APPENDIX 1 - Technical Specification of the Siemens 2.3-MW Mk II Wind Turbine

Rotor

Type	3-bladed, horizontal axis
Position	Upwind
Diameter	93 m
Swept area	6800 m^2
Synchronous rotor speed	6-16 rpm
Power regulation	Pitch regulation
Rotor tilt	6 degrees

Blade

Type	Self-supporting
Blade length	45 m
Tip chord	0.8 m
Root chord	3.5 m
Aerodynamic profile	NACA 63.xxx, FFAxxx
Material	GRE
Surface gloss	Semi-matt, <30/ ISO 2813
Surface color	Light gray, RAL 7035

Aerodynamic brake

Type	Full span pitching
Activation	Active, failsafe

Load supporting parts

Hub	Nodular cast iron
Main bearings	Spherical roller bearing
Main shaft	Alloy steel
Nacelle bedplate	Steel

APPENDIX 1 - Technical Specification of the Siemens 2.3-MW Mk II Wind Turbine

Transmission system

Coupling hub - shaft	Flange
Coupling shaft - gearbox	Shrink disc
Gearbox type	3-stage planetary-helical
Gearbox ratio	1 : 91
Gearbox lubrication	Splash/ forced lubrication
Oil volume	Approx. 400 l
Gearbox cooling	Separate oil cooler
Gearbox designation	PEAB 4456
Gearbox manufacturer	Winergy AG
Coupling gear - generator	Double flexible coupling

Mechanical brake

Type	Failsafe disc brake
Position	High speed shaft
Number of calipers	2

Generator

Type	Asynchronous
Nominal power	2300 kW
Synchronous speed	1500 rpm
Voltage	690 V
Frequency	50 Hz
Protection	IP 54
Cooling	Integrated heat exchanger
Insulation class	F
Generator designation	AMA 500L4 BAYH

Canopy

Type	Totally enclosed
Material	Steel

APPENDIX 1 - Technical Specification of the Siemens 2.3-MW Mk II Wind Turbine

Yaw system

Type	Active
Yaw bearing	Externally geared slew ring
Yaw drive	Eight electrical gear motors
Yaw brake	Passive friction brake

Controller

Type	Microprocessor
SCADA system	WPS via modem
Controller designation	KK WTC 3.0

Tower

Type	Cylindrical or tapered tubular
Hub heights	70 m, 80 m or site specific
Corrosion protection	Painted
Surface gloss	Silk matt, 30-40/ ISO2813
Surface color	Light gray, RAL 7035

Operational data

Cut-in wind speed	4 m/s
Nominal power at approx.	13-14 m/s
Cut-out wind speed	25 m/s
Maximum 2 s gust	55 m/s (standard version) 60 m/s (special version)

Masses (approximate)

Rotor	60 t
Nacelle excl. rotor	82 t
Tower (60 m, onshore)	81 t
Tower (60 m, offshore)	98 t
Tower (70 m)	134 t
Tower (80 m)	162 t

TETRA TECH, INC.

618 South 25th Street (59101)
P.O. Box 30615 (59107-0615)
Billings, MT
Office 406.248.9161
Fax 406.248.9282

November 23, 2005

Tom Balcon, Program Supervisor
Minnesota Department of Natural Resources
Environmental Review
500 Layfette Road
St.Paul, MN 55155-4040

RE: Project Area Environmental Scan
Maxim Project No. 6550922.100

Dear Mr. Balcon:

Maxim Technologies, a division of Tetra Tech, has been retained by a private company to conduct a preliminary investigation of the below referenced tracts in Mower County as potential locations of a wind-powered energy facility. While the project is still in the planning and development stage, it is estimated that the facility will consist of approximately 43, 2.3 MW turbines, a new collector substation and transmission line, and will be connected to an existing substation.

We are consulting the MN DNR for assistance in identifying sites and environmental properties within the boundaries of the tracts listed that would influence a decision regarding the use of the land for wind electric generation or transmission. We are specifically interested in such information as the location of notable State wildlife interests, sensitive species habitats, and any other special or sensitive environmental conditions that exist in or near the study area.

While many details, including the exact location of wind turbines and precise route of the transmission line, have yet to be determined, the area shown in the attached figure is the primary focus of our investigation. The project area includes portions of the following tracts:

Township	Range	Sections
101N	15W	2, 3, 4, 5, 6, 7, 8, 9, 18
102N	14W	3, 4, 5, 6, 7, 8, 17, 18, 19, 20, 21, 28, 29,
102N	15W	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36,
102N	16W	1, 12, 13, 14, 23, 24, 25,
103N	15W	26, 27, 33, 34, 35
Development will not occur in areas located within the city limits of Taopi or Elkton		

This information will be used as an initial step to help guide project development in a manner that identifies and avoids impacts to sensitive resources where practicable. We have sent similar query letters to other agencies including the U.S. Fish and Wildlife Service. If you are able, we

would appreciate a preliminary scan of these tracts by December 2, 2005. Please contact me at 406-248-9161 if you have any questions.

