LARGE FILING SEPARATOR SHEET

CASE NUMBER 09-479-EL-BGN

FILE DATE JUL 10 2009

SECTION 1 OF 3

NUMBER OF PAGES 202

DESCRIPTION OF DOCUMENT

APPLICATION

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FILE

July 10, 2009

VIA HAND DELIVERY

Ms. Renee Jenkins
Administration/Docketing
Ohio Power Siting Board
180 East Broad Street, 13th Floor
Columbus, Ohio 43215-3793

Re: Hardin Wind Energy LLC,
Case No. 09-479-EL-BGN

Dear Ms. Jenkins:

Enclosed, please find an original and twenty (20) copies of the application of Hardin Wind Energy LLC, a wholly-owned subsidiary of Invenergy LLC for a Certificate of Environmental Compatibility and Public Need under Chapter 4906-17 of the Ohio Administrative Code (OAC). Pursuant to OAC 4906-5-03(A)(3), the application makes the following declarations:

Name of Applicant:
Hardin Wind Energy LLC
a subsidiary of Invenergy LLC
One Wacker Drive, Suite 2020
Chicago, IL 60606

Name/Location of Proposed Facility:
Hardin Wind Farm
Lynn, Cessna, Marion, Roundhead, McDonald, and Taylor Creek Townships
Hardin County, Ohio

Authorized Representative: Technical
Nazre Adum, PE
Invenergy LLC
7564 Standish Place, Suite 123
Rockville, MD 20855
(301) 610-6417
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Authorized Representative: Legal
Sally W. Bloomfield
Bricker & Eckler LLP
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614-227-2368 (Telephone)
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Notarized Statement:

See Attached Affidavit of David Groberg,
Vice-President of Hardin Wind Energy LLC

Sincerely on behalf of,
Hardin Wind Energy LLC

Sally W Bloomfield

Sally W. Bloomfield

BEFORE
THE OHIO POWER SITING BOARD

In the Matter of the Application of **HARDIN WIND ENERGY LLC** for a Certificate to Site a Wind-Powered Electric Generation Facility in Hardin County, Ohio	))))	Case No. 09-479-EL-BGN

AFFIDAVIT OF VICE PRESIDENT OF HARDIN WIND ENERGY LLC

STATE OF MARYLAND :
: SS.
COUNTY OF MONTGOMERY :

I, David Groberg, being duly sworn and cautioned, state that I am over 18 years of age and competent to testify to the matters stated in this affidavit and further state the following based upon my personal knowledge:

1. I am the Vice President of Hardin Wind Energy LLC, which is a wholly-owned indirect subsidiary of Invenergy LLC.

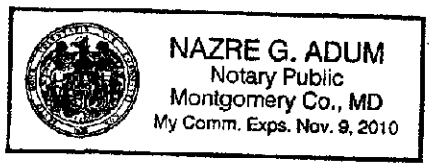
2. I have reviewed Hardin Wind Energy LLC's Application to the Ohio Power Siting Board For a Certificate of Environmental Compatibility and Public Need for the Hardin Wind Farm project.

3. To the best of my knowledge, information and belief, the information and materials contained in the above-referenced Application are true and accurate.

4. To the best of my knowledge, information and belief, the above-referenced Application is complete.

David Groberg, Vice President

Sworn to before and signed in my presence this 6th day of July 2009.

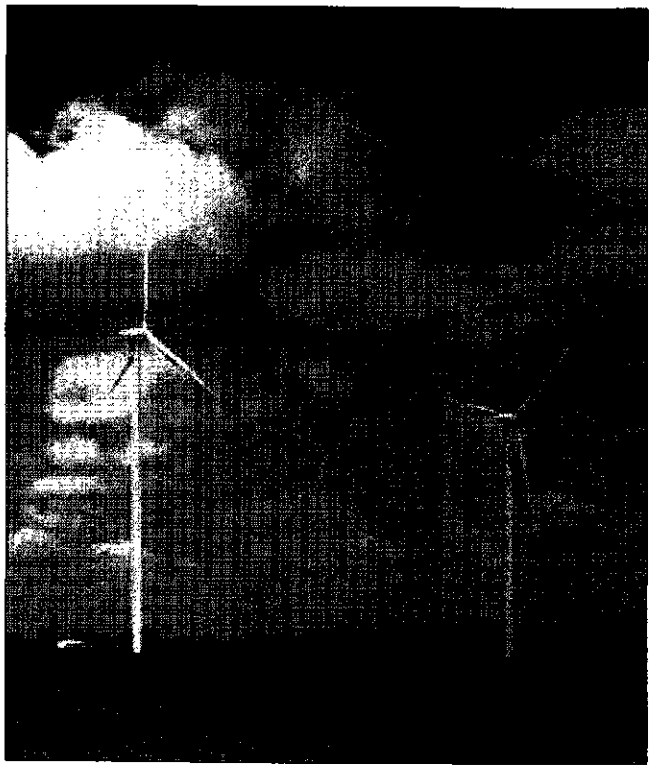


Notary Public

FILE

HARDIN WIND FARM

Application to the Ohio Power Siting Board For a Certificate of Environmental Compatibility and Public Need



Submitted By

HARDIN WIND ENERGY LLC

CASE NO. 09-479-EL-BGN

07/10/09

BEFORE THE OHIO POWER SITING BOARD
Application of Hardin Wind Energy LLC
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SUBMITTAL CHECKLIST

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4906-17-02	Project Summary	A	Project Summary	
4906-17-03	Project Description	A	Project Description	General Description provided
		B	Project Schedule	Expected Schedule Provided
4906-17-04	Project Area Analysis	A, B	Site selection criteria	General Site Selection Process provided
4906-17-05	Technical Data	A 1 - 3	Project Area Site	Maps have been provided
		A 4	Geology	Technical Memo provided
		A 5	Hydrology and Wind	Technical Memo provided
		B	Layout and Construction	Construction Sequencing provided
		C	Safety Equipment	Discussion of Safety Equipment
		D	Regional Electric Power System	All available studies provided
4906-17-06	Financial Data	A, B, C, D		General Wind Facility Cost provided
4906-17-07	Environmental Data	B	Air	Discussion Provided
			Water	Assessment provided
			Solid Waste	Assessment provided
4906-17-08	Social and Ecological Data	A 1	Demographics	Discussion provided
		A 2	Noise	Noise Assessment provided
		A 3 -5	Water, Ice Throw, Blade Shear	Risk Assessment provided
		A 6	Shadow Flicker	Shadow Flicker Assessment provided
		B	Ecological Impact	Desktop Assessment of Major Species
		C 1	Land Use	Section provided
		C 2	Economics	General Economic Analysis provided
		C 3	Public Services	Impact Assessment Provided

OP5II Section	Title	Subsection	Item	Status
		C 4	Regional Development	Impact Assessment Provided
		D	Cultural Impact	Partial Phase 1 Provided
		E	Public Responsibility	Assessment Provided
		F	Agricultural Impact	Impact Assessment provided

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LIST OF TABLES

GLOSSARY

AEP – American Electric Power, the interconnected utility

ARRA – American Recovery and Reinvestment Act

AWEA – American Wind Energy Association, a trade group

BAT - Best Available Technology

BMP - Best Management Practice

CFR - Code of Federal Regulations

CNG - Consolidated Natural Gas Company

dB – decibels

DOE – Department of Energy

FAA – Federal Aviation Administration

FEMA - Federal Emergency Management Agency

FERC - Federal Energy Regulatory Commission

GE – General Electric

IEC - International Electrotechnical Commission

MW – megawatt

MWh – megawatt-hour

NAAQS - National Ambient Air Quality Standards

NPDES - National Pollutant Discharge Elimination System

NRHP - National Register of Historic Places

O&M – Operations and Maintenance

OE/AAA - Obstruction Evaluation / Airport Airspace Analysis

ODNR - Ohio Department of Natural Resources

ODOT - Ohio Department of Transportation

OEPA - Ohio Environmental Protection Agency

OHPO – Ohio Historic Preservation Office

OPSB - Ohio Power Siting Board

OSHA – Occupational, Health and Safety Administration

PJM – PJM Interconnect, LLC, the interconnected independent system operator

POI – Point of Interconnection

PTI - Permit to Install

ROW - Right-of-Way

SCADA - Supervisory Control and Data Acquisition

USACE - United States Army Corps of Engineers

USEPA - United States Environmental Protection Agency

USDA – United States Department of Agriculture

USGS - United States Geological Survey

USFWS – US Fish and Wildlife Service

WWH - Warm Water Habitat

4906-17-02 Project Summary and Facility Overview

(A) PROJECT SUMMARY AND OVERVIEW OF THE PROPOSED PROJECT

Hardin Wind Energy LLC (the Applicant), an affiliate of Invenergy Wind Development LLC (Invenergy), is proposing to construct a 300 megawatt (MW) wind-powered electric generation facility in the western portion of Hardin County (the wind farm) consisting of either 120 General Electric (GE) 2.5 MW model xl wind turbines or 200 GE 1.5 MW model xle wind turbines. The wind farm will interconnect to the regional electrical system through the construction of a substation adjacent to the transmission lines that cross through the Project Area.

Invenergy and its affiliates are focused on the development, ownership, operation and management of large-scale wind energy facilities and other clean energy generation assets in the North American and European markets. The Invenergy companies have approximately 2,000 of MW wind-powered generation assets and 2,200 MW of natural gas-fired generating projects in operation. Invenergy is one of the top five largest owners of wind generation assets in the United States according to the American Wind Energy Association 2008 Annual Wind Industry Report.

(1) General Purpose of the Facility

The general purpose of the Project is to produce clean, renewable, reliably priced, low cost electricity to the Ohio bulk power transmission system. The electricity generated by the wind farm will be integrated into the transmission grid operated by the PJM Interconnection. Due to the size of the files of the digital, geographically referenced data which the Applicant used to generate the required hard copy maps has been uploaded by the Applicant to ftp://ftp.ttfwi.net for ease of use by the Ohio Power Siting Board Staff (OPSB Staff). A username and password will be provided to the OPSB Staff by the

Applicant upon request. Additionally a copy of the digital, geographically referenced data which the Applicant used to generate the required hard copy maps has been provided on CD to the OPSB Staff.

(2) Facility Description

The proposed wind farm will be located upon of approximately 20,000 acres of leased land in Hardin County, Ohio in the Townships of Lynn, Cessna, Marion, Roundhead, McDonald and Taylor Creek. These participating landowners are located entirely within the approximately 36,000 acre Project Area. Land use within the Project Area is predominantly agricultural. A further breakdown of the land use types is provided in Section 4906-17-08(B)(1)(b). The Applicant is proposing to install either 120 GE 2.5 xl wind turbines or 200 GE 1.5 xle wind turbines depending on equipment availability and economic considerations. The Applicant will locate the wind turbines so they are spaced far enough apart from each other to optimize the power output from the wind farm but in general will be spaced approximately 3 rotor diameters apart, from side to side, perpendicular to the predominant wind direction. This general spacing side-to-side will be approximately 1,000 feet for the GE 2.5 xl wind turbine and 800 feet for the GE 1.5 xle wind turbine. Parallel to the predominant wind direction, the spacing will generally be 10 rotor diameters or 3,300 feet for the GE 2.5 xl wind turbine or 2,500 feet for the GE 1.5 xle wind turbine. The Applicant has submitted an interconnection request to PJM Interconnect, LLC (PJM) for the American Electric Power (AEP) East Lima – Marysville 345kV transmission line as well as a secondary interconnection request on the AEP South Kenton – East Lima 138kV transmission line. The point of interconnection (POI) for both interconnection requests will be the transmission lines within the Project Area.

(3) Site Selection Process

The Applicant has determined that the Project Area is an ideal location through a state-wide review of wind resource, transmission location and availability, landowner interest, community interest, competitive analysis and evaluation of land use compatibility.

(4) Principal Environmental and Socioeconomic Considerations

A comprehensive desktop review of protected species has been completed and impacts to both state and federal threatened or endangered species' habitats will be avoided where possible. The potential exists for several protected birds (Northern harrier, and Sandhill crane) and one protected bat (Indiana myotis) to inhabit the Project Area. The Applicant, in consultation with the Ohio Department of Natural Resources (ODNR), is performing field studies to evaluate the potential for impacts to birds and bats (both generally and the protected species specifically) from both United States Fish & Wildlife Services (USFWS) and ODNR. As of the date of this application, the Applicant has completed the studies presented in the following table:

Table 02-01 ODNR Ecological Study Status

Description	Start Date	End Date	Percent Fieldwork Complete	Results
Fall Diurnal Bird and Raptor Survey	September 3rd 2008	October 31st 2008	100%	Overall raptor use rates low compared to raptor migration count sites. Northern harrier was observed.

Description	Start Date	End Date	Percent Fieldwork Complete	Results
Fall Passerine Survey Round 1	September 15th2008	November 15th2008	100%	Data collected to date at the Project Area do not seem to show high numbers of passerines utilizing the proposed Project Area as stopover habitat.
Late Fall Sandhill Crane Survey	November 8th 2008	December 13th 2008	100%	One group of 3 Sandhill cranes observed.
Spring Diurnal Bird and Raptor Survey	March 16th 2009	May 1st 2009	100%	Overall raptor use rates low compared to raptor migration count sites. Northern harrier was observed.
Raptor Nest Survey	March 25th 2009	March 25th 2009	100%	One active red-tailed hawk nest and three inactive raptor nest structures found.
Spring Passerine Migration	March 30th 2009	May 31st 2009	100%	Data collected to date at the Project Area do not show high numbers of passerines utilizing the Project Area as stopover habitat.
Breeding Bird Survey	May 1st2009	July 31st2009	70%	Data currently being collected.
Indiana Bat: mist net survey	June 15th 2009	June 22nd2009	100%* Report in progress	Nine sites were surveyed for ? net nights, and no Indiana bats were captured.
Indiana Bat: Acoustic Survey	March 18th 2009	November 15th 2009	40%	First bat pass recorded April 16th.
Fall Passerine Survey Round 2	August 15th 2009	September 15th 2009	0%	Surveys will be performed.

The Applicant has performed a desktop review of potential archaeological and architectural resources in and around the Project Area. The Applicant has developed a

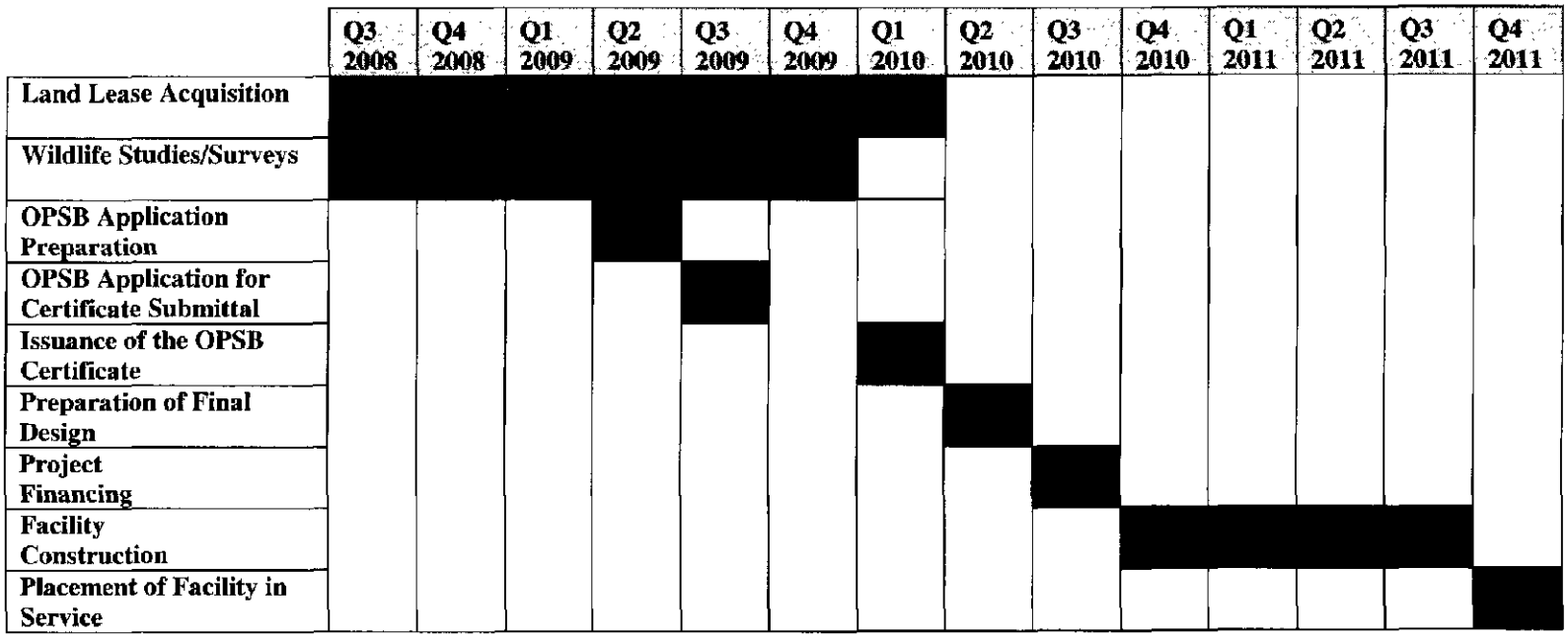
sensitivity model for these resources. This sensitivity model will act as a predictor of potential occurrences of archeological/architectural resources. If necessary, a work plan will be developed in coordination with the appropriate state agencies to confirm the accuracy sensitivity model and to perform field tests to determine if any archeological/architectural resources are present within the Project Area.

The wind farm will have a net positive impact on the economy of the communities where the wind farm is proposed. The Project Area currently has a strong agriculture industry and the wind farm will integrate well with this industry. Rules on taxation of wind farms are under discussion in Ohio, but it is expected that the wind farm will be the largest taxpayer in Hardin County.

(5) Project Schedule

Project schedule is on the next page.

Figure 02-01 Project Schedule



4906-17-03 Project Description and Schedule

(A) PROPOSED FACILITY DESCRIPTION

(1) Project Description

(a) Types of Turbines

The Applicant is proposing to install up to 300 MW of generating capacity using up to 120 GE 2.5 xl turbines or, depending on a variety of commercial considerations, up to 200 GE 1.5 xle turbines. Other turbine models could be used, but these would be similar in design to the two GE turbines proposed and would have physical dimensions similar to these two turbines. The Applicant's decision on final turbine selection will consider multiple factors that may affect project economics. These will include, but not be limited to, equipment availability from the manufacturers, electric production, equipment reliability and warranties, turbine pricing, commercial terms, and installation costs. The Applicant will submit a final layout based on comments received on the draft layout provided herein during the OPSB permitting process. This wind farm layout will be developed to optimize production and minimize environmental impacts for the chosen wind turbine type. The Applicant will locate the wind turbines so they are spaced far enough apart from each other to optimize the power output from the wind farm but in general will be spaced approximately 3 rotor diameters apart, from side to side, perpendicular to the predominant wind direction. This general spacing side-to-side will be approximately 1,000 feet for the GE 2.5 xl wind turbine and 800 feet for the GE 1.5 xle wind turbine.

The Applicant expects that with the proposed wind farm layouts (for the GE 2.5 xl or GE 1.5 xle), the wind turbines will operate for approximately 85% of the hours of the year and the wind farm's overall net capacity factor will be in the approximate range of 26% to 30% for an annual energy production for the whole wind farm of 709,560 Megawatt hours (MWh).

(b) Area Requirements

The area required will be greater during construction than during operation of the wind farm. Estimated area required during construction and operation are summarized in Table 03-01.

Table 03-01 Estimated Area Disturbances GE 2.5 xl Layout

Impact	Area Disturbance during Construction (Temporary)	Area Disturbance during Operation (Permanent)	Qty	Total Construction Disturbance	Total Permanent Disturbance
Turbines	2.9 acres per turbine[1]	0.04 acres per turbine[2] (that seems really low)	120 turbines	348 acres	5 acres
Access Roads	75 feet wide[3]	20 feet wide[4]	35 miles	320 acres	84 acres
Cables	30 feet wide[6]	None	65 miles	126 acres	None
Transformer Substation	2 acre[7]	1 acre	1	2 acres	1 acre
Interconnection Substation	6 acres[7]	5 acres	1	6 acres	5 acres
O&M Building	3 acres	2 acres	1	3 acres	2 acres
Staging Area (aka "Laydown Yard")	10 acres	None	1	10 acres	None
Total				813 acres	97 acres
Average per wind turbine				6.6 acres	0.7 acres

Notes:

1. During construction, the wind turbine assembly area will generally be a circular area with a radius of 200 feet or less. The following construction activities will take place within this area: foundation excavation and construction, crane pad construction, component laydown and assembly.

2. During operation, the wind turbine footprint will include the turbine base and a gravel apron approximately 15 feet wide.

3. During construction, access road disturbances are estimated to be a maximum of 75 feet wide. This width includes area for a gravel roadway of between 20 feet and 35 feet, depending on whether the section of roadway will be used for the main erection crane which is up to 30 feet wide, area for topsoil stockpiles, area for shoulders, and area for cable routes beside the road.

4. During operation, access road disturbances are estimated to average 20 feet wide. This width includes area for a gravel roadway of 16 feet plus up to 2 feet on each side for road shoulders.

5. During construction, cable route disturbances are estimated to average 30 feet wide. Actual disturbed areas would be less where only one circuit is run. This width includes the width of the actual cable cut which is typically 1-2 feet wide, and the width needed for machines to drive over the area. This calculation conservatively over estimates cable disturbances by assuming that that no cable routes are in the road disturbance area.

6. Area disturbances of substation, switchyard, and O&M building are assumed to be 1 acre larger during construction.

7. Average area disturbance per turbine does not include the areas for the substation, O&M building, and laydown yard.

8. The Applicant may be installing up to 3 permanent meteorological towers to more accurate monitor wind resources during operations of the wind farm. These permanent meteorological towers will require minimal acreage to be disturbed.

9. At the intersection of the access roads and public roads the turning radius will be larger than that of typical public roads in order to accommodate the wind turbine component delivery vehicles. This area will be regraded and reseed after construction. A calculation of this area will be determined as part of the final design.

As shown in Table 03-01, the total area occupied by the proposed project would disturb approximately 2.3% of the Project Area during construction and 0.3% of the Project Area permanently.

Table 03-01 is based on a project using 120 wind turbines. For the GE 1.5 xle layout using 200 wind turbines, the quantities in the table would change to 200 turbines, 50 miles of access roads, and 75 miles of cable circuits. As a result, the estimated area disturbance would be 1045 acres and 100 acres for construction and operation respectively. This amounts to 2.9% and 0.3% of the Project Area.

The areas in this section are conservative estimates that are provided to illustrate the maximum expected area disturbances. Actual disturbed areas should be less.

(2) Description of Equipment

Both proposed wind turbines discussed in this application are three-bladed, upwind, horizontal-axis wind turbines. The wind turbine rotor and nacelle are mounted on top of a tubular tower. The wind turbine employs active yaw control (designed to steer the machine with respect to the wind direction), active blade pitch control (designed to regulate wind turbine rotor speed), and a generator/power electronic converter system from the speed variable drive train concept.

Every wind turbine will be equipped with a wind speed and direction sensor that communicates to the wind turbine's control system to signal when sufficient winds are present for operation. Both feature variable-speed control and independent blade variable pitch to assure aerodynamic efficiency, and which functions as an aerodynamic over-speed control system. The wind turbines have active yaw and pitch regulation with power torque control capacity and asynchronous generators and a bedplate drive train design where all nacelle components are joined on common structures to improve durability.

The two proposed wind turbine models have identical operational characteristics: they begin operation in wind speeds of 3.5 meters per second (m/s) (7.9 miles per hour [mph]) and reach their rated capacity (2.5 MW and 1.5 MW, respectively) at a wind speed of 12.5 m/s (28 mph). The rotor direction, as an observer faces the wind turbines, will be clockwise.

GE has incorporated the supervisory control and data acquisition (SCADA) communication technology into all of their wind turbines. The SCADA communications system permits automatic independent operation and remote supervision, allowing the simultaneous control of many wind turbines. The computerized data network will provide detailed operating and performance information for each wind turbine. The Applicant will maintain a computer program and database for tracking each wind turbine's operational history.

A fail-safe braking system that includes electromechanical pitch control for each blade (three self-contained systems) and a hydraulic parking brake, which operates in a fail-safe mode, whereby the braking system is engaged in case of load loss on the generator. All wind turbines installed will be equipped with a redundant braking system. This includes both aerodynamic over-speed controls (including variable pitch, tip, and other similar systems) and mechanical brakes.

The rotor consists of three blades mounted to a rotor hub. The rotor blades are constructed of fiberglass and epoxy or polyester resin. The hub is attached to the nacelle, which houses the gearbox, generator, brake, cooling system, and other electrical and mechanical systems. The Applicant will use a 100 meter (328 feet) rotor diameter with a rotor swept area of 7,854 square meters (84,539 square feet) for the GE 2.5 xl or, in the case of the GE 1.5 xle, a 82.5 meter (270 foot) rotor diameter with a rotor swept area of 5,345 square meters (57,533 square feet) for the GE 1.5 xle. The rotor speed for either wind turbine will range between 5 to 18 revolutions per minute (rpm).

The tower consists of a monopole tubular steel tower, white in color, with a hub height of 100 meters (328 feet) for the GE 2.5 xl or a hub height of 80 meters (262 feet) for the GE 1.5 xle. The nacelle is mounted on the wind turbine tower, which consist of three to four sections manufactured from steel plates (depending on the wind turbine type). All welds are made in assembly of the wind turbines are made by automatically controlled power welding machines and ultrasonically inspected during manufacturing per American National Standards Institute (ANSI) specifications. All surfaces are sandblasted and multi-layer coated for protection against corrosion. Access to the turbine is through a lockable steel door at the base of the tower. The steel door at the base of each tower will also include a low voltage safety light on a motion sensor for entry. The maximum height of the turbine to the tip will be approximately 492 feet for the GE 2.5 xl and 398 feet for the GE 1.5 xle. The base of the tower regardless of turbine selected will be approximately 15 feet wide.

The underground medium voltage collection system will run from wind turbine to wind turbine, generally following the access roads, through which the electricity generated from each wind turbine will be collected and carried to the substation. The Applicant has had preliminary conversations with Hardin County Engineering Department in reference of potentially use the public right of way (ROW) for county and township owned ROWs for collection system routing. The Applicant does not anticipate the use of public ROW for collection system routing, however, if necessary the Applicant will meet any appropriate requirements. .

The substation will be designed to meet the requirements of PJM and American Electric Power Inc. (AEP). The substation will consist of two facilities located next to each

other: the transformer substation owned by the Applicant and the interconnection substation owned by AEP. The transformer substation will be a fenced-in facility covering approximately 1 acre. The transformer substation will consist mainly of a main step-up transformer, control house, and the switchgear coming from the medium voltage collection system. The interconnection substation will consist of a three-breaker ring bus connecting a tap from the interconnected transmission line to the transformer substation and its own control house. Based on the Applicant's experience, the interconnection substation is typically 5 acres. Both parts of the substation area will be gravel with a grounding grid installed below the gravel. The Applicant will determine the exact location of the substation as part of the final design of the wind farm.

The O&M building will be used to house personnel and replacement materials and will be the size of a small office. In addition this will be the location for the onsite SCADA system. The O&M building will be located adjacent to the substation.

(3) Description of New Transmission Lines

No new transmission lines are proposed for the wind farm. The point of interconnection will be a new interconnection substation to be located in the Project Area adjacent to the existing transmission line.

(B) DETAILED PROJECT SCHEDULE

(1) Project Schedule

(a) Land Acquisitions and Land Rights

The wind farm will be built on private land (and in one case land owned by the local school system) under lease and easement to the Applicant. Land leasing activities began in the 2nd Quarter of 2007 and are ongoing. Enough land has been secured to construct the wind farm, however additional "fill-in" leases are being negotiated to optimize the wind turbine layout.

(b) Wildlife Studies/Surveys

The Applicant met with ODNR staff on September 8th 2008 to determine the appropriate scope of avian and bat studies which are ongoing. Field studies started in the 3rd Quarter of 2008 and will be completed in the 4th Quarter of 2009. The Applicant has provided an interim report as Attachment 03-01 which shows that the Project Area has relatively little avian/bat activity as compared to other wind farms.

If the Applicant anticipates impacts to potential Major Species habitats (i.e. streams, woodlots), they will perform appropriate species-specific studies. Based on the range of species that could potentially inhabit these areas, the studies will most likely be performed in the 2nd Quarter of 2010. However, no impacts to potential Major Species habitats are anticipated at this time.

(c) OPSB Application Preparation

OPSB application preparation has been ongoing since the 3rd Quarter of 2008.

(d) OPSB Application for Certificate Submittal

The Applicant plans to submit the Application for Certificate to the OPSB on July 10th, 2009.

(e) Issuance of the OPSB Certificate

The Applicant anticipates that the OPSB Certificate will be issued by the end of the 1st Quarter of 2010.

(f) Preparation of Final Design

The final design will be prepared during the 2nd Quarter of 2010.

(g) Facility Construction

Wind farm construction is scheduled to begin in the 4th Quarter of 2010

(h) Placement of Facility in Service

The wind farm is scheduled to begin commercial operation in the 4th Quarter of 2011.

The bar chart on the next page lays out this information.

(2) Delays

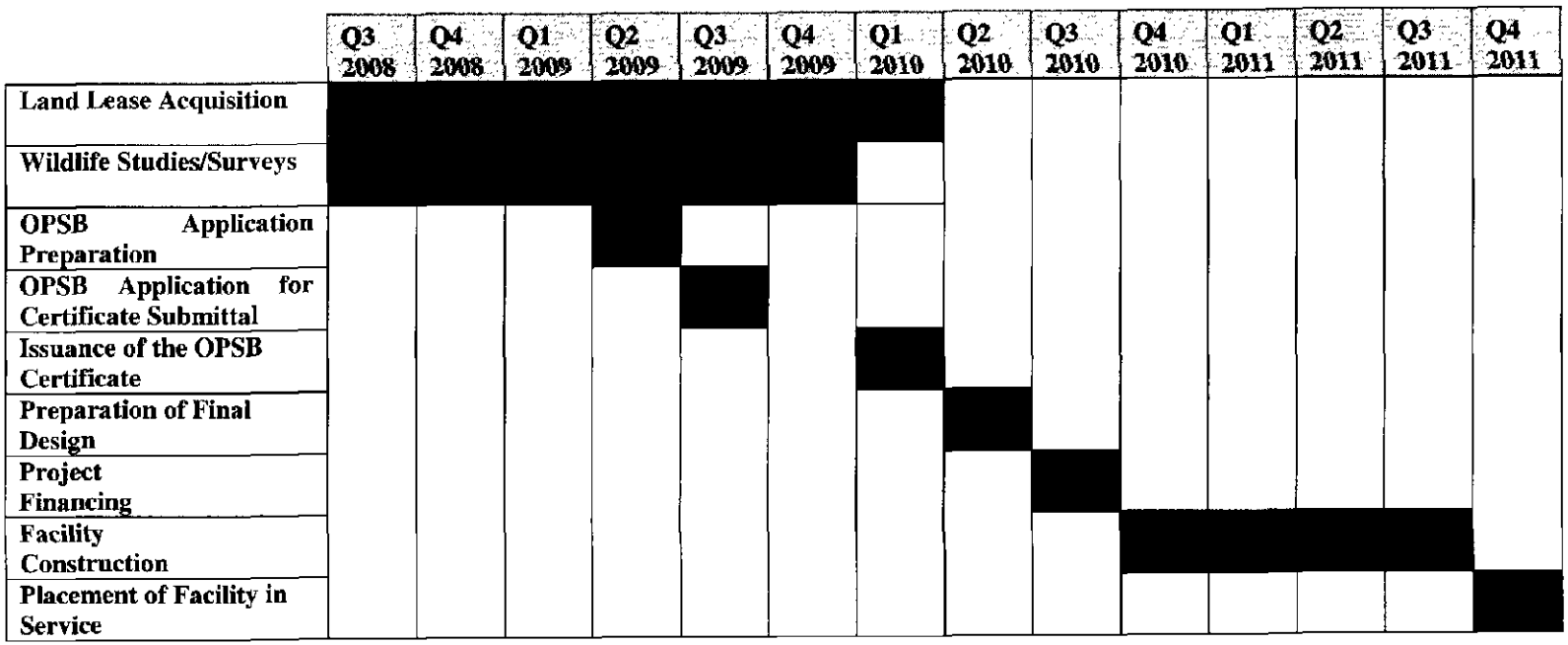
Aside from permits, there are three main items that could potentially delay construction of the wind farm according to the schedule shown in the previous Section: power purchase agreement, interconnection, and financing.

According to a letter from PJM (Attachment 05-04) the System Impact Study will be completed on or before the end of the 3rd Quarter of 2009. In addition, PJM has indicated that the Facilities Study should take approximately 6 months to complete. Thus the Applicant anticipates receiving the Facilities Study from PJM towards the end the 1st Quarter of 2010 and executing an Interconnection Services Agreement at that time. The schedule assumes that PJM meets the schedule is has provided and that the studies to not uncover the need for unreasonable upgrades that would require significant expense of delays. Preliminary studies conducted by PJM have not shown such expenses or delays. This schedule is consistent with the Invenergy's experience in having PJM complete similar studies for other wind farms.

The schedule assumes that the Applicant can enter into a power purchase agreement with a third party prior to the start of final design activities. The Applicant has completed several such power purchase agreements for other wind projects. Given this experience, the demand created by the Ohio Renewable Portfolio Standard (Amended Substitute Senate Bill 221), and the expectation that wind measurements will continue to show production from the wind farm will be competitive with other Ohio wind projects, the Applicant expects it will be able to enter into a power purchase agreement according to the schedule shown above.

Thirdly, the proposed schedule assumes that the Applicant is able to complete financing for the wind farm prior to construction. In the time period between 2005 and 2009, the parent company of the Applicant, Invenergy, has financed approximately 15 wind projects similar to the proposed wind farm. Historically, wind power development in the United States has depended on tax equity investors who provide financing for wind projects in order to obtain production tax credits. These tax credits were used as an offset for taxable income mostly by large investment banks and insurance companies. With the recent downturn in the economy, most large investment banks and insurance companies have significantly diminished taxable income. As a result, demand for production tax credits has diminished and as such most financing for wind energy projects has become more difficult to obtain. As part of the American Recovery and Reinvestment Act (ARRA), passed in February of 2009, renewable energy projects have an opportunity to qualify for cash grants if they commence construction before the end of 2010. This cash grant will allow the Applicant to secure construction financing terms needed to bring the wind farm to fruition. Delays that prevent the wind farm from qualifying for the cash grant will likely delay construction of the wind farm until major investment banks and insurance companies once again have the need for tax credits seen in the 2002-2007 timeframe.

Figure 03-01 Project Schedule



4906-17-04 Project Area Analyses

(A) SITE SELECTION STUDY

(1) General

Given the specific requirements of a wind farm and the limited number of potentially viable project locations in Ohio the Applicant has requested a Waiver from providing a comprehensive site selection study. However, the Applicant provides the following general discussion of wind farm siting practices below.

(a) Description of Study Area

Please refer to Section 4906-17-04(A)(1)(d) below.

(b) Maps of Evaluated Sites

A map of the Project Area compared with state wide wind resource is provided as Figure 04-01.

(c) Siting Criteria

The factors that need to be present for a viable wind energy project are: wind resource, transmission availability, competitive analysis, compatible land use and interest from landowners.

(d) Relevant Factors in the Site Selection Process

The Applicant followed its standard wind power site selection process which Invenergy has used to successfully locate and develop projects throughout the United States. The entire state of Ohio was reviewed to locate possible development sites which meet the following criteria in this order:

1. **Sufficient wind resource.** The Applicant performed a wind resource assessment of the State of Ohio and determined areas which contain sufficient wind resource to sustain a wind farms based on current wind turbine technology. A map of the Project Area showing the wind resource is included as Figure 04-01.

2. **Sufficient power transmission facilities.** Due to the difficulty of a private company siting new transmission lines over long distances, ideal wind farm sites are those at which transmission lines intersect with areas of high wind resource. The Applicant reviewed areas of high wind resource which had transmission lines intersecting it.

3. **Competitive Analysis.** Wind energy sites have been in the process of being developed – largely though land acquisition by the Applicant for several years. The Applicant reviewed publicly available information to determine where its competitors had

established, active developments and narrowed the pool of potential Project Areas based on this information.

4. **Compatible Land Use.** Wind turbines need to be spaced an appropriate distance away from homes for both safety and to reduce the possibility that homeowners are affected by the wind farm from annoyances such as noise and shadow flicker. The Applicant reviewed potential Project Areas to determine the level of residential development and focused on areas which had lower numbers of homes. Additionally, the Applicant focused on areas with large tracts of agricultural land so as to minimize impact to woodlots.

5. **Landowner Interest.** Wind developers have no way of compelling landowners to participate in their wind farm as some utilities do (i.e. eminent domain). Rather the Applicant has met with over a hundred landowners who are involved in this project and has negotiated terms of a lease of their property. Lack of interest from landowners can stop a project immediately. The overwhelmingly positive response from Hardin County was the impetus for moving forward with permitting this wind farm.

(e) Process for Determining Sites

The Applicant located several sites which could potentially host a wind farm. The Applicant selected the subject site for further development because of an overwhelmingly positive welcome from the area landowners and community leaders, good wind measurements, few environmental constraints, and positive results from initial transmission studies.

(2) Constraint Map

The Applicant proposes to construct the project to comply with the following minimum wind turbine setbacks, with distances measured from the center of the tower of the nearest wind turbine:

- 1,000 feet or more from non-participating Residences;
- 1,000 feet or more from participating Residences;
- 1.5 x Tip Height from boundaries of parcels owned by non-participants (597 feet for GE 1.5 xle & 738 feet for GE 2.5 xl);
- 1.1 x Tip Height from the edge of the right of way for public roads (437 feet for GE 1.5 xle & 541 feet for GE 2. 5 xl);
- 1.1 x Tip Height from the edge of right of way or easement for utility corridors for overhead electric transmission lines (437 feet for GE 1.5 xle & 541 feet for GE 2.5 xl).

Figures 04-02 and 04-03 illustrate these constraints imposed by the setbacks above and the resulting area available for siting wind turbines. Note that these figures assume that the Applicant will not obtain any additional agreements from landowners. On-going discussions may result in more participating owners and fewer constraints than shown in these figures. In the setbacks above, the following definitions are assumed:

"Residences" are houses existing, occupied, and fit for year round occupancy as of the date of this application. Distances to residences are measured to the nearest exterior wall.

"Tip Height" is the distance from ground elevation to the furthest reach of a wind turbine blade. Tip height for GE 1.5 xle is 398 feet and the tip height for GE 2.5 xl is 492 feet.

(B) SUMMARY TABLE OF EVALUATED SITES

The Applicant has requested a waiver from providing this summary table and has instead provided a more general description of its siting process.

4906-17-05 Technical Data

(A) PROJECT AREA SITE

(1) Geography and Topography

The Applicant has provided a map at 1:24,000 scale containing a five mile radius and showing: the proposed wind farm, major population centers and geographic boundaries, major transportation routes and utility corridors, bodies of water, topographic contours, major institutions/parks/recreational areas (including schools, nursing homes and religious institutions), residential, commercial buildings and installations, and both existing and proposed air transportation facilities known to the Applicant as Figure 05-01.

(2) Aerial Photograph

The Applicant has provided an aerial photo including a one-mile radius from proposed wind farm and indicating the location of the proposed wind farm in relation to surface features as part of Figure 05-02.

(3) Site Mapping

The Applicant has provided a map at 1:12,000 scale of the Project Area as Figure 05-03 which shows the following: topographic contours, existing vegetative cover, land use and classifications, individual structures and installations, surface waters. The surface waters shown on this map are those available from the National Wetland Inventory databases. An on site field delineation of the Project Area is planned for the 4th Quarter of 2009. Figure 05-03 also displays known locations of water and gas wells based on information from the United States Geological Survey, the U.S. Environmental Protection Agency –

National Technical Information Service, and ODNR – Division of Water Well Logs. The ODNR well log database represents the most comprehensive and detailed geologic and hydrogeologic database in Ohio. Note that for some of wells in the ODNR well log database, locations were given as street addresses and not as actual coordinates. These wells are not shown in Figure 05-03.

The Applicant has designed the wind farm so as to balance many goals, including minimization of removal of mature trees. The base layout for this application has no wind turbines in wooded areas.

(4) Geology and Seismology

(a) Site Geology

The Applicant has performed a desktop geological investigation of the Project Area. The surficial geology of Hardin County generally consists of glacial till. The glacial till throughout Hardin County has a widely varying thickness ranging from 1 foot to 723 feet (Figure 05-04). These glacial deposits are Quaternary and Neogene in age. Bedrock under the glacial till is generally relatively flat lying, except for a northeast trending valley in the northwest portion of the site, and typically begins with Silurian age dolomite and limestone as well as some gypsum, anhydrite and shale (Figure 05-05). The dolomite and limestone carbonate bedrock is an area of significant karst topography. Most of the karst topography is covered with generally 20 feet or more, but sometimes of a much greater thickness of glacial deposits (Figure 05-06). This carbonate dolomite and limestone is underlain with groups of older dolomite, limestone, and shale that are

Ordovician to Cambrian in age with some lower geologic units containing sandstone and siltstone. These are underlain by a formation that consists primarily of Precambrian age sandstone and volcanic rock (ODNR, 2006).

Earthquakes in the eastern United States are less common than west of the Rocky Mountains. However, because of the crustal properties, earthquakes of the same magnitude occurring in the east will affect a much larger area than they would in the west. Eastern North America is considered to be a part of a geographic area known as the Stable Continental Region. There are many known faults in this area but earthquakes in this region are infrequent, and even fewer of them can be associated with known faults. (ODNR, 2008).

