text of the MBTA upon request. As pointed out in the conversation, Service staff in Wisconsin are well aware that Dr. Kerlinger has had numerous conversations regarding MBTA and wind farm issues with Dr. Al Manville, the Service’s national lead on migratory birds and wind farm issues, and Mr. Alex Hoar, the Service’s Northeast Region coordinator of energy issues who has coordinated or contributed to Service review and response to wind farm issues throughout the eastern United States, including projects previously and currently involving Dr. Kerlinger. The nature and applicability of the MBTA does not vary by region of the country. We deferred during the conference call and we defer now to any guidance provided to Dr. Kerlinger by Dr. Manville and Mr. Hoar on that topic.

The Phase I Bat Risk Assessment states that there is a "fairly predictable rate of fatalities to tree bats plus the unknown risk to nearby cave bats." However, the assessment only recommends post-construction mortality studies. As noted in the assessment, the project is located approximately 10 miles from the Neda Mine bat hibernaculum, which houses up to an estimated 500,000 bats (because of the structure of the mine, no precise surveys have been completed within the mine). Bats have been observed feeding and traveling in the project area by both scientists and local residents, and are known to provide significant ecological and financial benefits to the area. To preserve those benefits, the applicant should conduct a pre-construction study of bat movements through the project area and use the results to avoid and minimize mortality of bats as much as possible in project design and operation. Radar and infrared technologies have been used to study birds and bats for a number of years. Although those technologies have not been used specifically in this context until recently, the Service does not believe that is sufficient justification to construct a project that may endanger local and/or regional bat populations without even minimal attempts to understand and mitigate this danger. Bat behavior studies have been successfully completed this past fall in West Virginia using radar and infrared technologies. Radar has also been used at wind farm project areas in the northeastern United States. As previously stated, the Service also recommends post-construction mortality studies in order to document actual impacts of the wind farm on wildlife (see *Project Recommendations,* below).

As the regional populations of the seven species of bats that occur in the project area have never been quantified, and even basic data on regional populations has not been collected, the Service questions how any conclusions drawn about larger impacts to those populations (specifically assessments of "biologically significant" impacts, or threats of localized extinction, etc.) could be reliable. Finally, we note that contrary to Dr. Kerlinger's description, Ms. Au has been closely involved in the efforts to mitigate potential impacts of the Butler Ridge Wind Farm in Dodge County on the populations of bats at and around Neda Mine. She also has some familiarity with bat issues at wind power facilities throughout the United States and is competent to comment on potential risks of wind farms to bats.

Conclusions

Due to its proposed size and its proximity to the Horicon Marsh and Horicon National Wildlife Refuge, a globally Important Bird Area, as well as the Neda Mine bat hibernaculum, the Forward Energy Wind Farm project has potential wildlife impacts that are currently unique in the United States. The Phase I Risk Assessments acknowledge that the potential for waterfowl and waterbird mortality is greater than with most other projects, and that the risk to populations of some bat species is unquantifiable using existing information, but may be substantial. It is imperative that potential displacement, injury, and mortality risks to wildlife be avoided and minimized to the extent possible, and, thus far, it appear that the risks specific to the wildlife on-site have been neither studied nor adequately avoided. To that end, the Service has the following recommendations for layout and construction of the project, as well as wildlife study and monitoring.

Project Recommendations

- Turbine layouts and wildlife surveys and monitoring should be consistent with the Service's *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* as much as possible. The guidelines are available on the internet at http://www.fws.gov/r9dhcbfa/wind.pdf.

- Turbines should be located a minimum of 3, preferably 4 or more aerial/linear miles from the borders of the Horicon Marsh and Horicon National Wildlife Refuge.

- Construction of turbines should be phased in, with construction of eastern turbines preceding western turbines by 1 year to allow pre-construction studies to occur or continue on the western project area, and post-construction mortality results from the eastern turbines to be evaluated and inform possible changes in size, location, or operation of western turbines.

- Pre-construction studies of bird and bat movement through the area should be conducted using horizontally and vertically scanning radar. Radar surveys should be conducted daily and nightly in April and May, and from mid-July through October. These surveys would capture the height, location, and relative number of vertebrates flying through the area during peak migration periods for both birds and bats, as well as the beginning and end of the breeding season for most birds. Radar surveys should be supplemented by use of forward looking infrared during mid-April through May, and August and September. This would allow observers to identify types as well as potentially observe specific behaviors of animals moving through the project area. Two years of data would provide a strong base of information for development of a project design that minimizes wildlife mortality.

- Post-construction mortality studies should be conducted for at least 2 years. Preliminary data from studies in West Virginia indicate that almost no carcasses remain after 5 days, and that scavengers may become habituated to turbines kills. Therefore, we recommend that data be collected daily, and that protocols account for both scavenger behavior and detection differences related to factors such as topography, species, and changes in ground cover.

- Exact study protocols for pre- and post-construction studies should be peer-reviewed, and data should be collected and analyzed by individuals or groups without a vested financial interest in the project or the specific study outcome.

The Service supports the development of renewable energy. However, it is increasingly apparent that not all renewable energy facilities are wildlife friendly. The applicant has a unique opportunity to demonstrate that a wind power facility may be designed and constructed within relatively close proximity to significant wildlife congregations without creating additional hazards. We do not believe that Forward Energy has yet demonstrated that the project can meet that standard. We strongly encourage the Wisconsin Public Service Commission and the applicant to ensure that risks to wildlife are adequately studied and mitigated before the project is finalized, approved, and constructed.

The Service welcomes the opportunity to provide any additional information or assistance with regards to this or other energy development projects. Questions pertaining to these comments may be directed to Ms. Leakhena Au at (920) 866-1734.

Sincerely,

Janet M. Smith
Field Supervisor

cc: FWS, Refuge Manager, Horicon National Wildlife Refuge, Mayville, WI
FWS, Migratory Bird Office, Washington, D.C Attn: Dr. Al Manville
FWS, Migratory Birds, Fort Snelling, MN Attn: Steve Lewis

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111-4056

IN REPLY REFER TO:
FWS/AES-DHC

February 8, 2005

Ms. Marilyn Weiss
Wisconsin Public Service Commission
610 North Whitney Way
Madison, Wisconsin 53707-7854

Re: Forward Energy LLC, Wind Electric Generation Facility, Dodge and Fond du Lac Counties, Docket 9300-CE-100

Dear Ms. Weiss:

The U.S. Fish and Wildlife Service (Service) provides the following scoping comments for consideration by the Wisconsin Public Service Commission (PSC) in preparation of the environmental impact statement for the proposed Forward Wind Energy Center (Energy Center). Forward Energy LLC (Forward Energy), a subsidiary of Invenergy Wind LLC, will construct, own and operate the Energy Center.

<u>Service Interests and Authorities</u>

The Service is the principal Federal agency responsible for conserving, protecting and enhancing fish, wildlife and plants and their habitats for the continuing benefit of the American people. The Service manages the 95-million-acre National Wildlife Refuge System, enforces Federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, and helps foreign and Native American tribal governments with their conservation efforts.

Development of wind energy is strongly endorsed by the Secretary of the Interior. Wind-generated electrical energy is renewable, produces no emissions, and is generally considered to be an environmentally friendly technology. Advances in wind turbine technologies and increased interest in renewable energy sources have resulted in rapid expansion of the wind energy industry in the United States. When properly sited and designed, wind energy development has the potential to reduce the loss of trust resources and their habitats by replacing other, more disruptive forms of energy development. However, the construction and operation of wind energy facilities can adversely impact wildlife habitat, as well as result in direct mortality or injury to birds and bats due to collisions with the turbines.

The Migratory Bird Treaty Act of 1918 (16 U.S.C. §§703-712), as amended, prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the Act has no provision for allowing unauthorized take, it must be recognized that some birds may be killed at structures such as wind energy facilities even if all reasonable measures to avoid it are implemented. The Service's Office of Law Enforcement carries out its mission to protect migratory birds not only through investigations and enforcement, but also through fostering relationships with individuals and industries that proactively seek to eliminate their impacts on migratory birds. To that end, the Service developed the 2003 *Service Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines* (Service guidance), which is available on the internet at http://www.fws.gov/r9dhcbfa/windenergy.htm. The Service guidance is not binding but is intended to aid industry and Service staff in evaluating and developing wind energy at sites that would be least harmful to wildlife resources. While it is not possible under the Act to absolve individuals, companies, or agencies from liability if they follow these recommended guidelines, the Office of Law Enforcement and the Department of Justice have used enforcement and prosecutorial discretion in the past regarding individuals, companies, or agencies who have made good faith efforts to avoid the take of migratory birds.

In working with wind energy proponents to avoid or minimize adverse impacts at individual projects, the Service seeks to ensure that the cumulative effects of this rapidly growing industry do not contribute to the decline of bird or bat populations. The potential harm to these populations from an additional source of mortality or adverse habitat impacts makes careful evaluation of each proposed facility essential. Due to local differences in wildlife concentration and movement patterns, habitats, area topography, facility design, and weather, each proposed development site is unique and requires detailed, individual evaluation.

Proposed Action and Potentially Affected Resources

The Forward Wind Energy Center is a proposed 133-turbine, 200-megawatt wind electric generation facility sited in southern Fond du Lac and northern Dodge Counties and is generally centered 1 mile west of the Town of Brownsville in Dodge County, Wisconsin. The western edge of the project site boundary is located, on average, approximately 1/2 mile from the eastern edge of the approved acquisition boundary of the Service's Horicon National Wildlife Refuge (Refuge). In addition, the project boundary is located less than 1/2 mile from two federally managed waterfowl production areas (WPAs). Some of the preliminary turbine locations in the westernmost array of proposed turbines are less than a mile from the WPAs and less than 1 ½ miles from the Refuge boundary (see enclosed map).

Horicon National Wildlife Refuge was established in 1941 as an inviolate sanctuary for migratory birds. The Refuge encompasses 21,457 acres and occupies the northern two-thirds of the larger 32,000-acre Horicon Marsh (Marsh). The southern third of the Marsh is managed as the Horicon Marsh State Wildlife Area by the Wisconsin Department of Natural Resources (DNR). In 1990, the Marsh was designated as a "wetland of international importance" under the Ramsar Convention of 1971. It is one of only 21 such sites in the United States. The Marsh is also recognized by the American Bird Conservancy as a "globally important bird area." Although famous as a migratory stopover for hundreds of thousands of Canada geese, the vitality of the Marsh is much better represented by the diversity of birds that use the area. Over 267 species have been recorded using the Marsh, some during all four seasons. Many of the bird species that use the Refuge as a rest stop during migration feed daily in the uplands around the Refuge. These and other wildlife that breed, winter, or migrate through the Marsh often do not remain on the Marsh year-round and may be influenced by changes on the surrounding landscape. Under the National Wildlife Refuge System Administration Act of 1966, as amended, and the National Wildlife Refuge Improvement Act of 1997 (16 U.S.C. §§668dd-668ee), it is the policy of the Secretary of the Interior to "ensure that the biological integrity, diversity, and environmental health of the [Refuge] System are maintained for the benefit of present and future generations of Americans."

Service Involvement

The Service was notified of the proposed project by Wisconsin DNR staff in early April 2004. The Service has since repeatedly expressed concerns and offered recommendations about the project and the biological assessments associated with the project through telephone calls, letters, and meetings with project representatives dating from April 15, 2004, through January 12, 2005. In a letter dated July 16, 2004, to consultants URS Corporation and Curry & Kerlinger, LLC, the Service recommended that the project be located at least several miles from the Marsh and Refuge and that no turbines be located between the Marsh and known feeding areas for migratory birds and waterfowl. In addition, we recommended that surveys be conducted during the peak of spring and fall bird migrations and during the breeding season, using widely accepted, standardized survey protocols such as those described in Smith (1995) and Pardieck (2001). The letter further referenced the Service guidance in providing recommendations for locating and designing the proposed facility. A copy of the letter is included in the application provided by Forward Energy to the Wisconsin PSC. While we appreciate the applicant's willingness to communicate with the Service, we do not believe that the applicant has substantively addressed our concerns. To the contrary, since our early contacts with the applicant, the project size, as well as the density and proximity of turbines to the Refuge, has only increased. We also refer you to the Service's November 18, 2004, letter to the Wisconsin PSC that provided more detailed comments regarding potential project impacts to wildlife resources and offered recommendations regarding project features and modifications that could result in avoiding and minimizing project impacts.

Wildlife Concerns and Recommendations

Millions of migratory birds use the Refuge, WPAs, State Wildlife Area, and the surrounding landscape for breeding, feeding, and sheltering. These include not only waterfowl, but cranes, songbirds, shorebirds, wading birds and raptors. There have been relatively few large scale studies of bird mortality at modern wind farms in the United States. Those that have been done have not indicated that high numbers of waterfowl or songbirds are killed at such wind farms. However, it is our contention that there are no wind farms in the United States that are located in areas with directly similar ecological, temporal, and spatial use of the landscape by wildlife. For instance, the wind facility located near the Suisun Marsh in California which was cited as potentially comparable by the applicant is indeed located on hills near a comparably large marsh with high waterfowl and shorebird use and, therefore, may have superficial similarities; however, historically (before construction of the turbines), the birds at Suisun Marsh did not spread out into the landscape to forage, roost, or stage as they do around the Horicon Marsh. Despite what is provided in the Service guidance and our recommendations to the applicant, the biological assessments produced by the applicant were not conducted during the peak of migration for most waterfowl species; did not account for songbird, shorebird, raptor, or other species; and according to the consultant, cannot be extrapolated to the western third of the project area, which is likely where bird use would be highest (Paul Kerlinger, personal communication via conference call January 12, 2005). In the absence of meaningful data, the Service suggests that greater caution should be employed in predicting impacts to migratory bird and Refuge resources than is demonstrated in the currently proposed project design. Twenty-eight turbines in the two western rows of turbines are located less than 2 miles from existing Refuge lands and are even closer to the approved land acquisition boundary of the Refuge. Observations by Refuge staff have indicated that many birds that forage off the Refuge fly to the northeast at low elevations to reach feeding areas. The Service is concerned that these birds in particular, including large numbers of geese and cranes, are in danger of collisions with turbines in the proposed western-most rows. We are also concerned about the potential for night-migrating songbirds to collide with the turbines and support structures, especially during periods of low ceilings that could cause the birds to fly at lower than normal altitudes.

The proposed project area is also located approximately 10 miles from the Neda Mine, a hibernaculum for hundreds of thousands of bats (because of safety concerns and the structure of the mine, no precise surveys have been completed within the mine). Bats have been observed flying and feeding in the project area by both biologists and local residents. Bats provide significant ecological and economic benefits to the area. Recently, researchers in West Virginia have estimated that thousands of bats have been killed in each of the last two years at a single wind farm site in that State. High mortality numbers have also been noted at sites in Tennessee and Washington and bat mortality has occurred at many wind farm sites throughout the country, including at small wind farms in Kewaunee County, Wisconsin. It is becoming increasingly apparent that bats may be more susceptible to turbine strikes than are most birds. Researchers at the Kewaunee site estimated 6.5 bat fatalities/MW/year (Howe et al. 2002), and there are no known major hibernacula in the area. It is our opinion that the determinations of detection probability (observer efficiency) in the Kewaunee study were flawed, and as a result, the study may have significantly underestimated mortality. Nonetheless, it is an indication that the cumulative levels of bat mortality at this and other proposed wind farms in the area could be into the thousands per year. Bats have relatively low reproductive rates and such high mortality levels may seriously impact local and regional population numbers.

Post-construction Monitoring

If approval for the project is given by the Wisconsin PSC, monitoring of operational impacts on birds and bats is critical. It needs to be much more rigorous than the pre-construction assessment, which we do not believe adequately or accurately characterized the extent of bird and bat occurrence in the project area. At a minimum, post-construction monitoring should assess seasonal mortality during both spring and fall migration, and during the spring/summer breeding and brood-rearing periods (Manville 2002, Derby et al. 2002) for birds and bats. It should also assess avian and chiropteran (bat) behavior, including activity (feeding, roosting, migration, resting), movement, blade avoidance, site use, perching/roosting, migration chronology, migration magnitude, weather-related behavior, and habitat fragmentation issues affecting behavior (Smallwood et al. 2003 and 2004). Because of the international importance of the adjoining Marsh and Refuge, and the wildlife resources that could potentially be impacted there, systematic monitoring should be conducted for a minimum of 2-full years (excluding wintertime), with 3 years being preferable. Because of the potential for adverse impacts to birds and bats that use the Refuge, WPAs, the State Wildlife Area, and other areas near the project site, it would be highly beneficial for the applicant to support detailed post-construction monitoring consistent with the guidance provided in Anderson et al. (1999). A detailed, robust, scientifically-valid, peer-reviewed, multi-year study will answer the question about impacts from this facility for the benefit of all stakeholders. If, as the applicant claims, impacts to avian resources are likely to be minimal, detailed monitoring will verify (or refute) that assertion. The protocol developed for post-construction monitoring should be peer-reviewed by professional ornithologists familiar with avian-wind and bat-wind issues, including biologists from the Service. Peer-reviewer suggestions should be incorporated into the monitoring protocol as much as possible, and Forward Energy should strive to have the monitoring results published in a peer-reviewed scientific journal.

Conclusion

The Service believes that potential project-related mortality of migratory birds and bats should be avoided and minimized as much as possible through prudent siting and design of wind farms. Collection of site-specific occurrence and behavior information as outlined in the previously referenced Service guidance would provide the information necessary to make decisions on project siting and design to have the least adverse impact. Measures to avoid and minimize before construction are crucial because of the projected long life spans of these projects. In this instance, we strongly suggest that a more complete, peer-reviewed study and peer-review of existing data on potential impacts of locating a large wind farm near a globally significant migratory bird resource such as the Refuge and Marsh are warranted before final project size and siting plans are approved. In the absence of further studies, caution and more conservative siting of turbines away from the Marsh resources should be considered. The Wisconsin Public Service Commission has an opportunity to ensure that the project, if approved, is designed and constructed in a way that would minimize impacts to State and Federal wildlife resources. In addition, a 2 to3-year, agency and peer-reviewed post-construction monitoring study should be included as a condition for any project approval. The results of the post-construction monitoring should be reviewed by the Wisconsin PSC, Wisconsin DNR, and Service, in collaboration with Forward Energy, with a view toward determining adaptive management measures (e.g., temporarily shutting down individual or arrays of turbines, etc.) that could be taken to eliminate adverse impacts on migratory birds, as well as bats, if such impacts are documented.

Sincerely,

/s/ Charles M. Wooley
Acting Regional Director

cc: Wisconsin DNR, Office of Energy, Madison, WI, Attn: Dave Siebert

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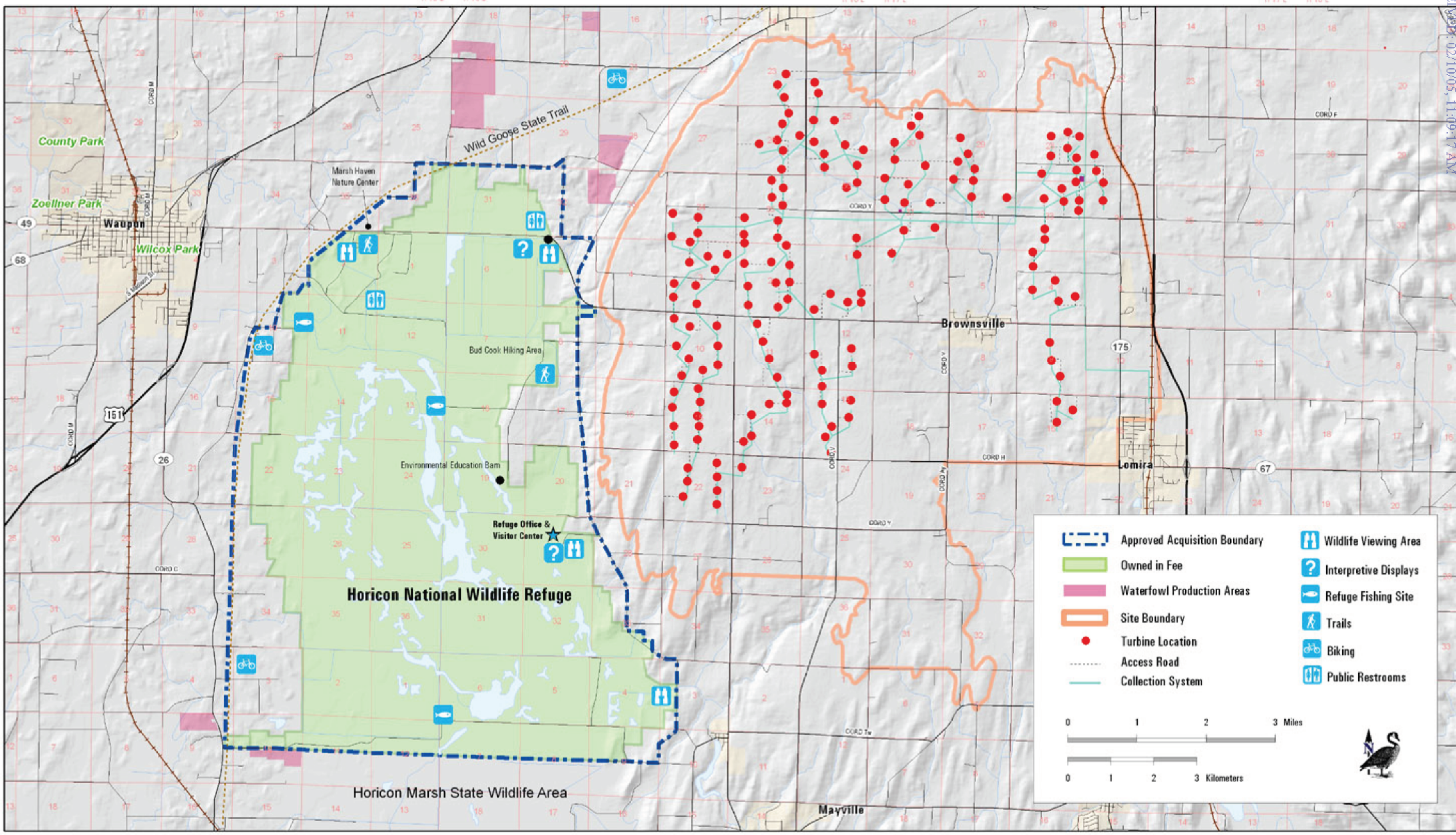
U.S. Fish & Wildlife Service

Horicon National Wildlife Refuge

Dodge and Fond du Lac Counties, Wisconsin

Forward Energy Center Conceptual Wind Turbine Layout



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WISCONSIN DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Jim Doyle, Governor
Scott Hassett, Secretary

101 S. Webster St.
Box 7921
Madison, Wisconsin 53707-7921
Telephone 608-266-2621
FAX 608-267-3579
TTY 608-267-6897

3 March 2005

Mr. Joel Link
Invenergy
One South Wacker Dr., Suite 2020
Chicago, IL 60606

SUBJECT: Endangered Resources Review (ERIR Log #04-085 and 04-093)
Proposed wind power facility for Forward Energy LLC (Forward Wind Energy Center)

Dear Mr. Link:

This letter is a follow-up to our 17 August 2004 letter regarding endangered resources. The Office of Energy has recently assumed responsibility for endangered resources review of utility projects and will work closely with the Bureau of Endangered Resources to implement Department endangered resources protection policies and regulations. The purpose of this letter is to provide recommendations for additional surveys and information that are needed to determine whether rare bird species may be impacted by the Forward wind project. Rare bird species include state or federally listed threatened or endangered species, species proposed for listing and special concern species. Special concern (watch) species are species about which some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become endangered or threatened.

Although this letter provides additional study recommendations for rare bird species, it does not diminish our concern for two special concern bat species, eastern pipistrelle and northern long-eared bat. These two species are likely to use and/or migrate through the project area. The absence of bat surveys at the Forward site and evidence from other wind turbine sites that mortality rates for bats are one to two orders of magnitude higher for bats than birds heighten our concern, especially if these species should become listed during the lifetime of the project.

The recommendations in this letter are based on our review of your report, “Abundance and Behavior of Migrant Waterfowl and Other Birds at the Forward Wind Energy Center”, December 2004, prepared for Invenergy Wind LLC by Curry & Kerlinger, LLC (referred to hereafter as Forward survey report). The Forward survey report states that:

> “Only 4 listed species of slightly more than 200,000 bird sightings were observed. Two Bald Eagles and 1 individual each of Great Egret, Red-shouldered Hawk, and Peregrine Falcon were observed during the fall study. This strongly suggests that listed species do not use the Project site, although they may fly through the area at times. Risk to these birds appears to be low and there are not likely to be adverse effects to these species.”

In addition to the listed threatened or endangered species noted above, the following eight state special concern species were also identified during the Forward surveys: Bonaparte’s gull, Tennessee warbler, common loon, American wigeon, northern harrier, great blue heron, northern goshawk and pine siskin. The bald eagle is also a state special concern species, but is a federally listed threatened species and is also protected under the Bald and Golden Eagle Protection Act. The first six special concern species in this list present varying degrees of abundance and frequency around Horicon Marsh, but all of them have been observed at least occasionally and may use upland areas to satisfy some of their habitat requirements. The last two species are rare, typically recorded as winter residents.

At present, we are unable to concur with the conclusions in the abovementioned paragraph from the bird survey report regarding listed species, primarily because the data are insufficient to draw such conclusions. The following text provides Invenergy with recommendations to fill information gaps regarding presence and habitat use by these and other rare bird species in the project area (i.e. state or federally listed and special concern species). The recommendations provided below are based on the following regulatory distinctions.

- Avoidance measures are required for State listed threatened and endangered animals to avoid “taking” as described in Wisconsin’s endangered species law (29.604, Wis. Stats.). Inability to avoid impacts will require an incidental take authorization to proceed.
- Avoidance and minimization measures are recommended for special concern animals, which are not afforded protection under Wisconsin’s endangered species law.
- Some species may be protected by other state or federal laws (e.g. bald eagle).

The additional surveys and information requested below are not avoidance measures per se. Rather this is information that is needed by the Department to determine whether the proposed project presents the potential for “take” of listed bird species, impact to special concern bird species, and what measures are needed to avoid or minimize such impacts.

Presence of rare bird species. The Forward survey report states that data were collected on 12 days during spring (April 3-23, 2004) and 33 days during fall (October 2-November 24, 2004) surveys, which yielded observation of 12 rare bird species. The survey area did not include portions of the westernmost project area, nor did it capture the peak migration period or breeding season for many rare species. In Wisconsin, surveys for red-shouldered hawks should be conducted from March 15 to May 1. Great egrets arrive in Wisconsin from early to mid-April, which overlaps with the 2004 spring survey period. However, fall migration for great egrets begins in mid-August and peaks occur from late August through September. In addition, many of Wisconsin’s rare bird species are Neotropical migrants. For these species, spring migration peaks in May and breeding occurs throughout the summer, neither of which was covered in the surveys. In addition, the use of road surveys and the emphasis on observing waterfowl and other birds present in large numbers may introduce bias against detecting birds that are cryptic or present in small numbers.

Because rare species, by definition, exist in low numbers, it is difficult to distinguish a false negative from a true negative except through focused surveys over several years. Such efforts are generally outside the scope of individual development projects. Still, the number of rare species observations recorded during the Forward survey is lower compared to 24 rare species observed by Howe et al. (2002) and 19 and 24 species, respectively, observed during surveys at proposed wind turbine sites near Stockbridge in Calumet County and Rosiere in Kewaunee County (PSC 1998). All of these surveys were undertaken in one year although at different times than the Forward survey. Importantly, the setting for all three sites is characterized similarly to the Forward site as predominantly agricultural where natural habitat is scarce. Most of the rare species identified by the surveys cited above were neotropical migrants that prefer grasslands or open areas. This indicates that even rare neotropical migrant species will use habitat in disturbed areas such as the Forward site. Surveys at the Forward site in 2004 were not planned to optimize observations of this group of birds. Observations of local birds, proximity to Horicon Marsh, and the absence of surveys in the westernmost project area, also suggest that more rare bird species may be present at the Forward site than were identified during the 2004 surveys.

Recommendation: We believe that surveys completed at the Forward site in 2004 were insufficient and the presence and abundance of rare species within the project area may be underestimated. To address this concern, rare bird surveys should be completed during 2005 to cover the full extent of the spring migration, the breeding season, and the early fall migration period that were missed in the 2004 surveys. The survey methodology should include point counts at locations extending radially from Horicon Marsh based on results from the Forward survey and a previous study by Howe and Atwater (1999) that abundance and perhaps diversity may be correlated with distance from the Marsh. In anticipation of post-construction monitoring that may be required, we strongly suggest that a suitable reference site also be identified and included in the 2005 survey. Our ornithologists would be able to assist you in making any adjustments to the 2004 survey methodology and schedule to maximize detection of any additional rare bird species that may be present at the site during a 2005 survey. We also recommend that Forward review Doppler radar data that might yield information on the patterns of nocturnal migrants around the project area and consider performing acoustical studies during 2005 and after project construction.

The information from 2005 surveys would allow us to get a more complete picture of birds in the project area that are rare as a species, but may be locally more abundant. Abundance and frequency are factors that may affect the number of fatalities, as implied in the paragraph excerpted from the Forward survey report. The greater certainty we have in this information, the better our ability to estimate risk. Regarding radar and acoustical studies, this would allow us to estimate the magnitude and height of nocturnal bird migration over the project area to forecast meteorological and migratory conditions where birds, forced to fly at lower altitudes because of bad weather, are unable to see clearly and might encounter turbine facilities in large numbers. This information could be used to set conditions for operating the facility to reduce risk to nocturnal migrants, of which many are rare species.

Habitat use by rare bird species. During the 2004 Forward surveys flight height, direction and activity of birds were recorded. However, the analysis of this data for rare bird species was generally absent from the report. Given insufficient information on habitat use and behavior of rare bird species coupled with the possibility that the presence of rare species in the project area may be underestimated, we are unable to evaluate or endorse the conclusion that rare species “do not use” the project area and rather “pass through” it.

Recommendation: During bird surveys in 2005, and using available information from 2004, we recommend that the location, flight height, direction, breeding, nesting and foraging behavior for rare bird species be documented. The data recorded in the field focus on rare bird species with improvements to the methodology used to estimate flight height and record bird behavior. Since abundance or frequency are not always correlated with fatality rates, there are likely other behavioral and environmental factors that affect collision risk like how often and how much time a bird or a species spends within the rotor swept area of the turbine, or whether flight in this zone occurs during migration, pursuing prey, etc. This information would allow us to determine whether some rare species exhibit behaviors in the project area that place them at greater risk of collision with turbines.

Rare bird species that have been experiencing population declines are generally considered uncommon. While there is a growing body of literature on avian mortality and habitat use at wind turbine sites, there is very little analysis on the impact of wind turbines on rare bird species, especially in the context of long-term population viability. Conclusions from existing studies that low fatality rates are insignificant or that certain bird groups are more or less susceptible to wind turbine collision are mostly applicable to common species. The number of deaths that would constitute a serious mortality factor for rare bird species would be much smaller than for any species that is more abundant. The Forward bird survey report does not allow us to reasonably estimate whether mortality at turbines located in the study area will or will not represent a significant mortality factor for rare species. We do not expect an additional year of surveys to establish 100 percent certainty in our conclusions, but more and better information obtained during 2005 will move us much further in that direction than we are with the information we currently have.

We would like to reassert our willingness to assist your organization in implementing these recommendations, which are within the scope of what should be expected of a project of this size and nature. While the DNR is collaborating with the Public Service Commission during the application review process under an interagency agreement, the recommendations provided in this letter are not intended to impact that process, but rather ensure compliance with Wisconsin's endangered species law and guidelines. Please contact me at (608) 261-4382 if you have any questions.

Sincerely,

Shari Koslowsky
Office of Energy

CC: Steve Ugoretz - OE/7
Betty Less - BER/6
Leakhena Au - FWS, GBFO
Shelly Schaetz - NER
Sarah Carter - SCR
Marilyn Weiss - PSC

Inv nergy

February 21, 2005

Mr. Steven Ugoretz
Wisconsin Department of
Natural Resources
101 South Webster Street
P.O. Box 7921
Madison, WI 53707-7921

Dear Mr. Ugoretz:

Re: Forward Energy Wind Energy Center
PSC Docket No. 9300-CE-100

As you know, we have attempted to arrange a meeting with you and the Department of Natural Resources ("DNR") to discuss the Forward Wind Energy Center in Fond du Lac and Dodge Counties. In the absence of a face to face meeting, however, we feel that it is important to respond to your correspondence to Marilyn Weiss of the Public Service Commission of Wisconsin ("PSC") dated November 16, 2004 (the "Letter"), and to information discussed during the conference call on November 23, 2004 involving representatives of the PSC, the Department of Natural Resources ("DNR"), and Invenergy, including Dr. Paul Kerlinger.

As you are aware, the Report of the Governor's Task Force on Energy Efficiency and Renewables which was released on December 1, 2004, recognizes that wind power has strong promise for Wisconsin in the near future. The Report finds that tapping wind energy to produce electricity avoids the air and water pollution caused by combustion of fossil fuels, such as coal, and the solid and hazardous waste concerns associated with the residues of that combustion. The Governor's Task Force also recognizes that wind and other renewable resources have the added economic benefit of being an instate resource, keeping dollars in the state which otherwise would go to the purchase of fuel. (Governor's Report, p. 33). Moreover, electric generation provided by wind energy is one form of the highest priority means of power generation (non-combustible renewable energy) under Wisconsin's energy priority law. (See §§ 1.12(4)(b) and 196.25, Stats.)

Our responses focus on a number of fundamental issues identified in the Letter. First, we identify various portions of the CPCN application and related information provided by Invenergy which directly address several points included in the Letter. A review of this available information would have avoided several mistaken statements and assumptions included in the Letter. We also analyze the scope of the DNR's interest in this matter. We trust that these observations will help to clarify the proper context in which the DNR's comments should be considered in the PSC's review of this renewable energy project.

PROJECT RELATED WILDLIFE IMPACTS

The Letter states that the DNR's comments are based on review of materials in Forward Energy's application as well as its supporting responses. However, considering the content of the Letter and the questions posed at the November 23rd meeting by DNR representatives, it appears that the DNR's review missed significant portions of the information provided.

The Letter asserts that bat and bird studies "are primarily literature review, and include only limited characterization of the actual use of the project area by birds and bats (based primarily on one brief site visit in April, 2004)." These statements are surprising because the materials which the Department claims to have reviewed advise that the April observations are based on a two day visit by the principal investigator, Paul Kerlinger, Ph.D., and an additional twelve (12) days of investigation by Dr. Kerlinger's field technician. (See Phase I Avian Risk Assessment, p. 7; and Phase I Bat Assessment, p. 4.) Moreover, the application materials expressly stated that Dr. Kerlinger would be submitting a full report by December 2004, a report the U.S. Fish and Wildlife Service ("FWS") recognized in its November 18, 2004 letter was pending based on its review of the same application materials. As you know from other contacts with Dr. Kerlinger, his field studies extended through October and November of 2004, in the interest of thoroughness. Thus, to the extent the premise of the Letter was that the initial work in April 2004 was the last pre-draft EIS work on avian studies, the premise is faulty.

The Letter expresses a concern for the safety of bats because bats travel by following wooded corridors, implying that such corridors exist in the area of the Forward Energy project. As the application materials document, 96.55% of the project's area is agricultural. The few wooded areas in and near the Forward Energy project are small in size and patchy in their locations, i.e., are not corridors for bat travel. This information was provided to the DNR through the URS Report (p. 22) and its discussion of the intense existing agricultural use of the area. Dr. Kerlinger confirmed this dominant agricultural land use during the meeting on November 23, 2004 and the reductive effect that that land use has on the presence of bats in the project area.

The DNR's suspicion that "large numbers of [bats] that hibernate in the [Neda Mine] may be using the landscape resources in a large area up and down the Niagara Escarpment for travel and feeding" seems to ignore the Phase I Bat Risk Assessment prepared by Dr. Kerlinger and submitted by URS. Because the land use in the project area is more than 96% agricultural, there is not a plentiful source of insects on which the bats could feed. Nor is there ample tree cover to attract insects or in which the bats could roost. Likewise, the turbines will not be placed in moist areas that are likely to breed insects, and, in turn, attract bats. If anything, bats will be attracted away from the fields in which the turbines are located to moist areas where insects might breed. This behavior probably explains why Dr. Merlin Tuttle, a strong advocate for protecting the bats which inhabit the Neda Mine, recommended only a two mile buffer area around the Mine for another wind power project in Dodge County to be located closer to the mine than the Forward Energy project. (See Phase I – Bat Risk Assessment, p. 6.)

The DNR's concern for bat mortality in an area where a wind turbine is operating and where bats are arguably plentiful because of a hibernaculum some ten miles south seems at odds with the unprotected status of all but one bat species in Wisconsin. Only the Indiana bat has a protected status, but it is not known to occur within about 80 miles of the project site. As unprotected animals bats may be killed by a property owner (or occupant) at any time and in any number without even obtaining a license.

According to Dr. Kerlinger's analysis, the annual rate of bat deaths from collisions with wind turbines at Midwestern sites is two to four per year per wind turbine. We do not believe that the DNR could reasonably consider significant the annual loss of two to four bats per household even if the loss occurred in one hundred thirty (130) households in Dodge and Fond du Lac Counties.

The Letter expresses concern that the project will be approved before its impacts on the Northern Harrier or other "listed and rare species" are studied. Dr. Kerlinger's assessment already demonstrated that in his spring survey there were no listed species in the project area and that the area, with its intense agricultural use, is not likely to become habitat that would attract, much less support, such species. Dr. Kerlinger has supplemented the Phase I study with a fall survey based on point counts and road surveys. His follow-up survey provided a fail safe to the DNR's or FWS's species assessments and Dr. Kerlinger's April study: out of more than 200,000 sightings, only two Bald Eagles, and a Great Egret, Redshouldered Hawk, and Peregrine Falcon were observed, all of which were simply passing through the Project site.

The assertion in the Letter that significant evidence of flight patterns by waterfowl and other birds to and from the marshes may need additional preconstruction study suggests that the DNR has not adequately considered the information already provided. The Atwater study, which is referred to and briefly discussed at page 16 of the Phase I Avian Risk Assessment, encompasses two (2) years of such flight patterns. While the Atwater study did not cover one relatively small area of the Marsh, the spring and fall Avian Use Report has now filled that void. Thus, avian flight patterns in the project area, particularly those associated with the Horicon Marsh, are well understood and further study is simply unnecessary.

The Letter criticizes the Phase I Avian Risk Assessment as a "superficial treatment" of avian usage because of the project's proximity to the Horicon and Theresa marshes. The apparent premise is that these locations by virtue of their relatively large bird populations are somehow so unique that the habit and habitat information from previous studies is not reliable or, at least, must be verified by lengthy preconstruction studies. We know no scientific reason to discount or ignore the habit and habitat data in the literature merely because of greater numbers or greater densities. The Letter provides none.

Furthermore, the fall survey demonstrates that the bird species present in the project area in largest numbers (Canada Geese) is not susceptible to collisions with wind turbines. The site specific information on flight altitudes, even without wind turbines present, demonstrates that the clear majority of flights were either above or below the rotor swept areas. This bird species facility in avoiding collisions should not come as a surprise, given substantial past information demonstrating that point. As the Fish & Wildlife Service has indicated in reference to studies of bird mortality at modern wind farms in the United States: "Those that have been done have not indicated that high numbers of waterfowl or songbirds are killed at such wind farms." See letter from Charles M. Wooley to Marilyn Weiss dated February 8, 2005. The DNR should not be reluctant to accept these preconstruction habits as transferable to post construction expectations regarding bird/turbine collisions.

The DNR has recognized the utility of transferring habit and habitat information from one study circumstance to another by its endorsement of the approach of using "population models", such as those discussed by Dr. Kerlinger in his Phase I study. In fact, we think that population modeling (transferring habit and habitat knowledge from existing sites and applying them to Forward Energy project and project area) is a very useful feature of the Phase I studies and their relevance to the Forward Energy project.

As you are aware from the discussion on November 23, Dr. Kerlinger has relied on a recent study of the effects on avian species of a wind farm in the Montezuma Hills near the Suisun Marsh (Grizzly Wildlife Management Area) in the Sacramento Valley of California, in addition to the two fatality studies (Buffalo Ridge and Mountaineer) previously cited. Among the features of the Suisun Marsh that make it an excellent predictor for the Forward Energy project's impacts on avian wildlife is that the California sanctuary area is significantly larger than the Horicon Marsh and the number of wind turbines currently in operation near the Suisun Marsh exceeds by almost 100% those that will be operated under the Forward Energy project. Evidence from several years of study show waterfowl fatalities from the Montezuma Hills wind turbines are almost non-existent and, thus, indisputably biologically insignificant.

The Top of Iowa wind farm project (89 turbines) is located in croplands in north central Iowa between and near three large wildlife management areas. Of particular interest is the report for post construction year 2003. The bird fatality results were the following:

- Adjusted total bird and bat mortality due to collisions with wind turbines April 15-December 15, 2003: 10.8 birds and 167.2 bats;

- No waterfowl among birds killed.

We understand that the year 2004 construction report is not available but understand that the bird fatality results are even lower in 2004. The Top of Iowa wind farm provides a strong analogy for the Forward Wind Energy site.

The information in the Phase I Bird Risk Assessment helps to put into perspective the issue of bird fatalities from wind turbines in Wisconsin:

> With respect to the biological significance of such estimated facilities to waterfowl at the Project area,

> waterfowl harvest statistics for the state of Wisconsin (Martin and Padding 2002) permit a powerful comparison. About 260,000 ducks and 55,000 Canada Geese are shot each year in the state, according to Martin and Padding (2002). This would mean that if each wind turbine killed 1 bird per turbine per year, which is about 30-100 times greater than the empirical fatality rates for these species at turbines in Wisconsin and Minnesota, the fatalities would amount to 0.03% of the annual legal harvest. Because the annual harvest of waterfowl varies from year to year in Wisconsin and elsewhere by 10% or more (more than 20,000 ducks and geese), this extremely low level of fatalities [related to wind turbines] cannot be construed as biologically significant. It would not likely be detectable via population viability analysis, which is the type of population model (Reed et al. 2002) used to determine whether impacts are biologically significant and is similar to the models used by the U.S.G.S. and U.S. Fish and Wildlife Service when they set harvest limits on various waterfowl species.

(Phase I Avian Risk Assessment pp. 33 and 34.) In view of these numbers, bird fatalities from the Forward Energy Project are not likely to be a significant causative factor to their overall population stability.

Another consideration which puts into perspective the anticipated bird mortality numbers from wind turbines among causes of avian wild life losses generally is the crop damage information marshaled by the DNR. We understand that in the most recent year for which figures are available (2003) the State paid $1,199 to farmers in Dodge County, $0.00 to farmers in Fond du Lac County and $17,172 to farmers in Brown County for the crop damage caused by geese. Among the likely explanations for these divergent crop damage awards, despite the known large number of geese present in the fields in the project area, is that the type of forage in the fields in Dodge and Fond du Lac Counties is less of an attractant than the forage in Brown County. To the extent that explanation is accurate, it suggests that the forage in the project area is not a strong attractant and the geese will easily adapt to seeking forage in fields away from where the turbines will be located.

We also understand that the waterfowl in the project area, particularly geese, create such nuisance conditions that the farmers and other land owners in the area are allowed to drive them away by use of propane cannons that fire every couple of minutes during daylight hours. In more extreme conditions, the land owners are permitted to kill the birds or have them killed by an agent. With these geese actually creating a financial and aesthetic burden to the area, the reduction in their numbers caused by the Forward Energy Wind Farm, however minimal, would appear to be beneficial.

The DNR's request for a two year post construction study for both bats and birds, however, is in order and was recommended by Dr. Kerlinger.

DNR'S LEGAL INTERESTS

We do not believe that any permit is required from the DNR related to this project. The DNR's letter dated July 26, 2004 regarding compliance with § 196.491(3)3.a, Stats., confirms this position. Instead we believe that DNR's interest is limited to joint preparation of the Environmental Impact Statement ("EIS") with the PSC.

The DNR's comments in the Letter are prefaced by stating that they are "in regard to the potential for impacts on wildlife resources subject to DNR management responsibility," specifically those related to hunting. Clearly, the construction and operation of wind turbines on private property, as is the case for the Forward Energy project, does not entail hunting. Thus, we question how the DNR's wildlife management responsibility for hunting transforms itself into authority to place conditions on the location, sequencing or number of the Forward Energy turbines or even the scope of post-construction studies presented in connection with a project for which an EIS is prepared by the DNR. Certainly, the provisions of ch. NR 150, Wis. Admin. Code do not grant such authority.

We believe that the absence of authority to place conditions on the project is true even if the activity (operation of wind turbines) results in "direct mortality" or "behavioral impacts." As a result we think the Letter fails to acknowledge the DNR's role in this matter, i.e., assisting the PSC in the preparation of a draft EIS and subsequent final EIS. We urge the DNR to make clear in its contributions to the EIS for the Forward Energy project its advisory capacity.

If the DNR considers it has broader authority than that envisioned under ch. NR 150, please explain the basis of that authority.

CONCLUDING STATEMENTS

We want to assure the DNR that avoidance and minimization of adverse impacts on birds and bats will be factored into the layout and operation of the Forward Energy Center. We remain willing to avoid, where possible, or minimize, to the extent feasible, the negative impacts of the Project on avian wildlife and bats, subject to the technical constraints involved in the need to serve Wisconsin's energy needs efficiently.

While we think the timing of the Letter was unfortunate in that it ignored the fact of a forthcoming report and significant parts of our client's prior submittals, we do appreciate the Department's position that it will work in cooperation with the PSC staff to complete the draft EIS. We expect that this cooperation will result in the DNR preparing its portion of the draft EIS expeditiously. To assist the Department in that regard Dr. Kerlinger made every effort to prepare his supplemental report so that it was available by December, 2004 as he projected. He has also agreed to make himself available for questions should any persist following the DNR's review of the report.

If you have any questions concerning this matter, please feel free to contact me at (312) 224-1414.

Very truly yours,

Joel M. Link

Joel M. Link
Project Manager

cc: Jim Lepinski, WPSC

Inv nergy

February 23, 2005

Mr. Charles M. Wooley
Acting Regional Director
Fish & Wildlife Service
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111-4056

Dear Mr. Wooley:

Re: Forward Wind Energy LLC Wind Electric Generation Facility, Dodge and Fond du Lac Counties, PSCW Docket 9300-CE-100

Forward Wind Energy LLC ("Forward Energy") is providing this letter in response to your scoping comments set forth in the letter to Marilyn Weiss of the Public Service Commission of Wisconsin dated February 8, 2005 (the "Letter"). By doing so we hope to promote further the dialogue Forward Energy has fostered through meetings and previous correspondence with the Fish & Wildlife Service's representatives in Green Bay.

Fish & Wildlife Service (the "Service") correctly, in our judgment, recognizes at the outset that the use of wind energy to generate electricity "produces no emissions, and is generally considered to be an environmentally friendly technology." We agree as well that a properly sited and designed wind energy development has the potential to reduce the loss of [wildlife] resources and their habitats by replacing, other more disruptive forms of energy development." Forward Energy is convinced that its project in Dodge and Fond du Lac counties is well designed and is well sited, after extensive consideration of its proximity to the Horicon National Wildlife Refuge and the adjacent state owned Horicon Marsh Wildlife Area. Our correspondence to Janet Smith dated February 4, 2005 and previous submittals to the Public Service Commission, we believe, support those claims.

Forward Energy, like the Service, has concluded that the large scale studies of bird mortality at modern wind farms in this country "have not indicated that high numbers of waterfowls or songbirds are killed at such farms." In addition to the High Winds project near the Suisin Marsh in California, there is the Top of Iowa study which was discussed in our letter to Janet Smith. Of particular interest is the Top of Iowa report for post construction year 2003 which we have attached for your convenience. We understand that the year 2004 post construction report is not yet available, but provides similar if not better results than the year 2003 report.

One South Wacker Drive, Suite 2020 Chicago, IL 60606 T 312.224.1400 F 312.224.1444 invenergyllc.com

Both of those post construction reports demonstrate that waterfowl mortality was extremely minimal at the wind farm despite its proximity to three wildlife management areas (WMA) in northern Iowa. Because of the project's location in agricultural land and among WMAs that form complexes of wetlands, grassland and forest, and that have had historically high bird use, we believe that the Top of Iowa site represents the "similar ecological, temporal and spatial use of the landscape by wildlife" which the Service is seeking as an analogy for the Forward Energy project. It should also be mentioned that the Buffalo Ridge turbine areas in southwestern Minnesota are in important waterfowl migration areas, yet after four years of study no significant impacts have been noted in a peer reviewed publication. (Johnson et al. 2002. Wildlife Society Bulletin 30:879-887).

As we noted in our February 4, 2005 letter to Ms. Smith, the post construction studies at the Top of Iowa project confirm even lower bird per turbine mortality numbers than the other modern, large scale wind farms that have been studied. Because the Letter does not refer to the Top of Iowa project we wonder if it was written without the benefit of reviewing our letter to Ms. Smith, the Top of Iowa field results or the Buffalo Ridge, Minnesota study. The Top of Iowa report indicates that the study design was collaboratively developed among the state and federal authorities and the developer and was peer reviewed in the manner the Service is suggesting Forward Energy consider. We request that the Service consider results from that project because of the similarity in bird use, assemblage and population between the Top of Iowa and Forward Energy's Dodge and Fond du Lac County project. A similar process was used for the Buffalo Ridge study in Minnesota. In our assessment these similarities are much more than merely superficial.

Despite the Service's concerns about the preconstruction survey done by Dr. Paul Kerlinger at the Forward Energy project, we believe his survey establishes the necessary density and use patterns that can be relied on to design and site the project to minimize bird fatalities. We consider that the results of Dr. Kerlinger's study are consistent with other projects of similar scope. It is also important to understand that Dr. Kerlinger's study was structured to dovetail with the Howe and Atwater study that was conducted in 1996 and 1997 at the Horicon Marsh. The Howe and Atwater study identified the numbers and directions of birds coming to and from the Marsh including the area of the Forward Energy site. We think, as a result, that Dr. Kerlinger's projections of biologically insignificant bird and bat fatalities following construction are based on sound habit and habitat observations from other projects.

On page 4 of the Letter it states: "It is our opinion that the determinations of detection probability (observer efficiency) in the Kewaunee study were flawed..." for the Howe et al.

(2002) study. Because the Service's rationale for this statement was not provided, we request that you do so in writing. Please note that the Wisconsin DNR and Bat Conservation International were acknowledged by Howe et al. (2002) as "contributors to the research design" for that research, suggesting agency and environmental review.

The U. S. Fish and Wildlife Service's guidance document, referred to in the Letter (page 2) has not yet been peer reviewed. That guidance document has been on the Federal Register for more than 18 months, during which time comments have been solicited, without revision of the original document. Moreover, the guidance document has been shown to be incorrect in places and needs to be revised at the conclusion of the two year comment period (July 2005). In turn, the revised document will require peer review. Also, to our knowledge the Anderson et al. (1999) document to which the Letter refers does not provide a specific post construction monitoring protocol. If we are wrong, please provide the specific pages in Anderson et al. (1999) on which the post construction monitoring protocol is found.

The letter also implies separation distances between the turbines (particularly the two western-most rows) and "the approved land acquisition boundary of the Refuge" is representative of the distances critical for purposes of minimizing bird fatalities. In our view, the separation distances should be determined by using the areas of bird use, not legal boundaries whose expansion or contraction will not affect the habits or habitats of birds.

With respect to the Service's contention that the Kerlinger study was "not conducted during the peak of migration for most waterfowl species," we believe this is incorrect. Kerlinger stated that he followed Frank Bellrose's (1976) classic treatise on waterfowl biology ("Ducks, Geese, and Swans of North America", Stackpole Books, Wildlife Management Institute). Please note that in the species descriptions for Canada Goose, Mallard, and most of the other more common waterfowl, the seasonal graphs provided in Bellrose for peak migration correspond to the period studied in 2004.

You indicate in the Letter that "it is becoming increasingly apparent that bats may be more susceptible to turbine strikes than are most birds." We believe that this statement is accurate as between bats and birds, but may be an over-statement as between various bat species. In addition, we would be reluctant without a more detailed comparison of the specifics of the Kewaunee sites to project to the Forward Energy site the bat mortality data from the Kewaunee study cited in the Letter. For example, while the Kewaunee sites do not identify "major hibernacula" in the area the study is apparently not able to rule out numerous smaller hibernacula much nearer the Kewaunee turbines than the Neda mine is to the Forward Energy site. Nor do the turbine strike numbers account for possible differences in the abundance of food because of either the proximity of the Kewaunee turbines to the lakeshore or the less intense level of farming that exists around those particular project sites.

Finally, Forward Energy has committed from the outset of this project that it will do a post construction study. Our current thinking is that the study will last two years. We are agreeable to modeling the study after that which received peer review and approval for the Top of Iowa study. It will be our intention to provide the study design for consideration by the Public Service Commission. We will also share the design with the Service and welcome its input.

Thank you for your consideration of this information. To the extent that the Service has any available information on post construction monitoring of existing wind farms that it believes would be beneficial in aiding in the siting of the Forward Energy project, we would be interested in receiving a copy or meeting face to face to review the data. As always, we would welcome the opportunity to meet with you or the staff in Green Bay to further discuss the project or any relevant information regarding wind turbine siting.