Thank you for your assistance.

Respectfully submitted,

Maxim Technologies
A DIVISION OF TETRA TECH, INC.

Jeffrey Rice
Project Manager,
Natural Resources

JRR(JS)rr

cc: Judd Stark (Maxim, Billings)
Stacy Pease (Maxim, Missoula)
Aileen Giovanello (TtEC, Boston)

Enclosure

n\typing\Env-fac\6550922\Query Letters\Mower_DNR

Minnesota Department of Natural Resources

Division of Fish and Wildlife
2300 Silver Creek Road NE
Rochester, MN 55972
PHONE: (507) 285-7435
FAX: (507) 285-7144

December 1, 2005

Stacy Pease, Biologist
Maxim Technologies
PO Box 2730
Missoula, Montana 59806

Dear Stacy:

I took a quick look at the species lists, but I don't have time to comprehensively review them, and find them of limited value in assessing the impacts of proposed developments. If you have not seen it, a good approach to pre-development risk assessment can be found in the Proceedings of the Wind Energy and Birds/Bats Workshop: Understanding and Resolving Bird and Bat Impacts. Washington, DC. May 18-19, 2004. Prepared by RESOLVE., Washington, DC. Susan Savitt Schwartz, ed. September 2004.

Here are some good sources for the species lists you are compiling. Amphibians and Reptiles Native to Minnesota by Barney Oldfield and John Moriarty (University of Minnesota Press 1994) if an excellent source for information on herps. A list of mammals of Minnesota can be found at http://sunny.crk.umn.edu/courses/natr/3464/mammals_of_minnesota.htm. The mammal list you provided is not bad but should include white-tailed jackrabbit and coyote. The lists of migratory and resident birds are pretty incomplete. A comprehensive checklist for Mower County can be found on a website maintained by the Minnesota Ornithologists' Union www.moumn.org/county-checklists.html

I am attaching a map showing the location of public lands in the vicinity of the proposed development. There are 3 state wildlife management areas near proposed development. Lake Louise State Park is a few miles southeast of development, and the Blazing Star State Trail (not shown) runs through the development. In addition, the Blazing Star Scientific and Natural Area (SNA) and the Wild Indigo SNA are abandoned railroad-rights-of way within a few miles of the proposed development.

Primary land use in area is row crop agriculture, specifically corn and soybeans. Wildlife habitat is associated mainly with river corridors along Upper Iowa, Little Iowa, South Branch of the Root, and Little Cedar rivers and their tributaries. Habitat is also associated with lands in retirement programs such as CRP and public lands. There are few lakes or large marshes in the area.

If you have not done so already, I suggest contacting MN DNR Natural Heritage program. Sarah Hoffmann is the contact person. She can be reached at 651-259-5107. She can provide you with

information on state listed species in the vicinity of proposed development and recommended measures to minimize impacts to those species.

Thank you for contacting us, and I look forward to an opportunity to further review this project. Please do not hesitate to contact me if you need further information.