The tristate area of Ohio, Kentucky and West Virginia have a history of sizeable earthquakes. In recent years, several small earthquakes have been observed in the area. By one estimate, Ohio has experienced more than 160 documented earthquakes since 1776. Though most of these events caused no damage or injuries, 15 of these resulted in property damage and some minor injuries.

There are four notable seismic zones in this area: 1) Eastern Tennessee (northern Tennessee into Kentucky), 2) Giles County northern Virginia into southern West Virginia), 3) Northeast Ohio (Cleveland area), and 4) Anna (southwest of the Project Area) (ODNR, 2008). The City of Anna, Ohio is approximately 30 miles southwest of the Project Area. The area surrounding Anna is considered as 'Anna seismic zone'. At least 40 earthquakes have been recorded in this seismic zone

since 1875. Moderately damaging earthquakes occur in this zone every two or three decades, and smaller earthquakes are felt two to three times per decade.

As noted on the Seismic Map of Project Area (Figure 05-07) earthquakes that occur in this zone would likely be recorded in the Project Area at an acceleration of gravity of 12-14% (percent), which would be the acceleration experienced by any foundations bearing directly on rock. This acceleration is expected to be exceeded in a 50 year time period with a probability of 2%. The largest historic earthquake in the state occurred in 1937. This event had an estimated magnitude of 5.4 and caused considerable damage in the town of Anna and in several other western Ohio communities (ODNR, 2008).

The Applicant will evaluate the data from seismographic monitor in Anna, Ohio to ensure that the designs of the wind turbine foundations take into account potential risks from seismic events. It is anticipated that geotechnical investigation of the Project Area will confirm that there are no known issues that would preclude development of the wind farm. The Applicant will obtain test borings at each wind turbine. The Applicant will determine these test boring locations when the wind turbine to be use has been chosen and the final layout has been provided to OPSB Staff. Once these test borings are complete, the Applicant will use the results to produce the final design. The Applicant intends to perform test borings in 2nd Quarter of 2010.

(b) Soil Suitability

The Applicant has performed a review of the Soil Survey of Hardin County, USDA Soil Survey data and Figure 05-08 to evaluate the soil suitability of the Project Area for wind farm development. The following eight predominant soil types have been mapped within the Project Area. The other soil types have similar characteristics as well.

- BoB: Blount silt loam, 2-6% slopes,
- GwB: Glynwood slit loam, 2-6% slopes,
- GyC2: Glynwood clay loam, 6-12% slopes,
- Mc: McGuffey muck,
- Mf: Milford silty clay loam,
- PkA: Pewamo silty clay, 0-1% slopes,
- Pm: Pewamo silty clay muck and
- Ro: Roundhead muck.

The slopes of the Project Area are generally gently to moderately sloping. The soils within the Project Area consist of very poorly drained soils formed in landforms such as marshes, depressions and flats. The soil survey information indicates that the soils have a moderately low to a moderately high capacity to transmit water (0.06 to 0.6 in/hr), with a depth to water table being 12 to 42 inches below ground surface.

The hydrologic groups for the site soils vary from Group C to Group D, with the occurrence of combinations like B/D and C/D types as well. The soils in the United States are placed into four groups, A, B, C, and D, and three dual classes, A/D, B/D, and C/D. In the definitions of the classes, infiltration rate is the rate at which water enters the soil at the surface and is controlled by the surface conditions. Transmission rate is the rate at which water moves in the soil and is controlled by soil properties. Definitions of the classes are as follows:

A. (Low runoff potential). The soils have a high infiltration rate even when thoroughly wetted. They chiefly consist of deep, well drained to excessively drained sands or gravels. They have a high rate of water transmission.

B. The soils have a moderate infiltration rate when thoroughly wetted. They chiefly are moderately deep to deep, moderately well drained to well drained soils that have moderately fine to moderately coarse textures. They have a moderate rate of water transmission.

C. The soils have a slow infiltration rate when thoroughly wetted. They chiefly have a layer that impedes downward movement of water or have moderately fine to fine texture. They have a slow rate of water transmission.

D. (High runoff potential). The soils have a very slow infiltration rate when thoroughly wetted. They chiefly consist of clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. They have a very slow rate of water transmission.

Dual hydrologic groups, A/D, B/D, and C/D, are given for certain wet soils that can be adequately drained. The first letter applies to the drained condition, the second to the undrained. Only those soils that are rated D in their natural condition, are assigned to dual classes. Soils may be assigned to dual groups if drainage is feasible and practical.

The three predominant soil types within the Project Area, are silt loam, silty clay loam and muck. Based on the soil survey, these soils have specific limitations due to the following: shallow depth to saturated zone, soils being clayey in nature, low strength, frost action, cutbanks caving, and shrink swell potential. These parameters will be considered as part of the final design of the wind farm and construction of the access roads as well as the excavation and subgrade preparation for foundations. The Applicant will address any issues through proper design and adherance to Ohio Environmental Protection Agency (OEPA) Best Management Practices (BMPs) related to erosion and sedimentation control.

The Applicant will manage surface water drainage to maintian positive drainage away from the wind farm. Since the soils have shrink-swell potential, the Applicant will take special consideration into account during final design to deal with the moisture fluctuations. The Applicant will provide a suitable base material of suitable thickness for roadways to reduce damage resulting from frost action. The Applicant will ensure that adequate shoring and excavation methods are implemented to mitigate the caving of the cut slopes. Frost action on these soil types varies from medium to high. To mitigate frost action the Applicant will ensure that all structures are embedded below the potential frost depth. The risk for corrosion for concrete ranges from moderate to low, whereas the risk for uncoated steel is high. Adequate measures will be taken by the Applicant during preparation of the final design.

The wind erodibility factor for muck is high. The potential for wind or water based soil erosion also exists with the type of soils present at the site; the Applicant will take proper conservation (erosion and sedimentation) measures to prevent this hazard during construction by following OEPA BMPs.

Glynwood silt loam is classified as prime farmland, all other soils are classified as prime farmland if drained. The Applicant will consult with the Ohio Department of Agriculture to determine if there are any limitations for development within the Project Area.

A majority of the soils within the Project Area are classified as hydric. The presence of water creates or supports vegetation adaptive to wet conditions and produces hydric soils. The Applicant has performed a desktop wetland evaluation and has included this as part of Section 4906-17-05(A)(3). The Applicant will perform a wetland field delineation to evaluate the presence of wetland vegetation and hydrology within the Project Area and to identify wetlands under federal and state jurisdiction.

The pH for the soils in the Project Area ranges from 4.5 near the surface to 8.4 at a depth of 60 inches below ground level.

As the wind farm will use buried medium voltage cables for the collection system, soil thermal resisitvity is an important characteristic. Overall, the Project Area is dominated by soils categorized as silt loam or clay loam. Typical estimated thermal conductivity ranges from 0.54 to 1.94 W/m K (Watts/meter degree Kelvin) for sands, 0.19 to 1.12 for sandy loam, from 0.29 to 0.76 for loam, and from 0.36 to 0.69 for clay loam, at soil densities in the range of 77 pcf (pound per cubic feet) to 100 pcf, and water contents in the range of 1.4 to 21.2 percent. The typical value of thermal conductivity for silt loam is expected to be on the order of 3.21 W/mK. However, site specific conditions can vary from this typical value and the Applicant will perform an on site geotechnical investigation to determine average soil thermal conductivity to use in the design of the electrical collection system. If insitu thermal resistivity values are determined to

be unsuitable for portions of the collection system, then select backfill with the desired thermal characteristics will be installed around the buried collection line.

(5) Hydrology and Wind

(a) Water Budgets

In general, wind turbines do not consume or use water for any purpose. However, periodically minimum amounts of water could be used for some activities related to the maintenance of the wind farm (e.g. access road dust suppression, equipment cleaning, etc).

The only wind farm component that will consume or use water regularly is the project O&M building described in Section 4906-17-03(A)(2). The O&M building will have approximately two showers and two bathrooms. Water usage will be similar to that of a new large residence and it will be permitted according to local building codes.

Installation of the wind turbines and access roads will not result in measurable changes in the flow of water across the Project Area. The Applicant will construct the wind farm so as to maintain the existing drainage patterns to the extent practicable. Water quantities and/or flow rates within water bodies will not be affected by the proposed wind farm. Therefore, water budget information is not applicable.

(b) Floods and High Winds

Two wind turbines, the GE 2.5 xl and the GE 1.5 xle, were evaluated to determine the capacity of each wind turbine to withstand high winds for Hardin County in western Ohio. Historical wind data obtained from the web site http://www.wunderground.com/ for Lima, OH (approximately 15 miles west of the project site) and Findlay, OH (approximately 20 miles northeast of the project site) were used to develop a representative regional wind climate.

Ten years of data were available from the Allen County Airport in Lima, OH and were compared to 30 years of wind data from Findlay Airport in Findlay, OH to determine the maximum average wind speed (the extreme 10-minute average, also referred to as the Reference Wind Speed), and the 50-year Return Gust Speed (1.4 X Reference Wind Speed). The Applicant performed an analysis of the data which indicated a Reference Wind Speed of 19.2 meters/second (m/s) and a 50-year Return Gust Speed of 26.9 m/s.

The GE 2.5 xl is certified by the International Electrotechnical Commission (IEC) as a Class 2B wind turbine. A Class 2B wind turbine is designed to withstand a Reference Wind Speed of 42.5 m/s, and a 50-year Return Gust Speed of 59.5 m/s.

The GE 1.5 xle is certified by the IEC as a Class 3B wind turbine. The Class 3B wind turbine is designed to withstand a Reference Wind Speed of 37.5 m/s, and a 50-year Return Gust Speed of 52.5 m/s. A comparison of the actual regional wind climate and the capacity of the wind turbines is shown in Table 05-01:

Table 05-01 Maximum Recorded Wind Speed at Project Area

	Regional Wind Climate	**GE 2.5 xl Rated to**	**GE 1.5 xle Rated to**
Reference Wind Speed	19.2 m/s	42.5 m/s	37.5 m/s
50-year Return Gust Speed	26.9 m/s	59.5 m/s	52.5 m/s

An analysis of the wind data shows that the GE wind turbines proposed for the wind farm are rated to withstand wind speeds well in excess of those that are expected to occur at the Project Area.

In the extremely unlikely event the Project Area were to experience winds in excess of the turbine maximum design speed, it is possible that wind turbines could be damaged. Any such event would also be accompanied by severe damage to other structures outside of the wind farm. However, the wind turbines have safety systems which cause them to shut down in high wind situations and the Applicant has proposed setbacks which will minimize the chance of any debris from wind turbines contributing to problems in such an event. There are no specific mitigation plans needed for high winds.

The Applicant will not be siting any wind turbines in this area within the Federal Emergency Management Authority (FEMA) 100 year flood plain. Public roads will be used to cross the floodplains and any cables crossing the floodplain will be buried underground. The FEMA 100 year floodplain map is included as Figure 05-09.

(c) Maps

Figure 05-10 is a map entitled "Ground-Water Resources of Hardin County" (ODNR 2009). This map illustrates groundwater resources of the proposed Project Area and surrounding vicinity. As Figure 05-10 shows, the Project Area is situated where groundwater yields of 100 to 500 gallons per minute (gpm) may be developed from limestone/dolomite and glacial deposit aquifers at depths of less than 300 feet. In addition, and based upon Figure 05-11 (ODNR 2009), no EPA sole-source aquifers are located in the proposed Project Area.

There are no anticipated impacts to underlying aquifers. Blasting is not expected during construction of the wind farm and foundations for wind turbines typically extend to a depth of approximately 8 feet below grade, with depths of 15 or 20 feet only necessary when appropriate bearing soils are not available at the more typical depths.

(B) LAYOUT AND CONSTRUCTION

(1) Project Area Site Activities

(a) Test Borings

As part of final design of the wind farm, the Applicant will perform geotechnical investigations, including one test boring at every turbine location to provide subsurface soil properties and recommendations needed for the final design and construction of each wind turbine foundation. Borings will also be performed at the final locations of the transformer substation and interconnection substation. Full geotechnical studies will be done when all wind turbine locations are finalized. All boreholes will be filled and borehole abandonment will comply with state and local regulations.

(b) Removal of Vegetation

The Applicant has designed the wind farm with a focus on balancing many goals, including minimization of removal of mature trees. The base layout for this application has no wind turbines in wooded areas. Impacts to woodlots will be avoided to the extent practicable.

If crops are damaged during construction, the Applicant will compensate landowners as per the terms of the lease between the landowner and Applicant.

The maximum areas expected to be impacted during construction are discussed in Section 4906-17-03(A)(1)(b). Almost all of the impacted acres will be in areas in active agricultural use. Hence, most concerns will be for crop loss and not for loss of mature trees.

(c) Grading and Drainage

Topography Project Area is relatively flat and will require minimal grading. The Applicant will design drainage provisions to follow Ohio Environmental Protection Agency (OEPA) erosion and sedimentation control Best Management Practices (BMPs) as well as stormwater management BMPs. The Applicant will submit an application for the OEPA's General Permit OHC000003: Storm Water Discharge from Small and Large Construction Activities under the National Pollutant Discharge Elimination System (NPDES) regulations. The Applicant will follow the OEPA's regulations and implement appropriate measures to prevent erosion and control sediment in the areas of construction. During wind farm construction, the Applicant will inspect the grading of disturbed areas within the Project Area following rainfalls of ½ inch or greater to check that erosion is minimized and proper drainage measures have been implemented.

(d) Access Roads

The permanent aggregate access roads will be approximately sixteen (16) feet wide, and consist of geotextile fabric and relatively uniformly graded aggregate base or other equivalent material as determined by the Applicant's geotechnical investigation. To the extent practical based on existing grades and the requirement to facilitate proper drainage, the finished elevation of the access roads will be level with existing grade so as to minimize impacts to farming activities. The Applicant will not construct access roads on natural slopes steeper than two horizontal over one vertical (2:1). While constructing the access roads, the Applicant will strip and stockpile the topsoil for site restoration in a manner

that will allow the Applicant to integrate permanent construction into contours of the existing grade to preserve drainage to what existed prior to construction. As needed, culverts or field drain tile inlets will be provided by the Applicant to prevent the ponding of water as a result of the construction of the roads. The Applicant will maintain access roads throughout the construction of the wind farm, including snow removal and erosion control/repair during construction.

(e) Removal and Disposal of Debris

Construction of the wind farm will generate some waste in the form of packaging materials. This material will be collected and temporarily disposed of in dumpsters located at the wind farm staging area and then taken to a licensed solid waste disposal facility.

(f) Post-Construction Reclamation

As the final step in construction of the wind farm, the Applicant will restore areas impacted by wind farm construction. Restoration may include decompaction of soils and revegetation of disturbed areas. The Applicant will remove all trash, debris and stockpiles and leave the area graded to facilitate proper drainage. The Applicant will ensure that the access road will be in workable condition through replenishing road aggregate, repairing road damage, such as ruts and weather damage that may have occurred during the course of construction. The Applicant will seed and mulch all areas of the Project Area that are disturbed. Seeding and mulching will be approved by landowner and meet any applicable regulatory requirements. Areas that were originally agricultural use that will return to

agricultural use will be decompacted and left in a condition ready to return to agricultural use.

(2) Layout

The Applicant has provided a map at 1:12,000 scale of the proposed wind powered electric generation facility as two figures. One assumes the wind farm is built using GE 2.5 xl turbines, the other assumes the project is built using GE 1.5 xle turbines. These figures show the following features of the proposed and existing facility or associated facilities wind turbines, transformers and collection lines, construction staging areas, transmission lines, substations, transportation facilities and access roads, security facilities, grade elevations, and any other pertinent installations. A map showing this information for the GE 2.5 xl wind turbine layout is provided as Figure 05-12. A map showing this information for the GE 1.5 xle layout is provided as Figure 05-13.

(3) Structures

(a) Estimated Overall Dimensions

The largest proposed turbine is the GE 2.5 xl machine. This turbine has a 100 meter (328 foot) diameter rotor installed on a tower that is 100 meter (328 foot) tall from ground elevation to hub height. For this tower, the tip height is 492 feet.

The smallest proposed turbine is the GE 1.5 xle machine. This turbine has a 82.5 meter (270 foot) diameter rotor installed on a tower that is 80 meter (262 foot) tall from ground elevation to hub height. For this tower, the tip height is 398 feet.

The base of the tower regardless of the wind turbine model selected will be approximately 15 feet wide.

The underground medium voltage collection system will run from wind turbine to wind turbine, generally following the access roads, through which the electricity generated from each wind turbine will be collected and carried to the substation. The substation will be designed to meet the requirements of PJM and AEP. The substation will consist of two facilities located next to each other: the transformer substation owned by the Applicant and the interconnection substation owned by AEP. The transformer substation will be a fenced-in facility covering approximately 1 acre. The transformer substation will consist mainly of a main step-up transformer, control house, and the switchgear coming from the medium voltage collection system. The interconnection substation will consist of a three-breaker ring bus connecting a tap from the interconnected transmission line to the transformer substation and its own control house. Based on the Applicant's experience, the interconnection substation is typically 5 acres. Both parts of the substation area will be gravel with a grounding grid installed below the gravel. The Applicant will determine the exact location of the substation in the 1st Quarter of 2010 and provide a final design to the OPSB Staff.

The O&M building will be used to house personnel and replacement materials and will be the size of a small office. In addition this will be the location for the onsite SCADA system. The O&M building will be located adjacent to the substation. Figure 05-14 shows a floor plan and photograph of a typical wind farm 6,000 square foot O&M building constructed by Invenergy.

(b) Construction Materials

The Applicant will be using reinforced concrete for the substation and wind turbine foundation. Roads will be gravel with either gravel or grass swales as needed.

(c) Color and Texture of Facing Surfaces

The wind turbine tower, nacelle and blades will be gray or off-white to minimize visual impact. The tower will be rolled steel, the outside shell of the nacelle will be fiberglass and the blades will be primarily fiberglass. The substation components will be gray and generally consist of metal material.

(d) Photographic Interpretation or Artist's Pictorial Sketches.

The Applicant has provided photosimulations of the wind farm as part of a report from Truescape Inc. as Attachment 05-01.

(e) Unusual Features

The wind turbines proposed for the wind farm will be similar to those that are in service throughout the country and neither they nor the other Project components will have unusual features.

(4) Plans for Construction

Final design activities will include geotechnical investigations and ALTA surveys of all participating properties. This information will be used to finalize wind turbine and substation foundation designs and cable routes and plans.

The Applicant will provide notification of commencement of construction to landowners and the appropriate government agencies. The Applicant will begin preparation of a staging or "laydown" area by clearing, grubbing, applying a layer of aggregate, and establishing any necessary erosion and sedimentation controls to a relatively flat location in the Project Area with good road access. The Applicant will then mobilize construction trailers and equipment to the staging area.

Clearing and grubbing for routes of access roads and buried cables, if needed, will likely be the first construction activity outside of the staging area. Access road construction will begin with grading, installation of geotextile fabric and aggregate. The Applicant will install the buried medium voltage collection system that will run between wind turbines and back to the transformer substation.

At each wind turbine location, appropriate silt fencing will be installed and the wind turbine assembly area will be cleared and grubbed, as needed. Excavation of each foundation will commence to a depth of approximately 8 feet depending on the foundation design. The Applicant will stockpile excavated soil in the wind turbine assembly area. The foundation area will be leveled and compacted, and a mud mat of approximately 2-inch thick concrete will be poured. Steel rebar will be shaped and installed on the mud mat. Concrete will be poured into the foundation and appropriate quality assurance tests will be performed to ensure concrete quality. The foundation will be poured up to the height of the embedment ring and left to set. Next the embedment

ring Section is poured and left to set. The foundation will then be backfilled and a level, compacted, graveled crane pad is installed.

Wind turbine components arrive on site and the tower is installed in three (3), four (4) or up to five (5) sections depending on the tower design. The first section is bolted and grouted to the foundation through a flange at the bottom of the tower. The remaining tower sections are bolted to the respective lower tower section. The nacelle is then attached to the top tower section. The wind turbine blades are attached to the hub while on the ground, and then the rotor is lifted as an assembly attached to the nacelle.

The medium voltage collection system cable is connected to the wind turbine transformer, as are the SCADA communication fiber optic cables. Both the medium voltage collection system cable and the SCADA cable are run from wind turbine to wind turbine and up to the substation/control center. When field drainage tile is encountered, the tile line is cut, the cable buried underneath and the Applicant will repair and document the tile line under observation of the landowner when practical.

Commissioning of wind turbines on a single collection line circuit can begin once all of the wind turbines on the circuit are assembled and connected to the collection line, when the collection line is terminated at the substation switchgear, and when the substations are energized. After all wind turbines have been commissioned, the wind farm can commence commercial operations and begin providing power into the grid. At this

point, the site is regraded and reseeded and notification of termination of construction permits will be sent to the appropriate government agencies.

(5) Future Plans

The Applicant has no plans for expansion at this time, if any expansion is planned a separate application will be submitted.

(C) EQUIPMENT

(1) Wind Powered Generation Equipment

Both proposed wind turbines discussed in this application are three-bladed, upwind, horizontal-axis wind turbines. The wind turbine rotor and nacelle are mounted on top of a tubular tower. The wind turbine employs active yaw control (designed to steer the machine with respect to the wind direction), active blade pitch control (designed to regulate wind turbine rotor speed), and a generator/power electronic converter system from the speed variable drive train concept.

Each wind turbine is equipped with a wind speed and direction sensor that communicates to the wind turbine's control system to signal when sufficient winds are present for operation. Both feature variable-speed control and independent blade variable pitch to assure aerodynamic efficiency, and which functions as an aerodynamic over-speed control system. The wind turbines have active yaw and pitch regulation with power torque control capacity and asynchronous generators and a bedplate drive train design where all nacelle components are joined on common structures to improve durability.

The two proposed wind turbine models have similar operational characteristics: they begin operation in wind speeds of 3.5 meters per second (m/s) (7.9 miles per hour [mph]) and reach their rated capacity (2.5 MW and 1.5 MW, respectively) at a wind speed of 12.5 m/s (28 mph) and 14 m/s, respectively. The rotor direction, as an observer faces the wind turbines, will be clockwise.

GE has incorporated the SCADA communication technology into all of their wind turbines. The SCADA communications system permits automatic independent operation and remote supervision, allowing the simultaneous control of many wind turbines. The computerized data network will provide detailed operating and performance information for each wind turbine. The Applicant will maintain a computer program and database for tracking each wind turbine's operational history.

A fail-safe braking system that includes electromechanical pitch control for each blade (three self-contained systems) and a hydraulic parking brake, which operates in a fail-safe mode, whereby the braking system is engaged in case of load loss on the generator. All wind turbines installed will be equipped with a redundant braking system. This includes both aerodynamic over-speed controls (including variable pitch, tip, and other similar systems) and mechanical brakes.

The rotor consists of three blades mounted to a rotor hub. The rotor blades are constructed of fiberglass and epoxy or polyester resin. The hub is attached to the nacelle, which houses the gearbox, generator, brake, cooling system, and other electrical and mechanical systems. The Applicant will use a 100 meter (328 feet) rotor diameter with a rotor swept area of 7,854 square meters (84,539 square feet) for the GE 2.5 xl or, in the

case of the GE 1.5 xl, a 82.5 meter (270 foot) rotor diameter with a rotor swept area of 5,345 square meters (57,533 square feet) for the GE 1.5 xle. The rotor speed for either wind turbine will range between 11 to 22 revolutions per minute (rpm).

The tower consists of a monopole tubular steel tower, white in color, with a hub height of 100 meters (328 feet) for the GE 2.5 xl or a hub height of 80 meters (262 feet) for the GE 1.5 xle. The nacelle is mounted on the wind turbine tower, which consist of three to four Sections manufactured from steel plates (depending on the wind turbine type). All welds are made in assembly of the wind turbines are made by automatically controlled power welding machines and ultrasonically inspected during manufacturing per ANSI specifications. All surfaces are sandblasted and multi-layer coated for protection against corrosion. Access to the turbine is through a lockable steel door at the base of the tower. The steel door at the base of each tower will also include a low voltage safety light on a motion sensor for entry. The maximum height of the turbine to the tip will be approximately 492 feet for the GE 2.5 xl and 398 feet for the GE 1.5 xle. The base of the tower regardless of turbine selected will be approximately 15 feet wide.

(2) Safety Equipment

(a) Description of All Proposed Public Safety Equipment

The wind turbines will be inaccessible to the public: they will have a locked door preventing access to the interior of the tower. The tower itself will not contain external ladders or other equipment that would allow climbing of the turbine.

The substation will be surrounded by a security fence meeting the requirements of the AEP. Gates to this fence will be locked at all times and only accessible by wind farm personnel entering or exiting the substation.

Operations and maintenance crews will be on site daily to perform routine maintenance and will provide further security.

Lightning protection systems are standard on modern wind turbines. These systems consist of lightning receptors on the blades and cable and grounding rods at the base of the turbine foundation to conduct the electricity to the ground. If a lightning strike occurs, the SCADA system will shut down the wind turbine automatically until an inspection can take place.

The Applicant will employ Occupational Health and Safety Administration (OSHA) measures to ensure worker safety during construction and operation of the wind farm.

(b) Description of the Reliability of the Equipment

Modern wind turbines have evolved to use a relative standard and reliable design. Operators of wind farms strive for, and often achieve, availabilities of 95%. The GE 1.5 MW series wind turbine is the most widely installed wind turbine in the world. More than 12,000 of these wind turbines are in operation in over 19 countries with more than 170 million operating hours and 100,000,000 MWh

produced. The GE 2.5 xl is a new turbine that GE is putting into production. The GE 2.5 xl was designed and is being manufactured to the same high quality standards that have made the GE 1.5 series so reliable. Equipment reliability will be an important consideration by the Applicant in selecting the turbine model used in this wind farm.

The proposed wind turbines are designed to have a lifespan in excess of 20 years. Wind turbine designs are certified as meeting international design standards by agencies such as Underwriters' Laboratory and Germanischer Lloyd. These certifications require that the wind turbines have a design life of at least 20 years for the specified wind regime. The wind regime considers factors such as weather extremes, average wind speed, wind gusts, and turbulence intensity.

(c) Description of Turbine Manufacturer's Safety Standards.

Due to confidentiality agreements with GE, the Applicant will provide the safety manual for the GE 1.5 xle and the installation manual for the GE 2.5 xl at its attorney's offices:

Bricker & Eckler, LLP

100 South Third St

Columbus, Ohio

43215-4291

(3) Any Other Major Equipment

Other than the wind turbines themselves, the other major equipment at the wind farm is the interconnection substation and the transformer substation. This was described in Section 4906-17-03(A)(2). The Applicant may be installing up to 3 permanent meteorological towers to more accurate monitor wind resources during operations of the wind farm.

(D) REGIONAL ELECTRIC POWER SYSTEMS

The Applicant will be connecting the wind farm to a transmission line owned by AEP which is part of the PJM Interconnection.

(1) Interconnection Queue

(a) Name of the Queue

Primary: East Lima – Marysville 345kV Line

Alternate: East Lima – South Kenton 138kV Line

(b) Web Link of the Queue

Primary
http://www.pjm.com/pub/planning/project-queues/feas_docs/u2041_fea.pdf

Alternate:
http://www.pjm.com/pub/planning/project-queues/feas_docs/u2042_fea.pdf

(c) Queue Number

Primary U2-041

Alternate: U2-042

(d) Queue Date

Primary: 6/13/08

Alternate: 6/13/08

(2) System Studies

PJM has prepared Feasibility Studies for the East Lima – Marysville 345kV interconnection and the alternate East Lima – South Kenton 138kV interconnection. The Applicant has included the Feasibility Studies as Attachments 05-02 and 05-03, respectively. PJM and AEP are currently performing the System Impact Studies for both interconnection alternatives. The System Impact Study is expected to be available on or before the end of the 3rd Quarter of 2009.

(a) Feasibility Study

The Feasibility Studies for the proposed wind farm were prepared for two interconnection queue positions: U2-041 for 300 MW and U2-042 for 201 MW. However, for the purpose of this application, only the U2-041 interconnection is applicable.

The proposed interconnection of the wind farm is via a three-breaker ring bus substation to tap into the East Lima – South Kenton 345kV transmission line.

The Feasibility Study performed by PJM for the interconnection of 300 MW on the East Lima –Marysville 345kV shows that there are no network upgrades required for interconnection. The wind farm does not contribute to any transmission facility overloads.

The report identifies two instances in which the output of the Project may be curtailed due to transmission congestion. The Project contributes minimally to this congestion and these curtailments are not expected to be significant.

(b) System Impact Study

The Applicant has requested a waiver from providing the system impact study as it has not been completed by AEP and PJM by the submission date of this application. The system impact studies will be provided to the OPSB Staff upon its receipt from PJM, the Applicant expects to receive these studies on July 30th 2009.

The System Impact Study agreements with PJM were executed in November 2008 for Queue Position U2-041 and January 2009 for U2-042.

As indicated in the electronic "System Impact Study Delay Notification" received from PJM on April 7, 2009 (See Attachment 05-04), PJM anticipates the completion of the impact study on or before the end of 3rd quarter of 2009.

4906-17-06 Financial Data

(A) OWNERSHIP

Hardin Wind Energy LLC is an affiliate of Invenergy Wind Development LLC (Invenergy). All of the wind farm will be owned and operated by Hardin Wind Energy LLC except for the interconnection substation (consisting primarily of the three-breaker ring bus and control house). The interconnection substation (as separate from the transformer substation) will likely be owned and operated by the interconnected utility, AEP.

(B) CAPITAL AND INTANGIBLE COSTS

The Applicant does not currently have project specific financial information but below has provided general financial information from the wind industry which is expected to be comparable to the Applicant's wind farm.

Capital, intangible cost and cost comparison estimates have been filed under seal with the OPSB.

(1) Capital and Intangible Cost Estimates

Based on the Invenergy's experience constructing over 15 utility scale wind facilities throughout the U.S. over the past five years, it expects the overall capital cost of the project will be between $1,800 and $2,200 per kilowatt (kw) of installed capacity, or $540 Million to $660 Million for the proposed 300 MW project. Final costs will depend on final wind turbine pricing, material costs, design details, and contractor bids.

(2) Cost Comparison

The largest component of the cost to build a wind farm is the cost of the wind turbines themselves, and these are priced the same regardless of where the wind farm is located in

the U.S. Costs to construct a wind farm in Ohio should not be dramatically different from the cost to construct a project in similar terrain in the Midwest or Northeast U.S., except for differences in costs for construction labor and materials.

(3) Tabulation of Present Worth and Annualized Capital Costs

Capital costs will include development costs, wind farm design, project planning, equipment procurement and construction. These costs will all be incurred within 1 – 2 years of the start of construction. As such, the present value of these costs is essentially the same as the costs presented in Section 4906-17-06(B)(1) above. Capital cost calculations are limited to this wind farm.

(C) OPERATION AND MAINTENANCE EXPENSES

(1) Estimate of Annual Operation and Maintenance Costs

Based on Invenergy's experience operating and maintaining its other wind farms in the U.S., the Applicant estimates that annual O&M costs for the wind farm will range from $7 Million to $10 Million per year, not including taxes, costs for land leases, or inflation increases. Annual operation and maintenance costs has been filed under seal with the OPSB.

(2) Cost Comparison

Based on Invenergy's experience O&M costs for the wind farm, not including costs for taxes or land leases, should not be substantially different than O&M costs for other U.S. wind farms.

(3) Present Worth and Annualized Capital Costs

The estimated annual O&M cost is shown above in section 4906-17-06(C)(1). Assuming an 8 percent discount rate and 2 percent escalation over the 20 year lifespan of the wind farm, the present worth of the O&M costs is approximately $113 Million.

(D) DELAYS

Any delay which would push the project beyond a December 30, 2010 construction commencement date would threaten the viability of the wind farm – construction must commence by the end of 2010 for the wind farm to be able to apply for the Department of Energy (DOE) grants related to the American Recovery and Reinvestment Act. That being said, based purely on the lost revenue from the wind farm and assuming a power price of between similar to other comparable wind farms, cost of delay prorated on a monthly basis would be approximately $6.2 Million per month.

4906-17-07 Environmental Data

(A) GENERAL

(B) AIR

(1) Preconstruction

(a) Ambient Air Quality

The Ohio EPA's Division of Air Pollution Control is responsible for monitoring ambient air quality within Ohio. Each year it publishes air quality data for Ohio that provide a comparison between the measured ambient air concentration and the ambient air quality standards for a calendar year. The most recent summary of air quality data available for the state is the *2007 State of Ohio EPA Annual Air Quality Report.* Included in this report are the most recent ambient air quality data, as well as long-term monitoring trends in air quality that have been collected and compiled from numerous state and private (e.g. industrial, utility) monitoring stations across the state. The Project Area is located within Hardin County, which is part of Ohio's Northwest Air Quality Control Region. The parameters monitored in the ambient air include ozone (O_3), sulfur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO), and inhalable and fine particulate matter with diameters less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$), respectively.

Hardin County does not have any monitoring stations located within it. Therefore, ambient air quality for the Project Area has been characterized with data measured at the nearest monitoring stations to Hardin County for each

pollutant. These data are presented in Table 07-01 along with the National Ambient Air Quality Standards (NAAQS) designed to protect human health and welfare.

Table 07-01: Ohio EPA Measured Pollutant Concentrations Representative of Hardin County Compared to the NAAQS

Pollutant (Monitoring Station)	**Averaging Period**	**Measured Concentration**	**NAAQS**	**Units**
SO_2 (#39-003-0002, Allen County)	3-hour	0.017	0.5	ppm
	24-hour	0.011	0.14	ppm
	Annual	0.0024	0.03	ppm
PM_{10} (#39-003-0006, Lima)	24-hour	35	150	$\mu g/m^3$
	Annual	22.7	50	$\mu g/m^3$
$PM_{2.5}$ (#39-049-0024, Columbus)	24-hour	33.5	35	$\mu g/m^3$
	Annual	13.1	15	$\mu g/m^3$
CO (#39-049-0005, Columbus)	1-hour	2.3	35	ppm
	8-hour	1.6	9	ppm
NO_2 (#39-035-0060, Cleveland)	Annual	0.02	0.053	ppm
O3 (#39-003-0002, Allen County)	8-hour	0.078	0.08	ppm

To be consistent with the corresponding NAAQS, the measured short term concentrations are based on second highest concentrations for all pollutants except $PM_{2.5}$ and O_3. 24-hour $PM_{2.5}$ concentrations are based the 98^{th} percentile values and 8-hour O_3 concentrations are based on the 4^{th} highest values.

The monitoring data presented in the table above show that measured concentrations are below the corresponding NAAQS and that therefore, air quality in Hardin County is better than the standards established to protect human health and welfare. In addition, the EPA lists Hardin County as in attainment or unclassified with the NAAQS for all pollutants.

(b) State/Federal New Source Performance Standards

The wind farm will not represent a new source of air pollution and therefore there are no applicable air quality limitations, applicable NAAQS, or applicable prevention of significant deterioration increments.

(c) List of Required Permits

The wind farm will not represent a new source of air pollution and therefore there are no necessary permits to install. In the unlikely event that the Applicant is unable to purchase sufficient quantities of concrete from local sources during construction, one of its contractors may elect to operate a temporary batch plant on or near the Project Area. Such a plant would likely require a temporary air permit which the Applicant or its contractor will obtain.

(d) Compliance Plans

The wind farm will not represent a new source of air pollution and therefore there are no necessary compliance plans.

(2) Construction

During the site preparation and construction phases of the wind farm, minor and temporary adverse impacts to air quality may result from the operation of construction

equipment and vehicles. Impacts would occur due to emissions from engine exhaust and from the generation of fugitive dust during earth moving activities and travel on unpaved roads. The increased dust and emissions would not be of a magnitude or duration that could significantly impact local air quality. The Applicant will control air emissions keeping the equipment in good working order and through adequate planning that will use the construction equipment in an efficient a manner as possible and by watering road during dry periods as necessary.

(C) WATER

(1) Preconstruction

Changes in wind farm layout based on input from the OPSB Staff may alter what permits are required. At this point, only a General NPDES permit for storm water discharges associated with construction is expected to be needed. Changes to the project layout could require the Applicant to apply for state or federal permits if water bodies are impacted by the wind farm.

(2) Construction

(a) Permits

With the proposed wind farm design as currently envisioned, the permit required due to potential impacts to water bodies is the General NPDES permit for storm water discharges associated with construction. The Applicant will apply for this permit and receive approval prior to construction.

(b) Aquatic Discharges

The only aquatic discharges from the project will be storm water discharges due to the construction of impermeable and semi-permeable surfaces. These discharges from the Project Area will be calculated as part of the NPDES permit and will be dependent upon the final project layout. The final wind farm layout will be determined with input from the various agencies involved in the OPSB and the OPSB Staff.

(c) Mitigation Plans

The Applicant will follow OEPA's BMPs for stormwater pollution prevention, stormwater management and erosion and sedimentation control.

(d) Changes in Flow Patterns and Erosion

The wind farm will not utilize or discharge measurable quantities of water as such water flow rates within water bodies will not be affected by the wind farm. Changes in flow patterns due to site grading will be minimal due to the relative little change in elevation across the wind farm. Applicant will control erosion by implementing BMPs for erosion and sedimentation control established by the OEPA.

(3) Operation

(a) Quantitative Flow Diagram

The only water run-off from the project will be storm water discharges due to the construction of impermeable and semi-permeable surfaces. The final project layout will be determined with input from the OPSB Staff.

(b) Conservation Practices

The Applicant will follow OEPA BMPs for stormwater pollution prevention, stormwater management and erosion and sedimentation control.

(D) SOLID WASTE

(1) Preconstruction

(a) Debris and Solid Waste

The Applicant is not aware of any debris or solid waste on the Project Area that would need to be removed for development and pre-construction of the wind farm, small quantities of waste may be generated during field studies or meteorological tower erection. The Applicant will dispose of this waste at a licensed solid waste disposal site.

(b) Plans To Deal with Waste

This Section is not applicable as the Applicant is not aware of any debris or solid waste on the Project Area which would need to be removed for development and pre-construction of the wind farm.

(2) **Construction**

(a) Debris and Solid Waste Generated

Construction of the wind farm will generate some waste in the form of packaging materials, trailer-office materials, and from employees. The Applicant will dispose of this waste at a licensed solid waste disposal site.

(b) Storage and Disposal Methods

The Applicant will collect wastes from around the wind farm and temporarily dispose of it in dumpsters located at the wind farm staging area and then transport it to a licensed solid waste disposal facility operated by a licensed contractor.

(3) **Operations**

(a) Solid Wastes Generated

During its operation, the wind farm will generate only a negligible amount of solid waste. The majority of the solid waste generated will be from the O&M office and would be the type and amount comparable to a small office. In addition, some used oils/lubricants from the wind turbines will be generated along with packaging for replacement parts. The Applicant will dispose of this waste at a licensed solid waste disposal site.

(b) Treatment, Transport, and Disposal

The O&M office will likely use a local solid waste disposal service for the small amount of office waste generated there.

(4) Licenses and Permits

No waste generation, storage, treatment, transportation permits are anticipated.

(A) HEALTH AND SAFETY

(1) Demographic Characteristics

Applicant obtained population estimates for Hardin County from the Ohio Department of Development (Attachment 08-01). Hardin County's population of 31,945 people in 2000 is expected to increase slightly to 32,450 people in 2010, slightly more to 32,720 people in 2020, and slightly more to 32,830 people in 2030.

(2) Noise

(a) Construction Noise Levels

The Applicant has retained Acentech Inc. (Acentech) as a consultant to conduct noise studies for both construction and operation of the wind farm. The Applicant has provided Acentech's report as Attachment 08-02 which addresses noise from dynamiting activities (not anticipated), operation of earth moving equipment, driving of piles (not anticipated), erection of structures, truck traffic, and equipment installation.

A majority of the construction activities associated with the proposed wind farm will be conducted during daylight hours. At times over the planned construction schedule, the construction activities will be audible to nearby residents. Any construction at the wind farm in the evening and nighttime is expected to be limited to relatively quiet activities in an effort to minimize disturbance to neighbors.

The Applicant will employ the following mitigation measures during the construction phase of the wind farm:

- Effective exhaust mufflers in proper working condition will be installed on engine-powered construction equipment at the site. Mufflers found to be defective will be replaced promptly.
- Contractors will be required to comply with federal limits on truck noise.
- Contractors will be required to ensure that their employee and delivery vehicles are driven responsibly.
- Nighttime construction work that does occur will generally be limited to relatively quiet activities, such as welding and installing equipment, cabling, and instrumentation.
- Contractors will be required to notify the community in advance of any blasting activity (not anticipated).

Construction sound that may be heard outside of the Project Area will vary from hour-to-hour and day-to-day in accordance with the equipment in use and the operations being performed at the site. Since the construction activity at the wind farm will be temporary, will occur mostly in the daytime hours, and will produce sounds that are already familiar to the community, including sounds from home construction, its overall noise impact on the community beyond 1,000 feet of the nearest wind turbine is not expected to be significant.

Typical on-site equipment used to construct the wind farm will include trucks, cranes, dozers, excavators, trenchers, and graders. Representative average sound levels (equivalent sound levels, Leq) associated with this construction equipment during the workday are listed in Table 08-01. For example, with 2 trucks, 1 dozer, and 1 excavator operating at a wind turbine, the calculated equivalent sound level during the workday is 59 dBA at 1050 feet. The construction sound level at the nearest property boundary will be greater than these values, depending on the actual distances from the construction activity to the boundary. Table 08-01 also lists the sound estimates at distances less than 1,000 feet from the construction equipment, and sound estimates at one-half mile and one mile from the equipment. These reported sound levels are based on the results of extensive previous acoustical studies of engine-powered construction equipment.

Table 08-01 Sound Levels of Construction Equipment (L_{eq}, dBA*)

Equipment	50 Feet	100 Feet	200 Feet	400 Feet
Blasting	71†	65†	54†	43†
Pile Driving	70†	64†	53†	42†
Dozer	60	54	43	32
Excavator	61	55	44	33
Trencher	61	55	44	33
Grader	59	53	42	31
Roller	56	50	39	28
Trucks	55	49	38	27
Batch Plant	52	46	35	24
Trucks	55	49	38	27
Crane	61	55	44	33
Trucks	55	49	38	27
Typical Mix of Equipment[3]		59		

* Estimated Leq sound levels over a 10-hour daytime shift. 24-hr Ldn would be 4 dBA less than each Leq.