Very truly yours,

Joel M. Link
Project Manager

cc Ms. Marilyn Weiss
Ms. Janet Smith
Dr. Paul Kerlinger

AVIAN MORTALITY ASSOCIATED WITH THE TOP OF IOWA WIND FARM

Progress Report
Calendar Year 2003

Principle Investigator:
Dr. Rolf Koford
Iowa Coop. Fish and Wildl. Res. Unit
Science Hall II
Iowa State University
Ames, IA 50011

Graduate Student
Aaftab Jain
Dept. of Natural Resource Ecology and Management.
Science Hall II
Iowa State University
Ames, IA 50011

Co-Investigators
Guy Zenner, Natural Resource Biologist
Alan Hancock, Natural Resource Technician
Iowa Dept. of Natural Resources
1203 N. Shore Drive
Clear Lake, IA 50428

February 28, 2004

Abstract
We examined bird and bat mortality at a new 89-turbine windfarm constructed in an environmentally sensitive area in north-central Iowa. The windfarm became operational in November 2001. It is located in cropland between three Wildlife Management Areas (WMA's) with historically high bird use. In the past, migrant and resident waterfowl, shorebirds, raptors, and songbirds moved between the WMA's through the area now occupied by the windfarm. Studies of bird collision mortality in California and elsewhere raised concerns about the possibility of mortalities in this area. From April 15, 2003 and December 15, 2003 we searched for dead animals under 26 randomly selected turbines. Six 76.2 m by 3.0 m transects were maintained as bare ground under each of these turbines. Access roads and construction pads under turbines were also searched. We found two birds (a yellow-throated vireo and a tree swallow) and 31 bats (hoary, red, little brown, big brown and silver-haired bats). Spring and summer search efficiency and scavenge rates were evaluated. During observer efficiency trials, observers found 77% of bird carcasses. In spring and summer and fall scavenging trials, scavengers removed 7%, 12% and 7% of carcasses respectively, within the duration of observer search cycles (i.e., 2 days). Point counts were conducted to compare bird activity in fields with and without turbines. We monitored waterfowl activity and behavior in the fall. 1.2 million total goose-use days and 194,029 total duck-use days were recorded in the WMA's, from September 15 to December 25, 2003. Canada goose foraging behavior was monitored for a total of 270 flocks, from September 27 to December 1, 2003. Bat detectors were used to compare bat activity at turbine versus adjacent non-turbine sites. No significant differences were found between relative bird and bat activity at turbine, turbine with transect and non-turbine sites. Results presented are preliminary. The study will continue until December 2004. While we have yet to evaluate the significance of the mortality data, proper siting of these facilities remains a priority.

Introduction
Electrical generation in the Midwest has historically been accomplished through the burning of fossil fuels. Burning fossil fuels, however, can have negative environmental impacts such as increasing atmospheric CO^2 emissions, which are known to contribute to global warming, or degrading air quality through release of particulate matter. Additionally, fossil fuels are a non-renewable limited source of energy. In northern Iowa, wind power is a financially competitive alternative source of renewable energy, as it is in other parts of the U.S., that is generally viewed as having few negative effects on the environment (Erickson *et al.* 2001). There are, however, concerns that bird and bat mortality resulting from collisions with wind turbines could be substantial in some areas (Orloff and Flannery 1992).

Study Area:
In December 2001, construction was completed on the 89-turbine Top of Iowa Wind Farm near Joice in Worth County, Iowa. Turbines are located on private land in Sections 14, 15, 16, 21, 22, 23, 24, 25, 26, 35 and 36 of Bristol Twp. (T- 99N, R-22W) and Sections 1, 2, and 11 of Fertile Twp. (T-98N, R-22W), an area comprising about 2,137 ha (5,280 acres) (Fig. 1). Turbines are mounted on 71.6 m (235-foot) high tubular towers and turned by three 25.9 m (85-foot) blades. Blade speed at the tips is approximately 337 kmph (130 mph).

Unlike other wind farms in Iowa, the Top of Iowa Wind Farm is located in an area that historically has had very high bird use, particularly water bird use. The wind farm is situated between three large state-owned WMA's that are complexes of wetland, grassland and forest habitat: the Rice Lake (~2,500 acres), Elk Creek (~2,500 acres) and Hanlontown Slough (~1,000 acres) WMAs (Fig. 1). The close proximity of these three large WMAs provides attractive habitat on a large scale, for north-central Iowa, and offers islands of strategic habitat. In addition to hosting numerous migrating birds during spring and fall, the Rice Lake – Elk Creek – Hanlontown Slough complex (RL-EC-HS) provides habitat for many breeding birds during the spring and summer, particularly wetland and grassland birds. In the past, migrant and resident shorebirds, rails, raptors, sparrows and icterids moved freely between the WMAs, their flight paths routinely taking them through the area that is now occupied by the wind farm. Additionally, part of the wind farm is contained within an area that has been closed to Canada goose hunting for 30 years to increase Canada goose use in the area. Finally, 2 of the adjacent WMA's contain inviolate waterfowl refuges that attract up to 40,000 Canada geese and 20,000 ducks to the area each year, resulting in 2.5 million waterfowl-use days in the vicinity of the wind farm. There is no other existing wind farm site in Iowa with higher potential bird use.

Objectives:

1. Determine bird and bat mortality resulting from impacts with wind-generator towers and turbine blades, with emphasis on mortality during the spring and fall migration periods.
2. Determine bird and bat species composition, relative abundance, habitat use, flight patterns and the relative mortality risk at turbine sites versus non-turbine sites.
3. Determine impacts of the wind turbines on waterfowl use of croplands by comparing waterfowl use of quarter sections containing wind turbines to similar quarter sections without turbines during the fall, with emphasis on Canada goose use of the area closed to Canada goose hunting around the Rice Lake WMA.

Methods:

Researchers looked for evidence of collision-induced mortality under 26 of 89 wind towers. Six 3m-wide transects were maintained vegetation free, using herbicides and manual weeding techniques, on each 76m x 76 m search plot under each of the 26 randomly selected towers. Transects were parallel to existing corn/soybean rows. Total transect area searched under each tower was 1371.6 m^2 (6 x 3m x 76.2m). This area comprised 24% of the search plot. Access roads and construction pads under turbines were also searched. Starting March 15, the turbine sites were being set up, and standardized searches of all mortality transects began April 15, 2003. Searching under each tower started immediately after transects were setup at its base. The search frequency was once every three days. From June 13 onwards, the search pattern was standardized to once every two days, in order to increase accuracy of the searches. Scavenger removal rates of collision evidence were measured during spring, summer, and fall by placing birds of 3 sizes (house sparrow, mallard/pigeon and Canada goose) on mortality transects under each of the 26 monitored wind towers. Carcasses were monitored daily for two weeks for evidence of scavenging. The status of each carcass was reported as intact, partially scavenged, or completely removed. Search efficiency trials were conducted for each observer by having an independent DNR wildlife technician place small birds, such as house sparrows, on transects without the field assistants' knowledge. The field assistants recorded all evidence of bird or bat collisions that they discovered, including evidence planted by the independent wildlife technician. Planted evidence of collisions was later removed from the database and a search efficiency rate calculated for each field assistant.

We estimated relative avian abundance and activity using fixed radius (100m) point counts from May 1, 2003 to December 1, 2003 (Ralph et al. 1995). Starting March 15, observers standardized their point counting techniques to reduce variance between observers. Additional point count sites were added as landowner permission was obtained until by May 1, all point count sites were in place in accordance with the experimental design. Observers recorded species, activity, and location of all birds within a 100m radius of the point count site. The duration of each point count was 10 minutes. Point counts were conduced in the morning from one-half an hour after sunrise until 4.5 hours after sunrise, during mid-day from 11 AM to 2:00 PM, in the evening from 4:00 PM to 7:30 PM, and at night from half an hour before sunset to an hour and a half after sunset. These times were periodically adjusted to account for changes in daylight hours. During morning and evening point count periods, observers usually completed 10 point counts. Due to the shorter time frame for conducting mid-day and night point counts, observers usually only completed 8 point counts for those periods. We conducted point counts under wind towers without mortality transects, as well as wind towers with mortality transects, and in adjacent fields without wind towers. We also conducted point counts in crop fields in an area approximately 4 miles southwest of the windfarm to contrast bird activity within the windfarm to similar sites outside the windfarm. Each site was visited approximately once every 6 days for each of the four time periods (morning, mid-day, evening and night).

Due to difficulties in acquiring functional bat monitoring equipment (shipping delays, malfunctioning equipment) we did not begin remotely monitoring bat activity around wind turbines until September. Prior to that time, bat activity was monitored in conjunction with evening and night point counts. Anabat ultrasonic bat detectors were used to monitor bat activity from September 4, 2003 to October 9, 2003 (O'Farrell 1999). Monitors were placed at wind tower sites as well as in adjacent fields without wind towers. The bat detectors were waterproofed for passive monitoring (O'Farrell 1998) and left overnight at each site. The collected data was downloaded (in a digital format) the following morning onto a computer. Using software programs and statistical analysis, the digital information was used to estimate relative bat activity and species on the windfarm (Jolly 1997).

Waterfowl activity was monitored in the fall, from September 15 to December 25, 2003. Waterfowl use of crop fields within the area closed to Canada goose hunting around Rice Lake was estimated twice weekly. Waterfowl behavior was also observed during morning and evening foraging periods in the same area. Behavior noted was time spent foraging (stationary and mobile) versus time spent vigilant (stationary and mobile) using scan sampling techniques (Altmann 1974). A flock was scanned for 2 minutes, and each bird observed was assigned a combination of behaviors (foraging, vigilant, mobile, stationary or other). For both activity and behavior, observations were made from county roads using a vehicle and spotting scope to keep disturbance to a minimum. Cropping and/or tillage practices and turbine activity were recorded for each field during each count along with any observations of other human activity that may have influenced waterfowl use of quarter sections. Fields with and without wind turbines in the area closed to Canada goose hunting were sampled for waste grain to estimate the relative amounts of grain available for foraging waterfowl in the fields. This was done to determine if the fields with wind turbines had similar amounts of waste grain in them, i.e., were as attractive to feeding geese, as fields without wind turbines, an important consideration in goose use of these fields. Farming practices were also documented for sampled fields. Farmers whose fields were not sampled were contacted to determine the farming practices they used in 2003 to predict the attractiveness of unsampled fields to foraging geese.

In addition, numbers of waterfowl using Rice Lake, Elk Creek and Hanlontown Slough were estimated twice weekly between 10:00 AM and 2:00 PM to get a relative picture of waterfowl use of the WMA's adjacent to the wind farm. These counts were conducted in a manner similar to past waterfowl counts, thereby providing indices to waterfowl populations that were comparable to previous years. To examine the feasibility of classifying waterfowl flight behavior relative to the wind turbines and to provide ideas for future observation methods, observations of waterfowl morning flight patterns into the wind farm area were made from October 1 through November 1. Observation data have been entered into a computer database (Excel) and/or ArcGIS and analysis is ongoing.

Results:

Between April 15, 2003, and December 15, 2003, we found two birds (a yellow-throated vireo and a tree swallow) and 31 bats (11 hoary, 9 little brown, 6 eastern red, 3 big brown and 2 silver-haired bats) on our mortality search transects. All appeared to have died as a result of collisions with the wind turbines.

The following adjustments have been made to extrapolate the mortality findings to the entire wind turbine. The mortality findings were adjusted for:

a) Proportion of the total plot area searched (76 m by 76 m plots for 89 towers)
b) Percent of test carcasses removed by scavengers within the search period
c) Percent of carcasses missed by observers in the search efficiency trials

Approximately 26% of the 76 m by 76 m plot under 26 towers was searched. Spring, summer and fall scavenging trials indicated scavengers removed 7%, 12% and 7% of carcasses, respectively, within the duration of the search frequency (2 days) in this study. Observer efficiency trials for mortality transect searches indicated that, as a group, observers found 77% of bird carcasses, although efficiency ratings varied from 40% to 95% for individual observers. Adjusted estimates of bird and bat mortality for the Top of Iowa Windfarm during the 2003 field season indicated that 10.8 birds and 167.2 bats died as a result of collisions with the wind turbines between April 15 and December 15, 2003 (Table 1).

Table 1. Adjustments for estimating total mortality at the Top of Iowa Windfarm.

Adjustment level	Bats	Birds
Raw mortality findings	31	2
Area adjusted	119.23	7.69
Scavenge Study adjusted	128.77	8.31
Search Efficiency adjusted	167.23	10.79

Preliminary analysis of point count data using ANOVA (Analysis Of Variance, SAS Institute Inc, 2001.) indicated there was no significant difference between bird activity for any combination of the three treatments (wind turbine site, wind turbine site with transects, and crop field without wind turbine) when analyzed for all bird species combined or for the 5 most common bird species observed at the windfarm (Table 2).

Table 2. Results of bird activity comparisons between 3 sites.

Category	P Value
All species	0.46
Common Grackle	0.67
Brown-headed Cowbird	0.79
Horned Lark	0.53
Vesper Sparrow	0.67
Red-winged Blackbird	0.15

The pilot study using Anabat ultrasonic bat detectors also indicated there was no significant difference between bat activity at wind turbine sites and crop fields without turbines (Paired T-test, $p = 0.63$, SAS Institute Inc, 2001).

Fall waterfowl use observations are currently being analyzed for the 270 flocks of geese that were observed foraging in fields with and without wind turbines. Approximately 1.2 million goose-use days and 194,000 duck-use days were recorded from September 15 to December 25, 2003 for the adjacent RL-EC-HS complex (Figure 2). Waterfowl use of the adjacent WMA's was below average for both ducks and geese in 2003 compared to historical counts due to a late summer drought in 2003. To compare goose use of fields with wind turbines to those without turbines, GIS analysis will be used to overlay goose counts in fields within the area that is closed to Canada goose hunting around Rice Lake WMA.

RECOMMENDATIONS FOR 2004 FIELD SEASON:

Mortality search methodology, including measurements of observer efficiency and scavenging rates, appeared to be satisfactory and will be continued as in 2004 as conducted in 2003. A substantial amount of staff time was needed for weeding and mowing during the 2003 field season to maintain transects vegetation-free. Transect maintenance will be reduced in 2004 by removing all crops immediately after germination and making transects more accessible for mowing (i.e., paying the landowners for some additional crop loss to maintain a 1 meter wide path to connect the transects on one end).

The pilot bat study indicated various problems with identifying bats by their calls. Several bat biologists have been contacted to provide assistance and advice for this aspect of the study.

The point counts serve to answer two questions. First, to estimate bird-use in the windfarm using on-windfarm point counts in the morning, mid-day, evening and night. Second, to contrast bird abundance on the windfarm with abundance at similar sites off the windfarm. For the later comparison, the accepted methodology is to conduct only morning point counts, since bird activity is highest at that time (Ralph *et al.* 1995). In 2004, only morning counts will be conducted to make comparisons of bird activity on and off the windfarm. To ensure a better comparison of bird activity on and off the windfarm, more morning counts will be conducted in 2004.

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Fig 1. Location of the Top of Iowa Wind Farm relative to the Rice Lake, Elk Creek and Hanlontown Slough Wildlife Management Areas in northern Iowa.

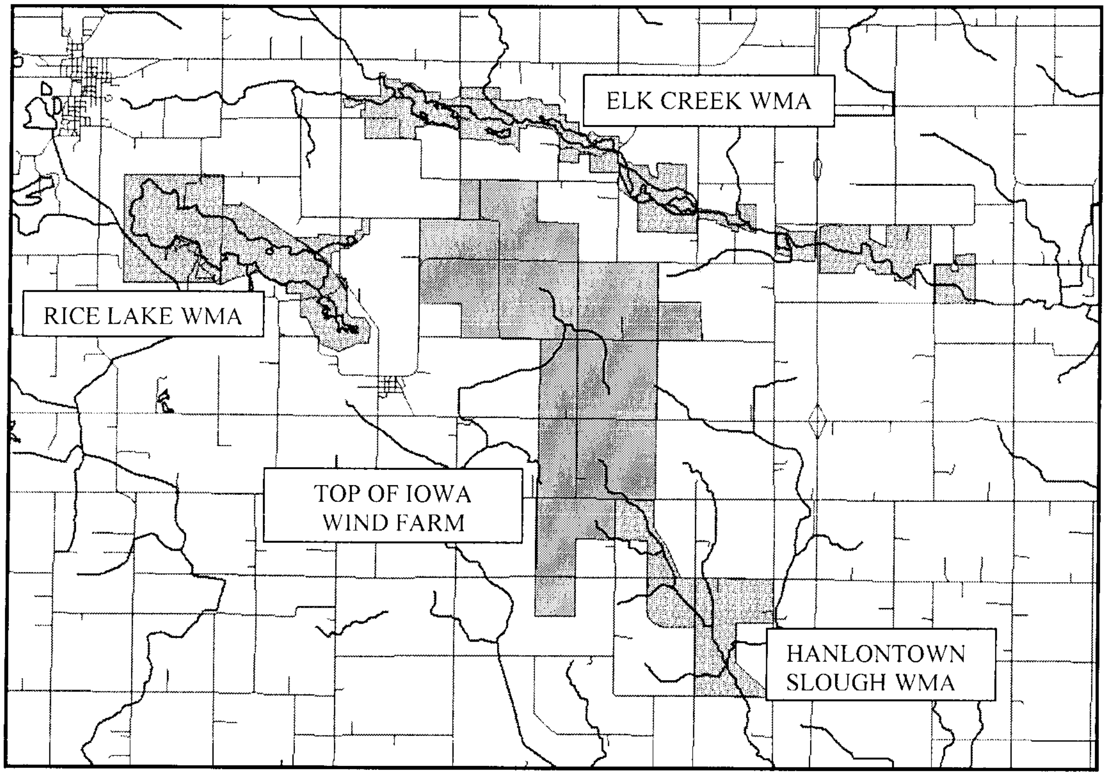
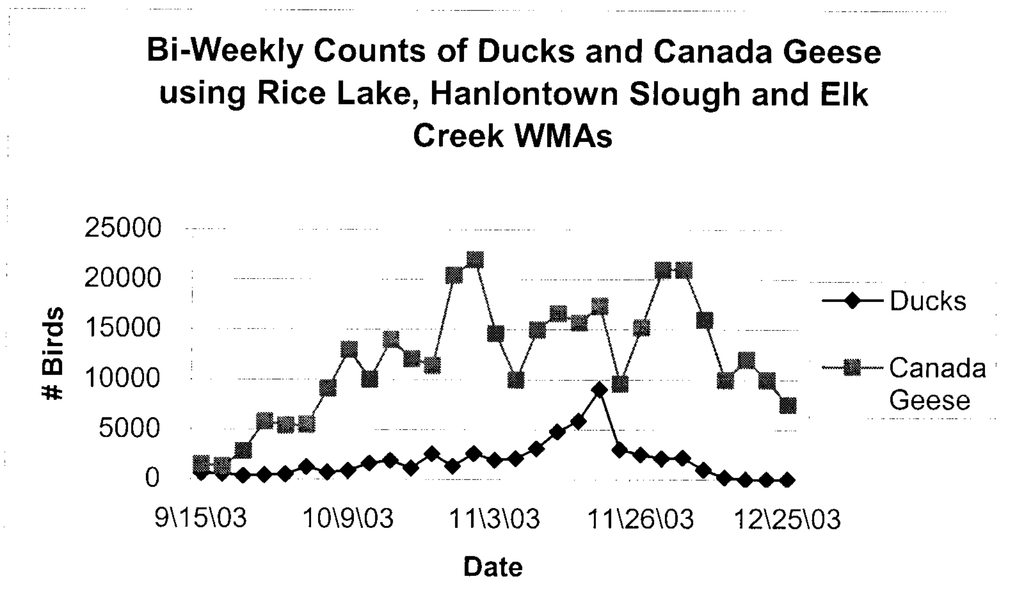


Fig 2. Bi-Weekly counts of Canada geese and ducks using Rice Lake, Hanlontown Slough and Elk Creek WMAs.



Appendix C

Abundance and Behavior of Migrant Waterfowl and Other Birds at the Forward Wind Energy Center, Dodge and Fond du Lac Counties, Wisconsin

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Prepared for:

Invenergy Wind LLC

Prepared by:

Paul Kerlinger, Ph.D.
Curry & Kerlinger, LLC
P.O. Box 453
Cape May Point, NJ 08212
609-884-2842; fax 884-4569
pkerlinger@snip.net

Abundance and Behavior of Migrant Waterfowl and Other Birds at the

Forward Energy Center, Dodge and Fond du Lac Counties, Wisconsin

Executive Summary

An avian use study was conducted during the spring and fall migration seasons at the proposed Forward Wind Energy Center (hereafter "Project"), located in Dodge and Fond du Lac Counties, Wisconsin. The study supplements the Phase I avian risk assessment regarding waterfowl, waterbirds, and other species that migrate into and out of the Horicon Marsh area, about 2 miles (3.2 km) from the Project site to the southwest. The purpose of this study was to determine the numbers and types of birds that use the Project site during the spring and fall migration seasons, their distribution within the Project area, and their behavior while on the Project site. This information was then used to refine the levels of risk determined by the Phase I risk assessment.

The study consisted of both driving surveys and point counts on the Project site. Two road surveys were chosen and designated as Eastern and Western sampling areas, which are 11.5 miles (18.5 km) and 12.7 miles (20.3 km) in length, respectively. In addition, 30 minute point counts were conducted at two locations within the Project site. Data were collected on 12 days during spring (April 3-23, 2004) and 33 days during fall (October 2-November 24, 2004) migration. The order in which the road surveys were conducted was reversed from day to day, as was the direction in which the surveys were driven. Miles driven during the road surveys amounted to 1,080 miles (1,728 km) during 45 days of study. Total field observations included 171 hours of direct observation.

As indicated in the Phase I avian risk assessment, the Project site has very high use during the migration seasons. A total of slightly more than 200,000 records of bird sightings were logged, including 88 different species. These included 13 species of waterfowl, 11 species of raptors, 4 species of blackbirds, 3 species of gulls, about 7-8 species of grassland songbirds, 8 species of shorebirds, and the remaining species are divided among various taxa. Waterfowl were the most numerous birds present on the Project site, accounting for 45.9% of the birds seen during both road surveys and point counts in spring and fall. Canada Geese accounted for the vast majority (94.8%) of the waterfowl observed. Blackbirds and gulls were the second and third most numerous on the surveys and point counts, accounting for 31.3% and 15.1% of the total bird observations, respectively. Sandhill Cranes accounted for 3.4% of all bird observations, while grassland songbirds accounted for slightly more than 1%. Raptors and shorebirds collectively accounted for less than about 1% of all bird observations. Among raptors, Red-tailed Hawks were the most numerous followed by American Kestrels. The absolute numbers of raptors on site was moderate to modest. It is important to note that the large numbers of birds reported in this document, particularly Canada Geese and Sandhill Cranes, represent individuals, some of which have been counted many times as they moved through the Project site on successive days.

Bird abundance was much higher in fall, with a rate of sightings about two times that found in spring. The rate for road surveys in fall was 1,395 birds per hour as opposed to 655 birds per hour in spring. For point counts, the fall rate was 1,136 birds per hour, whereas the rate for spring was only 638 birds per hour. The difference between seasons likely reflects the mortality experienced over winter from natural sources and hunting. The differences between fall and spring were particularly great for Canada Geese and Sandhill Cranes.

A dramatic decline in numbers of waterbirds, mostly Canada Geese and Sandhill Cranes, was observed between the two road survey areas of the Project. There are 1.5 miles (2.4 km) between the Western and Eastern sampling areas and the Western sampling area is about 2 miles (3.2 km) from the edge of Horicon Marsh, whereas the southeastern corner of the Eastern Sampling area is nearly 6 miles (9.6 km) away. The decline in numbers of geese and cranes between the two survey areas confirms that numbers of birds decline rapidly at greater distances from Horicon Marsh, larger than the differences reported at closer distances from the Marsh by earlier researchers.

Behavior, including altitude and direction of flight of various groups of birds was examined via visual observations. Flight direction did not reveal a seasonally specific migration corridor through the Project areas, suggesting that the site is not a migration corridor and that most flights are of birds moving locally within the general area. However, the flight direction of some birds was decidedly in the direction toward or from Horicon Marsh (southwest-northeast), with most flight toward the northeast or southwest for Canada Geese and Sandhill Cranes.

Altitude of flight indicated that roughly 20-40% of bird observations (variation among species and multiple observations of the same individuals), flew at the height of turbine rotors. The balance of birds flew either above or below this height range, below or above the rotor swept area. The altitude of flight indicated foraging flights in the area, rather than active migration. Although flight at rotor swept height is sometimes used as a correlate of risk, collisions have been found to occur among only a small percentage of those birds that fly at rotor height. Furthermore, the risk is species specific.

Conclusions and Risk

The overall findings of this study are consistent with what was presented in the Phase I risk assessment (Kerlinger 2004) conducted for the Forward Wind Energy Center, with the exception of Sandhill Crane abundance during fall. The abundance of these birds during the fall migration season was greater than expected in the original risk assessment. The Forward Wind Energy Center is approximately 2 miles (3.2 km) east of the Horicon Marsh. The Marsh attracts very large numbers of waterfowl and waterbirds during migration seasons. Although it is likely that collision risk to Canada Geese at the Project site will be slightly higher than at other sites, this assessment of higher risk is based on the large numbers of these birds that come and go from Horicon Marsh and their height of flight. However, impacts to this species are not likely to be biologically significant. Sandhill Cranes were more numerous in fall than expected from the Phase I risk assessment. Because turbines have never been constructed in areas where crane use is high, as is the case at the Forward Wind Energy Center, it is difficult to assess risk to this species. The large numbers of gulls and blackbirds could also be at elevated collision risk, although fatalities are not likely to be biologically significant. With respect to the very small numbers of listed species (Bald Eagle, Great Egret, Red-shouldered Hawk, and Peregrine Falcon) collision risk is not likely to be high because their presence on site is so infrequent. The Project is not likely to adversely affect listed species. Risk to other species is likely to be similar to that found at other wind power facilities where similar numbers of these birds are present.

Because the Forward Wind Energy Center site experiences significant waterfowl and waterbird abundance, a post-construction fatality study is recommended. Such a study would provide scientific insight into the interactions of these types of birds with wind turbines and provide the data needed for siting of future wind plants in Wisconsin and other locations where large numbers of waterfowl and waterbirds are located.

Introduction

A Phase I avian risk assessment (Kerlinger 2004) conducted for Invenergy Wind LLC's Forward Wind Energy Center (hereafter the "Project") concluded that large numbers of waterfowl and other waterbirds were frequent visitors to the farm fields within the Project site. Wind turbines on the Project site are proposed to be sited approximately 2 miles (3.2 km) east of the Horicon Marsh. Horicon is one of the largest and highest quality waterfowl and waterbird stopover sites in the north central United States. Various agencies (U. S. Fish and Wildlife Service and Wisconsin Department of Natural Resources) expressed concern regarding collision fatalities of ducks, geese, other waterbirds, and other species that use the farm fields during their south/north migrations during fall/spring, respectively.

To better assess potential risk to waterfowl and waterbirds, as well as other species of birds, that use the Project site, a study of avian use was designed for implementation during the spring and fall migration seasons. The study was designed to provide insight into the abundance and behavior, together being "use," of the species of most concern to the U. S. Fish and Wildlife Service and Wisconsin Department of Natural Resources. Although previous studies (Howe and Atwater 1998) had been conducted to determine the numbers and type of birds that use the farm fields surrounding Horicon Marsh, more detailed information was thought to be helpful for determining risk for the Project. The present study focuses on intensive sampling during the fall and spring migration seasons when bird use, particularly by waterfowl and other waterbirds, is greatest. In addition, the present study examined in detail, a small portion of the area surrounding Horicon Marsh that was not sampled by Howe and Atwater (1998). The studies are complementary, with the present study filling in details not provided in the earlier surveys.

Risk to waterfowl and other waterbirds, the majority of species observed in the Project area, have not been demonstrated to be high at any wind power facilities, including facilities that are situated along important migration corridors such as the Buffalo Ridge wind power facility in western Minnesota (Johnson et al. 2002) and the High Winds project adjacent to the Suisun Marsh along the Sacramento River in California (Curry & Kerlinger, LLC unpublished report to the High Winds Technical Advisory Committee). Both areas are recognized to be important migration and stopover areas for waterfowl (Bellrose 1976). The absence of waterfowl fatalities at these and other wind power facilities (Erickson et al. 2001) suggest that these species do not fly into structures, similar to their seeming lack of susceptibility to colliding with communication towers (Avery et al. 1998, Shire et al. 2000). This study focusing on risk of those species was undertaken despite the lack of demonstrated risk.

This report details the results of an avian use (abundance and behavior) study conducted during the spring and fall migration seasons at the Forward Wind Energy Center site area (Figure 1). The study determined avian abundance and behavior, together defined as "use" in areas where turbines will be located. Most importantly, the study provides detailed information on the species and numbers of birds that are present on the Project site during the migration seasons, the habitats used by the various species, and the flight behavior of those birds, including altitude, flight direction, and other behaviors relevant to assessing risk of collision with wind turbines.

Methods

A combination of road surveys and point counts were conducted in two areas of the Forward Wind Energy Center project site Figure 2. These methods were chosen to provide estimates of species composition of the birds in the areas, as well as abundance and distribution patterns within the Project area. In addition, an effort was made to determine the behaviors of birds while they were in the Project area, primarily including their altitude and direction of flight. Other data such as locations of birds within the wind plant, perching substrate, and habitat in which birds were feeding or resting were collected, but were not deemed useful for determining risk to birds at the Project site. These data will prove useful if post-construction studies are conducted and serve as a baseline for comparison of pre and post-construction.

Because of the large size of the Project site, road surveys were used in addition to point counts to insure that observations included a large proportion of the area where wind turbines would be located. Road surveys are often used to sample large areas because they enable field researchers to examine more of the landscape than other methods. The Project site is located approximately 2 miles east of the Horicon Marsh with turbines planned to be located as far west as Centerline Road. The eastern boundary for planned turbine locations is State Road 175. The northern and southern boundaries for the planned turbines locations are generally River Road to the north and Elm Road to the south. The Project site is shown in Figure 1.

The road surveys cover an area about one-half mile (0.8 km) on each side of the road, or about a 1 mile (1.6 km) swath with the road in the center. Therefore, the distance of each survey is approximately the area examined (Figures 1 and 2). The road survey routes and point count locations were chosen based on 2 days of field work conducted on the site in early April 2004 by the Author. During this site visit, incidental sitings were made. On these days, the survey routes and observation points were established and tested. The point count methodology is consistent with similar projects within the wind power industry. The observation area is functionally larger for larger birds because they can be seen at greater distances. Road surveys are a standard method for determining avian abundance over large areas, such as the Project site. They are particularly useful for determining abundance and distribution patterns in larger areas where point counts would require much longer periods of observation.

Methodology and protocols for conducting the road surveys and collecting data are described in Appendix I. The Western road survey area was approximately 12.5 miles (20 km) in length and the Eastern survey area about 11.5 miles (18.4 km) in length, for a total of about 24 miles (38.4 km) of roads surveyed each day (Figures 1 and 2).

In addition to road surveys, two point count locations were established. One point count site was established roughly near the center of Eastern and Western sampling areas at locations where observations could be made with minimal automobile traffic and from which the surrounding landscape could be surveyed. The point counts were conducted for 30 minutes each during which the behavior of birds was the primary focus. Data sheets used to collect information are provided in Figures 3 and 4.

The seasonal timing of the study corresponded to the peak migration season for Canada Geese and other waterfowl (Bellrose 1976), the focus species in this study because they were expected to account for a high proportion of observed species. For spring, the peak of migration in the Upper Mississippi and Great Lakes regions is the first week of April. The peak for fall migration in these regions is October into early November. For Mallards and other dabblers, the migration season is during a similar period. Bellrose (1976) summarizes the seasonality of migration for all species of waterfowl that occur on the Project site and provides graphic information on when during spring and fall these birds migrate through the Great Lakes and Upper Midwest areas.

A shorter seasonal observation period was used for the spring migration season for two reasons. First, northbound migration is more contracted seasonally. Birds intent on arriving at their nesting grounds do not make long stopovers and often tend to take fewer days to complete migration. Second, there are simply fewer birds during spring. After autumn and winter harvests of waterfowl and natural mortality, there are far fewer waterfowl migrating northward than southward. The mortality across the United States from hunting alone amounts to more than 25 million ducks and geese annually and the Wisconsin harvest amounts to about 250,000 to 330,000 per year. Most are removed from the population between October and February. Many millions of waterfowl and other birds die of natural causes during the winter, leaving fewer birds the following spring. Furthermore, southbound migration by adults and first-year birds that have never migrated before is more leisurely than northbound migration. Stopovers are longer and often last for several weeks to more than a month. Overall, southbound migration in autumn occurs over a longer period of time.

Based on the types of habitat observed, results from the Phase I avian risk assessment (Kerlinger 2004), and because of the size of the Project area, two road surveys and two point counts are an appropriate methodology for a project of this type and size based on standard industry and basic wildlife survey practice. By conducting both point counts and road surveys, the database reported herein can be considered representative of the Project site and is more robust than if only one of the two methods were used.

Results

Summary of Research Effort.

In April of 2004 two days of field work were conducted on the Project site during which incidental sightings were made. On these two days, the survey routes and observation points were established and tested. During the spring migration season, a total of 12 road surveys were done on each of the two routes, totaling 24 road surveys. Twelve days were spent in the field between April 3 and 23, 2004 (Appendix II). The surveys in spring covered a total of 288 miles (461 km) of roads (144 miles – 231 km for both survey routes). On each day, approximately 4.5 hours of road surveys were conducted and point count observations were made during 1 hour per day. Twenty-seven hours were logged conducting road surveys and 12 hours were logged conducting point counts. This totals 39 hours of field observations during the spring migration seasons.

The fall migration season study was conducted on 33 days between October 2 and November 24, 2004. Road surveys required about 3.0 hours per day, for a total of 99 hours of observations during these surveys. During the road surveys, approximately 792 miles (1,267 km) were driven (396 miles – 634 km for both survey routes). Point counts were conducted over a period of 33 hours. A total of 132 hours of direct field observations were logged during the fall study for both road surveys and point counts.

Road surveys were conducted at an average speed of 10-11 miles per hour during spring and 8 miles per hour during fall.

Species and Seasonal Abundance Patterns.

Spring and Fall. Overall, a total of 201,101 birds were observed during the spring and fall seasons through both road surveys and point counts. In both seasons, a total of 88 species were observed. More birds were observed during the fall season, than during spring with 87.3% of all bird sightings being from the fall period. Some of these observations were undoubtedly repeated observations of the same birds as they foraged within the Project area. The abundance and diversity patterns are discussed below for spring and fall separately.

Because the effort (number of days of observation and miles driven) differed between spring and fall, an "hour of observation" metric was calculated to examine the difference between these seasons. For both road surveys and point counts, the hourly rate of bird observations was greater in fall than in spring. There was a two to one margin between fall and spring with 1,395 birds per hour seen in fall on road surveys as opposed to 665 birds per hour seen in spring. Similarly, 1,133 birds per hour were observed during point counts in fall as compared to 638 per hour for spring point counts.

The largest difference in seasonal abundance for species of interest was for Sandhill Cranes and Canada Geese. In spring, only 10 Sandhill Cranes were observed on road surveys and point counts, whereas in fall 6,845 cranes were observed. On a per hourly basis, this translates to 0.3 cranes observed per hour in spring versus 51.9 cranes per hour in fall. For Canada Geese, 74,508 were observed in fall, whereas 10,963 were observed in spring. This means that in fall, the numbers seen per hour was 564.5 and in spring it was 281.1 per hour.

Spring. A total of 56 species were observed including 53 species during road surveys and 37 species during point counts (Appendix III). A total of 25,626 observations of individual birds were made on the road surveys and point counts combined. Slightly more than two-thirds (70.1%) of all bird observations were made during road surveys and less than one-third (29.9%) were made during point counts.

Waterfowl were the group most represented with 50.6% of individuals observed during the road surveys and 24.3% of the point counts. There were 9 species of waterfowl observed on the Project site during spring surveys. Most of the duck species were represented by very small numbers of individuals, whereas the bulk of the total were Canada Geese (Cackling Geese were pooled with Canada Geese). Canada Geese accounted for 82.9% of all waterfowl observed during spring surveys and slightly more than one-third (36.1%) of all bird observations in that season. The remaining 17.1% of waterfowl observed were spread among the other 8 species observed (Table 1).

Blackbird species (Brown-headed Cowbird, Common Grackle, Brewer's Blackbird, and Red-winged Blackbird) comprised about one-fifth to one-quarter of all bird observations on spring surveys. Gulls were rather common, as were grassland songbirds (Table 1). Raptors, shorebirds, and Sandhill Cranes were all rather uncommon and none of these groups accounted for more than 1-2% of the total bird observations made.

Fall. A total of 74 species were observed during the fall study period, with 71 species observed during road surveys and 41 species observed during point counts (Appendix IV). Overall, on both road surveys and point counts, a total of 175,475 bird observations were registered, with 78.7% being seen on road surveys.

Waterfowl were the most common of all birds observed accounting for between about 40 and 60% of all bird observations on road surveys and point counts, respectively (Appendix IV). There were a total of 8 species of ducks, geese, and swans observed during fall, of which Canada Geese accounted for 95.4% on road surveys and 91.4% on point counts. Mallards accounted for 4.4% of all waterfowl seen on road surveys and 8.0% on point counts. Together Canada Geese and Mallards account for more than 99% of all ducks, geese, and swans observed.

Blackbirds accounted for between one-quarter and one-third of the birds observed on the road surveys and point counts, respectively. Species determinations could not always be done on the large flocks. These birds were common during road surveys and point counts. Gulls were less common, accounting for about 10 to 17% of all bird observations during fall. The remaining species accounted for less than 10% of all birds seen on road surveys and point counts.

Raptors and shorebirds accounted for less than 1% of all birds observed during fall, and grassland songbirds only accounted for slightly more than 1% of birds observed. There were 11 raptor species seen in fall and 4 shorebird species. Grassland songbird species included 7 species that are normally considered to be grassland nesting birds. These percentages are not that different from the spring surveys. Sandhill Cranes were much more common in fall than in spring, accounting for about 2 to 4% of the total bird observations.

Table 1. Summary of species group representation on spring and fall road surveys and point counts 2004 at the Forward Wind Energy Center site, Dodge and Fond du Lac Counties, Wisconsin.

Species Group	**Spring**		**Fall**	
	Road Survey	**Point Count**	**Road Survey**	**Point Count**
Waterfowl	9,295 – 50.6%	1,863 – 24.3%	57,736 – 41.8%	21,368 – 57.1%
Blackbirds	4,468 – 24.9%	1,560 – 20.3%	46,291 – 33.5%	10,592 – 28.3%
Gulls	2,057 – 11.4%	1,131 – 14.8%	23,611 – 17.1%	3,612 – 9.7%
Grassland Songbirds	1,107 – 6.2%	2.716 – 35.4%	1,424 – 1.0%	490 – 1.3%
Raptors	168 – 0.9%	121 – 1.6%	272 – 0.2%	74 – 0.0%
Shorebirds	80 – 0.4%	39 – 0.5%	340 – 0.2%	7 – 0.0%
Sandhill Crane	7 – 0.0%	3 – 0.0%	6,116 – 4.4%	729 – 1.9%
Others	793 – 4.4%	228 – 3.0%	2,293 – 1.7%	520 – 1.4%
Total	17,968	7,658	138,083	37,392

Endangered and Threatened Species

Four listed species were observed during the spring and fall surveys at the Project site. Two individual Bald Eagles, a U. S. threatened species, were present during fall. Three Wisconsin listed species, Great Egret (threatened), Red-shouldered Hawk (threatened), and Peregrine Falcon (endangered) were seen during the fall survey, but not during spring. A single individual of each was seen on only one occasion on either a road survey or point count. These sightings constitute very low use by listed species.

Distribution Within the Project Site.

There was a distinct difference in abundance of all birds between the two survey routes and point count locations (Table 2). This difference was evident for both road surveys and point counts. The pattern also held for spring and fall. On road surveys in spring, less than one-fifth of birds observed were in the Eastern sampling area and on point counts in this sampling area about one-third of all birds were observed. In fall, the difference was not as distinct, with slightly more than one-third of all birds observed on road surveys being in the Eastern sampling area and about one-quarter of point count observed birds being in that same area. The Western sampling area road survey was about 10% longer in distance, but this does not explain the very large and consistent disparity between the two areas. It would seem that the greater abundance in the Western sampling area was a result of the proximity to Horicon Marsh. The Eastern sampling area is approximately 1.5 miles (2.4 km) farther from Horicon Marsh.

Table 2. Distribution of all birds within the both sampling areas on both road and point counts at the Project site, fall and spring 2004.

Road Survey			**Point Count**		
Spring	Eastern	3,384 – 18.9%	**Spring**	Eastern	2,564 – 33.5%
	Western	14,584 – 81.1%		Western	5,094 – 66.5%
Fall	Eastern	52,136 – 37.8%	**Fall**	Eastern	9,830 – 26.3%
	Western	85,947 – 62.2%		Western	27,561 – 73.6%

Much of the difference between the two survey area abundances is attributable to the differences in Canada Goose (Table 3) and Sandhill Crane (Table 4) sightings. For example, in spring, 97% of all Canada Goose sightings were in the Western sampling area during road surveys and nearly 88% of these geese counted at the point counts were at the point count in the Western sampling area. In fall the pattern was similar, although the difference was not as great. In the Eastern sampling area in fall, 10,000 fewer goose sightings were registered on road surveys, which translates to 17% fewer sightings. However, the numbers of observations of Canada Geese in Western sampling area was nearly four times those observed in Eastern sampling area.

Table 3. Canada Goose dispersion in Eastern and Western sampling areas on both road and point count surveys at the Forward Energy Center project site, fall and spring 2004.

Road Survey			**Point Count**		
Spring	Eastern	270 – 3.0%	**Spring**	Eastern	228 – 12.2%
	Western	8,830 – 97.0%		Western	1,635 – 87.8%
Fall	Eastern	22,825 – 41.5%	**Fall**	Eastern	3,650 – 18.7%
	Western	32,239 – 58.5%		Western	15,884 – 81.3%

With respect to Sandhill Cranes, the numbers counted in spring were very small. However, on both road surveys and point counts, the numbers observed were smaller in the Eastern sampling area. During fall, larger numbers of Sandhill Cranes were present, permitting a quantitative comparison. More than 30 times greater numbers of observations of Sandhill Cranes were registered on road counts in the Western sampling area during this season. Approximately nine times as many sightings of these birds were made in the Western sampling area during fall. These birds roost in the Horicon Marsh, so it is likely that the difference in distribution in both spring and fall is related to the closer proximity of the Western sampling area to the Marsh. Birds simply do not have to fly as far from the Marsh to forage in the Western sampling area as opposed to the Eastern sampling area.

Table 4. Sandhill Crane dispersion in Eastern and Western sampling areas sampling areas on both road and point count surveys at the Forward Wind Energy Center project site, fall and spring 2004.

Road Survey			**Point Count**		
Spring	Eastern	2 – 28.5%	**Spring**	Eastern	1 – 33.3%
	Western	7 – 71.5%		Western	2 – 66.7%
Fall	Eastern	166 – 2.7%	**Fall**	Eastern	74 – 10.2%
	Western	5,950 – 97.3%		Western	655 – 89.8%

Direction of Flight. There was no indication that the birds observed flying within the survey areas of the Project site were actively migrating. There was some indication that these birds were flying to and from the Horicon Marsh area and those observations were primarily restricted to a couple of key species. The following paragraphs describe the flight direction patterns of key species groups and two species.

Flight direction for 51,629 waterfowl (Figure 5) were determined, with 47, 984 of those birds being Canada Geese (Figure 6). Fewer than 1 in 10 birds was flying to the north or south. The predominant direction of flight for these birds was toward the northeast, with a lesser number flying toward the east. Together these directions accounted for roughly one-half of all waterfowl directional observations. The next greater direction was for these birds to fly toward the southwest and west. Because the two flight directions are opposite of each other, it suggests commuting between the areas, most likely coming and going to the Horicon Marsh.

For Sandhill Cranes, there was no indication of migration by the birds observed (Figure 7). Instead, the tendency for birds to be flying northeast and north about one-half of the time suggests that these birds are moving outward from Horicon Marsh into and through the Project areas. There was not a strong tendency for these birds to fly back toward the marsh, as was the case for Canada Geese.

Raptor flight directions were spread rather evenly in all directions of the compass (Figure 8), although nearly one-quarter of the birds were moving toward the south. Because more than 20% of the birds were flying north and northeast, it is unlikely that many of these hawks and vultures were migrating. Overall, there was not a directional trend with respect to raptor flight direction. This was basically the case for most other groups of birds, which showed no strong directional trends.

Altitude of Flight

Altitude of flight was examined for a subset of all birds observed; those birds numerically well represented; or birds particularly of interest to wildlife agencies. The species not examined were either represented by small numbers of individuals, thereby being less at risk, or they are groups like shorebirds that are not known to be at risk of colliding with structures such as turbines and communication towers.

Each analysis was conducted by pooling all observations from spring and fall and for road surveys and point counts and then calculating the percentage of individuals observed that were in each altitudinal category. The results are given in percentages in the histograms so the reader may calculate how many of all bird observations were made of flight within the rotor swept area. A large percentage of all observed birds were not observed flying. The categories represented above the rotor swept area of turbines (High), within the rotor swept area of turbines (Medium), and below the rotor swept area (Low). For birds that crossed through these zones or for which a single determination of altitude was difficult, crossover categories were recorded.

Waterfowl frequently flew above the rotor swept area in the High category (Figure 9), although not at the height of migrating waterfowl (Bellrose 1976, Kerlinger and Moore 1989). About 60% of these birds flew in this High category. Only a very small percentage of waterfowl (~10%) flew below the rotor swept area. This means that the rest of the birds, about 30%, flew at some time within the rotor swept area. The pattern for Canada Geese (Figure 10) was almost identical, because they numerically dominated the waterfowl category.

The altitudinal pattern for 1,925 Sandhill Cranes was almost the opposite of waterfowl, with slightly more than 55% of individuals flying below the rotor swept area in the Low height category. About 28% flew above the rotor swept area. This means that somewhat more than 20% of these birds flew within the rotor swept area.

Although the raptor sample was rather small (N = 351) for flight altitude (Figure 12), it was fairly obvious that most raptors were not flying at high altitudes. This corroborates statements above that these birds were not engaged in active migration (Kerlinger 1995). About one-third of these birds flew below the rotor swept area and another, approximately 30%, flew at the edge of the Low-Medium zone or flew from one zone into the other. About 13% of all raptors flew above the rotor swept height zone. This means that more than one-half of all raptor height observations, were flying within the rotor swept zone, at least at some time.

Discussion

As was reported by Howe and Atwater (1998) and stated in the Phase I avian risk assessment for this Project (Kerlinger 2004), large numbers of waterfowl, blackbirds, gulls, and some other species use the Project site, especially during fall migration. Lesser numbers use the area during spring. The species composition found in the present study in the Forward Wind Energy Center areas was similar to that found by Howe and Atwater (1998) with Canada Goose being most numerous followed by blackbirds, mostly Red-winged. The present study did find a greater percentage of gulls using or moving through the Project site than did the previous study. Otherwise, the species composition was very similar. The overall findings are consistent with what was presented in the Phase I risk assessment (Kerlinger 2004), with the exception of Sandhill Crane abundance during fall. The abundance of the Sandhill Cranes during the fall migration season was greater than expected in the original risk assessment.

Although the numbers of sitings recorded in this document, particularly Canada Geese and Sandhill Cranes are high, it is important to note that they do not reflect the actual numbers present within the Project site. It is likely that many of these birds are coming and going from Horicon Marsh to forage in farm fields on and around the Project site. It is possible that the same flocks of Canada Geese and Sandhill Cranes were counted on many occasions, so the absolute numbers involved are only a fraction of those counted. However, the use of the Project site by these species is still, seasonally, very high.

The same may be the case for some other species, especially Red-tailed Hawk and American Kestrel. These two species accounted for a majority of the raptors observed during the study period. They both nest locally and both migrate through the site. Some Red-tails also spend the winter in the area. That birds were seen in the same locations on several occasions, suggests that particular individual hawks may have been counted multiple times. This inflates the numbers in Appendix III and IV, but it reflects their potential risk at the wind turbines. Overall, the numbers of raptors using the site was not extraordinary.

<u>Distance to Horicon Marsh</u>.

Howe and Atwater (1998) reported that fewer birds were found as distance increased from Horicon Marsh. Although they did not distinguish among species, their data were also dominated by Canada Geese and blackbirds. In autumn, they found about a 35% reduction in numbers of birds between 1 and 2 km (~.6 to 1.25 miles) from the marsh and a nearly one-half reduction in numbers 4 km (2.5 miles) from the marsh. At 8 km (5 miles) from the marsh, the number of birds declined by about 57%. This suggests the most dramatic decline in numbers of birds occurs within the first 2 km (1.25 miles) of the marsh and from there outward there is a steady decline.

The present study found a dramatic decline in numbers of waterfowl, mostly Canada Geese and Sandhill Cranes between the two survey areas of the Project. There are 1.5 miles (2.4 km) between the Eastern and Western sampling areas. The Western sampling area is about 2 miles (3.2 km) from the edge of Horicon Marsh, whereas the southeastern corner of the Eastern sampling area is nearly 6 miles (9.6 km) away. The decline between the two survey areas confirms that numbers of birds decline rapidly at distances greater than 2.5 miles (4.0 km) from Horicon Marsh. The differences were large between Canada Geese and Sandhill Cranes, much larger than the differences reported at closer distances from the Marsh by Howe and Atwater (1998).

The significantly lower abundance of these birds in the Eastern sampling area suggests that risk to these birds would be less than in the Western sampling area. The rationale for this is that fewer birds fly in the Eastern sampling area and birds spend less time in that area than in the Western sampling area. It should b e noted that abundance or use by a species is not always correlated with collision risk (Erickson et al. 2002). This is because species vary greatly in their susceptibility to collision or their ability to detect and avoid turbines,. Some species, such as vultures and waterfowl do not seem to be susceptible, even when they are present in large numbers or spend a great deal of time near turbines. Other species, such as nesting Horned Larks (Erickson 2001), seem to be disproportionately susceptible to colliding with turbines because of their flight behavior. Therefore, interpreting high abundance or high use at a given site as being equivalent to high risk is not always correct. Susceptibility can only be determined via post-construction study at wind power facilities so that species specific patterns can be determined.

<u>Risk to Species Groups</u>

<u>Endangered and Threatened Species.</u> Only 4 listed species of slightly more than 200,000 bird sightings were observed. Two Bald Eagles and 1 individual each of Great Egret, Red-shouldered Hawk, and Peregrine Falcon were observed during the fall study. This strongly suggests that listed species do not use the Project site, although they may fly through the area at times. Risk to these birds appears to be low and there are not likely to be adverse effects to these species.

<u>Waterfowl</u>. Very large numbers of waterfowl, mostly Canada Geese, were found on the Project site. Although these birds are not known to be susceptible to colliding with turbines, their very large numbers suggest a slightly higher than average fatality rate for the Forward Wind Energy Center. The numbers of these birds killed at most wind power facilities and communication towers is very small (Erickson et al. 2001, Shire et al. 2000), although most of these facilities are not located close to areas such as the Horicon Marsh. Winkleman (1995) working with diving ducks at a lake in the Netherlands, demonstrated that these birds do collide with turbines, but provided no details on their behavior around these structures. (Diving ducks do not forage on the Project site and their presence there is likely to be very rare.)

Suisun Marsh, California, Fatality Studies. Fatality studies from California in the Solano Wind Resource Area (also called Montezuma Hills Wind Resource area) do not suggest significant risk to waterfowl. About 600 older model turbines were constructed in the late 1980s and during a 1year study (Howell and Noone 1992), only 2 ducks (Mallards) were found dead. Since that time, there have been no reports of large numbers of waterfowl fatalities. Those turbines are 1.1 miles (1.8 km) from the Sacramento River and 1.7 miles (2.7 km) from Suisun Marsh. A second study in the Solano area was conducted. During 1 year of study in 2003-2004 at 90 new turbines (328 feet tall – 100 m) at the High Winds wind power facility, not a single duck or goose was found dead. This site is 1.7 miles (2.7 km) from the Sacramento River and

3.3 miles (5.3 km) from the Suisun Marsh. The Suisun Marsh and adjoining Sacramento River area is one of the west coast's largest waterfowl areas, with up to 1.5 million ducks and geese spending the fall, spring and winter locally. Use of the agricultural lands around the Suisun Marsh by waterfowl is low, however, compared to that of the Project site near Horicon Marsh. These birds do seasonally migrate over the Solano turbine area.

It should be stated that waterfowl do negotiate flight around turbines without colliding with them. Tulp et al. (2000) used radar to study seaducks near modern wind turbines and found that they see them and fly around them day and night. The distance of avoidance at night was about 1 mile.

It should also be noted that studies in Europe have shown that few waterfowl, including some forms of geese, feed directly beneath turbines. In those situations, there have not been reports of large numbers of fatalities of these birds, although the turbines have rendered areas from 25 to 500+ meters from turbines less suitable for waterfowl feeding (Larsen and Madsen 2000, Percival 1999, Winkelman 1995). Therefore, it is likely that Canada Geese and other waterfowl may not forage within short distances of turbines, although this is not known with certainty.

The overall level of risk to Canada Geese and other waterfowl is not likely to be biologically significant. Nowhere in the United States has waterfowl mortality approached 1 bird per turbine per year. Even if 2-3 waterfowl, most likely Canada Geese, were killed per turbine per year, the total numbers killed (300-450 birds) would amount to but a small fraction of the annual harvest of Canada Geese in Wisconsin (40,000-70,000 in 2000-2001; Martin and Padding 2002), and an even smaller fraction of those harvested in the Mississippi/Central Flyway (1.06-1.21 million; Martin and Padding 2002) each year. At the higher rate, the turbine fatalities, if they amounted to 3 per turbine per year from Canada Geese alone, would amount to a maximum of about 1% of the hunting harvest for Wisconsin and 0.04% of the annual Flyway harvest. The above example is included as a form of sensitivity analysis to show that even unheard of fatality rates would not result in biologically significant impacts to populations of Canada Geese or other waterfowl. Instead, fatality rates on a per turbine per year basis are likely to be less than 1 goose and/or duck.

<u>Sandhill Cranes</u>. The numbers of Sandhill Cranes observed primarily during fall migration suggests that the area is an important stopover area for these birds and that they forage regularly in the farm fields within the Project site. The differential use between the two survey areas suggests differences in risk between these areas with the Western sampling area providing greater exposure. This suggests a greater potential for collisions. Although Sandhill Cranes have not been found to be susceptible to colliding with wind turbines or communication towers, they do collide with transmission lines. Because no turbines are currently located in areas with high Sandhill Crane use, it is not known what the degree of risk might be to these relatively uncommon birds.