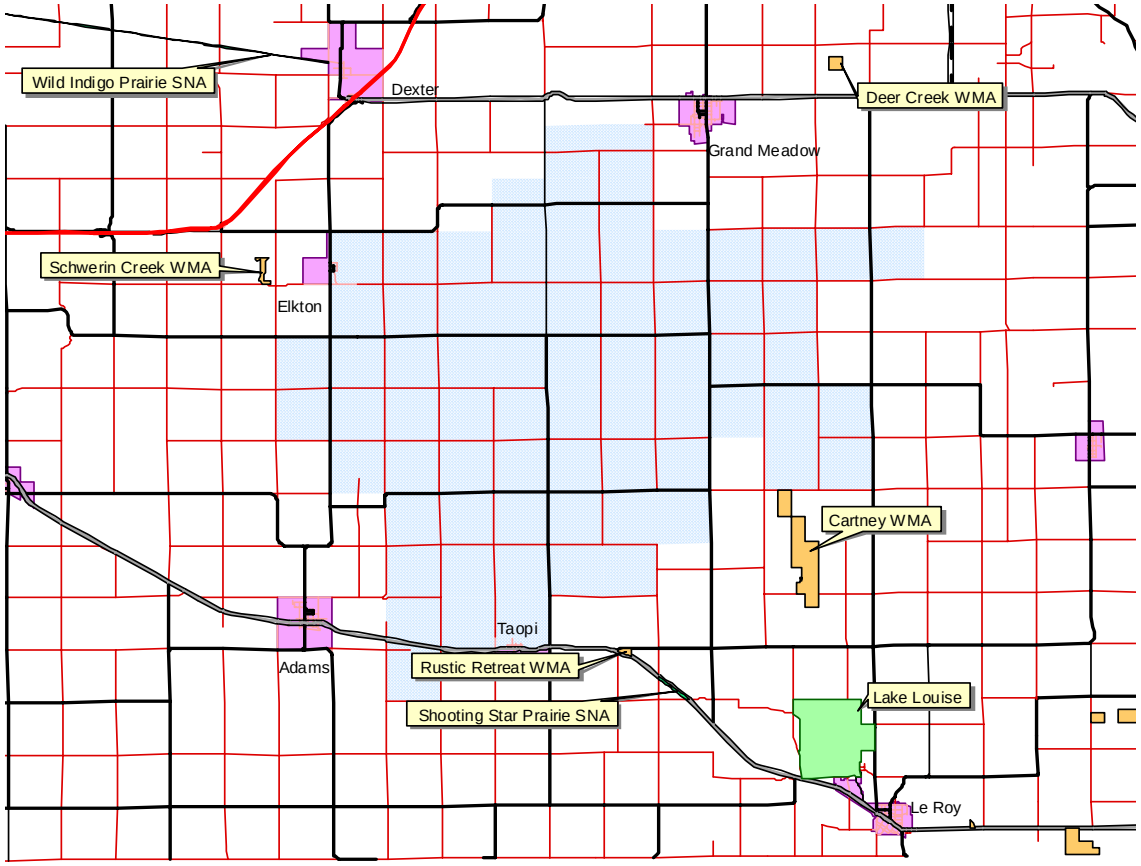
Sincerely,

Don Nelson
Area Wildlife Supervisor

Cc: Ken Varland
Steve Colvin
Tony Stegen
Sarah Hoffman

Attach.

Public Lands in Vicinity of Proposed Wind Farm



Scientific and Natural Areas (SNA)
State Park Statutory Boundaries
State Park
State Recreation Area
State Wayside
Wildlife Management Areas
DOT Roads - All Classes
Interstate Trunk Highway
U.S. Trunk Highway
MN Trunk Highway
County State-Aid Highway
County Road
Township Road
Unorganized Township Road
Municipal State-Aid Street
Municipal Street
Frontage Road
Leg
National Forest Development Road
National Park Road
National Monument Road
National Wildlife Refuge Road
Indian Reservation Road
State Forest Road
State Park Road
State Game Preserve Road
Military Road
Ramp
Private Road
Proposed Windf Farm

6 0 6 12 Miles

N W E S

Please do not staple request documents

For Agency Use Only:
Received _____ Due _____ RUSH
Related ES# _____
Search Radius _____mi. ER/All EOs _____
Map'd ____ C / NoC Let ____ Inv ____ Log out ____

MINNESOTA NATURAL HERITAGE INFORMATION SYSTEM DATA REQUEST FORM

DATE OF REQUEST 11/28/05

WHO IS REQUESTING THE INFORMATION?

Name and Title Jeff Rice/Judd Stack Project Manager

Agency/Company Maxim Technologies

Address 5 25th Street Billings MT 59101
(Street) (City) (State) (Zip Code)

Phone (406) 248.9161 FAX (406) 248 9282 e-mail jrice@maximusa.com

THIS INFORMATION IS BEING REQUESTED ON BEHALF OF (if applicable): High Prairie Wind Farm I, LLC.

WHAT INFORMATION DO YOU NEED?

____ Printouts of known occurrences of federally and state listed plants and animals; native plant communities; and aggregation sites such as bat hibernacula, colonial waterbird nesting sites, and prairie chicken booming grounds.

✓ Information listed above, plus geological features and state rare species with no legal status.

____ Other (specify): _____

Frequent applicants. Check here if you DO NOT need a copy of the field-by-field explanation of the printouts: ____

WHERE IS THE AREA OF INTEREST? 1) **ENCLOSE A MAP** showing detailed boundaries of the project area (topographic maps or aerial photos are preferred). 2) If a GIS shapefile of the project area is available, please provide a copy projected in UTM Zone 15, NAD83).