[1] Estimated sound levels at nearest non-participating landowner's property line to proposed GE 1.5 xle turbines. The GE 2.5 xl will be located farther away from the nearest non-participating landowner's property line and the noise will thus be lower.

[2] Estimated sound levels at nearest community residence to proposed GE 1.5 xle turbines.

[3] This typical mix of construction equipment consists of 2 trucks, 1 dozer, and 1 excavator.

† Estimated values for blasting and pile driving are maximum (Lmax) sound levels, not Leq.

(b) Operational Noise Levels

Acentech estimated project sound levels, which apply to both daytime and nighttime hours for the operation of the wind farm, using the computer noise modeling program, Cadna/A. This commercial software program, which was

developed by DataKustik GmbH (www.datakustik.de), is widely-accepted by the international acoustics community for the calculation of community sound levels due to industrial sources.

The wind farm will be available to operate 24-hours per day and seven days per week. The findings of Acentech's study indicate that operation of the wind farm during periods of maximum noise output will produce Leq noise levels ranging from 20 dBA to 47 dBA at the residences located in the Project Area and within one mile of the Project Area. At other times wind speeds and noise levels would be less than shown in the Acentech report.

No State or local noise standards are available for comparison to the projected levels. However, the estimated project Leq levels of 20 dBA to 47 dBA are comparable to the steady US Environmental Protection Agency guidelines of a 48 dBA Leq for residential sound levels.

The projected sound levels are also less than the effective 51 dBA Leq maximum level recommended by the the New York State Department of Environmental Conservation (NYDEC) for rural agricultural areas. The NYDEC policy recommends increases in the community sound levels not exceed 6 dBA above the existing ambient levels and it states that an ambient Leq sound level of 45 dBA is typical of rural communities. A 6 dBA increase over the 45 dBA level results in an effective limit of 51 dBA.

(c) Location of Noise Sensitive Areas

The Applicant has provided map displaying sound contours from the wind turbines and potential noise sensitive areas (including residential structures, schools, hospitals, nursing homes or assisted-living and health-care facilities, religious institutions and public libraries) as Figure 08-01 for the case of the GE 2.5 xl wind turbine and Figure 08-02 for the case of the GE 1.5 xl wind turbine.

(d) Mitigation of Noise Emissions

The most effective mitigation for noise from wind farms is implementation of appropriate setbacks. The Applicant proposes to locate the wind turbines 1,000 feet or more from all residences. The Applicant has based its 1,000 foot setback on its affiliate's experience developing, owning and operating wind farms throughout the U.S.

(3) Water

No impacts to public or private water supplies are anticipated due to construction and operation of the wind farm. The Applicant will implement the appropriate erosion control and spill prevention measures construction of the wind farm. Potential indirect impact to public and private water supplies will be minimized through the use of prudent design and operational measures, such as containments structures to ensure that oil and chemicals used during construction and operation are prevented from potentially contaminating groundwater sources. In addition to design measures, the Applicant will provide training to its staff in emergency procedures in the event of an unanticipated spill, to ensure that appropriate actions will be taken to limit the potential for impact.

Section 4906-17-05(A)(5) discussed potential impacts to aquifers. The wind farm will not be drawing water from groundwater sources related to operation. However, the Applicant will be digging a well for the O&M building's use. The Applicant will follow all applicable regulations related to this well.

(4) Ice Throw

Ice throw or more accurately, ice shedding, refers to the phenomenon that can occur when ice accumulated on rotor blades breaks free and falls to the ground. The accumulation of ice is highly dependent on local weather conditions and the wind turbine's operational state. However, when a wind turbine is stationary, it is no more likely obtain ice accretion than any other large stationary structure such as a building, tree or power line. As with other such structures, ice will eventually be released and fall to the ground. When a wind turbine is operating, ice can still accumulate on the rotor blades in appropriate conditions of temperature and humidity. In the case of an operating wind turbine, observations suggest that higher ice accretion rates occur due to the relative velocity of the rotor blades but that accretion is impeded by the flexing of the blades. Ice fragments that detach from the rotor blades can be blown so that they would land downwind of the wind turbine (Garrad Hassan, 2007). The risk of ice landing at a specific location is found to drop dramatically as the distance from the wind turbine increases.

The only known recorded and publicly available example of observations in Ontario is from an existing Tacke TW600 wind turbine near Kincardine. The operator monitored the operation of that turbine since its installation in December 1995 until March 2001 (Garrad Hassan, 2007). In that period, approximately 1,000 inspections were made and a

manual note was made on each occasion. In these notes, some form of ice build-up on the wind turbine was recorded on 13 occasions during the December 1995 and March 2001 observation period, and in those cases the ice pieces were never shed farther than 100 meters (328 feet) from the turbine tower.

The Applicant's minimum setback distance of 1,000 feet from wind turbines to permanent residences and at least 1.5 x tip height from non-participating landowner's property lines adequately protects the public from falling ice. Based upon the results of studies/field observations at other wind farms, modern turbine technological controls, wind farm siting criteria, the proposed control of public access to the turbine sites and the fact that there has been no reported injury caused by ice being "thrown" from an operating wind turbine, it is not anticipated that the Project would result in any measurable risk to the healthy or safety of the general public due to ice shedding.

(5) Blade Shear

Another potential public safety concern is the possibility of a rotor blade dropping from the wind turbine nacelle. Evidence suggests that the most common cause of blade failure is human error in interfacing with the control systems. Manufacturers have reduced that risk by limiting human adjustments that can be made in the field (Garrad Hassan, 2007). Most instances of blades being detached were reported during the early years of the wind industry. Technological improvements and mandatory safety standards during turbine design, manufacturing and installation have largely eliminated such occurrences. The reduction in blade failures coincided with the widespread introduction of wind turbine design certification and type approval. The certification bodies, such as Germanischer

Lloyd in the case of GE wind turbines, perform quality control audits of the blade manufacturing facilities. These audits typically involve a dynamic test that simulates the life loading and stress on the rotor blade. This approach has largely eliminated blade design as a root cause of blade failures (Garrad Hassan, 2007).

The engineering standards of the wind turbines proposed for this facility are of the highest level and meet all federal, state and local codes. The use of state of the art breaking systems, pitch controls, sensors and speed controls on wind turbines have greatly reduced the risk of blades dropping from the turbine. The wind turbines proposed for the facility will be equipped with two fully independent braking systems that allow the rotor to be brought to a halt under all foreseeable conditions. In addition, the turbines will automatically shut down at wind speeds over the manufacturer threshold as described in Section 4906-17-05(A)(5)(b) For all of these reasons the risk of blade throw is minimal.

(6) Shadow Flicker

Shadow flicker is defined as alternating changes in light intensity caused by the moving blade casting shadows on objects behind the sun side of an object, such as a rotating wind turbine. Shadow flicker frequency is related to the rotor speed and number of blades on the rotor, which can be translated into "blade pass frequency" measure in alternations per second, or hertz (Hz). The sensitive receptor for this analysis is a residence. Shadow flicker will not be an everyday event or be of extended duration.

The Applicant has retained Tetra Tech to perform an analysis of the expected shadow hours at all residences in the Project Area using the worst case scenario (the GE 1.5 xl

layout – which has the greatest number of wind turbines). Results are shown in Attachment 08-03. The analysis of potential shadow flicker impacts from the wind farm on nearby houses (receptors) shows that shadow flicker impacts are expected to be minor. Tetra Tech EC used the industry standard software, WindPro for this analysis.

The analysis makes several conservative assumptions:

1. It assumes that the houses all have a direct in line view of the incoming shadow flicker sunlight and does not account for trees or other obstructions which may block sunlight. In reality, the windows of many houses will not face the sun directly for the key shadow flicker impact times.

2. The analysis does not factor in lowering intensity of shadows at greater distances. It assumed that shadows further from the base of a turbine would have intensity just as intense at the turbine base. In reality shadow intensity decreases with distance.

3. The analysis predicts shadows for periods when any portion the turbine rotor masks (covers) the sun's disc. Typically, periods when the solar disc is masked less than 20% will not cause a significant shadow flicker impact.

For the reasons above, shadow flicker impacts are expected to be less than estimated with this conservative analysis, and shadow flicker is not expected to be a significant environmental impact.

The overwhelming majority of the residences evaluated have less than 50 hours per year of predicted shadow flicker impact. The shadow flicker impact prediction statistics are as summarized in Table 08-02.

Table 08-02 Statistical Summary of WindPro Predicted Shadow Flicker Impacts at Modeled Sensitive Residence

Total	988
= 0 Hours	343
> 0 and < 10 Hours	466
≥ 10 and < 20 Hours	105
≥ 20 and < 30 Hours	44
≥ 30 and < 40 Hours	15
≥40 and < 50 hours	11
≥ 50 and < 60 hours	4
> 60 hours	0

The Applicant has provided a further discussion of the shadow flicker analysis as Attachment 08-03.

(B) ECOLOGICAL IMPACT

(1) Project Site Information

(a) Mapping

The Applicant has provided a map at 1:24,000 scale containing a half-mile radius from wind farm and showing the Project Area boundary, undeveloped or abandoned land, and recreational areas as Figure 08-03.

(b) Vegetative Survey

The Applicant has performed a desktop vegetative survey of the Project Area. A plant community is a combination of different plants growing together. Each plant community has a unique structure and appearance, which is determined by the proportions of the species growing in it. The composition of a plant community type changes from place to place due to the physical environment and factors such as rainfall, temperature, elevation, soil type, and slope. Each species has certain limits to where it will grow and survive, and those species that have similar limits often are found growing together; hence, they become a loosely assembled "plant community."

Plant communities can influence the type of wildlife that use the area, including listed species or species of concern, and plant communities themselves can often be rare or in need of conservation. The identification of native plant communities is essential to identifying wildlife-habitat relationships. Cultivated crops (soybean, corn, and wheat) comprise approximately 88.3 percent of the total land cover of the Project Area (Table 08-03). Approximately 4.3 percent of the Project Area is identified as open space that is mostly made up of large family housing and plantation farming. Historically this area was characterized by prairie habitat that supported a variety of grassland and woody plant species. Deciduous forest comprises approximately 3 percent of the Project Area along with the woodland wetlands (<0.1 percent) interspersed throughout the Project Area as fragmented tracts consisting primarily of oaks, hickories, maples, and cottonwoods. Pastures managed as hayfields for cattle grazing make up an additional 2.7 percent of the

Project Area. The percentages of other less prevalent cover types are presented below in Table 08-03.

Table 08-03. Land Use/Land Cover within the Project Area

Crops	31,636.60	88.22%
Developed, Open Space	1,546.85	4.31%
Deciduous Forest	1,075.44	3.00%
Pasture/Hay	1,022.80	2.85%
Grassland	304.73	0.85%
Developed, Low Intensity	217.80	0.61%
Developed, Medium Intensity	15.86	0.04%
Woody Wetlands	11.95	0.03%
Emergent Wetlands	11.88	0.03%
Open Water	10.04	0.03%
Developed, High Intensity	4.15	0.01%
Evergreen Forest	3.44	0.01%
Barren	1.34	0.00%
Total Acreage	**35,862.86**	
Source: USGS 2009		

(c) Animal Life Survey

The Major Species listed in Section 4906-17-08(B)(1)(e) below represent the potential animal life that may inhabit the Project Area. In addition, the Applicant has retained Western EcoSystems Technology, Inc. (West, Inc.) to perform field surveys at the project site to estimate the impacts of the wind farm on wildlife (provided as Attachment 03-01). As part of this estimate, West performed a "breeding bird" and mammal survey in which biologists searched for visual and audible evidence of bird and mammal species in the Project Area during late spring 2009, the period of the year when birds are most likely to be resident and breeding in the area. West, Inc has recorded the following incidental animal observations:

Bird Observations

Birds recorded incidentally at the Project Area totaled 141 individuals in 87 groups. The most commonly recorded incidental bird species was American kestrel (*Falco sparverius*; 40 observations), followed by turkey vulture (27), red-tailed hawk (17), Canada goose (*Branta canadensis*; 15), and American crow (*Corvus brachyrhynchos;* 13). Two species, wild turkey (*Meleagris gallopavo*; seven observations) and short-eared owl (*Asio flammeus*; one observation), were observed during other surveys at the Project Area. One state endangered species, northern harrier (six observations), and one species of special concern, short-eared owl were observed incidentally.

Mammal Observations

The most commonly recorded incidental mammal species was white-tailed deer (*Odocoileus virginianus*; 26 observations). Two raccoon (*Procyon lotor*) were also observed, along with one coyote (*Canis latrans*), groundhog (*Marmota monax*), and an unidentified flying squirrel (*Glaucomys* spp).

Bat Observations

Bat mist net surveys on nine sites throughout the Project Area have been completed. During the 4 to 5 days that each site was surveyed by West, Inc in accordance with ODNR approved protocol, no Indiana bats (*Myotis sodalis*) or other endangered bat species were captured.

(d) Summary of Ecological Studies

The Applicant has retained Tetra Tech to performed desktop analyses of Major Species to evaluate the potential for these species to inhabit the Project Area. The results are detailed below in Section 4906-17-08 (B)(1)(e).

In addition the Applicant has retained West, Inc to develop and implement a standardized protocol for baseline wildlife use studies in the Project Area for the purpose of estimating impacts of the wind farm on wildlife. The protocols were based on the final wildlife study guidelines from the ODNR, correspondence received from the ODNR, and a meeting held with ODNR and USFWS officials on September 3, 2008. Protocols used in the study were approved by USFWS in a letter dated February 3, 2009. The ODNR also stated that they had no objections to the proposed protocols in an e-mail dated December 12, 2008.

Reasonable predictions of impacts to wildlife at proposed wind farms in Ohio are complicated by the lack of post-construction studies, lack of current wind farms in Ohio, and the lack of studies of wind farms in the Midwest in general. In lieu of Ohio comparison areas, results of bird surveys conducted to date were compared to data collected at other wind farms across the US. The data collected on bird use at the Project Area to date suggest that raptor migration rates are lower than migration rates observed at other wind farms and hawk migration counts across the US. Only three sandhill cranes (a Major Species discussed below in Section 4906-17-08 (B)(1)(e)) were observed during surveys, and relatively high numbers of migrating passerines were not observed utilizing the project as stopover habitat.

The Project Area is dominated by tilled agriculture, which is recommended by the USFWS in their interim guidelines as more suitable for wind farms than native habitats. Some species considered sensitive or endangered by the ODNR were observed during surveys; however; data collected to date do not suggest that most species are numerous within the Project Area. One potential exception is the northern harrier (a Major Species discussed below in Section 4906-17-08 (B)(1)(e)); however, northern harriers are generally not considered to have especially high risks of colliding with turbines due to the species tendency to hunt close to the ground. Potential impact analyses, including examining flight height data, will be presented within the final report for this wind farm which the Applicant anticipates will be completed in the 4th Quarter of 2009.

Studies of breeding songbirds, two weeks of fall passerine migration counts, acoustic bat surveys, and mistnet surveys for bats will be completed by November 15, 2009. The methods to be utilized to complete the surveys will be consistent with ODNR guidelines, and protocols have been approved by the ODNR. A full report describing the results of all surveys and potential impacts analyses will be written once all surveys are completed in the 4th Quarter of 2009.

(e) Major Species List

The Applicant has retained Tetra Tech EC to perform a desktop evaluation of the Major Species within the Project Area. The Applicant has provided Tetra Tech's full report as Attachment 08-04. The following evaluation of biological, resources within the Project Area is based on searches of relevant and readily

available databases and reports, and geospatial data. Existing information was collected from a number of public domain sources. Cartographic information and related literature compiled through agency and internet sources included the following datasets:

- U.S. Geologic Survey (USGS) 7.5-minute quadrangle maps;
- USFWS National Wetlands Inventory (NWI) data;
- USFWS Threatened and Endangered Species System (TESS);
- Ohio State Natural Heritage Program;
- Ohio Department of Natural Resources (ODNR);
- U.S. Geological Survey National Land Cover Database (NLCD)

Special-Status Plant Species

The USFWS and ODNR maintain a list of federally and state-protected plant species. Species listed as threatened or endangered by either of these agencies require protective measures for their perpetuation due to low populations, sensitivity to habitat alteration, and/or cultural significance.

According to the ODNR and the USFWS websites, no federally endangered or federally threatened species occur in Hardin County (ODNR 2009). Two state-endangered and one state-threatened species are known to occur in Hardin County.

State-protected Plant Species

Heart-leaved plantain (Endangered) – The heart-leaved plantain inhabits rock or pebble substrates of shallow slow-moving streams. Heart-leaved plantain is also

found, on occasion, in mud-bottomed streams and wooded floodplains. Heart-leaved plantain flowers from April to May. ODNR (2009) states that heart-leaved plantain is known to occur in Hardin County from post-1980 records and may still occur in any of the small intermittent streams associated with the Scioto River watershed. Threats to heart-leaved plantain include loss of habitat to development as the plant is only found in undisturbed streams and floodplains. Based on known information, the likelihood of occurrence within the Project Area is low given that most of the known habitat has already been disturbed by farming. As this species inhabits wetlands and the Applicant intends to avoid impacts to wetlands, the chance of the wind farm impacting this species is very low, and thus no on site studies are planned.

Lesser bladderwort (Threatened) – Lesser bladderwort inhabits undisturbed bogs and fens often rooted in calm shallow mud-bottomed wetlands. Lesser bladderwort flowers from May to August. ODNR (2009) states that lesser bladderwort is known to occur in Hardin County from post 1980 records. Threats include drainage of habitat and overgrowth by woody species through succession. Based on known information, the likelihood of occurrence within the Project Area is low. As this species inhabits wetlands and the Applicant intends to avoid impacts to wetlands the chance of the wind farm impacting this species is very low, and thus, no on site studies are anticipated.

Wildlife

This Section identifies sensitive wildlife species known to occur or potentially occur within the proposed project site. Based on issues identified at other wind generation facilities throughout the United States, those species of greatest concern are federally or state-protected avian species and bats that may occur in the vicinity of the wind energy facility. Other species of conservation concern are those directly associated with sensitive or unique habitats.

Special-Status Species

Two federally endangered species (Indiana myotis and clubshell), one federally threatened (copperbelly water snake), and two candidate species (eastern massasauga and rayed bean), have been documented within Hardin County. In addition, the ODNR lists 3 wildlife species that are considered state-endangered or threatened that are known to occur within Hardin County.

Federally Protected Species

Indiana myotis (Endangered) – In winter, Indiana myotis (bats) live in caves and abandoned mines (USFW 2007, ODNR 2009). Male and female Indiana bats then segregate in the summer. It is assumed that male bats roost alone or live in small bachelor colonies. Females nest under loose bark of exfoliating trees or in tree hollows. Based on known information, the likelihood of occurrence is low due to unsuitable habitat for maternity colonies or winter hibernacula. Some individuals may pass through the area during migration. Studies to evaluate the potential for impact on this species have been ongoing since 4th Quarter of 2008. At the

completion of the studies, the Applicant will provide them to the appropriate regulatory agencies and the OPSB Staff.

Copperbelly water snake (Threatened) – Copperbelly water snakes (copperbellies) have both wetland and terrestrial habitat requirements but are associated most often with wetland complexes characterized by shallow wetlands, many of which draw down seasonally (USFWS 2008). Thus, copperbelly water snakes need habitat complexes of isolated wetlands distributed in a forested upland matrix, floodplain wetlands fed by seasonal flooding, or a combination of both. Individuals often move hundreds of meters or more between wetlands and routinely use multiple wetlands over the course of an active season. They also spend substantial periods of time in upland situations, aestivating, foraging, and shedding. In addition, fishless wetlands that have high anuran (frog and toad) productivity are required to provide habitat and a suitable prey base (USFW 2008, ODNR 2009). The principal limiting factor for copperbellies is the availability of wetland/upland habitat complexes of sufficient size. Research indicates that copperbellies require many hundreds of hectares of contiguous habitat in order to persist (USFW 2008). Additional threats are human persecution, inadequate habitat management, and road crossings. Copperbelly Water Snakes are active May to September with most breeding occurring during the spring (May-June) depending on temperature and weather conditions. The likelihood of occurrence within the Project Area is low due to the lack upland forests. Suitable foraging habitat may exist along the Scioto River. Through additional correspondence

with the USFWS the Applicant has determined that this species is not expected to inhabit the Project Area and thus on-site studies are not anticipated.

Eastern massasauga (Candidate) - Throughout much of its range in the eastern United States, eastern massasaugas (rattlesnake) are found in wet prairies, sedge meadows, and early succession fields. Preferred wetland habitats are marshes and fens. They avoid open water and seem to prefer the cover of broad-leafed plants, emergents, and sedges. Eastern massasaugas are active from April to August with peak breeding activity during April and May (ODNR 2009). The likelihood of occurrence is low within the Project Area due to agriculture development and the lack of marshes and fens. Suitable habitat may exist in along the Scioto River. Through additional correspondence with the USFWS the Applicant has determined that this species is not expected to inhabit the Project Area and thus on site studies are not anticipated.

Clubshell (Endangered) - Historically known to have occurred in the Scioto River (USFW 1994, ODNR 2009), the clubshell is found in clean, coarse sand and aggregate in runs, often just downstream of a riffle. It cannot tolerate mud or slackwater conditions, and is very susceptible to siltation. Clubshell are known to bury itself in up to four inches of substrate making detection difficult (ODNR 2009). The clubshell are threatened by runoff and channelization, domestic and commercial pollution, in-stream sand and gravel mining, impoundment, and zebra/quagga mussel infestation. The likelihood of occurrence is low within the Project Area due to agricultural development. The best time to survey for these is

in the spring and summer. The Applicant does not intend to directly or indirectly impact streams or rivers capable of supporting this species and thus on site studies are not anticipated.

Rayed bean (Candidate) - Historically known to have occurred in the Scioto River system the rayed bean is now limited to a small isolated population found in the Brush Creek tributary of the Scioto River in nearby Scioto County (South of Hardin County; USFWS 1992a). Adult and juvenile specimens appear to produce byssal threads apparently to attach themselves to substrate particles (ODNR 2009). The Rayed bean is threatened by runoff and channelization, domestic and commercial pollution, in-stream sand and gravel mining, impoundment, and zebra/quagga mussel infestation. The likelihood of occurrence is low in within the Project Area given the amount of agricultural development within the Project Area. The best time to survey for these is in the spring and summer. The Applicant does not intend to directly or indirectly impact streams or rivers capable of supporting this species and thus on site studies are not anticipated.

State-protected Species

Northern harrier (Endangered) – The northern harrier breeds in abandoned fields, wet hayfields, prairies, and cattail marshes (ODNR 2009). Nesting sites are chosen based on availability and the abundance of prey (small mammals) in adjacent areas. They nest on the ground, commonly near low shrubs, in tall weeds or reeds, on top of low bushes above water, on knolls of dry ground or on dry marsh vegetation. Threats include habitat loss and degradation (e.g., draining of

wetlands, monotypic farming), human disturbance of nesting birds, and nest predation. The likelihood of occurrence is high within the Project Area as northern harriers will utilize open agricultural fields for hunting. Small amounts of grasslands may still be present to provide some habitat for breeding. The best time to survey for these are from April through July. Studies to evaluate the potential for impact on this species are on going. At the completion of the studies at the end of the month of July, these will be provided to the appropriate regulatory agencies and the OPSB Staff.

Sandhill crane (Endangered) - Sandhill cranes are primarily a wetland-dependent species (ODNR 2009). On their wintering grounds, they will utilize agricultural fields; however, they roost in shallow, standing water or moist bottomlands. On breeding grounds they require a rather large tract of wet meadow, shallow marsh, or bog for nesting. The likelihood of occurrence within the Project Area is moderate as sandhill cranes often utilize agricultural fields to forage in when during migration during the spring and fall. The best time to survey for these are from April through July. Studies to evaluate the potential for impact on this species are on going. At the completion of the studies at the end of July, these will be provided to the appropriate regulatory agencies and the OPSB Staff.

Bald eagle - The bald eagle can be found near sizeable bodies of water, natural and man-made. In Ohio, the bald eagle's stronghold is the marsh region of western Lake Erie (ODNR 2009). Bald eagles prefer an area where water with ample food (fish) is located within two miles of the nest site. Nesting begins as

early as February and March. Bald eagles have nested in Hardin County (ODNR 2009) however no specific information was given as when they nested or where in Hardin County. Given the presence of the Scioto River as potential suitable habitat and documentation that bald eagles have nested in Hardin County, the likelihood of occurrence is moderate. Bald eagles are protected by the Bald and Golden Eagle Protection Act. Studies to evaluate the potential for impact on this species are on going. However, the USFWS has stated that it does not anticipate any impact on the Bald Eagle due to its lack of proximity to the Project Area. As such, no studies have been conducted.

The ODNR maintains a list of species regularly hunted in the state. Several common commercial (muskrat, fox, coyote, beaver, skunk, raccoon, mink, and opossum) and recreational species (deer, squirrel, rabbit, woodchuck, pheasant, turkey, doves, boar, and waterfowl) may be present on the Project Area. Much of the Project Area is on privately owned lands and written permission from the land owner and a valid Ohio hunting permit is required to hunt on private lands (ODNR 2009). While it is anticipated that most of the species do occur on the Project Area (either permanently or seasonally) the likelihood of occurrence for most recreational and commercial species will be low to moderate. Several species (such as pheasant, turkeys, waterfowl, deer, and rabbits) that are attracted to agriculture will have a moderate to high likelihood of occurrence. Most of these species can be confirmed to be on the Project Area through other surveys such as avian and wetland surveys. No additional surveys will be performed unless directed by the ODNR. Additionally, as the project progresses, consultation with

the ODNR will identify any state protected hunting areas or game preserves that should be avoided.

(2) Construction

(a) Impact of Construction

The Applicant does not anticipate impacts to woodlots, wetlands, environmentally sensitive vacant fields, recreational areas, parks, wildlife areas, nature preserves or other conservation areas during construction.

(b) Impact of Construction on Major Species

The Applicant is not planning to impact any threatened or endangered species or their habitat. With input from the ODNR, the Applicant will design the wind farm to avoid impacts to threatened or endangered species and their habitat.

(c) Mitigation of Short and Long-term Construction Impacts

Short term and long term impacts to area ecology and threatened and endangered species from wind farm construction will be effectively avoided because Applicant does not plan construction activities in the habitats of threatened and endangered species.

(3) Operation

(a) Estimate the Impact of Operation on Areas

Areas of permanent impact are summarized in Section 4906-17-03(A)(1)(b) As proposed, the wind farm should not have any direct impacts to environmentally sensitive vacant fields, wetlands, woodlots, parks, wildlife areas, nature preserves, or other conservation areas.

(b) Estimate the Impact of Operation on Major Species

Because the proposed wind farm does not involve construction or operation of facilities in areas of habitat for Major Species, no impacts to these species are expected.

As discussed in Section 4906-17-08(B)(1)(c), pre-construction studies have not found any Indiana bats in the Project Area. Thus, based on the information gathered to date, the wind farm is not expected to have an impact on this federally listed species.

The Applicant will continue a consultation with ODNR to understand and incorporate other design changes that may be appropriate to further minimize potential impacts to threatened or endangered species.

(c) Mitigation of Impacts

Short-term and long-term impacts to threatened or endangered species' habitat by wind farm operation will be effectively mitigated by designing the wind farm so as to not locate wind energy facilities (roads, wind turbines, cables) in the habitats of threatened or endangered species. Based on the information gathered to date, no other active mitigation measures should be necessary to minimize impacts to threatened or endangered species.

(d) Post-Construction Monitoring of Wildlife Impacts

The Applicant is in the process of developing a post construction monitoring plan for the wind farm. This will be based on the final avian and bat impact analysis discussed in Section 4906-17-08(B)(1)(d) and in coordination with ODNR.

(C) ECONOMICS, LAND USE AND COMMUNITY DEVELOPMENT

(1) Land Uses

(a) Land Use Map

A map showing land uses is included as Figure 08-04.

(b) Residential Structures

There are 216 residences within 1,000 feet of the Project Area boundary (78 inside of the Project Area, 138 outside of the Project Area).

Table 08-04 shows the number of wind energy facilites within 100 feet of a residence for the two layouts in this application. In general, the vast majority of the wind energy facilities which make up the wind farm are located more than 100 feet from a residence. The Applicant will continue to work to locate wind energy facilities as far from residences as possible. In the case of access roads located close to residences, this is a result of the Applicant using existing roads on a landowner's property as access roads for the wind farm. The Applicant is using existing roads in an attempt to minimize new ground disturbance.

Table 08-04 Wind energy facilities within 100 feet of residences

Layout	Wind Turbines	Access Roads	Collection System	Substation	Permanent Meteorological Towers
GE 2.5 xl	0	2	5	0	0
GE 1.5 xle	0	4	10	0	0

(c) **Wind Turbine Structure Locations**

(i) Distance from base to property line

As discussed in Section 4906-17-04(A)(2), the proposed wind farm is designed with a turbine setback of one and one-half (1.5) times tip height from all non-participating property lines. Consequently, the distance between all wind turbine bases to the nearest non-participating property line will be more than the distance of one and one-tenth (1.1) times the turbine tip height that is required by OPSB regulations.

Note that in designing the wind farm and locating turbines, the Applicant has not imposed setbacks between wind turbines and the boundaries of participating properties. Consequently, some of the wind turbines may be located a distance from boundaries of participating properties that is less than one and one-tenth (1.1) times the wind turbine tip height.

(ii) Distance from blade to property line

The proposed wind farm has been designed to comply with the setbacks in Section 4906-17-04(A)(2), including a setback of 1,000 feet or more from all residences, whether participating or not. This setback exceeds, and therefore complies with, the regulatory requirement of 750 feet plus a blade length. Specifically:

- The length of the GE 2.5 xl blades are 50 m (164 feet), thus the regulatory requirement would translate to a setback of 914 feet for the subject wind turbines. The 1,000 feet setback used by the Applicant exceeds this amount.

- The length of the GE 1.5 xle blades are 41.25 m (135 feet), thus the regulatory requirement would translate to a setback of 885 feet for the subject wind turbines. The 1,000 feet setback used by the Applicant exceeds this amount.

(iii) Waiver of minimum setback

The Applicant is not requesting any waivers of the minimum regulatory setbacks to residences.

The Applicant is also not requesting any waivers of the minimum regulatory setbacks to the boundary of "the wind farm property." The Applicant notes that OPSB regulations define minimum setbacks relative to the "property line of the wind farm property." The Applicant interprets "the wind farm property" to be the collective properties of all participating parcels and thus, waivers are only required if the Applicant proposes to locate turbines closer to the boundary of these collective participating properties than is allowed by regulation. As discussed in paragraph (i) above the Applicant has designed the wind farm with setbacks to non-participating property lines that exceed OPSB regulatory requirements.

Lastly, the Applicant notes that the participating properties that comprise the "wind farm property" are all properties where the owner has executed a lease or lease option with the Applicant. As part of these leases, the owner grants the Applicant the right to locate wind power facilities on the

property, and the owner waives enforcement of applicable setbacks as they could apply to the individual owner's property. Thus, the agreements that the Applicant has in place with property owners support the interpretation that turbine setbacks are not applicable to boundaries between individual participating properties that comprise the overall "wind farm property."

(d) Impact of Proposed Facility

The Applicant will design the wind farm in such a way (setbacks from neighboring buildings, property lines, etc) so as to minimize impacts to land use within 1 mile of the Project Area.

(e) Identification of Structures to be Removed or Relocated

The Applicant does not plan to remove or relocate any structures.

(f) Plans for Future Use

The Applicant has no plans for future use of the Project Area and the Applicant knows of no such plans having been adopted by government agencies.

(g) Concurrent or Secondary Uses

The Applicant has no plans for concurrent or secondary uses.

(2) Economics

(a) Estimated Payroll

Based on the Invenergy's experience, about 32 percent of the installed cost of a wind farm goes to labor and materials while the remaining 68 percent goes to pay for the wind turbines, towers and substation equipment. Thus with an estimated wind farm cost of $540 Million to $660 Million, construction labor payroll and

materials is expected to range between $173 Million and $211 Million. Adding to this the range of present values of O&M payroll calculated in Section 4906-17-06(C)(3) of $113 Million, the present value sum for operations payroll throughout the life of the project is estimated to be between $286 Million and $324 Million.

(b) Estimated Employment

Construction Employment

Based on Invenergy's experience with other wind farms, it is expected that construction of the wind farm will require an average of 150 construction workers over a 9- to 12-month period. During peak construction periods, between 200 and 250 construction workers will be required. Skilled construction workers will include electricians, laborers, engineers, carpenters, cement finishers, iron workers, construction management, and operating staff. Depending on the availability of qualified persons, construction workers may be from regional labor sources.

Operations Employment

The Applicant plans to hire a permanent operations staff that in the first two to five years of operation will also be supported by a warranty maintenance team likely hired by the turbine vendor. The Applicant estimates its operations staff will include a site manager, an administrative assistant, and one technician for every 10 wind turbines. The wind turbine vendor typically has one manager on site plus a staff of one technician for every 25 turbines. For the base case wind turbine layout with 120 2.5 GE xl wind turbines, this would translate to a

permanent staff of 12 employees for the Applicant and approximately six employees for the wind turbine vendors warranty team.

If the wind farm were to be built with 200 1.5 GE xle wind turbines, the operations teams would be approximately 20 employees for the Applicant, and up to 9 employees for the wind turbine vendor.

Typically the Applicant's maintenance team and the warranty team will be led by an individual with experience in managing operating wind farms and this person would be hired from out of Ohio due to the lack of history of the wind industry in Ohio. In addition, each team would likely include one lead technician that would have experience and would likely be from out of state. All other positions are typically filled from the local area.

(c) Estimated Tax Revenue

Taxes in Ohio for wind farms are in flux. Because currently the Ohio tax structure is the subject of proposed legislation, the Applicant bases this calculation on the suggestions from American Wind Energy Association (AWEA).

Current Public Utility Law

Under current tax law, a "public utility" includes any person that is an electric company. R.C. 5727.01(A). An "electric company" includes any entity engaged in the business of generating, transmitting, or distributing electricity in Ohio for use by others is an "electric company." R.C. 5727.01(D)(3). Since a wind farm generates electricity in Ohio for use by others, it is a public utility *for tax*

purposes. The tangible personal property of an electric company is assessed at 85% of true (depreciated) value, in the case of transmission property; and at 24% of true (depreciated) value, in the case of generating property. This value is multiplied by the full local property tax rate to determine the annual property tax liability for the taxpayer.

Proposed Revision to Public Utility Law

Alternative electric providers often compete in an open market with other such suppliers for their products. In many neighboring states, the average annual tax burden per megawatt of installed capacity is in the range of $6,000-$10,000. Being taxed as a public utility in Ohio causes wind farms to incur annual tax burdens in excess of $41,000 per MW, rendering them uncompetitive in the marketplace. This inordinately high tax burden makes it unlikely that a significant number of new alternative electric generators will locate in the State of Ohio.

AWEA suggests that Ohio adopt legislation that excludes alternative electricity generators, such as wind farms, from the definition of "electric company", thereby removing them from the personal property tax (they remain subject to tax on real property). In its place, a new "wind energy conversion system" tax is imposed annually at graduated rates, based upon the number of kilowatt hours of electricity produced during the prior year. The rate of tax varies by the rated capacity of the facility. Although state administered, the tax is paid to the local county treasurer and is distributed in the same proportion as personal property taxes.

If AWEA proposal becomes law, the total tax (including property, personal, production and commercial activity tax) will be approximately $6,000 per MW of installed capacity per year or $1.8M for the wind farm based on 27% net capacity factor and $1.2 per MWh of production tax.

H.B. 218, which is pending before the House Ways and Means Committee, would maintain the current property tax structure for alternative energy providers. However, it would eliminate the annual allowance for depreciation and subject all generation equipment to tax at 12% of its book cost. This would result in a property tax burden that remains approximately twice (approximately $20,000 per MW of installed capacity or $6.0 Million per year for a 300 MW wind farm) that of surrounding states for the wind farm.

(d) Estimated Economic Impact

Beyond the economic impact of construction, taxes, and permanent employment discussed above, the Project will provide a significant positive impact to the community through lease payments. Based on the Hardin County Profile from the Ohio Department of Development, the median income in Hardin County in 1999 (the most recent year that information is available) was $34,440. Lease payments from a single wind turbine will be on the order of $10,000 per wind turbine per year. This additional source of revenue for farmer/landowners in Hardin County will provide a hedge against fluctuating commodity prices along with providing a new source of income. This new source of income will benefit the rest of the community through increased spending from landowners as well.

(3) Public Services and Facilities

The proposed wind farm is not expected to have any growth-inducing effects on the region surrounding the Project Area. Therefore, no significant impact on local services is expected. The basis for this estimate is the presumption that staffing of construction and operational jobs can be met with locally hired residents, with no significant need for workers to be relocated into the area. Workers will commute to the site on a daily basis. Any hiring of non-resident workers would be limited to highly specialized skills for brief periods of time; it is expected that such workers would stay in local motels and would not require new housing.

The principal impact on public services would be an increase in traffic on routes leading to the selected site due to deliveries of equipment and materials during construction. Worker traffic during construction would also increase traffic, however existing nearby roads should be able to accommodate increased worker traffic that is a result of construction activities. Some traffic management during the construction phase may be necessary on the roads adjacent to the job site to ensure safe and efficient maintenance of existing traffic patterns and usages. Once the wind farm is operational, related traffic would be minimal and would not be expected to impact the vicinity.

In addition to traffic, a second possible impact of the wind farm on public facilities is an impact to Project Area roads during construction from heavy traffic from trucks delivering gravel, concrete, turbine components, and other materials. Construction of the wind farm will include pre-construction surveys of roads, road and bridge reinforcement

as needed, and post-construction work, if necessary, to return roads to their pre-construction condition.

The turning radii for the wind turbine delivery trucks may require the adjustment of some intersections in and around the Project Area. The Applicant will obtain all necessary permissions to perform any needed upgrades in order to allow the wind turbine delivery trucks adequate turning radii.

The Applicant will coordinate potential emergency service requirements with local officials. However, the wind farm's proximity to Kenton and Lima indicates that sufficient level of service is currently available in the area to meet the wind farm's potential needs.

(4) Impact on Regional Development

The Applicant has reviewed the Hardin County Comprehensive Land Use and Housing Plan, 1979-1999 (the Plan) to evaluate the compatibility of the facility with the Plan.

The wind farm falls within the southwest portion of Hardin County, encompassing relatively large portions of McDondald, Marion, Cessna and Lynn Townships and relatively smaller portions of Taylor Creek and Roundhead Townships. The Plan's Planned Land Use Areas map shows this part of the County as mainly agricultural or prime agricultural land (attached as Figure 08-05). Prime agricultural land and a

floodplain area occur mostly in the northern part of the Project Area in northern McDonald Township and eastern Marion Township.

Zoning and planning authority in Hardin County is given to each individual township. Of the six townships the Project Area encompasses, only one, Taylor Creek Township, has adopted a zoning ordinance (which arguably, would not apply to this wind farm). The other five townships (McDonald, Roundhead, Marion, Cessna and Lynn) have not adopted zoning regulations or plans to guide development and land use within the townships. The Hardin County Regional Planning Commission (Planning Commission) serves in an advisory role to the townships to assist townships in adopting zoning regulations and to coordinate county-wide efforts to implement the Plan.

The overall goal of the Plan is to provide for urban and residential expansion in a manner that allows for the preservation of the agricultural and natural resources of the county. The Plan outlines areas where growth is desirable based on existing with residential density and transportation routes within the county. The Plan also indicates areas within the county that are favorable as agricultural land, areas of prime agricultural land, forested areas, flood plains, and other land types and uses that are shown on the Planned Land Use Area figure (Figure 08-05) Existing land use within the county at the time the Plan was developed consisted mainly of rural agricultural activities and vacant land. The Planned Land Use Areas shown in the Plan are still representative of the county land use goals until an updated plan can be developed.

(a) Compatibility

The Plan does not specifically address wind energy facilities, but as proposed the wind farm would be compatible with the overall goals of the Plan. In particular, the wind farm will support the Plan's Long Range Goal #2 to "encourage preservation and optimum use of the ever-decreasing agricultural and natural resources of the county." Wind farms provide supplemental income to rural property owners and allow agricultural activities to continue throughout the overall Project Area. Other goals of the plan are less applicable to the wind farm, but the project does not conflict with any of these goals.

(D) CULTURAL IMPACT

(1) Map of Landmarks of Cultural Significance and Recreational Areas

A map of landmarks of cultural significance and recreational areas is provided as Figure 08-04. This maps shows of the Project Area and a five mile buffer. Contents include land uses, and national registered landmarks.

(2) Estimated Impact on Landmarks

The Applicant has retained Tetra Tech EC, Inc to gather background information to assess archaeological sensitivity of the Project Area and potential effects on cultural resources, including archaeological sites, from the wind farm. Tetra Tech EC conducted this Phase I review under the OPSB Wind Energy rules (Ohio Administrative Code, Chapter 4906-17), and following consultation between the Applicant, OPSB, and the OHPO, at Columbus, Ohio on May 21, 2009.

The literature review included three major tasks: background research; field overview; and report preparation. The OHPO site files identify 40 previously documented prehistoric Native American archaeological sites located within one mile of the Project Area. Previously recorded prehistoric sites range from Paleo-Indian to Late Prehistoric periods. No recorded historic archaeological sites are known within one mile of the Project Area. Six historic bridges within one mile of the Project Area are listed on the Ohio Historic Inventory. No determination of eligibility for the National Register has been made for these bridges. No archaeological or architectural properties listed on the National Register are present within one mile of the Project Area. Two National Register Historic Districts and two National Register-listed individual properties are located within five miles of the Project Area. Geographical Information System (GIS) review indicates the presence of 44 churches, 33 cemeteries, 72 former and current schools, and 4 parks and recreation areas within five miles of the Project Area.