<u>Shorebirds.</u> Very few shorebirds were observed during spring and fall migration, although the main migration season for these birds is during May and August-September. Therefore, the main migration season for these birds was not included in this study. However, risk of collision with

turbines and communication towers has never been demonstrated to be significant and such risk to these birds is unlikely. Migrating shorebirds normally fly well above the turbine height (Kerlinger 1995, Kerlinger and Moore 1989). Collision risk to these birds is likely to be negligible.

Raptors. Relatively few raptors were observed during the study. The numbers observed were not as great as some wind power facilities in the western United States, such as the Altamont Pass Wind Resource Area of California. Red-tailed Hawks and American Kestrels are among the most likely of raptor species to be killed by wind turbines (Erickson et al. 2001; Smallwood and Thelander 2004), although the numbers killed outside of the Altamont Pass Wind Resource Area of California has been very low. It is likely that small numbers of these birds will collide with the turbines and these low levels of impact are not likely to adversely affect these species.

Grassland Songbirds. Modest numbers of grassland songbirds were found on the Project site. The site is comparable in many ways, with respect to these birds, to fatality studies from Wisconsin (Howe, Evans, and Wolf 2002) and Minnesota (Johnson et al. 2002) turbines. Fatality rates are likely to be similar to those at these facilities and not likely to be biologically significant.

Leddy et al. (1999) found that nesting grassland songbirds can be disturbed and displaced by wind turbines. It is likely that the Forward Wind Energy Center turbines will render some small areas unsuitable for foraging by these birds. However, habitat in the general area is not limiting, so these impacts will not impact these birds in a substantial fashion.

Gulls. Gulls were present in fairly large numbers, especially during fall migration. Risk to these birds has been demonstrated in areas where larger numbers of these birds congregate around turbines in Europe. Here in the United States, few gulls are killed by wind turbines, even in places such as the Altamont where many gulls forage at landfills and loaf at lakes nearby. To get to the landfills, these birds simply fly over the turbines, with very few fatalities being registered (Smallwood and Thelander 2004, Erickson et al. 2001). A discountable number of gulls have been killed at wind turbines situated at harbors near nesting and foraging locations of these birds in Belgium (Everaert unpublished data). Because gulls are present on site for only a portion of the year and because they do not normally show a susceptibility to collide with wind turbines, biologically significant risk to these birds is not likely.

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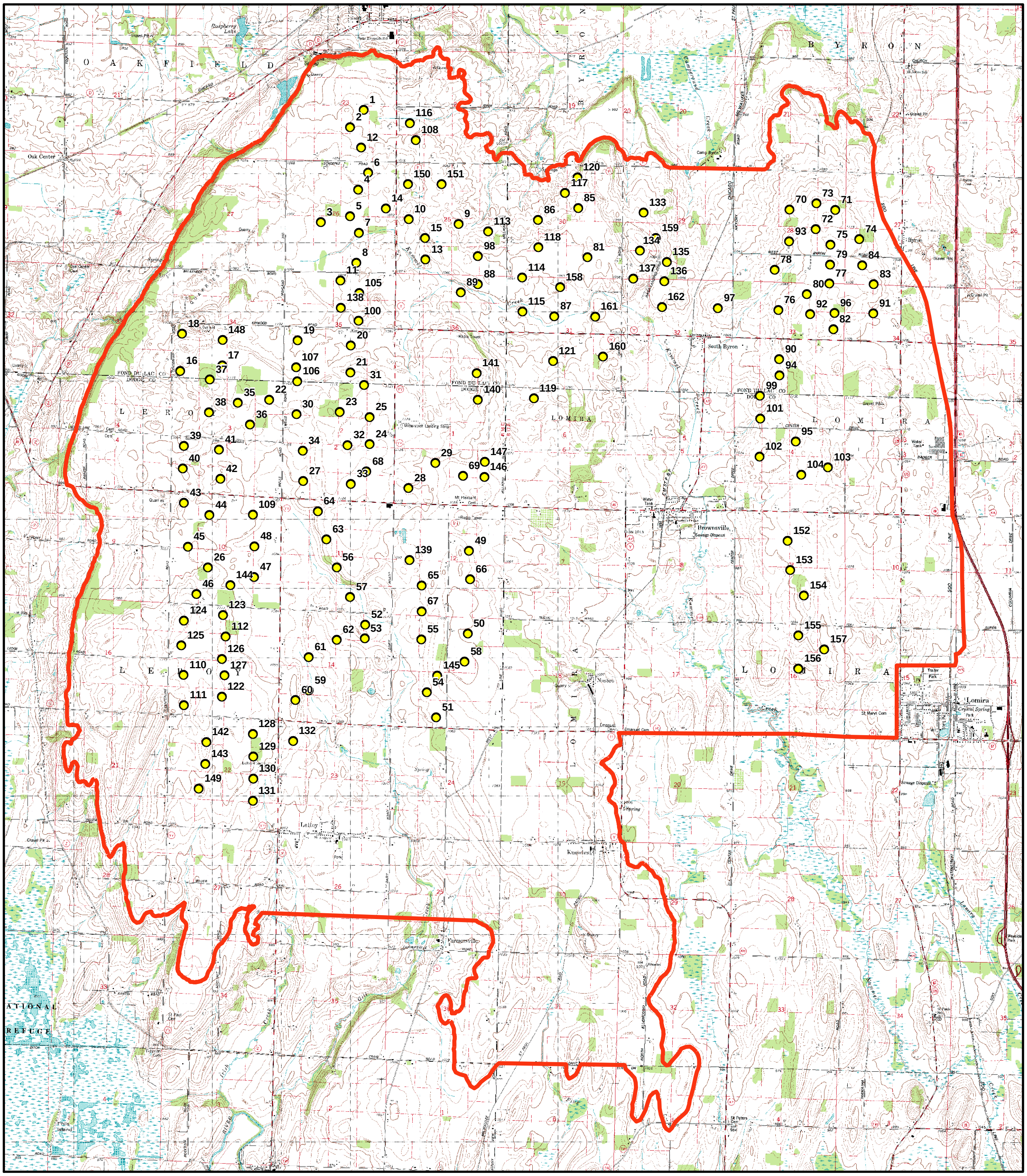
Figure 1. Map showing the location and boundaries of the Forward Wind Energy Center, Dodge and Fond du Lac Counties, Wisconsin.



Legend

Proposed Wind Turbine Location

Approximate Project Area Boundary

N

3,500 0 3,500

Feet

1 inch equals 7,000 feet

Source:
USGS 7.5 Minute Series
Topographic Map
- Byron Quad, WISC., 1974.
- Lomira Quad, WISC., 1974.
- Mayfville North Quad, WISC., 1981.
- Oakfield Quad, WISC., 1980.

DESIGN: JS	CHK'D: --	Project Topographic Map Forward Energy LLC Forward Wind Energy Project Dodge and Fond du Lac Counties, Wisconsin	URS Chicago, Illinois Appleton and Milwaukee, Wisconsin	
DRAWN: MDC	DATE: 12/20/04		Project No. 25365114	Fig No. 1
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Figure 2. Forward Wind Energy Center road survey route and observation point locations for the Eastern sampling area. The red line identifies the 11.55 mile (18.5 km) survey route and the yellow triangle identifies the Eastern observation point.

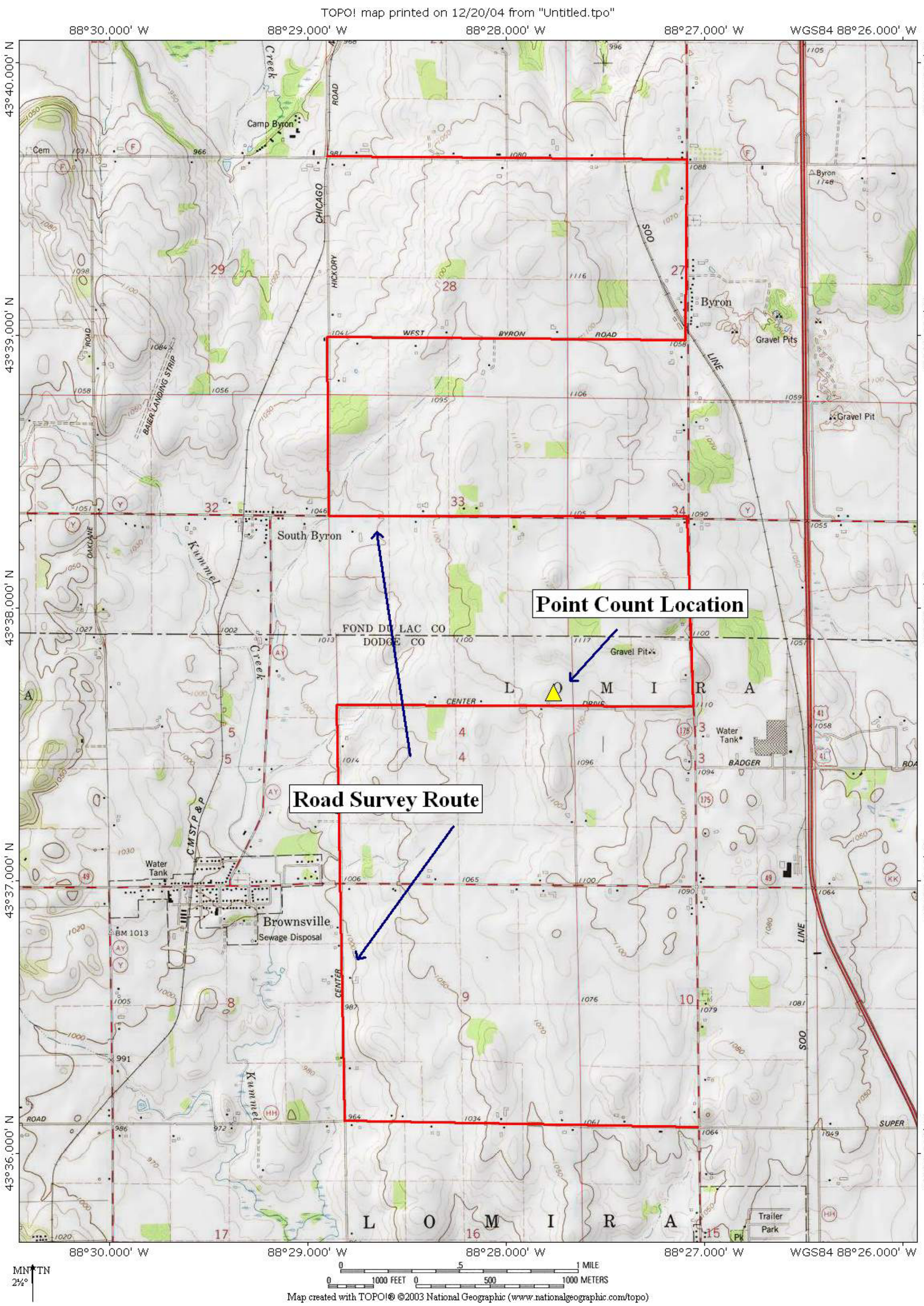


Figure 2. Forward Wind Energy Center road survey route and observation point locations for the Western sampling area. The red line identifies the 12.7 mile (20.3 km) driving route and the yellow triangle identifies the Western observation point.

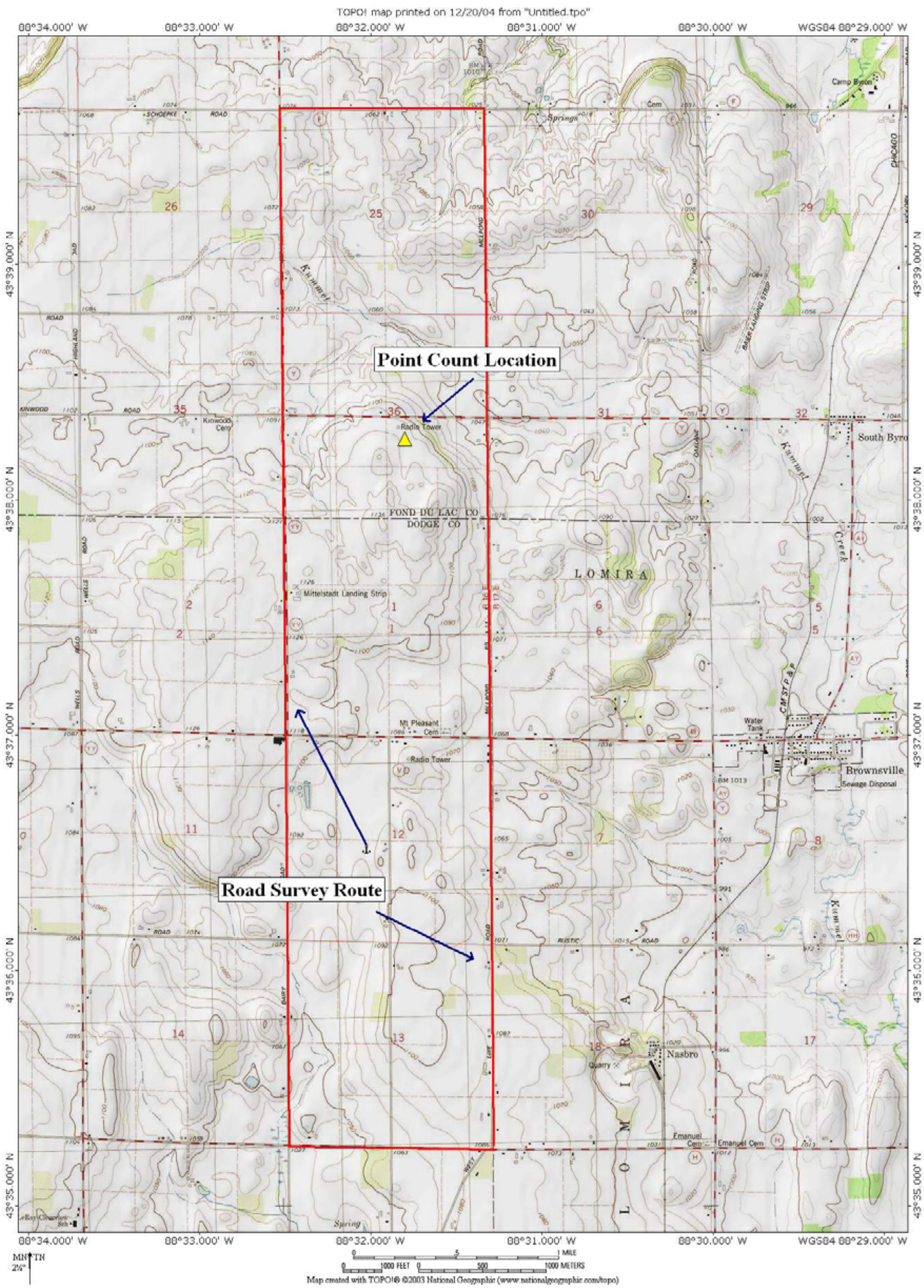


Figure 3. Sample data sheet used for spring and fall road surveys within Invenergy Wind LLC's Forward Wind Energy Center Project area to determine abundance and behavior (use) by migrating waterfowl and other birds.

Invenergy, WI – Avian Road Survey Data Sheet –

Date: ______________ Observer: _______________________ Area: ______________

Time Start: __________ Temp.: ____________ Wind: _____________

Cloud Cover: ___________ Visibility: _____________ Precipitation: __________________

Sector	Number	Species	Habitat	Height	Behavior	Direction	Notes

Figure 3. Sample data sheet used for spring and fall point count surveys within Invenergy Wind LLC's Forward Wind Energy Center Project area to determine abundance and behavior (use) by migrating waterfowl and other birds.

Invenergy, WI – Avian Point Count Survey Data Sheet

Date: ______________ Observer: _______________________ Area: ______________

Time Start: __________ Temp.: ____________ Wind: _____________

Cloud Cover: ___________ Visibility: _____________ Precipitation: __________________

Number	Species	Habitat	Height	Behavior	Notes

Figure 5. Direction of flight of all waterfowl species observed during spring and fall study periods at the Forward Wind Energy Center project site, 2004.

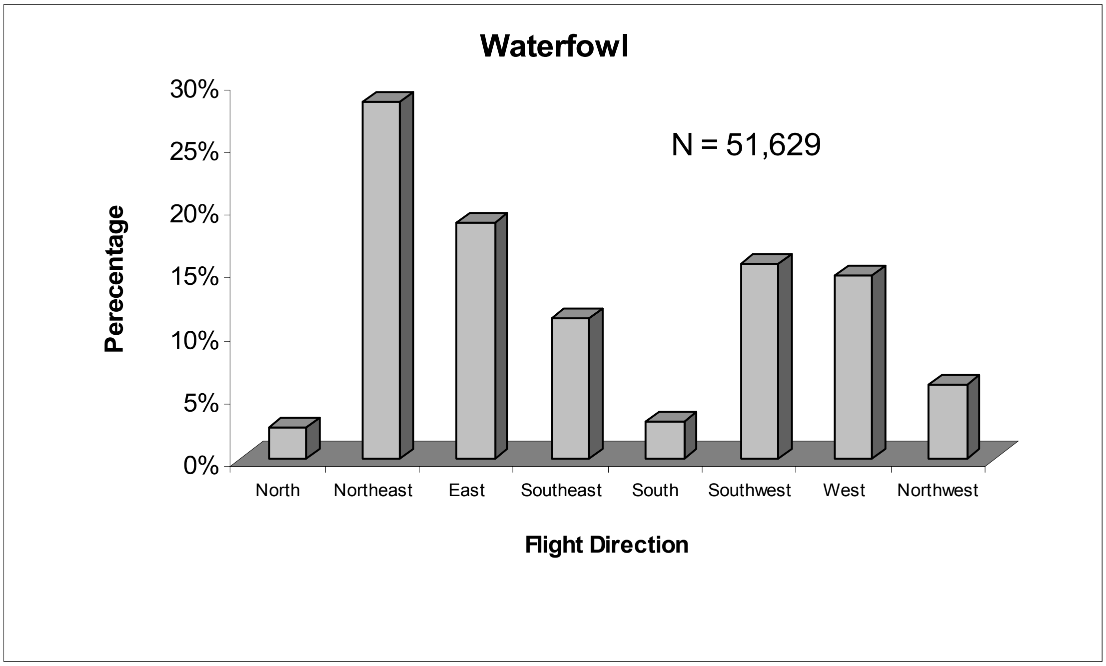


Figure 6. Direction of flight of Canada Geese observed during spring and fall study periods at the Forward Wind Energy Center project site, 2004.

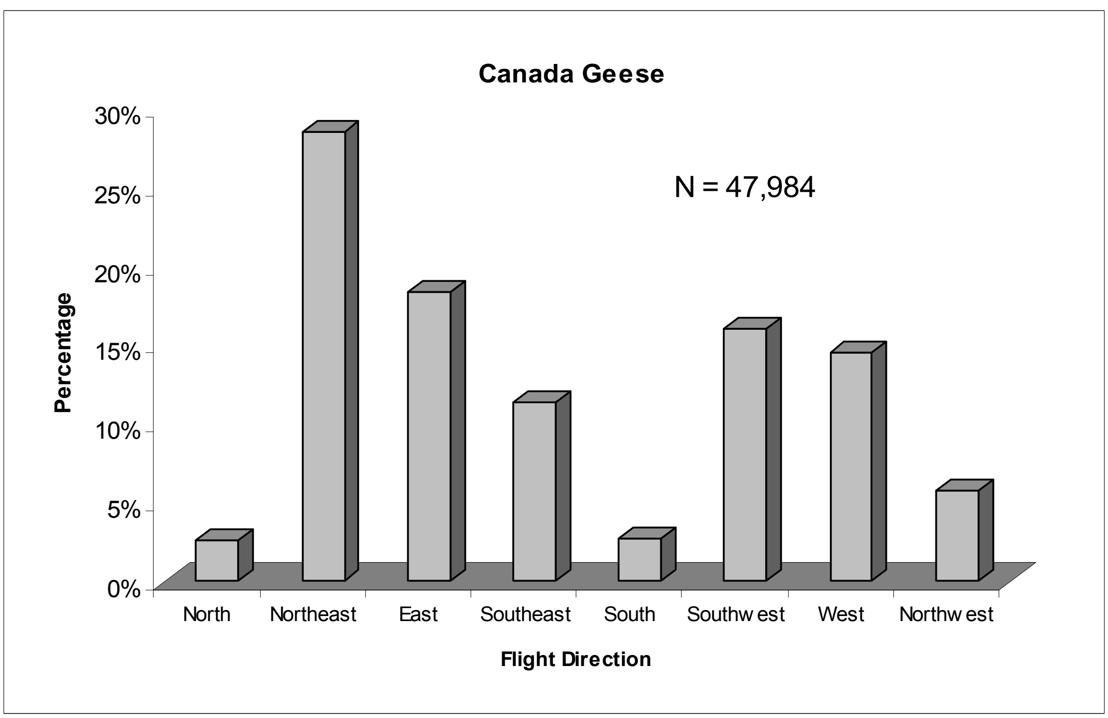


Figure 7. Direction of flight of Sandhill Cranes observed during spring and fall study periods at the Forward Wind Energy Center project site, 2004.

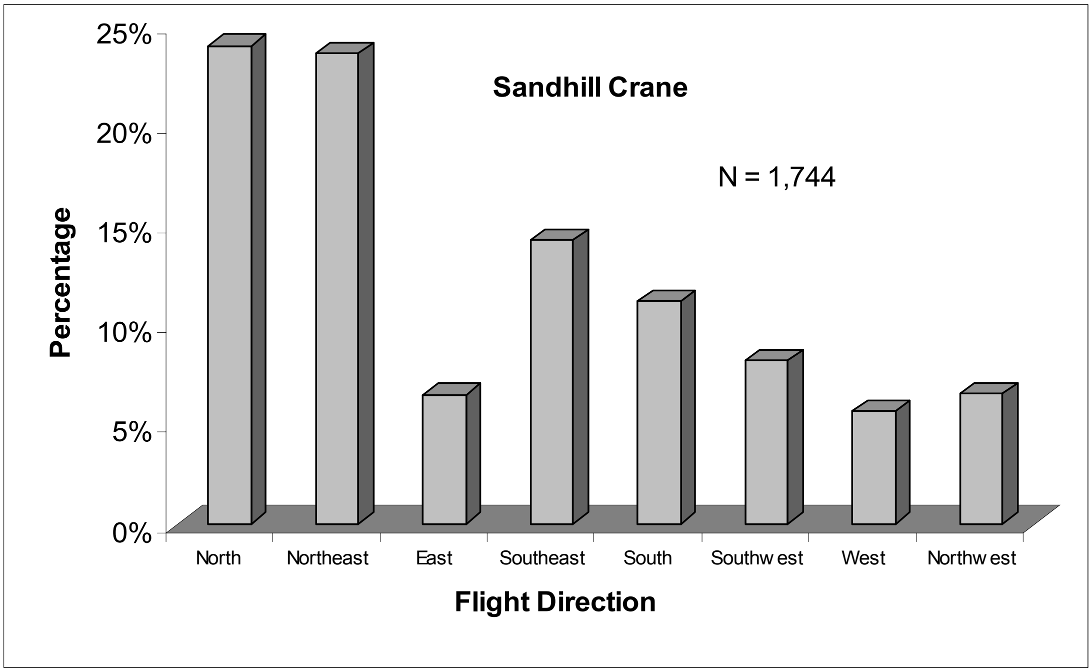


Figure 8. Direction of flight of raptors observed during spring and fall study periods at the Forward Wind Energy Center project site, 2004.

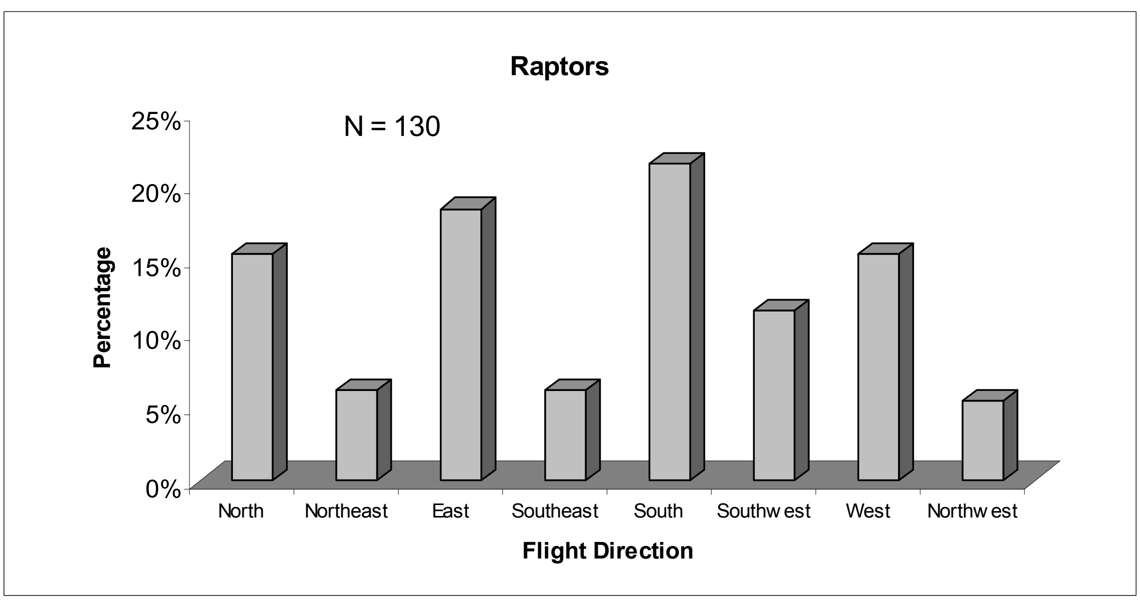


Figure 9. Altitude of flight of waterfowl observed during spring and fall study periods at the Forward Wind Energy Center project site, 2004

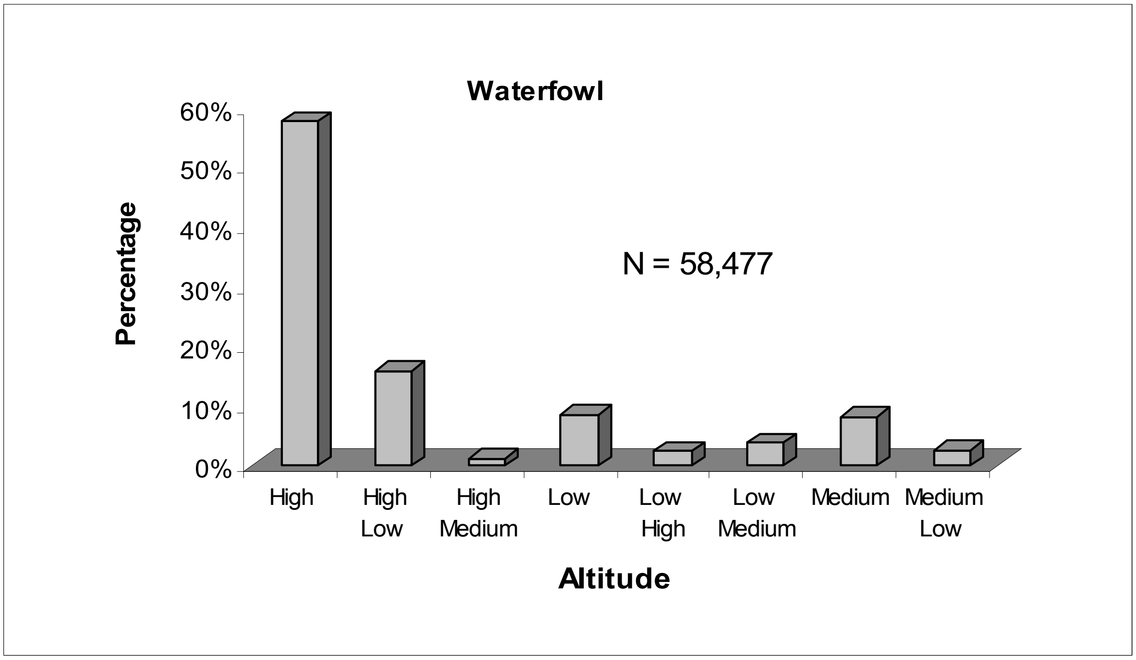


Figure 10. Altitude of flight of Canada Geese observed during spring and fall study periods at the Forward Wind Energy Center project site, 2004.

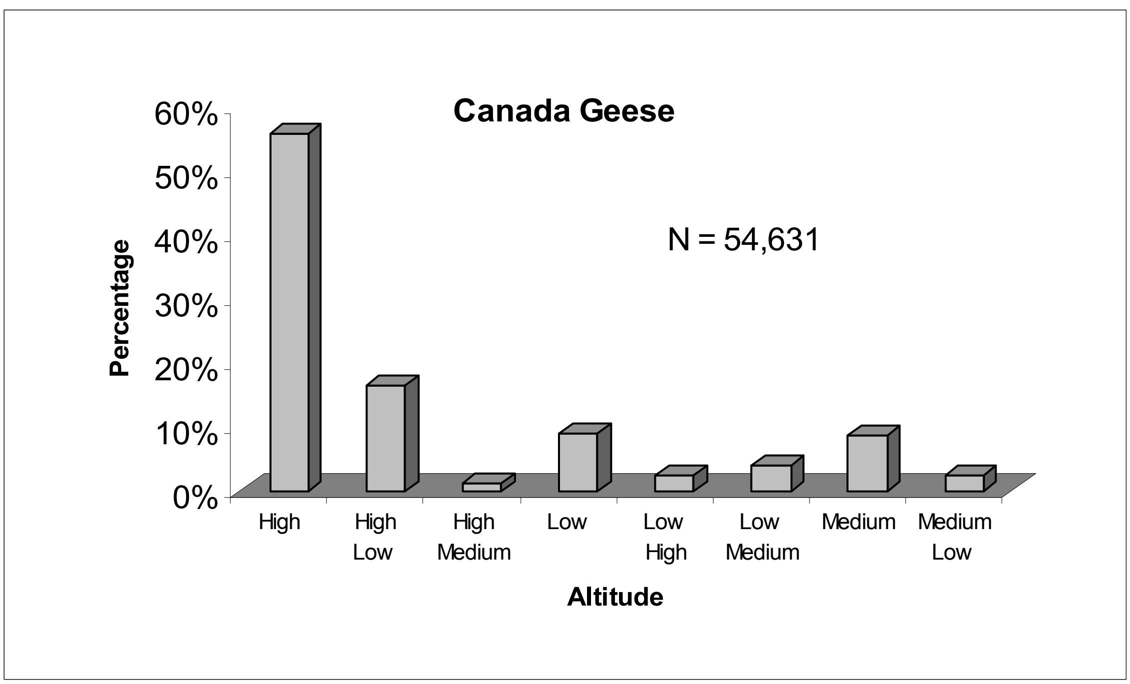


Figure 11. Altitude of flight of Sandhill Cranes observed during spring and fall study periods at the Forward Wind Energy Center project site, 2004

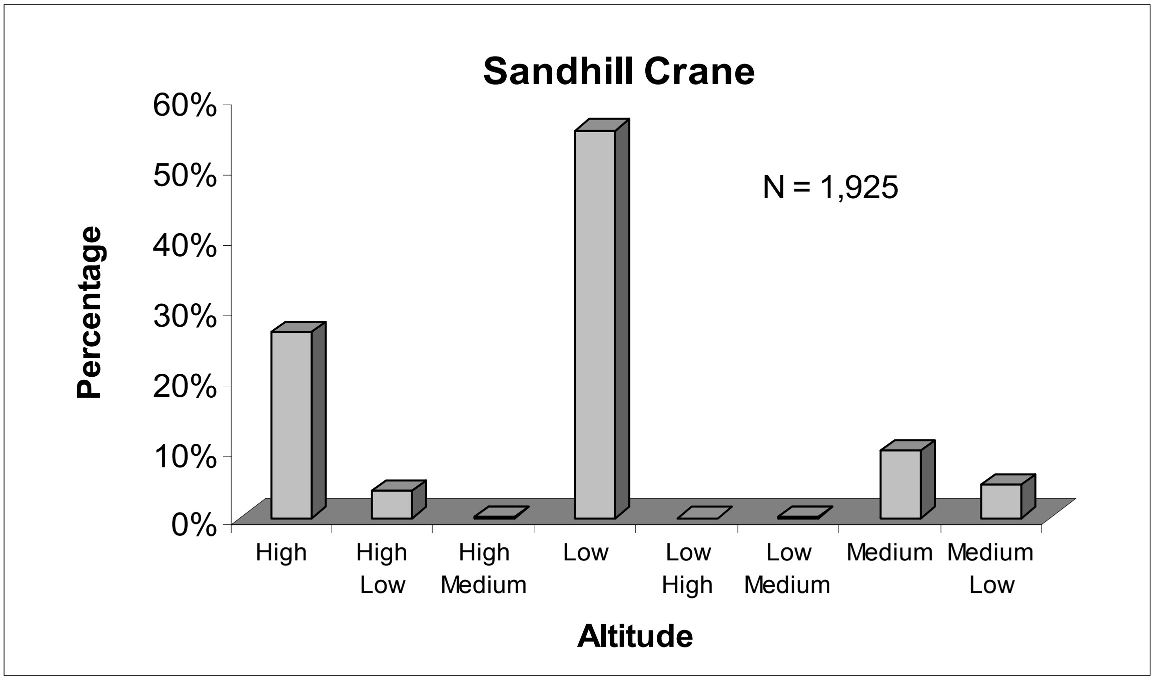
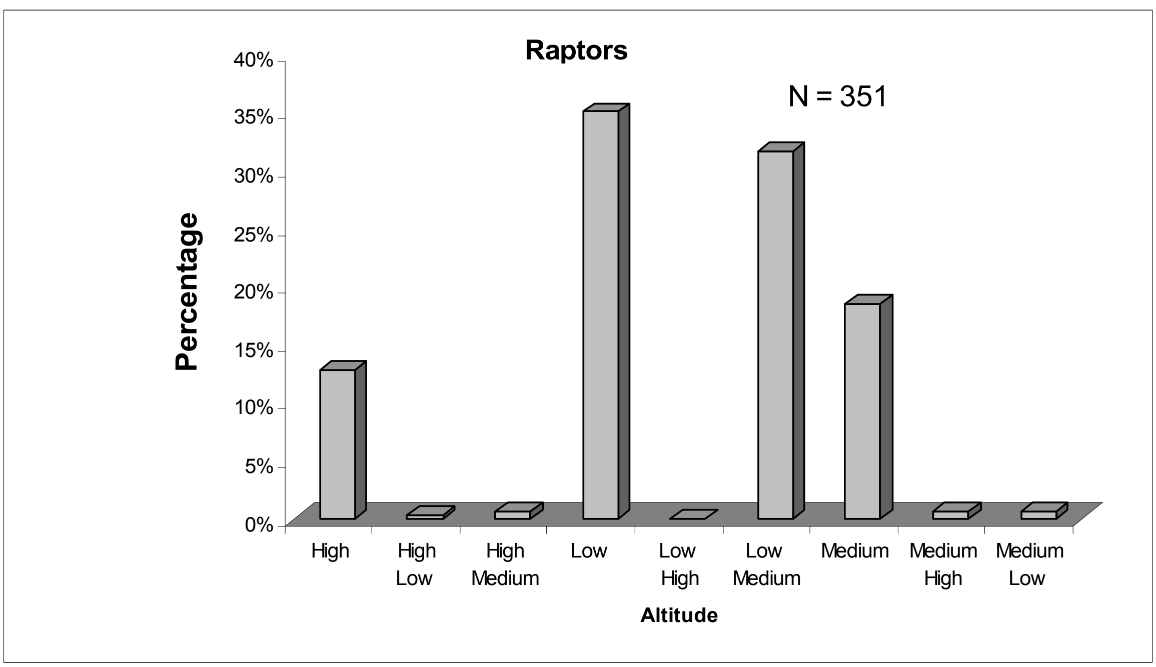


Figure 12. Altitude of flight of raptors observed during spring and fall study periods at the Forward Wind Energy Center project site, 2004



Appendix I. Protocols for Conducting Road Surveys and Point Counts on the Forward Wind Energy Center Project site. These instructions were given to the two technicians who conducted the field work during spring and fall migration seasons.

Drive slowly along the designated roads, looking as you go. Try to maintain 15 miles per hour where possible. Stop for birds and to take notes. Pull off the road in locations where you can get much of the car out of traffic - for safety purposes. Make sure you look for cars behind you.

Do 4 surveys of the two point counts and two road routes each week. The days you do them on do not matter. Conduct road surveys before point counts on day 1 and after point counts on day 2. Start your observations at sunrise or within 20 minutes of sunrise. Alternate which point count you do first and which road survey you do first. Also, reverse the direction in which you drive the road surveys each on successive days. This will insure that there will be little bias and that you conduct these surveys over as diverse an array of time as possible.

At the beginning of the road survey or point count record on the appropriate data sheet: Site – East or West, Date – 10/01/04, Time Start: 07:32 (CST), and the following weather conditions. Temperature – in degrees Fahrenheit (you may provide a range if necessary – e.g., 41-44 degrees), Visibility – note as Excellent, Good, Fair, or Poor (this is your own judgement and is a relative and qualitatively determined variable), Cloud Cover – record the amount of sky covered in percentages (10%, 50%, etc. – you may add that it is think cloud cover or variable, etc.), Wind – direction and speed in miles per hour (direction should be in one of the 8 cardinal directions NE, N, NW, W, SW, S, SE, E – you will have to estimate speed).

For birds observed record as follows and as appropriate.

Sector: A-DD
Species: 4 letter abbreviations (make a list of the abbreviations you are using and be consistent)
Number: Number of individuals in flock or group
Behavior: H = hunting, D = display, P = perched, PP = perched on pole, PT = perched on tree, PF = perched on fence, etc. make up others and record them as you did for species abbreviations so we may interpret them, F = flying.
Height (if flying): L = 1-75 feet above the ground, M = 76 feet to 350 feet, H = greater than about 350 feet, LM = not distinguishable or changing from L to M, L-H, etc…
Direction (if flying): To North (N), etc., ND if no direction or you can leave it blank
Habitat: AG = tilled agriculture, TR = Tree or hedge row, HA = hay or wheat, FO = forest, AGW = winter wheat, W = Wetlands (cattails, etc.), PO = pond, TW = temporary water (puddles in farm fields), R = residential area or cemetery/factory. If there is another habitat, make up letters
Notes. Miscellaneous observations may be made that are relevant to the study.
Time End. Record the time when you finish a point count or road survey.

*Do not record American Robins, House Sparrows, European Starlings, Mourning Doves, or Rock Doves

Appendix II. Summary of dates on which road surveys and point counts were conducted at the Forward Wind Energy Center, Dodge and Fond du Lac Counties, Wisconsin during the spring and fall 2004 study periods.

Spring	**Fall**
April 2 – Trial Survey – data not taken	October 2
April 3	October 4
April 4	October 5
April 5	October 6
April 6	October 7
April 7	October 11
April 8	October 12
April 9	October 13
April 10	October 14
April 20	October 17
April 21	October 18
April 22	October 19
April 23	October 20
	October 27
	October 28
	October 29
	October 30
	October 31
	November 1
	November 2
	November 3
	November 7
	November 8
	November 9
	November 10
	November 15
	November 16
	November 17
	November 18
	November 21
	November 22
	November 23
	November 24

Appendix III. Summary of species observed, numbers of individuals, percentage of total individuals, and number of observations of each species during spring 2004 road and point count surveys at the Forward Wind Energy Center project site, Dodge and Fond du Lac Counties, Wisconsin.

Species	**Road Survey**			**Point Count**		
	Number of Individuals	**% of Total**	**Observations**	**Number of Individuals**	**% of Total**	**Observations**
American Crow	129	0.7%	72	63	0.8%	30
American Goldfinch	13	0.1%	4	8	0.1%	3
American Kestrel	60	0.3%	55	9	0.1%	9
American Wigeon	18	0.1%	2	0	0.0%	0
Barn Swallow	11	0.1%	7	1	0.0%	1
Black-capped Chickadee	2	0.0%	2	1	0.0%	1
Brown-headed Cowbird	605	3.4%	41	290	3.8%	20
Blue Jay	25	0.1%	9	4	0.1%	2
Bonaparte’s Gull	841	4.7%	16	118	1.5%	8
Brewer’s Blackbird	639	3.6%	10	0	0.0%	53
Blue-winged Teal	8	0.0%	2	0	0.0%	0
Canada Goose	9,100	50.6%	147	1,863	24.3%	53
Chipping Sparrow	65	0.4%	35	8	0.1%	4
Cliff Swallow	1	0.0%	1	0	0.0%	0
Common Grackle	1,891	10.5%	151	318	4.2%	16
Cooper’s Hawk	3	0.0%	3	1	0.0%	1
Dark-eyed Junco	176	1.0%	19	0	0.0%	0
Double-crested Cormorant	0	0.0%	0	17	0.2%	2
Downy Woodpecker	4	0.0%	4	1	0.0%	1
Eastern Bluebird	26	0.1%	21	2	0.0%	2
Eastern Meadowlark	4	0.0%	3	0	0.0%	0
Eastern Phoebe	1	0.0%	1	0	0.0%	0
Gadwall	6	0.0%	1	0	0.0%	0
Great Blue Heron	2	0.0%	2	1	0.0%	1
Green Heron	1	0.0%	1	0	0.0%	0
Greater Yellowlegs	14	0.1%	4	0	0.0%	0
Green-winged Teal	105	0.6%	10	0	0.0%	0

Herring Gull	0	0.0%	0	1	0.0%	1
House Finch	23	0.1%	9	8	0.1%	4
Horned Lark	906	5.0%	83	1,903	24.8%	24
Killdeer	25	0.1%	19	37	0.5%	14
Lapland Longspur	195	1.1%	4	813	10.6%	16
Lesser Yellowlegs	12	0.1%	3	0	0.0%	0
Mallard	128	0.7%	19	6	0.1%	3
Northern Cardinal	3	0.0%	3	3	0.0%	2
Northern Flicker	30	0.2%	24	20	0.3%	11
Northern Harrier	8	0.0%	7	2	0.0%	2
Pectoral Sandpiper	29	0.2%	1	2	0.0%	1
Ring-billed Gull	1,216	6.8%	39	1,012	13.2%	63
Red-bellied Woodpecker	1	0.0%	1	0	0.0%	0
Red-winged Blackbird	1351	7.5%	128	952	12.4%	25
Ring-necked Pheasant	1	0.0%	1	1	0.0%	1
Red-tailed Hawk	89	0.5%	79	85	1.1%	54
Sandhill Crane	7	0.0%	2	3	0.0%	2
Savannah Sparrow	11	0.1%	10	11	0.1%	8
Sharp-shinned Hawk	0	0.0%	0	1	0.0%	1
Smith’s Longspur	2	0.0%	1	0	0.0%	0
Song Sparrow	78	0.4%	41	26	0.3%	18
Tree Swallow	52	0.3%	34	38	0.5%	13
Tundra Swan	22	0.1%	1	0	0.0%	0
Turkey Vulture	8	0.0%	6	23	0.3%	13
Vesper Sparrow	9	0.1%	7	6	0.1%	6
White-faced Goose	1	0.0%	1	0	0.0%	0
Wilson’s Snipe	4	0.0%	4	0	0.0%	0
Wild Turkey	5	0.0%	2	0	0.0%	0
Wood Duck	2	0.0%	1	0	0.0%	0
Total	**17,968**	**100.0%**		**7,658**	**100.0%**	

Appendix IV. Summary of species observed, numbers of individuals, percentage of total individuals, and number of observations of each species during fall 2004 road and point count surveys at the Forward Wind Energy Center project site, Dodge and Fond du Lac Counties, Wisconsin.

Species	**Road Survey**			**Point Count**		
	Number of Individuals	**% of Total**	**Observations**	**Number Individuals**	**% of Total**	**Observations**
Accipiter sp.	1	0.0%	1		0.0%	
American Crow	665	0.5%	360	196	0.5%	90
American Golden Plover	141	0.1%	3		0.0%	
American Goldfinch	361	0.3%	82	23	0.1%	16
American Kestrel	33	0.0%	29		0.0%	
American Pipit	229	0.2%	19	10	0.0%	3
Bald Eagle	1	0.0%	1	1	0.0%	1
Black-bellied Plover	1	0.0%	1		0.0%	
Black-capped Chickadee	39	0.0%	27		0.0%	
Brown-headed Cowbird	104	0.1%	24		0.0%	
Blue Jay	190	0.1%	148	11	0.0%	10
Brewer's Blackbird	159	0.1%	16	2	0.0%	1
Brown Creeper	1	0.0%	1		0.0%	
Blue-winged Teal	1	0.0%	1		0.0%	
Cackling Goose	10	0.0%	3	8	0.0%	4
Canada Goose	55,054	39.9%	1,034	19,526	52.2%	667
Chipping Sparrow	32	0.0%	18	2	0.0%	2
Common Grackle	54	0.0%	18	25	0.1%	5
Cooper's Hawk	11	0.0%	11	3	0.0%	3
Dark-eyed Junco	186	0.1%	65	16	0.0%	5
Double-crested Cormorant		0.0%		164	0.4%	2
Downy Woodpecker	39	0.0%	36	11	0.0%	11
Eastern Bluebird	41	0.0%	19	23	0.1%	6
Eastern Meadowlark	12	0.0%	5		0.0%	
Eastern Phoebe	3	0.0%	3		0.0%	

Eurasian Collared- Dove	2	0.0%	2		0.0%	
Golden-crowned Kinglet	1	0.0%	1		0.0%	
Goose Species ?	20	0.0%	1		0.0%	
Gray Catbird	1	0.0%	1		0.0%	
Great Blue Heron	2	0.0%	2		0.0%	
Great Egret	1	0.0%	1		0.0%	
Gull Species ?				1	0.0%	1
Hairy Woodpecker	1	0.0%	1		0.0%	
Herring Gull	4	0.0%	3	2	0.0%	2
House Finch	62	0.0%	24	10	0.0%	5
Horned Lark	157	0.1%	65	34	0.1%	15
Killdeer	163	0.1%	46	6	0.0%	4
Lapland Longspur	1,187	0.9%	36	338	0.9%	20
Lincoln's Sparrow	1	0.0%	1		0.0%	
Mallard	2,566	1.9%	69	1,699	4.5%	65
Meadowlark Species ?	17	0.0%	3		0.0%	
Mixed Blackbirds	44,624	32.3%	370	9,912	26.5%	131
Northern Cardinal	12	0.0%	10	2	0.0%	1
Northern Flicker	10	0.0%	6	2	0.0%	2
Northern Goshawk	1	0.0%	1		0.0%	
Northern Harrier	42	0.0%	40	17	0.0%	17
Northern Pintail	1	0.0%	1		0.0%	
Northern Shoveler	1	0.0%	1		0.0%	
Palm Warbler	2	0.0%	2	1	0.0%	1
Peregrine Falcon				1	0.0%	1
Pine Siskin	17	0.0%	3		0.0%	
Purple Finch	1	0.0%	1		0.0%	
Raptor Species ?				1	0.0%	1
Red-bellied Woodpecker	15	0.0%	15	1	0.0%	1
Red-breasted Nuthatch	2	0.0%	2		0.0%	
Red-shouldered Hawk	1	0.0%	1		0.0%	
Red-tailed Hawk	160	0.1%	146	37	0.1%	33
Red-winged Blackbird	1,258	0.9%	141	646	1.7%	109

Ring-billed Gull	23,607	17.1%	470	3,609	9.7%	266
Ring-necked Pheasant	17	0.0%	11		0.0%	
Rough-legged Hawk	4	0.0%	4		0.0%	
Ruby-crowned Kinglet	5	0.0%	5		0.0%	
Rusty Blackbird	92	0.1%	12	7	0.0%	3
Sandhill Crane	6,116	4.4%	156	729	1.9%	51
Savannah Sparrow	48	0.0%	23	1	0.0%	1
Sharp-shinned Hawk	4	0.0%	4	3	0.0%	3
Snow Bunting				117	0.3%	5
Snow Goose	61	0.0%	10	98	0.3%	7
Song Sparrow	45	0.0%	31		0.0%	
Swamp Sparrow	2	0.0%	2		0.0%	
Tennessee Warbler	4	0.0%	3		0.0%	
Tree Sparrow	37	0.0%	11	1	0.0%	1
Tree Swallow	134	0.1%	14	32	0.1%	5
Tundra Swan	22	0.0%	2	37	0.1%	2
Turkey Vulture	14	0.0%	12	11	0.0%	6
Unidentified Shorebird Species	32	0.0%	1		0.0%	
Vesper Sparrow	3	0.0%	3		0.0%	
White-breasted Nuthatch	16	0.0%	16		0.0%	
White-throated Sparrow	13	0.0%	8		0.0%	
Wilson’s Snipe	3	0.0%	2	1	0.0%	1
Yellow-rumped Warbler	104	0.1%	55	15	0.0%	13
Total	**138,083**	**100.0%**	**3,776**	**37,392**	**100.0%**	**1,599**

Invenergy

April 18, 2005

Jim Lepinski
Docket Coordinator
Public Service Commission
P.O. Box 7854
Madison, WI 53707-7854

Re: Forward Wind Energy Center, Docket No. 9300-CE-100

Enclosed is a copy of the agreed upon Final Work Scope for the Spring and Summer Avian Study for the Forward Wind Energy Project. We are pleased to have worked closely with the Wisconsin Department of Natural Resources (WDNR) and the Public Service Commission of Wisconsin (PSCW) to design a study to address the concerns discussed in the Draft EIS.

If there any questions, please feel free to contact me at 312-224-1435.

Sincerely,

Mick Baird

Mick Baird
Project Manager

Enc.

Study Plan for 2005 Avian Preconstruction Studies at Invenergy's Forward Energy Center in Dodge and Fond du Lac Counties, Wisconsin

Final

March 29, 2005

Prepared for:

Invenergy, LLC; Wisconsin PSC; and Wisconsin DNR

Prepared by:

Paul Kerlinger, Ph.D.*
Curry & Kerlinger, LLC
P.O. Box 453
Cape May Point, NJ 08212

* The research design presented herein is authored by Kerlinger with primary input from Shari Koslowsky, Wisconsin DNR; Marilyn Weiss, Wisconsin PSC; and Bill Volkert, Wisconsin, DNR (among others).

Introduction

To evaluate risk to birds at the proposed Invenergy, LLC's Forward Energy Center (hereafter the "Project") site in Fond du Lac and Dodge Counties, Wisconsin, the following research is proposed. The research plan follows a fall and spring season of field observations at a portion of the proposed Forward Energy site. Three separate studies are proposed, each addressing a key issue with respect to avian risk. The three studies focus on three groups of birds: all birds (excluding Canada Geese, American Robins, Mourning Doves, blackbirds [except Brewers Blackbird], cowbirds, and the three species not protected by the Migratory Bird Treaty Act [European Starling, House Sparrow, and Rock Dove]); raptors, and rare species. The latter specifically addresses Wisconsin and U. S. listed species and Wisconsin species of concern (Table 1). The rationale for excluding the common species listed above from data collection and analysis is that they are not likely to be at great population risk, they are not protected by wildlife laws, and, or they are so numerous as to deter the observer from focusing on species that are of greater concern to the Wisconsin DNR and, presumably, at greater risk of impact to individuals and possibly populations from development of the wind plant. With respect to Canada Geese, the research done in 2004 focused on that species and provides the information needed to assess risk and evaluate impact to that species. It has been determined, with input and guidance from Wisconsin DNR, that Canada Geese can be excluded from this study because it is not at a great population risk from this Project.

The study designs are standard field methodologies used to survey birds by wildlife managers. They are modeled after Howe (1999) around Horicon Marsh and at the Shirley Wind Power Facility, Howe and Atwater (1998) around Horicon Marsh, and by Howe et al. (2002) at a wind power project in northeastern Wisconsin. The present study is modeled after these studies so that the Wisconsin DNR and Public Service Commission can make quantitative comparisons. By using almost identical methodologies, direct comparisons have been facilitated. For some of the studies, a modified Impact Gradient (IG) methodology is used, wherein the abundance and distribution of birds is determined by studying birds along concentric transects outward from Horicon Marsh. IG studies are a standard environmental methodology for determining differences in a dependent variable going outward from a source area. In this case, the source area for birds is hypothesized to be Horicon Marsh, rather than a pollution source, which is what this type of study is often used for. Other researchers who have used IG methodologies with respect to evaluating the impacts of wind turbines include Leddy et al. (1999) working in southwestern Minnesota to study grassland songbirds around wind turbines and Larsen and Madsen (2000) in Denmark to study waterfowl near turbines.

In addition to the IG methodology, the general avian transect study has been designed to fit into a BACI (Before After Control Impact) approach. This method is described in Anderson et al. (1999) and has been used for determining impacts to birds at other wind power sites. The method basically provides a means of examining abundance and behavior of birds at a project site by examining the site before and after construction, as well as examining reference (sometimes called) control sites that are similar to a project site in vegetation. In this case, the reference sites are also similar in terms of distance from Horicon Marsh. By controlling this covariate, a more robust determination of impacts can be made.

Rare Bird Study

The rare bird study focuses on determining whether several species of U. S. and Wisconsin endangered and threatened species, as well as Wisconsin species of concern and rare species are present on or near the Forward Energy Center site (see Table 1 for list of species of particular interest to the Wisconsin DNR). In addition, if these species are present their abundance and behavior while present on site will be determined. The study design includes a thorough examination of habitat within the red-lined area shown in Figure 1. That area is the boundary of the overall Forward Energy Center project site. Turbine locations are shown on the map and are well within the red-lined boundary. The habitat examination will result in the selection of the 12-16 sites that represent the best habitats for rare species within the Project boundary. The actual number of sites to be surveyed may vary, depending on the number of sites within the Project at which habitat is deemed to be suitable to rare and listed species.

Of the 12-16 sites, approximately eight will be located in forested areas, four in grassy/pasture/fallow areas/CRP areas, and four in wetland habitats (pond with emergent vegetation edge, wet meadow with emergent vegetation, stream corridor with emergent vegetation). The number of sites will be finalized after the site has been surveyed for habitats to examine and include as a rare bird site. The selection process will be documented and included in the report. Selection will be dependent on access.