For Agency Use Only

REGION

PROVIDE THE FOLLOWING REQUIRED PROJECT INFORMATION

County	Twnshp#	Range#	Section(s) (and half-section, quarter-section, etc., if known)
Mower	T101N	15W	~~All~~ 2, 3, 4, 5, 6, 7, 8, 9, 18
"	T102N	14W	✓ 3, 4, 5, 6, 7, 8, 17, 18, 19, 20, 21, 28, 29
"	T103N	15W	~~All~~ 26, 27, 33, 34, 35
"	T102N	15W	A 11
"	T102N	16W	→ 1, 12, 13, 14, 23, 24, 25

Project Name High Prairie Wind Farm

Project Proposer High Prairie Wind Farm I, LLC.

Detailed Project Description (attach additional sheets if necessary) Approximately 40 wind turbines with associated transmission lines and substation

Past Land-Use of Project Site Agricultural

(OVER)

HOW WILL THE INFORMATION BE USED? Describe the planned use of the information, including in what form and detail you wish to publish this information, if any. Preparation of permit applications for proposed wind farm project. Data will be presented in both verbal/and visual/graphic format and as hard copy and digital format

TURN-AROUND TIME

Requests generally take 3 weeks from date of receipt to process, and are processed in the order received. Rush requests are processed in 2 weeks or less.

FEES

For-profit organizations, including consultants working for governmental agencies, are charged a fee for this service. In addition, a fee may be charged for large requests from any source. A surcharge (currently $50) is applied for rush orders; if this is a rush order, please check the blank below. Fees subject to change. A fee schedule is available upon request. Please do not include payment with your request; an invoice will be sent to you.

✓ **Rush**

"The information supplied above is complete and accurate. I understand that material supplied to me from the Minnesota Natural Heritage Information System is copyrighted and that I am not permitted to reproduce or publish any of this copyrighted material without prior written permission from the Minnesota DNR. Further, if permission to publish is given, I understand that I must credit the Minnesota Natural Heritage and Nongame Research Program, Minnesota Department of Natural Resources as the source of the material."

Signature

Mail or email completed forms to: jrice@maxinusa.com For further information call:

Endangered Species Environmental Review Coordinator *(for project reviews)* (651) 259-5107 or 259-5109
Sarah.holtmann@dnr.state.mn.us e.g. EAWs
or
Assistant Database Manager *(for general requests)* (651) 259-5123
Sharron.nelson@dnr.state.mn.us
at
Natural Heritage and Nongame Research Program
Minnesota Department of Natural Resources
500 Lafayette Road, Box 25
St. Paul, Minnesota 55155

Or FAX completed forms to: (651) 296-1811

Additional information about the Natural Heritage & Nongame Research Program is available at http://www.dnr.state.mn.us/ecological_services/nhnrp/index.html

For Agency Use Only:

EO's requiring comment

Sources contacted	Topic	Response

Response Summary

Responder

Revised 10/05

Instructions for the Minnesota Natural Heritage Information System Data Request Form

Please read the following!

< Legible **maps** clearly showing the location and boundaries of the project are required for processing all project reviews.

< We cannot begin processing information requests until we receive all parts of the request, including a map and a completed, signed information request form.

< Please provide as detailed a **project description** as possible, attaching separate pages to the form if necessary (i.e. identify the type of development to be constructed (housing, commercial, utility, etc.), the size and # of units, if applicable, any associated infrastructure and utility connections, and construction methods).

< **Responses** are returned to the party which appears in the "Who is requesting the information?" section. This must also be the person who signs the form on the second page, acknowledging the State of Minnesota's copyright on all printouts generated in response to project reviews.

< On the form, note the first sentence under the subheading "**FEES**". As a courtesy, we provide database searches to other governmental agencies and non-profit entities free of charge. For-profit entities, including consultants working for governmental agencies, are charged a fee. Please do not include payment with your request; an invoice will be sent to you.

< There is generally a 3-week **turn-around time** on environmental reviews. Rush jobs (2 week turn-around) are charged an additional $50 (only applies to for-profit entities).

< For **large projects** (>30 sections) we request that the township/range/section information be submitted on disk or via e-mail. Please submit the file in Word or ASCII, and in the following format: Township#,Range#,Section#s separated by commas. There should be no ending punctuation, no spaces, no letters, except an "E" after appropriate ranges, and each Township / Range combination should be typed on a separate line. For example, T62N R1W Sections 1-3, 11, 12 and T62N R3E Sections 4-9, 17, 18 should be listed as:

62,1,1-3,11,12
62,3E,4-9,17,18

If a **GIS shapefile** of the project area is available, please provide a copy projected in UTM Zone 15, NAD83 .