Seven environmental zones were identified during the field inspection and following analysis of geo-physical map data and archaeological site patterning. These zones include: end moraine; ground moraine; lake-planed moraine; Scioto Marsh; sand terrace; Scioto River floodplain (non-marsh); and kames. Three local habitats are expected to be especially sensitive for prehistoric archeological sites. The Ft. Wayne end moraine, located at the northern edge of the Project Area, forms the drainage divide between the Ohio-Mississippi-Gulf of Mexico system to the south and the Great Lakes to the north. Recorded archaeological sites are clustered on the Ft. Wayne end moraine in proximity to the northern margins of Scioto Marsh. Well-drained locations on the Ft. Wayne Moraine

are anticipated to be sensitive for the presence of undocumented prehistoric archaeological resources. Well-drained soils on the Wabash end moraine in the southern portion of the Project Area are also expected to be sensitive for the presence of unrecorded prehistoric archaeological sites, particularly in proximity to the southern margin of Scioto Marsh, and near the North Fork Great Miami River and its tributaries. Several known archaeological sites cluster on the sand terrace at the northern margin of Scioto Marsh near the town of McGuffey. This zone is considered to be sensitive for the presence of as yet undocumented archaeological resources.

Review of historic maps indicated that most historic buildings and structures occurred on or near roads. The wind farm design has minimized construction impacts on potential historic archeological sites. Wind turbines are proposed to be located at least 1.5 times the height of the wind turbine from and dwellings and at least 1.1 times tip height from active roads. The Applicant anticipates that all wind turbines, substations, access roads and buried cables can be located to avoid known archeological sites.

The Applicant will continue to coordinate its efforts with the appropriate regulatory agencies if necessary so as assess impacts to cultural resources and to ensure impacts are minimized. The Applicant has provided Tetra Tech EC's report as Attachment 08-05.

(3) Consideration of Landmarks

In developing the list of landmarks in Section 4906-17-08(D)(2), the Applicant considered all of the following possible landmarks: districts, sites, buildings, structures,

and objects which are recognized by, registered with, or identified as eligible for registration by the national registry of natural landmarks, the Ohio Historical Society, or the Ohio Department of Natural Resources. Also in developing the list in Section 4906-17-08(D)(2), the Applicant considered any existing and formally adopted land and water recreation areas.

(4) Mapping Landmarks

Figures 08-04 is a set of maps with 1:24,000 scale showing all areas in the Project Area plus a five mile buffer and any existing or formally adopted land and water recreation areas.

(5) Recreational Areas

Five recreation areas or parks are located in whole or part within five miles of the Project Area. Indian Lake State Park, located in northern Logan County, Ohio, is tangential to the five-mile radius around the Project Area; more than 99 percent of the park lies outside the five-mile ring. The impounded 5,800-acre Indian Lake contains numerous islands and wetlands, and is fed by the North Fork Great Miami River which traverses the Project Area. Three municipal parks are located in the Townships of Liberty, Buck, and Marion. The Colonial Golfers Club is located in Jackson Township near the town of Harrod, Ohio. The Applicant will coordinate its efforts to evaluate the impacts of the wind farm on the above recreational areas with the appropriate regulatory agencies and expects to complete its evaluation in the 4th Quarter of 2009.

(6) Visual Impacts

Wind turbines will be of a uniform design and painted white or off-white to minimize visual impacts.

The wind turbines will be required to be lit in accordance with Federal Aviation Administration (FAA) regulations. Currently these regulations do not require any daytime lights, but they do require red lights that operate at night on approximately one-third to one-half of the wind turbines. These lights will need to be synchronized so that the light and fade in simultaneously.

(E) PUBLIC RESPONSIBILITY

(1) Public Information Program

The Applicant has been working in Hardin County for two years meeting with landowners and reaching out to citizens regarding the proposed wind farm. The Applicant has become a member of the Hardin County Chamber and Business Alliance, an organization designed to educate the community, increase community wealth and pride, and provide a positive network for a unified purpose. The Alliance is divided into several areas including economic development, tourism and downtown development. The Applicant has retained a consultant to provide governmental affairs and public relations. Current efforts are focused on introducing staff to local community leaders, local media and businesses. In preparation for the public meeting prior to the initial filing with the OPSB Staff, a central location was selected and introductions with the Kenton Times have been conducted. A newsletter introducing the Applicant to the community has been issued and efforts are underway to select summer activities in the

county to participate in. (i.e. county fairs, firework displays.) Periodic newsletters will keep citizens of Hardin County informed of wind farm activities. The Applicant will work with the local schools regarding the process of siting a wind farm. Local officials and educators will be updated on activities.

(2) Liability Insurance

All wind turbines will be installed on property under lease or easement to the Applicant. Terms of the leases or easements include requirements for the Applicant to pay annual rent, to pay for all tax-related payments, to minimize impacts on the landowner's current use of the property, and to remove wind turbines upon termination of the land agreement. In addition, the terms of the leases require the Applicant to provide insurance for all wind farm components and to indemnify the landowner and other 3rd parties from liability claims resulting from the wind farm's construction and operation.

The Applicant has consulted with Willis of Illinois, Inc. insurance advisors on the possible impacts of installation and operation of the wind farm. Willis of Illinois, Inc. has over 20 years of experience in providing insurance and risk management services to the wind industry and works with the industry's leading experts and underwriters in the wind power generation field. Willis of Illinois, Inc. employs a dedicated team of risk managers, engineers and specialty brokers who possess a wealth of industry knowledge and are experienced in treating the unique exposures customary to a wind farm.

The wind farm will carry limits of insurance during development, construction, operation and decommissioning that will ensure proper indemnification for 3rd parties and for the

interests of the Applicant. A program will be specifically tailored to meet the risk management and indemnification needs of all of the wind farm's stakeholders.

A Certificate of Liability Insurance is provided as Attachment 08-06.

(3) Evaluation of Interference with Radio and Television

The Applicant has retained Comsearch to evaluate the potential for the facility to interfere with microwave reception. Comsearch performed an analysis to evaluate the potential effects of the wind farm on existing non-Federal Government microwave telecom systems. The Applicant has provided this analysis as Attachment 08-07.

Comsearch's Wind Power GeoPlanner™ provides a graphical representation of affected microwave paths and provides supporting technical parameters. The microwave path data is overlaid on topographic base maps. Comsearch identified 4 microwave paths that intersect the Project Area.

Comsearch then calculated a Worst Case Fresnel Zone (WCFZ) for each microwave path in the Project Area. The mid-point of a full microwave path is the location where the widest (or worst case) Fresnel zone occurs. The calculated WCFZ radius, giving the linear path an area or swath, buffers each microwave path in the Project Area. The Applicant will site wind turbines in a manner such that the wind turbines are not located within the WCFZs. A wind turbine layout is required before impacts to TV and AM/FM radio stations can be performed. Once the Applicant has determined which wind turbine is available to use, the Applicant will perform an analysis of impacts to TV and AM/FM

and the Applicant will coordinate the appropriate analyses with the National Telecommunication and Information Agency.

(4) Evaluation of Interference with Military Radar

Utilizing the publicly available long-range radar preliminary screening tool (available https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showLongRangeRadarToolForm), the Applicant inputted the corners of the Project Area into the screening tool. Based on this preliminary analysis, the entire Project Area is located within an area coded by the Federal Aviation Administration (FAA) as green (see Attachment 08-08), which indicates no anticipated impacts to Air Defense and Homeland Security radars. Due to the height of the wind turbines, coordination with the FAA Obstruction Evaluation / Airport Airspace Analysis (OE/AAA) office will be required. The Applicant will need to apply for a Notice of Proposed Construction or Alteration (Form 7460-1) with the OE/AAA. The OE/AAA will review and evaluate impacts to federally regulated civilian and military radar systems to ensure that the turbine locations do not impact these systems.

(5) Evaluation of Impact to Roads and Bridges

The Applicant has retained Tetra Tech to review local roads and bridges which is provided as Attachment 08-09. This review consisted of a desktop and field review of the roads along the preliminary regional delivery route, identifying possible impacts from wind farm construction and identifying potential mitigation measures.

There are three main impacts expected to the local roads from the wind farm construction traffic; impacts to the roads, bridges and intersections. The Hardin County Engineer is a key stakeholder in these impacts and the County but is still working on the process for permitting truck loads in excess of the state's legal limits. The anticipated impacts, including potential mitigation, include:

- The pavement condition of the county and township roads along the regional delivery route is generally good. However, the Hardin County Engineer is concerned about how the construction of this wind farm will impact the condition of the roads. The Applicant will work with the County to determine the existing capacity of the pavement to support loads. If the capacity does not equal the anticipated actual loads, the Applicant will work with the County to determine appropriate mitigations.
- Truck loads heavier than the state legal loads limits may impact the existing county and township bridges. There is only one bridge in the project vicinity, along County Road 150, that is currently posted for loads less than the state legal limit, which the Applicant will avoid or reinforce prior to using. In general, a majority of the other county and township bridges are in good condition. However, through its research, the Applicant discovered that not all bridges in the Project Area are covered in Ohio Department of Transportation GIS databases. For superload vehicles (gross weight in excess of 120,000 pounds) the Applicant will work with the County to evaluate the impacts to their bridges on a case by case basis.

- Turns from the transport of longer wind turbine components (specifically blades) will require the truck and/or trailer to travel outside of the existing pavement at intersections. These wide turns will impact the facilities around the intersections including ditches, signs and utility poles. The Applicant will work with the County to determine how these loads impact each intersection, and how they will be mitigated. Mitigation activities will likely include installing gravel fill outside of the pavement limits as a temporary pavement surface for truck/trailer turns, installation of drainage pipes in these fill locations as an alternate means of drainage and relocation of utility poles, signs and other appurtenances. Some corners of some of the intersections will be avoided because of issues that would be difficult or expensive to mitigate.

(6) Plan for Decommissioning

At the end of the useful life of the wind farm, or in the unlikely event that it becomes necessary prior to that, the Applicant is prepared to decommission the wind farm. The wind turbine blades, nacelle, and tower will be dismantled and unbolted from the foundation. Pad-mount transformers will be unbolted from their foundations and removed from the wind farm. Similar to initial construction, this will necessitate the use of cranes and heavy equipment. If resold and not scrapped, wind turbine components will be transported in the same manner as their delivery to the site. Wind turbine foundation/pedestals would be removed to three feet below grade. Although the manner of demolition would be the responsibility of the decommissioning contractor, it is not anticipated that foundations would require blasting. Construction debris would be removed to a disposal facility permitted to operate under the current and applicable

regulations at that time. The wind turbine site would be backfilled with suitable soils and re-graded to meet adjoining existing grades. Topsoil would be applied to the rough graded wind turbine site.

To ensure that funds are available to complete decommissioning the Applicant will post a bond or provide equivalent financial security. The amount of the bond or financial security will be set to cover the expected costs of decommissioning less the salvage or resale value of the wind turbines and related equipment.

(F) AGRICULTURAL DISTRICT IMPACT

Figure 08-06 is a 1:24,000 scale map identifying all agricultural district land located within the project boundary.

(1) Impact Assessment on Agricultural Land

(a) Acreage Impacted

Table 03-01 summarizes the temporary and permanent area disturbances expected for the project. The vast majority of this disturbance will be in areas currently in active agricultural use.

(i) Field operations

Access roads will be installed, where possible, to be at the same elevation as the surrounding farmland. The Applicant will avoid using swales wherever possible while following OEPA BMPs. Landowners will be able to keep using their property in a similar manner as they did prior to construction of the wind farm: they will be able to cross the access roads with their equipment without ceasing planting/harvesting.

Additionally, the new access roads which Applicant will be constructing will increase the ability of the landowners to locate offload equipment further into their fields than before.

(ii) Irrigation.

Some center pivot irrigation systems are being used on the Project Area but the wind turbines have been positioned in such a way that neither construction nor operation of the wind farm will impact irrigation.

(iii) Field drainage systems.

Construction activities may damage tile lines, but Applicant will repair them as further described in Section 4906-17-08(F)(2)(b) below. Operation of the project will not impact drainage systems.

(b) Mitigation

The Applicant will reimburse landowners for crops lost due to construction activities. In addition, the Applicant will ensure that drain tile or irrigation lines damaged in connection with the construction of the wind farm will be promptly repaired. The location and condition of all drain tiles and irrigation lines encountered will be documented with GPS coordinates landowners will be given the opportunity to inspect and approve repairs to drain tiles on their property.

(2) Viability Assessment

There are 2,619 acres of agricultural district land in the Project Area. In the case of the layout for the GE 2.5 xl wind turbine, 7 wind turbines would be sited in agricultural district land impacting 46 acres during construction or approximately 1.8% of the

agricultural district land within the Project Area. In the case of the layout for the GE 1.5 xle wind turbine, 14 wind turbines would be sited in agricultural district land impacting approximately 92 acres or approximately 3.5% of the agricultural district land within the Project Area. Both of these estimates are for impacted area during construction; impacted area during the operation of the wind farm will be less than 1%, approximately 5 acres or 0.2% for the GE 2.5 xl layout and 10 acres or 0.4% of the agricultural district land. As such this wind farm will not fundamentally alter the use of the land as farmland.

Other Considerations in Preparing the Application:

As noted earlier, this wind farm will not be solely operated remotely but will also have an O&M office within the Project Area.

REFERENCES

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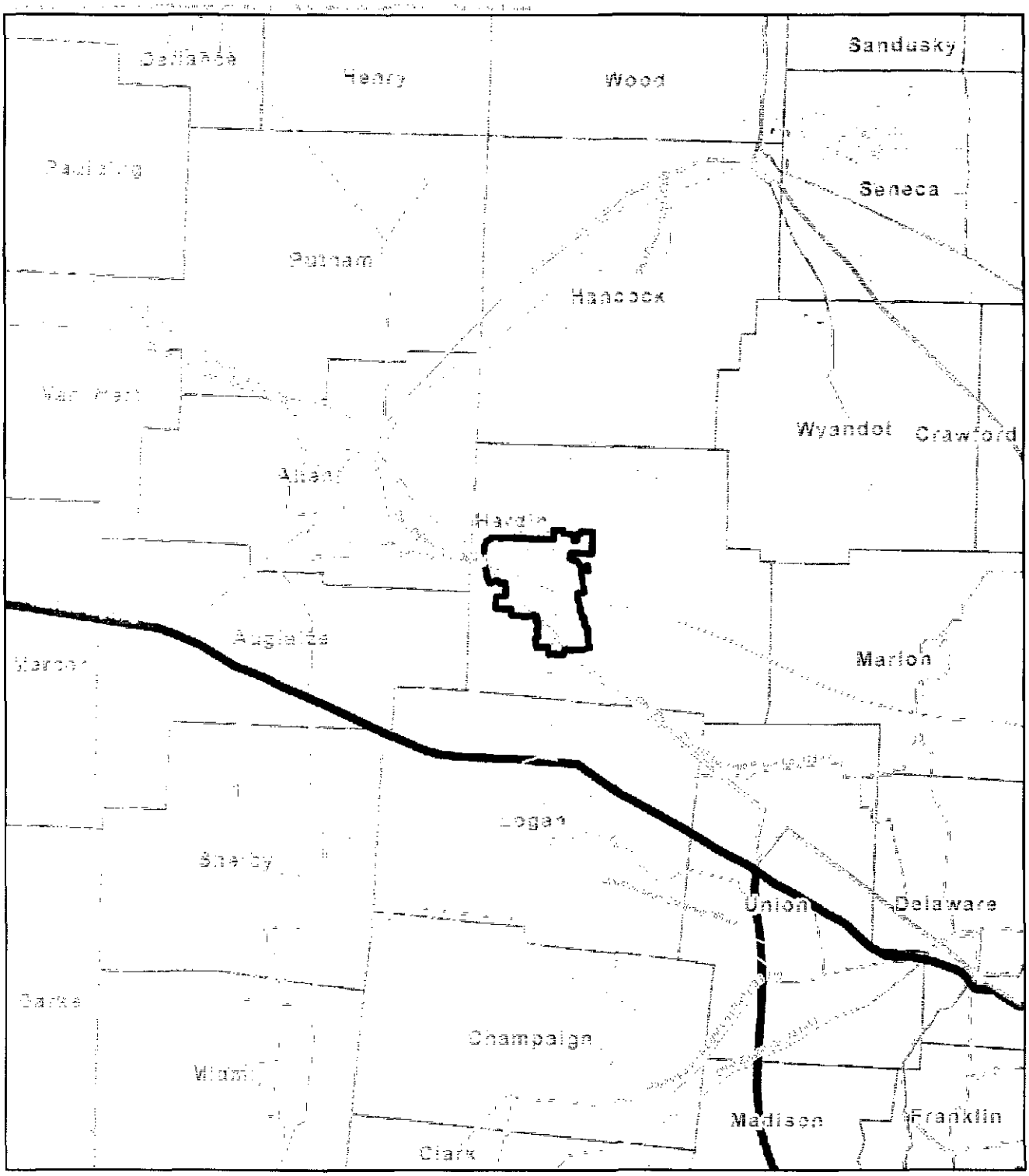
Figure 04-01



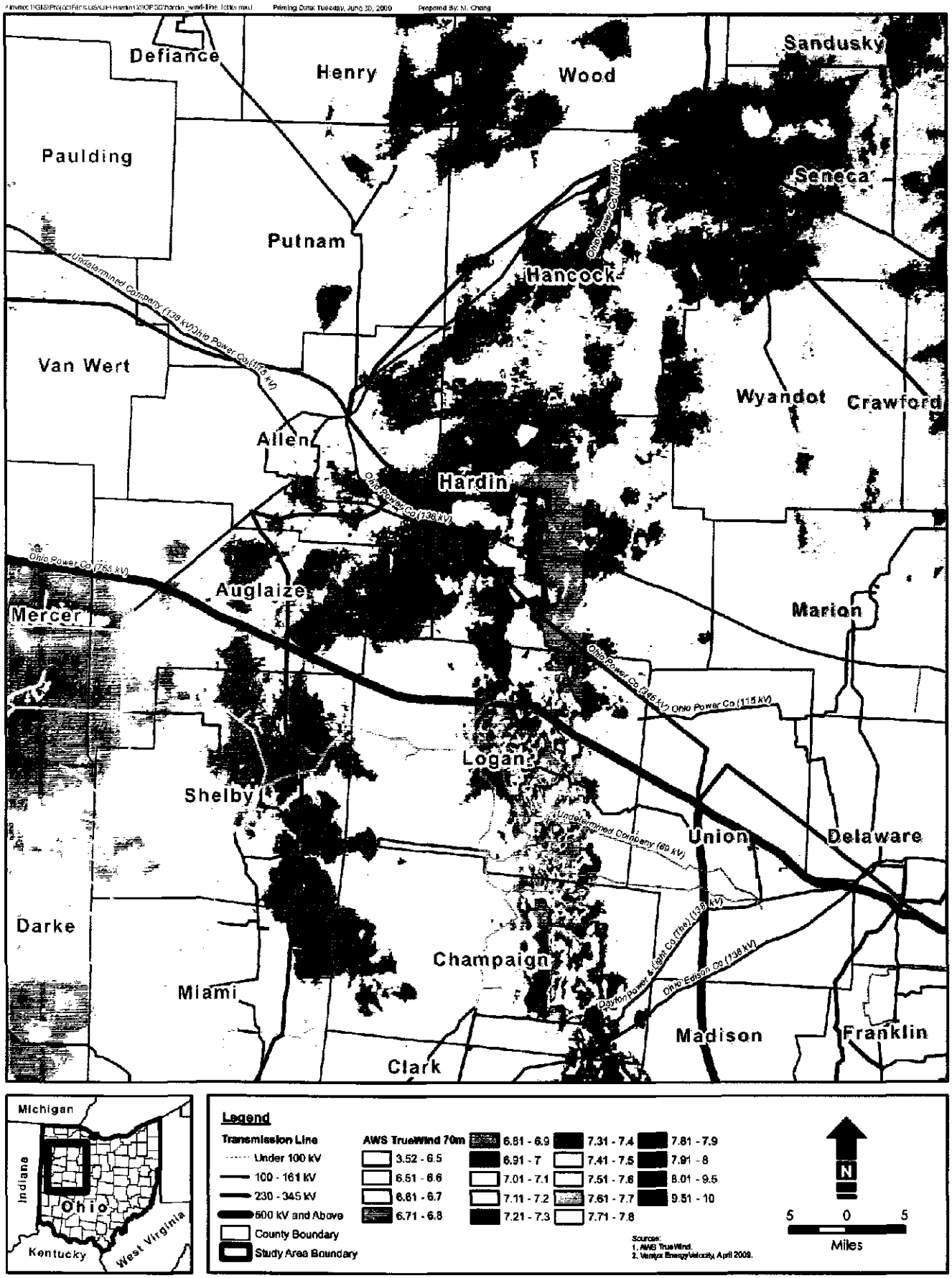
Wind Resources and Transmission Line Summary

Hardin County, Ohio

Rev. 00

June 30, 2009

Figure 04-01



Wind Resources and Transmission Line Summary

Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 30, 2009

Figure 04-02

Hardin 2.5 XL Setbacks Summary

Hardin Wind Farm, Hardin County, Ohio

Rev. 01
June 22, 2009

Figure 04-03

Legend

Residential Structures
Stream
Transmission Line
US Highway
State/County Road
Town Road
Hardin County OWI Wetlands
Residential Setback (1,000 ft)
T-Line Setback (437.5 ft)
Road Setback (437.5 ft)
Non-Participating Land Owner Setback
Hardin Project Study Area
Land Owner Status
Participating Landowner
Non Participating Landowner

N

1,000 0 1,000
Meters

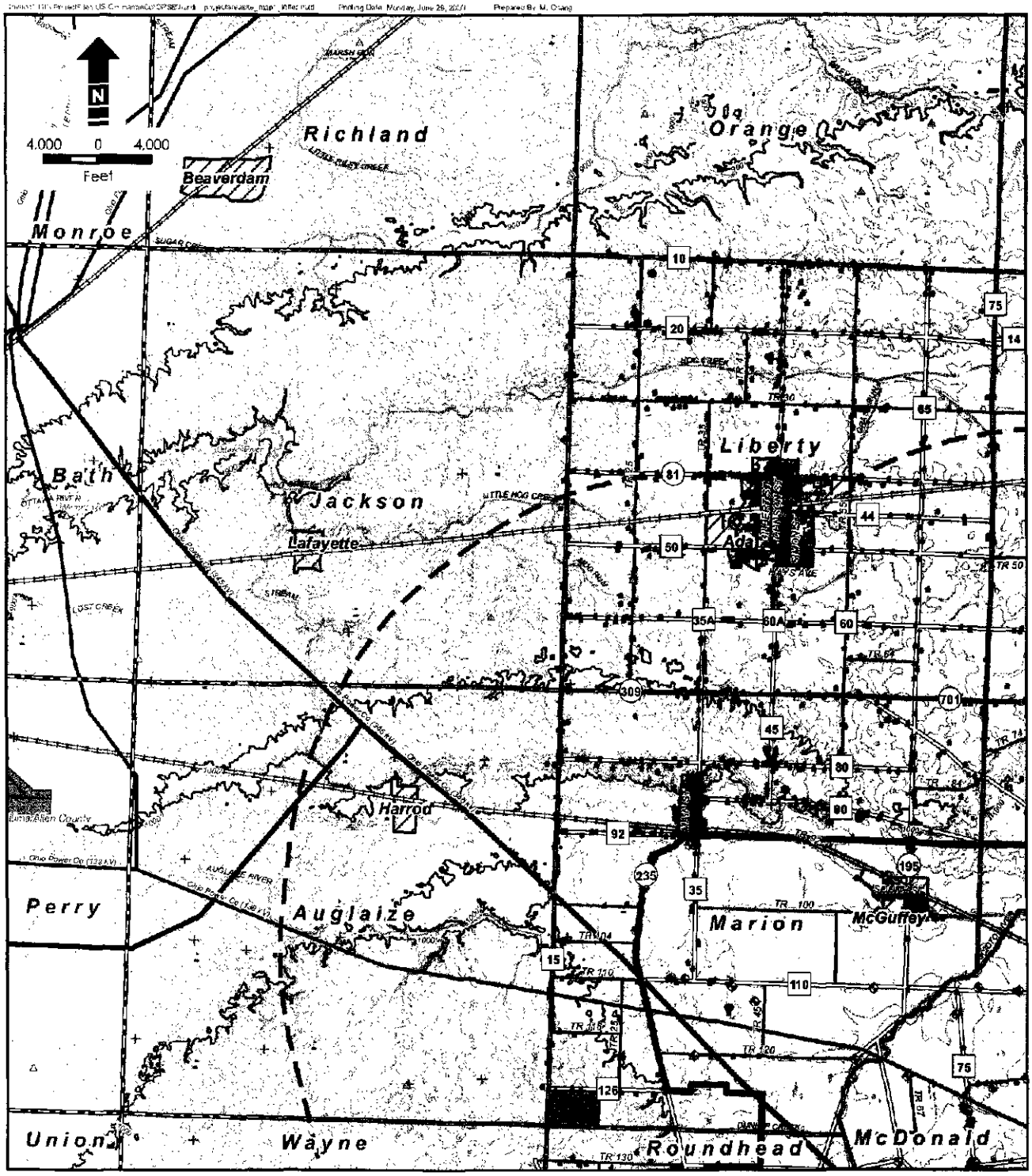
Hardin 1.5 XLE Setbacks Summary

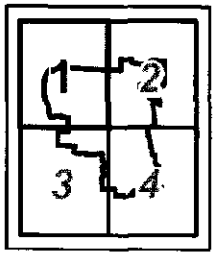
Hardin Wind Farm, Hardin County, Ohio

Rev. 01
June 22, 2009

hardin wind

Figure 05-01





Legend

- School
- Church
- Hospital
- Public Building
- Cemetery
- Residential Structures
- Water Well
- Gas Well
- Oil Well
- Oil & Gas Well
- 10 ft Contour Interval
- 100 ft Contour Interval
- Railroad
- Existing Transmission Line
- River
- Water Body
- Park
- 5-Miles Project Area Setback
- US Highway
- State/County Road
- Town Road
- Municipal Boundary
- Township Boundary
- Project Study Area

Notes:
1. Ohio Department of Natural Resources (ODNR), 1997
2. ESRI Data & Maps, 2007
3. Iberdrola Energy-Velocity, April 2009

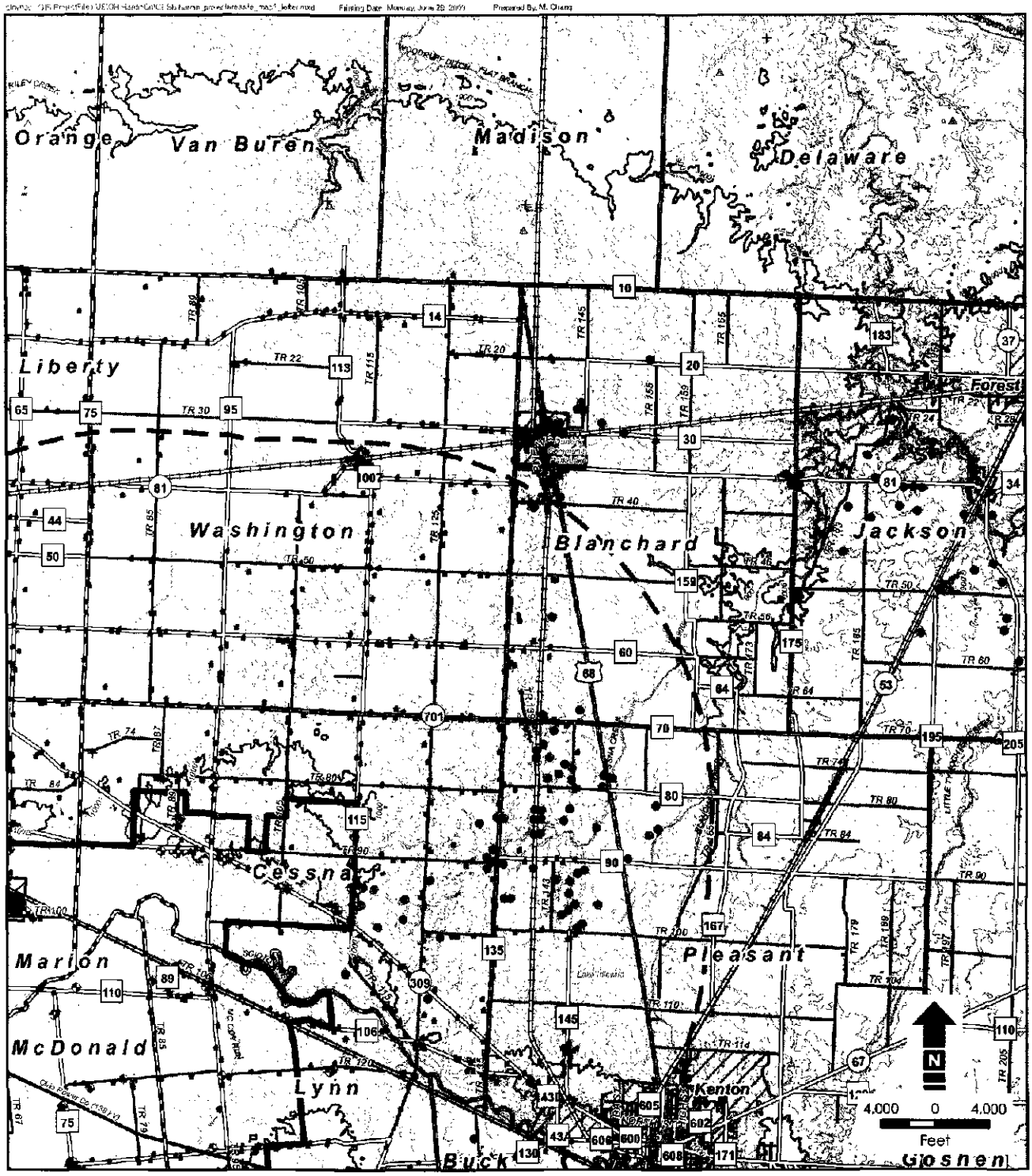
Hardin Project Site Area

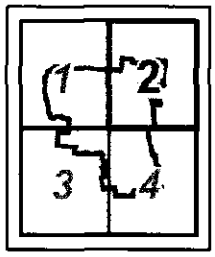
Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 29, 2009

Figure 05-01





Legend

- School
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- Oil Well
- Oil & Gas Well
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Notes:
1. Ohio Department of Natural Resources (ODNR), 1997
2. ESRI Data & Maps, 2007
3. Ventyx Energy-Velocity, April 2009

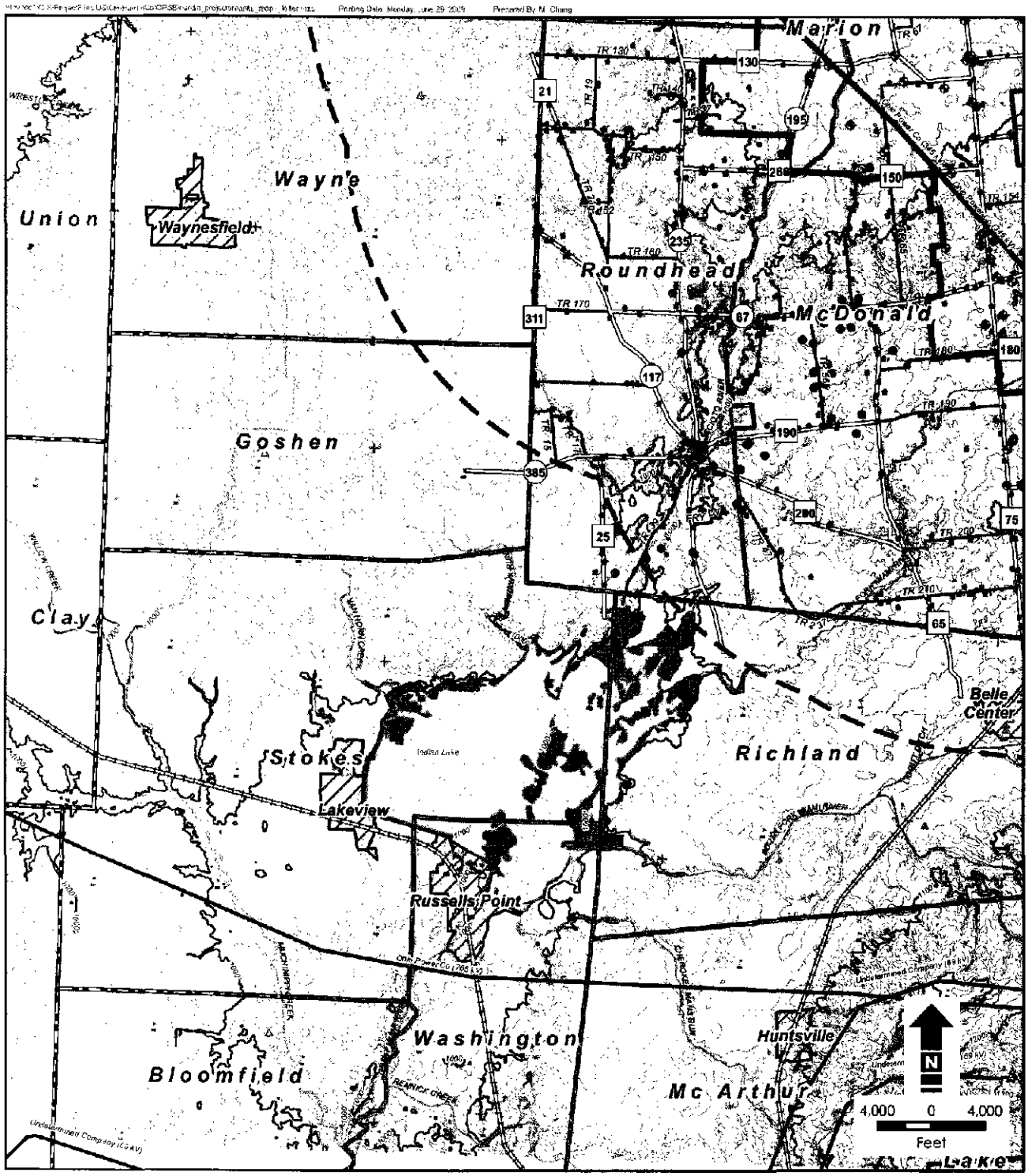
Hardin Project Site Area

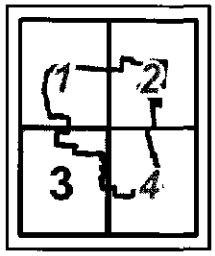
Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 29, 2009

Figure 05-01





Legend

- School
- Church
- Hospital
- Public Building
- Cemetery
- Residential Structures
- Water Well
- Gas Well
- Oil Well
- Oil & Gas Well
- 10 ft Contour Interval
- 100 ft Contour Interval
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- Existing Transmission Line
- River
- Water Body
- Park
- 5-Miles Project Area Setback
- US Highway
- State/County Road
- Town Road
- Municipal Boundary
- Township Boundary
- Project Study Area

Notes:
1. Ohio Department of Natural Resources (ODNR), 1987
2. ESRI Data & Maps, 2007
3. Vestas Energy-Velocity, April 2009

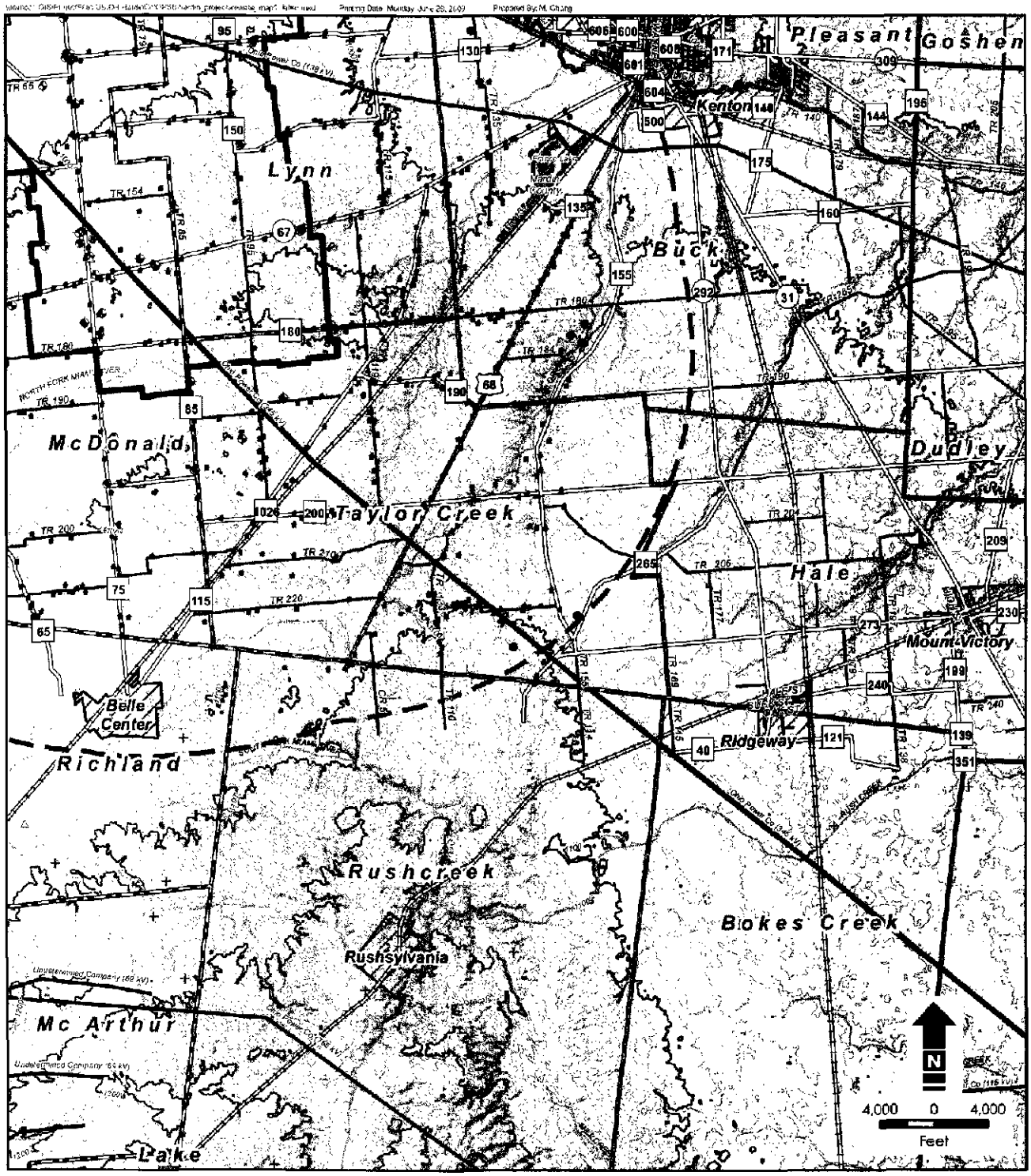
Hardin Project Site Area

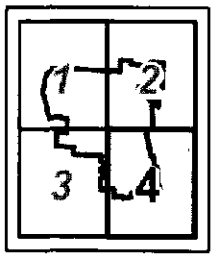
Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 29, 2009

Figure 05-01





Legend

- School
- Church
- Hospital
- Public Building
- Cemetery
- Residential Structures
- Water Well
- Gas Well
- Oil Well
- Oil & Gas Well
- 10 ft Contour Interval
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- River
- Water Body
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- 5-Miles Project Area Setback
- US Highway
- State/County Road
- Town Road
- Municipal Boundary
- Township Boundary
- Project Study Area

Notes:
1. Ohio Department of Natural Resources (ODNR), 1997
2. ESRI Data & Maps, 2007
3. Vestyx Energy-Velocity, April 2009

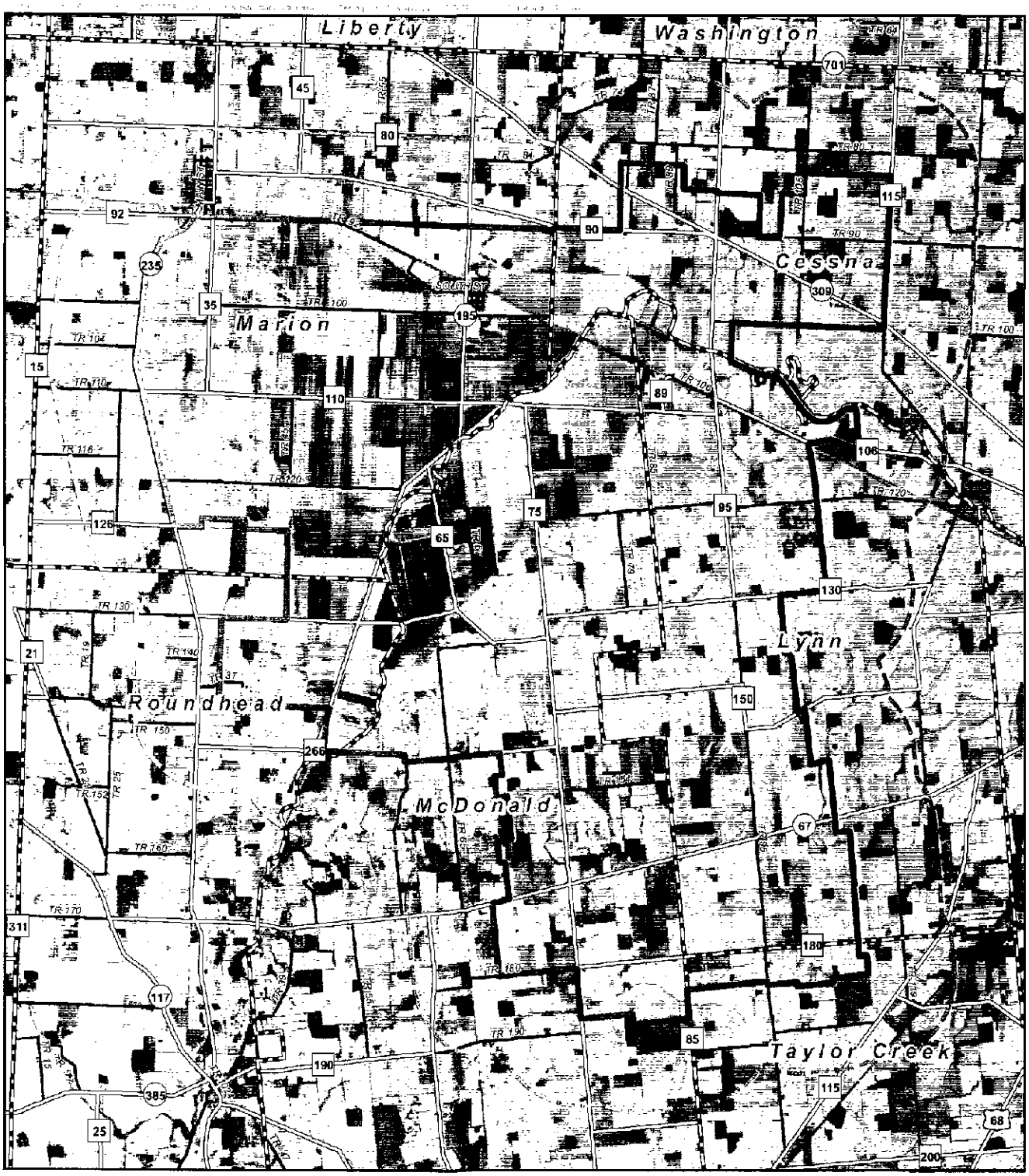
Hardin Project Site Area

Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 29, 2009

Figure 05-02



Legend

- US Highway
- State/County Road
- Town Road
- One-Mile Radius of Proposed Facility
- Township Boundary
- Study Area Boundary