The study design is basically a series of searches of each of the 12-16 sites for rare, threatened, or endangered species. The latitude and longitude of all locations will be determined via GPS for later mapping. This design is biased towards maximizing the likelihood of observing such species. In addition, lists of all species and numbers of individuals will also be collected during each site visit. For forested areas, transects should be established with point counts established at about 250 m intervals. At each point, the observer will listen and look for birds for 10 minutes, recorded in 5 minute intervals, and record all birds observed (with the exception of species listed above). At forested tracts, surveys will commence 0.5 hours before sunrise and extend to approximately 9:00 roughly following guidelines for Breeding Bird Surveys. Thereafter these surveys could be followed by the raptor surveys from 9:00 to 3:00 (see below) or surveys of wetlands sites. For smaller woodlots, a single sampling point will be established in the middle of the forested patch or at a location close to the center of the forested patch where observations may be made. For grassland areas, the plot will be walked, stopping for 10 minutes, recorded in 5 minute intervals, at point count locations located at about 300 m intervals. For wetland areas, observation points will be established that will allow the observer views of the entire wetland area in question. At each of these sites, a minimum of 15 minutes of actual observations will be undertaken. Because the size, access to, and location of these sites varies and cannot be determined at this time, the actual number of observation points will be determined on an ad hoc basis after the sites have been established.

For all rare bird points to be surveyed, a time-efficient road route would be established to access the point count locations. Then, the order in which the points would be surveyed would be reversed from one round of search to the next. For forested sites that would be studied early in the morning, the order would be reversed on successive surveys such that the last one surveyed on the first round of surveys would be the first one surveyed for the next round. For wetland and grassland areas, surveys would be conducted by reversing order as stipulated for the forest surveys.

The study schedule will include:

- 1+ day selection of sites to survey
- 1+ day to acquire access to property
- 3 surveys (4.5 days) in late March through April 23, 2005 (migration season and prenesting)
- 4 surveys (6 days) during April 23-May 31 (migration and early nesting season)
- 2 surveys (3 days) in June (nesting season)
- 2 surveys (3 days) in July (late nesting, dispersal, and early fall migration)
- 2 surveys (3 days) in August (dispersal and early fall migration)

Total Days = 21.5+ (to be adjusted by field biologist to suit the conditions and time necessary to complete the tasks)

(*For determination of nesting standard breeding bird atlas procedures should be followed, including safe dates for nesting of various species.)

Quantitative description of the data will be the primary mode of data analysis for this portion of the Forward Energy avian studies. In other words, the species and numbers of individuals of that species will be recorded along with the behavior of each individual. The behaviors to be recorded will include: whether a bird was flying or perched, whether it was foraging or not, whether it was flying directly over the site and not using the habitat, and whether it was resting. Height of flight will be recorded as L = below rotor height, M = within rotor swept height, or H = above rotor height. These height categories will be determine prior to field observations commencing. In addition, the date, time of day, site identification code, weather at the time of observations (temperature, wind speed and direction, cloud cover (1-100%), and precipitation. A data sheet for recording this information will be Each site will be assigned an alpha-numeric as follows: forested sites will be identified as F1, F2, etc., grassland sites will be identified as G1, G2, etc., and wetland sites will be identified as W1, W2, etc. These data will be entered into an Excel spreadsheet for analysis.

Raptor Surveys

A raptor survey will be conducted at 12 observation points located along the transects (Figure 1, marked by Xs), all of which will be within the Project site. Observation points will be located at 1, 3, 6 and 10 km from Horicon Marsh. For each observation point a GPS location will be determined for later mapping. The distribution of observation points provides an optimal design with respect to covering as much of the Project area via 12 observation points. In fact, because raptors can be seen at long distances from an observation point, the locations of these points provides for coverage of a large proportion of the Project area. Any raptor seen will be noted and its behavior recorded. Observations will be made between 9 a.m. and 3 p.m. at each point for a total of 60 minutes at each site before moving to the next point. At least 4 of these points may be sampled in a given day. The order in which these sites are surveyed will be determined via randomization with out replacement. This will provide an equal or roughly equal sample size at each location. Observations will be done via naked eye and binoculars from the observation point. The observer will observe in all directions by slowly scanning the horizon for flying and perched raptors so that all directions will be examined.

- 5 surveys of all points in April through May (all points surveyed 5 times during the two-month period)
- 4 surveys of all points in June through August
- Total of 9 surveys at all observation points

Data will be recorded on standard data sheets and entered into an Excel spreadsheet. For each raptor observed, the following data will be recorded: date, time, species, number of individuals, behavior (flying or perched), hunting, territoriality or other reproductive behavior, height above the ground, and direction of flight. In addition, each raptor will be determined to be on the proximal (i.e., less than 3 km) or distal (i.e., greater than 3 km) side of the transect line. This will enable a finer scaled examination of distance from Horicon Marsh by dividing each observation points into two areas, thereby resulting in eight areas in which raptors could possibly be seen.

Analysis of the data will be accomplished as follows. First, the average numbers of raptors per hour and duration of their time per hour (and standard deviations) within visual range at each of point count sites will be computed, along with species diversity (richness = numbers of species) for each point count site. These numbers will then be used in an anova with regression type analysis with distance from Horicon Marsh as the independent variable and abundance and diversity being the independent variables. This analysis will be done for each of the three Project sectors (numbers 1, 2, and 3 in Figure 1). A second analysis will be done pooling all three Project sectors in a similar fashion. In addition to these statistical procedures, quantitative description will be used to describe the type and abundance of raptors in the study area. Both will be useful for determining whether raptors are migrating through the Project site, nesting on site, and examining overall risk to those species by comparing the use estimates to studies where use and risk have been studied simultaneously.

[Note. The Howe et al. 2002 study in northeastern Wisconsin employed 12 long counts, each of which was observed for 30 minutes. The total observation time for one round of surveys at all 12 sites in the present study will be two times that of the Howe et al. 2002 study.]

Avian Transect Surveys

As a means of determining potential impact to the larger group of avian species (all species except those listed in the **Introduction** section of this study plan), a series of eight transects extending outward from Horicon Marsh will be established. These transects will extend in a parallel fashion approximately 1, 2, 3, 4, 6, 8, 10, and 12 km from the Marsh (Figure 1). In addition, five radial sectors have been delineated in Figure 1, with three radial sectors within the Project area and two outside (north-counter clockwise and south-clockwise) the Project area. A total of 80 point counts have been superimposed onto the transects (Figure 1) with two being located on each transect within each of the five sectors. This totals to 16 point count locations in each of the five sectors. The latitude and longitude of all point counts will be determined with a GPS device for mapping. The exact locations of the point counts will correspond to locations where there is good visibility, easy (and legal) access), and safe pull off areas along roads. This necessitates some small deviation from the exact transect locations, which usually not amount to more than small distance off the transects. Landowner permissions would be secured for any sites that are on private land (for all three studies).

Each point count will be surveyed for a period of 10 minutes and outward to a distance of about 500 m. (Raptors, cranes and other birds will be noted beyond 500 m, but those observations will be noted as beyond the actual point count 500 m boundary.) Data recorded for each sighting at each point count would include: species identification, number of individuals, direction of flight when bird is first seen, height above the ground (same categories as above for raptors), and general behavior (categories include – territoriality/nesting, hunting, perching, direct flight, and combinations of the above). These will be refined and provided to the field researcher as a “cheat sheet” along with codes for each behavioral category.

The schedule that is proposed for sampling of point count locations during the study period includes three complete surveys of all 80 points during April, May, June, July, and August. This would provide a total of 240 points sampled during each month, for a total of 1,200 point counts surveyed during the entire study period. If sampled three times each month, this would result in a total of 15 complete rounds of samples at all 80 point count locations. However, it is possible that only 2 complete surveys of all points are needed during July and August. Observations would be distributed in such a way that each point would be sampled at different times of the day on successive rounds of surveys. This would insure that bias due to time of day would not be an issue. The times of day for these surveys will be from 0.5 hours before sunrise until mid-morning and from mid-afternoon until sunset in order to best capture bird activity. Mid-day observations will be limited to the raptor surveys. The order in which the point counts will be sampled will be randomized with replacement such that all point count locations would be sampled a roughly equal number of times.

Reference Transects. To provide data necessary for a BACI type (Before-After-Control-Impact) research design, the transects have been extended clockwise (south) and counter clockwise (north) from the Project area. This will provide transects outside of the Project area that will serve as “control” or reference transects. Point counts along these transects will amount to about 40% of those that are within the Project area. Following construction, these transects can be studied in the same manner as prior to construction to determine whether the turbines have displaced individuals of various species.

Data Analysis. Data will be entered into and Excel spreadsheet for statistical analysis. The primary analyses will consist of Impact Gradient type analyses using an anova/regression model. The purpose of this analysis will be to determine whether there are gradients in abundance from transects closest to Horicon Marsh outward to a distance of about 12 km. The transects will be divided into sectors so that multiple gradients outward from Horicon Marsh can be examined. These will consist of one gradient area to the south (clockwise) from the Marsh, three within the

Project area and one north or counter clockwise from the Project area. The data will be analyzed for each sector separately and for all sectors combined (by pooling all sections).

In addition to the IG type analyses, behavior of birds will be examined in the standard way for evaluating risk at prospective wind power facilities. Data for each bird or flock observed will include those data collected for the original Forward Energy avian surveys from 2004, in addition to additional notes regarding territorial/nesting behavior as well as foraging behavior. Particular attention will be paid to endangered, threatened and rare species listed in Table 1, although information for all other species will also be examined. This combination of abundance data from the transects and behavioral data will provide information that is useful for assessing risk.

Caveat: Some of the observation points along the 1 and 2 km transects, as indicated in Figure 1, may be off the Niagara Escarpment. Such points may not be valid for comparisons. Determination of the exact location for observation points will have to be made on site while designing the study. Each observation point will be located above the escarpment, which may necessitate having point count locations more than 1-2 km from the marsh. This will avoid being below the escarpment and potentially invalidating the study.

[Notes: Howe and Atwater, 1998, in their study of Horicon Marsh selected a total of 160 points around the entire Marsh along 4 transects at intervals of 1, 2, 4, and 8 km from the Marsh. So, the current study extends farther from the Marsh, but has a higher density of sampling locations. Howe and Atwater sampled outward from point counts to about 500 m. The plan to survey all point counts three times per month results in a sample size that is nearly identical to those used by Howe and Atwater (1998, 1999) for their studies, which included point counts surrounding the perimeter of Horicon Marsh. Therefore, the 240 point counts for April constitute roughly 4 times the intensity of sampling used by Howe and Atwater (1998, 1999) during spring and a much higher intensity of sampling used in June-August. Howe and Atwater (1998, 1999) did not sample a defined area of 500 m as stipulated for the current study. Instead, they sampled all birds seen and recorded distance. However, they did not provide any indication as to the area they sampled in either the 1999 or 1998 reports. If the reviewers wish to follow the Howe and Atwater protocol, this researcher will change the methods above to reflect that difference.]

Integration and Coordination of Study Designs

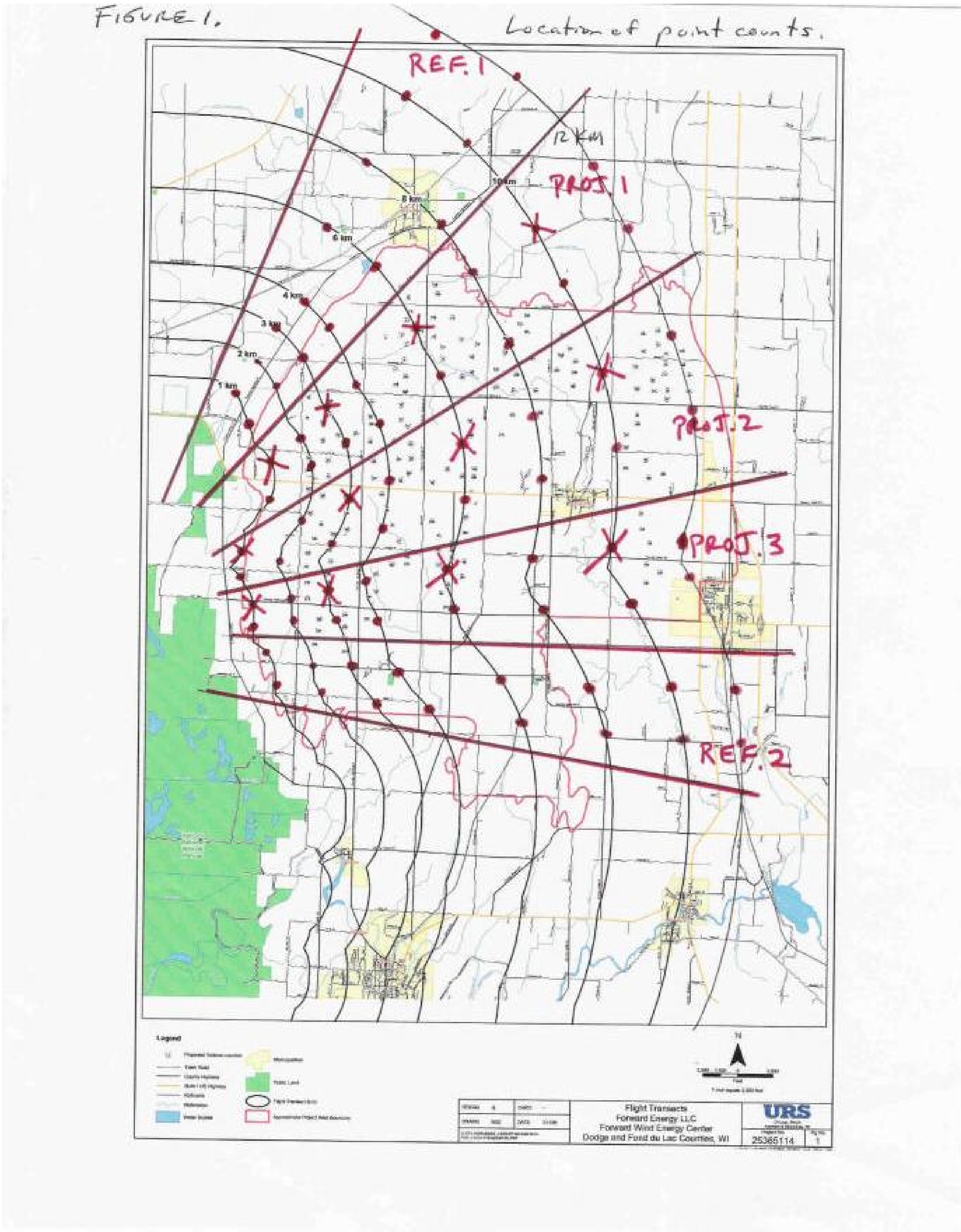
Because three different study designs are proposed, there will be a need for integration and coordination of field observations among the different methods. For example, rare bird observations and raptor observations may be done on the same day and the general avian survey and raptor observations may be made on the same day. An exact schedule and numbers of field staff will be determined following field set-up of the design. Once those are finalized, a schedule will be established that will promote the most efficient use of time and collection of data.

Table 1. Species of interest to the Wisconsin DNR. List provided by Bill Volkert, Wisconsin, DNR. Wisconsin species: WE = endangered, WT = threatened, WSC = species of concern; WO = other species of interest. "US" indicates that the species is federally listed. Status refers to nesting or foraging behavior on site. Many of the species listed as not likely to be on site may pass over the site during migration. The habitat and status on site columns were written by the author of this study plan with input from Volkert. The status on site column determinations are in some ways tentative and are made only to determine the potential for occupation of the Forward Energy site. The Status on Site column is intended only to be a rough indication of the likelihood of each species being present on site. Effort will be equal for all species such that even species that are "not likely present" will be recorded if or when seen. In other words, all Wisconsin rare species will be looked for as part of the study.

Water Dependent Species	**Status**	**Habitat**	**Status on Site**
Trumpeter Swan	WE	Open Water	Foraging possible – not likely
Bald Eagle	WSC-UST	Waterways/Forest Edge	Not likely
Snowy Egret	WE	Wetland/Water Edge	Foraging possible
Red-necked Grebe	WE	Open Water	Not likely present
Caspian Tern	WE	Open Water	Foraging possible – not likely
Forster's Tern	WE	Open Water/Marsh	Foraging possible
Great Egret	WT	Wetland/Water Edge	Foraging likely
Yellow Rail	WT	Wetland	Not likely present
Yellow-crowned Night-heron	WSC	Wetland/Water Edge	Not likely
Whooping Crane	WSC/US-EX	Wetland/Field	Foraging possible
Osprey	WT	Open Water/Edge	Not likely present
American Wigeon	WSC	Open Water/Wetlands	Foraging likely
Black-crowned Night-heron	WSC	Wetland/Water Edge	Foraging – not likely
Great Blue Heron	WSC	Wetland/Water Edge	Foraging likely
Bonaparte's Gull	WSC	Open Water/Fields	Foraging likely
American Black Duck	WSC	Open Water/Wetlands	Foraging likely
Lesser Scaup	WSC	Open Water	Foraging, not likely
Canvasback	WSC	Open water	Foraging possible
Common Goldeneye	WSC	Open Water	Not likely present
Common Merganser	WSC	Open Water	Not likely present
Common Loon	WSC	Open Water	Not likely present
Redhead	WSC	Open Water	Foraging possible
Grassland Species	**Status**	**Habitat**	**Status on Site**
Loggerhead Shrike	WE	Tall Grass w/ few trees	Not likely

Henslow's Sparrow	WT	Tall Grass (mature)	Not likely
Greater Prairie-chicken	WT	Tall Grass	Not likely
Upland Sandpiper	WSC	Tall Grass/Mixed	Not likely
Short-eared Owl	WSC	Tall Grass/Marshy	Not likely?
Northern Harrier	WSC	Tall Grass/Fields/Wetland	Possible nester; forages on site
Dickcissel	WSC	Tall Grass w/ few trees	Not likely
Western Meadowlark	WSC	Tall-Mixed Grass	Not likely ???
Forest Species	**Status**	**Habitat**	**Status on Site**
Cerulean Warbler	WT	Mature Forest/Riparian	Not likely
Acadian Flycatcher	WT	Mature Forest	Not likely
Red-shouldered Hawk	WT	Forest/Riparian Forest	Not likely?
Yellow-billed Cuckoo	WSC	Forest	Possible nesting?
Orchard Oriole	WSC	Forest/Edge	Possible nesting?
Red-headed Woodpecker	WSC	Forest/Parkland/Edge	Possible nesting?
Tennessee Warbler	WSC	Forest	Not likely
Northern Goshawk	WSC	Forest	Not likely, foraging?
Pine Siskin	WSC	Forest	Likely foraging
Cape May Warbler	WSC	Forest	Possible foraging
Other	**Status**	**Habitat**	**Status on Site**
Peregrine Falcon	WE	Variable	Foraging possible
Barn Owl	WE	Variable/Grassland	Possibly nesting, not likely
Merlin	WSC	Variable/Grassland/Forest	Foraging possible

Figure 1. Map showing the location of 8 transects, approximate location of 80 point counts along transects (dots), 12 raptor point count locations (noted by X), and the Invenergy Forward Energy Center Wind Power Project site, Fond du Lac and Dodge Counties, Wisconsin.



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Appendix I. The following list and status notes was submitted by Bill Volkert, Wisconsin DNR. It includes Wisconsin state or federally listed threatened or endangered birds and special concern species that occur or may occur in the Project area.

Trumpeter Swan – as the statewide population continues to increase, the possibility of sighting these birds on Horicon Marsh also increases. Several pairs of swans were released onto Horicon Marsh in 1998 but were not successfully introduced.

Snowy Egret – a few pairs nest in Green Bay regularly and last years it appears that we had a pair nesting on the north end of Horicon Marsh. This bird occurs on Horicon about every other year. While sparse in numbers it should be watched for.

Peregrine Falcon – a regular migrant in the Horicon Marsh area. This species is regularly sighted on the north end of the marsh and nearby uplands. If we have good shorebird habitat on the marsh they can be expected to remain in the area for a while during migration.

Loggerhead Shrike – Only about 5 nest records per year are known for the entire state. There are no records of this species on Horicon Marsh and only one recent record of a pair nesting some 20 miles to the east of the marsh about 3 years ago.

Red-necked Grebe – This species is known to occur on the marsh in low numbers and sighted every few years. We may have had a nesting attempt last year. It appears that this species may follow the Rock River to the marsh, and therefore the probability of it occurring in the project area is rare.

Caspian Tern – Found on Lake Michigan and sighted on Horicon Marsh primarily following storms on the great lakes. It is of rare occurrence at the marsh and always a good sighting, but when it does occur it is most likely approaching from the east and more rarely from the north at Lake Winnebago.

Forster's Tern – a common nesting species at Horicon, which also supports one of only two major nesting colonies in the state. They are more likely to wander prior to the nesting season and then tend to stay around the marsh proper during the nesting season. Should be watched for in the project area, especially in early spring and also to confirm their limited movement from the marsh during summer.

Barn Owl – a very rare bird in the state with one recent hypothetical sighting record. If you do see this, call us immediately since no other records exist for the area.

Henslow's Sparrow – an uncommon to rare nesting species in the tall grass habitat around Horicon Marsh. Best recognized by its call, it should be watched for in any grassland habitat management areas and set-aside areas in the project area.

Great Egret – Horicon Marsh supports one of the largest concentrations of great egrets in the state. There is movement of birds between Horicon and Theresa marshes, but their flight path is unknown and may very likely include the project area.

Red-shouldered Hawk – sighted numerous times along the Niagara Escarpment during migration, although in low numbers. Watch for occurrence and height in the area, particularly near the escarpment.

Yellow Rail – a rare migrant at Horicon Marsh. As a very secretive species and rarely detected in migration, except while calling or through collisions (as has been noticed in downtown Milwaukee) it probably will not be detected in the project area, even if it flies through the area.

Cerulean Warbler – a rare migrant at Horicon Marsh and an uncommon nesting species in the Kettle Moraine to the east, it should be watched for in the woodlots in the project area.

Acadian Flycatcher – same as the status of cerulean warbler.

Merlin – a rare migrant with lower numbers than peregrine falcon in the area, but should be watched for since most Horicon sightings have been from the surrounding uplands.

Whooping Crane – one bird in particular has been coming back to Horicon Marsh for the past few years. In the fall of 2003 it was regularly making use of the project area as it fed in the uplands among several hundred sandhill cranes.

Bald Eagle – one nesting pair occurs on the marsh and one pair nests at Lake Sinissippi. With a statewide population of some 800 nesting pairs, it is often seen in the area during migration. Eagles often feed in the uplands on carrion before ice-out on the marsh.

Yellow-crowned Night Heron – a rare bird in Wisconsin and at Horicon Marsh. It is unlikely to be seen on the marsh due to it being a more southerly species.

Osprey – an uncommon migrant in the area but sighted annually and often in the uplands to the east of the marsh. Need to watch for occurrence and height of flight. One pair nests in the northern Kettle Moraine, but as the state population in the northern portion of Wisconsin saturate the habitat and compete with the increasing eagle population, chances for occurrence in the area increase including the eventual probability of nesting here.

Greater Prairie Chicken – the statewide population is primarily confined to managed lands in central Wisconsin. This prairie grouse occurred in the area surrounding Horicon Marsh up to the 1950's but has disappeared since.

American Wigeon – a common spring and fall migrant with fall populations being quite abundant. It is my belief that Horicon Marsh supports one of the state's largest migrant populations.

Upland Sandpiper – This bird was known to the agricultural areas beyond the marsh some 15 to 20 years ago when I would often sight a few individuals in the area. It has not been recorded on the marsh or nearby for many years.

Black-crowned Night Heron – a common nesting species that, like the great egret, does move between Horicon and Theresa marshes. Should be watched for to see if there is any movement through the project area.

Great Blue Heron – a very common nesting species on Horicon Marsh which will fly between the marsh and upland feeding sites on a daily basis. This species needs to be watched for as well as the height of flight as it appears to me to be quite vulnerable.

Yellow-billed Cuckoo – a rare summer resident with population numbers fluctuating due to outbreaks in its food supply. Should be watched and listened for during late spring and summer.

Bonaparte's Gull – this species commonly migrates through the marsh and surrounding uplands in large flocks of hundreds at times. Although its occurrence in the area may be brief it needs to be watched for.

Dickcissel – this species is eruptive in its habits and usually does not occur in the area. In about 2001 we had a nesting population on the northeast edge of the marsh.

Orchard Oriole – an increasing species in Wisconsin. A male was singing last spring on the northeast side of the marsh. Should be watched and listened for in the woodlots of the project area.

Western Meadowlark – a severely declining species in eastern Wisconsin. Numbers have decreased over the past 10 to 20 years in our area. Eastern meadowlarks are the more abundant species, but watch and listen closely.

Red-headed Woodpecker – also a severely declining species in eastern Wisconsin. However, it may occur in the small and open woodlots in the project area.

Tennessee Warbler – a migrant only in our area which may occur as loose flocks during migration. I would expect it to occur for a brief time in May and again in August and early Sept in the woodlots of the project area.

Northern Harrier – this species has been increasing over the past 10 to 15 years due to the CRP program and other grassland management projects. A regular occurring species in the uplands around Horicon Marsh.

American Black Duck – an uncommon species on the marsh, but does feed in the upland and flooded corn fields around Horicon Marsh. A hunting guide in the area mentioned to me the large number of mallards and some black ducks that feed daily in the uplands of the project area during migration.

Lesser Scaup – a bird of the deeper water areas, it may restrict its feeding to the larger pools of Horicon and Theresa marshes. Should be watched for as flocks move across the project area from Horicon Marsh to the lakes of the Kettle Moraine and even Lake Michigan.

Canvasback – similar to scaup.

Cape May Warbler – similar to Tennessee warbler in occurrence.

Common Goldeneye – similar to scaup.

Common Merganser – similar to scaup

Common Loon – rarely sighted on Horicon Marsh due to its preference for deeper water areas. I have sighted this species on the marsh every 2 to 3 years.

Northern Goshawk – in earlier surveys this species was mentioned as possibly nesting in the area. This is a misidentification of a Cooper's hawk, which is common in the area. Goshawks are restricted to nesting in the northern forests of Wisconsin, but birds do come into the Horicon area in winter.

Pine Siskin – rather eruptive, populations seem to be higher this winter but not at record high density. Should be watched for in late spring as birds return north.

Redhead – Horicon Marsh supports among the largest nesting population of this species in the eastern U.S. While it restricts its use to deeper water, it does fly to outlying areas in spring and fall.

Red-breasted Merganser – similar to the scaup and other diving ducks, mergansers rely on deeper water areas. The occur at Horicon Marsh and surrounding larger bodies of water in migration but do not nest here.

Short-eared Owl – a winter visitor. It is rare in the area but in exceptional years may move into the nearby uplands. Habit and habitats similar to northern harrier, but far less abundant.

Appendix D

Draft Model Wind Ordinance for Wisconsin
October 22, 2003
WISCONSIN MODEL WIND ORDINANCE FOR TOWNS/COUNTIES

1. **PURPOSE**

The purpose of the Ordinance is to provide a regulatory scheme for the construction and operation of Wind Energy Facilities in the Town/County, subject to reasonable restrictions, which will preserve the public health and safety.

2. **DEFINITIONS**

As used in this Ordinance, the following terms shall have the meanings indicated:

Committee shall mean [Town/County Planning Committee or Planning Commission.]

FAA shall mean the Federal Aviation Administration.

Hub Height shall mean, when referring to a Wind Turbine, the distance measured from ground level to the center of the turbine hub.

MET Tower shall mean a meteorological tower used for the measurement of wind speed.

Total Height shall mean, when referring to a Wind Turbine, the distance measured from ground level to the blade extended at its highest point.

Town/County shall mean [_______ Town/County.]

Wind Access Permit shall mean a wind access permit within the meaning of Wis. Stats. §66.0403 or any successor statute.

Wind Energy Facility shall mean an electricity generating facility consisting of one or more Wind Turbines under common ownership or operating control, and includes substations, MET Towers, cables/wires and other buildings accessory to such facility, whose main purpose is to supply electricity to off-site customer(s). It includes substations, MET towers, cables and wires and other buildings accessory to such facility.

Wind Energy Facility Siting Permit shall mean a construction and operating permit granted in accordance with the provisions of this Ordinance.

Wind Turbine shall mean a wind energy conversion system which converts wind energy into electricity through the use of a wind turbine generator, and includes the turbine, blade, tower, base and pad transformer, if any;

provided that such a system shall only be a Wind Turbine for purposes of this Ordinance if it both has a Total Height greater than 170 feet and nameplate capacity of greater than 100 kilowatts [Note: wind turbines less than 170 feet in height or less than 100 kilowatts will be regulated pursuant to Town/County Ordinance Section ______].

3. **REGULATORY FRAMEWORK**

3.1. **ZONING (Option #1)**

Wind Energy Facilities may only be constructed in areas that are zoned [insert permitted zoning. See Appendix] on the official zoning map for the Town/County.

3.1 **ZONING (Option #2 – Wind Overlay)**

Wind Energy Facilities may only be constructed in areas that are zoned [insert permitted zoning. See Appendix] and within areas designated as a Wind Energy Facility Overlay District on the official zoning map for the Town/County.

3.2. **PRINCIPAL OR ACCESSORY USE**

Wind Energy Facilities may be considered either principal or accessory uses. A different existing use or an existing structure on the same lot shall not preclude the installation of a Wind Energy Facility or a part of such facility on such lot. Wind Energy Facilities that are constructed and installed in accordance with the provisions of this Ordinance shall not be deemed to constitute the expansion of a nonconforming use or structure.

4. **APPLICABILITY**

The requirements of this Ordinance shall apply to all Wind Energy Facilities proposed after the effective date of this Ordinance. Wind Energy Facilities for which a required permit has been properly issued prior to the effective date of this Ordinance shall not be required to meet the requirements of this Ordinance; provided, however, that any such pre-existing Wind Energy Facility which does not provide energy for a continuous period of twelve (12) months shall meet the requirements of this Ordinance prior to recommencing production of energy. However, no modification or alteration to an existing Wind Energy Facility shall be allowed without full compliance with this Ordinance.

5. **GENERAL REQUIREMENTS FOR WIND ENERGY FACILITIES**

5.1. **VISUAL APPEARANCE; LIGHTING; POWERLINES**

1) Wind Turbines shall be painted a non-reflective, non-obtrusive color.

2) At Wind Energy Facility sites, the design of the buildings and related structures shall, to the extent reasonably possible, use

materials, colors, textures, screening and landscaping that will blend the Wind Energy Facility to the natural setting and then existing environment.

3) Wind Energy Facilities shall not be artificially lighted, except to the extent required by the FAA or other applicable authority.

4) Wind Turbines shall not be used for displaying any advertising except for reasonable identification of the manufacturer or operator of the Wind Energy Facility.

5) Electrical controls and control wiring and power-lines shall be wireless or not above ground except where wind farm collector wiring is brought together for connection to the transmission or distribution network, adjacent to that network.

5.2. **SETBACKS**

The following setbacks and separation requirements shall apply to all Wind Turbines; provided, however, that the Committee may reduce the standard setbacks and separation requirements if the intent of this Ordinance would be better served thereby.

1) Inhabited structures: Each Wind Turbine shall be set back from the nearest residence, school, hospital, church or public library, a distance no less than the greater of (a) two (2) times its Total Height or (b) one thousand (1,000) feet.

2) Property lines: Each Wind Turbine shall be set back from the nearest property line a distance no less than 1.1 times its Total Height, unless appropriate easements are secured from adjacent property owners, or other acceptable mitigation is approved by the Committee.

3) Public Roads: Each Wind Turbine shall be set back from the nearest public road a distance no less than 1.1 times its Total Height, determined at the nearest boundary of the underlying right-of-way for such public road.

4) Communication and electrical lines: Each Wind Turbine shall be set back from the nearest above-ground public electric power line or telephone line a distance no less than 1.1 times its Total Height, determined from the existing power line or telephone line.

5.3. **NOISE**

1) Audible noise due to Wind Energy Facility operations shall not exceed fifty (50) dBA for any period of time, when measured at

any residence, school, hospital, church or public library existing on the date of approval of any Wind Energy Facility Siting Permit.

2) In the event audible noise due to Wind Energy Facility operations contains a steady pure tone, such as a whine, screech, or hum, the standards for audible noise set forth in subparagraph 1) of this subsection shall be reduced by five (5) dBA. A pure tone is defined to exist if the one-third (1/3) octave band sound pressure level in the band, including the tone, exceeds the arithmetic average of the sound pressure levels of the two (2) contiguous one-third (1/3) octave bands by five (5) dBA for center frequencies of five hundred (500) Hz and above, by eight (8) dBA for center frequencies between one hundred and sixty (160) Hz and four hundred (400) Hz, or by fifteen (15) dBA for center frequencies less than or equal to one hundred and twenty-five (125) Hz.

3) In the event the ambient noise level (exclusive of the development in question) exceeds the applicable standard given above, the applicable standard shall be adjusted so as to equal the ambient noise level. The ambient noise level shall be expressed in terms of the highest whole number sound pressure level in dBA, which is succeeded for more than five (5) minutes per hour. Ambient noise levels shall be measured at the exterior of potentially affected existing residences, schools, hospitals, churches and public libraries. Ambient noise level measurement techniques shall employ all practical means of reducing the effect of wind-generated noise at the microphone. Ambient noise level measurements may be performed when wind velocities at the proposed project site are sufficient to allow Wind Turbine operation, provided that the wind velocity does not exceed thirty (30) mph at the ambient noise measurement location.

4) Any noise level falling between two whole decibels shall be the lower of the two.

5) In the event the noise levels resulting from the Wind Energy Facility exceed the criteria listed above, a waiver to said levels may be granted by the Committee provided that the following has been accomplished:

a. Written consent from the affected property owners has been obtained stating that they are aware of the Wind Energy Facility and the noise limitations imposed by this Ordinance, and that consent is granted to allow noise levels to exceed the maximum limits otherwise allowed; and

b. If the applicant wishes the waiver to apply to succeeding owners of the property, a permanent noise impact easement has been recorded in the [Office of the Town/County Register of Deeds] which describes the benefited and burdened properties and which advises all subsequent owners of the burdened property that noise levels in excess of those permitted by this Ordinance may exist on or at the burdened property.

5.4. **MINIMUM GROUND CLEARANCE**

The blade tip of any Wind Turbine shall, at its lowest point, have ground clearance of no less than seventy-five (75) feet.

5.5. **SIGNAL INTERFERENCE**

The applicant shall minimize or mitigate any interference with electromagnetic communications, such as radio, telephone or television signals caused by any Wind Energy Facility. (If the applicant is a public utility, s. PSC 113.0707 also applies.

5.6. **SAFETY**

1) All wiring between Wind Turbines and the Wind Energy Facility substation shall be underground.

2) Wind Turbine towers shall not be climbable up to 15 feet above ground level.

3) All access doors to Wind Turbine towers and electrical equipment shall be lockable.

4) Appropriate warning signage shall be placed on Wind Turbine towers, electrical equipment, and Wind Energy Facility entrances.

New 5-05

4.11 WIND ENERGY SYSTEM OVERLAY DISTRICT

4.11.1 General

A) **Purpose**
The purpose of this Overlay District is to promote the health, safety, property value, aesthetics and general welfare of the County by establishing a program to ensure the effective regulation of wind energy system facilities in Dodge County.

B) **Statement of Intent**
The purpose of this Overlay District is to establish standards for the siting of wind energy system towers and related facilities. The intent of this Overlay District is to:

1) Encourage the location of Wind Energy System (WES) facilities in non-residential areas,

2) Encourage owners of WES facilities to locate them in areas where the adverse impact on the community, surrounding properties, natural resources, migratory birds, raptors and other wildlife are minimal,

3) Encourage owners of WES facilities to locate and configure them in a way that minimizes the adverse visual impact, and

4) Protect owners of WES facilities from impermissible interference and blockage of wind.

C) **Applicability**

1) The jurisdiction of this Wind Energy System Overlay District shall include those areas that are subject to the County zoning regulations contained within this Code.

2) Personal Wind Energy Systems that are under 100 feet in total height are exempt from the conditional use provisions of this Overlay District. Personal Wind Energy Systems shall be limited to one for each property and shall be setback a distance equal to the total height from the nearest property line. All other wind energy systems shall require a land use permit and conditional use permit in accordance with Subsection 4.11.2.

3) WES facilities for which a required permit has been properly issued prior to the effective date of this amendment shall not be required to meet the requirements of this Overlay District. However, no structural alteration to an existing WES facility shall be allowed without full compliance with these requirements.

D) **Principal or Accessory Use**
WESs may be considered either principal or accessory uses. A different existing use or an existing structure on the same lot shall not preclude the installation of a WES on such lot. For purposes of determining whether the installation of a WES complies with setback requirements, lot coverage requirements, and other such requirements, the dimensions of the entire lot shall control, even though the WES may be located on leased parcels or easements within such lots. WESs that are constructed and installed in

accordance with the provisions of this Code shall not be deemed to constitute the expansion of a nonconforming use or structure.

E) **Indemnification**

The operator of a wind energy system facility shall defend, indemnify and hold harmless the County and Town and their officials from and against any and all claims, demands, losses, suits, causes of action, damages, injuries, costs, expenses and liabilities whatsoever including attorney fees arising out of the acts or omissions of the operator concerning the operation of the wind energy system facility without limitation, whether said liability is premised on contract or on tort.

4.11.2 Administration

A) **Permits for Wind Energy Systems**

No WES shall be constructed, located, installed, reconstructed, enlarged, or relocated, including the placement of additional buildings or other supporting equipment used in connection with said WES, without first obtaining a Land Use Permit and Conditional Use Permit. The Committee may authorize the Land Use Administrator to issue a Land Use Permit for a WES after a Conditional Use Permit is issued pursuant to the procedures set forth in Subsection 2.3.6 of this Code and this subsection.

B) **Conditional Use Permit Applications**

Applications for Conditional Use permits under this section shall be submitted to the Dodge County Planning and Development Department in accordance with Subsection 2.3.6.

1) *Factors Considered in Granting Permits*

The Committee shall consider the following factors in determining whether the granting of the Conditional Use Permit will not unreasonably interfere with the orderly land use and development plans of the County and that the benefits to the applicant and the public will exceed any burdens. The Committee may waive or reduce the burden on the applicant of one or more of these factors if the Committee concludes that the purpose and intent of this Code are better served thereby.

a) Proximity of the WES facility to residential structures and residential zoning district boundaries; or areas identified for future residential use within a local comprehensive plan or the Dodge County Plan.

b) Nature of uses on adjacent and nearby properties.

c) Surrounding topography.

d) Surrounding tree coverage and foliage.

e) Design of the WES with particular reference to design characteristics that may reduce or eliminate visual obtrusiveness.

f) Proposed ingress and egress.

g) The location of other WES facilities in the surrounding area.

h) The number of wind turbines to be located on the subject property.

i) The possible adverse effects on migratory birds, raptors and other wildlife or animals.

j) The impact on the view from the Horicon Marsh.

k) The possible adverse effects on area residents due to stray voltage, earth currents, interference with T.V., radio microwave, cell phone or wireless internet service reception, shadow effect and noise.

l) The recommendation of the Town Board of the Town in which the WES facility is to be located.

C) **Expiration of Conditional Use Permit**
A Conditional Use Permit granted by the Committee for a WES facility shall expire in accordance with Subsection 2.3.6(E) of this Code.

D) **Preservation of Rights**
The transfer of title to any property shall not change the rights and duties under this Code.

E) **Complaint Resolution Procedure**
The owner of the wind energy system facility shall, at the owner's expense and in coordination with the County, develop a system for logging and investigating all complaints from residents of the County related to the operation of the facility and the development standards set forth in this Subsection 4.11.3 of this Code. All such complaints regarding the operation of the wind energy system facility shall be dealt with in accordance with Subsection 11.4.3 and 11.4.4 of this Code.

4.11.3 Development Standards

A) **Aesthetics and Lighting**

1) WESs shall, be painted a non-reflective color, so as to reduce visual obtrusiveness and blend into the natural setting and built environment.

2) At WES sites, the design of the buildings and related structures shall, to the extent possible, use materials, colors, textures, screening and landscaping that will blend the WES facilities to the natural setting and built environment.

3) If a WES is installed on a structure other than a tower, the WES and supporting electrical and mechanical equipment must be of a neutral color that is identical to, or closely compatible with, the color of the supporting structure so as to make the WES and related equipment as visually unobtrusive as possible.

4) Wind energy systems shall not be artificially lighted, unless required by the FAA or other applicable authority. If lighting is required, the governing authority requiring the lighting may review the available lighting alternatives and approve the design that would cause the least disturbance to the surrounding views.

5) All electrical wires and lines connecting each turbine to the next turbine shall be installed underground. The wires and lines running from the last turbine in a string to any substation connecting to the electric utility shall also be run underground, unless the Committee determines that overhead lines would best serve the intent of the Code.

B) **Requirements**

1) *Federal and State Requirements*
All Wind energy systems shall meet or exceed current standards and regulations of the FAA and Wisconsin State Statutes Sections 66.031 and 66.032 and any other agency of the federal or state government with the authority to regulate wind energy systems.

2) *Other Requirements*

a) Wind energy systems and related facilities shall not be used for displaying any advertising, except for reasonable identification of the manufacturer and/or operator of the facility.

b) The Total Wind Turbine Height of any Wind Energy System Tower shall not exceed 500 feet. The Total Wind Turbine Height of any Wind Turbine shall not exceed 500 feet.*

**"Explanatory Note – The Dodge County Land Use Code currently includes the following definition: Total Wind Turbine Height shall mean, when referring to a WES tower or wind turbine, the distance measured from ground level to the blade extended at its highest point."*

c) Wind Towers shall not be installed at a rate greater than one per each five acres of land owned or controlled, unless it is determined by the Committee that a higher density would be in the best interest of the public and would not have an adverse affect on surrounding property owners.

d) The owner of the WES facility shall reimburse the municipality responsible for providing emergency services for the cost of responding to each incident at the facility. In addition, the owner of the WES facility shall provide at their expense, specialized training and equipment to the municipality responsible for providing emergency services. The Committee may waive this requirement if the intent of this Code would be better served.

e) The owner of an affected wind turbine shall immediately cease operation of the affected wind turbine for the duration of any emergency. Emergency shall mean a condition or situation caused by the affected wind turbine that presents an imminent physical threat of danger to human life or significant threat of damage to property.

f) The owner of a WES facility shall operate the facility so as not to cause groundwater contamination.

g) No blasting shall occur in connection with the construction of the facility unless the applicant has provided prior notification to the property owner, any abutting property owners, property owners within 1,500 feet of the blasting site, and officials from the Town in which the blasting site is located. All blasting shall be done in accordance with all applicable laws and regulations.

h) The owner of a WES facility shall minimize to the extent possible the impact of any stray voltage caused by the facility.

C) **Setbacks and Separation**

The following setbacks and separation requirements shall apply to all WES facilities; provided, however, that the Committee may reduce the standard setbacks and separation requirements if the intent of this Code would be better served thereby.

1) WES towers and wind turbines shall be setback a distance equal to their total height from the nearest property line, unless appropriate easements are secured from adjacent property owners, or other acceptable mitigation is approved by the Committee.

2) WES towers shall be setback a distance of no less than three times their total height from the nearest residence, school, hospital or church except that a lesser setback may apply to a residence where agreed to by the residence owner. The agreement between the residence owner and the WES operator shall be a recorded document with the Dodge County Register of Deeds, and a copy of the agreement shall be provided to the Land Use Administrator.

3) WES towers shall be setback a distance of no less than their total height from the nearest above-ground public electric power line or telephone line.

D) **Noise**

The audible noise due to Wind Energy System operation shall not exceed the sound levels specified in Subsection 8.5.3 of this Code. In the event the noise levels resulting from the Wind Energy System exceed the maximum limits allowed, a waiver to said levels may be granted by the Committee provided that the following has been accomplished:

1) Written consent from the affected property owners has been obtained stating that they are aware of the Wind Energy System and the noise limitations imposed by this Code, and that consent is granted to allow noise levels to exceed the maximum limits allowed; and

2) If the applicant wishes the waiver to apply to succeeding owners of the property, a permanent noise impact easement has been recorded with the County Register of Deeds which describes the benefited and burdened properties and which advises all subsequent owners of the burdened property that noise levels in excess of those permitted by this Code may exist on or at the burdened property.

E) **Signal Interference**

The applicant shall take reasonable steps to eliminate and/or mitigate any interference with radio or television signals caused by any Wind Energy System.

F) **Security Fencing**
The Committee may require that WES sites be enclosed by security fencing and be equipped with an appropriate anti-climbing device sufficient to deter the general public from obtaining access to the site if the intent of this Code would be better served thereby.

G) **Landscaping**
The following requirements shall govern the landscaping surrounding WES facilities; however, the Committee may waive such requirements if the intent of this Code would be better served thereby.

1) WES maintenance facilities and substations shall be landscaped with a buffer of plant material that effectively screens the view of the site from adjacent property. The standard buffer shall consist of a landscaped strip at least four feet wide outside the perimeter of the security fencing.

2) In locations where the visual impact of the WES tower and facilities would be minimal, the landscaping requirement may be reduced or waived altogether.

3) Existing mature tree growth and natural landforms on the site shall be preserved to the maximum extent possible. In some cases, such as WES facilities sited on large, wooded lots, natural growth around the property perimeter may be sufficient buffer.

H) **Removal of Abandoned WES Facilities**
Any WES facility that does not produce energy for a continuous period of 12 months, excluding time spent on repairs or improvements, shall be considered abandoned. In such circumstances, the following shall apply:

1) "Dodge County and the owner of a WES facility shall enter into an agreement under which the owner of such WES facility agrees to provide to the County a bank letter of credit to the Land Use Administrator to secure its obligations under this Subsection 4.11.3 H) 1). Such bank letter of credit shall be kept in effect by the initial owner of the WES facility and by all subsequent owners of the WES facility until such time as the Land Use Administrator has certified that the removal and restoration requirements and obligations set forth in this Subsection 4.11.3 H) 1) have been met. The owner of the WES facility shall be required to provide annual notification to Dodge County that the Bank Letter of Credit has been reinstated at least 30 days prior to the expiration of the Letter of Credit. If notification is not provided within said 30 days, the Bank Letter of Credit terms shall allow Dodge County to request of the issuer full payment of said funds for the benefit of Dodge County. This shall be in addition to terms allowing for payment in the event of noncompliance with any other provisions of this Code, or terms agreed to by the Land Use Administrator and Planning and Development Committee. The owner of such WES facility shall remove said WES facility including all supporting equipment and building(s), and shall restore the land on which the WES facility is located to a depth of four feet below grade, within 90 days of receipt of notice from the Land Use Administrator notifying the owner of such WES facility of such abandonment. The Land Use Administrator shall make a reasonable effort to provide such notice of abandonment to the owner of the WES facility. Failure of actual notice to the owner of the WES facility shall not alter the obligations arising under this Subsection

4.11.3 H) 1). If removal of the WES facility and restoration of the land on which the WES facility is located to a depth of four feet below grade to the satisfaction of the Land Use Administrator does not occur within said 90 days, then, said Land Use Administrator shall cause such removal and restoration to occur and the costs for such removal and restoration shall be the liability of the owner of the WES facility, and the Land Use Administrator shall draw on the bank letter of credit to pay for such costs of removal and restoration.

2) The applicant for a Conditional Use Permit under this Code shall submit a copy of a signed agreement between the property owner and owner of the WES tower and supporting equipment and building(s) detailing requirements for abandonment and subsequent removal. Said agreement shall also identify that the agreement shall be binding on future property owner(s) and future owner(s) of a WES tower and all supporting equipment and building(s). Said agreement shall also include the legal description of the property on which the WES tower and all supporting equipment and buildings shall be located. The County may charge the permit holder for the cost of recording said agreement with the Register of Deeds after a Conditional Use Permit is issued.

I) **Protection of Public Haul Roads**

The owner of the WES facility (applicant) shall reimburse the County and/or Town for any and all repairs and reconstruction to the public roads resulting directly from the construction of the wind energy system facility.

1) A qualified independent third party, agreed to by the County and/or Town and applicant, and paid for by the applicant, shall be hired to inspect the roadways to be used during construction. This third party shall be hired to evaluate, document, videotape and rate road condition prior to construction of the wind turbine project and again within 30 days after the facility is complete. Any road damage done by the applicant or its contractors or subcontractors shall be repaired or reconstructed at the applicant's expense.

2) The applicant shall provide the County and/or Town with written notices of completion of construction within 10 days after the facility or a specific phase of the project is completed. Determination as to how the roads should be repaired and by who, will be at the option of the County and /or Town in consultation with the owner of the facility. The applicant shall provide the appropriate amount of money to repair the damaged roads to the County and/or Town within 30 days after receiving notice of the amount due from the County and/or Town. Any subsequent damage to the public roads resulting directly from the maintenance of the WES facility shall be repaired in accordance with the above.

J) **Repair and Replacement**

The owner of a WES facility shall be authorized to repair and replace the wind turbine generators and associated equipment consistent with the terms of the conditional use permit. Replacement may require a new Land Use Permit. However, no such repair or replacement shall entitle the owner to any extension of the terms of the conditional use permit.

PSC REF#: 33567

Public Service Commission of Wisconsin
RECEIVED: 05/05/05, 2:35:44 PM

Invenergy

May 5, 2005

Christy L. Zehner
Secretary
Public Service Commission
P.O. Box 7854
Madison, WI 53707-7854

Re: Forward Wind Energy Center, Docket No. 9300-CE-100

Dear Ms. Zehner:

Attached is the Dodge County Conditional Use Permit granted on April 26, 2005.

If you have any questions concerning this matter, please feel free to contact me.

Sincerely,

/s/ Mick Baird

Mick Baird

Enc.

Resolution: 05-0162r

Resolved that the application of Forward Energy, LLC and Invenergy for Conditional Use Permit #2005-0162 to construct and operate Wind Energy Systems on the Town of Leroy and Lomira is hereby granted and the Land Use Administrator is authorized to issue a Conditional Use Permit in accordance with Chapter 2.3.6 of the Land Use Code, Dodge County, Wisconsin.

CONDITIONS:

1. The operation of the WES Facilities shall be conducted without offensive noise, vibration, dust, smoke, odor, glare, lighting or the risk of fire, explosion or other accident and shall not be detrimental to the public health, safety or general welfare of the immediate neighborhood or community;
2. The applicant shall submit an erosion control plan in accord with Subsection 7.9 of the County Land Use Code to the Dodge County Planning and Development Department for review and approval prior to the issuance of the Conditional Use Permit. All work shall be done in accordance with soil erosion control plans approved by the Dodge County Planning and Development Department. No grading on the subject property and no construction shall occur until after approval of the soil erosion control plans;
3. The applicant shall obtain Project approval from the Public Service Commission of Wisconsin for any project which produces 100 mega watts of power or more before the issuance of the Dodge County Conditional Use Permit;
4. All Federal, State and Local Municipality permits required for this project shall be obtained prior to beginning construction;
5. The WES Facilities shall be painted a non-reflective color, so as to reduce visual obtrusiveness and blend into the natural setting and built environment;
6. The WES Turbines shall be lighted in accord with FAA regulations and the lighting plans shall meet the functional and security needs of the proposed development without adversely affecting adjacent properties or the community. A lighting plan for the WES Turbines shall be submitted to the Dodge County Planning and Development Department prior to the issuance of the Conditional Use Permit;
7. All wind energy system facilities shall meet or exceed current standards and regulations of the FAA and Wisconsin State Statues, and any other agency of the federal or state government with the authority to regulate wind energy systems;
8. The applicant shall ensure that none of the turbine sites shall constitute a risk to aircraft using private airstrips within the proposed development area;
9. Each WES Facility shall be sited in accordance with FAA Rules, part 77, regarding unobstructed flight paths for existing public and private airstrips;
10. All WES Turbines shall comply with the height, separation and setback requirements of the Dodge County Land Use Code;
11. The audible noise due to WES operation shall not exceed the sound levels specified in Subsection 8.5.3 of the Dodge County Land Use Code unless a waiver is granted by the Committee in accord with this code;
12. The applicant shall take reasonable steps to eliminate and/or mitigate any interference with radio or television signals caused by any WES;
13. The WES turbine sites shall be equipped with an appropriate anti-climbing device sufficient to deter the general public from obtaining access to the site;
14. All access doors to the WES turbines and electrical equipment shall be locked; and appropriate warning signage shall be placed on each tower and on all electrical equipment;
15. Any WES facility that does not produce energy for a continuous period of 12 months, excluding time spent on repairs or improvements, shall be considered abandoned and shall be removed in accord with the removal provisions of the Dodge County Land Use Code;

16. The operator of a WES facility shall defend, indemnify and hold harmless the County and Town and their officials from and against any and all claims, demands, losses, suits, causes of action, damages, injuries, costs, expenses and liabilities whatsoever including attorney fees arising out of the acts or omissions of the operator concerning the operation of the WES facility without limitation, whether said liability is premised on contract or on tort;
17. The owner of the WES facility shall, at the owner's expense and in coordination with the County, develop a system for logging and investigating all complaints from residents of the County related to the operation of the facility and the development standards set forth in Subsection 4.11.3 of the Dodge County Land Use Code. All such complaints regarding the operation of the WES facility shall be dealt with in accordance with the provisions of the Dodge County Land Use Code;
18. All electrical wires and lines connecting each turbine to the next turbine shall be installed underground in accord with the provisions of the Dodge County Land Use Code;
19. The owner of an affected WES turbine shall immediately cease operation of the affected wind turbine for the duration of any emergency;
20. The owner of a WES facility shall operate the facility so as not to cause groundwater contamination;
21. No blasting shall occur in connection with the construction of the facility unless the applicant has provided prior notification to the property owner, any abutting property owners, property owners within 1500' of the blasting site, and officials from the Town in which the blasting site is located. All blasting shall be done in accordance with all applicable laws and regulations;
22. The owner of the WES facility shall minimize to the extent possible, the impact of any stray voltage cause by the operation of the WES Facility;
23. Forward shall repair, maintain and replace the WES Turbines and associated equipment in a manner consistent with Good Utility Practice as needed to keep the Project in good repair and operating condition;
24. No advertising material or signage other than warning, equipment identification or ownership information shall be allowed on the WES turbines. This prohibition shall include the attachment of any flag, decorative sign, streamers, pennants, ribbons, spinners, or waving, fluttering or revolving devices on the wind turbines, but not including weather devices;
25. The WES Turbines and associated equipment shall comply with the applicable setback provisions of the Dodge County Land Use Code;
26. A Dodge County Land Use Permit shall be submitted to the Dodge County Planning and Development Department for review and approval for each WES Turbine or Turbines, associated equipment and access roads that are located on a lot in accord with the Subsection 2.3.5 of the Dodge County Land Use Code;
27. The owner of the WES facility (applicant) shall reimburse the County and/or Town for any and all repairs and reconstruction to the public roads resulting directly from the construction of the WES facility. A qualified independent third party, agreed to by the County and/or Town and applicant, and paid for by the applicant, shall be hired to inspect the roadways to be used during construction, This third party shall be hired to evaluate, document, videotape, and rate road condition prior to the construction of the WES project and again within 30 days after the WES project is complete. Any road damage done by the applicant or its contractors or subcontractors shall be repaired or reconstructed at the applicants expense;
28. No WES Facilities shall be sited within three (3) miles of the eastern boundary of the Horicon Marsh National Wildlife Area;
29. The applicant shall provide the County and/or Town with written notices of completion of construction within 10 days after the facility or a specific phase of the project is completed. Determination as to how the roads should be repaired and by who, will be at the option of the County and/or Town in consultation with the owner of the WES facility.