Sources:
1. Ohio State Imagery Program (OSIP), March/April 2006.
2. ESR. Data & Maps, 2007

N

5,000 0 5,000
Feet

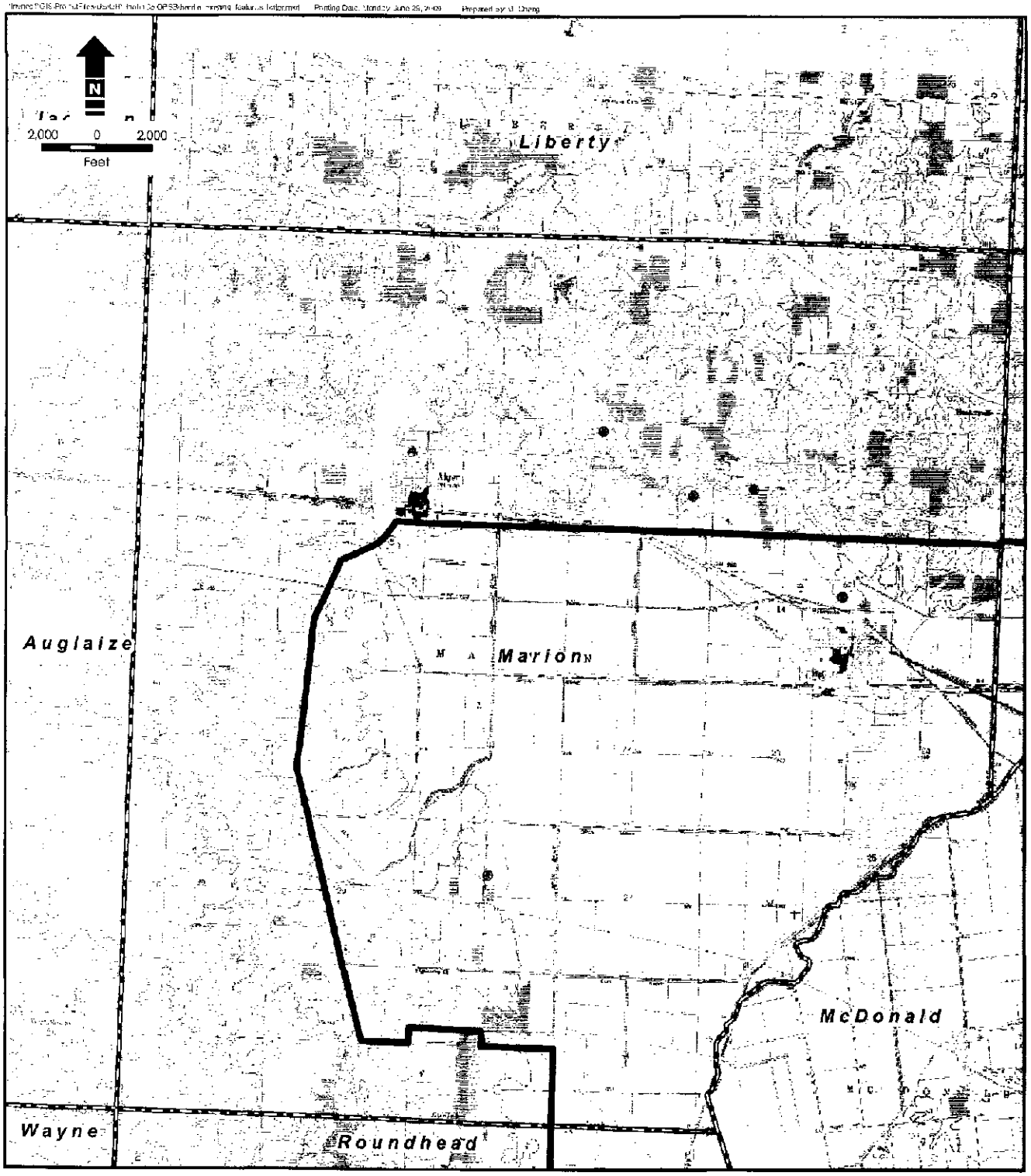
Aerial Photograph of Project Area Site

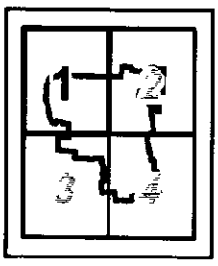
Rev. 00

June 25, 2009

heartland wind energy LLC

Figure 05-05





Legend

- Gas Well
- Oil Well
- Oil & Gas Well
- Township Boundary
- Project Study Area

Land Use Classification

- Open Water
- Perennial Ice/Snow
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land (Rock/Sand/Clay)
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands

Notes:
1. Ohio Department of Natural Resource (ODNR) 1997
2. U.S.G.S. 7.5 Minute Series Topographic Maps:
   - Hamed Quadrangle, OH; 1961, Photoinsp. 1984
   - Alger Quadrangle, OH; 1961
   - Forester Quadrangle, OH; 1961, Photoinsp. 1984
   - Roundhead Quadrangle, OH; 1960, Photorev. 1982
   - Silvercreek Quadrangle, OH; 1960, Photorev. 1973
3. Multi-Resolution Land Characteristics Consortium (MRLC) National Land Cover Database (NLCD) 2001

Hardin Existing Features of Project Area Site

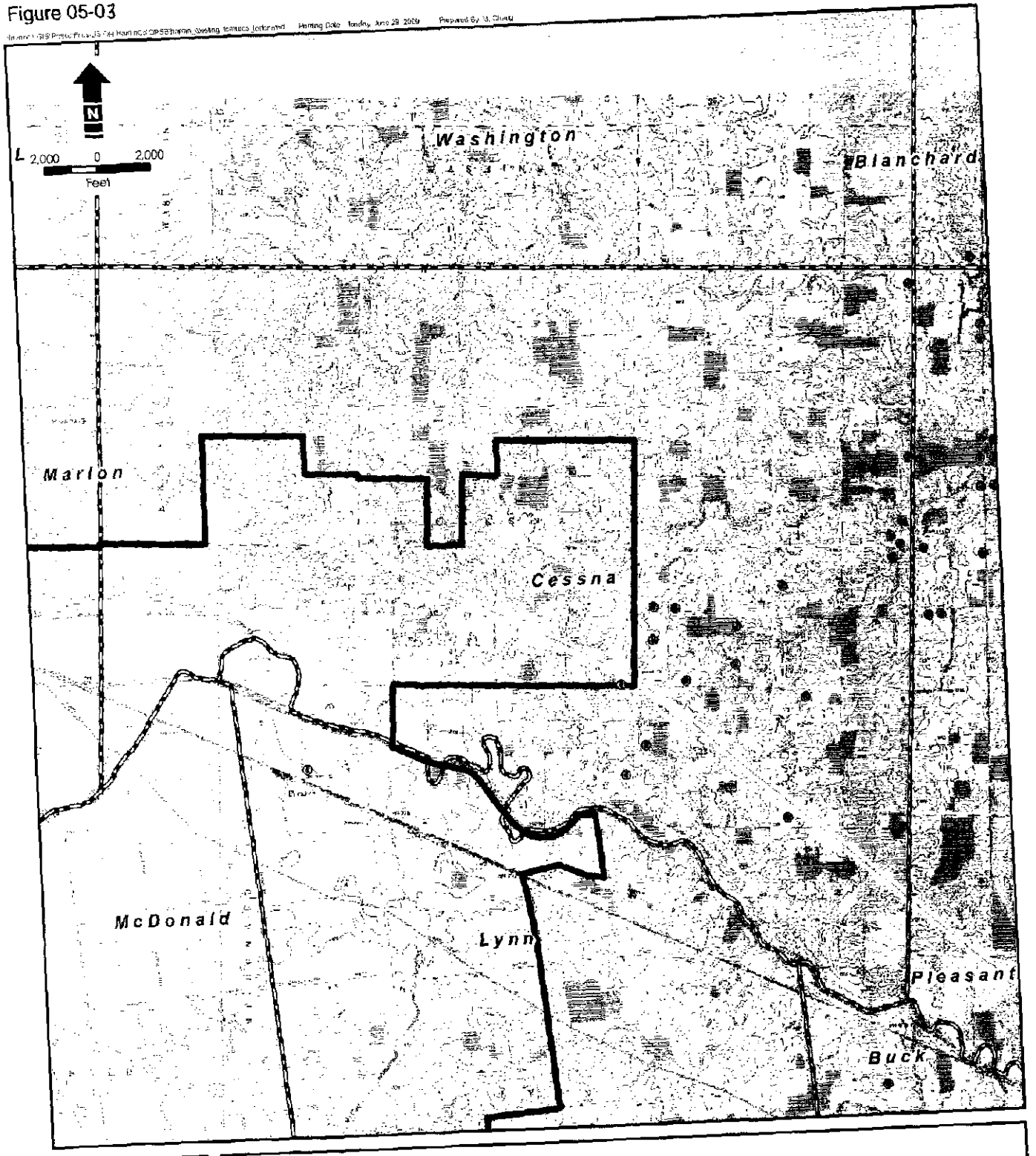
Hardin Wind Farm, Hardin County, Ohio

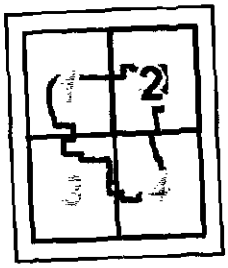
Rev. 00

June 29, 2009

hardin wind energy

Figure 05-03





Legend

- Gas Well
- Oil Well
- Oil & Gas Well
- Township Boundary
- Project Study Area

Land Use Classification

- Open Water
- Perennial Ice/Snow
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land (Rock/Sand/Clay)
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands

Notes:
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Hardin Existing Features of Project Area Site

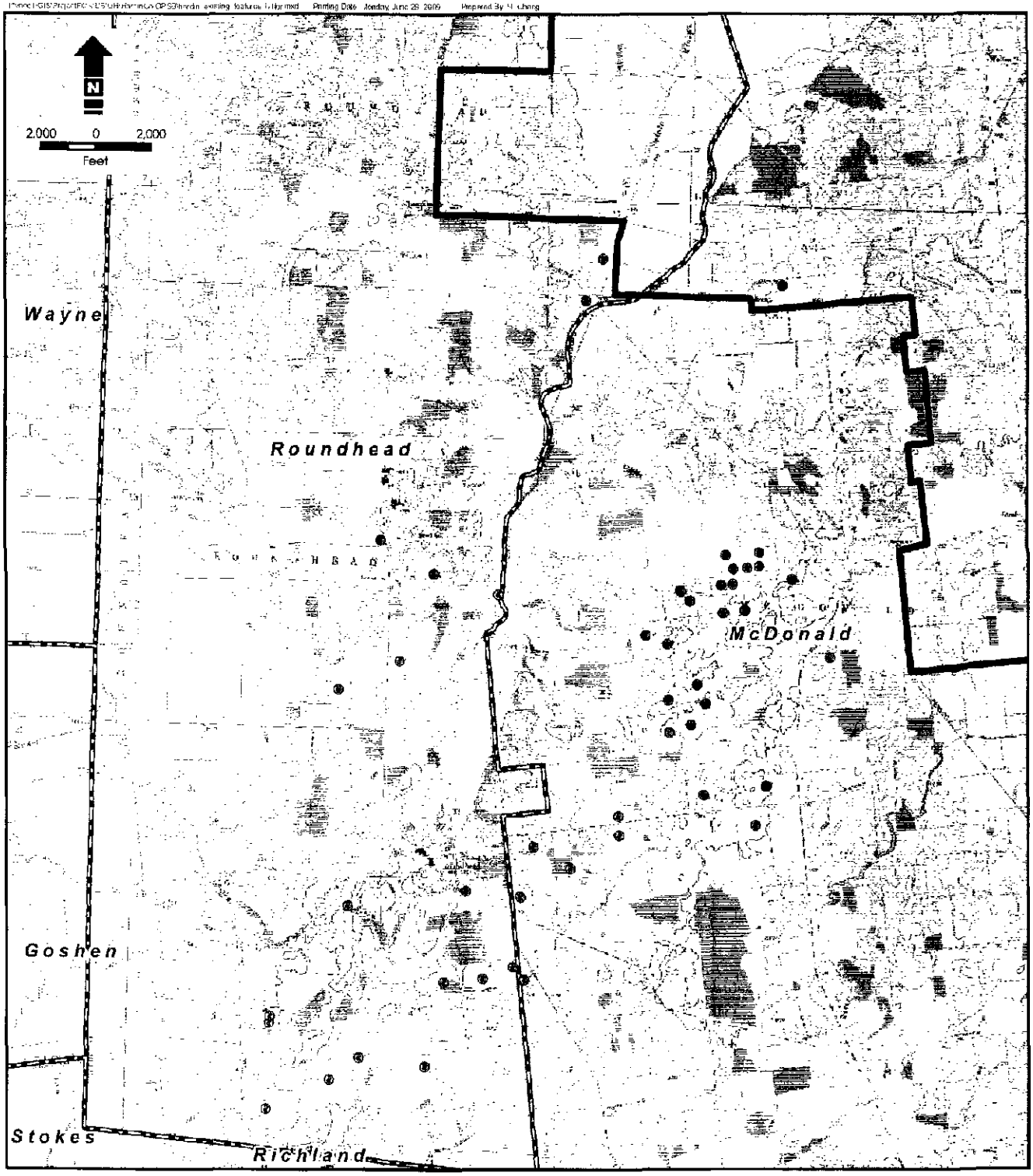
Hardin Wind Farm, Hardin County, Ohio

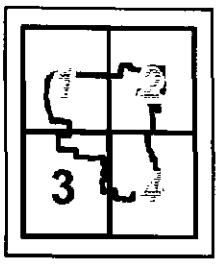
Rev. 00

June 29, 2009

hardin wind energy

Figure 05-03





Legend

- Gas Well
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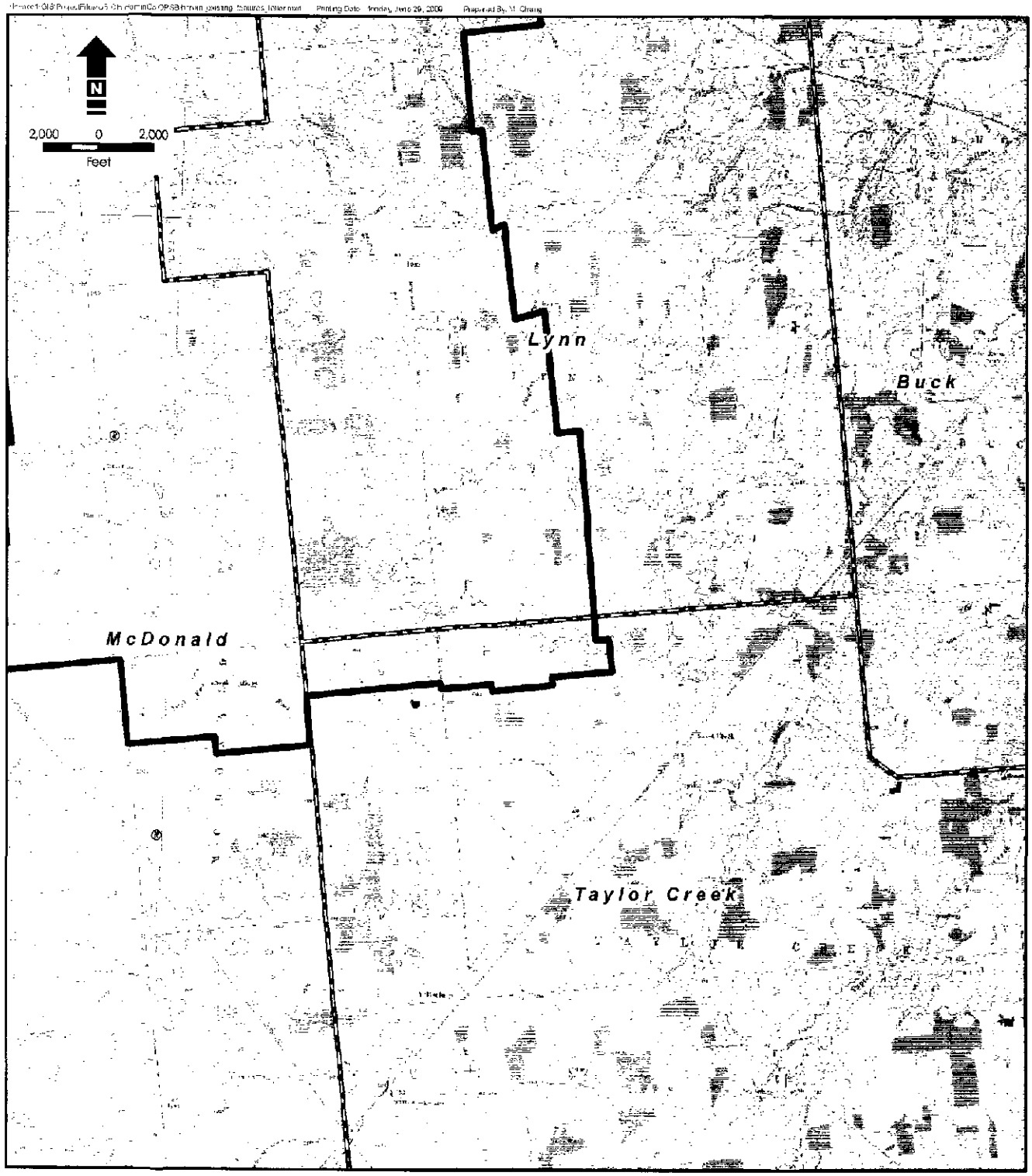
Hardin Existing Features of Project Area Site

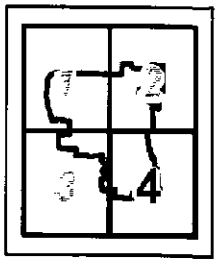
Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 29, 2009

Figure 05-03





Legend

- Gas Well
- Oil Well
- Oil & Gas Well
- Township Boundary
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- Perennial Ice/Snow
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   - Silvercreek Quadrangle, OH; 1960, Photorev. 1973
3. Multi-Resolution Land Characteristics Consortium (MRLC) National Land Cover Database (NLCD) 2001

Hardin Existing Features of Project Area Site

Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 29, 2009

hardin wind energy

Figure 05-04


Legend
hardin_projectboundary
Glacial Drift Thickness
Value
High : 723
Low : 0
0
2.5
5
Miles

Figure 06-06

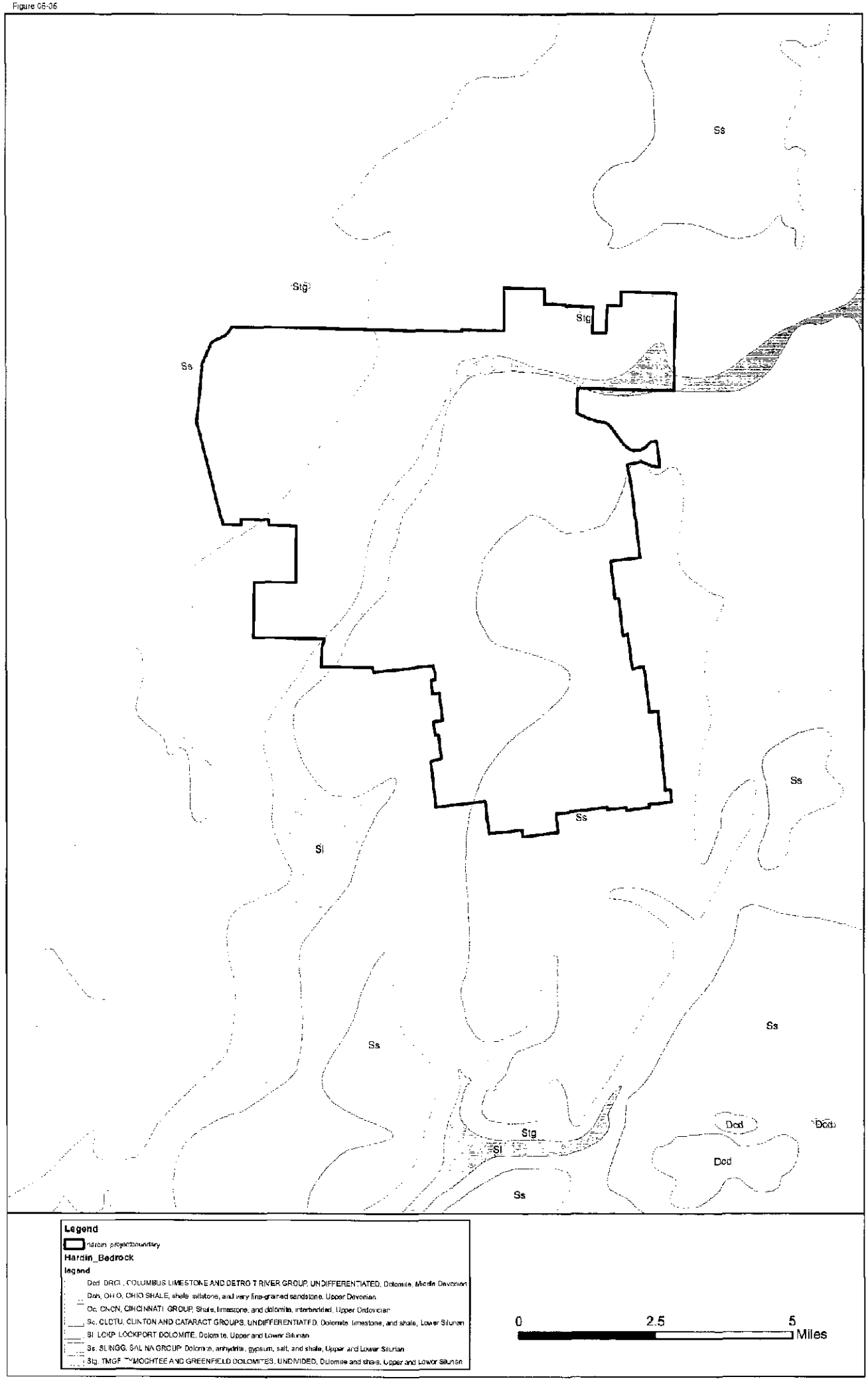

Ss
Stg
Stg
Ss
Ss
Sl
Ss
Ss
Ss
Stg
Sl
Ss
Dod
Dod
Dod
Legend
Hardin project boundary
Hardin_Bedrock
legend
Dod, DRCI, COLUMBUS LIMESTONE AND DETROIT RIVER GROUP, UNDIFFERENTIATED, Dolomite, Middle Devonian
Doh, OHIO, OHIO SHALE, shale, siltstone, and very fine-grained sandstone, Upper Devonian
Oc, CNCN, CINCINNATI GROUP, Shale, limestone, and dolomite, interbedded, Upper Ordovician
Sc, CLCTU, CLINTON AND CATARACT GROUPS, UNDIFFERENTIATED, Dolomite, limestone, and shale, Lower Silurian
Sl, LOKP, LOCKPORT DOLOMITE, Dolomite, Upper and Lower Silurian
Ss, SLINGG, SALINA GROUP, Dolomite, anhydrite, gypsum, salt, and shale, Upper and Lower Silurian
Stg, TMGF, TYMOCHTEE AND GREENFIELD DOLOMITES, UNDIVIDED, Dolomite and shale, Upper and Lower Silurian
0
2.5
5
Miles

Figure 05-05

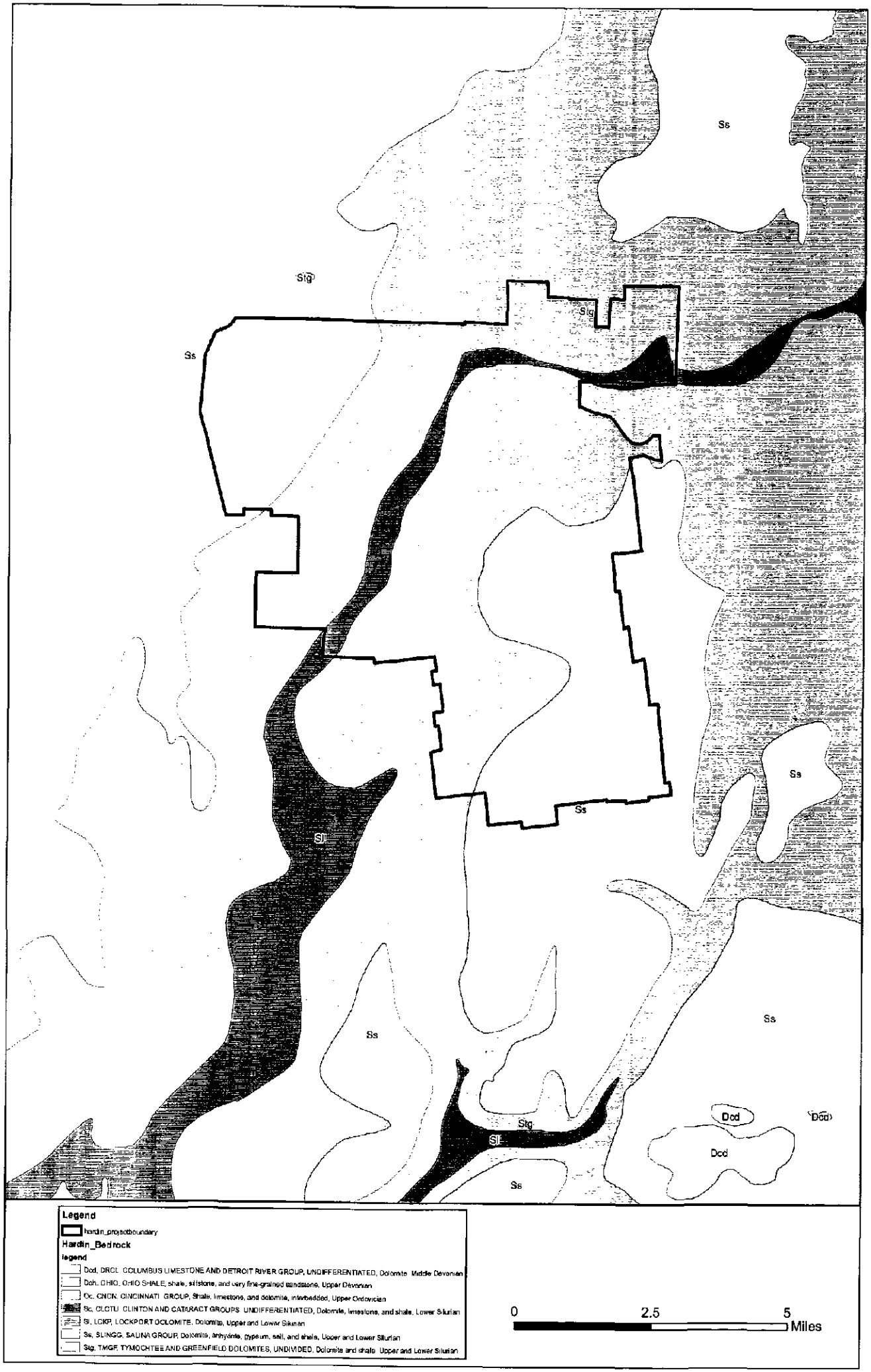

Ss
Stg
Stg
Ss
Ss
Ss
Sl
Ss
Ss
Stg
Sl
Dod
Dod
Dod
Ss
Legend
hardin_projectboundary
Hardin_Bedrock
legend
Dod, DRCL COLUMBUS LIMESTONE AND DETROIT RIVER GROUP, UNDIFFERENTIATED, Dolomite Middle Devonian
Doh, OHIO, OHIO SHALE, shale, siltstone, and very fine-grained sandstone, Upper Devonian
Oc, CNCN, CINCINNATI GROUP, Shale, limestone, and dolomite, interbedded, Upper Ordovician
Sc, CLCTU CLINTON AND CATARACT GROUPS UNDIFFERENTIATED, Dolomite, limestone, and shale, Lower Silurian
Sl, LCKP, LOCKPORT DOLOMITE, Dolomite, Upper and Lower Silurian
Ss, SLINGG, SALINA GROUP, Dolomite, anhydrite, gypsum, salt, and shale, Upper and Lower Silurian
Stg, TMGF TYMOCHTEE AND GREENFIELD DOLOMITES, UNDIVIDED, Dolomite and shale Upper and Lower Silurian
0
2.5
5
Miles

Figure 05-06

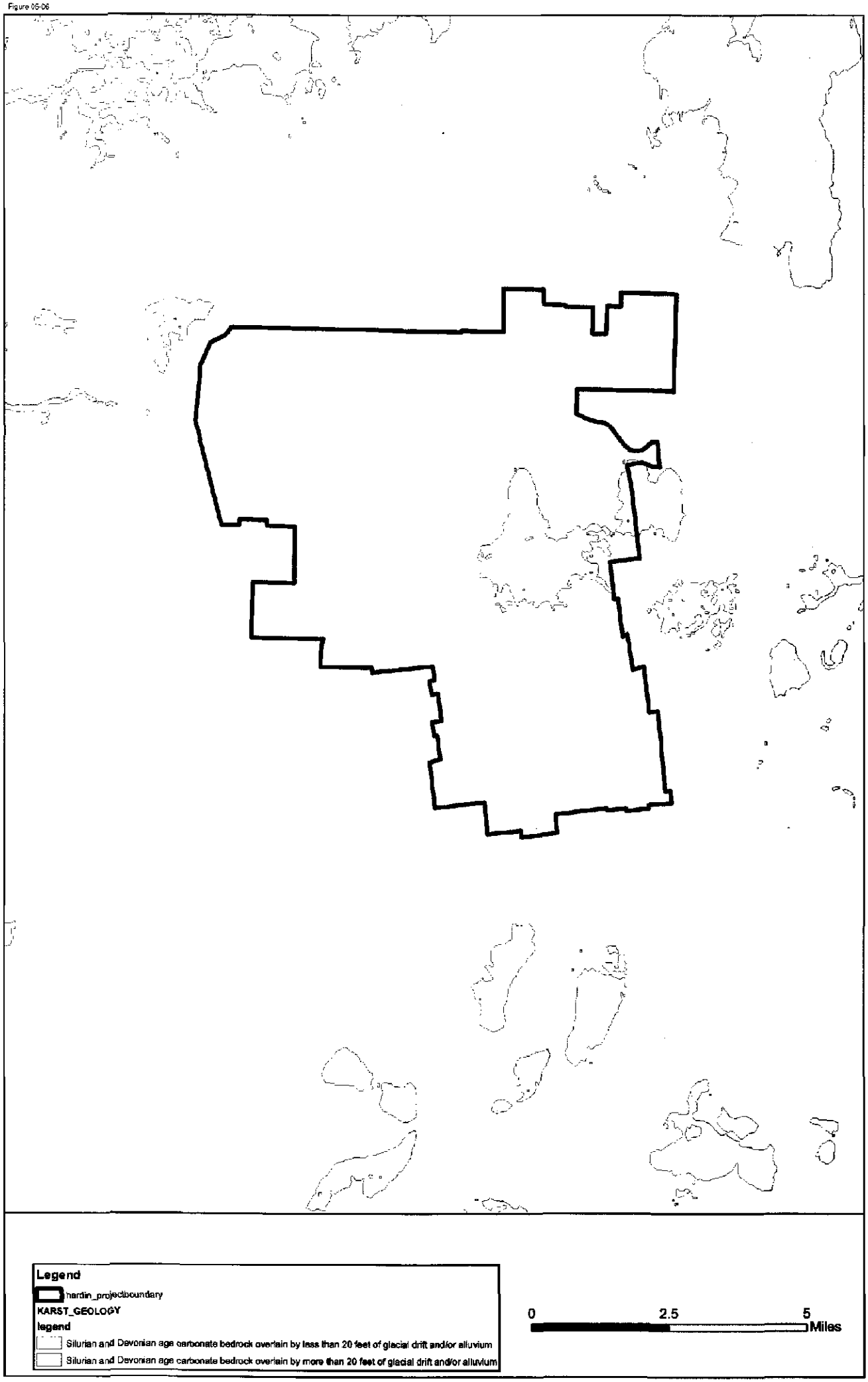

Legend
hardin_projectboundary
KARST_GEOLOGY
legend
Silurian and Devonian age carbonate bedrock overlain by less than 20 feet of glacial drift and/or alluvium
Silurian and Devonian age carbonate bedrock overlain by more than 20 feet of glacial drift and/or alluvium
0
2.5
5
Miles

Figure 05-07

USGS

science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT

Prepared in cooperation with the Ohio Department of Natural Resources, Division of Geological Survey

Earthquakes in Ohio and Vicinity 1776–2007

Compiled by Richard L. Dart[1] and Michael C. Hansen[2]

2008

EARTHQUAKES

EASTERN U.S. EARTHQUAKES

EARTHQUAKES IN OHIO AND VICINITY

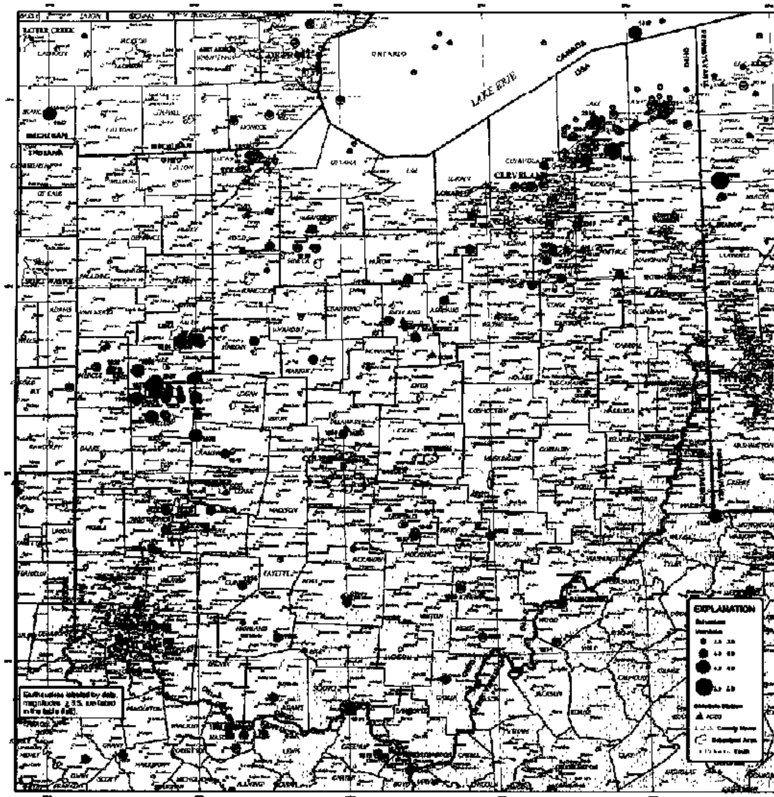
OHIO SEISMIC NETWORK

EARTHQUAKE CATALOGS

SELECTED REFERENCES

DATA SOURCES AND WEB INTERNET INFORMATION RESOURCES

Earthquake Locations

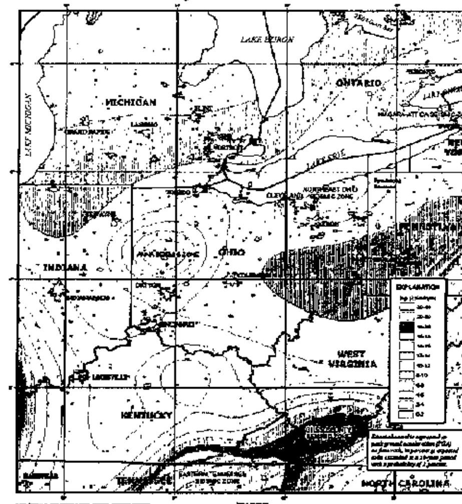


SEISMIC HAZARD

OHIO SEISMIC ZONES

NEARBY SEISMIC ZONES

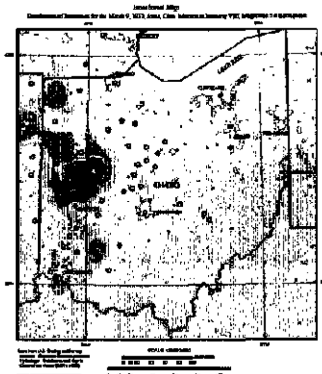
Regional Seismic Hazard



ABBREVIATED MODIFIED MERCALLI INTENSITY SCALE

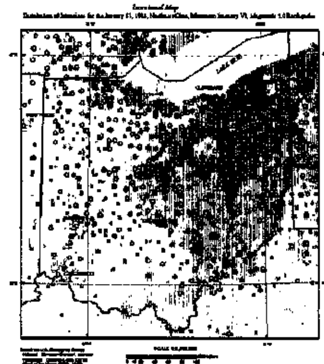
INTENSITY AND MAGNITUDE

NOTES ON THE ISOSEISMAL MAPS



EXPLANATION

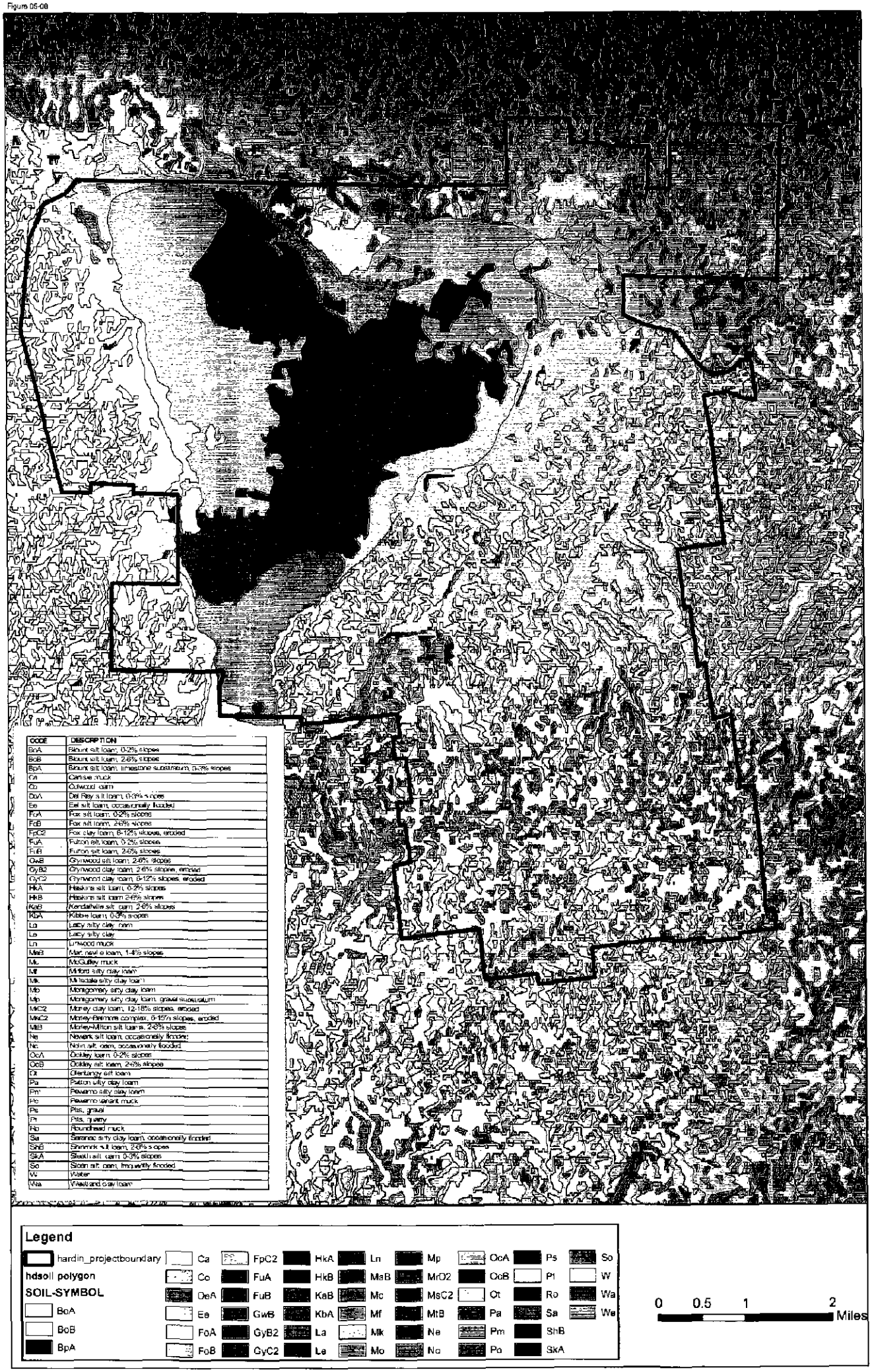
Main Shock



Author's Note

DISCLAIMER

Figure 05-08



CODE	DESCRIPTION
BoA	Blount silt loam, 0-2% slopes
BoB	Blount silt loam, 2-6% slopes
BpA	Blount silt loam, limestone substratum, 0-3% slopes
Ca	Carlisle muck
Co	Colwood clay
DeA	Del Rey silt loam, 0-3% slopes
Ee	Eel silt loam, occasionally flooded
FoA	Fox silt loam, 0-2% slopes
FoB	Fox silt loam, 2-6% slopes
FpC2	Fox clay loam, 6-12% slopes, eroded
FuA	Fulton silt loam, 0-2% slopes
FuB	Fulton silt loam, 2-6% slopes
GwB	Grenwood silt loam, 2-6% slopes
GyB2	Grenwood clay loam, 2-6% slopes, eroded
GyC2	Grenwood clay loam, 6-12% slopes, eroded
HkA	Haskins silt loam, 0-2% slopes
HkB	Haskins silt loam 2-6% slopes
KaB	Kendallville silt loam, 2-6% slopes
KbA	Kibbie loam, 0-3% slopes
La	Lacy silty clay loam
Le	Lacy silty clay
Ln	Linwood muck
MaB	Marlette silt loam, 1-4% slopes
Mc	McCutchey muck
Mf	Milford silty clay loam
Mk	Milkdale silty clay loam
Mp	Montgomery silty clay loam
Mp	Montgomery silty clay loam, gravel substratum
MrC2	Morley clay loam, 12-18% slopes, eroded
MsC2	Morley-Pewamo complex, 6-15% slopes, eroded
MtB	Morley-Mitton silt loams, 2-6% slopes
Ne	Newark silt loam, occasionally flooded
Nc	Nolin silt loam, occasionally flooded
OcA	Ockley loam, 0-2% slopes
OcB	Ockley silt loam, 2-6% slopes
Ot	Ottokee silty clay loam
Pa	Patton silty clay loam
Pm	Pewamo silty clay loam
Po	Pewamo variant muck
Ps	Pits, gravel
Pt	Pits, quarry
Rb	Roundhead muck
Sa	Saranac silty clay loam, occasionally flooded
ShB	Shoemaker silt loam, 2-6% slopes
SkA	Shoals silt loam, 0-3% slopes
So	Sloan silt loam, frequently flooded
W	Water
Wa	Wallkill clay loam

Legend

hardin_projectboundary

hdsoil polygon

SOIL-SYMBOL

BoA, BoB, BpA, Ca, Co, DeA, Ee, FoA, FoB, FpC2, FuA, FuB, GwB, GyB2, GyC2, HkA, HkB, KaB, KbA, La, Le, Ln, MaB, Mc, Mf, Mk, Mo, Mp, MrO2, MsC2, MtB, Ne, Nc, OcA, OcB, Ot, Pa, Pm, Po, Ps, Pt, Ro, Sa, Sa, ShB, SkA, So, W, Wa, We

0 0.5 1 2 Miles

Figure 05-09

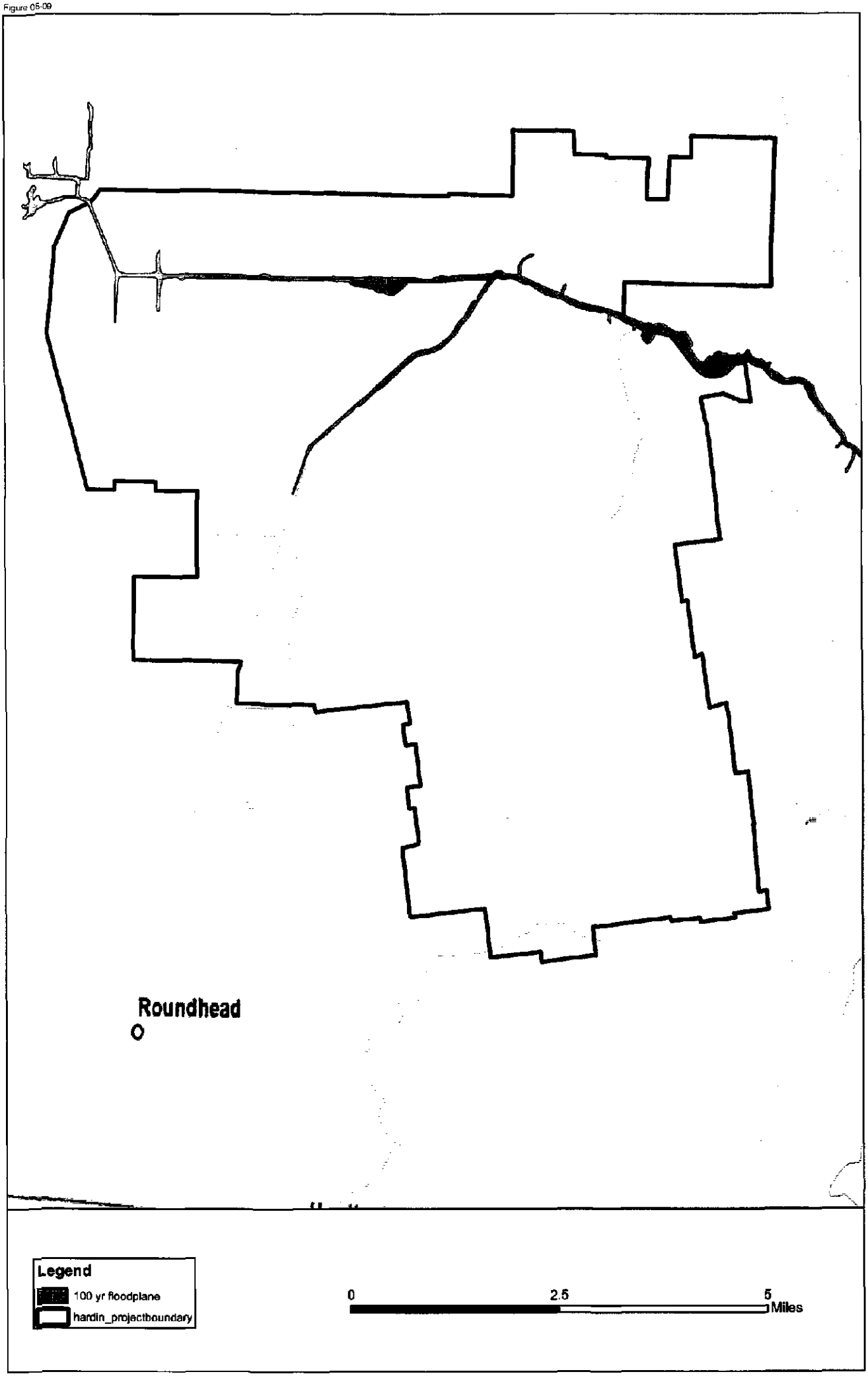

Roundhead
Legend
100 yr floodplane
hardin_projectboundary
0
2.5
5
Miles

Figure 05-10

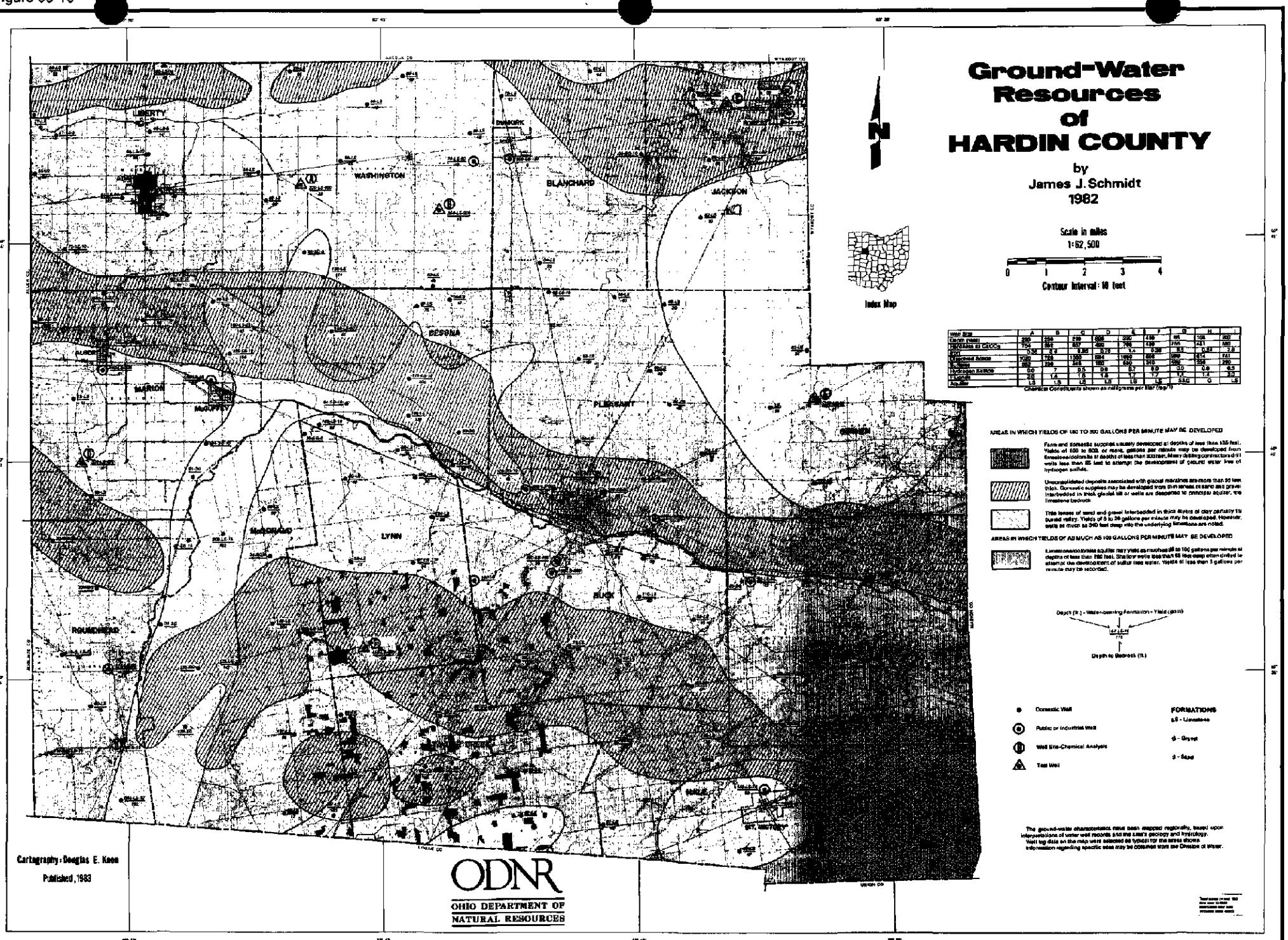
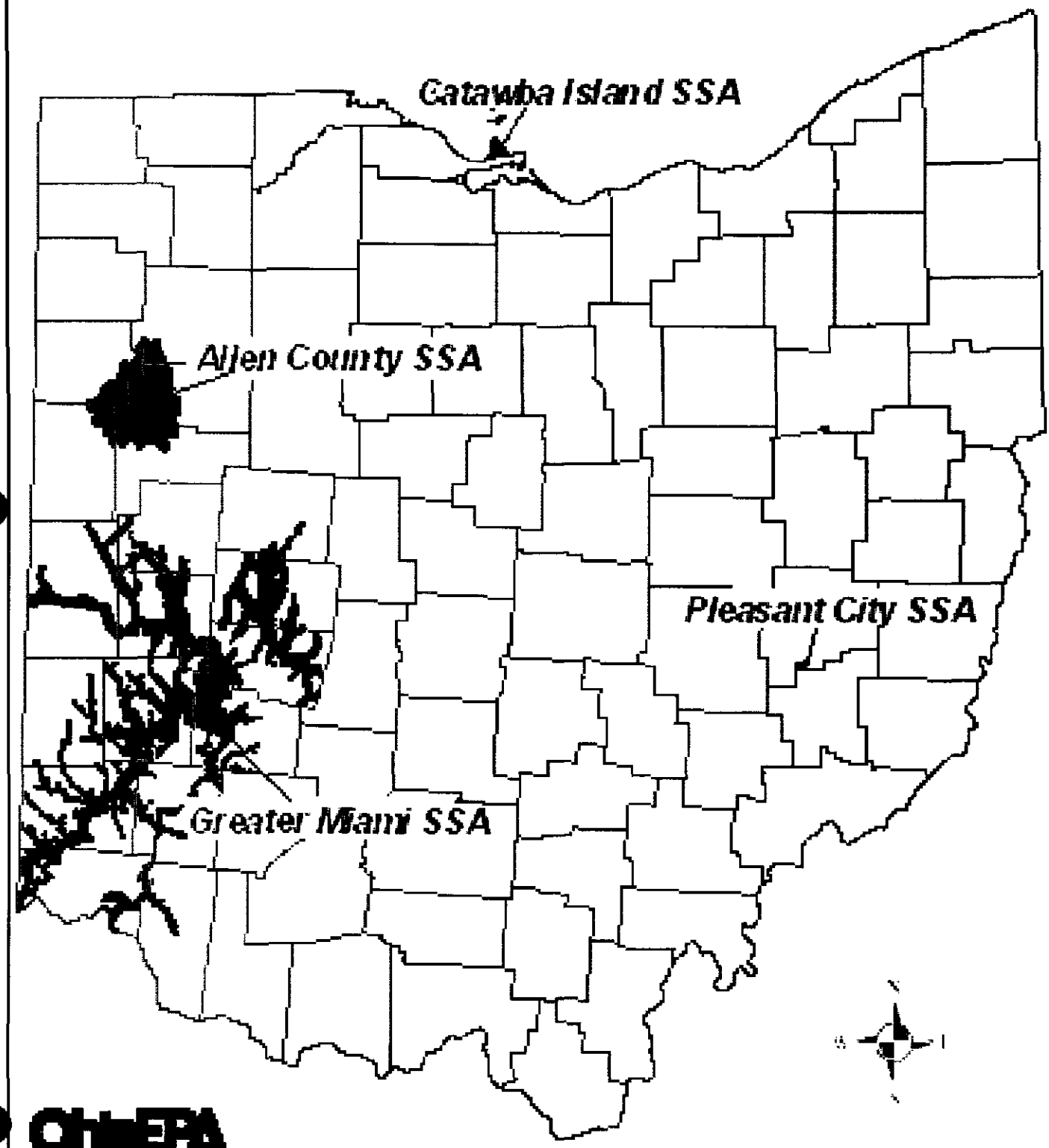

Ground-Water Resources of HARDIN COUNTY
by
James J. Schmidt
1982
Scale in miles
1:62,500
0 1 2 3 4
Contour Interval: 10 feet
Index Map
N
LIBERTY
WASHINGTON
BLANCHARD
JACKSON
DUDLEY
SCIOTA
MARION
McCUTCHEY
PLEASANT
ROUNDHEAD
LYNN
BUCK
Cartography: Douglas E. Keen
Published, 1983
ODNR
OHIO DEPARTMENT OF NATURAL RESOURCES
AREAS IN WHICH YIELDS OF 100 TO 500 GALLONS PER MINUTE MAY BE DEVELOPED
AREAS IN WHICH YIELDS OF AS MUCH AS 100 GALLONS PER MINUTE MAY BE DEVELOPED
Domestic Well
Public or Industrial Well
Well Site-Chemical Analysis
Test Well
FORMATIONS
ls - Limestone
g - Gravel
s - Sand

Figure 05-11

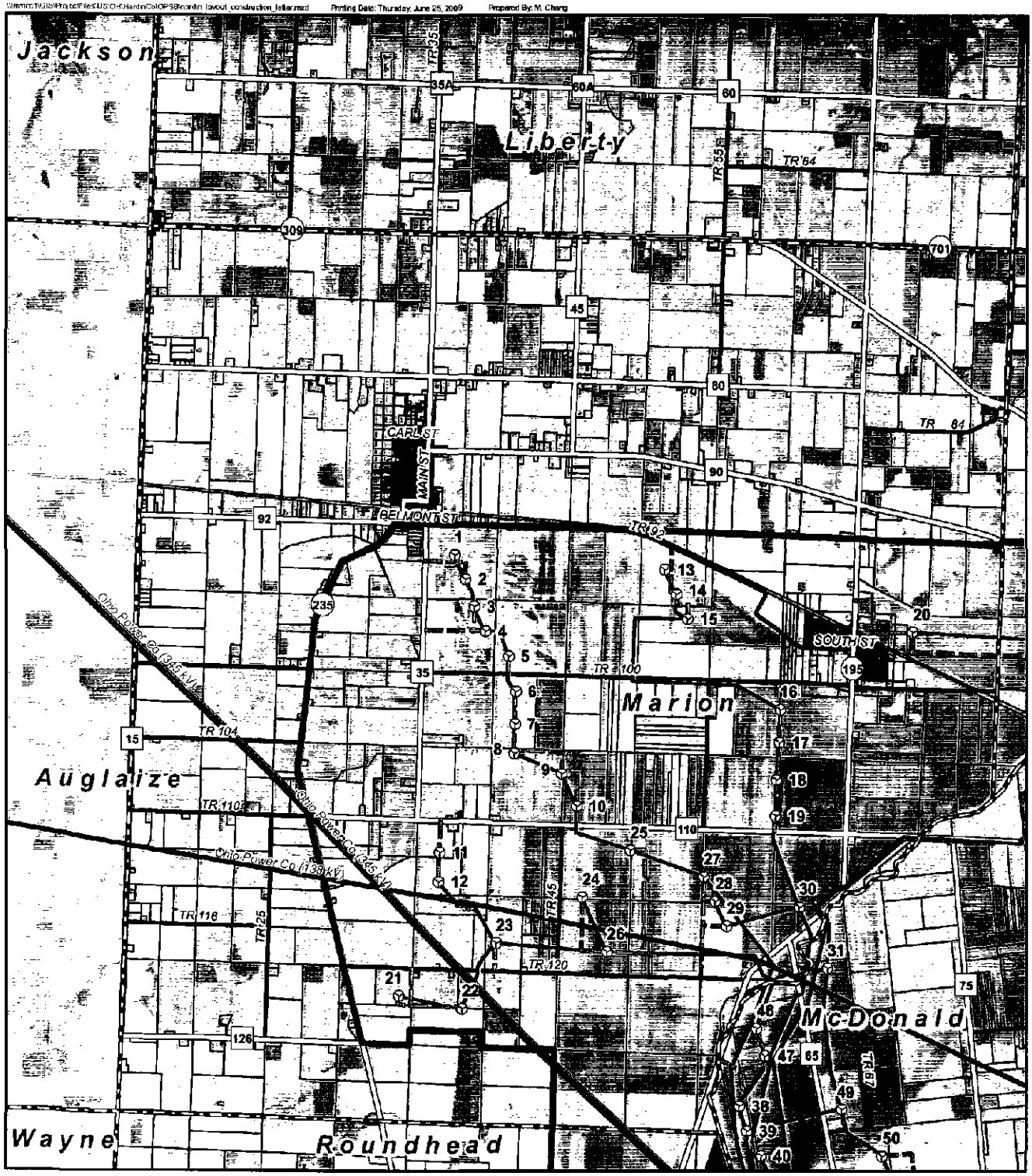
Sole Source Aquifers in Ohio

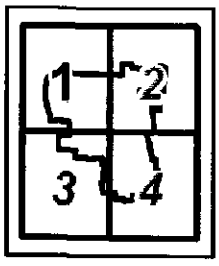


OhioEPA
Division of Drinking and Ground Waters

November 28, 2006

Figure 05-12





Legend

- Proposed 2.5 XL Turbine Location
- Proposed Substation
- Existing Transmission Line
- Proposed Access Road
- Proposed Collection Routing To 345 kV Line
- US Highway
- State/County Road
- Town Road
- Hardin County Parcels
- Township Boundary
- Project Study Area

Notes:
1. Ohio State Imagery Program (OSIP), March/April 2006
2. Ventyx Energy/Velocity April 2009
3. ESRI Data & Maps, 2007

N

2,000 0 2,000

Feet

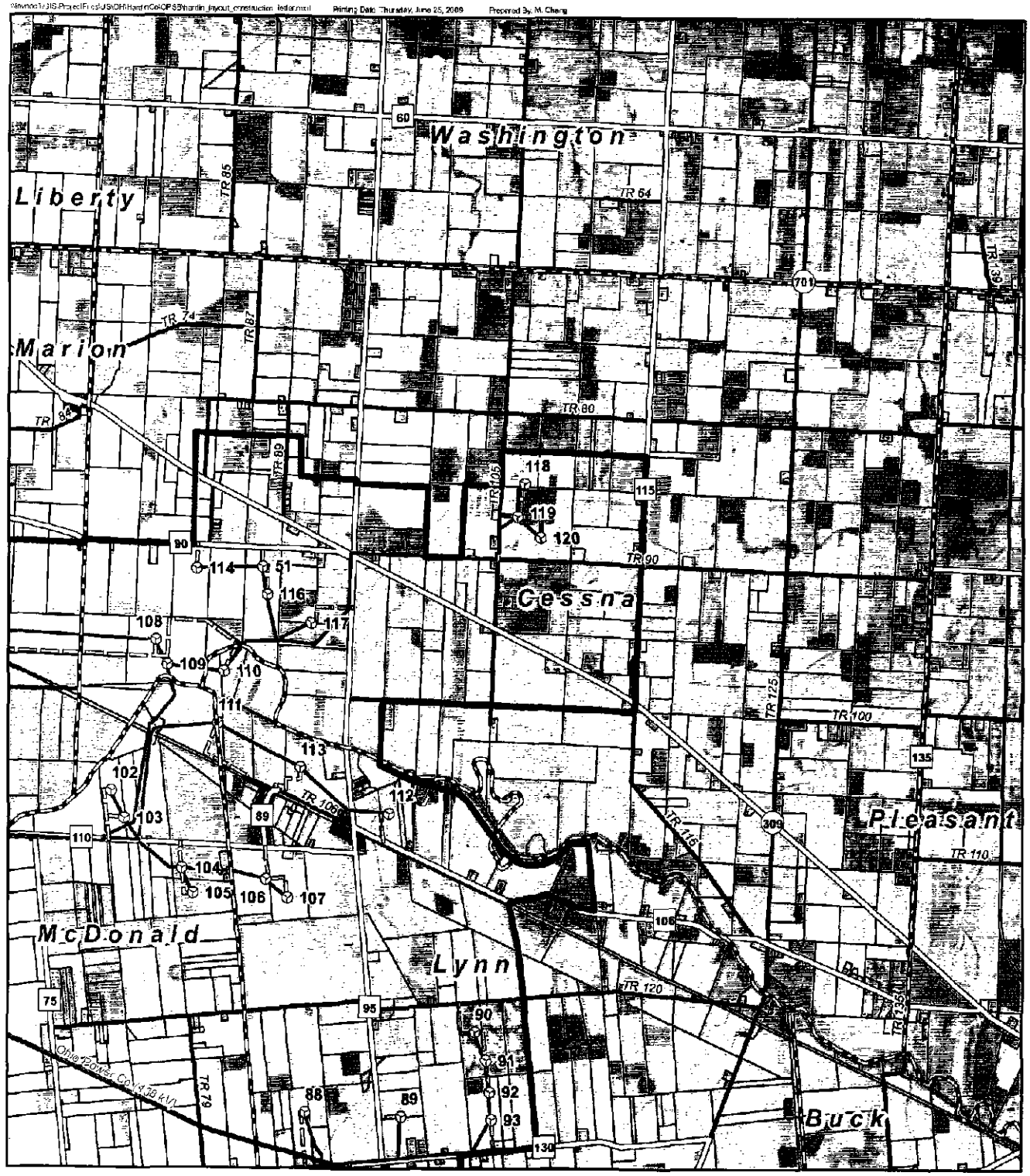
Hardin 2.5 XL Layout and Construction

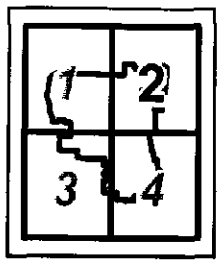
Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 25, 2009

Figure 05-12





Legend

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N

2,000 0 2,000
Feet

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Rev. 00

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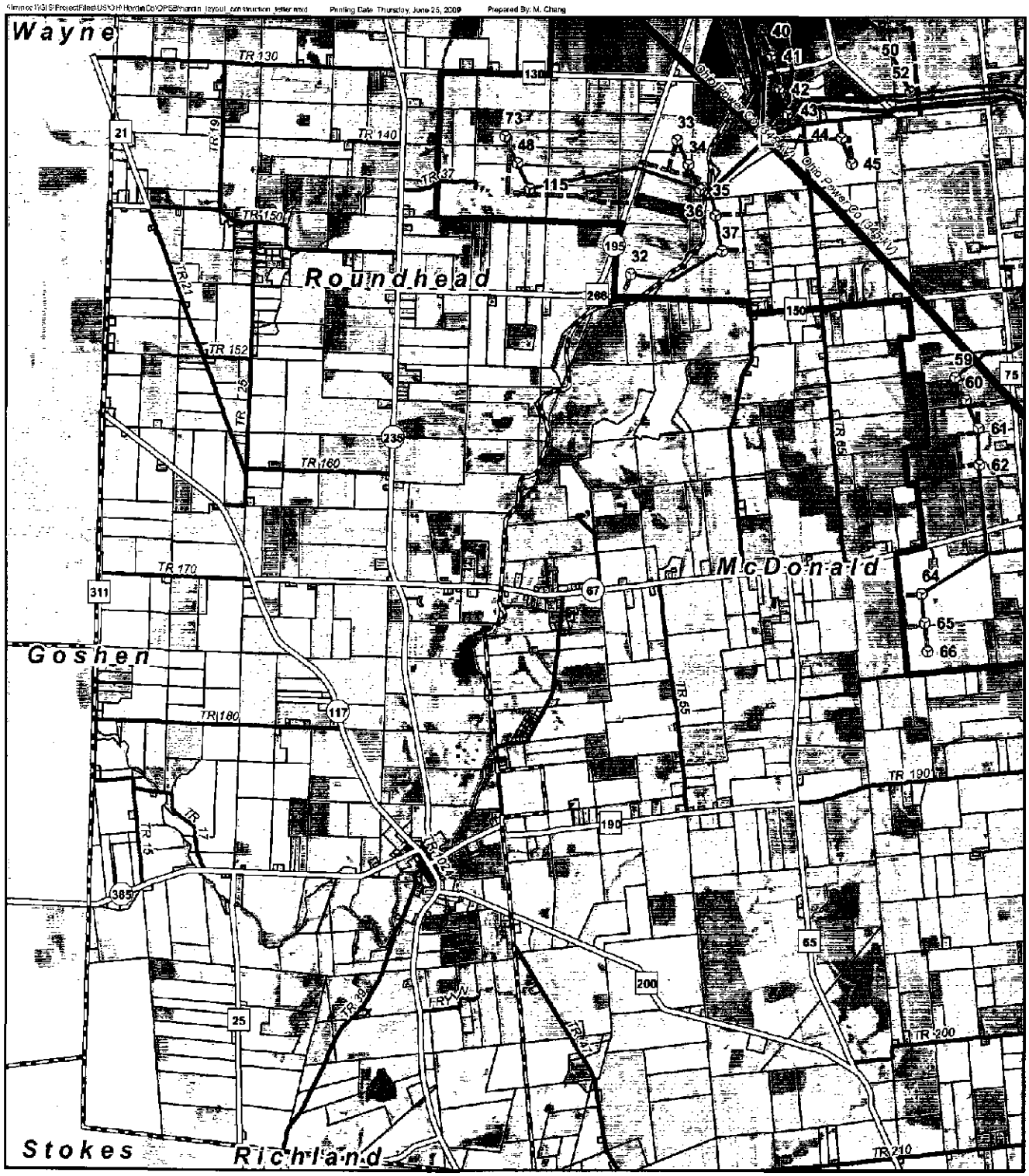

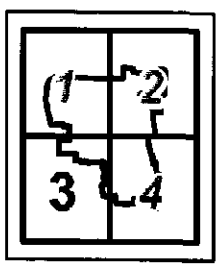

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N

2,000 0 2,000

Feet

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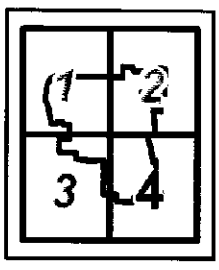
Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 25, 2009

Figure 05-12



Legend

- Proposed 2.5 XL Turbine Location
- Proposed Substation
- Existing Transmission Line
- Proposed Access Road
- Proposed Collection Routing To 345 kV Line
- US Highway
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2. Vantyx EnergyVelocity April 2009
3. ESRI Data & Maps, 2007

N

2,000 0 2,000

Feet

Hardin 2.5 XL Layout and Construction

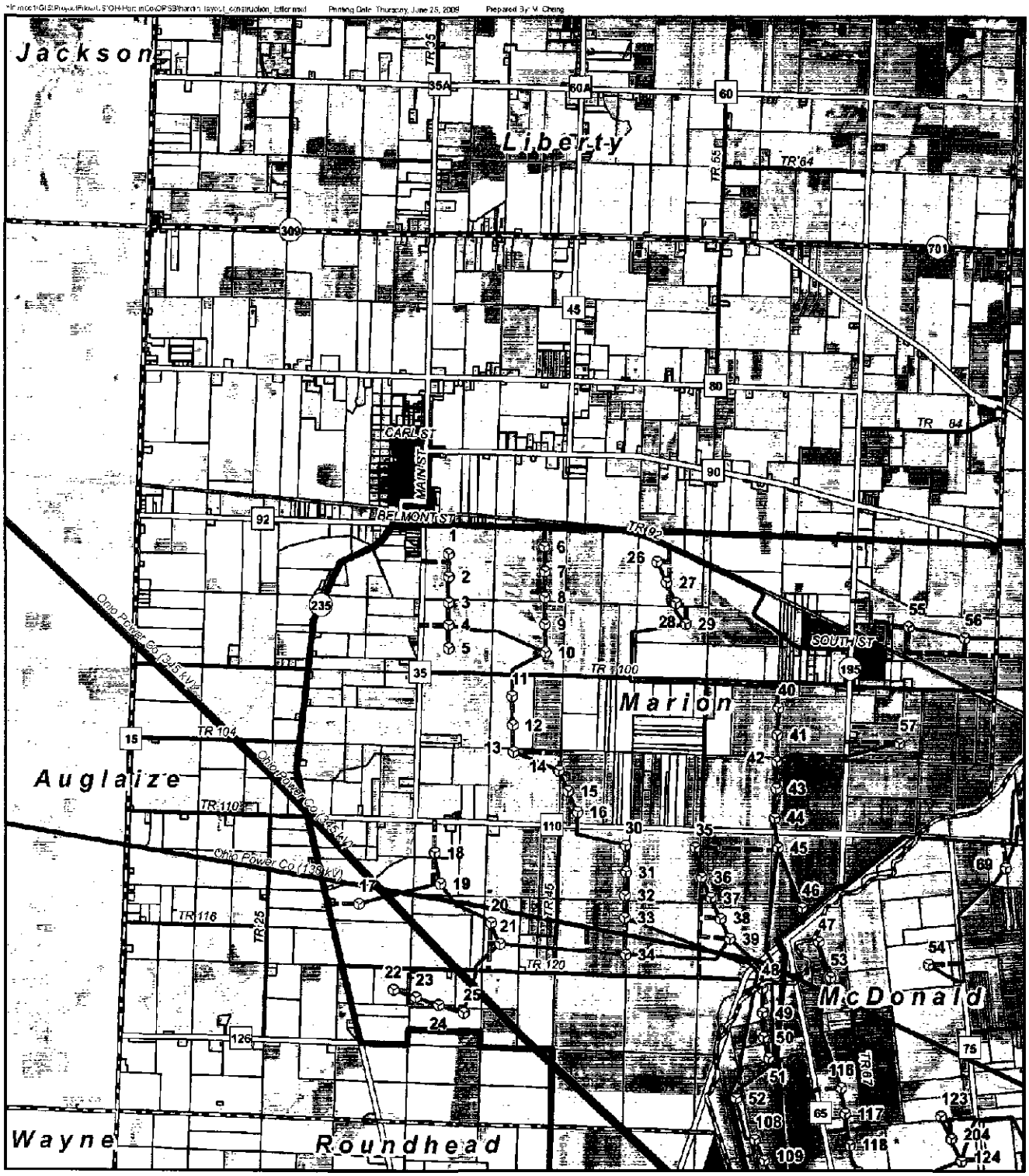
Hardin Wind Farm, Hardin County, Ohio

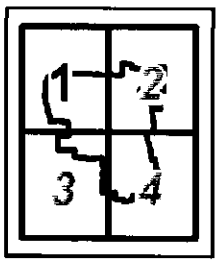
Rev. 00

June 25, 2009

hardin wind

Figure 05-13





Legend

- Proposed 1.5 XLE Turbine Location
- Proposed Substation
- Existing Transmission Line
- Proposed Access Road
- Proposed Collection Routing To 345 kV Line
- US Highway
- State/County Road
- Town Road
- Hardin County Parcels
- Township Boundary
- Project Study Area

Notes:
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3. ESRI Data & Maps, 2007

N

2,000 0 2,000

Feet

Hardin 1.5 XLE Layout and Construction

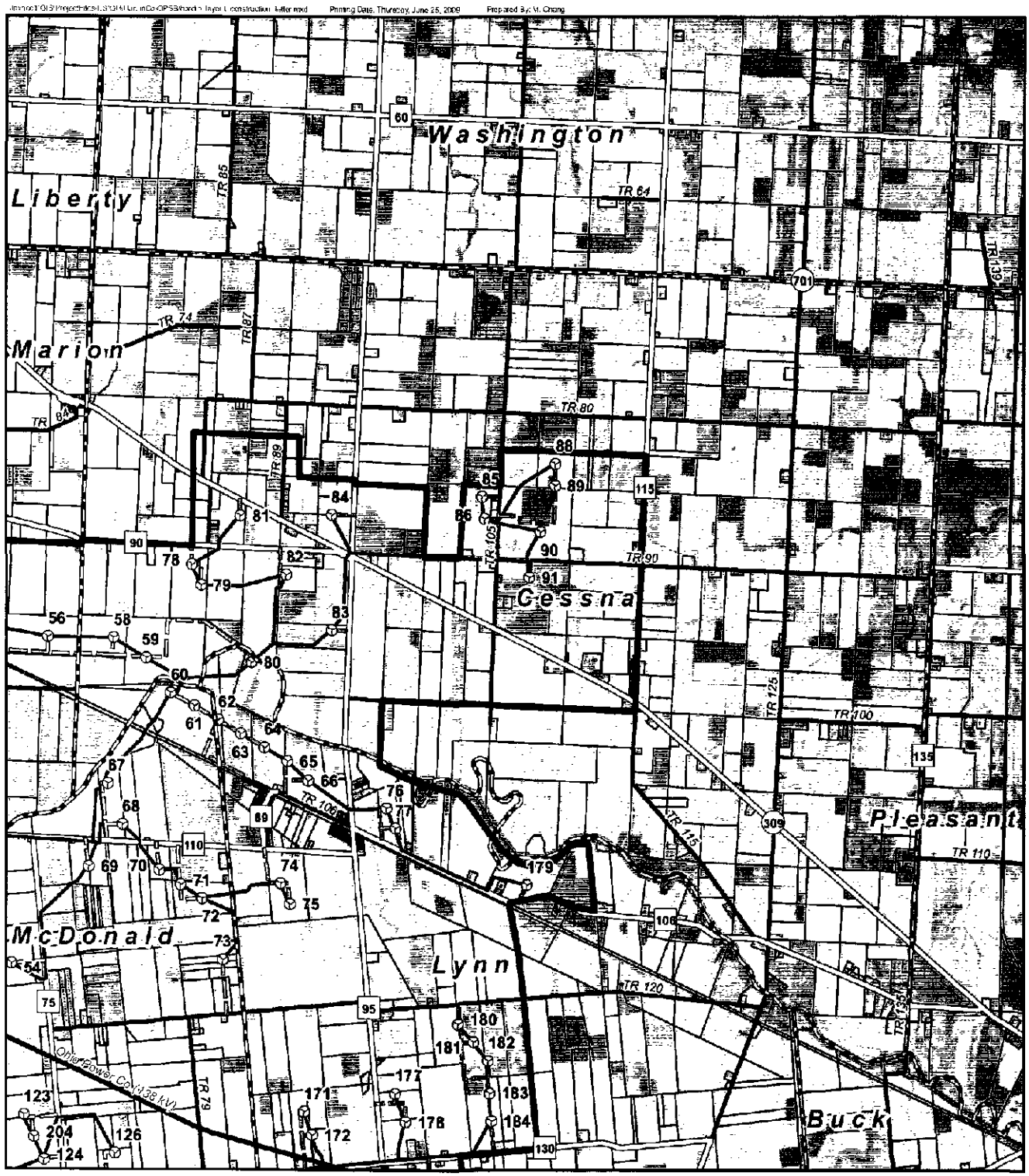
Hardin Wind Farm, Hardin County, Ohio

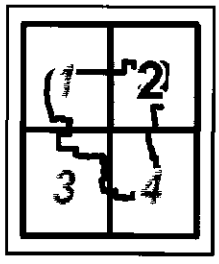
Rev. 00

June 25, 2009

hardin wind energy

Figure 05-13





Legend

- Proposed 1.5 XLE Turbine Location
- Proposed Substation
- *Existing Transmission Line*
- Proposed Access Road
- Proposed Collection Routing To 345 kV Line
- US Highway
- State/County Road
- Town Road
- Hardin County Parcels
- Township Boundary
- Project Study Area

Notes:
1. *Ohio State Imagery Program (OSIP), March/April 2006*
2. Vantyx EnergyVelocity April 2009
3. ESRI Data & Maps, 2007

N

2,000 0 2,000

Feet

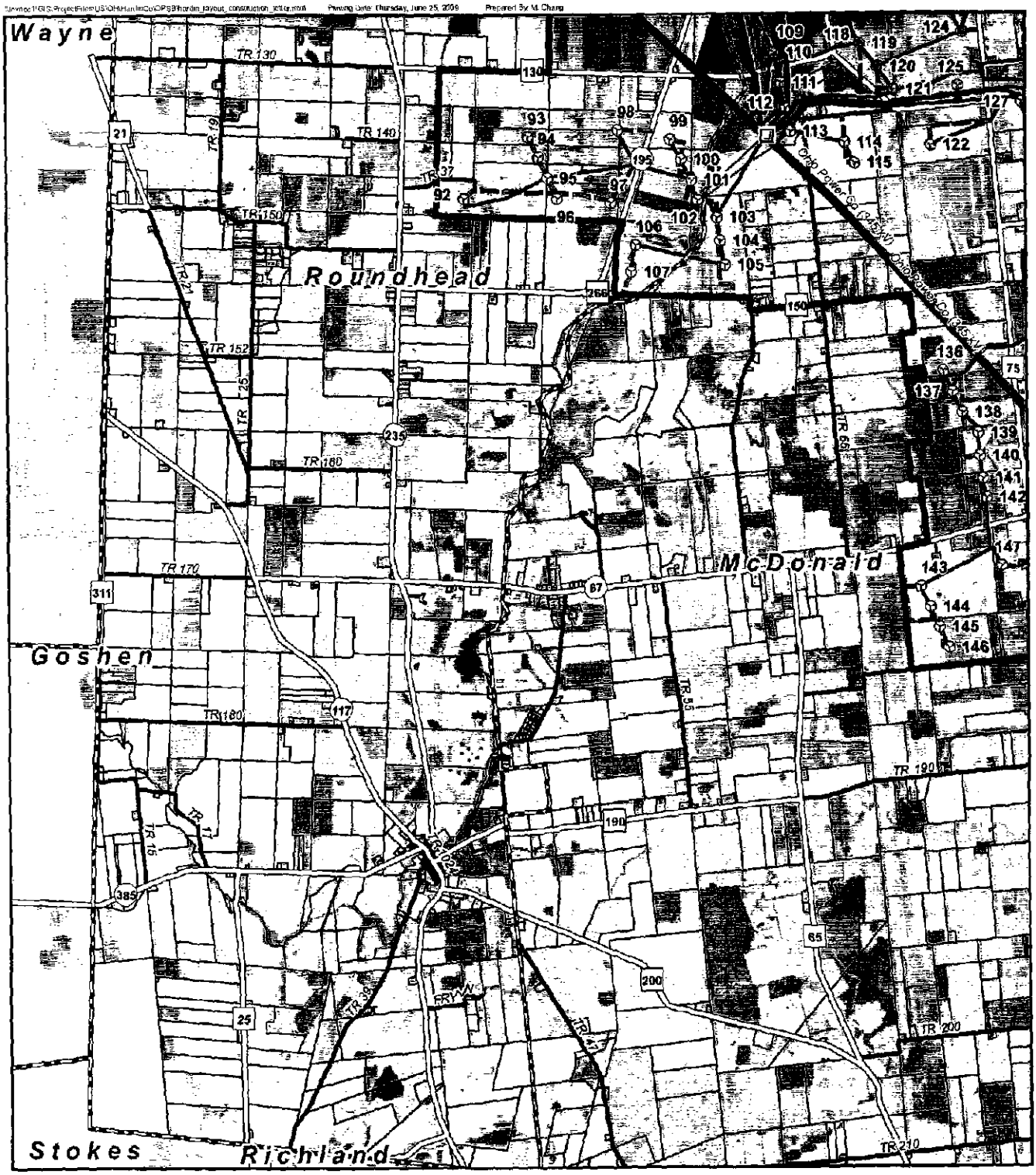
Hardin 1.5 XLE Layout and Construction

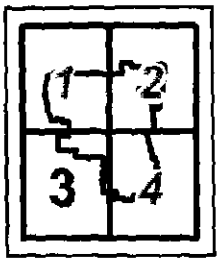
Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 25, 2009