The applicant shall provide the appropriate amount of money to repair the damaged roads to the County and/or Town within 30 days after receiving notice of the amount due from the County and/or Town. Any subsequent damage to the public roads resulting directly from the maintenance of the WES facility shall be repaired in accordance with the above;

30. The owner of the WES facility shall assure funding of the removal obligations for the abandoned WES Facilities by a letter of credit, cash or the equivalent held in trust in favor of Dodge County, in a form to be approved by the Dodge County Corporation Counsel in the following amounts:

	Letter of Credit Formula: (Per Turbine)
Year 1	$3,750.00
Year 2	$3,750.00
Year 3	$3,750.00
Year 4	$3,750.00
Year 5	$3,750.00
Year 6	$7,500.00
Year 7	$7,500.00
Year 8	$7,500.00
Year 9	$7,500.00
Year 10	$7,500.00
Year 11	$15,000.00
Year 12	$15,000.00
Year 13	$15,000.00
Year 14	$15,000.00
Year 15	$15,000.00
Year 16	$30,000.00
Year 17	$30,000.00
Year 18	$30,000.00
Year 19	$30,000.00
Year 20	$30,000.00
Year 21	$30,000.00
Year 22	$30,000.00
Year 23	$30,000.00
Year 24	$30,000.00
Year 25	$30,000.00
Year 26	$30,000.00
Year 27	$30,000.00
Year 28	$30,000.00
Year 29	$30,000.00
Year 30	$30,000.00
Year 31	$30,000.00
Year 32	$30,000.00
Year 32	$30,000.00
Year 33	$30,000.00
Year 34	$30,000.00
Year 35	$30,000.00

31. Any significant change or expansion of the WES facilities as shown in the application received on 2-25-2005 require that a new conditional use permit be obtained;

FINDINGS:

The Committee finds that the proposed Forward Energy Project, as conditioned, would be in conformance with the considerations listed in Subsection 2.3.6 B) and 4.11.2.b) 1) of the County Land Use Code and the granting of the conditional use permit will not unreasonably interfere with the orderly land use and development plans of the County. The Committee also finds that, as conditioned, the benefits to the general public will exceed the burdens.

Appendix E

Response to Comments on the Draft EIS

The applicants, parties to the case, several organizations and over 90 individuals provided written comments on the draft EIS. Many members of the public also provided oral comments on the draft EIS to Commission and DNR staff during the public information meetings conducted in Brownsville on April 7, 2005. Comments from the applicants, parties, government organizations, and the public generally provided substantive information, constructive criticisms, questions regarding unknown impacts, and recommendations regarding the content and format of the draft EIS. Some comments related to PSC review procedures or expressed personal opinions about the proposed project. All written comments postmarked by April 22, 2005, and all comments and information obtained during the public meetings were considered in the development of this final EIS.

All members of the public who submitted comments that addressed issues or questions about the draft EIS have been listed in Table E-1 below. Commenters are listed alphabetically by last name. The public comments have not been reproduced in the final EIS due to cost or production problems (scanning difficulties, being handwritten, etc.). Comments from parties to the case and organizations are reproduced following Table E-1.

A summary of significant changes to the EIS by chapter and general topic within the chapter appears after Table E-1 and the reproduced comments.

Commission and DNR staff are appreciative of the time and effort that interested persons or parties invested in reading the draft EIS and giving thoughtful consideration to the project and its potential effects in their comments. Individuals are encouraged to attend the public hearings in the project area to be held on June 21, 2005 and express their views about the project and its potential impacts in testimony.

Table E-1 Public commenters and the topics addressed

Last Name	First Name	Topics Discussed
Albert	Lincoln	Impacts to Horicon Marsh, birds, and bats, clean energy
Bauer	Lori	Community relations, Horicon Marsh, birds, property values, use of tax dollars
Bauman	Wilbur	Uneconomic power, aesthetics
Beay	Todd	Shadow flicker, noise, property values, well failure, VHF interference, electricity rates, additional bird studies, aesthetics, noise, hunting rights, lightning, aerial spraying
Bennett	Arthur	Need for additional bird studies, inadequate setback distances, property values, inconsistent use of tax dollars
Boelk	Donna	Horicon Marsh, Niagara Escarpment ecosystem, soil compaction, alternative energy technologies
Breaden	Barbara	Need for additional bird studies, migratory bird buffer zone around Horicon, inclusion of geese and ducks in impact discussions, operation limitations
Breaden	Joe M.	Need for 2 years of additional studies before construction, whooping cranes, ducks, geese
Briggs	Joann and John	Land use compatibility
Cobb	Patti	Migratory birds, bats, stray voltage, shadow flicker, tornado effects, aerial applicators
Congdon	Cheryl	Project size and scale, Horicon Marsh
Congdon	Laura	Character of Dodge County, Horicon Marsh, gourndwater contamination, road conditions, shadow flicker, aesthetics, bird and bat mortality, private airstrips, communication and TV interference
Congdon	Sarah	Horicon Marsh, tourism, Niagara Escarpment, White pelicans, other birds, bats, water quality and wetlands
Decker	Doug	Clean renewable energy, few or insignificant adverse impacts of Byron wind turbines
Delfeld	Phil	Invenergy public process, community relations, tower height and scale
Delorme	Darlene	Horicon Marsh and birds
Demorest	Ann	Horicon Marsh, Neda Mine bats, inadequate studies
Ehrhardt	Myron and Lenita	Clean energy
Franke	Emma	Property values
Frankowski	Frank	Property values, lighting requirements, shadow flicker, TV and communication interference, stray voltage, aesthetics, private airstrips, structural integrity of turbines, community relations, groundwater contamination, bats and birds, tourism
Frankowski	Pamela and Steve	Birds, migration routes, property values, groundwater, traffic, noise, aesthetics, property rights, EIS has no recommendations
Futrell	Jo	Inadequate studies, impacts on birds
Gebhard	Margaret	Impacts to birds and bats
Geisthardt	Alan	Lack of on-site research, white pelicans, Horicon Marsh, need for additional bird study
Goth	Steve	Horicon Marsh
Gouin	JoAnn	Clean energy, bird and bat impacts
Hafner	Marguerite	Horicon Marsh, migratory birds
Hansen	Jacqueline	Horicon Marsh, need for additional studies
Harrer	Margaret	Need for more bird and bat studies,

Last Name	First Name	Topics Discussed
Harvey	Barbara	Horicon Marsh, raptors, bats
Heinemann	Jane	Alternate energy sources, Horicon Marsh
Herrman	Sara	Horicon Marsh, birds, and bats
Hungerford	Robert	Inadequate bird studies, lighting requirements, future increase in # of turbines
Jensen	John	Horicon Marsh, aesthetics, safety
Johnson	Brian	Revenue sharing benefits, clean energy
Jordens	Tom	Clean energy
Jungbleth	David	Project benefits including jobs, farmland preservation, economic impacts, clean energy
Junger	Eugene and Marjorie	Horicon Marsh birds, property values
Kalbhoff	Glenn	Longer setbacks, lighting requirements, property values
Kelderman	Shawn	Property values, need for additional studies
Kelroy	Tom	Clean renewable energy,
Kindschuh	Curt	Tornado frequency, Neda Mine and bats, private airstrip safety, community relations, terrorism issues
Kindschuh	Jeff	Need for more studies, Horicon Marsh, need for alternatives
Kindschuh	Joyce	Tornado effects on turbines
Koford	Rolf	Typos and inconsistencies in text
Labros	Arthur	Migratory birds and bats, turbine grouping, groundwater and well contamination
Larkin	John	Aesthetic impact from Horicon Marsh, Geese, tourism and economic impact
Liegl	Tom and Deb	Operating costs of wind vs fossil fuel, compensation to non-host landowners, relocation to public lands, health effects
Luedtke	Dean	Inadequate bird studies, tourism, bats, property values, energy future
Mass	Amy Schoepke	Aesthetics, noise, birds, shadow flicker, well contamination, property values
Maas	Randy	Inadequate bird studies, well contamination, lightning strikes, population density, tax credits
Mahlberg	Steven	Horicon Marsh, migrating birds
Malesevich	Mike	Geese, bald eagles, hawks, ducks, need for more studies, Invenergy interactions with Horicon Marsh management
Malesevich	Pamela	Well effects, bats, tourism, Horicon Marsh
McClain	Nelda	Need for additional studies, Horicon Marsh
Meinhardt	Lorilyn	Noise, turbine lighting, groundwater contamination, communication interference, stray voltage, Horicon Marsh
Messner	Al	Clean quiet energy, local economic benefits and revenue sharing.
Michels	Kevin and Patrick	Clean, renewable energy, construction jobs, tax revenue,
Mikelson	Karen	Geese and other birds, Horicon Marsh
Miller	Kristine	Show turbine size in relation to other objects, emphasize Fond du Lac County's lack of planning, inadequate bird studies, install smaller numbers of turbines around towns and cities to provide local power
Mittelstadt	Ralph	Private airstrip safety and clearance needs, offset of air pollutants, factual errors in the DEIS
Nelson	Robert	Need for more feasibility studies

Last Name	First Name	Topics Discussed
Page	Kris	Large birds associated with Horicon Marsh, traffic, property values, aesthetics
Panzer	John and Ione	Horicon marsh, birds, bats, need for more studies, communication interferences, property values, noise, health, electricity costs, Invenergy's public notice
Panzer	Tim	Wildlife impacts, Horicon Marsh aesthetics, energy need
Pesch	John Jr	Property values, wildlife, Invenergy notice and process
Poston	Tracy	Horicon Marsh
Roy	Liz	Need for more studies, wildlife impacts
Schaefer	Rob	Property values, private airstrips, community relations and social issues
Schaefer	Susan	Horicon Marsh, more noise information, real estate depreciation
Scharf	Steve and Dawn	Critique of East point count location, inadequate bird study,
Schmidt	Dan and Paul	Horicon Marsh, birds, property values, Invenergy's public notice and process
Schmidt	Janet	Whooping cranes, tundra swans and other birds, alternative sites, well contamination and failure, need for more bird studies
Schmidt	Robert	Need for renewable energy, adequate buffers
Schraufnagel	Tes	Horicon Marsh, intervenor compensation, Marsh boundaries, community relations, whooping cranes
Schuenemann	Marion	Horicon Marsh, wildlife and aesthetic impacts
Schultz	John	Inadequate studies on birds and bats, need for back-up energy sources
Soboleski	Lisa	Health effects related to transmission lines, stray voltage, property values, traffic
Thrall	Mark	Inadequate bird studies, low frequency noise, wind turbulence
Thurk	Clarence Jr.	Economic benefit to farmers, land use compatibility
Tighe	Shelley	Inadequate bird studies, well contamination and failure, Invenergy's liability, property values, communication interference
Vercauteren	Sandy	Horicon Marsh ecosystem, inadequate studies, aesthetics, lighting requirements, shadow flicker, noise, TV reception, stray voltage, EMF, property values
Vercauteren	Zachery	Horicon Marsh, drying effects
Voight	Cal and Kathryn	Clean renewable energy, increased energy use
Weiglein	Jeffrey	Horicon Marsh impact
Weiglein	Richard and Janet	Need for tax relief, need for electricity,
Williams	Dana and Linda	Bird impacts, Invenergy interactions with Marsh management, bat impacts and rabies issues
Wunsch	Sharon and Larry	Private airstrip clearance distances for safety
Zangl	Tom and Jackie	Shadow flicker, aesthetics, property values, Horicon Marsh
Zuber	Thomas	Too many unknown effects, process timeline
Zuelsdorf	Gayl	Project size and scale, birds, Horicon Marsh

Comments on the Draft Environmental Impact Statement, submitted by the Citizens Natural Resources Association of Wisconsin

CITIZENS NATURAL RESOURCES ASSOCIATION

OF WISCONSIN

(Incorporated under the laws of Wisconsin – 1953)

April 18, 2005

Jim Lepinski
Public Service Commission
P.O Box 7854
Madison, WI 53707-7854

Re: 9300-CE-100

Dear Mr. Lepinski:

CNRA strongly supports development of clean, renewable energy sources. Nevertheless, we would like to go on record in opposition to the placement of 133 wind turbines in the neighborhood of Horicon Marsh and the Neda bat hibernaculum. We are concerned about potentially significant negative impacts on birds, bats and the scenic character of the area.

For more than 50 years CNRA has worked to protect Horicon Marsh as a unique wildlife refuge. The world has finally caught up with us, designating the marsh as a Wetland of International Importance and a Globally Important Bird Area. Hundreds of thousands of birds migrate through the area annually, with additional large numbers using the Marsh for nesting and feeding. The nearby Neda bat hibernaculum, too, has been recognized as the largest and most important bat hibernaculum in North America.

Our major concern is the potential damage wind turbines can have on birds and bats in the area. Mortality rates by large wind turbines have not been well researched, but sufficient evidence is now available to indicate that each site is unique and requires a thorough and detailed evaluation. For example, an estimated 3,000 migrating bats were reportedly killed at a wind farm in West Virginia, including all four species hibernating at Neda. Bats already are one of the fastest declining mammals in the U.S, with a very low reproduction rate. We are concerned that the cumulative impact of hundreds of wind turbines built along ridge tops such as the Niagara Escarpment could prove to be disastrous, with potentially irreversible consequences. Ridge tops have been migration routes for birds and bats for thousands of years.

We believe the research conducted by Forward Energy at the site is inadequate. It relies on a general evaluation of the area and a literature search. We would like better assurances that Forward Energy is basing its proposal on site-specific information. We know at this stage the proposed project does not appear to be following some of the siting guidelines for wind turbines recommended by the USFWS and WDNR. These guidelines include avoidance of known bird and migration pathways or near bat hibernation sites; avoidance of paths between bat colonies and feeding areas; and avoidance of landscapes

CITIZENS NATURAL RESOURCES ASSOCIATION

OF WISCONSIN

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known to attract raptors, such as hawks, falcons, eagles and owls, which are especially vulnerable to turbines, as are cranes and other slow flying birds. .

CNRA believes that better pre-construction research has to be conducted on the site. Forward Energy needs to show a willingness to cooperate with a research team including federal and state agency professionals familiar with the area and with no vested interests. Research needs to be conducted during at least two seasons: spring and fall. The same types of assurances are needed for post-construction studies and monitoring.

The Federal Production Tax Credit for wind generation applies only to projects that become operational before December 31, 2005. This is the driving force behind Forward Energy's rushed and superficial assessment of this project. The financial incentives provided by Forward Energy to local farmers and town officials also generate quick support without a full understanding of the issues. Similarly, the promise of a clean, renewable energy source poses a dilemma for organizations such as ours. It is difficult to mobilize opposition in so short a time when we are going against energy policies and principles we have been promoting for decades.

Yet when priceless resources are at stake, management agencies need to remain vigilant and strong to protect them. They need to take time to do the proper studies necessary to ensure continued protection of the resource. CNRA's hope is that with rapidly changing technologies becoming the norm for the 21st century, our nation will be able to find ways to harness energy sources which are not only clean and renewable, but also friendly to wildlife and the landscape.

Please require further site-specific research by qualified wildlife specialists before a decision is made on this project. Thank you for your consideration.

Sincerely,

Leonie Vrtilek

Leonie Vrtilek,
CNRA Horicon Marsh Coordinator
330 Ledgeview Avenue
Fond du Lac, WI 54935
920-921-0407

For the Preservation, Management, and Restoration of Wisconsin's Natural Resources

Comments on the Draft Environmental Impact Statement, submitted by the Dodge County Supervisor District 31, James Layman

Lepinski, Jim PSC

From: James Layman [layman1@charter.net]
Sent: Thursday, April 21, 2005 11:00 AM
To: Jim Lepenski
Subject: Re: Forward Energy LLC, Wind Electric Generation Facility, Dodge and Fond du Lac Docket 9300-CE-100
Attachments: Report to County Board.doc; For Public Information Release.doc

Mr. Lepinski,

On April 19, 2005, the Dodge County Board 29-7 to approve amending the county's wind energy system overlay district. The motion was to amend Ordinance No. 608 subsection 4.11.3 H) 1). I was the first supervisor to speak on this motion. See **Report to County Board** attached. Due to time restraints on the floor. I did not have time to read from the PSC Executive Summary. But I did read the last paragraph of 4.11.6 titled Conclusion on page 128 of the document, and top of the page 174 of the document, titled Negative economic impacts. In the Report to county board document, I stated that, " I am surprised that a 'regulated company' such as Wind Energy has so much influence on this county board." After I was finished with my speech, a fellow board supervisor stated " For some reason or another, the applicant was allowed to rewrite the ordinance as favorable to them. I hope this won't become a regular event. I throws our ordinances and zoning to the wind to allow some to have input and others not. Its not the democratic way." He did vote in favor.

The second document For "Publication Information Release" is what I am using for Radio and Newspapers.

Thank You,

James 'Jim' Layman
Dodge County Supervisor District 31
Waupun, Wisconsin
920-324-9152

Read: Highlighted excerpts from PSC Executive Summary.

- Pages XIV, XV, XVI, XVII, XIX.

Read: Highlighted excerpts from Forward Wind Vol. 1

Summary:
One item that was proposed and submitted to the board for approval on the 21 December 2004, that was tabled and brought in March 2005 and was returned back to the Planning and Development Committee and revision, was omitted. This item should be re-inserted with additional language.

The Dodge County Board, the decision makers in this process must not be persuaded to move or vote on this ordinance or any other action until all the necessary cost and additional information have been clearly identified.

Do not let the expiration of the Production Tax Credit (December 31, 2005) be used to cause the Dodge County Board to act Prematurely.
Production Tax Credit: Public Law No. 108-357. " American Jobs Creation Act of 2004" (HR4520)-Sec. 710

I am surprised that a 'regulated company' such as Wind Energy has so much influence on this County Board.

The current amended resolution does not clarify or contain the following:

- Dodge County should require irrevocable letter of credit or surety bond from a highly rated bank or insurance company.

- Dodge County would need to make sure the irrevocable letter of credit is not allowed to expire in any case, including bankruptcy or non-payment of renewal fees by Forward Wind/Invenergy.

- If a irrevocable letter of credit is chosen, it should take into account future inflation on the original principal amount and the cost of restoration and should be reviewed every 5 years after the first year of operation to make sure the appropriate security is in place.

- Dodge County should require Forward Wind/Invenergy to provide a current, itemized, estimated cost (in 2005 dollars) to remove the turbine facilities per turbine location. Include:
    1. An itemized list of activities required and associated cost for each activity.
    2. The total cost per turbine.
    3. The cost to remove the turbine facilities each of the following facilities: turbine blades, nacelle, tower structure, foundation, transformer, collection cabling, access road, and land restoration costs including decompaction of soils.

- The Forward Wind/Invenergy agreements with landowners hosting turbines include provisions for removing foundations (aboveground and below ground to a depth of four feet), turbines, and any other Forward project structures from the property. The disturbed areas would be restored to a condition reasonably similar to their original condition. Reclamation would include leveling, terracing, mulching, seeding, and other necessary steps to prevent soil erosion.

- Before construction begins Forward Wind/Invenergy must present to the Dodge County Board its initial site restoration plan. Construction may not begin until the Dodge County Board has approved a plan adequately providing for site restoration, cost, and for the funding of site restoration in the event Forward Wind/Invenergy being terminated before it has completed its planned useful operating life.

- Re-insert (**The possible significant adverse effects on migratory birds, raptors and other wildlife or animals.)** The term significant is to mean that if any individual turbines annual avian mortality rate exceeds Forward Wind/Invenergy mortality estimate for either the East (1-4 birds per year) or West side (4-10 birds per year) should immediately cause concern as to the reasons for such higher mortality rates.

- **This clause was in the march 2005 proposed amendment which was not approved and sent back to the Planning and Development Committee. I wanted it re-inserted with added language.**

- It is essential that anyone receiving compensation for Forward Wind/Invenergy project should also be held accountable for decommissioning cost. This cost must not be borne by the tax paying citizens of Dodge County and Fond du Lac County.

- Immediately after I read the proposals I changed the wording to:

- *It is essential that any landowner receiving compensation for Forward Wind project should be held accountable for decommissioning cost. This cost must not be borne by the tax paying citizens of Dodge County and Fond du Lac County. If landowners want to enter into a lease with Forward Wind and take money from the project they should be willing to take a risk.* But I did not get to restate it to the board.

I did this after I suddenly realized That Dodge County itself would be receiving compensation, along with the townships of Leroy and Lomira.

Table 5-10 Projected maximum shared revenue payments (if 162 wind turbines are constructed) Maximum Annual

LOCATION	Maximum Wind Turbines	Maximum MW	Maximum Annual Shared Revenue Payments
LEROY	73	110	$182,500
LOMIRA	13	20	$32,500
BYRON	41	62	$102,500
OAKFIELD	35	53	$87,500
COUNTIES:			
DODGE	86	129	$301,000
FOND DU LAC	76	114	$266,000

The above comments should be considered in any amendment to Subsection 4.11.3 H) 1

On April 19, 2005, The Dodge County Board voted in favor of the modified petition of the Planning Development Committee requesting amendment of the Land Use Code, Dodge County, Wisconsin, for the purpose of modifying the development standards contained in the Wind Energy Overlay District. This was a motion to amend Ordinance No. 608 subsection 4.11.3 H) 1). I spoke on this issue and ultimately voted against it.

How did this happen?

First it seems like a tremendously amount of influence was used on the Dodge County Planning Development Committee by a 'Regulated Company.' It would appear that anything Forward Wind Energy wanted, it got.

One of the main issues was removing the landowners from any financial obligations if Forward Wind Energy defaulted or declared bankruptcy.

Why did Forward Wind Energy want this removed? Most landowners would not sign a lease with Forward Wind Energy if they would be financially responsible along with Forward Wind Energy.

The downside to this is, if Forward Wind Energy defaulted or declared bankruptcy and there was not enough funds coming from the bank letter of credit for decommissioning and restoration, then the burden of cost will fall on the Dodge County taxpayers.

Basically the only financial requirement of Forward Wind Energy is to produce "a bank letter of credit."

My statement to the board was this:

- Dodge County should require irrevocable letter of credit or surety bond from a highly rated bank or insurance company.

- Dodge County must make sure the irrevocable letter of credit is not allowed to expire in any case, including bankruptcy or non-payment of renewal fees by Forward Wind Energy.

- If a irrevocable letter of credit is chosen, it should take into account future inflation on the original principal amount and the cost of restoration and should be reviewed every 5 years after the first year of operation and inflation adjustments made to make sure the appropriate security is in place.

- Dodge County should require Forward Wind Energy to provide a current, itemized, estimated cost (in 2005 dollars) to remove the turbine facilities per turbine location. Include:
    1. An itemized list of activities required and associated cost for each activity.
    2. The total cost per turbine.
    3. The cost to remove the turbine facilities each of the following facilities: turbine blades, nacelle, tower structure, foundation, transformer, collection cabling, access road, and land restoration costs including decompaction of soils.

- **The** Forward Wind Energy **agreements with landowners hosting turbines include provisions for removing foundations (aboveground and below ground to a depth of four feet), turbines, and any other Forward project structures from the property. The disturbed areas would be restored to a condition reasonably similar to their original condition. Reclamation would include leveling, terracing, mulching, seeding, and other necessary steps to prevent soil erosion.**

- Before construction begins, Forward Wind Energy must present to the Dodge County Board its initial site restoration plan. Construction may not begin until the Dodge County Board has approved a plan adequately providing for site restoration, cost, and for the funding of site restoration in the event Forward Wind being terminated before it has completed its planned useful operating life.

- Re-insert (***The possible significant adverse effects on migratory birds, raptors and other wildlife or animals***.) The term significant is to mean that if any individual turbines annual avian mortality rate exceeds Forward Wind Energy mortality estimate for either the East (1-4 birds per year) or West side (4-10 birds per year) should immediately cause concern as to the reasons for such higher mortality rates.

This clause was in the march 2005 proposed amendment which was not approved and sent back to the Planning and Development Committee. I wanted it re-inserted with added language.

- It is essential that any landowner receiving compensation for Forward Wind project should be held accountable for decommissioning cost. This cost must not be borne by the tax paying citizens of Dodge County and Fond du Lac County. If landowners want to enter into a lease with Forward Wind Energy and take money from the project they should be willing to take a risk.

The above comments should be considered in any amendment to Subsection 4.11.3 H) 1.

My concerns are this:

First, I wanted more inclusive legal language in the ordinance. If you compare the language I proposed, as to what is listed in the now amended ordinance, I believe almost anyone would agree, it is more comprehensive and will offer better protection for all Dodge County taxpayers.

Second, I want the proposed windmill towers sites removed to at the very least, 2½ - 3 miles from the Horicon Marsh instead of 1.2 miles as proposed by Forward Wind.

James 'Jim' Layman
Dodge County Supervisor District 31
Waupun, WI
920-324-9152

Comments on the Draft Environmental Impact Statement, submitted by the Friends of the Horicon National Wildlife Refuge

Comment Sheet

Forward Wind Project
Draft Environmental Impact Statement

Public Service Commission of Wisconsin, Docket 9300-CE-100

From:

Name Harold Steinback

Address W 8929 Homestake Acres

Phone 920 885-6546

E-mail hnsteinback@PowerCom.Net

Representing President of Horicon Natl Wildlife Refuge Friends

☒ Check this box for a copy of the Final EIS

PLEASE DEPOSIT AT THE
INFORMATION MEETING,
OR...
To mail, fold this sheet
(our address is on the back), or add
additional sheets and put in an envelope,
and send to:

Jim Lepinski
PUBLIC SERVICE COMMISSION
P.O. BOX 7854
MADISON WI 53707-7854

My comments on the draft EIS:

See attached sheet

Additional sheets are included: X Yes ___ No

DOCKET 9300-CE-100

We are not opposed to alternative energy but we are very concerned about the proposed location of this wind turbine farm. Listed below is our reasoning for opposing this location.

The proposed location within one and one half miles from the Refuge border is much too close. We recommend four miles. Our recommendation is based on the fact that during the fall goose migration we often see upwards of 250,000 geese on the marsh. One of the major flight and feeding areas for these geese is directly where the towers' location is proposed.

There is no doubt that this wind farm is going to cause bird mortality. Bird mortality will attract large numbers of predators. This lends itself to predator disease which could spread to domestic animals and ultimately to humans.

Each year we have about one half million visitors who enjoy the great aesthetics and quiet setting of the Refuge. The proposed location of this project will destroy this quality that visitors are seeking.

The Horicon National Wildlife Refuge is a wetland of international importance, are we going to destroy this important wetland in order to produce .7 of 1% of the power consumed in Wisconsin?

Sincerely

H Steinback

Harold J. Steinback, President
Friends of the Horicon National Wildlife Refuge

Enclosure: Letter to Russel Kotke ,Chairman Dodge County Board of Supervisors

Docket 9300-CE-100

January 14, 2005

Russell Kottke, Chairman,
Dodge County Board of Supervisors
127 East Oak Street
Juneau, WI 53039

Dear Mr. Kottke,

The Friends of Horicon National Wildlife Refuge have been reviewing correspondence and data relating to the establishment of a massive wind energy system in Dodge and Fond du Lac Counties. We support the concept of wind energy as long as it is environmentally friendly. One of the documents studied is a proposed change and amendments to the land use code of Dodge County in subsection 4.11.1.A through subsection 4.11.3.J. We feel the proposed changes and additions to this ordinance will provide a developer of a wind energy system (Forward Energy Wind Farm Project) easy access to the lands of Dodge County for the establishment of a wind energy system It further assigns liability away from the Town and County governments and their officials and leaves only the property and equipment owners to defend themselves against damages and law suits.

We do not feel that these changes will enhance rural Dodge County and we feel the erection and operation of the many, many, towers proposed will be a hazard to the birds that fly into and out of the Horicon marsh each day while stopping there during migration. Local bird populations that nest there will be at risk whenever they leave the safety of the marsh. We feel the way to minimize this risk is to erect the towers further away from the marsh and not in a direct line with a known flyway. A minimum distance of four miles from the marsh or boundaries of the Horicon National Wildlife Refuge is recommended.

We are hoping that the Dodge County Board of Supervisors understand our interest in the welfare of the birds in the Horicon marsh and surrounding areas. We would like to see some restrictions added to this ordinance, namely: NO WIND TURBINES SHOULD BE ERECTED WITHIN FOUR MILES OF THE MARSH OR REFUGE BOUNDARIES.

Some of the material reviewed on this issue indicated the developer had insufficient data to evaluate the risk factor to birds and bats. In that case it would be best to delay any approval of this development until more studies on site could be conducted and evaluated with regard to avian mortality at the turbines.

The Friends of Horicon National Wildlife Refuge is a non-profit organization that supports the Horicon NWR and assists the refuge staff with their programs. We are dedicated to conservation and education and appreciation of the Horicon NWR. The marsh is recognized by Ramsar as a site of International Importance, especially as waterfowl habitat. It is also recognized as the number one birding location in Wisconsin. Let us all strive to protect this status.

Sincerely, Bill Holmes for the Board of Directors, Friends of Horicon NWR

cc:
Tom Schafer, Supervisor; Dean Perlick, Dodge County Land Use Dept.; Horicon NWR; Wisconsin PSC; Horicon Marsh Systems Advocates.

Comments on the Draft Environmental Impact Statement,
submitted by the HMS Advocates, Inc.

BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application of Forward Energy LLC for a Certificate of Public Convenience and Necessity to Construct a Wind Electric Generation Facility and Associated High Voltage Electric Transmission Lines, to be Located in Dodge and Fond du Lac Counties	Docket No. 9300-CE-100

COMMENTS OF HMS ADVOCATES, INC. TO DRAFT ENVIRONMENTAL IMPACT STATEMENT

HMS Advocates, Inc. respectfully submits the following comments to the draft environmental impact statement ("DEIS") in this proceeding:

NEGATIVE IMPACT ON RESIDENTIAL PROPERTY VALUES

The conclusions of the DEIS regarding residential property values are jarring. The proposed use will likely decrease the value of local residential real estate. Local residential real estate is growing as a percentage of use in the surrounding area and is the source of increased property value (and therefore tax revenue) of local communities. The only evidence supplied by applicant[1] to support its misguided claim that there will be no negative impact on property values, the REPP study, is squarely debunked by DNR and PSC. The flaws of the REPP study are not worth repeating here. However, it is worth noting that the absence of any evidence from applicant ought to lead DNR and PSC to conclude that, at the very least, more study ought to be done. Such absence of evidence ought also lead DNR and PSC to conclude that there will clearly be an adverse impact on residential property values. The sole issue is to what extent will residential property values (and, therefore, local tax revenues) decline.

[1] The term "applicant" refers to Forward Energy, LLC.

Alternatively, DNR and PSC should conclude that the Danish study cited in the DEIS is persuasive evidence that significant negative impacts on residential property values are inherent to the siting of wind turbine facilities. In turn, this should lead DNR and PSC to determine precisely what distance criteria were used to show that turbines decrease residential property values in Denmark. Knowing that criteria would permit DNR and PSC to compare the Danish study to the present situation.

Additionally, DNR and PSC should be using market data that isolates the impact being studied from all other variables that affect value. The best way to do this is paired sales analysis. Such analysis allows for comparison between sales that differ only in the characteristic being tested. Because DNR and PSC may have difficulty finding data to support such a study, HMSA suggest an alternative methodology -- search for a similar impact that can be isolated from analogous sales data.

One such alternative is electrical tower impacts on the prices of residential lots. Sufficient paired sales isolating the affects of view loss due to electrical towers exist in the marketplace to reach reasonable conclusions as to market tendencies. This data can isolate impacts due to specific distances and heights associated with electrical towers. Paired sales data can provide meaningful results. Conclusions from such results would also have to consider and include differences in the physical characteristics (e.g., size and movement) and noise levels between electrical towers and wind turbines.

Ultimately, DNR and PSC must consider in a more meaningful way the negative impacts of the wind turbines on residential property values.

NEGATIVE IMPACTS ON AVIAN LIFE

The conclusions of the DEIS regarding the harm to avian life are perhaps more disturbing than those related to property values. While DNR and PSC have sufficiently detailed the inadequacies of applicant's avian studies, DNR and PSC are failing to take necessary reasonable steps to protect one of Wisconsin's most valuable natural resources. Instead of requiring post-construction surveys, DNR and PSC must require applicant to perform the necessary surveys prior to construction. This is simply requiring applicant to do what DNR and PSC clearly recognize should have been done before applicant ever filed. The inherent value of the Horicon Marsh and its ecosystems, and the likelihood of harm to them, as outlined in the DEIS, clearly demonstrate the need for thorough study before construction begins. Thorough study must include at least three years of data collection (in the case of raptors, DNR and PSC ought to require four years of study due to the four-year prey cycle). In the absence of such data, DNR, PSC and applicant are being reckless stewards of Wisconsin's precious natural resources.

Importantly, as also noted in the DEIS, limited options are available after the fact to enjoin applicant from violating pertinent conservation statutes.[2] Accordingly, DNR and PSC must act with considerable forethought. The burden associated with the fact that applicant has not acted with adequate forethought should be borne by applicant not the protected species or the general public.

---

[2] DNR and PSC note the civil action filed by the Center for Biological Diversity. Closer to home, another action is pending based on the federal and Illinois state conservation statutes, *Bald Eagle, et al. v. Crescent Ridge, LLC, et al.*, 04-CV-1182 (United States District Court for the Central District of Illinois).

NEGATIVE IMPACTS DUE TO NOISE

The draft EIS fails to consider more than an acoustical, three-dimensional model that is based on estimated sound level outputs. Insufficient consideration has been given to the known range of sound output levels. Clearly, the manufacturer has data from existing installations. At minimum, DNR should require disclosure of these known output levels from the manufacturer and should then require the applicant to re-model using that data. This would allow DNR to make reasoned conclusions on the likely impact of the increases in noise due to the proposed use.

The vast majority, if not all, of the area surrounding the proposed electrical generation use is rural. The DEIS states that typical background noise levels for rural areas is approximately 45 dBA. The DEIS also states that an increase of 5 dB is perceptible, while an increase of 10 dB is twice as loud. Thus, according to the scant data used thus far, at MP1, sound levels would be significantly and persistently greater than twice what they are today (for both dBA and dBC). Similarly, at MP4, for significant portions of the day, the sound level would be nearly or much more than doubled.

Of particular concern is the profound increase in low frequency noise. At five of the six sites, low frequency noise will be doubled (and in most cases inordinately more than doubled) during some portion of the day. At four of those sites, the local residents will likely be forced from their homes (much like the residents of Kewaunee County, who were forced to leave their homes after a wind-turbine power project was put in operation).

Tellingly, the DEIS admits that the proposed use will dramatically shift the character of the surrounding area, in terms of noise, from rural to being like "most quiet residential suburbs." DEIS at 153. According to Figure 5-3, estimated sound levels from the turbines alone would render vast parts of the surrounding area non-rural. These measurements do not even take into consideration existing noise sources. As the DEIS appropriately notes, "two noise sources emitting sound at the same dB level would have a combined noise impact of 3dB greater than either noise source alone." DEIS at 146. Members of the HMSA did not choose to live their lives in any type of suburban setting. They chose to live in a rural setting. DNR and PSC clearly recognize that "the value of their [HMSA members'] property is likely related to the esthetics of living in a rural setting." Applicant should not be permitted to change the character of their environment or the value of their property. DNR and PSC should not permit applicant to do so either.

Respectfully submitted,

/s/ Geoffrey A. Baker

GEOFFREY A. BAKER (SBN 1027083)
DOWELL BAKER, P.C.
229 Randolph Street
Oak Park, IL 60302
(708) 660.1413 (phone)
(312) 873.4466 (facsimile)
Dated: April 22, 2005

Attorneys for HMS Advocates, Inc.

Comments on the Draft Environmental Impact Statement, submitted by the Forward Energy LLC, Volume I

Invenergy

April 5, 2005

Jim Lepinski
Docket Coordinator
Public Service Commission
P.O. Box 7854
Madison, WI 53707-7854

Re: Forward Wind Energy Center, Docket No. 9300-CE-100

Pursuant to the Commission's letter dated March 21, 2005, Forward Energy LLC submits its comments and suggested changes to the Draft Environmental Impact Statement (Volume I). Forward Energy LLC intends to submit its comments, explanation of suggested amendments, and suggested amendments to the Draft Environmental Impact Statement (Volume II) by April 22, 2005, if not before.

Thank you for the opportunity to comment on this matter.

Sincerely,

/s/ Bryan Schueler

Bryan Schueler
Vice President, Project Management

Enc.

INVENERGY LLC One South Wacker Drive, Suite 2020 Chicago, IL 60606 T 312.224.1400 F 312.224.1444 invenergyllc.com

BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application of Forward Energy LLC for a Certificate of Public Convenience and Necessity for the Forward Wind Energy	Docket No. 9300-CE-100

COMMENTS AND SUGGESTED CHANGES TO DRAFT ENVIRONMENTAL IMPACT STATEMENT (VOLUME I)

Invenergy LLC
One South Wacker Drive, Suite 2020
Chicago, IL 60606

Contact Person:

Bryan Schueler
Vice President, Project Management
(312) 224-1421 – Telephone
bschueler@invenergyllc.com

April 5, 2005

GENERAL COMMENTS

Birds

Forward has spent considerable time with the DNR (meetings in Madison, teleconferences, and meetings in the project area) in constructing and designing a 2005 Spring and Summer Avian Study to address the concerns discussed in Section 4.11 of the DEIS. The 2005 Spring and Summer Avian Study was developed with substantial input and guidance from the DNR, and incorporated comments from USFW via discussions with DNR, and both Forward and the DNR believe it will help to provide an accurate picture of bird usage at the site in regard to assessing potential effects of the project. Specifically the study covers three distinct and separate issues: rare birds, raptors, all birds (except some limited species as agreed upon by the DNR) and their distance relationship from the Horicon Marsh. Field work has begun.

Bats

Volume 2 of our comments will include detailed observations concerning Section 4.12 Bats. However, we believe it is important to point out now that this section provides little technical reasoning supporting the claims or requests and is biased in its conclusions.

For instance, the Final EIS should include a clear statement indicating that no federally or state-listed species of bats are known to occur in Dodge or Fond du Lac counties. We believe a discussion in the Draft EIS of the potential presence of Indiana bats in the project area is completely unwarranted and misleads the reader for the following reasons:

- the distance from the project to the only recorded occurrence in the state is over 100 miles;
- the last known occurrence was documented in winter, when bats typically are not present, over 50 years ago by an unknown source;
- the lack of known occurrences of the species that would place the project site within an area used by migrating Indiana bats (i.e. sitings in surrounding counties);
- the project area is completely outside the recognized geographic range of the species (as specified by USFW); and
- 97% of the project area is farmed, while the roosting habitat preferred by the Indiana bat is loose bark of dead large-diameter trees located near tree-lined streams and rivers.

For these reasons, Indiana bats are exceedingly unlikely to be present in the project area. Moreover, the Indiana bat should not be identified as "present in the state" in table 4-15. The listing of eight species in the table contradicts the first sentence in Section 4.12.1 and the first sentence in 4.12.2. Since it has been more than 50 years since the last documented occurrence, there is no evidence the species now exists in Wisconsin.

Airstrips

Clearance distances between the Forward wind turbines and the approaches and take-off paths for planes at private airstrips are described in the DEIS as based on 40 CFR, Part 77 and represented as standards and requirements, thereby implying that these distances have the force of law. The further implication is that the Forward wind turbines may adversely impact established rights and privileges associated with these airstrips. Because 40 CFR, Part 77 does not apply to private airstrips, and because private airstrips do not have the rights and privileges of public airports under Part 77 or Wisconsin Statutes, the DEIS exceeds the bounds of reasonable analysis associated with the "hard look" criterion that underlies § 1.11, Wis. Stats. and § PSC 4.30(3), Wis. Admin. Code. We urge that this text, particularly that found at pages xix-xx, Table 1-1, page 125 and the carryover onto page 126, and the discussions associated with Fig. Vol. 2-21 be stricken in their entirety as contrary to law.

GE Turbine Blade Size

GE has indicated that there will be a design revision to its 1.5 MW turbine to increase efficiency of the turbine. The design revision increases the rotor diameter, and hence the blade length. The rotor diameter for the GE 1.5 MW turbine is presently 77 meters. Forward's application was submitted with the expectation that the 77 meter rotor would be used on the GE 1.5 MW turbine. GE has indicated that the rotor diameter on the revised 1.5 MW turbine will be 82.5 meters with a resulting blade length increase of 2.75 meters. This modification increases the overall height of the turbine from ground to blade tip from approximately 389 feet to approximately 398 feet. Therefore, depending on the timing of the design change and the delivery schedule from GE, Forward may be utilizing turbines manufactured with the new rotor diameter and blade length. We suggest that the applicable references to turbine height in the DEIS reflect this revision in order to allow incorporation of GE's modification to improve efficiency. The change to the DEIS references should include "overall turbine height to be between 389 and 398 feet depending on timing of GE design change and delivery schedule."

EXECUTIVE SUMMARY

(p. xi) Forward Energy's Proposal Section, after third paragraph: Suggest the following:

Wis. Stat. § 1.12(4) creates a priority list of preferred methods for meeting future electricity demands. Energy conservation is ranked first. Noncombustible renewables (wind, solar, and hydro) are the second preference. Based on the Energy Priorities list, the proposed Forward wind project would be a positive step toward meeting the goals of the State Energy Policy as outlined in Wis. Stat. §1.12.

(p. xi) Forward Energy's Proposal Section, third paragraph: Suggest the following changes:

These easements would allow the facilities to be built and operated for a period of ~~30~~ 25 years, with an option to extend the easement an additional ~~20~~ 10 years.

(p. xii) Project Area, second full paragraph: Suggest the following:

Comment: The current paragraph does not describe the project area accurately. Replace the paragraph as follows:

The general topography of the Forward wind project area is gently rolling with elevations ranging from about 900 feet to 1,132 feet above mean sea level (msl). The entire project area is on the gently sloping side, or top, of the Niagara cuesta, an upland landform with a short steep descent (an "escarpment"), on one side and a long, gentle slope on the other. Directly west of the escarpment lies Horicon Marsh. The majority of the project area, 96.55 percent, is currently farm land in tilled crops and hay. There are some forested fencerow trees throughout the area. There is also some rural residential housing in the area.

Comment: If the current paragraph describing the area west of the project is retained, add the following sentences:

None of these portions of the Escarpment are likely to be affected by the Forward project. Forward has established a buffer of approximately 1.5 miles between the eastern edge of the Horicon Marsh and the western wind turbine locations. None of the turbines will be located within 100 feet of the ledge, the distance recommended to prevent disturbance of the natural communities.

(p. xii) Project Area, second full paragraph, third sentence: Suggest the following changes:

Portions of the Escarpment are known to harbor many ~~rare~~ unique and protected species and important natural communities found in few places elsewhere in the world.

(p. xii) Power Contracts: Suggest the following changes:

Forward has negotiated contracts with several Wisconsin utilities for purchase of the power that would be generated by the Forward project. As of ~~December~~ April

2005~~4~~, contracts have been negotiated and executed with Wisconsin Public Service Corporation (WPSC) (70 MW), Madison Gas and Electric Company (MGE) (40MW), ~~and~~ Wisconsin Public Power Inc. (WPPI) (4~~2~~0 MW), and Alliant Energy Corporation (Alliant) (50 MW).

(p. xiii) Environmental Effects of the Forward Project Section.

Comment: The following additions and changes that discuss the many benefits of the project on the environment should be included in this "Environmental Effects" section.

(p. xiii) First paragraph, first sentence: Suggest the following changes:

With the exception of potential impacts on avian and bat resources, the proposed Forward project would have few ~~serious~~ impacts ~~effects~~ on environmental~~natural~~ resources.

(p. xiii) Second paragraph: Suggest the following changes:

Unlike most power plants that combust fossil-fuels to generate needed electricity, the proposed wind project would not emit air pollutants, ~~or~~ require water for cooling purposes, or require wastewater to be discharged from plant operations. Unlike coal fired power plants, the proposed wind project would not require daily deliveries of coal to the power plant (typically transported by train) nor would it require landfilling ash and other byproducts that result from burning coal for energy.

(p. xiii) Third paragraph: Suggest the following changes:

Some of the benefits and potential impacts on the natural and human environment that could occur due to the construction and operation of the proposed Forward project are discussed below.

(p. xiii) Environmental Effects of the Forward Project. Add new section entitled "Air Quality" as follows:

AIR QUALITY

The proposed wind project will provide 200 MW of needed power into Wisconsin without the added air pollutants that are associated with power generated by fossil fuels. The below table provides an estimate of the air emissions avoided each year as a result of the proposed wind project[1]. The table also provides an estimate of emissions avoided for a 30-year period, the life expectancy of the wind project.

Table: Projected Air Emissions Avoided Each Year and Life of Wind Project

Type of Pollutant	Amount of Reduction/Year	Amount of Reduction/Life of Project[2]
Greenhouse gases (CO_2)	640,100 tons	19.2 million tons

[1] Estimates are based on air emissions listed for all power plants in Wisconsin as provided by USEPA. The figures below are calculated assuming that Forward Wind Energy Center operates 32% of the year and replaces fossil fuel-based electric generation.

[2] Invenergy expects to operate the facility for 30 years.

Volatile Organic Compounds (VOCs)	51,578 tons	1.55 million tons
Nitrogen Oxides (NOx)	1,368 tons	41,040 tons
Carbon Monoxide (CO)	267 tons	8,010 tons
Sulfur Dioxide (SO2)	2,436 tons	73,080 tons
Particulates (PM)	83 tons	2,490 tons
Mercury (Hg)	28.4 pounds	852 pounds

A single 1.5 megawatt wind turbine in the proposed wind project area will produce approximately 4,204,800 kilowatt hours annually. This means that each wind turbine will prevent the emission of approximately 4,800 tons of CO2 annually. The average forest absorbs approximately 3 tons of CO2 per acre per year[3]. Thus, a single wind turbine prevents as much carbon dioxide from being emitted as could be absorbed by 1,600 acres of forest. The proposed Forward project will prevent as much carbon dioxide from being emitted each year as could be absorbed by 213,367 acres of forest.

(p. xii) Environmental Effects of the Forward Project: Add new section entitled "Water Consumption and Use" as follows:

WATER CONSUMPTION AND USE

The proposed wind project will provide needed power into Wisconsin without the consumption of water that is associated with power generated by fossil fuels. The table below provides an estimate of the water saved each year as a result of the

[3] "Our Ecolgical Footprint," Wackemagel & Rees, 1996

proposed wind project[4]. The table also provides an estimate of water saved over a 30 year period, the life expectancy of the wind project.

Table: Projected Water Consumption Avoided Each Year and Life of Wind Project

Type of Power Plant	Amount of Water Consumption Avoided Each Year	Amount of Water Consumption Avoided for Life of Project[5]
Coal	274,713,600 gallons	8,241 million gallons
Oil	241,075,200 gallons	7,232 million gallons
Combined Cycle Natural Gas	140,160,000 gallons	4,204 million gallons

Small amounts of water would be required during construction for dust suppression and other typical construction uses and for potable water requirements for the operation and maintenance building.

(p. xii) Environmental Effects of the Forward Project: Add new section entitled "Solid Waste" as follows:

SOLID WASTE

The proposed wind project will provide 200 MW of needed power into Wisconsin without generating solid waste during operation. The table below provides an estimate of the volume of solid waste that would be generated each year and over a 30-year period by a 200 MW power plant fueled by coal[6]. As indicated in the

[4] According to the California Energy Commission (cited in Paul Gipe's "Wind Energy Comes of Age", John Wiley & Sons, 1995). Assumes 200 MW x 8760 hours x 32% = 560,640 MW/year.
[5] Invenergy expects to operate the facility for 30 years.
[6] Assumes a 200 MW plant, burning 2.5% sulfur, 12,500 Btu/lb, 10% ash Midwestern coal, with a natural oxidation FGD system (makes disposal grade by-product, not commercial grade gypsum). Source for

table, the amount of solid waste avoided by the use of wind energy versus coal is significant.

Solid Waste Avoided		
	Amount of Reduction/Year	Amount of Reduction/Life of Plant
Solid Waste[7]	160,000 tons	4.8 million tons
Solid Waste mixed with Lime for Landfilling Purposes[8]	120,000 cubic yards	3.6 million cubic yards

(p. xiii) Geology and Groundwater, second paragraph: Suggest the following changes:

Because of the karst geology, Forward Energy will take precautions during installation of the foundations to prevent or minimize water movement into the groundwater. ~~there is a concern regarding the potential for surface water to enter the bedrock and contaminate local aquifers during construction of the proposed turbines.~~ The excavation for the foundation, pouring of concrete and assembling/installing prefabricated materials necessary for the construction of wind turbines generally does not involve the introduction of contaminants into the turbine construction site except for a possible release of the petroleum products that power the machinery used during these activities. Surface water entering the excavation during the construction activities from outside the turbine site is not

calculations is the Landfill Cost Model for Coal Combustion Products, developed by Consol Energy, co-funded by the Ohio Coal Development Office.

[7] Includes bottom ash, fly ash, and scrubber by-product. Values are approximate.

[8] In this case, the fly ash, bottom ash, and scrubber by-product would be blended together with lime, compacted-and disposed of in a lined landfill. Using 1.35 tons per cubic yard. Values are approximate.

likely to introduce any contaminants that would not otherwise percolate to the groundwater except for soil particles which might be carried into the excavation if berms or plastic sheeting are not provided. The latter are among the techniques known as best management practices (BMPs).

(p. xiii) Geology and Groundwater, second and third paragraphs: Suggest the following changes:

Similar concerns would arise when the concrete base for a wind turbine tower is ~~were~~ removed at the end of its~~heir~~ useful life. ~~It would be necessary to seal the foundation sites and divert surface water away from the sites after the tower foundations were removed.~~

~~There is also a potential for groundwater contamination from fuel spills during construction or from increased infiltration after additional incidental cracking of bedrock during certain turbine tower installation.~~ Forward plans to employ the precautions known as BMPs to avoid fuel spillage during construction and turbine removal as well as to reduce incidental cracking of bedrock.

(p. xiv) BIRDS, fourth paragraph, first sentence:

Comment: The statement "less rigorous than other Wisconsin wind farm avian studies" should be supplemented with specific references to those studies which the authors of the DEIS contend are more rigorous than the Forward studies.

(p. xiv) BIRDS, fifth paragraph, first sentence: Suggest the following changes:

From out of a total of more than 200,000 observations, ~~a total of~~ 89 bird species were ~~observed~~ identified during the Forward ~~P~~point counts and road surveys, which is slightly less than that observed by other bird studies conducted in the region.

(p. xv) BIRDS, carryover paragraph:

Comment: Specify the bird studies referred to.

(p. xv) Full paragraph: Suggest the following changes:

The Forward project could pose some level of risk to species listed under the Endangered Species Act (ESA) ~~and~~ or protected by the Migratory Bird Treaty Act (MBTA), both of which prohibit the ~~taking~~ take of ~~protected~~ specified species.

(p. xvi) First paragraph, after fourth sentence: Suggest the following changes:

The likelihood of a whooping crane that has associated itself with sandhill cranes being able to reproduce or facilitate acclimation of other whooping cranes to the Marsh environment are matters for which no experience is available.

(p. xvi) BIRDS, second paragraph: Suggest the following changes:

~~Forward appears to have ignored this relationship when it redesigned the project to place 23 more turbines within five miles of Horicon Marsh.~~

During the third tier of the study analysis (as described on p. 31-32 of the DEIS) Forward obtained data that indicated a set back from the Horicon Marsh was prudent. As described on p 32 of the DEIS, “Figures Vol. 2-1A and 2-1B shows the areas excluded from potential turbine development within the Forward project area based on the results of the tier three evaluation. These areas have been excluded for various reasons. The western edge of the project area has been designated as an exclusion area because of its proximity to the Horicon Marsh and National Wildlife Refuge and also because of the sensitive biological features of the Niagara Escarpment and the unique plant and animal resources it supports.” Based on the data reviewed by Forward, consideration was taken to avoid placement of turbines within close proximity of the western project area.

(p. xvi) Third paragraph, last sentence:

Comment: The antecedent of the subject pronoun, "they," is not clear. Does "they" refer to the "larger studies" alluded to (but not identified) earlier in the paragraph? The clarification should specifically list the so-called "larger studies" and/or replace the pronoun with identifiable studies.

(p. xvii) Second paragraph, second to last sentence:

Comment: Specify what specific conditions, e.g., bird density, assemblage or the like, which are claimed to be different for the Forward project area as compared to the areas studied and which study results suggest that mortality numbers will be low.

(p. xvii) BATS, fourth paragraph, prior to last sentence: Suggest the following changes:

Bats are not protected species in Wisconsin with the exception of the Indiana Bat. A wind turbine project is already planned for a site which is approximately two miles distant from the Neda Mine.

(p. xviii) Agricultural Impacts and Soil Compaction, last paragraph, last sentence: Suggest the following changes:

These applications could result in a slightly lower vegetable yield~~s~~ if crop damage occurs from use of this equipment. The use of ground equipment will result in less drift of pesticides and therefore less pesticide use and, in all likelihood, a reduced potential for damage to wildlife and humans as a result.

(p. xix) Road Conditions and Traffic Congestion, second paragraph: Suggest the following changes:

The commercial and industrial truck traffic that exists in the project area is attributable to ~~Because of~~ Quad Graphics in the southeast part of the project area, canning companies to the north and south, the Michels construction company complex in Brownsville, numerous stone and gravel operations, and many farms in the area~~, many of the state, county, and town roads currently carry a substantial amount of truck traffic~~.

(p. xx) AIRPORTS AND AIRSTRIPS, first paragraph, last sentence: Suggest the following changes:

Some of the private airstrips are used occasionally ~~regularly~~ by the attendees of the Experimental Aircraft Association (EAA) annual event as emergency runways during its two week period in August.

(p. xx) AIRPORTS AND AIRSTRIPS, second paragraph, second sentence: Suggest the following changes:

Several different ~~standards~~ criteria for determining ~~appropriate~~ clearance distances are described in Chapter 5, Section 5.4.5. These criteria are not standards or requirements that apply to private airstrips. Implementing one or more of these ~~standards~~ criteria could eliminate some of the proposed turbine sites from use or result in their relocation.

~~Application~~Implementation of ~~FAA Part 77~~ (40 CFR § 77.25) clearances when they are not legally applicable around the private airstrips in the project area would mean that wind turbines could not be located within a 5,000 foot radius of a private airport runway. ~~A more modest~~ Implementation of the clearances derived from § 77.25 when they are not legally applicable, ~~requirement~~ but limited to take off and landing approaches only ~~would relate to~~ and based on the distance needed for air turbulence from a turbine rotor to dissipate ~~beyond a turbine rotor~~ ~~Use of this standard would require a distance of~~ might result in locating turbines approximately 1,600 to 2,000 feet from downwind runways ~~and turbines~~.

(p. xx) AIRPORTS AND AIRSTRIPS, final paragraph: Suggest the following changes:

No landowner has protection privileges under Wisconsin Statutes.

(p. xxiii) AESTHETICS, second paragraph, first sentence: Suggest the following changes:

While the Forward project would enable farming to continue as the primary land use, it would ~~significantly~~ change the existing visual landscape in southern Fond du Lac County and northern Dodge County.

CHAPTER 1

(p. 2) Section 1.1.2, last sentence: Suggest the following changes:

The proposed turbine sites within the project area (as of~~ 12/2/04~~4/4/05) are shown in Figure Vol. 2-1A and Vol. 2-1B. Forward is continuing to have discussions with landowners to optimize the specific location of turbine sites, access roads, and collection systems to minimize crop loss in the selected fields and utilize existing farm roads.

(p. 4) Section 1.1.4, first paragraph, last sentence: Suggest the following changes:

The applicant may retain the services of a third party to provide some of the maintenance for the turbines and related equipment, which is common for such projects.

(p. 4) Section 1.1.5, second sentence: Suggest the following changes:

As of ~~December ~~April 2005~~4~~, contracts have been negotiated with Wisconsin Public Service Corporation (WPSC) (70 MW), Madison Gas and Electric Company (MGE) (40 MW), ~~and ~~Wisconsin Public Power, Inc. (WPPI) (40~~20~~ MW), and Alliant Energy Corporation (Alliant) (50 MW).

(p. 4) Section 1.1.6, end of second paragraph: Suggest adding the following:

Forward anticipates the project to have a 30 year life.

(pp. 6-7) Section 1.3.2, last two sentences. Suggest the following changes:

Erosion control and stormwater runoff during construction ~~are issues that would~~ will be addressed ~~through a DNR general permit. A letter indicating that the general permit cover the proposed project activities must be issued by DNR prior to the start of construction.~~ by the applicant through erosion control and stormwater runoff plans for the construction sites as part of its BMPs.

Comment: These sentences discuss stormwater runoff during construction as subject to a DNR general WPDES permit. This legal conclusion is incorrect in that the area affected by each turbine location and its associated access road is less than the threshold area specified by the relevant provision of the Wisconsin Administrative Code, § NR 216.42: stormwater construction site management permits are required for a point source discharge one acre or more in area. Each wind turbine construction site will have an approximate area of less than 5,000 square feet with the associated access road being, at most, three times that area, for a total area of approximately one half acre. Each construction site is separated by a minimum of 1,200 feet from its nearest construction site, resulting in no interrelationship of surface or groundwater impacts. The whole project area (consisting of 133 separate construction sites) is more than 32,000 acres. The aggregating of clearly separate sites as one site to satisfy § NR 216.42's threshold is not consistent with the intent of the rule, much less a common sense application.

(p. 9) Section 1.4.5.1, During the scoping process: Suggest the following changes:

Re-title to "Before, during and after the scoping process"

Suggest adding three paragraphs after the first paragraph:

Forward also held open community meetings and met with area landowners, including property owners who were not hosting a wind turbine site. These meetings occurred first in 2003 at the following locations and frequencies: the Town Board of Leroy (once); the Town Board of Lomira (once); the Town Board of Byron (twice); and the Town Board of Oakfield (once). Each meeting was publicly noticed, opened to the public and attended by 15-25 people.

In the spring of 2004, Forward held two meetings at the Brownsville Community Building. Attendance at each meeting was more than 125, the majority of whom were non-host landowners.

Open House meetings in the area were conducted on December 14, 2004 at the Brownsville Community Building. Invitations to this meeting were sent to 2,000 local residences. Another open house is planned for late April or May, 2005.

(p. 10) Section 1.5, third paragraph, third sentence: Suggest the following changes:

Discussions of historical and archeological considerations are in Chapter 4, section 4.6.1 of this ~~final~~ draft EIS under the heading "Protection of archeological or historic sites listed by the state."

(p. 11) Section 1.6, State Interests, first sentence: Suggest the following changes:

In addition to the approval interests of PSC~~ and DNR~~, several other state agencies ~~must ~~may have ~~approve ~~approval authority over plans, designs, or specific components of the proposed generating facility and auxiliary equipment.

Comment: These changes are necessary because it is questionable whether DNR has jurisdiction over construction stormwater management via WPDES general permit, as is the conclusion that approval by the Wisconsin Historical Society or the Wisconsin Department of Transportation ("DOT") under § 114.135 is required. As to the latter, the DOT has concluded that it is likely that none of the turbine sites will require approval under § 114.135 as high structures. DNR's ch. 30 authority only applies to those turbine sites whose access roads cross a stream. If these sites are not among those approved for construction by the PSC, the DNR has no authority over the project.

(p. 11) Section 1.7, second paragraph, last two sentences: Suggest the following changes:

The Conditional Use Permit and the Land Use permit would be in effect for the life of the project. ~~, but t~~The Land Use permit would~~ be in effect for six months for each turbine. A six-month extension may be granted~~ expire if substantial construction has not begun within six months, or if a six-month extension is not obtained.

Comment: Section 2.3.5(H) of the Dodge County Ordinances states that "[a]ll Land Use Permits shall expire within 6 months unless substantial construction has begun, or unless one 6-month extension is approved." This provision requires the permit holder to begin construction of the project within 6 months after the date on which the permit is obtained or to obtain an extension. If construction of the project has begun within 6 months after the date on which the permit was obtained (or, with an extension, 12 months), then the Land Use Permit does not expire.

CHAPTER 2

(p. 13) Section 2.1.1, at the end of Turbine Tower paragraph: Suggest the following addition:

The ladder and fall arresting system as well as all other systems are located inside the tower. The outer portion of the tower is smooth and does not have any components or systems attached to it.

(p. 18) Figure 2-4:

Comment: The Plan View drawings need to correct the diameter of the tower base from 13 ft to 15 ft. The Profile view shows the foundation sitting on Bedrock. This should read Bedrock/Native Soils.

(p. 25) Section 2.5.1, first full paragraph, second sentence: Suggest the following changes:

These easements would allow the facilities to be built and operated for a period of ~~30~~ 25 years, with an option to extend the easement an additional ~~20~~ 10 years.

Note: Similar change should be made elsewhere in the Draft EIS where easement time period is referenced.

(p. 25) Section 2.5.2, third paragraph, third sentence: Suggest the following changes:

Once the facilities ~~were~~ <u>are</u> installed, the option payment would be discontinued and would be replaced by the operating payment.

(p. 26) Section 2.5.2, last paragraph: Suggest the following changes:

According to the basic easement form, all of the easement payments would be provided ~~yearly~~<u>bi-annually</u>, per turbine, and would be without regard to the selected type of turbine, the capacity of the turbine, or the energy produced.

(p. 26) Section 2.5.3, third paragraph, sixth sentence: Suggest the following changes:

<u>The cranes will likely travel cross country between turbine sites</u>. ~~Between sites,~~ ~~t~~<u>T</u>he large crane would be limited in where it could travel, so it would likely follow a path from turbine sit to turbine site~~, along the route of a future access road~~.

(p. 26) Section 2.5.3, third paragraph, first two sentences: Suggest the following changes:

When facility installation was complete, a typical turbine foundation, <u>the</u> pad mounted transformer <u>and the access road</u> would occupy an area about 0.5 acre, at the most. The electricity collector circuit(s) would consist of three buried cables<u>,</u>

plus a communication cable, in a 48-inch deep trench about nine to 12 inches wide.

(p.26) Section 2.5.4, first paragraph, second sentence: Suggest the following changes:

The company would pay the taxes or any other governmental charges or assessments that resulted from the turbines' presence or operation.

CHAPTER 3

(p. 29) Section 3.1.1 No Action Section, first paragraph, first sentence: Suggest the following changes:

Taking no action on this application by denying ~~the application~~ it would result in ~~no change in~~ an increase in either the number of power plants elsewhere in the state or an increase in capacity at an existing plant. The Wisconsin utilities that Forward has contracted with to receive power would have to identify other power sources and negotiate new power purchase agreements to meet their electric demand and comply with their obligations under the RPS legislation (Wis. Stat. § 196.378(2)). Additionally, the benefits of the Forward project (i.e., power generation without negative impacts to air quality, water consumption, and solid waste generation) may not be realized.

(p. 30) Section 3.1.2, first full paragraph, last sentence: Suggest the following changes:

The proposed Forward wind generating facility would be powered by a noncombustible renewable resource and thus the proposed project ~~appears to~~ supports the goals of the energy priorities statute.

(p. 30) Section 3.1.2, second full paragraph: Suggest the following changes:

The four Wisconsin utilities that have negotiated contracts with Forward to purchase the power generated by the project are striving to meet their obligations under Wis. Stat. § 196.378(2) and are relying on this project to help meet their requirements.

(p. 30) Section 3.2.1.1, end of second paragraph: Add the following:

The strong wind resource in this area is expected to increase the overall capacity factor of the project thereby reducing the cost of renewable power to the four Wisconsin utilities purchasing the power (and their customers) when compared to other locations in the state with lower wind speeds.

(p. 31) Section 3.2.1.2, second set of bullet points, second bullet point: Suggest the following changes:

- A specific area of the region is above an elevation of ~~1,000~~1,050 feet providing added wind resource availability.

(p. 32) Section 3.2.1.3, first paragraph: Add the following:

- Wildlife
- Birds
- Bats

(p. 33) Section 3.2.2.1, Consideration of Alternative Sites, fourth paragraph, before the last sentence: Suggest the following addition:

Geographically, the alternative locations are spread over four townships in two counties, encompassing a total of 32,400 acres. Each location is distinct from every other location in at least the following ways or for the following reasons:

each location is capable of operating independently of every other location; each location is independent of every other location for siting purposes; each location varies in the amount of wind energy it can capture; each location will have its own access road and underground electrical system; each location has a different aesthetic impact on the surroundings; the locations on which the turbines will be built are under numerous different ownerships; and each location varies in its distance from the Horicon Marsh.

(p. 35) Section 3.2.2.3, fourth paragraph, second and third sentences: Suggest the following changes:

The effects of wake loss are significantly diminished at a distance of six to eight ~~to ten~~ rotor diameters. The diameter of the rotor on the proposed Forward turbines is approximately ~~262~~253 to 271 feet depending on the blade design of the GE turbine at the time of installation.

CHAPTER 4

(p. 38) Section 4.1.2, Potential impacts of Forward activities, first paragraph, third sentence: Suggest the following changes:

Depending on the depth to bedrock <u>and the site specific geotechnical conditions</u>, each turbine would be installed using one of two techniques: a "deep" foundation or a "spread footer" or "mat" foundation.

<u>Comment</u>: The foundation design is not based solely on the depth to bedrock:

(p. 38) Section 4.1.2: Fourth paragraph, first sentence: Suggest the following changes:

Table 4-1 lists the turbines that Forward has identified at locations where the depth to bedrock from the surface is <u>potentially</u> five feet or less.

(p. 40) Section 4.3.1, last paragraph: Suggest the following changes:

<u>While there could be impacts to soil from compression, erosion, spills leaching into groundwater, these possibilities seem remote, particularly if Forward uses best management practices (BMPs).</u>

(p. 41) Section 4.3.2, Carryover paragraph: Suggest the following changes:

…would help determine the stability of soils for the turbine base. <u>Forward would take precautions during construction to avoid fuel spillages onto soil surfaces.</u> ~~If a~~

~~soil is well drained, fuel or other spills and leaching could result in groundwater contamination, unless the ground is too compacted to let water percolate.~~

(p. 42) Section 4.4: Suggest adding the following as section 4.4.3, Water Use and Wastewater Discharge.

4.4.3.1 WATER CONSUMPTION AND USE

The proposed wind project will provide needed power into Wisconsin without the consumption of water that is associated with power generated by fossil fuels. The table below provides an estimate of the water saved each year as a result of the proposed wind project[9]. The table also provides an estimate of water saved over a 30-year period, the life expectancy of the wind project.

Table: Projected Water Consumption Avoided Each Year and Life of Wind Project

Type of Power Plant	Amount of Water Consumption Avoided Each Year	Amount of Water Consumption Avoided for Life of Project[10]
Coal	274,713,600 gallons	8,241 million gallons
Oil	241,075,200 gallons	7,232 million gallons
Combined Cycle Natural Gas	140,160,000 gallons	4,204 million gallons

9 According to the California Energy Commission (cited in Paul Gipe's "Wind Energy Comes of Age", John Wiley & Sons, 1995). Assumes 200 MW x 8760 hours x 32% = 560,640 MW/year.
10 Invenergy expects to operate the facility for 30 years.

Small amounts of water would be required during construction for dust suppression and other typical construction uses and for potable water requirements for the operation and maintenance building.

Comment: The project will not use water for cooling purposes and therefore no wastewater discharge will occur, thus impacts to water resources in Wisconsin will be significantly reduced in comparison to typical fossil fuel generation. This benefit should be reflected in this section of the EIS. Suggested language describing the benefits was also included in the Executive Summary section. This is important information when considering the balance of environmental impacts caused by power generating plants.

(p. 43) Section 4.4.1.2, second paragraph: Suggest the following changes:

A Chapter 30 permit ~~would~~ may be required ~~where~~ if access roads cross streams as well.

(p. 46) Section 4.4.1.3, last paragraph:

Comment: Best Management Practices for construction to minimize effects of soil erosion or construction spills by way of tributary streams will be used.

(p. 44) Table 4-4: Suggest the following changes:

Underground 34.5 kV collection system:

- Kummel Creek Between #87 and #161 - Township should be 14N

- Kummel Creek Between #78 and #80 - Connection goes from Section 28 to 33
- Kummel Creek Between #76 and #97 - Connection goes from Section 32 to 33

Aboveground 34.5 kV collector line

- Kummel Creek about 1 mile east of eastern transition point - Range should be 17E
- Kummel Creek where overhead lines angles from west to north... - Range should be 17E and Section - along the border between Sections 32 and 33

(p. 45) Section 4.4.1.3, first sentence: Suggest the following changes:

The Wisconsin Wetland Inventory database shows that there are approximately 495 acres of wetlands in the 32,400 acre project area.

(p. 46) Section 4.4.1.3, fifth paragraph, third sentence: Suggest the following changes:

~~However, if soil erosion or construction spills are not controlled adequately, it is possible that sediment, nutrients, or contaminants could enter the marsh by way of connecting tributary streams.~~During construction of the project, Forward will take precautions and utilize industry best management practices to prevent or minimize impacts to area wetlands and waterbodies.

(p. 46) Section 4.4.2 Groundwater:

Comment: Several locations in the Draft EIS indicate concern for surface water or spills to enter the bedrock and contaminate local aquifers during construction because of the karst geology of the area. Forward will follow best management practices to avoid this situation.

(p. 46) Section 4.4.2, paragraph 1: Suggest the following changes:

Because of the karst geology of the area, there would be a potential for opening numerous conduits for surface water to enter the fractured bedrock and contaminate local aquifers during construction ~~of many~~ of the proposed turbines. Forward will employ construction practices such as building berms in areas where surface water is present during construction ~~Surface runoff into these conduits might be avoided if berms are built~~ to divert surface flow away from open construction sites, thereby avoiding the potential for water to be channeled into the exposed bedrock.

To prevent or minimize water movement into the groundwater as a result of the installation of rock anchors, Forward would use rotary boring with a tricone bit combined with air pressure forced down the bore hole to remove the chips and cuttings instead of water or mud rotary boring. With this method, there would be no water used in the process that could enter the bedrock or groundwater. Pressure grouting would be applied after installation of the rock anchors has been completed.

(p. 46) Section 4.4.2, second paragraph, second sentence: Suggest the following changes:

~~It~~ Forward would take the necessary precautions ~~would be necessary~~ to prevent or minimize impacts to groundwater by ~~to~~ sealing the foundation sites and diverting surface water away from the sites after the tower foundations were removed.

(p. 47) Section 4.4.2, top paragraph, second sentence: Suggest the following changes:

Precautions would also be taken by Forward to avoid fuel spillage during construction and reduce incidental cracking of bedrock.

(p. 47) Section 4.5, first paragraph. Suggest adding these paragraphs.

The proposed wind project will provide 200 MW of needed power into Wisconsin without the added air pollutants that are associated with power generated by fossil fuels. The below table provides an estimate of the air emissions avoided each year as a result of the proposed wind project[11]. The table also provides an estimate of emissions avoided for a 30-year period, the life expectancy of the wind project.

Projected Air Emissions Avoided Each Year and Life of Wind Project

Type of Pollutant	Amount of Reduction/Year	Amount of Reduction/Life of Project[12]
Greenhouse gases (CO2)	640,100 tons	19.2 million tons
Volatile Organic Compounds (VOCs)	51,578 tons	1.55 million tons
Nitrogen Oxides (NOx)	1,368 tons	41,040 tons

[11] Estimates are based on air emissions listed for all power plants in Wisconsin as provided by USEPA. The figures below are calculated assuming that Forward Wind Energy Center operates 32% of the year and replaces fossil fuel-based electric generation.
[12] Invenergy expects to operate the facility for 30 years.

Carbon Monoxide (CO)	267 tons	8,010 tons
Sulfur Dioxide (SO2)	2,436 tons	73,080 tons
Particulates (PM)	83 tons	2,490 tons
Mercury (Hg)	28.4 pounds	852 pounds

Carbon dioxide and other gases caused by human activity - including power generation - build up in the earth's atmosphere and trap the sun's rays like a greenhouse and contribute to global warming. The buildup of greenhouse gases may be causing a gradual rise in average temperatures, and more frequent and severe droughts and floods. The United States, with 5 percent of the world's population, emits 23 percent of the world's CO_2. Recent studies link harmful health effects to air pollution and particularly to high levels of sulfur dioxide, CO_2, nitrogen oxide, particulate matter and toxic heavy metals found in the air. High levels of mercury in Wisconsin waters due to fossil fuel air emissions have prompted health advisories on the annual amounts of fish consumed.

Wind turbines are extremely effective at reducing emissions of carbon dioxide (CO_2) produced by fossil fuel electric generating sources. A single 1.5 megawatt wind turbine in the proposed wind project area will produce approximately 4,204,800 kilowatt hours annually. This means that each wind turbine will prevent the emission of 4,800 tons of CO_2 annually.

The average forest absorbs approximately 3 tons of CO_2 per acre per year[13]. Thus, a single wind turbine prevents as much carbon dioxide from being emitted as could be absorbed by 1,600 acres of forest. The total 133 turbines, 200 megawatt MW of the proposed wind project will prevent as much carbon dioxide from being emitted each year as could be absorbed by 213,367 acres of forest.

Comment: This information is also included in the Executive Summary to outline the benefits of zero emissions. This is important information when considering the balance of environmental impacts caused by power generating plants.

(p. 47) Section 4.5.1, first paragraph, last sentence: Suggest the following changes:

For the proposed Forward project, these impact risks would be completely avoided.

(p. 49) Section 4.5.5, third paragraph, fifth and sixth two sentences: Suggest the following changes:

With a blade length of ~~1,26.3~~ 126.3 to 135.3 feet, which is planned for the Forward turbines, the rotor diameter would be 252.6 to 270.7 feet. Thus, a distance of approximately 2,021 to 2,166 feet would be needed to clear the air

[13] "Our Ecolgical Footprint," Wackemagel & Rees, 1996

turbulence caused by the rotating turbine blade (using 8x rotor diameter instead of 6x rotor diameter).

(p. 50) Section 4.5.6: Suggest the following addition:

The proposed wind project will provide 200 MW of needed power into Wisconsin without generating solid waste during operation. The table below provides an estimate of the volume of solid waste that would be generated each year and over a 30-year period by a 200 MW power plant fueled by coal[14]. As indicated in the table, the amount of solid waste avoided by the use of wind energy versus coal is significant.

Solid Waste Avoided		
	Amount of Reduction/Year	Amount of Reduction/Life of Plant
Solid Waste[15]	160,000 tons	4.8 million tons
Solid Waste mixed with Lime for Landfilling Purposes[16]	120,000 cubic yards	3.6 million cubic yards

Comment: This additional text helps provide a balance when comparing environmental impacts from fossil generation.

(p. 51) Section 4.7, Table 4-5: Suggest the following additions:

[14] Assumes a 200 MW plant, burning 2.5% sulfur, 12,500 Btu/lb, 10% ash Midwestern coal, with a natural oxidation FGD system (makes disposal grade by-product, not commercial grade gypsum). Source for calculations is the Landfill Cost Model for Coal Combustion Products, developed by Consol Energy, co-funded by the Ohio Coal Development Office.

[15] Includes bottom ash, fly ash, and scrubber by-product. Values are approximate.

[16] In this case, the fly ash, bottom ash, and scrubber by-product would be blended together with lime, compacted-and disposed of in a lined landfill. Using 1.35 tons per cubic yard. Values are approximate.

Table 4-5 State natural resources in project region

DNR State Properties	Township	County	Size (Acres)	Approx. Distance and Direction from Project Boundary	Approx. Distance and Direction from nearest wind turbine
Horicon Marsh State Wildlife Area	Burnett, Williamstown	Dodge	11,091	~~0.5~~ 2.8 miles west	4.5 miles SW of #149
Fourmile and Cotton Island Rookeries	Williamstown	Dodge	15	5 miles southwest	6.5 miles SW of #149
Oakfield Ledge	Oakfield	Fond du Lac	208	0 miles northwest	0.5 miles NW of #1
Mayville Ledge State Natural Area and Rookery	Williamstown, Hubbard	Dodge	60	7 miles south	8.4 miles S of #131
Neda Mine State Natural Area Bat Hibernaculum	Hubbard	Dodge	N/A	9.5 miles south	11.2 miles S of #131
Theresa State Wildlife Area	Lomira, Theresa, Wayne, Addison	Dodge	5,499	3.4 miles southeast	4.3 miles SE of #156
Eldorado State Wildlife Area	Eldorado, Lamartine	Fond du Lac	6,371	8.1 miles north	8.6 miles N of #1
Mullet Creek State Wildlife Area	Forest	Fond du Lac	2,177	14 miles northeast	14.5 miles NE of #74
Kettle Moraine State Forest	Various	Dodge, Fond du Lac	221	~~11.5~~ 12.6miles ~~west~~east	13.8 miles E of #83
Other DNR-Managed Properties within 10 miles of Project Boundary	Various	Dodge, Fond du Lac	Approx. 4,390	<10 miles	N/A

Comments: The additions clarify and show voluntary buffer area established by Forward between the project boundary and location of turbines.

(p. 52) Section 4.7, Table 4-6: Suggest the following additions:

Federal Properties	Township	County	Size (acres)	Approx. Distance and Direction from Project Boundary	Approx. Distance and Direction from nearest wind turbine
Horicon National Wildlife Refuge	Chester, Burnett, Leroy, Oakfield, Waupun	Dodge, Fond du Lac	21,417	0.5 miles west	1.5 miles W of #111
Breakneck, 2 parcels (Waterfowl Production Area)	Oakfield	Fond du Lac	238	1 mile northwest	1.5 miles NW of #18
Oakfield (Waterfowl Production Area)	Oakfield	Fond du Lac	314	2.5 miles northwest	3.1 miles NW of #18
Lamartine (Waterfowl Production Area)	Lamarine	Fond du Lac	204	4.75 miles northwest	5.3 miles NW of #1
Pieper (Waterfowl Production Area)	Burnett	Dodge	81	6.25 miles southwest	7.5 miles SW of #149
Trenton (Waterfowl Production Area)	Trenton	Dodge	374	9 miles west	10.1 miles W of #111
Robbins Shorebirds (Waterfowl Production Area)	Trenton	Dodge	123	12 miles southwest	13 miles SW of #149

Comment: The additions clarify and show voluntary buffer area established by Forward between the project boundary and location of turbines.

(p. 52) Section 4.7, paragraph below Table 4-6, first, fifth, and sixth sentences:

First sentence: Directly west of the Forward project area is a small portion of the Niagara Escarpment.

Fifth sentence: Within the Escarpment are the Oakfield Ledge along the northwest edge of the project boundary, and the Mayville Ledge and the Neda Mine, approximately 11 miles from the closest turbine to the south.

Sixth sentence: These portions of the Escarpment are known to harbor many unique and protected ~~rare~~ species and important natural communities found in few places elsewhere in the world.

Suggest adding the following after the paragraph discussed above:

Along the northwest edge of the project area boundary is a portion of the Niagara Escarpment that provides very specific habitat for several protected species. Based on information in its application, Forward has not proposed constructing any turbines along the Niagara Escarpment cliffs. It is unlikely that the proposed project would have any impact on these species, provided no construction activities occur within 100 feet of the Escarpment and proper erosion control is implemented around any ground disturbing activities that are upslope from the Escarpment.

Comment: The text is not consistent with threatened/endangered species on page 53. Moreover, and the project will not be constructed on the Escarpment ledge itself.

(p. 53) Section 4.7, third paragraph:

Comment: A discussion of the hunting activities in this area and the number of ducks and geese that are killed annually in Dodge and Fond du Lac Counties near the Marsh would add perspective to this discussion.

(p. 53) Section 4.7, last paragraph, last sentence: Suggest the following changes:

The project area is located ~~in the midst~~ east of this landscape.

(p. 55) Section 4.9, second sentence: Suggest the following changes:

~~Eighty percent~~ Almost 97% of the project area is in agricultur~~e~~al use, planted principally in corn and alfalfa.

(p. 56) Section 4.10, first paragraph, last sentence: Suggest the following changes:

However, no construction activities are proposed near this area, therefore potential impact is negligible and not expected.

Comment: The changes provide consistency with text of DEIS found elsewhere.

(p. 56) Section 4.10, third paragraph, first sentence: Suggest the following changes:

Because of the ~~controversy regarding wind farms and their~~ limited impact of wind farms on wildlife and the high profile discussion of potential impacts to bird and bat populations, these species are discussed in detail in Sections 4.11 and 4.12 respectively.

(p.57) Section 4.11:

Comment: Forward has spent considerable time with the DNR (meetings in Madison, teleconferences, and meetings in the Project area) in constructing and designing a 2005 Spring and Summer Avian Study to address the concerns discussed in this Section 4.11 of the draft EIS. Specifically, the study covers three distinct and separate issues: rare birds, raptors, all birds (except some limited species as agreed upon or suggested by the DNR) and their distance relationship from the Horicon Marsh. A copy of the Spring and Summer Study Design and Work Scope will be submitted to the PSC. Field work has commenced. The study design also incorporated comments from USFWS via discussions with DNR. Both the DNR and Forward believe that this study is an improvement over the previous 2004 spring and fall studies, and will help to provide a better picture of bird usage at the site in regard to assessing mortality and other effects.

(p. 57) Section 4.11.1, first paragraph of the Introduction, fourth sentence:

Suggest the following changes:

In the Midwest, studies have been conducted in Minnesota, ~~Illinois,~~ Iowa and Wisconsin.

Comment: We are not aware of any fatality studies at wind plants in Illinois. The same paragraph includes the following statement: "different types, heights, and configurations of wind turbines can have a substantial effect on bird impacts." Without a specific designation of the effects referred to, it is difficult to assess whether their degree truly qualifies as "substantial". Similarly, the third from last sentence in the paragraph refers to variability of "bird impacts … due to variation in migration routes … " While there may be a general perception that migration routes vary, there is no documentation in the literature for this form of variability in behavior.

(p. 57) Section 4.11.1, first paragraph of the Introduction, fifth sentence: Suggest the following changes:

The results of these studies vary somewhat with respect to avian mortality but generally show low numbers by comparison to older sites outside the Midwest. ~~and it is difficult to compare different~~ Transfer of the mortality data at the Midwest sites to the Forward site may require caution due to differences in the types of studies ~~from different~~and differences in the types of wind farms studied.

(p. 57) Section 4.11.1, second paragraph of the Introduction, second and third sentences: Suggest the following changes:

~~In addition to~~ The Horicon Marsh~~, the project~~ region contains various state and federal lands managed for the protection and proliferation of various types of birds. There is a basic question as to whether ~~an area~~a region that attracts ~~significant~~ populations of endangered species ~~in~~and very high numbers of common birds is compatible with a wind farm ~~which~~ within that same region that might cause bird mortality~~ or bird avoidance within that same region~~.

Comment: The rationale for these changes is that the Forward project does not create a region whereas federal and state activity may. Moreover, there is no evidence that birds which might avoid the turbine locations will also avoid the "region" as a whole.

(p. 57) Second paragraph of the Introduction, last sentence: Suggest the following changes:

The USFW has expressed its support for properly sited and designed wind energy developments, but has concerns that the applicant has not adequately addressed potential impacts on birds ~~and bats~~ in the project area in relation to Horicon Marsh.

Comment: Concerns related to the project area and bats, whether expressed by USFWS or not, should not be in relation to the Horicon Marsh. Whatever the basis for concern about bat mortality may be associated with the Forward project, the relationship of the project area to the Neda Mine, not the Marsh, should be the basis of concern. The topic is discussed in section 4.12.

(p. 58) Section 4.11.1.2, first paragraph, topic sentence: Suggest the following changes:

Predictions of ~~T~~the likelihood and frequency of bird mortality in a proposed wind farm ~~is~~ are generally based on the overall abundance of species that occur in the project area, the type … of bird … within the blade-swept area, and particular behaviors that might increase a species' chances for encountering turbine blades.

(p. 58) Section 4.11.1.2, first paragraph, last two sentences: Suggest the following changes:

~~Behaviors, such as migrating during a foggy night, have the potential for such a large-scale collision event.~~ Whether turbines are likely to be operating in such meteorological conditions or when operating will result in the lack of visibility normally associated with tall structures on foggy nights is a matter concerning which evidence is lacking. These large-scale events are often widely speculated ~~reported~~ in the press, but have not been documented.

Comment: The discussion in the last three sentences of the first paragraph in sec. 4.11.1.2 implies that "a single large-scale [bird kill] event" has been documented at wind turbines. To our knowledge no such event has ever been documented, including particularly as a consequence of fog. We are aware of this occurrence at tall communication towers, but not wind turbines. To the extent the documentation exists, the FEIS should cite the source document(s). If no such documentation exists, the discussion of large scale events should be regarded as speculation and either identified as such or stricken.

(p. 58) Section 4.11.1.2:

Comment: The topic sentence of the second paragraph of sec. 4.11.1.2, appears to state "regional migration patterns" have impacted mortality at wind energy plants. We do not believe the relationship exists. However, to the extent PSC and DNR believe it does, specific examples of the studies should be cited.

(p. 59) Section 4.11.1.3, Regulations, second paragraph, second sentence:

Suggest the following changes:

~~The MBTA states that m~~Most bird~~s~~ species and their parts (feathers, eggs, nests, etc.) are protected ~~by~~under the federal ~~law~~ MBTA from being killed, taken, transported, possessed, bought, sold, imported or exported without a valid federal permit.

(p. 59) Section 4.11.1.3, fifth paragraph, second sentence: Suggest the following changes:

The ESA prohibits the direct killing, taking, or any other activity that may be detrimental to a federally listed animal species.

Comment: The ESA does not prohibit a "take" of a listed plant species on private land.

(p. 59) Section 4.11.1.3, Regulation, last paragraph, last sentence: Suggest the following changes:

The Altamont suit will probably be determined on its own unique facts: use of the older lattice type towers (some with guying wires), much higher blade velocities than will apply at the Forward project and several other features not present at Forward, including open nacelles and much higher raptor populations than have been noted in the project area, especially Golden Eagles.

(p. 60) Section 4.11.2.1, Methodology, second paragraph, topic sentence: Suggest the following changes:

Observations of American Robins, house sparrows, European Starlings, mourning doves and rock doves were ~~excluded from~~ not specifically enumerated in the Forward bird study.

Comment: Under the new 2005 study it was agreed with the DNR that the same species would not specifically be enumerated. In addition, Canada Geese, as suggested by the DNR, would not be specifically enumerated because Canada Geese are not known to be susceptible to wind turbines and any mortality would not be expected to be biologically significant.

(p. 63) Section 4.11.3:

<u>Comment</u>: In the topic sentence of the last paragraph, the DEIS discusses the greater number of "rare species" … "observed by other studies of proposed wind farms in nearby areas with similar habitats…" as compared to the Forward survey by Dr. Kerlinger. Reference is made to the 2002 Howe study and a 1998 PSC study. This paragraph is not clear whether the listed or rare species referred to are listed or rare in Wisconsin but present in the area as migrants from another state (or other jurisdiction) where they are not listed or rare. This distinction is not inconsequential in consideration of the DEIS's later statement to the effect that losing even one bird from a rare species may threaten that species' survival: birds that are listed by Wisconsin as endangered, threatened or species of concern that are migrating through Wisconsin from Canada frequently are from populations that are not listed or species of concern there. A qualification or clarification is in order, particularly for observations during migratory seasons.

(p. 63) Section 4.11.3, fifth paragraph, concluding sentence: Suggest the following changes:

A spring <u>and summer</u> survey ~~would be needed to confirm nesting and delineate its territory~~ <u>has begun and is scheduled to extend through August 2005. The methodology for this survey has been jointly developed by the applicant, DNR and USFWS</u>.

(p. 64) 4.11.3.1, Bald Eagle, after the concluding sentence: Suggest the following changes:

Forward's 2005 spring and summer survey is expected to quantify these previously qualitative observations.

(p. 66) Section 4.11.3.7, Conclusions for rare species, first full paragraph: Suggest adding the following:

The rationale for Forward statements that risk of mortality is low, and adverse effects unlikely based on the rare presence (one or two individuals), was based on the fact that risk is often correlated to use. If rare species are present on only a few occasions, that suggests they do not use the site heavily and are unlikely to be at risk. Additionally, the level of risk to rare species from wind turbines is low compared to the level of risk posed by numerous other man-made structures including, particularly, tall communication towers, other tall structures which are lighted more densely than the wind turbines will be lighted in this circumstance and environmental conditions such as the presence of feral cats.

(p. 66) Section 4.11.3.7 paragraph below the bullet-points: Suggest adding the following:

DNR provided substantial input and guidance into the design of Forward's 2005 spring and summer survey and is deemed adequate to address use of project area by rare birds.

(p. 73) Section 4.11.4.2, last paragraph: Suggest adding the following:

Forward's 2005 spring and summer study is designed with survey points along transects out to 12 km from the Marsh which will help further address the relationship with different species and the distance from the Marsh.

(p. 76) Section 4.11.4.3.3 bottom paragraph:

Comment: Flight heights will be estimated in Forward's 2005 Study that correlate to under the blade swept area, blade swept area and above blade swept area.

(p. 77) Section 4.11.4.4.1

Comment: The first paragraph refers to "the tendency for migrating raptors to be 'drifted,' by westerly winds, east from the Mississippi valley to the Lake Michigan shoreline, where some raptors continue along the shore rather than attempt crossing the Lake." The statement, which is attributed to the curator of the Richter Museum at the University of Wisconsin, is: not based on empirical data; speculative; and, in some respects of doubtful logic. The latter because the proponent of this concept is saying the raptors allow themselves to be blown off course until they reach the shore of Lake Michigan when they suddenly become able to fend off the force of the westerly winds and fly virtually straight north thereafter.

The Forward study is not evidence for this wind drift phenomenon. Most of the hawks sighted were not actively migrating, contrary to the assertion of the DEIS.

Reference in this paragraph to broad-winged hawks and numbers such as 35,000 versus 500 depending on climactic conditions are irrelevant to the project area, including because there is no evidence of collisions by that species with communication towers, much less with wind turbines or that "drifted" hawks would cross or forage in the project area in numbers of any consequence.

Some raptors and other migrants may soar on the updrafts created by the Escarpment. However, there is no documentation that this is an important migration route for these species, despite decades of observations by the biologists at the adjacent federal and state refuges. Furthermore, the Escarpment is relatively low, broken and not very distinct. Ridges of this size and condition have not been shown to concentrate large numbers of migrants, as might be the case in the Appalachians or the Rockies. In addition, if small migrations of raptors do occur along the Escarpment, the impact of the project's wind turbines is unlikely to be significant because the closest turbines will be more than a mile from the Escarpment.

(p. 78) Section 4.11.4.4.2, paragraph below Table 4-11, second sentence: Suggest adding the following:

Despite the Foote Creek Rim site recording these observations of raptors on an hourly basis, fatalities were extremely low as only four raptors were killed during three years at the 69-100 turbine wind farm site.

(pp. 78-79) Section 4.11.4.4.1, carryover paragraph, second to last sentence: Suggest adding the following:

Nonetheless, recorded raptor fatalities at the Foote Creek Rim site in Wyoming, for example, were about 4 raptors total in three years, involving 69-100 turbines. Likewise, no raptors have been killed at the Kewaunee site despite the higher proportion of raptors than other birds being found at the rotor swept heights.

(p. 79) Section 4.11.4.4.2, last paragraph: Suggest the following changes:

The timing of the Forward study coincided with the peak periods [April and October-November] for most raptor species migrating through Wisconsin, except for Broad-winged hawks. To the extent ~~Additionally,~~ the Forward study may not have been timed to fully characterize raptor migration ~~and use which means that~~, flight risks for raptors may be more or less than those calculated by Forward.

(p. 79) Section 4.11.4.4.3, second paragraph, as second and third paragraphs: Suggest adding the following:

The Howe study at the Wisconsin site showed no raptor fatalities; the Johnson, et al. paper published in the Wildlife Society Bulletin showed that in four (4) years at the Buffalo Ridge site (Minnesota) only one (1) raptor fatality occurred. In addition no raptor fatalities were observed at the Top of Iowa wind project in the two (2) years of the study, 2003 and 2004. Assuming that it is a valid analysis to average the non-Midwest numbers with the Midwest numbers, this totals fewer than 13 raptors per year at a wind farm with 133 turbines.

Comment: There are no Midwestern wind projects where raptor fatalities have been found to be great. It is not correct to associate Forward with non-Midwestern wind projects where raptor fatality may be higher due to different technology or raptor use of the project area. For example, at the Kewaunee site, zero raptor fatalities have been found.

(p. 82) Section 4.11.4.5.2, last paragraph: Suggest the following changes:

~~Apart from bird fatalities, t~~The displacement of passerines and other small birds from this area is not significant for common birds, ~~but could become~~and, considering the area of the project as tilled, agricultural land use, not likely to be significant for rare species ~~in a cumulative context,~~ even taking into account ~~all of~~ the cumulative effects of all existing wind farms ~~proposed~~ and other existing land ~~use changes~~ uses in the region.

Comment: The last paragraph refers to "displacement of passerines and other small birds from this area" and states that "[displacement] could become significant for rare species in a cumulative context …." The paragraph (or any preceding text) did not identify these rare species that are likely to be presented in the tilled farmland, which comprises approximately 97% of the project area. The paragraph also introduces the erroneous concept that an EIS should analyze the cumulative effects of "all of the wind farms proposed …." The PSC rule (§ PSC 4.30(3)(c)1.) which defines the content of an EIS limits the analysis of effects to "the project's direct, indirect and cumulative effects." (This concern is discussed further in our comment on ch. 7 of the DEIS.)

(p. 83) Section 4.11.4.6.1:

Comment: The DNR suggested and Forward agreed to not specifically enumerate Canada Geese in the 2005 study in order to concentrate on other species because Canada Geese are not known to be susceptible to fatalities by wind turbines and such fatalities would not be expected to be biologically significant. Koford et al. from Top of Iowa (2005 report for first two years after construction of that plant) found no displacement impacts to foraging geese.

(p. 82-85) Waterfowl and Shorebird Sections:

Comment: There is mention of height of flight of waterbirds with respect to turbine height, but an accompanying review of fatality literature is absent. Discussion of flight height without a review of fatalities from the accompanying literature is incomplete. There is virtually no mention regarding collision fatalities. This is needed, partly for completeness and partly to show that these bird species have never been shown to be highly susceptible to colliding with wind turbines or other vertical structures such as communication towers.

(p. 86) Section 4.11.4.6.4, second to last sentence: Suggest the following changes:

~~This is a concern because s~~Sandhill cranes are relatively weak flyers compared to ducks and geese and may be more vulnerable to strikes with the turbines than waterfowl, due to their flight habits.

Comment: The second full sentence in the carry over paragraph misrepresents what was said in the Forward avian reports: the initial report did not state that the abundance of Sandhill Cranes was similar to other studies.

(p. 86) Section 4.11.4.6.5, third paragraph: Suggesting adding the following:

Fatalities of shorebirds at wind turbine farms are very low.

Comment: No mention is made of fatalities of shorebirds at wind power sites. Fatalities of such are very low.

(p. 87) Section 4.11.4.6.6:

Comment: The reference to Tulp, et al. in the topic sentence of the last paragraph seems inappropriate in this context because that study related to waterfowl at turbines over an ocean.

(p. 89) Section 4.11.4.8, last paragraph, topic sentence: Suggest the following changes:

Forward concludes that, with the exception of waterfowl, use by all other bird groups is low~~ or insignificant~~.

Comment: The topic sentence of the last paragraph on this page incorrectly attributes a conclusion to the Forward study, namely, insignificant use by nonwaterfowl birds.

(p. 90) Section 4.11.4.8, first full paragraph, after third sentence: Suggest adding the following:

The Impact Gradient (IG) methodology may be substituted for the BACI design and has advantages over the BACI design. Most importantly, the IG is more accurate and quantitative with respect to determining the areas of impact. The impacts can also be measured over distances, unlike for BACI designs. IG studies are mentioned in Anderson et al. 1999 and are routinely used by researchers in a variety of situations. This methodology was used by Leddy et al. (1999) for grassland bird impacts in Minnesota at a wind power site and by Larsen and Madsen (2000) to study waterfowl impacts at wind turbines in Denmark. Both studies are published in reviewed journals.

Comment: A BACI study on a wind power facility has not been published in a reviewed journal. The USFWS guidance document on BACI will be reviewed and revised in July 2005, following two years of comments. That document did not receive peer review outside of the Service.

(p. 91) Section 4.11.5.1: Suggest adding the following:

<u>Some species when displaced may habituate to the new conditions. For example, many bird species readily habituate to tall structures while others, including their subsequent generations, may not. Most studies have focused on 1 or 2 years following construction when displacement is likely to be at its maximum.</u>

(p. 92) Section 4.11.5.1, first bullet, after first sentence: Suggest adding the following::

<u>There is no evidence that flashing red lights like those on widely spaced wind turbines attract birds or bats. There is some evidence that this lighting does not.</u>

(p. 92) Tables 4-13 and 4-14, as concluding sentence to both: Suggest adding the following:

<u>These numbers represent totals for all avian fatalities.</u>

<u>Comments</u>: If presented on a species basis the fatality numbers would provide the reader with more clarity on whether larger numbers of individuals of a given species are more likely to be killed and whether the numbers are significant.

(p. 93) Section 4.11.5.2.1

Comment: The second paragraph of the "Buffalo Ridge Wind Farm Study" refers to rare species but fails to state examples of rare species that were observed and killed in Minnesota. Likewise, although the presence of Golden Eagles at the Foote Creek Rim site in Wyoming is mentioned, the reader is not advised that no Golden Eagle fatalities occurred. This information is necessary for the reader to not conclude fatalities occurred.

(p. 93-94) Section 4.11.5.2.1, carryover paragraph, second to last sentence:

Comment: The inference of this sentence is that most fatalities were nocturnal migrants. Johnson et al. (2002) provides a list of those fatalities, so night migrants can be sorted out. There was also a radar study at that site that showed millions of migrants flew over the site – many more than during daytime. However, the numbers of fatalities were small, which the DEIS should mention.

(p. 94) Section 4.11.5.2.2, second paragraph, first sentence: Suggest adding the following:

After 2 years, the rate of birds killed per turbine per year is approximately 1.5. The second year progress report shows very low numbers of birds killed. No waterfowl, raptors, shorebirds, or cranes were among the birds killed. Similar results were found at other Midwestern wind plants. The results from plant to plant in the Midwest is consistent.

Comment: The first line of the second paragraph of the "Top of Iowa Study" inaccurately gives "10.79 birds per wind turbine" as a study finding.

(p. 95) Section 4.11.5.2.3:

Comment: The High Winds site is located immediately adjacent to one of the largest waterfowl areas in the western United States. Waterfowl come and go regularly, as do other waterbirds and shorebirds. Turbines are set on hills overlooking the marsh and Sacramento River, yet fatalities of the millions of waterbirds that come and go are inconsequential. There is no exact duplicate site, but the presence of a major waterfowl area near a wind farm and the resulting low mortality should be considered when reviewing against other sites.

(p. 96) Section 4.11.6 first paragraph:

Comment: The Draft EIS concludes from review of avian studies the following….. "However, estimating collision risk is very difficult, in part because of the low number of fatalities." We agree, fatalities are low across wind farms in the U.S. and argue that the zero air and water emissions from wind farms compared to fossil plants help balance the environmental impact from the fatalities that do occur. Nonetheless, Forward is committed to a more in-depth study in 2005 (already begun) including a more detailed survey for rare birds and raptors, in addition to the general study for determining a distance relationship from the Marsh.

(p. 96) Section 4.11.6:

Comment: The number 10 in the topic sentence of the first paragraph is very likely an error. Forward has not seen any wind farm in this country reporting these numbers. We recommend review of original reports, not secondary materials, to verify the number.

(p. 97) Section 4.11.6, third paragraph, last sentence: Suggest the following changes:

~~Based on limited data regarding distance relationships from another study and incomplete data from its own surveys, Forward concluded that operating wind turbines at 1.2 miles from Horicon Marsh would have minimal impacts on avian species.~~

Comment: The independent clause in the last sentence of the third paragraph on this page is incorrect

(p. 97 and 98) Section 4.11.6: General comments:

Comment 1: The studies cited by the DEIS and those that were not cited, do address "single events that may result in large-scale mortality" despite the DEIS stating that they did not. Despite dozens of studies, not a single, large-scale fatality event has been demonstrated at a wind turbine site, with the exception of the West Virginia incident in which turbines were illuminated with sodium vapor lamps. Once those lamps were turned off, another event did not occur, despite fog and light rain during the migration season. The DEIS does not recognize that such events also do not occur at communication towers less than 500 feet in height and having no guy wires, which is significant to the issue at wind turbine sites because it shows that for large-scale events to occur, a taller tower is needed (and a tower with guy wires is needed). To affect such an event at a shorter tower or wind turbine, bright illumination is needed (not normal FAA lighting for turbines).

Comment 2: It is incorrect to state that the studies done do not "address the susceptibility of rare bird species to collisions with wind turbines" because these same species fly over wind turbines in Minnesota, Wisconsin, and Iowa, in addition to many other wind turbines in the United States. These birds are not unique to the Forward site, but are broadly dispersed throughout much of the midwestern and eastern United States. Many of these birds are not rare in other states, yet they are not killed by turbines in places where they are much more numerous.

Comment 3: The concerns expressed in the DEIS about large-scale fatality events is not based on science, but on a yet to be documented event that has been expected for many years. Studies done at wind plants simply do not provide evidence that this concern is justified.

CHAPTER 5

(p. 117) Section 5.1, second paragraph, first sentence: Suggest the following changes:

The area proposed for the project is mostly farmed (97% of land in the project area is farmland). There are, as discussed in Section 5.2, a growing number of exurban housing developments, unrelated to farming, in the area~~ as well~~.

(p. 118) Section 5.2.1, first paragraph after Table 5-1: Suggest the following changes:

As indicated in Table 5-1, the demographics of the communities in the proposed Forward project area show a mostly white population, with a generally higher rate of employment and annual income than in the state, ~~or~~ nation, or county. The value of owner-occupied homes in the project area is ~~similar~~ above~~to~~ the average value in Wisconsin, ~~and~~ the U.S., and the county.

(p. 118) Section 5.2.1, last paragraph, final sentence: Suggest the following changes:

Thus, it ~~appears that~~is apparent the proposed project would not disproportionately or unfairly affect residents of minority races or low incomes.

(p. 119) Section 5.2.2, first two sentences of paragraph: Suggest the following changes:

There have been changes in the area population since the year 2000, but ~~it does not appear that~~ the changes are <u>not</u> substantial. While the vast majority of the land in the project area of the proposed project is farm land <u>(97%)</u>, there is a growing community of non-farm rural homes on smaller parcels of land.

(p. 119) Section 5.2.3, last three sentences: Suggest the following changes:

Placing turbines on farm land so as to interfere as little as possible with the farm operations ~~has been a subject of easement negotiations~~ <u>is addressed in the easement agreement by allowing the host to approve all final locations</u>. The easements are for <u>25</u>~~30~~ years, with options to extend them for another <u>10</u>~~20~~ years. The annual compensation for hosting the turbines, provided for in the easement agreements, could mean an increase in farm profitability that allows the land to remain in farming<u>, which is consistent with the future land use goals of the counties described in Section 5.4.4.</u>

(p.120) Section 5.3.2:

<u>Comment</u>: In reference to the January 6, 2005 letter from Village of Brownsville President, Forward has worked with the Village to address every concern mentioned in the letter and is continuing to work closely with the Village.

(p 121) Section 5.3.2, second paragraph, last sentence: Suggest the following changes:

Forward has indicated that it is not planning to route an access road across this DNR land~~ but is instead negotiating~~ and negotiated a different route across private property through an easement agreement for an access road that would approach Turbine 3 from the Turbine 5 site to the east.

(p. 122) Section 5.3.3, last paragraph, second sentence: Suggest the following changes:

Depending on one’s point of view, i~~I~~t may or may not interfere with the enjoyment of natural landscapes and wildlife.

(p. 122) Section 5.3.4, first paragraph, second and third sentences: Suggest the following changes:

There are ~~several~~ six public use airports ~~surrounding~~ located outside the project area (within 20 miles).~~.~~ The nearest is the Fond du Lac County Airport (FDL), seven miles to the North.

(p. 123) Section 5.3.4, first paragraph, first sentence: Suggest the following changes:

There are also ~~several~~ five existing private ~~airports~~ airstrips operating in the project area and one private airstrip located ~~or very~~ near the project area.

(p. 123) Section 5.3.4.1, first paragraph, second sentence: Suggest the following changes:

The turbines proposed for the Forward project have a maximum height of between 389 feet and 398 feet depending on blade size, exceeding the FAA ~~standard~~ notice threshold of 200 feet.

(p. 123) Section 5.3.4.1, second paragraph, first two sentences: Suggest the following changes:

The FAA recently drafted a new set of recommendations for lighting wind farms that ~~could~~ will require fewer lights than needed under its current policy. The new lighting recommendations would ~~likely~~ reduce the visibility of wind farms at night for those living in the surrounding areas.

(p. 123) Section 5.3.4.1, second full paragraph, after final sentence: Suggest the following changes:

The applicant has agreed to seek minimal lighting proposed by the new FAA standards for wind farms, including lights 1/2 mile apart around the perimeter of the wind farm.

(p. 124) Section 5.3.4.2, last paragraph, second to last sentence: Suggest the following changes:

The turbine towers proposed for the northern-most edge of the project would be the closest ones to the Fond du Lac County Airport and the most likely to exceed the thresholds, but does not.

(p. 125) Section 5.3.4.3, Table 5-6:

Comment: Mr. W. Baier's airstrip is completely located outside the Forward project area. The only potential effect is if the public airport rules under FAA Part 77 were applied which is contrary to law. Therefore, reference to his airstrip should only indicate that it is close to the project area, but not within the project area and further that the recommendation by BOA of an approximate 2000 foot clearance from a runway's traffic pattern be provided is also entirely outside the project area (see comment on next page regarding BOA recommendation).

(p. 125) Section 5.3.4.3, Private Airstrips, second full paragraph below Table 5.6: Suggest the following addition:

Two of the runways are used for emergencies during the EAA fly-in which occurs only once per year for a 2 week period in August.

Comment: The phrase "… those runways have been stable and in place long enough that the EAA uses them regularly as emergency runways," may be misleading in that it suggests all of the airstrips have been in place for a long time and are regularly used by the EAA for emergencies. The addition will provide clarification with respect to the former.

Forward questions whether the Wunsch airstrip has actually been "established and used" given that as of 2 months ago Mr. Wunsch did not yet own an airplane, and there had been snow cover on his property from at least January 2005 until the DEIS was issued, which likely would preclude establishing or landing on a grass airstrip.

(p. 125) Section 5.3.4.3, third paragraph below Table 5-6: Suggest the following changes:

If they prove not to provide the safety needed, ~~he~~ R. Baier has determined that users of ~~the~~ his airstrip might be limited to calm days.

Comment: The Mr. Baier being referred to is Mr. R. Baier, not Mr. W. Baier.