Figure 05-13





Legend

- Proposed 1.5 XLE Turbine Location
- Proposed Substation
- Existing Transmission Line
- Proposed Access Road
- Proposed Collection Routing To 345 kV Line
- US Highway
- State/County Road
- Town Road
- Hardin County Parcels
- Township Boundary
- Project Study Area

Notes:
1. Ohio State Imagery Program (OSIP), March/April 2008
2. Ventyx EnergyVelocity April 2009
3. ESRI Data & Maps, 2007

N

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Feet

Hardin 1.5 XLE Layout and Construction

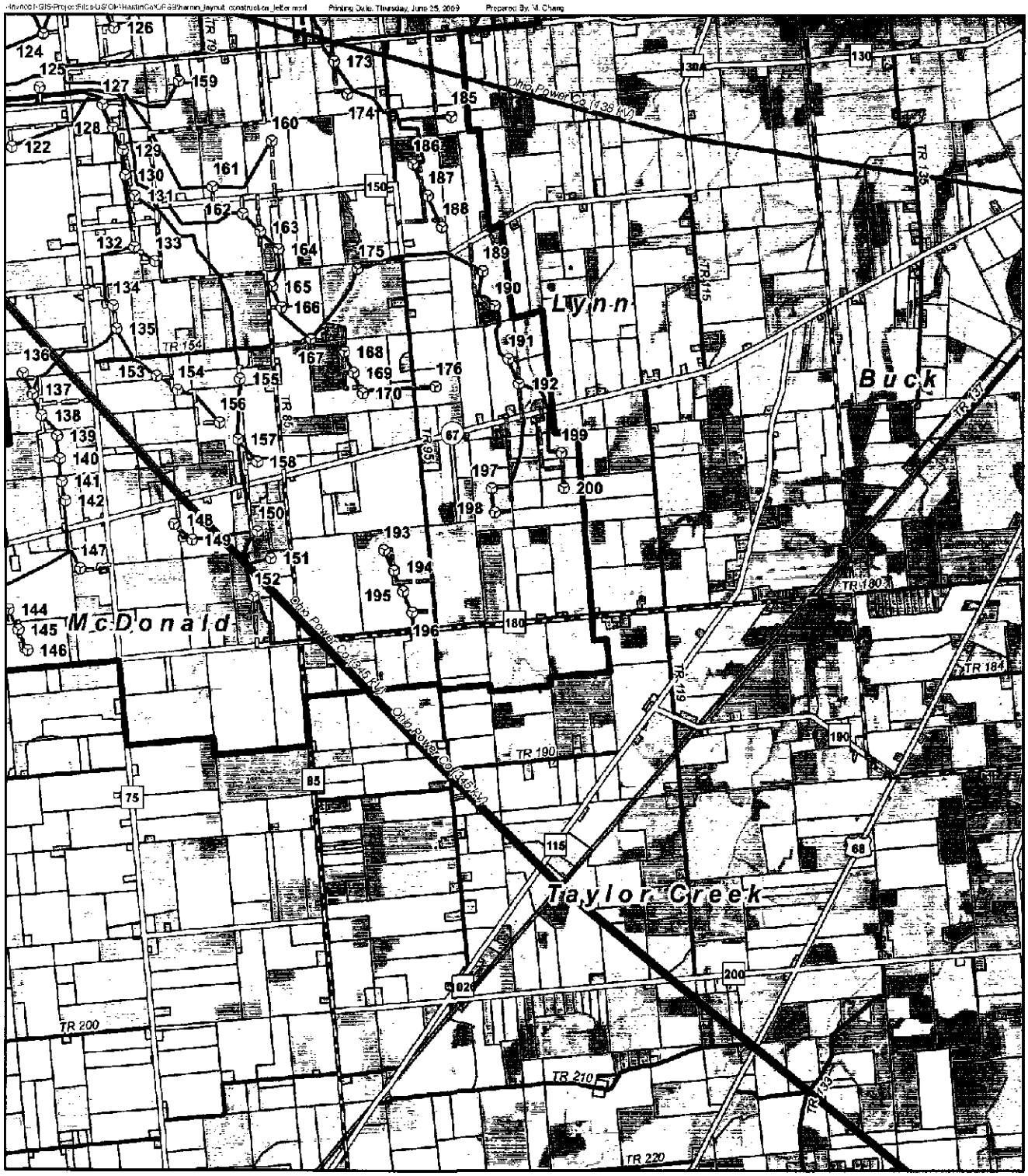
Hardin Wind Farm, Hardin County, Ohio

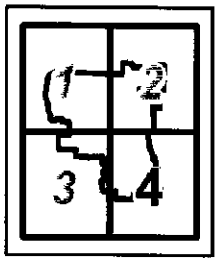
Rev. 00

June 25, 2009

hardin wind

Figure 05-13





Legend

- Proposed 1.5 XLE Turbine Location
- Proposed Substation
- Existing Transmission Line
- Proposed Access Road
- Proposed Collection Routing To 345 kV Line
- US Highway
- State/County Road
- Town Road
- Hardin County Parcels
- Township Boundary
- Project Study Area

Notes:
1. Ohio State Imagery Program (OSIP), March/April 2006
2. Ventyx Energy/Velocity April 2009
3. ESRI Data & Maps, 2007

N

2,000 0 2,000

Feet

Hardin 1.5 XLE Layout and Construction

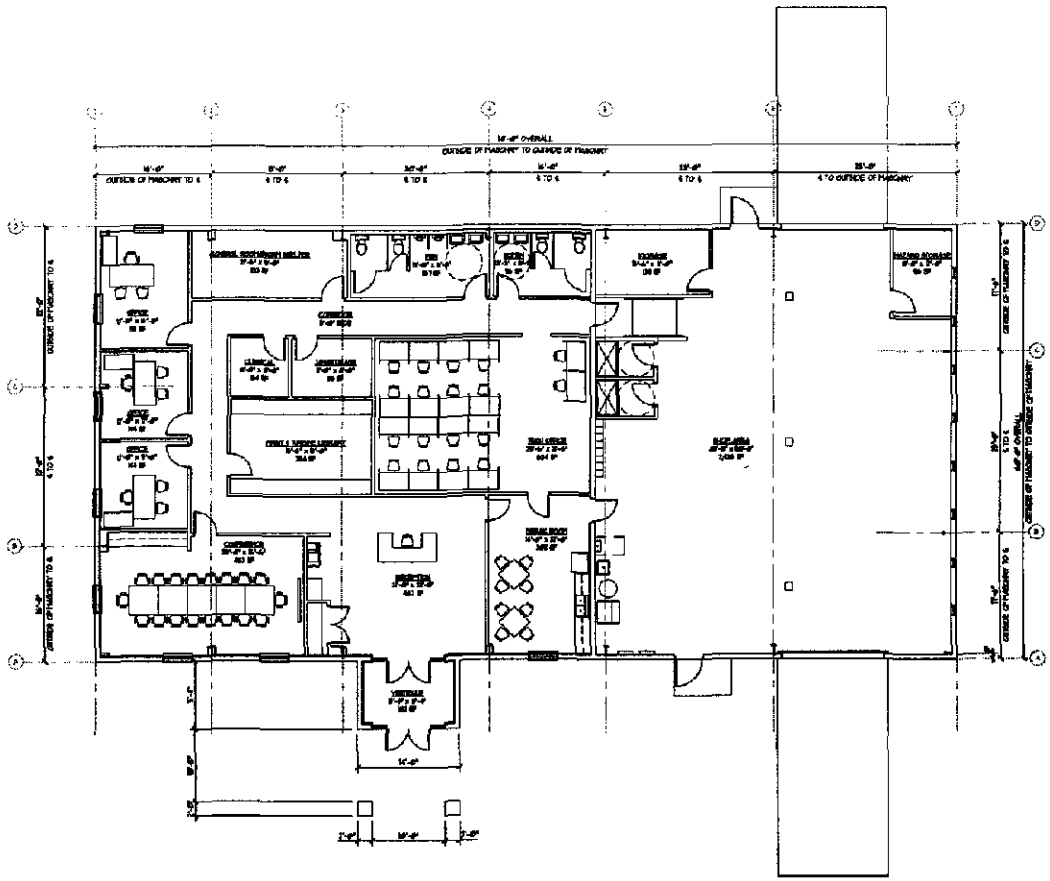
Hardin Wind Farm, Hardin County, Ohio

Rev. 00

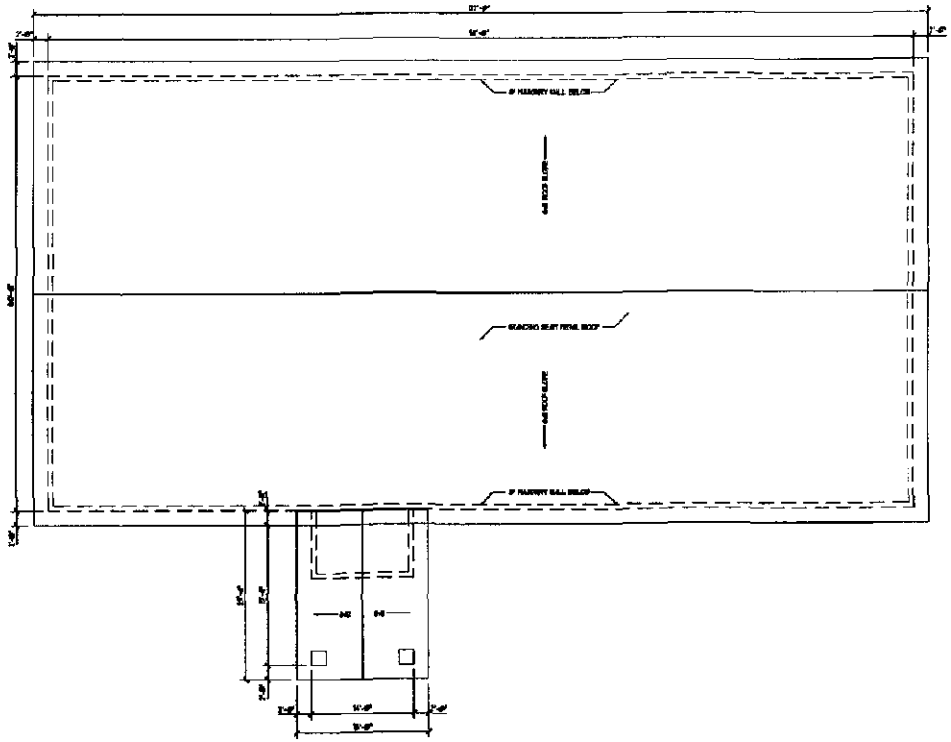
June 25, 2009

hardin wind

Figure 05-14



PROPOSED PLAN



PROPOSED ROOF PLAN

DRAWINGS ARE PRELIMINARY. NOT FOR CONSTRUCTION.

REV	ISSUE DATE	DESCRIPTION	LETTER	BY
	6-15-2009	ROOF/VISION DRAWINGS ISSUED FOR PERMIT		TDS

Lehigh Construction Group, Inc.

INVENERGY O&M BUILDING
NORTH SHELDON ROAD
SHELDON, NEW YORK

PROPOSED ROOF PLAN

AS NOTED

© 2009

A1

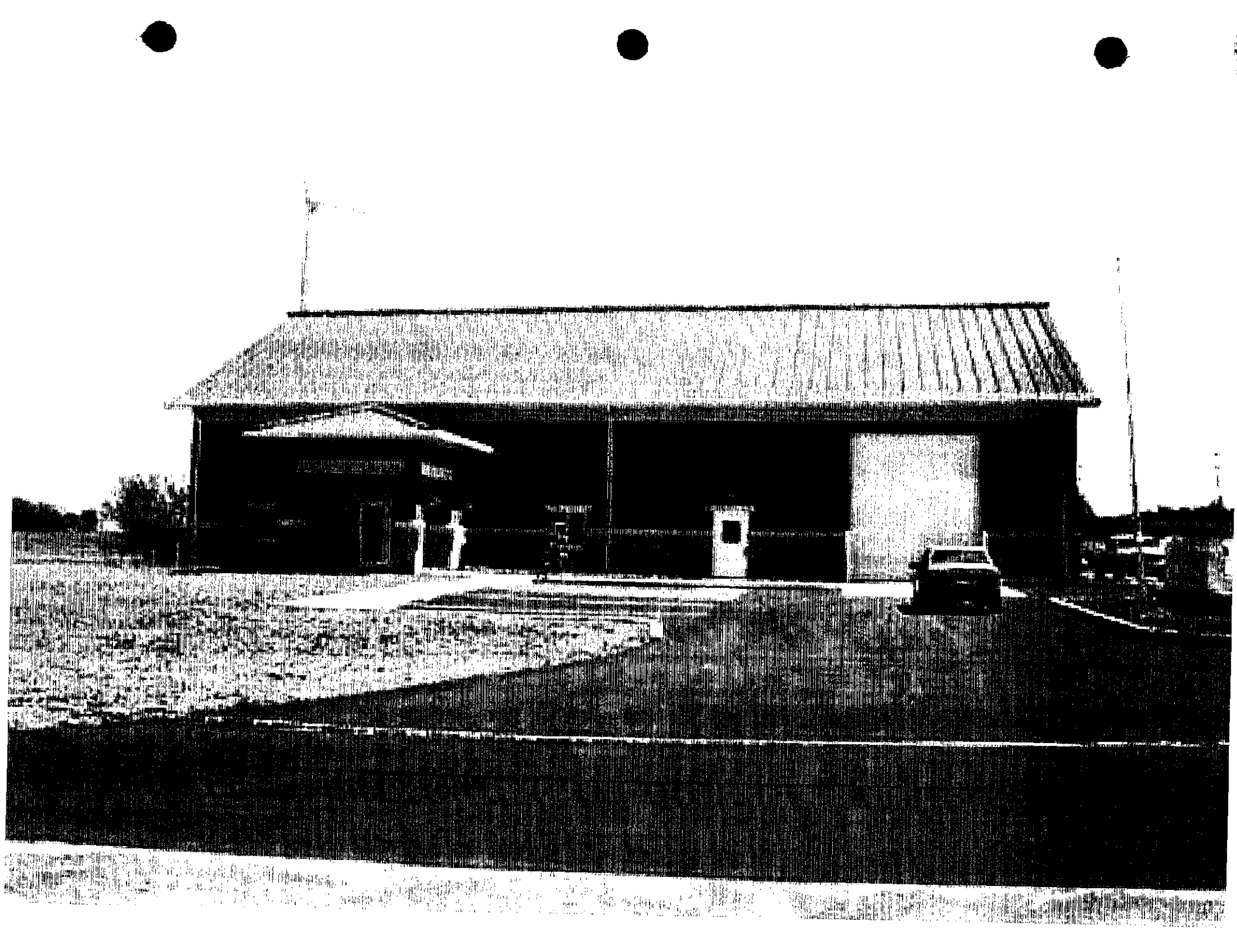


Figure 08-01

Hardin Noise Map for Proposed 2.5 XL Layout

Hardin Wind Farm, Hardin County, Ohio

Rev. 00
June 24, 2009

Figure 08-02

Legend

- Proposed 1.5 XLE Turbine Location
- NonParticipating Land Owner House
- Participating Land Owner House
- Hardin County Parcels
- Project Study Area

Noise Contour

- 45 dB
- 50 dB

Notes:
1. Ohio State Imagery Program (OSIP), March/April 2008
2. Hardin County, State of Ohio
3. Noise contours created by Acentech

N

4,000 0 4,000
Feet

Hardin Noise Map for Proposed 1.5 XLE Layout

Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 29, 2009

hardin wind

Figure 08-03

Legend

- River/Stream
- 100-Year Flood Hazard Area
- Hardin County OWI Wetlands
- Water Body
- Park
- ½-Mile Project Boundary Setback
- Study Area Boundary
- Developed, Open Space
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Woody Wetlands
- Emergent Herbaceous Wetlands

Notes:
1. U.S.G.S. 7.5 Minute Series Topographic Maps:
   - Harrod Quadrangle, OH; 1981, Photoinsp. 1994
   - Alger Quadrangle, OH; 1961
   - Forester Quadrangle, OH; 1961, Photoinsp. 1994
   - Roundhead Quadrangle, OH; 1960, Photorev. 1982
   - Silvercreek Quadrangle, OH; 1960, Photorev. 1973
2. Multi-Resolution Land Characteristics Consortium (MRLC) National Land Cover Database (NLCD) 2001
3. ESRI Data & Maps 2007
4. Ohio Department of Natural Resources
5. Federal Emergency Management Agency (FEMA)

N

4,000 0 4,000

Feet

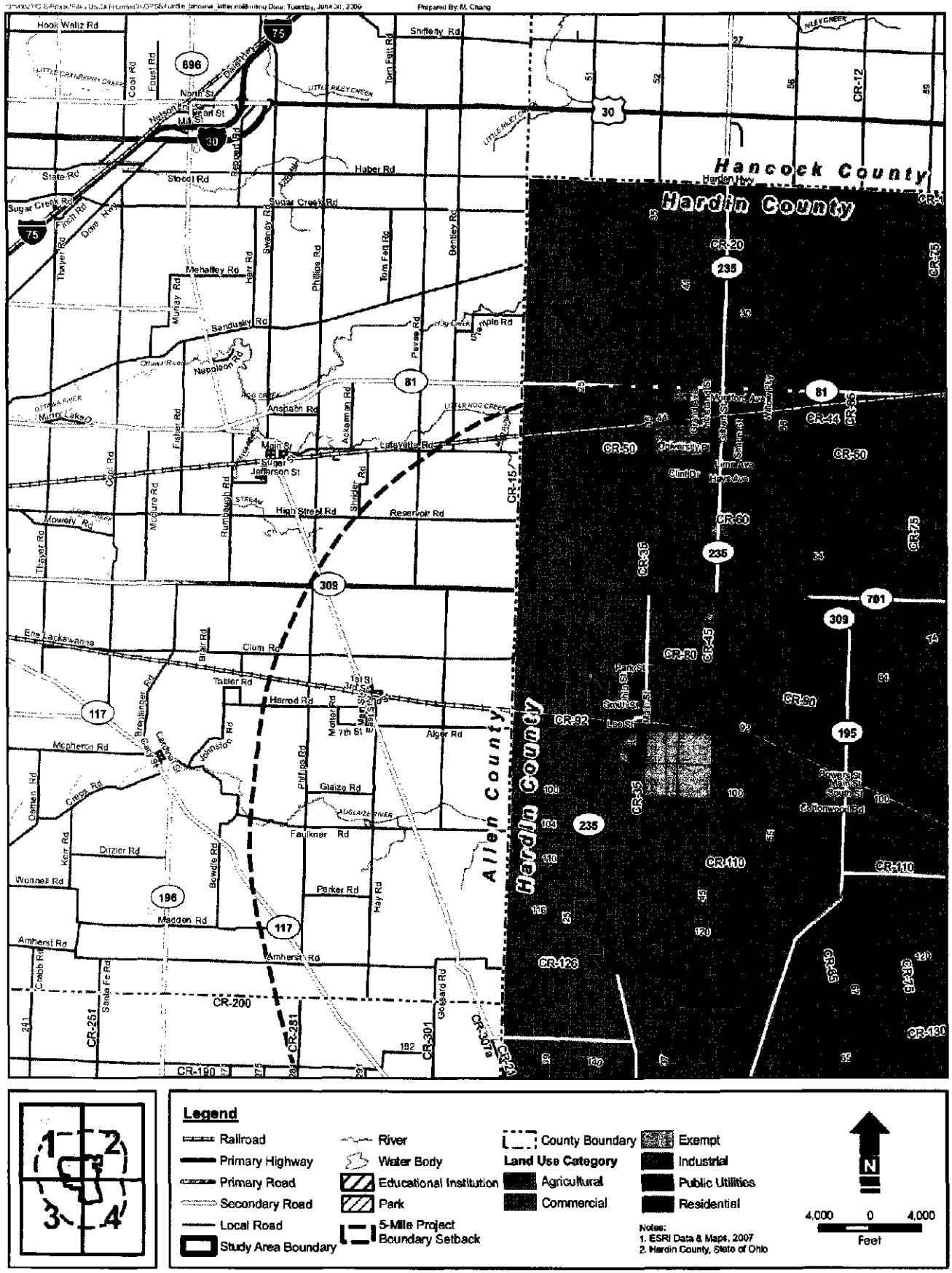
Hardin Ecological Impact

Hardin Wind Farm, Hardin County, Ohio

Rev. 01

June 30, 2009

Figure 08-04



Legend

- Railroad
- Primary Highway
- Primary Road
- Secondary Road
- Local Road
- Study Area Boundary
- River
- Water Body
- Educational Institution
- Park
- 5-Mile Project Boundary Setback
- County Boundary

Land Use Category

- Agricultural
- Commercial
- Exempt
- Industrial
- Public Utilities
- Residential

Notes:
1. ESRI Data & Maps, 2007
2. Hardin County, State of Ohio

N

4,000 0 4,000
Feet

Hardin Land Use

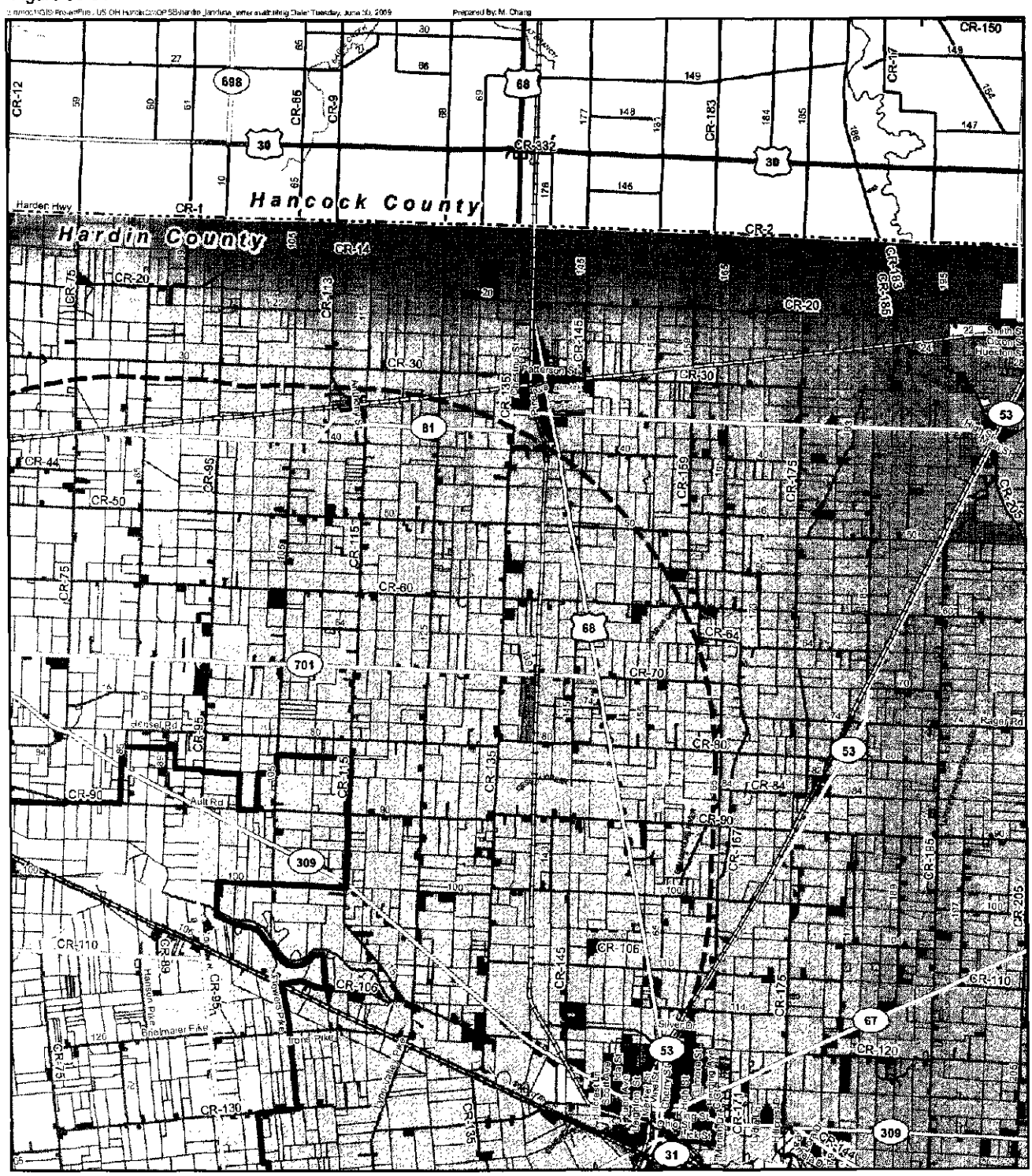
Hardin Wind Farm, Hardin County, Ohio

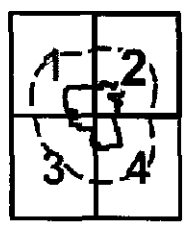
Rev. 00

June 30, 2009

hardin wind

Figure 08-04





Legend

- Railroad
- Primary Highway
- Primary Road
- Secondary Road
- Local Road
- Study Area Boundary
- River
- Water Body
- Educational Institution
- Park
- 5-Mile Project Boundary Setback
- County Boundary
- Land Use Category
- Agricultural
- Commercial
- Exempt
- Industrial
- Public Utilities
- Residential

Notes:
1. ESRI Data & Maps, 2007
2. Hardin County, State of Ohio

N

4,000 0 4,000
Feet

Hardin Land Use

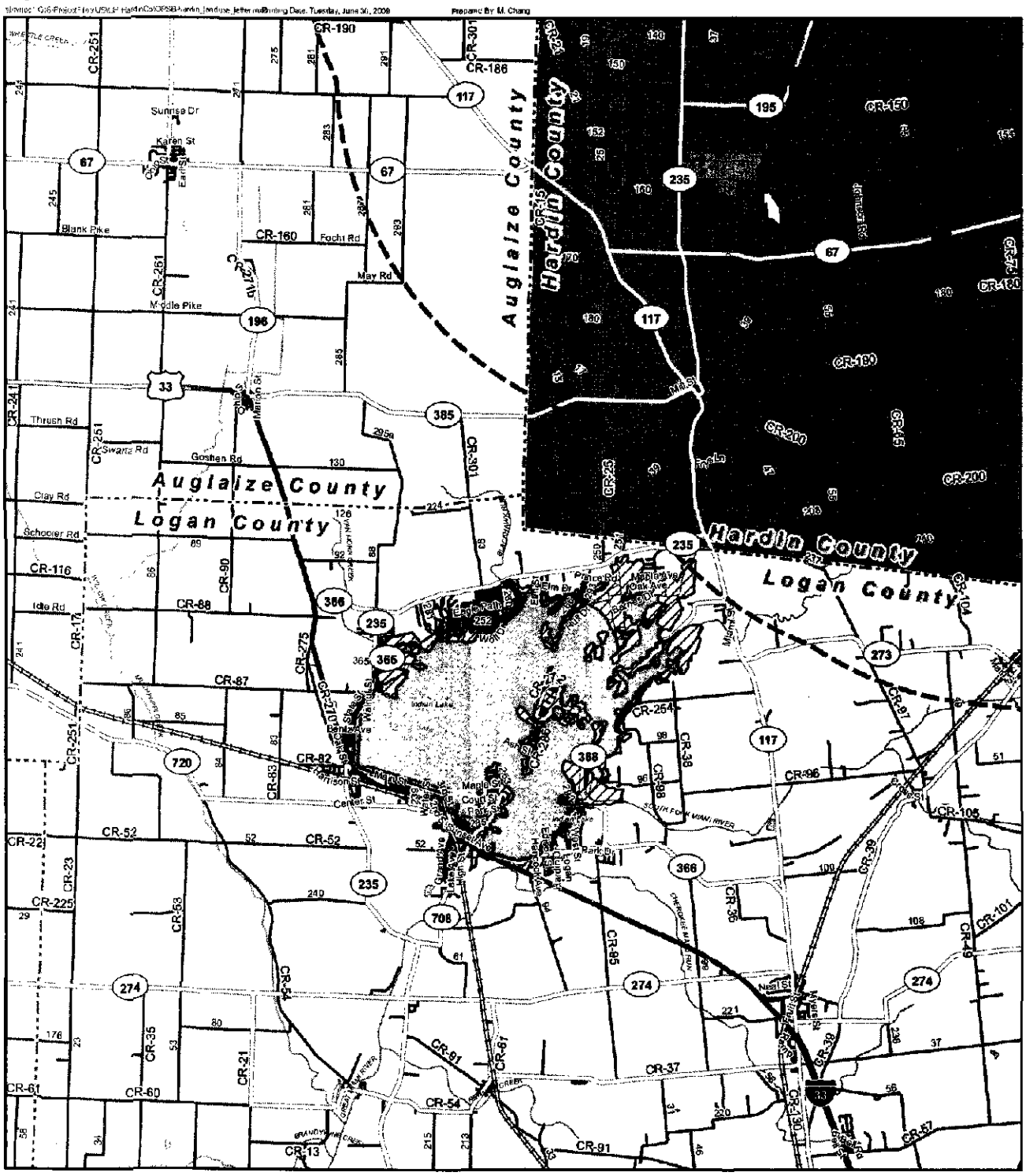
Hardin Wind Farm, Hardin County, Ohio

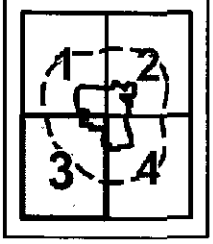
Rev. 00

June 30, 2009

hardin wind

Figure 08-04





Legend

- Railroad
- Primary Highway
- Primary Road
- Secondary Road
- Local Road
- Study Area Boundary
- River
- Water Body
- Educational Institution
- Park
- 5-Mile Project Boundary Setback
- County Boundary

Land Use Category

- Agricultural
- Commercial
- Exempt
- Industrial
- Public Utilities
- Residential

Notes:
1. ESRI Data & Maps, 2007
2. Hardin County, State of Ohio

N

4,000 0 4,000
Feet

Hardin Land Use

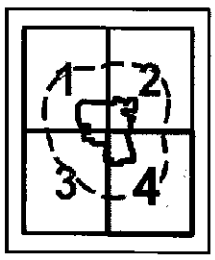
Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 30, 2009

hardin wind energy

Figure 08-04



Legend

- Railroad
- Primary Highway
- Primary Road
- Secondary Road
- Local Road
- Study Area Boundary
- River
- Water Body
- Educational Institution
- Park
- 5-Mile Project Boundary Setback
- County Boundary

Land Use Category

- Agricultural
- Commercial
- Exempt
- Industrial
- Public Utilities
- Residential

Notes:
1. ESRI Data & Maps, 2007
2. Hardin County, State of Ohio

N

4,000 0 4,000
Feet

Hardin Land Use

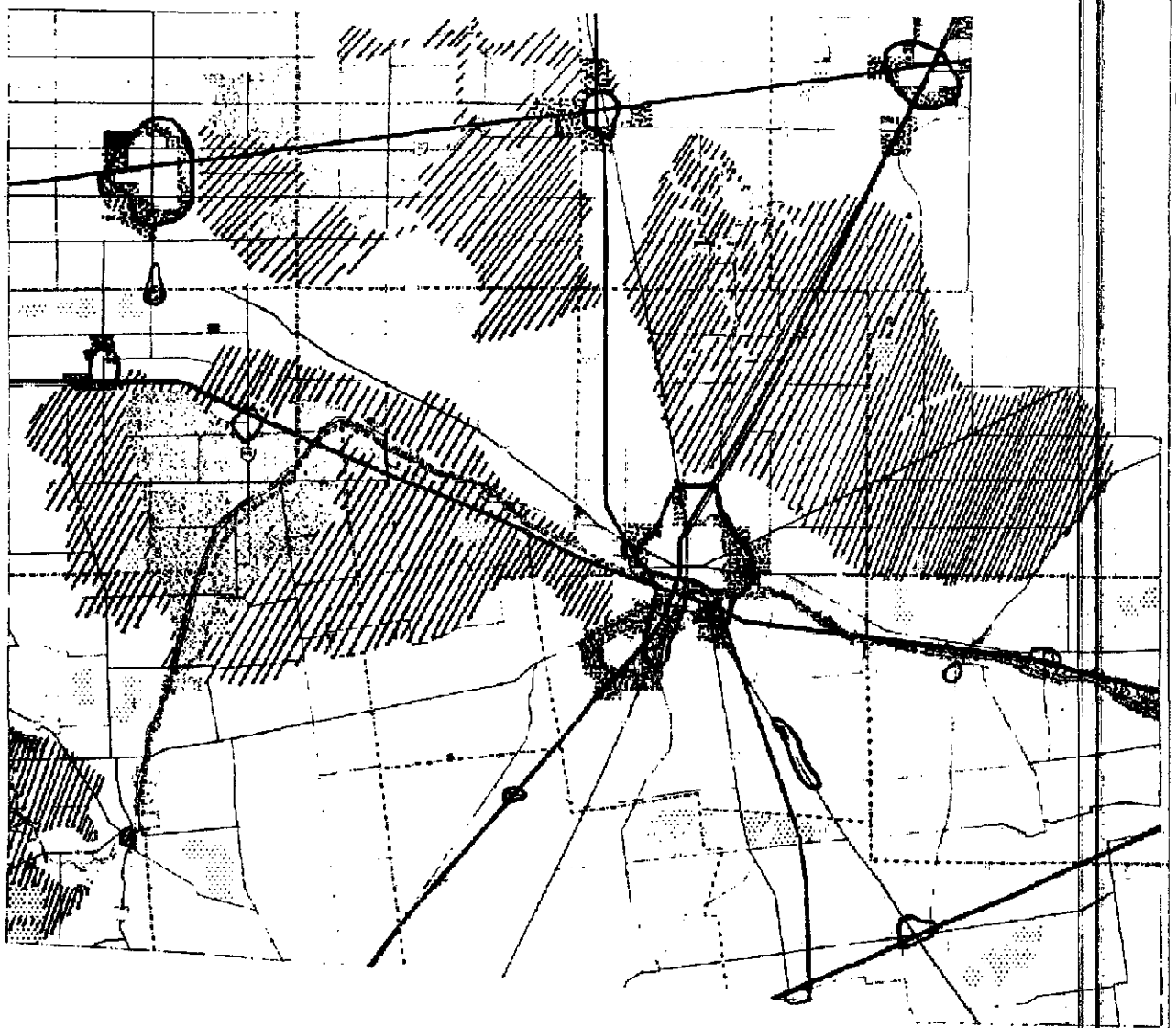
Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 30, 2009

hardin wind energy

Figure 08-05



HARDIN COUNTY
OFFICIAL LAND USE PLAN

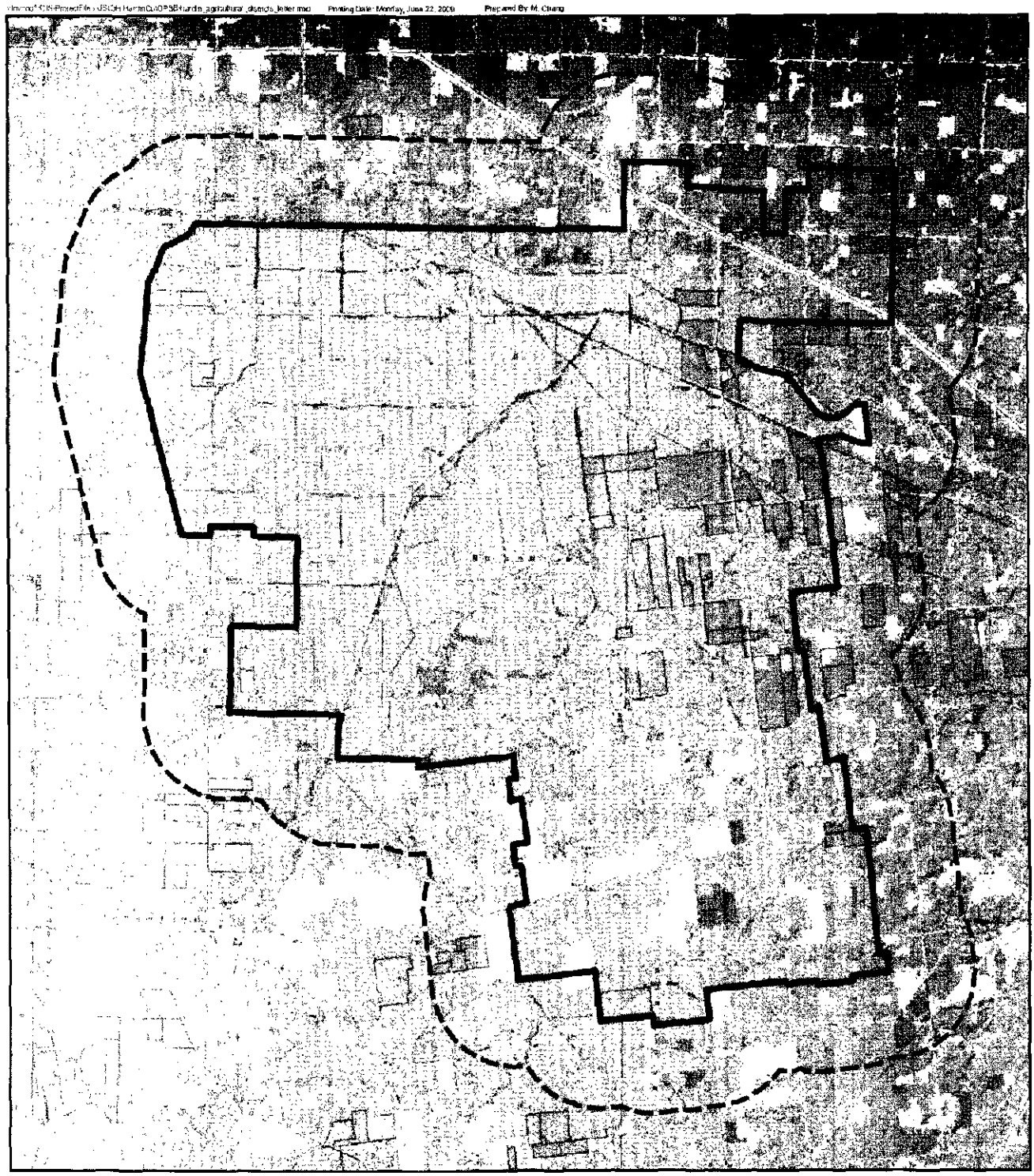
PLANNED LAND USE AREAS

- FLOOD PLAIN
- AGRICULTURAL LAND
- PRIME AGRICULTURAL LAND
- FOREST & TREE COVER
- MINERAL EXTRACTION
- INDUSTRIAL DEVELOPMENT
- COMMERCIAL DEVELOPMENT
- INCORPORATED MUNICIPALITY
- COMMUNITY EXPANSION
- RESIDENTIAL DEVELOPMENT & HOUSING
- PUBLIC & QUASI-PUBLIC LAND
- PARKLAND & OPEN SPACE
- TOWNSHIP LINES
- MAXIMUM GROWTH

HARDIN COUNTY

0 2000

Figure 08-06



Legend

- Agricultural District
- Pasture/Hay
- Cultivated Crops
- 1-Miles Project Boundary Setback
- Study Area Boundary

Notes:
1. *U.S.G.S. 7.5 Minute Series Topographic Maps:*
   - Harrod Quadrangle, OH; 1961, Photoinsp. 1984
   - Alger Quadrangle, OH; 1961
   - Forsker Quadrangle, OH; 1961, Photoinsp. 1984
   - Roundhead Quadrangle, OH; 1960, Photorev. 1982
   - Silvercreek Quadrangle, OH; 1960, Photorev. 1973
2. *Multi-Resolution Land Characteristics Consortium (MRLC)* National Land Cover Database (NLCD) 2001
3. Hardin County, State of Ohio

N

5,000 0 5,000

Feet

Hardin Agricultural Impact

Hardin Wind Farm, Hardin County, Ohio

Rev. 00

June 22, 2009

Wildlife Studies for the Hardin Wind Resource Area Hardin County, Ohio

Interim Report
September 3, 2008 – June 25, 2009

Prepared for:

Invenergy Wind
7564 Standish Place, Suite 123
Rockville, Maryland 20855

Prepared by:

Rhett E. Good, Kimberly Bay and Michelle Carder

Western EcoSystems Technology, Inc.
2003 Central Avenue
Cheyenne, Wyoming

June 30, 2009

EXECUTIVE SUMMARY

Hardin Wind Energy LLC, an affiliate of Invenergy Wind Development LLC is proposing to develop a wind-energy facility in the Hardin Wind Resource Area, located in Hardin County, Ohio. Hardin Energy LLC requested Western EcoSystems Technology, Inc. to develop and implement a standardized protocol for baseline wildlife use studies in the Hardin Wind Resource Area for the purpose of estimating impacts of the wind-energy facility on wildlife. The protocols were based on the final wildlife study guidelines from the Ohio Department of Natural Resources, correspondence received from the ODNR, and a meeting held with Ohio Department of Natural Resources and US Fish and Wildlife Service officials on September 3, 2008. Protocols used in the study were approved by the US Fish and Wildlife Service in a letter dated February 3, 2009. The Ohio Department of Natural Resources also stated that they had no objections to the proposed protocols in e-mail dated December 12, 2008 and June 26, 2009.