(p. 125) Section 5.3.4.3, bottom paragraph, first sentence: Suggest the following changes:

Several local airstrip owners and users, including the chief pilot for Quad Graphics and a local aerial pesticide applicator, have indicated strongly that they would prefer that the airstrip clearances be similar to those required for public airports under ~~FAA Part 77~~ 40 C.F.R. § 77.25.

Comment: The clearances that were previously referenced and that are described in figure Vol. 2-21 which includes the "visual approach" specified in 40 C.F.R.

§ 77.25 are not "requirements" for private airstrips. Likewise, Wisconsin towns and counties are not able to impose protection privileges on behalf of private airstrips without exercising their power of eminent domain. The DEIS fails to identify the cost to the host property owners if they are precluded from leasing their property for wind turbines by operation of §§ 60.61(2)(f) and 59.69(4)(g), Wis. Stats.

(p. 126) Section 5.3.4.3:

Comment: Dodge County, Fond du Lac County and the Towns of Leroy, Lomira, Byron and Oakfield have not initiated procedures to develop ordinances to protect privately owned airstrips. Therefore, the reference to the Dane County ordinance is not relevant. In fact, Dodge County has developed and is continuing to amend their existing Ordinance regarding Wind Energy Systems as described in Section 5.4.2, thereby allowing landowners the ability to use their airspace above their property and work with wind developers.

(pp. 128-29) We suggest all of the text of section 5.3.4.3 regarding the application of part 77 clearances to turbines near airstrips be stricken, except for the final two paragraphs. (See proposed amendment to p. xx of Executive Summary.)

(p. 129) Section 5.3.4.3, top of the page:

Comment: It is stated that BOA recommends that as a rule of thumb a turbine be located 2,000 feet away from the runway's traffic pattern (equivalent to 6-8 rotor diameters as discussed in Section 4.5.5). Forward is actively working with each individual airstrip owner to optimally place turbines away from such traffic patterns per this recommendation. On page 125 (last paragraph) it is referenced that BOA staff agrees that imposing FAA Part 77 clearances would be safer. It should be clear that their recommendation is 6 to 8 rotor diameters away from traffic patterns, not recommending FAA Part 77 be imposed. The latter requirement would impede private airstrip owners and surrounding landowners from utilizing their airspace rights to garner revenue from wind energy.

(p. 129) Section 5.3.4.3, last paragraph, first sentence: Suggest the following changes:

~~A different level of impact would arise from the installation of ~~T~~t~~he proposed overhead 34.5 kV collection line that would run east-west along CTH Y would not impact any airstrip under any existing regulations.

(p. 130) Section 5.3.5, first paragraph after Table 5-9, last sentence: Suggest the following changes:

~~It does not appear likely that t~~The proposed turbines would not have direct adverse impacts on any of the schools or daycares listed in **Table 5-9**.

(p.131) Section 5.3.5, first and second bullet points and following paragraph:

Suggest following changes:

1. The Dodge County Board approves, in mid-~~March~~ April 2005, a change to the Dodge County ordinance regulating wind power sites.
2. Certain property owners agree to turbines being located closer than the ~~1,166- foot~~3x turbine height setback requirement from their occupied structures.

(p. 131) Section 5.3.5, last paragraph: Suggest the following changes:

A look at Figures Vol 2-2A and Vol 2-2B reveals about ~~45~~ 16-22 turbine sites that might be within ~~1,000 feet~~the 3x turbine height setback requirement of a non-participating home. It is difficult to discern on the maps whether the residence is the home of a landowner who has agreed to host a turbine or an adjacent landowner. Forward is working with participating landowners to optimize the turbine site location to meet setback requirements, plus reduce crop damage and maximize use of existing farm roads for access. The current ordinance in Dodge County also requires the turbines to be set back from property lines a distance equal to their heights~~ (388.7 feet)~~.

(p. 131) Section 5.4, end of first paragraph: Suggest the following additions:

Wis. Stat. § 66.040(1) places further limitations on the authority of local bodies, such as counties and towns, to restrict the installation or use of a wind energy system. Section 66.040(1) states in relevant part as follows:

> (1) Authority to restrict systems limited. No county, city, town, or village may place any restriction, either directly or in effect, on the installation or use of a … wind energy system … unless the restriction satisfies one of the following conditions:
>
> (a) Serves to preserve or protect the public health or safety.
>
> (b) Does not significantly increase the cost of the system or significantly decrease its efficiency.
>
> (c) Allows for an alternative system of comparable cost and efficiency.

Despite this provision and as noted in Section 1.4.5.1, Forward submitted an application to Dodge County for a conditional use permit, held open community meetings and met with local landowners in the Towns of Leroy, Lomira, Byron and Oakfield and in the Village of Brownsville.

(p. 132) Section 5.4.1, third paragraph, second sentence: Suggest the following changes:

Section 4.11.3(C)(2) of the Dodge County ordinance states that turbines must be located at least a distance equaling three times the turbine height ~~(in this case, 1,166.1 feet)~~ from any occupied structure.

(p. 132) Section 5.4.1, fourth paragraph, after last sentence: Suggest the following addition:

Forward submitted an application on February 24, 2005 for a Conditional Use Permit with Dodge County and a public meeting is schedule for April 11, 2005.

(p. 133) The last sentence of the "NOTE" should reference April 19, 2005, rather than ~~"March 15, 2005."~~

(p. 134) Section 5.4.4.1, first sentence: Suggest the following changes:

Of the roughly 32,400 acres in the Forward project area, about 11,000 acres (about 34 percent of the ~~32,000~~ 32,400 acres) have been dedicated to turbine easements with over 60 landowners.

(p. 135) Section 5.4.4.1, second complete paragraph, last sentence: Suggest the following changes:

Increased farm profitability could increase the likelihood that the farms in the area would be able to continue operating into the future, reducing the rate of the farmland losses in this state and helping to meet the farmland preservation goals described in Section 5.4.3 "Land Use Plans".

(p.135) Section 5.4.4.2, second paragraph, last sentence: Suggest the following changes:

Spot zoning would not be desirable, but such zoning changes would not be needed for the Forward project and the Forward project will help meet the farmland preservation goals described in Section 5.4.3 "Land Use Plans".

(p. 135) Section 5.4.4.2, third paragraph:

Comment: This paragraph does not deal with land use and the turbines are not located near the edge of the Escarpment, therefore suggest deleting entire paragraph.

(p. 136) Section 5.4.4.3, after the bullet points: Suggest the following addition:

As noted in Section 5.4, the validity of the above suggested requirements is subject to the conditions of Wis. Stat. § 66.0401(1). Nonetheless, Forward has been and is continuing to meet with the Village of Brownsville to address the concerns mentioned in this section.

(p. 137) Section 5.5.2, third bullet point: Suggest the following changes:

- Increased farm income or profitability for local farmers due to payments made by the company for placing and operating turbines on farm lands;

(p. 140) Section 5.5.2.6, second paragraph, last sentence: Suggest the following changes:

Of course, growers that are not turbine hosts would not have contracts or be eligible for compensation.

(p. 141) Section 5.6.1, third paragraph, first sentence: Suggest the following changes:

Multiple trips of large construction vehicles as described in Section 5.8 ~~would likely~~ may cause ~~significant~~ damage to the local roads in and around the project area.

Comment: As written, the topic sentence is without basis in fact. Also, this concern is specifically addressed in the proposed Ordinance changes to be voted on by Dodge County in April. An independent engineer will evaluate the roads both before and after construction and Forward will be responsible for making repairs. See Section 5.8.3, third paragraph, detailing this Ordinance amendment.

(p. 141) Section 5.6.2.1, last paragraph: Suggest the following changes:
Forward does not anticipate that the construction or operation of the Forward Energy Center ~~requiring~~ <u>will require</u> any additional emergency personnel (police, fire, ambulance) from either the counties or local communities.

(p. 142) Section 5.6.2.2, third paragraph, last sentence: Suggest the following changes:
These potential unintended consequences of the proposed Forward project ~~would~~ <u>may</u> reduce the amount of recreational dollars spent in the region.
<u>Comment</u>: The claim that a reduction in visitors to Horicon Marsh due to visibility of the turbines is not certain. It should be pointed out that visitors on the eastern edge of the marsh will be looking west, away from the turbines. People on the western edge of the marsh will be a long distance away from the project site and may or may not see the turbines on the horizon. Also, it is very likely that the project could bring additional recreational dollars into the area as families may bring their children to see an active wind farm in operation in addition to seeing the wildlife at the marsh. We Energies holds tours of the two wind turbines located in Byron which brings families into the area who may not have otherwise visited.

(p. 143) Section 5.6.3, paragraph before Table 5-10, second to last sentence:

Suggest the following changes:

Forward's application shows 162 wind turbine sites, ~~even though they propose to construct approximately 133 turbines~~133 turbine sites plus 29 alternate sites.

(P. 145) Section 5.5.4.2 should be titled 5.6.4.2

(p. 145) Section 5.6.4.2, first paragraph:

Comment: The last four sentences of this paragraph provide the reader an impression that this is a predominately residential area. 97% of the land is tilled agricultural and all towns have indicated preserving farmland is an important element of their future land use plans.

(p. 145) Section 5.6.4.2, second paragraph, third sentence: Suggest the following changes:

For these non-agricultural properties, the value of their property is likely related to the aesthetics of living in a rural setting and the project will help preserve agricultural land use.

(p. 146) Section 5.7.2, second paragraph, third sentence: Suggest the following changes:

This means that the decibel levels emitted by two different noise sources cannot simply be arithmetically added together to determine the combined effect of those noise sources.

(p. 146) Section 5.7.2, fourth paragraph, second sentence: Suggest the following changes:

Assuming there are no obstructions between the noise source and receptor, the noise from a single point source decreases by approximately 6 dBA for every doubling of the distance.

(p. 147) Section 5.7.3, first paragraph, fourth sentence: Suggest the following changes:

Chapter 8.5.3 of the Dodge County Land Use Code sets the maximum sound ~~power~~ levels permitted at the property line of the receiving premises. Agricultural counties such as Dodge and Fond du Lac do not typically have the same noise ordinances as residential areas because tractors, grain dryers, and machinery may exceed noise limits in residential areas.

(p. 147), Section 5.7.4, second paragraph, first sentence: Suggest the following changes:

Percentile ~~O~~octave band (Ln) unweighted sound levels were measured, in addition to A-Weighted and C-Weighted decibel levels.

(p. 148) Section 5.7.4, first paragraph, fourth sentence: Suggest the following changes:

The table lists the Leq (equivalent continuous sound level-a measure of average energy ~~representing the steady state noise level~~ during the measurement period) reported in both dBA and dBC, and the L10 and L90 (sound levels exceeded 10 percent and 90 percent of the time during the measurement period) all reported in dBA.

(p. 148) Section 5.7.4, second paragraph, first sentence: Suggest the following changes:

~~Background ambient sound levels, as represented by L90 measurements, appear to be strongly influenced by local traffic, particularly for MP5 and MP6.~~ Ambient sound levels were influenced by traffic, particularly at MP5 and MP6.

(p. 148), Section 5.7.4, second paragraph:

Comment: The first sentence in this paragraph refers to noise levels at MP5 and MP6. The second sentence then indicates the range of background L90 levels reported. However, the second sentence refers to all the measurements, not just those collected at MP5 and MP6. As such, the reader may be confused. We suggest that some segue be added between the sentences, or that the second sentence be re-written as follows:

~~The L90 background noise levels ranged from about 25 to 54 dBA (see Table 5-12).~~ In general, background noise levels for all locations ranged from about 25 to 54 dBA.

(p. 148) Section 5.7.4, second paragraph, second line: Suggest the following changes:

~~The ambient noise levels appear to be somewhat lower towards the western side of the project area.~~ The ambient noise levels appear to be somewhat higher at locations closer to heavily traveled roadways (i.e. Highways 41 and 175).

(p. 149) Section 5.7.5, Table 5-13:

Comment: Suggest adding reference source in the Table 5-13.

(p. 149) Section 5.7.5, second paragraph, second sentence: Suggest the following changes:

This statistical parameter is intended to quantify the sound level that is exceeded 10 percent of the time and is an indication of the near maximum noise levels reached in the ambient environment.

(p. 149) Section 5.7.5, second paragraph, last two sentences:

Comment: This section should indicate that maximum construction noise levels, as listed in the table, are measured at 50 feet, and would not be observed at the residences due to set-back requirements. Instead, the levels in the table need to be adjusted for distance to the receivers (which are at least 950 additional feet away) in most cases.

(p. 150) Footnote 52: Suggest the following changes:

(52) Acoustic modeling software SoundPLAN Version 6.2 was used by Consultants.

(p. 153) Section 5.7.6.2, second paragraph, first sentence: Suggest the following changes:

Even though the sound ~~power~~ levels created by the wind turbines tend to be somewhat higher in the low frequency range, ~~it is also true that~~ the overall sound ~~power~~ levels are relatively low.

(p. 155) Section 5.8.1, second paragraph: Suggest the following changes:

The commercial and industrial truck traffic that exists in the project area is attributable to ~~Because of~~ Quad Graphics in the southeast part of the project area, canning companies to the north and south, the Michels construction company complex in Brownsville, numerous stone and gravel operations, and many farms in the area~~, many of the state, county, and town roads currently carry a substantial amount of truck traffic~~.

(p. 159) Section 5.8.3, end of third paragraph: Suggest the following addition:

This proposal is being submitted as an amendment to the WES Ordinance to the Dodge County Board on April 19, 2005.

(p. 166) Section 5.9.1.3, end of second paragraph: Suggest the following changes:

Any shadow flicker caused by Forward's turbines is at a frequency of 1 Hz or less.

(p. 174) Section 5.10, second paragraph, second sentence: Suggest the following changes:

It also discusses the potential physical changes in the existing visual environment that would result from construction of 133~~5~~ turbines that would be up to approximately 398~~89~~ feet tall and located as shown on the proposed turbine siting map, **Figure Vol. 2-1A and 2-1B**.

(p. 174) Section 5.10, second paragraph, last sentence: Suggest the following changes:

This is because many factors, ~~as well as~~specifically including individual perceptions, would determine how a wind energy facility such as the Forward project was aesthetically viewed.

(p. 175) Section 5.10.2, last sentence: Suggest the following changes:

In addition, the construction activities associated with the wind generation project would temporarily add a new dimension to the rural landscape and temporarily alter the visual environment as ~~more~~ trucks, heavy machinery, and construction workers enter the project area to install ~~over 100~~the turbines in a relatively short time-frame.

(p. 175) Section 5.10.2.1, first sentence: Suggest the following changes:

The number and size of trucks entering, traversing, and leaving the project area would temporarily increase substantially during the construction period.

(p. 177) Section 5.10.4, bottom of page, first and fourth sentences: Suggest the following changes:

In summary, the Forward wind energy project, consisting of approximately 133 turbines that are approximately 389 to 398 feet tall at the blade tip would significantly change the existing visual landscape in southern Fond du Lac County and northern Dodge County.

After dark, a number of the turbines<u>, as determined by the FAA,</u> would likely support red flashing lights that will be visible against the night sky.

CHAPTER 7

(p. 195) Section 7.3.3, last three sentences: Suggest the following changes:

~~For these same reasons, it would be important when siting individual turbines, to provide an adequate buffer around communities within a project area, that would enable them to grow and attract new business.~~ Forward's choice of individual turbine locations appears to be compatible with future growth and attraction of new businesses within those portions of the project area that currently support such uses. ~~It could also be important to identify existing land uses. Such as~~ ~~p~~Private airstrips ~~which may need~~ will be buffered for safety separations up to eight rotor diameters of separation. ~~distances in order to continue to operate safely.~~

Comment: The potential turbine locations are planned and spaced so that future growth within municipal boundaries and in proximity to existing clusters of residential housing will not be impaired. The text of the DEIS suggests otherwise. The issue of protection of private airstrips through buffers of six to eight rotor diameters of separation was previously addressed.

(p. 196) Sections 7.3.4 Aesthetics, and 7.4 Anticipated Impacts On Wildlife. Comment: These sections use Table 7-1 as their information base when analyzing cumulative impacts on visual impacts and rare bird species or their populations. The Table includes several wind projects which are not built and may never be built. The PSC's rule related to the content of an EIS states as follows: "an evaluation of the positive and negative effects on the affected local and regional environments, including the proposed action's direct, indirect and cumulative environmental effects." (Section PSC 4.30(3)(b)1, Wis. Admin. Code; emphasis supplied.) Analyzing the cumulative impacts of a future project on a proposed project goes beyond the rule. As a result, a new table should be prepared for the purposes of discussing these cumulative impacts of the Forward project. The new table should include only those projects currently constructed or those projects for which it is certain that construction will commence prior to the construction of the Forward project, the latter being slated to start construction as early as the late summer of 2005. Table 7.1 in its present form remains appropriate for the analyses in sections 7.1 through 7.3.2.

Comments on the Draft Environmental Impact Statement, submitted by the Forward Energy LLC, Volume II

Invenergy

April 22, 2005

Jim Lepinski
Docket Coordinator
Public Service Commission
P.O. Box 7854
Madison, WI 53707-7854

Re: Forward Wind Energy Center, Docket No. 9300-CE-100

Pursuant to the Commission's letter dated March 21, 2005, Forward Energy LLC submits its comments and suggested changes to the Draft Environmental Impact Statement (Volume II).

Thank you for the opportunity to comment on this matter.

Sincerely,

/s/ Bryan Schueler

Bryan Schueler
Vice President, Project Management

Enc.

BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application of Forward Energy LLC for a Certificate of Public Convenience and Necessity for the Forward Wind Energy	Docket No. 9300-CE-100

COMMENTS AND SUGGESTED CHANGES TO DRAFT ENVIRONMENTAL IMPACT STATEMENT (VOLUME II)

Invenergy LLC
One South Wacker Drive, Suite 2020
Chicago, IL 60606

Contact Person:

Bryan Schueler
Vice President, Project Management
(312) 224-1421 – Telephone
bschueler@invenergyllc.com

April 22, 2005

EXECUTIVE SUMMARY

(p. xvii) Bat Section, first paragraph

Comment: This section begins with a paragraph describing the Neda Mine hibernaculum. This is out of place as the lead off paragraph in this section of the DEIS because the mine is more than 11 miles from nearest proposed turbine and there is no scientific reason for concern.

(p. xvii) Bat Section, second paragraph:

Comment: Rather than state that "bat mortality occurs, sometimes in high numbers," the paragraph could more objectively present the potential risk of bat mortality at other wind projects. Revised narrative should clearly indicate that in the vast majority of cases, wind farms do not cause substantial bat mortality. The cases of "high mortality numbers" are well documented, are limited to only several wind farms, and have occurred in areas with vegetative cover and topography not present in the Forward project area.

(p. xvii) Bat Section, third paragraph:

Comment: As stated in the Executive Summary, there are seven known species of bats in Wisconsin. The seven species in Wisconsin do not include the Indiana bat. As we indicated in Volume 1 of our Comments to the DEIS, all reference to the Indiana Bat potentially living in, near, or migrating through the project area should be removed from the EIS.

(p. xvii) Bat Section, fourth paragraph:

Comment: We believe it very unlikely that "loss of even a few individuals may significantly affect the viability of regional populations." There is no data to suggest that this may occur. This allusion to significant effects to *regional* populations seems to be contradicted later in the same paragraph by a sentence indicating it is not possible, given the best available data, to determine if viability of *local* populations will even be affected. Moreover, the absolute significance of any cumulative effects to migratory populations, or the importance of the effects of wind turbines relative to other sources of mortality, is not well understood. Given the vegetative cover and topography in the Forward project area, the best available data indicate significant mortality at the site will not occur.

CHAPTER 1

(p. 11) Section 1.7 first paragraph, second sentence:

Comment: The two counties are not necessarily approaching the project in different ways; rather they are following their respective approval and permitting processes. Dodge County approaches permitting from the county level. Fond du Lac County does not have county wide zoning and instead handles approvals and permits at the town level.

(p. 11) Section 1.7 second paragraph, the following is an update:

Update: Forward submitted an application for a conditional use permit at the end of February, 2005. The Dodge County Planning and Development Committee, comprised of five Dodge County Board Supervisors, will act on the application. The Planning and Development Committee held a public hearing on April 11, 2005. Approximately 150 people attended the public hearing. Over 50 people elected to speak publicly to the Planning and Development Committee regarding the project. The majority of the speakers spoke in favor of the project. The Planning and Development Committee then asked questions of Forward to address concerns brought forth during the public hearing.

Prior to the public hearing by the Planning and Development Committee, both Dodge County towns within the project area, Town of Leroy and Town of Lomira, held their own individual public hearings on the project on April 6, 2005. The public hearings were held to decide whether the Town Board should recommend to the county to approve the application for a conditional use permit by Forward. Approximately 40 people attended the Town of Lomira public meeting and approximately 95 people attended the Town of Leroy public meeting. All attendees were given the opportunity to speak in favor or against the project. Each Town Board unanimously recommended the approval of Forward's conditional use permit application to Dodge County and provided a resolution to the Planning and Development Committee at the public hearing on April 11, 2005.

In addition, the Dodge County Planning and Development Department staff reviewed the CUP application and provided input to the Planning and Development Committee. The staff report indicates the following: "It is the staff's position that the proposed Forward Energy Project would be in conformance with the considerations listed in Subsection 2.3.6 B) and 4.11.2.b) 1) of the County Land Use Code and the granting of the conditional use permit will not unreasonably interfere with the orderly land use and development plans of the County. It is also the staff's position that the benefits to the general public will exceed the burdens."

As a result, the staff report suggests approval of Forward's conditional use permit with a standard set of conditions which the Planning and Development Committee will discuss, along with the public input received from the public hearing, at its next scheduled meeting on April 25, 2005.

(p. 11) Section 1.7, third paragraph, second sentence: Suggest the following changes:

~~However, the residents of the two towns appear to differ in their viewpoints about the project.~~ "The Town Board of the Town of LeRoy and the Town Board of the Town of Lomira, after holding public hearings, unanimously recommended Dodge County approve Forward's conditional use permit."

(p. 12) Section 1.7 first full paragraph, first sentence, suggest the following change:

Dodge County is also in process… in order to accommodate ~~the Forward~~ wind energy projects utilizing modern technology without requiring a separate process for variances…..

(p. 12) Section 1.7 first full paragraph:

Update: Dodge County has amended the existing Wind Energy System Overlay District portion of its zoning ordinances. The Dodge County Board approved the modifications to the ordinance on April 19, 2005 with a 29-7 vote.

(p. 12) Section 1.7 second full paragraph:

Comment: In reference to the four towns involved with the project working together, we are providing the attached letter from the Office of the Attorney General, Department of Justice, State of Wisconsin. The letter was written to the Chairman of the Town of Byron regarding a municipality's ability to restrict or regulate wind energy systems. As a measure of the town's working together, this letter to the Town of Byron was provided to the both the Town of Leroy and Town of Lomira and both towns read the letter into the record at their individual public hearings regarding Forward's conditional use permit.

CHAPTER 3

(p. 32) Section 3.2.1.3, Project Area Level. We suggest adding the following bullet point:

- Average annual wind speed.

CHAPTER 4

General Comment: Invenergy has committed to perform post-construction studies. Invenergy has been actively working with the PSC and DNR regarding whether pre-construction studies should be undertaken. There is not a consensus between PSC and DNR on what pre-construction studies should address or how they should be implemented. The advisability of conducting pre-construction studies is uncertain given the lack of accepted standard study protocols, the lack of specifically articulated purpose of the studies, the lack of specifically articulated application of study results, the low likelihood of substantial bat mortality given the project habitat, and the project schedule. In light of the fact that the benefit of pre-construction study is uncertain, we believe implementation of post-construction study is where the effort should be focused.

(p. 66) Section 4.11.3.7 last paragraph: We suggest the following changes:

In comments to the PSC, USFWS (Appendix A), stated that the Forward project could pose some level of risk to species listed under the Endangered Species Act (ESA) and the Migratory Bird Treaty Act (MBTA). ~~Both~~Each act~~s~~ prohibits the taking of its listed species. A discussion of the regulatory authority of the state and federal agencies is included in Section 4.11.1.3. ~~Under the federal and state ESA, if a "taking" is reasonably certain to occur, Forward should apply for an incidental take permit from the USFWS and/or an incidental take authorization from the DNR. The federal permit requires the development of a Habitat~~

~~Conservation Plan, among other things. No such permitting process for incidental take exists under the MBTA.~~

Comment: To the extent that the last three sentences of this paragraph seem to suggest that Forward is (or should be) "reasonably certain" that an incidental take may occur based on existing information, Forward disagrees. Any such suggestion is premised on speculation, not certainty, about impacts to the few ESA-listed species observed. In addition, the known degree of enforcement discretion already acknowledged by the DEIS (p. 59) and the federal government's policy of promoting the use of wind energy to generate electric power suggest that neither an incidental take permit nor an HCP would be required.

(p. 101) Section 4.12 first paragraph, second sentence: We suggest the following changes:

The second sentence refers to fatalities at two eastern wind power projects. The reference, if intended to reflect the potential impact of the Forward project on bat mortality is an example of an inappropriate association between conditions in mountainous regions of the eastern United States and the Forward project area. Available data indicate anything higher than minimal mortality has only been observed at two, or perhaps three sites, each of which is located on high elevation, forested, Appalachian ridgelines. This habitat and land type differs significantly from the Forward project site. We request that the second sentence be followed by this:

Bat mortalities per turbine per year at the eastern sites are at least an order of magnitude higher than those observed at midwestern and western locations (See Table 4-16).

(p. 101-102) Section 4.12, carryover paragraph, top of page:

Comment: It should be noted that there are currently no accepted or standard protocols that can accurately or reliably predict risk of mortality to bats. Such a technology has yet to be validated. Mist net surveys can characterize bat species, but is limited by only surveying bats occurring within approximately 30 feet of the ground.

(p. 102) Section 4.12, first full paragraph, second sentence: We suggest the following change:

In Wisconsin there are two bat species of special concern ~~and potentially one federally listed endangered species of bat~~ (see Table 4-15).

Comment: According to several sources, including USFWS, the project area is not within the range of the Indiana Bat.

(p. 102) Section 4.12: We suggest that the first full paragraph on this page be supplemented as follows:

However, with the exception of the species which are specifically listed, Wisconsin law generally does not protect bat species, which may be killed or taken at any time without license by property owners who regard them as a health or safety concern or a nuisance.

(p. 102) Section 4.12.1, First paragraph, first seven sentences: We suggest the following changes:

Seven species of bats are known to occur in Wisconsin~~, and one additional species may be present~~ (Table 4-15). In addition, t~~T~~he State's Natural Heritage Inventory (NHI) and the USFWS identify one historical record for the Indiana bat, a federal endangered species and state species of special concern. This o~~O~~ne individual was observed in 1954 in the southwestern part of the state. A recent report of Indiana bats near this location is currently being ~~verified~~ evaluated by the DNR. Documentation however, shows that the project area is not within the known range of the Indiana bat. In addition, 97 percent of the project area is actively farmed, with some fencerow trees and small forested areas scattered throughout the area. With less than 5% forested cover, the project area provides no habitat value for the species (Rommé et al. 1995).

As such it is exceedingly un~~not~~likely that Indiana bats are present in the project area. ~~However, it should be noted that bat identification in the field is difficult and that comprehensive bat surveys have not been conducted across the state or specifically in the project area.~~ The closest concentration of cave dwelling bat species to the project area is the regionally important Neda Mine (Neda), ~~which is~~

an abandoned iron ore mine~~,~~ located approximately 11~~0~~ miles south of the nearest proposed wind turbine (Turbine No. #131) ~~project area~~ (Figure 4-9).

(p. 102) **Table 4-15 - Bat species found in Wisconsin:** We suggest the removal of the Indiana Bat from the Table per the underscored language under the previously suggested change.

Comment: The FEIS should include a clear statement indicating that no federally or state-listed species of bats are known to occur in Dodge or Fond du Lac counties.

(p. 103) Section 4.12.2, first paragraph, second sentence: We suggest the following changes:

Bat abundance in the project area may be greater than in other areas of East Central Wisconsin because of its proximity to Neda~~, Horicon Marsh and Theresa Marsh~~.

Comment: The EIS states bat abundance in the project area may be "greater than in other areas of East Central Wisconsin." Review of Figure 4-9 reveals bats traveling from the Neda mine to either the Horicon wetland or the Theresa wetland would be unlikely to cross the project area, and bats traveling from one wetland to the other would be likely to cross at most, only a small portion of the project area.

(p.103) Section 4.12.2 first paragraph, third sentence: We suggest the following change:

….and 11~~0~~ miles north of the Neda Mine.

(p. 103) Section 4.12.2 Second paragraph:

Comment: The eastern pipistrelles in Wisconsin are probably not numerous because they are near the western edge of their range. There is no evidence that this species is threatened or declining, only that, like any other animal at the edge of its range, it is less numerous than at the core of its range.

(p. 105) Section 4.12.2, first paragraph, first sentence: We suggest the following change:

The presence of Neda and nearby large wetland areas suggest that bat use (foraging, roosting, etc.) dispersal and migration through the area ~~(including the proposed project area) would~~may be higher than in other areas of similar land use patterns and vegetation in southeastern Wisconsin.

Comment: The sentence, without the proposed amendments, presents speculation as fact. We believe the near absence of forest cover in the project area, and the effect that absence has on overall habitat quality for bats, and therefore the number of bats likely to utilize the area for foraging or roosting, is substantially overstated in the EIS.

(p. 105) Section 4.12.2 first paragraph, second to last sentence:

Comment: The EIS states the project area may be an “important travel zone between the hibernaculum and the two large wetlands.” Review of Figure 4-9 reveals bats traveling from the Neda mine to either the Horicon wetland or the Theresa wetland would be unlikely to cross the project area, and bats traveling from one wetland to the other would be likely to cross, at most, only a small portion of the project area.

(p. 105) Section 4.12.2, first paragraph, last sentence:

Comment: The statement that the “Niagara escarpment may be an important migration corridor for three tree bat species” is not substantiated. If bats do migrate along the escarpment they are unlikely to be affected by the Forward project as the escarpment is more than a mile from the nearest proposed turbine locations. The EIS should provide additional explanation regarding the proximity of the Niagara Escarpment to the proposed turbines, and of the term “migration corridor” as it is related to bats.

(p. 105) Section 4.12.2, second paragraph, first half:

Comment: Research from Minnesota’s Buffalo Ridge and elsewhere do not demonstrated large risk to bats foraging over farm fields (see page 110 of the DEIS). Anabat studies from Minnesota show a great deal of bat foraging activity over open fields with few fatalities (see Johnson et al. reports). As mentioned before, high bat mortality has occurred only in a very small, unique, and consistent subset of wind farm locations (forested Appalachian ridge tops).

(p. 105) Section 4.12.2, second paragraph, second half:

Comment: The reference to data generated by McCracken (1996) pertains to Mexican free-tailed bats (*Tadarida brasiliensis*). We believe this reference is out of place in this EIS. Mexican free-tailed bats are known for particularly high altitude flight, and the species does not occur in the Midwestern United States. It creates confusion for those readers not familiar with the geographical range occupied by this bat species and is not relevant to Wisconsin or the project area.

(p. 105) Section 4.12.2, third paragraph:

Comment: The EIS should define or delete the word "large" from the statement "Large numbers of these bat species are more likely to be present during…migrations." The authors may have intended to use the word "larger" (relative to summer populations of these species in the project area).

(p. 105) Section 4.12.2.1 second paragraph, and (p. 106) first paragraph we suggest the following change:

Comment and suggested change: The DEIS states: "The directions of greatest spring bat migration are to the north, northeast, southeast, and south Redell (2005)." This narrative is very misleading. Data in Redell (2005) would be most accurately represented by the following sentences and should replace the current sentence: "<u>The directions of greatest spring bat migration from the Neda mine, in order from greatest to least percentage of bat detections near the mine, are south (36%), northeast (17%), southeast (15%), and north (14%). If bats exited the mine in random directions, 12.5% of detections would be expected in each of the eight directions monitored. Less than 12.5% of detections occurred west, southwest, east, or northwest of the mine. The Forward project area lies only within the direction "north" as described in Redell (2005).</u>"

The way the DEIS is written leads the reader to believe that the majority of the bats leave the mine and head to the project area, when in fact the number of bats that travel north approximates what would be expected if bats dispersed in random directions.

(p. 107) Section 4.12.3.3 first paragraph:

<u>Comment</u>: Other sources of mortality exist, but have not been cited (e.g., acute and or chronic effects of environmental toxicants, disturbance of congregated hibernating bats, collisions with buildings [see Timm, 1989], predators). We know of no data that quantify the relative contributions of the many mortality sources, or relate these causes to regional, or range-wide population-level effects.

(p. 108) Section 4.12.4:

<u>Comment</u>: We believe it highly unlikely that soil compaction will indirectly affect bats in the area. Considering the relatively high amount of off-road traffic associated with agriculture in the area, the small amount of soil compaction caused by the construction of the project will present an immeasurably small change from background conditions.

(p. 108) Section 4.12.5.1 Table 4-16:

<u>Comment</u>: The data described in Table 4-16 summarizes bat mortality data from three wind projects in the Midwest at Buffalo Ridge, Minnesota; Lincoln, Wisconsin; and Top of Iowa, Iowa. These facilities occur in topography and vegetation cover generally similar to the Forward project site, and provide what we believe to be results most applicable to the Forward site. These data appear to receive less than adequate attention in the DEIS. Rather the DEIS mistakenly focuses upon the potential for mortality as high as that experienced at three wind projects on forested Appalachian ridge tops.

<u>Additional Comment</u>: The mean number of bats killed for the East is not inclusive of sites away from mountainous forested ridges. Very few bats die at wind projects away from the ridges. Ed Arnette of BCI has used dogs to search at sites in farmland within a few miles of the ridges, without finding more than a very small number of dead bats. Studies at that same site (Green Mountain Wind Farm) and other sites in the northeastern United States have failed to reveal large

numbers of bat fatalities (New York, Vermont, and Pennsylvania). These studies were done to determine if large numbers of birds and bats were being killed, but failed to document anything like the numbers reported from forested Appalachian ridge tops. The number provided in the Table exaggerates the numbers of bat fatalities at wind plants in the eastern United States.

(p. 109) Section 4.12.5.1, second full paragraph: Correction as follows:
Change “Meyersville” to “Meyersdale.”

(p. 109) Section 4.12.5.1, General Comment on Study Review:
Comment: This review is selective and does not adequately cover all studies done. Citing newspaper articles rather than the original reports is selecting sensationalism over scientific method. Although the authors state that “adjusted numbers per turbine have not been published” the fact is that Kerns and Kerlinger (2004) is readily available on the web or from the authors.

(p. 110) Section 4.12.5.1 carryover paragraph from p. 109:
Comment: The authors state that “many of these studies did not use current, more accurate detection technologies” but do not state what those technologies might be. Clearly the authors can not be implying these “current, more accurate detection technologies” more precisely predict risk of mortality. There is large-

scale disagreement regarding which methods can be used to predict risk, if any can.

(p. 110) Section 4.12.5.2: Comment on entire section:

<u>Comment</u>: The DEIS states that “rough estimates of bat mortality” are available from the Kewaunee County turbines in WI, and attribute a number to Erickson et al. (2003). Howe et al. (2002) reports the same thing in the original document. There seems to be criticism of the Howe et al. study with respect to size of the area searched, without providing any details. In fact, the authors of Howe et al. did show (see Figure 39, page 65 of Howe et al. [2002]) that they adjusted for the size of the area they searched when they made final calculations regarding the total number of bats killed (see page 68 of Howe report). In other words, the authors of the Howe et al. report extrapolated upwards from the numbers they found and included the numbers of carcasses likely present beyond the boundary of their search area. They quantitatively estimated that number by conducting transects going away from the turbines.

The DEIS fails to state the important point from the study, and the following sentence should be added to this section: <u>The mortality at the Kewaunee project, in similar habitat to Forward, was low when compared to the three Allegheny ridge top projects.</u>

(p. 111) Section 4.12.5.3, first paragraph:

Comment: The DEIS incorrectly states that the only way to determine accurately if bats are displaced from an area is to measure use prior to construction. The FEIS should note that Impact Gradient methodologies can be used in which the amount of displacement is measured along a transect going away from a turbine. This is standard for bird displacement studies in both the United States and Europe. BACI study designs often have problems finding adequate controls or reference sites. The IG methodology is superior because it provides quantitative assessments of the amount of area impacted instead of a rough measure as is the case with BACI designs.

(p. 111) Section 4.12.5.3 fifth paragraph, suggested addition:

Comment: From an academic perspective, additional data describing species behavior, local and regional populations, movement patterns, and other aspects of their biology are always desirable. In practice, this information is often unavailable for numerous species with potential to be affected by a wide variety of developments.

Therefore, the following sentence should be added to the Final EIS: The lack of data to support precise, quantitative estimates of impacts, especially impacts to species not protected by law, is not uncommon in federal or state-level NEPA analyses.

(p. 112) Section 4.12.5.3 fourth bullet point:

Comment: Whereas bats do have a low reproductive rate, they are long-lived and reproduce many times. Also, some bats produce 2 (sometimes 3) young per year.

(p. 112) Section 4.12.5.3 fifth bullet point:

Comment: Mortality at wind farms mostly involves autumn migrating bats. No data exists that indicates wind farms disrupt foraging bats. Because the quality of foraging habitat in the project area is very low, the potential disruption of bats by wind turbines should be considered minimal. There is no basis to link this speculation regarding disruption of foraging patterns to reduction of the fat needed to successfully hibernate.

(p. 112) Section 4.12.5.3 sixth bullet point:

Comment: With substantial bat mortality being detected only during the autumn migration, the pertinence of this statement is unclear. Available data (including the Kewaunee wind farm study mentioned in this section) appear to indicate the mortality of foraging bats (i.e., "daily activity") is not a serious concern.

(p. 112) Section 4.12.5.3 eighth and ninth bullet points:

Comment: The important feeding areas discussed in the Draft EIS are large wetlands southwest and southeast of the project area. Bats moving from Neda mine to either area are unlikely to cross the project area.

(p. 112) Section 4.12.6, third and fourth paragraph:

Comment: The DEIS makes an unsubstantiated link between bat mortalities being higher than bird mortalities at wind plants in the Midwest to the biological significance of mortalities at wind plants in eastern forested mountain ridges. It appears the DEIS implies that the mortality rates from eastern mountain ridges can be applied to the Forward site, and therefore biologically significant impacts to bat populations may result. The best available information supports a conclusion to the contrary. Additionally, we understand the author's desire for additional data to support assessment of other future wind power projects. Available data appear sufficient to support the conclusion that the Forward project will not substantially affect bats.

(p. 112-113) Section 4.12.6, carryover paragraph:

Comment: The Draft EIS states that because "regional populations of the seven species of bats that occur in the project area have never been quantified, it is not possible to draw any conclusions about the extent and magnitude of impacts to those populations, assess significance…, or determine whether the viability of local populations may be threatened." The clause "present in the project area" should be changed to "present in the state," or "potentially present in the project area."

Again, from an academic perspective we understand the author's sentiments. However, in real-world applications of NEPA and NEPA-like regulation, and especially in the case of species not listed as threatened or endangered, less data is often available than is available in this case, and conclusions regarding the anticipated nature of effects are reached.

(p. 113) Section 4.12.6 second full paragraph:

<u>Comment</u>: We are unaware of any wind power projects where disturbance/displacement of bats has been shown to be significant. Further, given the very low habitat quality in the project area, we believe it very unlikely that disturbance/displacement at any biologically meaningful level would occur.

(p. 113) Section 4.12.6 fourth full paragraph:

<u>Comment</u>: The DEIS states that three years of post-construction fatality studies are needed. It should be noted that in the case of multi-year fatality studies, the 2^{nd} and 3^{rd} year fatality rates have been very similar to those experienced in the first year. With this in mind, the Final EIS should recommend a one year post-construction study.

(p. 114) Section 4.12.6 Top of page:

<u>Comment</u>: Identifying at this time that operational timing is, "the only practical option for post construction mitigation" is premature. Numerous other options for

post construction mitigation exist (e.g., manipulation of vegetation/habitat in the project area, manipulation of habitat features outside the project area, development and application of measures that deter bat/blade collisions). Other options are available. The necessity of further mitigation beyond these options and its costs cannot be determined until the benefits of the options have been determined, at that time the incremental benefits of additional strategies can be assessed.

CHAPTER 5

(p. 124) Section 5.3.4.3 Private Airstrips, General Update:

Update: Invenergy has met with the two private airstrip owners who have expressed concern with the project. Another discussion with an expanded group of airstrip owners is scheduled to be held on April 26, 2005. Mr. Gary Dikkers from the Wisconsin Department of Transportation will be in attendance.

(p. 130) Section 5.3.5 last paragraph second to last sentence, Suggest following change:

While the figures show 1,000-foot reaches around each turbine, the Wind Energy Overlay District ~~actually~~ prohibits turbines from being located ~~within~~ at a distance from residences of less than three times the height of the turbines. ~~1,166.1 feet of residences.~~

(p. 130) Section 5.3.5 last paragraph footnote #39 on second to last sentence:

Comment: The overall setback distance (3 times height) will depend on whether the 77 meter or 82.5 meter rotor is used.

(p. 131) Section 5.3.5 first bullet point at top of page:

Comment: The Dodge County Board approved the amendment to allow turbines to be sited closer than 3 times the height of the turbine if property owners agree to it. Therefore, the only condition is described in the second bullet point.

(p. 131) Section 5.4 first paragraph: We suggest adding the following to the end of the paragraph:

Moreover, Wis. Stat. § 66.0401(1) provides that no county, city, town or village may place any restriction, either directly or in effect on the installation or use of a wind energy system unless the restriction preserves or protects the public health or safety, does not significantly increase the cost of the system or decrease its efficiency, or provides for an alternative system of comparable costs and efficiency. The Office of the Attorney General, Department of Justice, State of Wisconsin provided a letter to the Chairman of the Town of Byron explaining the limitations on a local government's ability to restrict or regulate wind energy systems under § 66.0401. This letter was also provided to the Town of LeRoy and the Town of Lomira.

Comment: As stated earlier and per our inclusion of the letter from the Attorney General's Office to the Town of Byron describing the statutes mentioned in this paragraph, the Towns are aware of the statutes precluding local governments from inhibiting the installation or use of a wind energy system. Invenergy has been working closely with the Towns in the project area to address concerns and to seek local approvals and permits to build the project, in addition to working with the state through the CPCN process, while reserving rights under Wis. Stat. §§ 66.0401 and 196.491(3)(i).

(p. 131) Section 5.4 second paragraph, suggested addition to this paragraph:

“It is the staff’s position that the proposed Forward Energy Project would be in conformance with the considerations listed in Subsection 2.3.6 B) and 4.11.2.b) 1) of the County Land Use Code and the granting of the conditional use permit will not unreasonably interfere with the orderly land use and development plans of the County. It is also the staff’s position that the benefits to the general public will exceed the burdens.”

Comment: The suggested addition is Dodge County’s Planning and Development Department staff’s analysis of Forward’s conditional use permit application and is relevant in the paragraph.

(p. 132) Section 5.4.1 second full paragraph:

Comment: The ordinance has been modified to allow wind energy projects to have a lesser setback if agreed to by the affected landowner (see Section 5.4.2).

(p. 132) Section 5.4.1 third full paragraph:

Comment: Forward is working with each of the municipalities as evidenced by the number of public hearings held thus far at Town of Leroy, Town of Lomira and Dodge County. The same will occur at Town of Oakfield and Town of Byron.

(p. 132) Section 5.4.2 second paragraph, bullet points that carryover to page 133 and the NOTE:

Comment: The Ordinance addressing Wind Energy Systems has been amended. The amendments approved by the County Board on April 19, 2005 are attached to these comments. This section should reflect the changes. The following changes to the bullet points are in relation to the modified ordinance:

- Facilities shall be painted a neutral color that blends in with the natural setting.
- Facilities shall not be artificially lighted except as required by the FAA.
- Facilities shall not be used to display advertising except identification of manufacturer or operator.
- The total height of each WES shall not exceed ~~3~~500 feet.
- Setback from a property line shall be equal to total height of WES unless appropriate easements are secured from adjacent property owners.
- Setback from a residence, school, hospital or church shall be at least three (3) times total height of WES, except that a lesser setback may apply to a residence where agreed to by the residence owner. The agreement between the residence owner and the WES operator shall be ~~unless there is~~ a recorded document with the Dodge County Register of deeds.~~agreement with owner.~~
- Facilities must comply with the general county noise ordinance unless a waiver is obtained from neighboring landowners.
- The Applicant must mitigate any interference with radio or television signals caused by WES.
- WES maintenance facilities and substations shall be landscaped in such a way that the facilities are screened from view by adjacent landowners.
- Dodge County and the owner of the WES facility shall enter into an agreement under which the owner of such WES facility agrees to provide to the County a bank letter of credit to the Land Use Administrator to secure its obligations under this Subsection 4.11.3 H) 1). The agreement shall be kept in effect by the initial owner and all subsequent owners of the WES facility until the Land Use Administrator has certified that the removal and restoration requirements and obligations have been met.
- Any WES that does not produce energy for a continuous period of one year shall be removed and the site reclaimed to a depth of four feet. If the project owner does not perform this reclamation ~~the landowner is ultimately responsible~~ Dodge County will be able to draw upon the Letter of Credit described above.

Comment: Reference in the Ordinance to the landowner being responsible for removal and restoration have been eliminated by requiring the WES owner to provide a Bank Letter of Credit to the County under an agreement in which the County could draw upon the Letter of Credit for removal and restoration of the turbines. The Letter of Credit will be a condition to the conditional use permit.

CHAPTER 6

(p. 187) Section 6.5.4, first paragraph:

Comment: There is a discrepancy between the written explanation of the path of the overhead transmission line and the path shown on Figure Vol. 2-3. The path shown on Figure Vol. 2-3 is the proposed path. Forward is willing to work with the Town of Byron and neighboring landowners to find an alternative overhead route that goes north and east of South Byron prior to running through South Byron to avoid the homes located along County Road Y in South Byron.

ATTACHMENT

(State of Wisconsin, Department of Justice letter to Town of Byron dated February 23, 2005)

STATE OF WISCONSIN
DEPARTMENT OF JUSTICE

PEGGY A. LAUTENSCHLAGER
ATTORNEY GENERAL

Daniel P. Bach
Deputy Attorney General

17 W. Main Street
P.O. Box 7857
Madison, WI 53707-7857
www.doj.state.wi.us

Christopher J. Blythe
Assistant Attorney General
blythecj@doj.state.wi.us
608/266-0180
FAX 608/267-2223

February 23, 2005

Mr. Francis Ferguson
Chairman
Town of Byron
N3576 Hwy. 175 South
Fond du Lac, WI 54937

Dear Mr. Ferguson:

Attorney General Peggy A. Lautenschlager has asked me to respond to your February 14, 2005, letter regarding a municipality's ability to restrict or regulate wind energy systems. As noted by the Wisconsin Court of Appeals, section 66.0401 of the Wisconsin Statutes "represents a legislative restriction on the ability of local governments to regulate solar and wind energy systems. Local restrictions are permitted only if they serve the public health or safety, do not significantly increase the cost or decrease the efficiency of the system, or allow for an alternative system of comparable cost and efficiency. Beyond those, no other restrictions are allowed. The statute is not trumped, qualified or limited by § [66.0403] or by a municipality's zoning and conditional use powers." *State ex rel. Numrich v. City of Mequon*, 2001 WI App 88, ¶ 17, 242 Wis. 2d 677, 626 N.W.2d 366.

The *Numrich* court goes on to note that the owner of a wind energy system does not need a permit to construct such a system, and that such a system can be constructed without prior municipal approval. *Id.*, ¶ 15.

As you may be aware, Wisconsin has no known sources of oil, natural gas, coal or uranium. We therefore import the vast majority of our fuel sources from outside the state. The Legislature has recognized the enormous drain this has on our state's economy and has enacted measures (including the statute cited above) to attempt to foster a greater reliance on renewable energy sources that can be produced here in Wisconsin.

Therefore, based on the facts as you have represented them, your township may not regulate solar or wind energy systems unless one of the exceptions listed in the statute applies to your situation.

I hope this information is helpful to you. Please contact me with any questions.

Sincerely,

Christopher J. Blythe

Christopher J. Blythe
Assistant Attorney General

CJB:ajw

ATTACHMENT

(Dodge County Ordinance No. 713 –
approved by the County Board on April 19, 2005)

REPORT 3

TO THE HONORABLE DODGE COUNTY BOARD OF SUPERVISORS

We, the Dodge County Planning and Development Committee, hereby report favorably on the modified petition of the Planning and Development Committee requesting amendment of the Land Use Code, Dodge County, Wisconsin, for the purpose of modifying the development standards contained in the Wind Energy System Overlay District and recommend adoption of the attached ordinance.

Respectfully submitted this 19th day of April, 2005

ADOPTED
by DODGE COUNTY BOARD

APR 19 2005

AYES 29 NOES 7
ABSENT 1
ABSTAIN 0

Karen J. Gibson
County Clerk

Arnold Bashynski
Allen Behl
Thomas J Schaefer

Dodge County Planning and Development Committee

ORDINANCE NO. 713

AN ORDINANCE AMENDING THE LAND USE CODE, DODGE COUNTY, WISCONSIN

WHEREAS THE SUBJECT MATTER OF THIS ORDINANCE HAS BEEN DULY REFERRED TO AND CONSIDERED BY THE DODGE COUNTY PLANNING AND DEVELOPMENT COMMITTEE AND A PUBLIC HEARING HAVING BEEN HELD, AFTER THE GIVING OF REQUISITE NOTICE OF SAID HEARING AND A RECOMMENDATION THEREON HAVING BEEN REPORTED TO THE BOARD OF SUPERVISORS, DODGE COUNTY, WISCONSIN AS REQUIRED BY SECTION 59.69 OF THE WISCONSIN STATUTES.

THE COUNTY BOARD OF SUPERVISORS OF THE COUNTY OF DODGE DO ORDAIN AS FOLLOWS:

Section 1. The Dodge County Land Use Code has been amended as follows:

1. Amend Subsection 4.11.1 A) as follows:

A) **Purpose**
The purpose of this Overlay District is to promote the health, safety, property value, aesthetics and general welfare of the County by establishing a program to ensure the effective regulation ~~and restriction~~ of wind energy system facilities in Dodge County.

2. Amend Subsection 4.11.1 B) as follows:

B) **Statement of Intent**
The purpose of this Overlay District is to establish ~~minimum~~ standards for the siting of wind energy system towers and related facilities. The intent of this Overlay District is to:

3. Amend Subsection 4.11.1 C) 2) as follows:

2) Personal Wind Energy Systems that are under ~~75~~ <u>100</u> feet in total height are exempt from the conditional use provisions of this Overlay District. Personal Wind Energy Systems shall be limited to one for each property and shall be setback a distance equal to the total height from the nearest property line. All other wind energy systems shall require a land use permit and conditional use permit in accordance with Subsection 4.11.2.

4. Amend Subsection 4.11.1 D) as follows:

D) **Principal or Accessory Use**
WESs may be considered either principal or accessory uses. A different existing use or an existing structure on the same lot shall not preclude the installation of a WES on such lot. For purposes of determining whether the installation of a WES complies with setback requirements, lot coverage requirements, and other such

least 30 days prior to the expiration of the Letter of Credit. If notification is not provided within said 30 days, the Bank Letter of Credit terms shall allow Dodge County to request of the issuer full payment of said funds for the benefit of Dodge County. This shall be in addition to terms allowing for payment in the event of noncompliance with any other provisions of this Code, or terms agreed to by the Land Use Administrator and Planning and Development Committee. The owner of such WES facility ~~or owner of the property~~ shall ~~take reasonably appropriate site reclamation steps~~ remove said WES ~~tower~~ facility including all supporting equipment and building(s), and shall restore the land on which the WES facility is located to a depth of four feet below grade, within 90 days of receipt of notice from the Land Use Administrator notifying the owner of such WES facility of such abandonment. The Land Use Administrator shall make a reasonable effort to provide such notice of abandonment to the owner of the WES facility. Failure of actual notice to the owner of the WES facility shall not alter the obligations arising under this Subsection 4.11.3 H) 1). If removal of the WES facility and restoration of the land on which the WES facility is located to a depth of four feet below grade to the satisfaction of the Land Use Administrator does not occur within said 90 days, then, said Land Use Administrator shall cause such ~~may order the~~ removal and ~~salvage said tower and all supporting equipment and building(s) at the property owner's expense~~ restoration to occur and the costs for such removal and restoration shall be the liability of the owner of the WES facility, and the Land Use Administrator shall draw on the bank letter of credit to pay for such costs of removal and restoration.

14. Create Subsection 4.11.3 I) as follows:

I) **Protection of Public Haul Roads**

The owner of the WES facility (applicant) shall reimburse the County and/or Town for any and all repairs and reconstruction to the public roads resulting directly from the construction of the wind energy system facility.

1) A qualified independent third party, agreed to by the County and/or Town and applicant, and paid for by the applicant, shall be hired to inspect the roadways to be used during construction. This third party shall be hired to evaluate, document, videotape and rate road condition prior to construction of the wind turbine project and again within 30 days after the facility is complete. Any road damage done by the applicant or its contractors or subcontractors shall be repaired or reconstructed at the applicant's expense.

2) The applicant shall provide the County and/or Town with written notices of completion of construction within 10 days after the facility or a specific phase of the project is completed. Determination as to how the roads should be repaired and by who, will be at the option of the County and /or Town in consultation with the owner of the facility. The applicant shall provide the appropriate amount of money to repair the damaged roads to the County and/or Town within 30 days after receiving notice of the amount due from the County and/or Town. Any subsequent damage to the public roads resulting directly from the maintenance of the WES facility shall be repaired in accordance with the above.