Reasonable predictions of impacts to wildlife at proposed wind-energy facilities in Ohio are complicated by the lack of post-construction studies and lack of current wind-energy facilities in Ohio, and the existence of relatively few studies of wind-energy facilities in the Midwest. In lieu of Ohio comparison areas, results of bird surveys conducted to date were compared to data collected at other wind-energy projects across the US. The data collected on bird use at the Hardin Wind Resource Area to date suggest that raptor migration rates are lower than migration rates observed at other wind-energy facilities and hawk migration counts across the US. Only three sandhill cranes were observed during sandhill crane surveys, and thus far, relatively high numbers of migrating passerines were not observed utilizing the project as stopover habitat. The proposed wind-energy facility is located within an area dominated by tilled agriculture, which is recommended by the US Fish and Wildlife Service in their interim guidelines as more suitable for wind-energy development than native habitats. Some species considered sensitive or endangered by the Ohio Department of Natural Resources were observed during surveys; however; data collected to date do not suggest that most listed species are numerous within the project area. One potential exception is the northern harrier; however, northern harriers are generally not considered to have especially high risks of colliding with turbines due to the species tendency to hunt close to the ground. Potential impact analyses, including examining flight height data, will be presented within the final report for this project.

Studies of breeding songbirds, passerine migration counts, and acoustic bat surveys will be completed by November 15, 2009. The methods to be utilized to complete the surveys will be consistent with Ohio Department of Natural Resources guidelines, and protocols have been approved by the Ohio Department of Natural Resources. A full report describing the results of all surveys and potential impacts analyses will be written once all surveys are completed.

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INTRODUCTION

Hardin Wind Energy LLC (HARDIN), an affiliate of Invenergy Wind Development LLC is proposing to develop a wind-energy facility in the Hardin Wind Resource Area (HWRA), located in Hardin County, Ohio (Figure 1). HARDIN requested Western EcoSystems Technology, Inc. (WEST) to develop and implement a standardized protocol for baseline wildlife use studies in the HWRA for the purpose of estimating impacts of the wind-energy facility on wildlife. The protocols were based on the final wildlife study guidelines from the Ohio Department of Natural Resources (ODNR), correspondence received from the ODNR (Appendix A), and a meeting held with ODNR and US Fish and Wildlife Service (USFWS) officials on September 3, 2008. Protocols used in the study were approved by the USFWS in a letter dated February 3, 2009. The ODNR also stated that they had no objections to the proposed protocols in e-mails dated December 12, 2008 and June 26, 2009.

The following is an interim report describing the results of surveys during the fall of 2008 and spring of 2009. The scope of the fall and spring wildlife studies included diurnal bird/raptor migration surveys, passerine migration surveys, sandhill crane migration surveys, raptor nest surveys, and incidental wildlife observations. Other work currently in progress for the HWRA includes breeding songbird surveys, passerine migration surveys, acoustic bat surveys, and bat mist-nesting surveys.

STUDY AREA

The proposed HWRA is located on approximately 35,862 acres (ac; 56.0 square miles [mi^2]; 145.1 kilometers [km^2]) in northwestern Ohio in Hardin County (Figure 1). The HWRA is located in the Level IV Clayey, High Lime Till Plains Ecoregion within the Eastern Corn Belt Plains physiographic region of Ohio (Woods et al. 1998). This zone covers approximately the western one third of the state and is a rolling till plain with local end moraines. Elevations in the study area range from approximately 935-1,099 feet (ft; 285-335 meters [m]). The boundaries of the proposed HWRA occur within an area formerly dominated by wetlands and American beech (*Fagus grandifolia*) and elm (*Ulmus americana*) forests, which has been converted almost entirely to corn (*Zea mays*), soybean (*Glycine max*), carrot (*Daucus carota*) and livestock production (Figure 2). According to the National Landcover Dataset (2001; Table 1), cultivated cropland and developed open space are the two most dominant land use types, totaling approximately 92 % of the total land area. Forested areas and pasture/hay fields comprise 3 % each of the project area. The remaining area is comprised of developed areas, wetlands, grasslands, open water and barren land (Table 1). Developed areas are generally confined to residences and farms scattered throughout the site, and are found within the town of McGuffey.

The Scioto and Miami Rivers and associated tributaries are present within the project boundary. Most streams, including the Scioto River, have been altered from their natural state, and are heavily channelized.

The proposed project experiences relatively moderate to warm summers, and cool winters. The temperature range in winter is 19-40°F (-7.2-4.4 °C), and the summer temperature range is 59-89

°F (15.0-31.7 °C). Total annual precipitation in the area is 34-40 inches (in; 86.4-101.6 centimeters [cm]) (Woods et al. 1998).

METHODS

Diurnal Bird/Raptor Migration Surveys

The objective of the diurnal bird/raptor migration surveys was to estimate the temporal and relative abundance raptors (defined here as kites, accipiters, buteos, harriers, eagles, falcons, and owls) migrating through the HWRA. Fixed-point surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980).

Survey Plots
Four survey points were established within the HWRA to survey for migrant raptors and other diurnal migrants (Figure 1). The points were selected within areas representative to turbine locations, and areas that maximized viewsheds surrounding the point location. The survey radius of the circular plots was up to a half-mile (2,625 ft; 800 m), depending on the limitations of the terrain. Efforts were made to place the plots in areas containing maximum visibility.

Survey Methods
The four plots were surveyed for 1.75 hours each survey day, for a total of seven hours of observation. All large birds observed perched or flying over the plot were recorded and mapped during the entire survey. Small birds (e.g., sparrows) within 100 m (328 ft) of the point were recorded during the first 10 minutes (min) of the survey, but were not mapped. Observations of large birds beyond the 800-m (2,625-ft) radius were recorded, but were not included in the statistical analyses. A unique observation number was assigned to each observation.

The behavior of each raptor/large bird observed and the habitat in which or over which the bird occurred was recorded. Behavior categories recognized include perched (PE), soaring (SO), flapping (FL), flushed (FH), circle soaring (CS), hunting (HU), gliding (GL), and other (OT, noted in comments). Vegetation types within which or over which observations were made were also recorded. Flight tracks and vegetation types (at first observation) were uniquely identified on the data sheet. The flight direction of observed birds was also recorded on the data sheet map. Approximate flight height above ground level (AGL) at first observation was recorded to the nearest three ft (one m); the approximate lowest and highest flight heights observed was also recorded. For each bird observed the amount of time spent flying in the rotor swept area, or 20 – 120 m (66 – 394 ft) AGL) was estimated to the nearest minute. Any comments or unusual observations were noted in the comments section. Locations of raptors, other large birds, and any species of interest seen were recorded on the field maps by observation number. The field maps were prepared as portions of recent aerial photographs, which included the survey plot.

Landmarks were located to aid in identifying the 800-m (2,625-ft) boundary of each observation plot. Observations of birds beyond the specified radius of a half-mile were recorded, but were not included in the standardized use estimates. Weather information, including temperature, wind speed, wind direction, cloud cover, and barometric pressure were recorded for each survey point.

The date, start, and end time of observation period, plot number, species or best possible identification, number of individuals, sex and age class if possible, distance from plot center when first observed, height (AGL), activity, vegetation type(s), and estimated amount of time spent flying in rotor swept area were recorded.

Observation Schedule
Sampling intensity was consistent with the recommendations of the ODNR. Surveys were conducted approximately three times per week during the fall (September 3 – October 31, 2008) and spring (March 16 – May 1, 2009). To the extent practical, all surveys were conducted between 0900 – 1600 hrs, and each plot was surveyed during a different time of day from the previous survey.

Passerine Migration Surveys

The objective of the passerine migration surveys was to estimate the temporal and overall rate of use of the combined forest, shrub and native grassland habitats in the general area by migrating birds. Passerine migration data consisted of counts of birds observed within circular plots around fixed observation points following standard methods (Reynolds et al. 1980). Surveys were conducted once weekly during the fall and spring (September 15, 2008 – November 15, 2008; March 30, 2009 – May 1, 2009).

In order to be consistent with the ODNR's guidelines, surveys will continue from May 1 - May 31, 2009 and August 15 – September 15, 2009.

Per ODNR recommendations, three point-count stations were placed in the proposed HWRA (Figure 1). Stations were stratified throughout the study area and placed on leased lands with forested and shrub habitats. Station locations within these habitats were randomly selected. The radius of the survey plot included areas up to 200 m (656 ft), depending on terrain limitations.

Passerine migration surveys were scheduled to occur during daylight hours, between 0600 and 1000 hrs. During a set of surveys, each plot was visited once. Stations were surveyed for 10 min each survey day. Any bird seen or heard during the survey was recorded. Each bird's estimated distance from the observer was recorded to the nearest three ft (one m). Any bird flying over the plot that did not originate from or land within 200 m (656 ft) of the center of the plot was recorded as a "fly over". The flight direction of observed birds was also recorded. Approximate flight height AGL at first observation was also recorded to the nearest three ft; the approximate lowest and highest flight heights observed was also recorded.

The behavior of each bird observed during the surveys was recorded. Behavior categories recognized include perched (PE), soaring (SO), flapping (FL), flushed (FH), circle soaring (CS), hunting (HU), gliding (GL), and other (OT, noted in comments). Any comments or unusual observations were noted in the comments section. Weather information, including temperature, wind speed, wind direction and cloud cover, was recorded for each survey point. The date, start, and end time of observation period, plot number, species or best possible identification, number of individuals, sex and age class if possible, distance from plot center when first observed, closest distance, height (AGL), and activity were recorded.

Sandhill Crane Migration Surveys

Sandhill crane (*Grus canadensis*) migration surveys were an extension of weekly diurnal bird/raptor migration protocol. Surveys were conducted approximately three days per week from November 8 through December 13, 2008. Surveys were conducted between 0900 – 1600 hrs.

Raptor Nest Surveys

Potential raptor nesting habitat was present in the form of deciduous trees and man-made structures such as power poles. One survey for raptor nests was conducted in the study area and a one-mile (1.6 km) buffer on March 25, 2009. Surveys were conducted from public roads within the boundary and a one mile buffer of the HWRA. Woodlots were searched on foot if they could not be adequately surveyed from public roads, and if lands were leased by HARDIN. The survey effort focused on species that build large nest structures, such as red-tailed hawk (*Buteo jamaicensis*). The species and locations of nest sites were marked on recent aerial photographs. Data recorded for each nest site included nest status (active or inactive), species occupying nest site, behavior of adults at the nest, nest condition (poor, fair, good), nest location (GPS coordinates) and nest substrate.

Breeding Bird Surveys

Surveys for breeding songbirds will be conducted during the summer of 2009. The purpose of these surveys will be twofold: 1) To serve as pre-construction data for a songbird habitat disturbance and avoidance study and 2) Identify any state listed songbirds breeding within the project area. Approximately 7% of the project area is located within native habitats that will require surveys. Assuming that 7% of 150 turbines will occur in native habitats, 11 turbines (22 point count locations) will be surveyed (Figure 2). Three 10 -minute surveys will be conducted at each point (1 in May 2009, and 2 in June 2009). Turbine locations will not be available at the start of the surveys, and survey points will be spread across the project area, within non-cropland habitats. The number of points in each habitat type will vary with the percentage of habitat types within the project area. Point count locations will only be placed on leased land within the project area.

One additional survey will occur in July 2009. This survey will occur only in areas with suitable habitat for Henslow's sparrows, Dickcissels, and/or sedge wrens. These are areas that contain or are directly adjacent to >50 hectares of contiguous grassland or >1 hectare of wet meadow or freshwater marsh. Based on preliminary assessments, 2 – 4 point-count locations may require a single survey in July 2009.

Surveys will be conducted by experienced personnel able to distinguish species by sight and sound. Surveys will begin at approximately dawn and will not extend past 10 am. Surveys will not be conducted on mornings with winds exceeding 5 m/s, periods of rain lasting more than 20 minutes or heavy fog due to reduced detectability of birds.

All birds observed during point-counts will be identified to species level, or best possible identification. The distance to each bird will be estimated to the nearest 3 ft (1 m). Birds that fly over the point and do not originate from, or land within 200 m of the center of the plot will be recorded as a "fly over". The flight direction (bearing) of observed birds will be recorded and flight characteristics [height above ground (AGL) at first observation, lowest and highest observations] will be recorded to the nearest meter. Using the breeding bird atlas codes[1], indications of breeding activity will be recording in addition to each bird's behavior. Behavior categories recognized include perched (PE), soaring (SO), flapping (FL), flushed (FH), circle soaring (CS), hunting (HU), gliding (GL), and other (OT, noted in comments). Weather information, including temperature, wind speed, wind direction and cloud cover, will be recorded for each survey point. Any comments or unusual observations will be noted in the comments section and incidental observations of state and federal threatened or endangered species will be recorded regardless of whether they were detected within the survey time or while at a point-count location.

Acoustic Bat Surveys

Bats will be surveyed in the HWRA using AnaBat® II (AnaBat) ultrasonic detectors coupled with Zero Crossing Analysis Interface Modules (ZCAIM) (Titley Electronics Pty Ltd., NSW, Australia). The detectors use a broadband high-frequency microphone to detect and record the echolocation calls of foraging and commuting bats. Incoming echolocation calls are digitally processed by the detector and passed to the ZCAIM for further processing and data storage. Each series of echolocation calls is saved to a file on a high-capacity CompactFlash™ card, and these files are then transferred to a computer for analysis. The ZCAIM produces a file that, when viewed in appropriate software, produces a digital "sonogram" of the echolocation calls showing change in frequency over time. During analysis, these frequency-versus-time displays can be useful for identifying the species of bat that generated the calls, and are used to separate bat calls from other types of ultrasonic noise (e.g., wind, insects, etc.). To help reduce interference from these other sources of ultrasonic noise a sensitivity level of six will be used on the detectors, depending on the level of background noise.

The overall goal of the acoustic bat surveys is to determine if the project area is heavily utilized by bats, especially during the migration period. The majority of migration for these species occurs from August 1 – September 15. The proposed HWRA will be sampled continuously from March 15 through November 15, 2009 in order to include the spring migration, summer breeding, and fall migration seasons. Monitoring will occur at all met towers within the project area. A detector will be placed at 5 m AGL, and one near the top of the met tower (within the rotor swept area of turbine blades) for total of two detectors at each met tower (Figure 1). Each detector's sensitivity will be adjusted to detect a calibration tone at 20 meters and the units will be programmed to monitor activity from 0.5 hour before sunset until 0.5 hour after sunrise.

The metric of interest for this study will be number of bat calls per detector per night. The total number of bat passes, regardless of species, as well as by species group, will be used as an index of bat use within the HWRA. A pass is defined as a train of echolocation calls produced by an individual bat, and consists of a continuous series of ≥ 2 call notes with no pauses between call

notes of > 1 second. The number of bat passes will be determined by downloading the calls from ZCAIMS onto a computer and counting the number of echolocation passes recorded.

All data files collected by the detectors will be analyzed, and bat calls will be separated from non-bat noise files. Bat calls will be identified to species group by frequency. Calls will be identified by comparing visual metrics (e.g., minimum frequency, slope, duration) to reference calls of known bats. Where possible, calls of non-myotis will be identified to species. Data suggest that a handful of species face disproportionate risks from wind turbines (Johnson 2005; Kunz et al. 2007).

To assess potential for bat mortality, the mean number of bat passes per detector-night will be compared to existing data from other wind-energy facilities where both bat activity and fatality levels have been measured. Although fatality rates correlate with activity levels at some locations, this may not be true at all facilities. Turbine-related bat fatalities are likely the result of complex interactions among variables at multiple spatial and temporal scales, and the biology and ecology of the bats in a particular area. A clear picture of which of these variables are most important has not yet emerged, though migratory tree-roosting bats seem to be most susceptible at many of the wind-energy facilities studied to date (Johnson 2005). The proposed study will add to the general understanding of the relationships between overall bat activity and bat fatality rates.

Bat Mistnet Surveys

Bats will also be surveyed using mist nets. Because some bats can not be identified to species based solely on echolocation calls, it is important that mist net surveys be conducted to confirm species presence. Mist-net surveys will be conducted in accordance with USFWS guidelines for Indiana bats (*Myotis sodalis*), and will be performed by an individual approved to handle Indiana bats.

ODNR has recommended that nine net sites be placed throughout the forested areas of the project (Appendix A). At each netting site, a minimum of four net sets will be used, with at least one set being a high net (7.5 meters tall). Each site will be surveyed twice between June 15 – July 31, 2008 and will have at least one day occurring between the two survey efforts. Mist netting will take place during the five hours following sunset.

For every mist netting night the date, start, and end time, site description, site coordinates, type of mist net setup (stacked or single), and weather data (temperature, cloud cover and wind speed) will be recorded. Captured bats will have the species, sex, reproductive status, capture status (recapture/new) and measurements (forearm, ear, tragus, and weight) recorded. The net number each captured bat was found in will also be recorded. Documentation photographs will be taken of each bat and a small (~ 5 mm) mark of non-toxic, water-soluble paint applied to the forearm to identify recaptures.

During mist netting survey additional information will be recorded if Indiana bat, Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), or eastern small-footed myotis (*Myotis leibii*) are encountered. Captured individual will have voucher photographs taken of species-specific

identifiable features (head, body, calcar, foot, or masks). Following USFWS guidelines, any captured Indiana bat or Rafinesque's big-eared bat will be banded using bands provided by ODNR. Eastern small-footed myotis will not be banded because of concerns of entrapment associated with its over-wintering habitat. Up to 4 Indiana bats (3-4 females, no more than 1 male) and all Rafinesque's big-eared bats or eastern small-footed myotis will be outfitted with radio-transmitters. The purpose of the telemetry study will be to determine if endangered bats are utilizing areas in or near the project area for breeding or as hibernacula. Radio tagged bats will have their home range determined by recording locations every night at five minute intervals for the life of the transmitter allowing for identification of roost trees and maternity colonies. Each roost tree or maternity colony identified will have photographs, GPS location, tree species, DBH, site characteristics, and emergence counts collected. If >15 lactating females of a more common colonial species are captured in one night radio telemetry will be used to identify the location of the maternity colony. Maternity colony locations will be determined using a maximum of 10 transmitters stratified across the proposed facility. All equipment used for netting will be decontaminated following USFWS protocols due to the concern over White Nose Syndrome (WNS).

Incidental Wildlife Observations

Wildlife observations, especially large birds (raptors, shorebirds, waterfowl, waterbirds, upland gamebirds), and unusual species (such as state listed or sensitive-status species, mammals, reptiles, and amphibians) sighted while observers were traveling between plots or on the HWRA were recorded on in-transit or incidental wildlife observation data sheets. The observation number, date, time, species, number of individuals, sex/age class, and habitat were recorded. Observations of threatened, endangered, or sensitive species were recorded in additional detail, mapped on a US Geological Survey (USGS) quadrangle map or GPS coordinates by the unique observation number, and summarized.

RESULTS

This interim report presents the results of the field work conducted in the fall of 2008 and spring 2009 for the HWRA.

Diurnal Bird/Raptor Migration Surveys

A total of 163 1.75-hour surveys were conducted during fall and spring diurnal bird/raptor migration surveys. A total of 205 raptors were observed within 184 separate groups and eleven unique raptor species were recorded (Table 2). In addition, 696 turkey vultures (*Cathartes aura*) were recorded within 419 groups. The most common raptors observed were red-tailed hawks (105 individuals) and northern harriers (*Circus cyaneus*; 54). The number of raptors observed per day ranged from one to 60 (Figure 3), with an average of 20.0 raptors/day, while vultures ranged from one to 53 vultures (Figure 4), with an average of 18.4 vultures/day. Raptor and vulture observations both peaked on September 20.

Passerines were by far the most abundant bird type observed in the HWRA during the diurnal bird/raptor migration surveys, comprising 74.3% of all observations (Table 2). This was primarily due to high numbers of European starling (*Sturnus vulgaris*; 1,628 individuals) and red-winged blackbird (*Agelaius phoeniceus*; 1,411 individuals). Eight unique species of shorebirds were observed (841 waterbirds observed; 8.3% of all observations) during the diurnal bird/raptor migration surveys. Four unique waterbird and three unique waterfowl species were also recorded. Waterbirds totaled 60 individuals in 32 groups, and waterfowl, totaled 425 individuals in 45 groups.

Passerine Migration Surveys

Bird use point surveys were conducted at the HWRA nine times during the fall (September 1 – October 31, 2008) and five times in the spring (March 30 – May 1). Thirty-six unique species were identified (Table 3). A total of 358 individual bird observations within 200 separate groups were recorded (Table 3). Cumulatively, three species (8.3% of all species) composed 49.4% of the individual observations. These were red-winged blackbird, European starling, and American robin (*Turdus migratorius*). All other species composed no more than ten percent of the observations individually.

Sandhill Crane Migration Surveys

Sandhill crane surveys were conducted on 16 days, for a total 64 surveys between November 8 and December 13, 2008. A total of 1,909 individual bird observations within 298 separate groups were recorded (Table 4). Only one group with three individual sandhill cranes was observed during migration surveys. Passerines were the most abundant group with 1,298 individual observations, followed by waterfowl (251 individual observations), and doves/pigeons with 170 individual observations.

Raptor Nest Surveys

One active red-tailed hawk nest and three inactive nests were located in the HWRA (Figure 5). The inactive nests were likely those of red-tailed hawk based on the relative abundance of this species in the HWRA.

Breeding Bird Surveys

Breeding bird surveys are currently in progress. Surveys were conducted at the 22 point count locations on May 9,13,15 and June 10,11, and 12. The second round of surveys in June will be completed during the week of June 22. One additional survey will be conducted in July within grassland habitats that meet standards described within the ODNR guidelines. The results of the breeding bird surveys will be presented within the final wildlife report.

Acoustic Bat Surveys

Anabat detectors were placed at Met tower one on March 18, 2009. Equipment failures resulted in malfunctioning units during March. Anabat units began continuous recording on April 1,

2009. The first bat pass was recorded on April 16, 2009. Additional Anabat units were placed at Met tower two on June 16, 2009, and will be monitored through November 15, 2009. The third met tower will be monitored beginning the week of June 20 through November 15, 2009. The results of the acoustic bat monitoring will be presented within the final wildlife report.

Bat Mistnet Surveys

Bat mistnet surveys were conducted at nine sites between June 15 – June 25, 2009. Summaries of bat captures are presented in Table 5 and Figure 6. Total numbers of bats captured at all nine sites will be presented within the final report. No Indiana bats (*Myotis sodalis*) were captured at the nine sites.

Incidental Wildlife Observations

Incidental wildlife observations recorded at the HWRA included 14 bird species and five mammal species (Table 6).

Bird Observations
Birds recorded incidentally at the HWRA totaled 141 individuals in 87 groups (Table 6). The most commonly recorded incidental bird species was American kestrel (*Falco sparverius*; 40 observations), followed by turkey vulture (27), red-tailed hawk (17), Canada goose (*Branta canadensis*; 15), and American crow (*Corvus brachyrhynchos;* 13). Two species, wild turkey (*Meleagris gallopavo*; seven observations) and short-eared owl (*Asio flammeus*; one observation), were observed during other surveys at the HWRA. One state endangered species, northern harrier (six observations), and one species of special concern, short-eared owl were observed incidentally.

Mammal Observations
The most commonly recorded incidental mammal species was Twenty-six white-tailed deer (*Odocoileus virginianus*; 26 observations). Two raccoon (*Procyon lotor*) were also observed, along with one coyote (*Canis latrans*), groundhog (*Marmota monax*), and an unidentified flying squirrel (*Glaucomys* spp.; Table 6).

Threatened and Endangered Species Observations

Two Ohio state-listed endangered species, the northern harrier and sandhill crane, were recorded within the HWRA (93 and three observations, respectively). In addition, three species of special concern in Ohio were recorded within the proposed wind resource area: golden-crowned kinglet (*Regulus satrapa*; four observations), red-breasted nuthatch (*Sitta canadensis*; one observation), and short-eared owl (one observation).

DISCUSSION

The primary purpose of conducting pre-construction wildlife surveys at proposed wind-energy facilities is to provide information for making reasonable estimates of potential impacts. The methods used to collect information on bird and bat populations at the HWRA closely follow the

final ODNR guidelines (Dated May 4, 2009). The ODNR guidelines provide a framework for establishing relatively consistent methods to be used at wind-energy facilities in Ohio, which will allow results to be compared between facilities within Ohio. Currently, the results from one pre-construction wildlife survey are available for comparison, and no data are available describing measured impacts to wildlife populations from post-construction studies at wind-energy facilities in Ohio. However, the impacts of wind-energy facilities to wildlife have been studied at several facilities across the US. Thus, our estimates of potential impacts to wildlife are based on studies of wind-energy facilities conducted throughout the US, with a focus of available studies from the Midwest.

The results presented within this report are part of a larger, ongoing study for the HWRA. Surveys of raptor migration, sandhill crane migration, and passerine migration are largely complete, and initial assessments of potential impacts to these resources are described below. Surveys for breeding songbirds and bats are ongoing. Impacts to bats and breeding songbirds are not addressed in this report, but will be provided after surveys are complete.

Impacts to wildlife resources from wind-energy facilities can be direct or indirect. Indirect impacts include the potential for wildlife to avoid wind turbines, resulting in a net decrease in available habitat. Indirect impacts are not addressed in this report, but will be addressed once breeding songbird surveys are complete. Direct impacts are considered to be the potential for fatalities from construction and operation of the proposed wind-energy facility.

Project construction could affect birds through loss of habitat, potential fatalities from construction equipment, and disturbance/displacement effects from construction activities. Impacts from the decommissioning of the facility are anticipated to be similar to construction in terms of noise, disturbance, and equipment. Potential mortality from construction equipment is expected to be very low. Equipment used in wind facility construction generally moves at slow rates or is stationary for long periods (e.g., cranes). The risk of direct mortality to birds from construction is most likely potential destruction of a nest for ground- and shrub-nesting species during initial site clearing. Impacts from the construction of the proposed project to wildlife are not expected to jeopardize the continued existence of bird and bat populations, based on the preponderance of tilled agriculture within the project area.

Initial assessments of impacts from operation of the project are described for the following species or groups of species: raptors, sandhill cranes, migrating passerines, and endangered or sensitive species.

Raptors

Although high numbers of raptor fatalities have been documented at some wind-energy facilities in the western US (e.g. Altamont Pass), a review of studies at wind-energy facilities across the United States reported that only 3.2% of casualties were raptors (Erickson et al. 2001a). Wind-energy facilities that have shown the highest raptor fatality rates have also shown the highest raptor use rates (Figure 7). Comparing raptor use at HWRA to wind-energy facilities in the west, where raptor fatality rates have been highest, provides one metric for estimating potential impacts. Fall and spring raptor use at the HWRA was relatively low when compared to western

wind-energy facilities (Figures 8 and 9). Similarly, use rates at HWRA were low when compared to raptor migration count stations in the eastern US (Table 7). Raptor nest densities within the proposed HWRA were also relatively low, and only one active red-tailed hawk nest was documented during nest surveys.

The susceptibility of raptor to collisions with wind turbines may also be influenced by individual species biology and hunting habits. For example, only three northern harrier fatalities at existing wind-energy facilities have been reported in publicly available documents, despite the fact they are commonly observed during point counts at many wind-energy facilities (Erickson et al. 2001a; Whitfield and Madders 2006). Because northern harriers often hunt close to the ground, risk of collision with turbine blades is generally considered low for this species. A full assessment of risk, including examinations of flight heights and species behavior, will be included within the final bird and bat report for the HWRA.

To date, relatively few raptor fatalities have been reported at wind-energy facilities in the Midwest located within landscapes dominated by tilled agriculture. A total of four raptors were recorded as fatalities at studies of four wind-energy facilities in Iowa, Wisconsin, Minnesota, Illinois and Ontario located in tilled agriculture landscapes (Howe et al. 2002, Johnson et al 2002, 2003, 2004, Jain 2005, James 2007, Kerlinger et al. 2007). Studies of other wind-energy facilities in areas dominated by tilled agriculture are currently underway. The impacts of wind-energy facilities in the Midwest and Ohio to raptors will be better understood as more research at wind-energy facilities is conducted.

Sandhill Cranes

The sandhill crane is listed as a threatened species by the State of Ohio. Some concern exists regarding the potential for wind-energy facilities to cause fatalities of birds as they migrate between breeding areas north of Ohio, and wintering areas south of Ohio. Surveys within the Hardin WRA followed ODNR guidelines, and were timed to coincide with sandhill crane migrations. One group of three sandhill cranes was observed within the HWRA. The level of sandhill crane use of the HWRA was relatively low, when compared to well used stopover sites. For example, more than 10,000 sandhill cranes utilize the Jasper-Pulaski Indiana Fish and Wildlife Area as stopover habitat during the fall migration (IDNR 2009).

Migrating Passerines

To date, overall fatality rates for birds (including nocturnal migrants) at wind-energy facilities have been relatively consistent in the Midwest. The range of overall bird fatality estimates at four Midwest wind-energy facilities that were studied using comparable methods have ranged from 0.7 to 3.4 birds/MW/year (Howe et al. 2002; Johnson et al. 2002b; Jain 2005; Kerlinger et al. 2007). Bird fatality rates have been shown to be higher in the eastern US, especially within forested landscapes (NRC 2007).

Data collected to date at the HWRA do not seem to show high numbers of passerines utilizing the proposed wind-energy facility as stopover habitat. However; the lack of post-construction studies of facilities in Ohio makes it difficult to utilize the data collected at HWRA to predict

potential impacts to migrating passerines. The proposed facility is located within a landscape largely dominated by tilled agriculture, which is generally recommended by the USFWS as more suitable for wind development versus areas containing native habitats (USFWS 2003). The proposed HWRA and the surrounding landscape is more similar to the wind-energy facilities studied in tilled agricultural landscapes the Midwest versus those studied in more forested landscapes in the eastern US. The efficacy of passerine migration counts as predictors of potential bird fatality rates will be better understood after more research is conducted at wind-energy facilities in Ohio.

Endangered or Sensitive Species

Three sandhill cranes and 93 northern harriers, both state endangered species in Ohio, were observed during all surveys. The number of sandhill cranes observed in the study area was low, relative to known stopover sites utilized by sandhill cranes during migration. The majority of the northern harrier observations were recorded during the raptor migration and sandhill crane migration periods, between September 1 – December 15. These may represent individuals migrating through the study area, or wintering within the area. The number of northern harriers reported during the survey may not represent 93 individuals; rather, they may represent repeated observations of the same individuals.

Between one to four observations of golden-crowned kinglet, short-eared owl, and red-breasted nuthatch, all state species of concern, were recorded during the passerine migration surveys, sandhill crane migration surveys, or as incidental wildlife observations. No Indiana bats were captured during mistnet surveys in the project area.

CONCLUSION

Reasonable predictions of impacts to wildlife at proposed wind-energy facilities in Ohio are complicated by the lack of post-construction studies and lack of current wind-energy facilities in Ohio, and the existence of relatively few studies of wind-energy facilities in the Midwest. In lieu of Ohio comparison areas, results of bird surveys conducted to date were compared to data collected at other wind-energy facilities across the US. The data collected on bird use at the HWRA to date suggest that raptor migration rates are lower than migration rates observed at other wind-energy facilities and hawk migration counts across the US. Only three sandhill cranes were observed during sandhill crane surveys, and thus far, high numbers of migrating passerines were not observed utilizing the HWRA as stopover habitat. The proposed wind-energy facility is located within an area dominated by tilled agriculture, which is recommended by the USFWS in their interim guidelines as more suitable for wind-energy development than native habitats. Some species considered sensitive or endangered by the ODNR were observed during surveys; however; data collected to date do not suggest that most listed species are numerous within the study area. One potential exception is the northern harrier; however, northern harriers are generally not considered to have especially high risks of colliding with turbines due to the tendency of this species to hunt close to the ground. Potential impact analyses, including examining flight height data, will be presented within the final report for this proposed wind-energy facility.

Studies of breeding songbirds, passerine migration counts and acoustic bat surveys will be completed by November 15, 2009. The methods to be utilized to complete the surveys will be consistent with ODNR guidelines, and protocols have been approved by the ODNR. A full report describing the results of all surveys and potential impacts analyses will be written once all surveys are completed.

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Table 1. Land cover types present within the project area (USGS 2001).

Land Cover Type	Acres	Percentage
Crops	31,636.60	88.22%
Developed, Open Space	1,546.85	4.31%
Deciduous Forest	1,075.44	3.00%
Pasture/Hay	1,022.80	2.85%
Grassland	304.73	0.85%
Developed, Low Intensity	217.80	0.61%
Developed, Medium Intensity	15.86	0.04%
Woody Wetlands	11.95	0.03%
Emergent Wetlands	11.88	0.03%
Open Water	10.04	0.03%
Developed, High Intensity	4.15	0.01%
Evergreen Forest	3.44	0.01%
Barren	1.34	0.00%
Total	**35,862.86**	**100**

Table 2. Summary of groups and individual observations from fall and spring diurnal bird/raptor migration surveys at the Hardin Wind Resource Area.

		Fall		Spring		Overall	
Species	Scientific Name	# grps	# obs	# grps	# obs	# grps	# obs
Waterbirds		**6**	**7**	**26**	**53**	**32**	**60**
Bonaparte's gull	*Larus philadelphia*	0	0	3	26	3	26
great blue heron	*Ardea herodias*	6	7	20	24	26	31
great egret	*Ardea alba*	0	0	1	1	1	1
ring-billed gull	*Larus delawarensis*	0	0	1	1	1	1
unidentified gull		0	0	1	1	1	1
Waterfowl		**11**	**328**	**34**	**97**	**45**	**425**
American wigeon	*Anas americana*	0	0	1	1	1	1
Canada goose	*Branta canadensis*	8	215	14	67	22	282
mallard	*Anas platyrhynchos*	2	13	17	24	19	37
unidentified duck		0	0	2	5	2	5
unidentified waterfowl		1	100	0	0	1	100
Shorebirds		**200**	**530**	**114**	**311**	**314**	**841**
American golden-plover	*Pluvialis dominica*	0	0	2	39	2	39
greater yellowlegs	*Tringa melanoleuca*	1	1	0	0	1	1
killdeer	*Charadrius vociferus*	196	502	102	131	298	633
pectoral sandpiper	*Calidris melanotos*	0	0	1	6	1	6
semipalmated sandpiper	*Calidris minutilla*	0	0	3	56	3	56
spotted sandpiper	*Actitis macularia*	1	8	0	0	1	8
unidentified sandpiper		1	4	0	0	1	4
unidentified shorebird		0	0	3	67	3	67
white-rumped sandpiper	*Calidris fuscicollis*	1	15	1	8	2	23
Wilson's snipe	*Gallinago delicata*	0	0	2	4	2	4
Raptors		**93**	**101**	**91**	**104**	**184**	**205**
American kestrel	*Falco sparverius*	14	17	2	2	16	19
bald eagle	*Haliaeetus leucocephalus*	1	1	0	0	1	1
broad-winged hawk	*Buteo platypterus*	1	1	0	0	1	1
Cooper's hawk	*Accipiter cooperii*	4	4	5	5	9	9
northern harrier	*Circus cyaneus*	34	37	17	17	51	54
osprey	*Pandion haliaetus*	1	1	0	0	1	1
peregrine falcon	*Falco peregrinus*	0	0	1	1	1	1
red-shouldered hawk	*Buteo lineatus*	0	0	3	3	3	3
red-tailed hawk	*Buteo jamaicensis*	28	30	62	75	90	105
rough-legged hawk	*Buteo lagopus*	0	0	1	1	1	1
sharp-shinned hawk	*Accipter striatus*	2	2	0	0	2	2
unidentified buteo		1	1	0	0	1	1
unidentified raptor		7	7	0	0	7	7
Vultures		**272**	**441**	**147**	**255**	**419**	**696**
turkey vulture	*Cathartes aura*	272	441	147	255	419	696

Table 2. Summary of groups and individual observations from fall and spring diurnal bird/raptor migration surveys at the Hardin Wind Resource Area.

		Fall		Spring		Overall	
Species	Scientific Name	# grps	# obs	# grps	# obs	# grps	# obs
Upland Gamebirds		**0**	**0**	**3**	**3**	**3**	**3**
ring-necked pheasant	*Phasianus colchicus*	0	0	3	3	3	3
Doves/Pigeons		**80**	**274**	**38**	**69**	**118**	**343**
mourning dove	*Zenaida macroura*	65	192	22	42	87	234
rock pigeon	*Columba livia*	15	82	16	27	31	109
Passerines		**469**	**5,638**	**526**	**1,937**	**995**	**7,575**
American crow	*Corvus brachyrhynchos*	75	277	91	145	166	422
American goldfinch	*Carduelis tristis*	7	12	3	5	10	17
American redstart	*Setophaga ruticilla*	0	0	1	2	1	2
American robin	*Turdus migratorius*	10	33	49	68	59	101
barn swallow	*Hirundo rustica*	19	86	8	10	27	96
blue jay	*Cyanocitta cristata*	30	47	9	14	39	61
bobolink	*Dolichonyx oryzivorus*	4	25	1	13	5	38
brown thrasher	*Toxostoma rufum*	0	0	1	2	1	2
brown-headed cowbird	*Molothrus ater*	11	65	38	80	49	145
chipping sparrow	*Spizella passerina*	0	0	4	7	4	7
common grackle	*Quiscalus quiscula*	5	83	54	142	59	225
eastern bluebird	*Sialia sialis*	3	4	0	0	3	4
eastern meadowlark	*Sturnella magna*	5	6	8	10	13	16
European starling	*Sturnus vulgaris*	75	1,262	62	366	137	1,628
field sparrow	*Spizella pusilla*	1	1	8	8	9	9
golden-crowned kinglet	*Regulus satrapa*	0	0	1	1	1	1
horned lark	*Eremophila alpestris*	117	296	72	123	189	419
house finch	*Carpodacus mexicanus*	1	1	0	0	1	1
house sparrow	*Passer domesticus*	12	96	0	0	12	96
Lapland longspur	*Calcarius lapponicus*	0	0	31	727	31	727
northern cardinal	*Cardinalis cardinalis*	7	8	5	5	12	13
purple martin	*Progne subis*	1	1	1	2	2	3
red-winged blackbird	*Agelaius phoeniceus*	41	1,234	57	177	98	1,411
savannah sparrow	*Passerculus sandwichensis*	1	2	10	15	11	17
snow bunting	*Plectrophenax nivalis*	2	3	0	0	2	3
song sparrow	*Melospiza melodia*	1	2	7	8	8	10
tree swallow	*Tachycineta bicolor*	6	34	4	6	10	40
unidentified blackbird		18	2,035	0	0	18	2,035
unidentified passerine		4	9	0	0	4	9
unidentified sparrow		7	9	0	0	7	9
vesper sparrow	*Pooecetes gramineus*	6	7	1	1	7	8
Other Birds		**8**	**9**	**5**	**5**	**13**	**14**
hairy woodpecker	*Picoides villosus*	0	0	1	1	1	1
northern flicker	*Colaptes auratus*	3	3	3	3	6	6
red-bellied woodpecker	*Melanerpes carolinus*	1	1	0	0	1	1

Table 2. Summary of groups and individual observations from fall and spring diurnal bird/raptor migration surveys at the Hardin Wind Resource Area.

		Fall		Spring		Overall	
Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
red-headed woodpecker	*Melanerpes erythrocephalus*	2	2	1	1	3	3
ruby-throated hummingbird	*Archilochus colubris*	1	1	0	0	1	1
yellow-bellied sapsucker	*Sphyrapicus varius*	1	2	0	0	1	2
Unidentified Birds		**3**	**29**	**0**	**0**	**3**	**29**
unidentified bird		3	29	0	0	3	29
Total		**1,142**	**7,357**	**984**	**2,834**	**2,126**	**10,191**

Table 3. Summary of groups and individual observations from fall and spring passerine migration surveys at the Hardin Wind Resource Area.

		Fall		Spring		Overall	
Species	Scientific Name	# grps	# obs	# grps	# obs	# grps	# obs
Waterfowl		**0**	**0**	**2**	**5**	**2**	**5**
Canada goose	*Branta canadensis*	0	0	1	2	1	2
mallard	*Anas platyrhynchos*	0	0	1	3	1	3
Shorebirds		**5**	**5**	**1**	**1**	**6**	**6**
killdeer	*Charadrius vociferus*	5	5	1	1	6	6
Raptors		**0**	**0**	**1**	**1**	**1**	**1**
red-tailed hawk	*Buteo jamaicensis*	0	0	1	1	1	1
Vultures		**0**	**0**	**1**	**2**	**1**	**2**
turkey vulture	*Cathartes aura*	0	0	1	2	1	2
Upland Gamebirds		**0**	**0**	**1**	**1**	**1**	**1**
ring-necked pheasant	*Phasianus colchicus*	0	0	1	1	1	1
Doves/Pigeons		**4**	**8**	**0**	**0**	**4**	**8**
mourning dove	*Zenaida macroura*	4	8	0	0	4	8
Passerines		**75**	**187**	**72**	**108**	**147**	**295**
unidentified passerine		5	7	0	0	5	7
Blackbirds/Orioles		*17*	*104*	*26*	*50*	*43*	*154*
Baltimore oriole	*Icterus galbula*	0	0	1	2	1	2
brown-headed cowbird	*Molothrus ater*	0	0	3	4	3	4
common grackle	*Quiscalus quiscula*	0	0	2	4	2	4
European starling	*Sturnus vulgaris*	12	39	13	30	25	69
red-winged blackbird	*Agelaius phoeniceus*	4	59	7	10	11	69
unidentified blackbird		1	6	0	0	1	6
Creepers/Nuthatches		*3*	*6*	*2*	*2*	*5*	*8*
red-breasted nuthatch	*Sitta canadensis*	0	0	1	1	1	1
white-breasted nuthatch	*Sitta carolinenis*	3	6	1	1	4	7
Flycatchers		*0*	*0*	*3*	*3*	*3*	*3*
eastern phoebe	*Sayornis phoebe*	0	0	3	3	3	3
Gnatcatchers/Kinglets		*2*	*3*	*1*	*1*	*3*	*4*
golden-crowned kinglet	*Regulus satrapa*	2	3	0	0	2	3
ruby-crowned kinglet	*Regulus calendula*	0	0	1	1	1	1
Grassland/Sparrows		*2*	*4*	*10*	*12*	*12*	*16*
field sparrow	*Spizella pusilla*	0	0	2	2	2	2
horned lark	*Eremophila alpestris*	1	1	1	1	2	2
northern cardinal	*Cardinalis cardinalis*	0	0	7	9	7	9
unidentified sparrow		1	3	0	0	1	3