10. Amend Subsection 4.11.3 B) 2) b) as follows:

b) The Total Wind Turbine Height of any Wind Energy System Tower ~~or wind turbine~~ shall not exceed ~~300~~ 500 feet. ~~in total height~~. The Total Wind Turbine Height of any Wind Turbine shall not exceed 500 feet.*

***"Explanatory Note – The Dodge County Land Use Code currently includes the following definition: Total Wind Turbine Height shall mean, when referring to a WES tower or wind turbine, the distance measured from ground level to the blade extended at its highest point."**

11. Create Subsection 4.11.3 B) 2) e) f) g) and h) as follows:

e) The owner of an affected wind turbine shall immediately cease operation of the affected wind turbine for the duration of any emergency. Emergency shall mean a condition or situation caused by the affected wind turbine that presents an imminent physical threat of danger to human life or significant threat of damage to property.

f) The owner of a WES facility shall operate the facility so as not to cause groundwater contamination.

g) No blasting shall occur in connection with the construction of the facility unless the applicant has provided prior notification to the property owner, any abutting property owners, property owners within 1,500 feet of the blasting site, and officials from the Town in which the blasting site is located. All blasting shall be done in accordance with ~~the~~ all applicable laws and regulations.

h) The owner of a WES facility shall minimize to the extent possible the impact of any stray voltage caused by the facility.

12. Amend Subsection 4.11.3 C) 2) as follows:

WES towers shall be setback a distance of no less than three times their total height from the nearest residence, school, hospital or church, except that a lesser setback may apply to a residence where agreed to by the residence owner. The agreement between the residence owner and the WES operator shall be a recorded document with the Dodge County Register of Deeds, and a copy of the agreement shall be provided to the Land Use Administrator.

13. Amend Subsection 4.11.3 H) 1) as follows:

1) "Dodge County and the owner of a WES facility shall enter into an agreement under which the owner of such WES facility ~~or owner(s) of the property where the site is located~~ agrees to provide to the County a bank letter of credit to the Land Use Administrator to secure its obligations under this Subsection 4.11.3 H) 1). Such bank letter of credit shall be kept in effect by the initial owner of the WES facility and by all subsequent owners of the WES facility until such time as the Land Use Administrator has certified that the removal and restoration requirements and obligations set forth in this Subsection 4.11.3 H) 1) have been met. The owner of the WES facility shall be required to provide annual notification to Dodge County that the Bank Letter of Credit has been reinstated at

requirements, the dimensions of the entire lot shall control, even though the WES may be located on leased parcels or easements within such lots. WESs that are constructed and installed in accordance with the provisions of this Code shall not be deemed to constitute the expansion of a nonconforming use or structure.

5. Create Subsection 4.11.1 E) as follows:

E) **Indemnification**

The operator of a wind energy system facility shall defend, indemnify and hold harmless the County and Town and their officials from and against any and all claims, demands, losses, suits, causes of action, damages, injuries, costs, expenses and liabilities whatsoever including attorney fees arising out of the acts or omissions of the operator concerning the operation of the wind energy system facility without limitation, whether said liability is premised on contract or on tort.

6. Amend Subsection 4.11.2 B) 1) k) as follows:

k) The possible adverse effects on area residents due to stray voltage, earth currents, interference with T.V., ~~or~~ radio, microwave, cell phone or wireless internet service reception, shadow effect and noise.

7. Create Subsection 4.11.2 E) as follows:

E) **Complaint Resolution Procedure**

The owner of the wind energy system facility shall, at the owner's expense and in coordination with the County, develop a system for logging and investigating all complaints from residents of the County related to the operation of the facility and the development standards set forth in this Subsection 4.11.3 of this Code. All such complaints regarding the operation of the wind energy system facility shall be dealt with in accordance with Subsection 11.4.3 and 11.4.4 of this Code.

8. Amend Subsection 4.11.3 A) 4) as follows:

4) Wind energy systems shall not be artificially lighted, unless required by the FAA or other applicable authority. If lighting is required, the governing authority requiring the lighting may review the available lighting alternatives and approve the design that would cause the least disturbance to the surrounding views.

9. Amend Subsection 4.11.3 A) 5) as follows:

5) All electrical wires and lines connecting each turbine to the next turbine shall be installed underground. The wires and lines running from the last turbine in a string to any substation connecting to the electric utility shall also be run underground, unless the Committee determines that overhead lines would best serve the intent of the Code.

Additions in text are indicated by underline; ~~deletions by single strikethrough.~~

15. Create Subsection 4.11.3 J) as follows:

J) **Repair and Replacement**
The owner of a WES facility shall be authorized to repair and replace the wind turbine generators and associated equipment consistent with the terms of the conditional use permit. Replacement may require a new Land Use Permit. However, no such repair or replacement shall entitle the owner to any extension of the terms of the conditional use permit.

16. Add the following definition in proper alphabetical order to Chapter 12, DEFINITIONS:

Earth Currents shall mean the flow of electrons into the earth from either a Personal Wind Energy System or a Wind Energy System Facility.

Section 2. This ordinance shall be in full force and effect upon adoption.

Section 3. All ordinances or parts of ordinances inconsistent with or in contradiction of the provisions of this ordinance are hereby repealed.

Adopted and approved this 19 day of April 2005.

Russell Kottke
Russell Kottke
Chairman

Karen J Gibson
Karen Gibson
County Clerk

Comments on the Draft Environmental Impact Statement, submitted by the Iowa Cooperative Fish & Wildlife Research Unit

USGS
science for a changing world

Iowa Cooperative Fish & Wildlife Research Unit
U.S. Department of the Interior, U.S. Geological Survey
11 Science II, Iowa State University, Ames, IA 50011-3221
515/294-3056; Fax 294-5468
http://www.ag.iastate.edu/centers/cfwru

IOWA STATE UNIVERSITY

DNR

April 19, 2005

Jim Lepinski
(Docket Coordinator)
Public Service Commission
P.O. Box 7854
Madison, WI 53707-7854

Subject: Comments on Draft EIS for Forward Wind Project,
PSC docket number 9300-CE-100

I am a wildlife biologist and I have confined my comments to parts of the Draft EIS related to wildlife. The draft EIS did a thorough job, I thought, of covering possible effects on wildlife species. My comments are in paragraphs below, ordered by page number in the Draft EIS. With one exception, these comments are minor or editorial. The exception is the second-from-last paragraph (referring to page 94), which contains an erroneous interpretation of data in a progress report that I co-authored.

Pages XI, 1, 86, and others:
The area is described as "agricultural." From the standpoint of which bird species are likely to be using the area for foraging or nesting, it would be good to indicate the approximate proportion of the area that was in rowcrops, hayfields, and pastureland. I would expect the number of bird species and individuals to be lowest in rowcrops and highest in pastureland. From some figures that appear to show aerial photography, it seems like the vast majority of the area is rowcrops. It might also be useful to know whether the proportions of various land uses is likely to remain similar during the expected life of the project.

On page 54:
Wigeon (*Anas Americana*)" should be "Wigeon (*Anas americana*)"
"Bonaparte's Gull (*Larus Philadelphia*)" should be "Bonaparte's Gull (*Larus philadelphia*)"
"Forester's Tern" should be "Forster's Tern"
All of the common names on this page, both plants and birds, are capitalized. This contrasts with the rest of the document, which doesn't capitalize common names.

On page 55, "sp." and "spp." should not be italicized.

On pages 78, 79, 80, 85, 86 and 110: "Howe (*et al.* 2002)" should be "Howe *et al.* (2002)" to be consistent with the rest of the document (e.g., Johnson citation on page 73) and standard scientific usage. On pages 80 and 81, the same problem occurs with "Johnson (*et al.* 2000b)", and on page 81 it occurs with "Erickson (*et al.* 2001)"

On page 98, the text states that "Suitable nesting habitat is scarce within the proposed project area because of the fragmented and/or disturbed nature of woodlots, wetlands and open areas, and it is unlikely that the site would support large nesting populations of any bird group or species." What is "large" depends on one's perspective, I suppose, but species such as horned larks and vesper sparrows are regular breeders in midwestern cropland (Best, Freemark, Dinsmore and Camp. 1995. A review and synthesis of habitat use by breeding birds in agricultural landscapes of Iowa. Amer. Midl. Nat. 134:1-29; Lokemoen and Beisser. 1997. Bird use and nesting in conventional, minimum-tillage, and organic cropland. J. Wildl. Manage. 61:644-655).

On page 94, the text states that "Between April and December 2003, total adjusted mortality was estimated at 10.79 birds per wind turbine." This information came from a progress report (mine) that could have been better edited. Actually, this figure is not per turbine, but for the 26 (of 89) turbines where searching occurred. A corresponding correction should be made on page 96, where the text states "The mortality rates at operating wind farms range from less than one bird per turbine to just under 10 per turbine." If a per-turbine rate from our progress report for 2003 is desired, a crude estimate would be 10.8/26, or 0.4 birds per turbine.

On page 207, canvasback and cerulean warbler probably shouldn't be capitalized. On page 208, dickcissel, merlin, northern goshawk and northern harrier probably shouldn't be either.

Thank you for giving me the opportunity to comment.

Sincerely yours,

Rolf R Koford

Rolf R. Koford
Assistant Unit Leader (Wildlife)

Comments on the Draft Environmental Impact Statement, submitted by the Madison Audubon Society, Inc.

Madison Audubon Society Inc.

222 S. Hamilton Street, Suite 1 • Madison, WI 53703-3201 • 608/255-BIRD (2473)
masoffice@mailbag.com • http://madisonaudubon.org • fax 608/255-2489

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Gas & Energy Division

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2005 APR 11 A 9:55
WISCONSIN PUBLIC SERVICE COMMISSION

April 7, 2005

Jim Lepinski, Docket Coordinator
Public Service Commission
P.O. Box 7854
Madison, WI 53707-7854

Dear Mr. Lepinski:

The Madison Audubon Society wishes to submit the attached resolution regarding the proposed Forward Wind Energy Center as part of the public comment period for PSC Docket 9300-CE-100.

The Madison Audubon Society has reviewed the draft environmental impact statement and, as indicated in the attached resolution, we oppose the proposal by Forward Energy, LLC.

Thank you for your time and attention.

Sincerely,

Joy Stewart

Joy Stewart, Chair
Population and Habitat Committee
Madison Audubon Society

cc: Joanne Herfel, President

Madison Audubon Society Inc.

222 S. Hamilton Street, Suite 1 ◆ Madison, WI 53703-3201 ◆ 608/255-BIRD (2473)
masoffice@mailbag.com ◆ http://madisonaudubon.org ◆ fax 608/255-2489

RESOLUTION

Whereas, the Madison Audubon Society, Inc. supports the use of wind power as an alternative to traditional energy generation systems, and

Whereas, the Madison Audubon Society, Inc. is an environmental advocacy organization in support of the protection of birds and other wildlife and their habitats,

Therefore, be it resolved that the Madison Audubon Society, Inc. is opposed to Forward Energy LLC's proposal to locate its 200 megawatt wind turbine facility in close proximity to the Horicon National Wildlife Refuge because of its potential and unknown impact on wildlife.

Adopted by the Madison Audubon Society, Inc. Board of Directors
at its meeting on April 4, 2005.

Comments on the Draft Environmental Impact Statement, submitted by the National Wildlife Refuge Association

National Wildlife Refuge Association

1010 Wisconsin Avenue, NW, Suite 200, Washington, D.C. 20007
202.333.9075 ❖ Fax 202.333.9077 ❖ www.refugenet.org

Protecting America's Wildlife

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APR 1 2 2005
Gas & Energy Division

April 8, 2005

Jim Lepinski
Public Service Commission of Wisconsin
P.O. Box 7854
Madison, WI 53207

Dear Mr. Lepinski,

Comments which follow pertain to docket number 9300-CE-100 before the Public Service Commission.

The National Wildlife Refuge Association (NWRA) and its membership, comprised of current and former refuge professionals, members of a network of refuge "Friends" groups throughout the United States, and individuals interested in the health of National Wildlife Refuge System, thank you for the opportunity to offer comments on the Draft Environmental Impact Statement (EIS) regarding Forward Energy LLC's (Forward) proposed 200 megawatt wind energy generating facility, for 133 wind turbines located in a project area of 32,400 acres near Brownsville, in Dodge and Fond du Lac Counties, Wisconsin. We are taking an interest in this since Horicon National Wildlife Refuge is located approximately 1.2 miles west of the project area boundary, and both the refuge and the state-managed Horicon Marsh State Wildlife Area have been designated a Ramsar Wetland of International Importance.

We found the initial findings of the Commission's EIS to be thoughtful and thorough. The investigators have done an admirable job in collecting the facts and presenting them in a coherent fashion. We wish, however, to stress a few overarching points which should carry additional weight when compared with the spectrum of findings presented and as you assess Forward's plans.

First, the initial proposal by Forward placed turbines over 4 miles from the refuge, but then the plan doubled the number of proposed turbine and placed them closer - within 1.2 miles. Such a shift in plans has significantly increased the potential hazard to birds posed by the turbines. Currently, the two westernmost rows of turbines - approximately 38 of the 133 - are the ones of most concern. A 1999 study done for the Wisconsin DNR (by Robert W. Howe and Ryan Atwater from the Richter Museum of Natural History at the University of Wisconsin-Green Bay) stated that bird activity is much reduced at distances of 8km (approximately 5 miles) of the edge of Horicon Marsh, and the placement of "generators at distances 8km or greater will have significantly lower impacts than generators closer to the marsh." Unfortunately, the current placement runs counter to this recommendation.

Second, we understand that the total elimination of avian mortality under these circumstances is impossible, but the risk to some species of concern is particularly troubling. For example, Sandhill Cranes at Horicon National Wildlife Refuge use not only the marsh itself but also surrounding farmland for feeding and assembling. Concern for this operating buffer is important. Not surprisingly, more Sandhill Cranes have been observed in the western portions of the current turbine zone. Indeed, the hundreds of Sandhill Cranes (plus the single experimental Whooping Crane) use a few of the same fields (in the fall) where turbines are planned. It is unknown how they will adjust, if at all.

Third, the impact on four cave-dwelling bat species at the abandoned Neda Mine, 10 miles south of the project area, which fly in and out of the marsh as they feed on insects, is unknown. Here is another case – with proximity to the marsh an issue – where further research needs to be done.

As your Draft EIS has noted, the study methodology used by Forward was less rigorous than other Wisconsin wind farm studies. Most importantly, as indicated above, the bird and bat surveys did not sufficiently address the importance of Horicon Marsh's effect on wildlife use within the project area.

Because of these reasons, and other reasons that your report made reference to, we are concerned that the plans of Forward have not sufficiently addressed wildlife, land-management, and environmental concerns. We expect to provide further comments after the final EIS is issued, in reference to the Commission's decision to approve, modify, or deny the project.

We appreciate that unlike most power plants that use fossil fuels to generate electricity, the proposed wind-project would not emit air pollutants. Nor would the project require water for cooling purposes. Still, this is no reason to require from Forward anything less than rigorous standards when evaluating the project's environmental impact.

Sincerely,

Evan Hirsche
President

cc: Kathleen Zuelsdorff, Gas and Energy Division
Patti Myers, Manager, Horicon NWR
Harold Steinback, Friends of Horicon
Joe Breadon, Horicon Marsh Systems Advocates
Russell Kottke, Chairman, Dodge County Board of Supervisors
Larry Michael, Horicon Marsh Bird Club

Comments on the Draft Environmental Impact Statement, submitted by the RENEW Wisconsin

Cullen
Weston
Pines
& Bach
A Limited Liability Partnership

Attorneys at Law
122 West Washington Avenue
Suite 900
Madison, Wisconsin 53703
(608) 251-0101
(608) 251-2883 Fax
www.cwpb.com

April 22, 2005

FILED ELECTRONICALLY VIA ERF
Mr. Jim Lepinski
Docket Coordinator
Public Service Commission of Wisconsin
610 North Whitney Way
P.O. Box 7854
Madison, WI 53707-7854

Re: Application of Forward Energy LLC for a Certificate of Public Convenience and Necessity to Construct a Wind Electric Generation Facility and Associated High Voltage Electric Transmission Facilities, to be Located in Dodge and Fond du Lac Counties
Docket No. 9300-CE-100

Dear Mr. Lepinski:

Attached for electronic filing in the above-referenced docket is RENEW Wisconsin's Comments on Draft Environmental Impact Statement. We have provided same electronically to the parties listed on the Service List.

Sincerely,

CULLEN WESTON PINES & BACH LLP

Curt F. Pawlisch

CFP/rss

Attachment

cc: Service List (w/Attachment electronically)
RENEW (w/Attachment electronically)

BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application of Forward Energy LLC for a Certificate of Public Convenience and Necessity to Construct a Wind Electric Generation Facility and Associated High Voltage Electric Transmission Facilities, to be Located in Dodge and Fond du Lac Counties	Docket No. 9300-CE-100

RENEW WISCONSIN'S COMMENTS ON
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Pursuant to Wis. Admin. Code PSC § 4.30(4)(e), RENEW Wisconsin ("RENEW") submits these comments on the Draft Environmental Impact Statement ("DEIS") issued in the above-captioned matter.

RENEW supports the Forward Energy project subject to such conditions or project alterations as may be needed to reasonably ensure the protection of wildlife while maintaining project viability. Whether such conditions or project alterations are required in large measure will be determined by the adequacy of the Final Environmental Impact Statement ("FEIS"). Importantly, however, whatever *potential* wildlife impacts may be identified in the FEIS must also be weighed against *known* wildlife impacts from existing hazards. As explained below, RENEW submits that the DEIS can be improved in both respects.

1. Obtaining greater knowledge concerning potential wildlife impacts of the Forward Wind Energy project.

The DEIS states:

> Inadequacies in the Forward bird study could have been avoided had Forward worked earlier in the project design and closely with the regulatory agencies (PSC, DNR, USFWS) to define the goals and methodology for the studies prior to initiating them.

> . . .
>
> The Forward study was too general for this stage of the project where there are specific concerns about avian impacts. Further, Forward did not study the westernmost portion of the project area which would likely be impacted the most by the proposed wind turbines.
>
> . . .
>
> In addition, while Forward frequently cites the relationship between bird abundance and distance from Horicon Marsh in its risk assessment (submitted as part of the CPCN application), on December 2, 2004 it redesigned the project to include 16 more turbines that would be 2 to 4 km from Horicon Marsh and 7 more turbines between 4 and 8 km from the Marsh.

DEIS at 97.

To ensure an adequate review of this project, RENEW believes that the FEIS should provide greater detail about the types and level of impact on avian populations which the project might pose in the western portion of the project closest to the Horicon marsh, i.e., the area roughly located west of CTH YY. To this end, it would be beneficial for Forward to continue to study this western area in collaboration with the DNR and USFWS, in order to verify that impacts to the bird populations are minimized by the proposed project. Such a study should estimate bird mortality in the project area in comparison to bird mortality experienced on wind turbine projects and other structural installations elsewhere, specifically identifying impacts on threatened/endangered species, as can best be assessed in a reasonable period of time. To this end, RENEW offers to assist the parties to this process in bringing the study to completion as soon as possible. A key objective of the study here is to reduce the level of uncertainty regarding avian impacts prior to the PSC's ultimate decision on Forward's application. Certainly, it is reasonable to decline to approve the project if the avian study does not provide the PSC with what it needs to make an informed decision.

2. **The FEIS must consider other sources of avian and bat mortality and other negative impacts.**

The DEIS fails to disclose the environmental threats to wildlife that exist outside of the project boundaries. A wind farm in Wisconsin has no effect on migrating birds and bats when they are elsewhere. But other potential causes of harm to birds and bats, such as cats, cars, communication towers, exterminators, buildings, pesticides, highway expansion, and suburban encroachment, are widespread. A comprehensive review should disclose all the hazards to which all Horicon Marsh area wildlife are subject, whether year-round residents or transients, during their lifespan. Without such a discussion, the reader comes away with the impression that the Forward project represents the most pressing threat that wildlife species identified in the EIS will face. This is highly misleading.

The DEIS is also silent on existing threats *within* the project development zone to resident and transient bird populations. These threats would include cats, habitat loss due to human infringement, pollution, and collisions with man-made objects such as communication towers, cars, buildings, and transmission lines.

By not including any discussion on both existing on-site and off-site causes of avian mortality, the DEIS conveys the impression that the Forward project is the only significant threat to the birds that use the marsh and the surrounding farmland. For instance, the DEIS is silent on the proportion of avian deaths in the U.S. attributable to wind farms versus other causes of bird mortality. The National Wind Coordinating Committee reports: "Based on current estimates, wind plant-related avian collision fatalities probably represent from 0.01 percent to 0.02 percent (i.e., 1 out of every 5,000 to 10,000) of the annual avian collision fatalities in the United States." (Wind turbines and birds, at 3, by Mick Sagrillo (2003 Wisconsin Focus on Energy).) In contrast, research performed by Dr. Stanley Temple and John Coleman estimated the number of birds killed annually by rural cats in Wisconsin from 7.8 million on the low side to 219 million on the high end. These estimates appeared in the December 1996 issue of Wisconsin Natural Resources magazine. Furthermore, RENEW notes that the list of references in the bird chapter (4.11) does not include any research or papers published by Temple and Coleman, both of whom have studied bird mortality issues in Wisconsin.

The DEIS should evaluate these other causes of mortality and estimate their impacts on resident and migratory bird populations. By leaving out best estimates of bird deaths in the U.S. due to collisions with man-made structures, pesticide use, and cats and other alien predators, the DEIS denies the public a meaningful context for evaluating this wind farm's potential to diminish populations. The Commissioners and public would benefit by receiving adequate information to enable them to weigh the potential impacts from the Forward Wind project as a subset of the full range of concerns about avian and bat wildlife in the area.

The DEIS also addresses other potential avian impacts with respect to the project. For instance, the DEIS (page 87) states in regard to impacts to waterfowl: "The potential loss of foraging habitat may be a more practical concern." However, the DEIS does not recognize or discuss the possibility that various turbine sites within the project area may have differing values as forage areas, and therefore, not all turbine sites would pose the same avian risk. RENEW submits that the FEIS should address this potential differentiation.

3. Greater discussion is needed about avoided off-site impacts by wind turbines.

Except for Chapter 7, which deals with cumulative impacts, the scope of the DEIS is narrowly drawn, and mostly confined with local impacts in the project zone. This can be problematic for wind power projects, as their physical impacts are almost completely localized (on roads, neighbors, etc.). This is not true in the case of coal plants, and to a lesser extent natural gas-fired plants. New fossil fuel generation increases the quantity of carbon dioxide released into the global atmosphere, as well as other pollutants (NOx, SO_2, mercury and particulates) which have local and regional impacts. In the case of gas-fired plants, a growing percentage of the fuel availability will be imported from overseas, in the form of liquefied natural gas ("LNG"). Increased tanker traffic, expanded pipeline capacity and new LNG regasification terminals are unavoidable consequences of any new gas-fired plant in Wisconsin, but the impacts would be felt outside of Wisconsin. Similarly, displacing coal generation with wind generation avoids the physical destruction that occurs with coal mining in such states as Wyoming and West Virginia.

Likewise, the discussion in 7.2 (Effects On Statewide Energy Supply) is bereft of any discussion on future petroleum and natural gas availability. The coming energy crunch calls into question the sustainability of our living arrangements as well as the expectation of economic growth. At a minimum, the closing window of liquid fossil fuel availability argues for greater use of non-depleting renewable energy resources. As natural gas becomes increasingly scarce, utilities will have no choice but to add wind, solar, biogas (and perhaps coal) to minimize their use of a sunset energy source. The FEIS should state that increasing wind generation will often--though not always--enable utilities to throttle back expensive gas-fired generation sources. Considering the large number of peaking and intermediate gas-fired generators built in the previous 10-year period, as well as the larger units now under construction, prices will continue to trend upward. Relative to other fuels, wind power is becoming increasingly attractive to utilities as a source of pricing relief.

4. Impacts on adjacent properties.

As to impacts on residential properties located next to the properties hosting wind turbines, the DEIS notes that it is reasonable to expect that such properties “could be adversely impacted.” (DEIS at 145) RENEW submits that such an expectation is not reasonable. The impact on neighboring properties will be largely subjective, that is, in the eye of the beholder, based on the values and expectations of the current homeowner and future buyers. The statement has no predictive value.

5. Conclusion.

RENEW respectfully requests that the above comments be considered in the Public Service Commission’s preparation of the FEIS in this proceeding.

Dated this 22nd day of April, 2005.

Respectfully submitted,

/s/ *Michael Vickerman*

Michael Vickerman
Executive Director
RENEW Wisconsin
222 South Hamilton Street
Madison, WI 53703
(608) 255-4044 (phone)
(608) 255-4053 (fax)
mvickerman@renewwisconsin.org

Comments on the Draft Environmental Impact Statement, submitted by the United States Department of the Interior – Fish and Wildlife Service

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111-4056

IN REPLY REFER TO:
FWS/AES-DHC

April 22, 2005

Mr. Jim Lepinski
Docket Coordinator
Public Service Commission
P.O. Box 7854
Madison, Wisconsin 53707-7854

Re: Draft Environmental Impact Statement (EIS) Associated with Application of Forward Energy LLC for a Certificate of Public Convenience and Necessity to Construct a Wind Electric Generation Facility and Associated High Voltage Electric Transmission Facilities, to be located in Dodge and Fond du Lac Counties, Wisconsin, Docket 9300-CE-100

Dear Mr. Lepinski:

The U.S. Fish and Wildlife Service (Service) has reviewed the draft EIS prepared by the staffs of the Public Service Commission of Wisconsin (Commission) and Wisconsin Department of Natural Resources (DNR) and issued on March 8, 2005. Forward Energy LLC (Forward Energy), a subsidiary of Invenergy Wind LLC, proposes to construct and operate a wind turbine facility utilizing 133 turbines rated at a total of 200 megawatts (MW), hereafter referred to as the Forward project. The wind turbines proposed for the project are General Electric Wind Energy 1.5 MW turbines mounted on 262-foot tubular steel towers, with three 126-foot-long blades. At the top of the rotor sweep, the tips of the turbine blades would be approximately 389 feet above ground level. The draft EIS provides an analysis of the economic, social, cultural, and environmental impacts that could result from the proposed construction and operation of the proposed facilities. The Service offers the following comments and recommendations with respect to the potential environmental impacts of the Forward Energy project for your consideration.

GENERAL COMMENTS

We found the draft EIS to be very well written and comprehensive in its coverage. We appreciate the extensive review of literature associated with wind power provided in the draft EIS and believe that the final EIS will serve as a good reference document on the larger issue of wind power impacts on birds. We also appreciate that the Service's comments of

November 18, 2004, and February 8, 2005, concerning the proposed project have been included in Appendix B of the draft EIS.

As previously indicated in the Service letter of February 8, 2005, the Department of the Interior strongly endorses the development of wind energy. However, if not properly sited and designed, wind energy facilities have the potential to adversely impact wildlife habitat, as well as reduce use of some habitats by certain bird species. Operation of the facilities can also result in direct mortality or injury to birds and bats due to collisions with the turbines. As part of an effort to work cooperatively with individuals and industries that proactively seek to avoid or minimize their impacts on migratory birds and other wildlife resources, the Service developed the 2003 *Service Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines* (Service guidance or voluntary guidance).

The Service guidance advocates the use of a team approach to designing detailed pre-construction studies of proposed project sites, as well as alternative sites in the same wind resource area. The studies provide the basis for assessing the potential risks posed to wildlife at each site and allow for a ranking of the sites based on the relative level of risk. The guidance also contains a series of recommendations on site selection for wind energy facilities and configuration of turbine locations on the site. One of the primary recommendations is to avoid locating turbines in known local bird migration pathways or in areas where birds are highly concentrated, unless mortality risk is low (e.g., birds present rarely enter the rotor-swept area). The draft EIS identifies many of the shortcomings of the pre-construction avian studies conducted by Forward Energy and notes that inadequacies in the studies could have been avoided if Forward Energy had worked more closely with the resource agencies earlier in the process to define the goals and methodology for the studies. The proposed location of the project and the shortcomings of the avian studies are of particular concern due to the proximity of the project to the Horicon Marsh and other important bird concentration areas. The Service's Horicon National Wildlife Refuge (NWR) occupies the northern two-thirds of the 32,000-acre Horicon Marsh. The southern third of the marsh is managed as the Horicon Marsh State Wildlife Area by the Wisconsin DNR.

The Service concurs with the conclusions of the Commission staff with respect to potential impacts of the proposed project and inadequacies of the pre-construction studies of birds, as summarized in section 4.11.6 of the draft EIS, as well as those for bats, as summarized in section 4.12.6 of the draft EIS. The Service also supports implementation of the recommendations in sections 4.11.6 and 4.12.6 to minimize risk to birds and bats and to verify that project impacts to birds and bats are minimized if all or part of the proposed project is approved by the Commission. In particular, the Service concurs with the conclusion of the Commission staff on page 98 that one of the best ways to minimize the risk to common and rare birds is to increase the distance between the turbines and Horicon Marsh. The Service supports the recommendation that it would be prudent to have a setback from Horicon Marsh greater than the 1.2 miles presently proposed by Forward Energy. We provide additional comments concerning this recommendation in the summary comments at the end of this letter. We also believe that it is especially important that adequate post-construction monitoring be required of Forward Energy if the project is approved. The Service is prepared to work with Forward Energy, the Commission, Wisconsin DNR, and other interested parties to develop the monitoring methodology, to review the results of the monitoring, and to develop and assess mitigation measures if results of the monitoring indicate that mitigation might be needed.

SPECIFIC COMMENTS

Page XV, Figure 4-2: The depiction of the Service-owned lands in the Horicon NWR in this figure, as well as in figure 4-2 on page 60 and in figure 4-9 on page 104, is not entirely accurate. These figures also fail to show the approved acquisition boundary. The figure that the Service provided to the Commission with our letter of February 8, 2005, accurately shows both the approved refuge acquisition boundary and existing Service-owned lands within that boundary. Low and medium resolution copies of the figure are available on the Commission web site under PSC Ref# 28115 and PSC Ref# 28117, respectively. We recommend that the referenced figures be revised in the final EIS according to the figure provided by the Service and/or a copy of the figure we provided be included in Vol. 2 in the final EIS and be referenced in the description of Horicon NWR provided in section 4.7 of the final EIS.

Page XVI, Executive Summary, Birds: The third paragraph on this page provides some information on bird fatality rates at other wind farms studied in the United States. If the rate of 10 mortalities per turbine per year provided in this paragraph refers to the Top of Iowa study, please see our comments below for page 94 regarding that study. Similarly, the first sentence in section 4.11.6 (page 96) should also be modified if the mortality rate of 10 birds per turbine is purported to have come from the Top of Iowa study.

Page 31, section 3.2, Site Alternatives, subsection 3.2.1.2, Regional level: The draft EIS indicates that “a preliminary environmental review to determine sensitive environmental resources in the project area was conducted (by the applicant) so as to avoid or minimize any adverse environmental impacts. The results of this preliminary review showed that adverse impacts to the environment are avoidable or unlikely.” At the regional level (second tier of evaluation process), the applicant’s review should have noted the presence of the nearby Horicon and Theresa Marshes. It would be instructive to have Forward Energy provide a description of what the review entailed, including whether the conclusions of the review were revised when the project size was increased and how the decision was made that adverse impacts to these sensitive environmental resources are avoidable or unlikely given the proximity of the proposed project site to such important bird-concentration areas.

Page 52, section 4.7, Regional Environmental Resources: In describing the Horicon Marsh, we believe it is significant to mention that the designation of the marsh as a "wetland of international importance" occurred in 1990 under the Ramsar Convention on Wetlands held in 1971, and that the marsh is one of only 21 sites designated as such in the United States. We recommend that this information be included in the final EIS.

Page 54, section 4.8 Threatened, Endangered, and Species of Special Concern: In listing and summarizing the project's potential impacts to rare and listed species, the draft EIS fails to mention the bat species that are listed as state species of concern which use Neda Mine. There is a high likelihood that these bats also occur in the project area and therefore, we disagree with the following conclusion in the EIS: “With the exception of potential impacts to birds (see Section 4.11), the applicant's analysis, as reviewed and verified by the state agencies, concludes that construction of the Forward Energy project would not affect endangered, threatened, or species of special concern."

Page 54, section 4.8, paragraph 3: The draft EIS indicates that the consultant for the Forward Energy project conducted bird surveys during the spring and fall of 2004. It would aid the reader if the final EIS provided reference to the specific subsections of section 4.11 in which information could be found concerning the number, duration, and intensity of these surveys, as well as the protocol used to conduct them. Information on the number of each of the listed species and "birds of special concern" observed on each of the survey dates would be useful. If it cannot be provided in the final EIS, but is available in reports available on the Commission's web site, it would be helpful if the PSC Reference Number(s) for the report(s) containing the information could be provided in appropriate sections of the final EIS.

Page 57, section 4.11, Birds, subsection 4.11.1, Introduction: In the final EIS, it would be helpful to indicate that wind development can have impacts other than those caused by strikes to birds and bats. Habitat fragmentation, disturbance, and site avoidance should also be mentioned within the introduction. Weather needs to be mentioned, especially in relation to spring and fall bird migration and possible collisions resulting from migration flight altitudes being lower due to inclement weather, especially at night.

Page 58, Table 4-7: It would be useful to add the literature citations for the studies that were reviewed for this section of the EIS, as listed in table 4-7.

Page 58, section 4.11.1.2, Factors affecting wind farm-caused avian mortality: The reference to Hodos *et al.* 2000 should include a mention of bird avoidance and perception problems with blades at close range. The second paragraph of this section mentions that habitat use and bird movements are complex in this area. This paragraph should also mention the high degree and great variety of avian species use of this key area.

Page 59, section 4.11.1.3, Regulations: We recommend that this section be re-titled, "Federal and State Laws." The paragraphs concerning the Migratory Bird Treaty Act (MBTA) should mention that the MBTA currently protects 836 species of migratory birds. As the mute swan nests in Wisconsin and also migrates through the state, it should be included among the species mentioned as nonnative species that are not protected under the Act. With respect to the Endangered Species Act, it should be mentioned that the Service has responsibility for all species that are federally listed at the present time in Wisconsin. The National Marine Fisheries Service plays no role regarding listed species or critical habitat within the State of Wisconsin. It should also be noted that the National Marine Fisheries Service has been renamed the National Oceanic and Atmospheric Administration's Fisheries Division.

Page 62, section 4.11.2.2, Inadequacies with the design of the Forward Energy bird study: The Service fully agrees with the Commission staff's assessment of the inadequacies regarding this pre-construction avian study conducted for the Forward Energy project in spring and fall of 2004. There are many flaws in the analysis, including the failure to conduct any assessment on the western boundary of Forward Energy's proposed project site, immediately adjacent to the Horicon NWR; insufficient study time (including duration) and number of point counts; over-use of vehicle assessments; failure to address avian migration chronologies; questionable methodologies to address flight heights; and failure to address passerine behaviors. By failing to use methodologies previously used at the site by Howe and Atwater 1999, Howe *et al.* 2002, and others, the Forward study has further biased its results through inconsistent and inadequate analyses. In light of the globally important nature of Horicon NWR and the many species of avifauna using, breeding, feeding, staging, and migrating on and through it, we concur with the Commission staff that one would have expected a far more rigorous and adequate study than what was conducted.

The results of the study do not provide a basis for drawing accurate conclusions about potential impacts of the proposed project on waterfowl, wading birds, shorebirds, raptors, passerines, or rare species. A longer and more rigorous study is needed to understand bird use of the project area. We understand that a more rigorous study is currently underway. The Service recommends that preliminary results of that study be made available for review and analysis by the natural resource agencies and be used to inform upcoming decisions on the project.

Page 64, subsection 4.11.3.2, Whooping crane: The information that is attributed to Meyers (personal communication) appears to have been misinterpreted, or the information originally provided by the Service may not have been as specific and detailed as needed. The immature female whooping crane was seen as far east as Highway V; however, that was not in 2004 but in the two previous years. This whooping crane was observed in the project area throughout the late summer and fall of 2002 and 2003. She was seen less frequently in 2004, perhaps due to molting. During 2004, she was mainly observed just outside the project area to the west in the late spring and near Theresa Marsh in the late summer. It is possible she flew through the project area to go to each site but that is not a known fact. In addition to correcting the information in this section with the above information, it should also be noted that during the summer of 2004, there was a second whooping crane that briefly visited the Horicon NWR west of the project area near Oak Center Road.

Page 65, subsection 4.11.3.5, Greater prairie chicken: The Service recommended in its voluntary guidance on wind turbines a minimum buffer of 5 miles between wind facilities and greater prairie-chicken leks. Upon a request from the American Wind Energy Association, the Service published a peer-reviewed briefing paper justifying this metric (Manville, A.M., II, 2004. Prairie grouse leks and wind facilities: U.S. Fish and Wildlife Service justification for a 5-mile buffer from leks; additional grassland songbird recommendations. Division of Migratory Bird Management, USFWS, Arlington, Virginia, peer-reviewed briefing paper. 17 pp., available electronically). Although greater prairie-chickens are not presently found in the vicinity of the project site, efforts are underway to increase grasslands in the area. Reestablishment of the birds might be possible if a sufficient acreage of grasslands can be established. Construction of turbines too close to such grasslands might preclude or reduce the possibly of use by greater prairie-chickens. Disturbance, habitat fragmentation, and site avoidance are important factors that can impact a number of other avian species, as well.

Page 66, subsection 4.11.3.7, Conclusions for rare species: The Service concurs with the Commission staff's assessment that Forward Energy's surveys to determine use of the project area by rare birds were inadequate.

<u>Page 66, subsection 4.11.4.1, Project area bird abundance</u>: As we had recommended for rare bird species, information on the number of each of the other bird species observed on each of the survey dates would be useful. If it cannot be provided in the final EIS but is available in reports available on the Commission's web site, it would be helpful if the PSC Reference Number(s) for the report(s) containing the information could be provided in appropriate sections of the final EIS.

<u>Page 76, section 4.11.4.3.3, Bird flight heights observed in the project area</u>: The Service concurs that the methodologies to assess avian flight heights are questionable and inadequate. Forward Energy failed to assess potential impacts of the true height of the rotor swept areas, which biases the data they did collect, and their analyses missed a number of groups of avifauna including passerines and species that are listed or of special concern.

<u>Page 87, section 4.11.4.6.6, Conclusions for shorebirds, waders, and waterfowl</u>: The Service strongly agrees that the potential displacement of shorebirds, waders, and waterfowl is of concern. However, we believe this concern applies to other species as well. The loss or reduction in use of such a large area for foraging may have significant but unquantifiable impacts to local populations of some species.

<u>Pages 88-90, section 4.11.4.8, Summary of bird presence and use in the project area</u>: We concur with the Commission staff's concerns about the Forward Energy avian study. Of particular note, we are concerned about the need to better define the effects of distance from Horicon NWR and turbine siting within the project area. The study could have been better designed to answer this question. Bird flight heights during stopovers need to be better assessed, and passerines and other small birds should be included in these surveys. Failing to include the western-most portion of the proposed wind facility is a major shortcoming of the study since this area has the greatest number and diversity of avifauna. The survey timing, methodology, and its duration may have contributed to underestimating diversity, occurrence, and bird abundance in the area of proposed wind energy development. Forward Energy's conclusion that, "with the exception of waterfowl, use by all other bird groups is low or insignificant" does not appear to have been substantiated in a scientifically valid way.

<u>Page 90, section 4.11.5, Avian mortality from wind turbines, and subsection 4.11.5.1, Studied bird fatality rates</u>: The last bullet in the summary of risks published by the National Wind Coordinating Committee discusses avoidance. This is not necessarily a direct source of mortality unless birds cannot find suitable alternative resources. In order to encompass avoidance and other behavioral impacts, it may be more appropriate to change the titles of these two sections to include risks or impacts other than mortality or, alternatively, to move this discussion to another section of the final EIS.

<u>Pages 92-96, section 4.11.5.2, Summary of avian impact studies</u>: The Service has concerns with Forward Energy's reliance on and comparison to studies conducted at Buffalo Ridge, Minnesota; the Top of Iowa Wind Farm, north-central Iowa; the Suisun Marsh along the Sacramento River, California, and other studies referenced in the draft EIS. In its voluntary guidelines, the Service recommends that different sites within a wind resource area be evaluated to determine the potential risk to wildlife at each site and the sites be ranked against each other on this basis. This recommendation was not followed for the Forward project. The comparisons provided by

Forward Energy are interesting but differences between the referenced study sites in vegetation, climate, topography, soil chemistry, food availability, agricultural development, proximity to major wetlands, and other conditions may make close comparisons invalid. We note that the Commission staff expressed similar concerns.

Page 94, section 4.11.5.2.2, Top of Iowa study: Our review of the Top of Iowa Progress Report for Calendar Year 2003 indicates that the estimated adjusted mortality of 10.79 birds is the estimated total for all 89 turbines and not the estimated mortality per turbine, which would be approximately 0.12 mortalities per turbine. The Service also reviewed the 2004 progress report, in which the total estimated avian mortality for 2003 appears to have been modified from the 2003 report. It is now reported to be 35 (0.39 mortalities per turbine) instead of 10.78. The preliminary mortality estimate for the period between March 24 and December 15, 2004, is a total of 100 birds (1.12 mortalities per turbine). The actual total number of carcasses collected for the two survey years combined was seven. The preliminary estimated total mortality for both years included large variances.

Pages 96-98, section 4.11.6, Conclusion: We concur with the conclusions and recommendations made by the Commission staff and appreciate their detailed review and forthright approach in suggesting ways to make this study a meaningful and significant one. In particular, the Service agrees that any evaluation of the project area must be placed in a regional context because of the project area's location relative to Horicon and Theresa Marshes and the Niagara Escarpment.

For a wind farm project, the goal of not threatening species viability is insufficient. With respect to wildlife, design and operation of a wind project should include, at a minimum, the goal of not significantly impacting local populations of individual species. Depending on the species, a threshold of species viability may involve high mortality and/or may be more difficult to assess than impacts to local populations. Further, there is recognition in the ecological community that local populations may have distinct characteristics separate from other populations within a species range, and it is unlikely that such characteristics would be recognized in the process of evaluating impacts of individual facilities such as wind farms. For migratory birds, the Service is obviously interested in ensuring that wind energy projects, both individually and cumulatively, do not have adverse population-level impacts. In addition, in keeping with the MBTA, one of the objectives of the Service’s development of its voluntary guidelines for wind turbines is to work with wind project proponents in the siting and design of wind farms to ensure that all reasonable measures are taken to avoid the loss of migratory birds.

We generally agree with all of the proposed mitigation strategies in the draft EIS and support their adoption as conditions for any project approval. It is very important that meaningful, multi-year post-construction surveys are conducted using peer-reviewed methodology. Because of the potential impacts to migratory birds, the Service has a strong interest in reviewing any study protocols to ensure that they adequately capture the nature and degree of wildlife impacts.

If the project is approved and post-construction surveys are required, Forward Energy or the consultant to conduct the surveys should obtain a permit from the Service’s Regional Migratory Bird Permit Office to authorize possession under the MBTA of any carcasses of migratory birds that are collected. Information that the Service would want to receive periodically in the survey reports would include information on the species, dates, and original locations of observed or recovered carcasses.

Page 108, Table 4-16: This table for bat mortality rates includes a superscript "3" in the “Region” column of the table, but there is no corresponding footnote below the table.

Page 109, section 4.12.5.1, Bat mortality studies at existing wind farms in the U.S.: We note that preliminary results from the Top of Iowa study, conducted in a rural, largely agricultural area, indicate that the carcasses of 75 bats of 6 species were found at transects under 26 towers over the two-year study period. Almost all mortality occurred during the fall migration. For the 2003 and 2004 study periods, the preliminary estimate for total bat mortality is 525 and 905, respectively. We understand that work to refine these preliminary estimates is continuing and that they may be revised downward.

Page 110, section 4.12.5.2, Bat mortality studies at existing wind farms in Wisconsin: Toward the end of the first paragraph of this description of the Howe et al. study in Kewaunee County, the draft EIS also cites Erickson et al. 2003. This reference appears to be out of place.

Page 112, section 4.12.6, Conclusions and recommendations: We suggest clarification of the statement "It is likely that bat fatalities will be additive as more wind farms are constructed in the region." We recommend discussion, at this point or earlier in the document, of the fact that adult bats generally have a very low natural mortality rate and that a large proportion of the carcasses recovered in the West Virginia study were of adult bats. This is also true for the Buffalo Ridge, Minnesota, study. In our view, this suggests that wind farms may cause not only additive mortality but may have disproportionate impacts on the effective (reproductive) populations of the species in question.

Page 113: The reference in the second full paragraph on this page to the Service letter submitted to the Commission should be corrected to say Appendix “B” rather than “A.” This should also be corrected in footnote 9 on the bottom of page 57.

Page 191, section 7.1, Wind Projects Proposed and Completed in the Region: Table 7-1, Existing and proposed utility-scale wind projects along the escarpment, does not include the proposed Emerging Energies wind farm to be located in the Town of Mishicot, Manitowoc County. That project would include 3 to 6 turbines of 1.4 to 3 MW each.

Pages 196-197, section 7.5, Long Term Mitigation Strategies: The Service agrees with the proposed long-term mitigation strategies. In particular, we strongly endorse the recommendation to lower the regulatory-review threshold because of the number of turbines already existing or proposed on the Niagara Escarpment, as well as similar wind resource areas, and the likelihood that there will be many future proposals for additional turbines. State regulatory agencies could then assess or address project-specific or cumulative impacts to local or regional wildlife resources. We believe it is important for local natural resource experts and stakeholders to have the opportunity to influence the outcome of such long-term and significant cumulative changes to the landscape.

SUMMARY COMMENTS

The Service believes that wind energy can be a very desirable alternative to other forms of energy production. However, prudent siting, design, and operation of wind farms is required to ensure that potential impacts to migratory birds, bats, and other wildlife are avoided or minimized to the extent possible. Due to inadequacies in the applicant's pre-construction avian studies, the type of information needed to adequately support a decision on whether a large wind farm should be located near such a globally significant migratory bird resource as the Horicon Marsh is lacking. In the absence of further extensive studies, we recommend adoption of a precautionary approach to ensure protection of this valuable environmental resource.

If the project is approved, we concur with the Commission staff's recommendation that it would be prudent to have a setback from Horicon Marsh greater than the 1.2 miles presently proposed by Forward Energy. We believe the greater the distance between the Marsh (and Horicon NWR) and the turbines, the better, as the number of birds that have been observed using the project site decreases substantially from west to east. At a minimum, we recommend that no turbines be located west of the road running north from Leroy, for which sections are shown (from south to north) as County Road YY, Wells Road, and Highland Road on figures 1-A and 1-B in volume 2 of the draft EIS. This would create a separation distance of approximately 2 miles between the eastern boundary of the Horicon NWR and the nearest turbines. The results of the additional surveys being conducted this spring should be reviewed to allow for a better understanding of the relationship between bird use and distance from the Marsh and other bird concentration areas, such as the Service's waterfowl production areas. Depending on the results of the surveys, consideration of even a greater separation distance might be warranted.

In addition, we recommend that a multi-year, agency and peer-reviewed post-construction monitoring study be included as a condition if the project is approved. It should also be required that the results of the post-construction monitoring be reviewed by the Commission, Wisconsin DNR, and Service, in collaboration with Forward Energy, with a view toward determining adaptive management measures that could be taken to eliminate adverse impacts on migratory birds, as well as bats, if such impacts are documented.

We appreciate the opportunity to review and comment on the draft EIS.

Sincerely,

/s/ Charles M. Wooley
Acting Regional Director

cc: Wisconsin DNR, Office of Energy, Madison, WI, Attn: Dave Siebert

Comments on the Draft Environmental Impact Statement, submitted by the Wisconsin Audubon Council

WISCONSIN
AUDUBON COUNCIL

21 April 2005

Jim Lepinski, Docket Coordinator
Public Service Commission
P.O. Box 7854
Madison, WI 53707-7854
Jim.lepinski@psc.state.wi.us

Re: PSC docket 9300-CE-100

Dear Mr. Lepinski:

The Wisconsin Audubon Council would like to submit the attached resolution regarding the proposed Forward Wind Energy Center as part of the public comment period for PSC Docket 9300-CE-100.

The Wisconsin Audubon Council has reviewed the draft environmental impact statement and, as indicated in the attached resolution, opposes the proposal by Forward Energy, LLC.

Sincerely,

Randy Korb, President
Wisconsin Audubon Council
P.O. Box 1963
Green Bay, WI 54305
rkorbbio@aol.com

WISCONSIN
AUDUBON COUNCIL

Whereas, the Wisconsin Audubon Council, Inc. supports the use of wind power as an alternative to traditional energy generation systems, and

Whereas, the Wisconsin Audubon Council, Inc. is an environmental advocacy organization in support of the protection of birds and other wildlife and their habitats,

Therefore, be it resolved that the Wisconsin Audubon Council, Inc. is opposed to Forward Energy LLC's proposal to locate its 200 megawatt wind turbine facility in close proximity to the Horicon National Wildlife Refuge because of its potential and unknown impact on wildlife.

Adopted by the Wisconsin Audubon Council, Inc. on April 21, 2005.

Comments on the Draft Environmental Impact Statement, submitted by the Wisconsin Metro Audubon Society

Lepinski, Jim PSC

From: Diane Lembck [dluvs2hike@core.com]
Sent: Thursday, April 21, 2005 11:36 PM
To: Lepinski, Jim PSC
Subject: PSC docket number 9300-CE-100

Dear Mr. Lepinski:

Whereas, the Wisconsin Metro Audubon Society supports the use of wind power as an alternative to traditional energy generation systems, and

Whereas, the Wisconsin Metro Audubon Society is an environmental advocacy organization in support of the protection of birds and other wildlife and their habitats,

Therefore, be it resolved that the Wisconsin Metro Audubon Society is opposed to Forward Energy LLC's proposal to locate its 200 megawatt facility in close proximity to the Horicon National Wildlife Refuge because of its potential and unknown impact on wildlife.

Adopted by the Wisconsin Metro Audubon Society on April 21, 2005

Summary of Significant Changes to EIS

In response to many of the written oral comments received on the draft EIS, and as a result of additional analysis by PSC and DNR staff, some major changes to the draft EIS have been made.

The following section summarizes these major changes. The information is presented chapter by chapter. The sections or subsections (shown in bold) under each chapter heading indicate where the text changes occur.

There were also some changes made that are not listed in the summaries below. The overwhelming majority of those changes were made to improve the readability of the text, correct errors, and improve the consistency of the formatting throughout the document.

CHAPTER 1 - PROJECT OVERVIEW AND REGULATORY REQUIREMENTS

1.1.5 Power Contracts: Changes have been made to reflect Alliant's contract to purchase power from the Forward project and an increase in the amount of energy purchased by WPPI.

1.2.4 Federal Production Tax Credit: The 2005 tax credit is reflected.

1.4.2 CPCN application for the Forward project: Additional information decided at a prehearing conference held on March 14 has been included. Also, the currently scheduled dates for the public and technical hearings were added.

1.4.5 Public participation opportunities: A section (1.4.5.1) was added describing Forward's public outreach efforts.

1.7 Local interests: Updates relating to the Dodge County Conditional Use Permit and Dodge County's amendments to the ordinance regulating WES have been added.

CHAPTER 2 - ENGINEERING

2.3.4 Energy Costs: A new section discusses the cost of wind energy versus other traditional sources of power.

2.5.6 Removal of Facilities: More detail was added about the turbine removal process and Forward's obligations as required by the Dodge County Ordinance and Conditional Use Permit.

CHAPTER 3 - ALTERNATIVES

3.3.2 Turbine siting process: Changes have been made to reflect the amendments to Dodge County's ordinance regulating WES.

CHAPTER 4 - NATURAL ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION MEASURES

4.4.2 Groundwater: This discussion has been expanded to address the concerns and potential impacts related to well contamination and/or failure. Forward's proposed plan and procedures for avoiding and mitigating impacts to groundwater are also included.

4.4.3 Avoidance of water consumption and thermal pollution: This discussion has been expanded to include a comparison of the Forward project and other traditional fossil fuel generation facilities with respect to water consumption and water quality impacts.

4.5.1 Air emissions avoided by using wind energy: This section has been expanded to include a comparison of the Forward project and other traditional fossil fuel generation facilities with respect to air emissions.

4.11 Birds: This section has been substantially revised. The revisions reflect: the comments of USFWS and information provided by local residents and organizations that actively observe birds and bird use in the area; information related to Forward's 2005 bird study design; and updates on cited bird studies.

4.12 Bats: Changes in this section reflect updates in existing or on-going bat studies and the implications of this work on the ability to assess the potential for impacts on bats caused by the Forward project.

CHAPTER 5 - SOCIAL ENVIRONMENT AND COMMUNITY IMPACTS

5.3.3 Recreation: A short discussion of possible tourism effects due to "curiosity" about the turbines was added.

5.3.4 Airports and airstrips: This section was revised to clarify the potential setback zones that could be applied to ensure the safety of pilots using private airstrips in and near the project area. A new discussion and diagram related to turbulence buffer zones was added. Also, two figures in Volume 2 related to this discussion (Figures Vol. 2-22 and 2-23) have been altered to better reflect the new discussion.

5.4.1 Existing zoning in the project area: This section has been revised to incorporate a description of the Condition Use Permit granted to Forward for the project and Forward's response to the permit.

5.4.2 Local wind energy system ordinances: This section has been altered to reflect the amendments to Dodge County's ordinance that were approved on April 19, 2005.

5.5.2.6 Aerial pesticide applications: A new paragraph about the potential for use of helicopters in aerial applications was added.

5.6.4 Property values: The text has been expanded to include measures that could be implemented to mitigate potential adverse property value impacts.

5.10.2 Potential visual impacts from the project: Text has been added to describe a new photo simulation of a panoramic view looking east from STH 49 as it passes through Horicon Marsh. This new simulation is Figure Vol. 2-13.

CHAPTER 6 - GENERATION INTERCONNECTION AND TRANSMISSION FACILITIES

6.5.4 Overhead 34.5 kV line: The route described in the text has been changed to reflect the route shown in Figure Vol. 2-3 which is Forward's currently proposed route. Comments were received from the Byron town government that it would oppose the overhead line passing through the community of South Byron. In light of these comments, possible solutions proposed by Forward to accommodate the town's concerns are discussed.

CHAPTER 7 - CUMULATIVE IMPACTS

7.1 Environmental and social effects of the Forward project: This section has been added to discuss, separately, the cumulative effects of the Forward project.

EXECUTIVE SUMMARY

The Executive Summary has been revised to reflect many of the important changes described above.

VOLUME 2

A new figure (2-23) has been added to illustrate possible turbulence buffer zones that could be implemented around private airstrips located in and near the project area. Also, a new photo simulation was added (2-13) to show the view looking east from STH 49 as one passes through the Horicon Marsh.