< **Gray wolf** locations are not tracked in the Natural Heritage databaes. Please contact the U.S. Fish & Wildlife Service for information on this species.

< An **electronic copy** of the form is available at the DNR's web site – http://files.dnr.state.mn.us/ecological_services/nhnrp/nhis_data_request.pdf

< You may reproduce this form for your own use or to distribute.

6550922.100

Minnesota Department of Natural Resources

Natural Heritage and Nongame Research Program, Box 25

500 Lafayette Road

St. Paul, Minnesota 55155-4025

Phone: (651) 259-5107 Fax: (651) 296-1811 E-mail: sarah.hoffmann@dnr.state.mn.us

RECEIVED DEC 19 2005

December 14, 2005

Mr. Jeff Rice
Maxim Technologies
618 South 25th Street
Billings, MT 59101

Re: Request for Natural Heritage information for vicinity of proposed High Prairie Wind Farm, Mower County

Township (N)	Range (W)	Sections
101	15	2-9, 18
102	14	3-8, 17-21, 28, 29
102	15	1-36
102	16	1, 12-14, 23-25
103	15	26, 27, 33-35

NHNRP Contact #: ERDB 20060428

Dear Mr. Rice,

The Minnesota Natural Heritage database has been reviewed to determine if any rare plant or animal species or other significant natural features are known to occur within an approximate one-mile radius of the area indicated on the map enclosed with your information request. Based on this review, there are 2 known occurrences of rare species in the area searched (for details, see enclosed database printouts and explanation of selected fields). Following are specific comments for **only those elements that *may* be impacted** by the proposed project. Rare feature occurrences not listed below are not anticipated to be affected by the proposed project.

- Blanding's Turtles (*Emydoidea blandingii)*, a state-listed threatened species, have been reported in and adjacent to the Cartney Wildlife Management Area, which is located just outside the southeast corner of the project area. Blanding's Turtles spend much of their time in shallow wetlands (1-3 feet deep), but they nest in open, sandy uplands up to 1 mile from wetlands. As there are very few wetlands within the project area, we do not have any serious concerns about impacts to this species. Please note however, that Blanding's turtles may use the creeks and streams within the project area as travel corridors between wetlands. For your information, I have attached a fact sheet and a flyer about the Blanding's Turtle. The fact sheet is intended to provide you with background information regarding habitat use, life history, and reasons for the species' decline, as well as recommendations for avoiding and minimizing impacts to this rare turtle. As you will note, there are two lists of recommendations. The first list contains recommendations to prevent harm to turtles during construction work, and is relative to all areas inhabited by Blanding's Turtles. Please refer to this first list of recommendations for your project. The second column expands on the first column, and contains greater protective measures to be considered for areas known to be of state-wide importance to Blanding's Turtles, or any area where greater protection for turtles is desired. Your project area is not within one of these priority areas. The flyer, which should be given to all contractors working in the area, contains an illustration and description of the Blanding's Turtle, as well as a summary of the recommendations provided in the fact sheet.

- Several rare mussel species including Ellipse (*Venustaconcha ellipsiformis*), a threatened species, and Creek Heelsplitter (*Lasmigona compressa*), a special concern species, have been documented in Deer Creek and the South Branch of the Root River (the mussel data is currently maintained in a separate dataset and so does not show up on the database printouts). Freshwater mussels are declining nation-wide and have been described as one of North America's most imperiled groups of animals. In Minnesota, 25 of our 48 native mussel species are listed as either endangered, threatened, or of special concern. The primary reason behind the decline is the degradation of our lakes and rivers as a result of runoff and physical changes such as damming, channelization, and dredging. Mussels are particularly vulnerable to deterioration in water quality, especially increased siltation. As such, it is imperative that sound erosion and sediment control practices be implemented and maintained throughout the duration of the project.

The Natural Heritage database is maintained by the Natural Heritage and Nongame Research Program, a unit within the Division of Ecological Services, Department of Natural Resources. It is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. Its purpose is to foster better understanding and protection of these features.

Because our information is not based on a comprehensive inventory, there may be rare or otherwise significant natural features in the state that are not represented in the database. A county-by-county survey of rare natural features is now underway, but has not been completed for Mower County. Therefore ecologically significant features for which we have no records may exist on the project area.

The enclosed results of the database search are provided in two formats: index and full record. To control the release of locational information, which might result in the damage or destruction of a rare element, both printout formats are copyrighted.

The index provides rare feature locations only to the nearest section, and may be reprinted, unaltered, in an Environmental Assessment Worksheet, municipal natural resource plan, or report compiled by your company for the project listed above. If you wish to reproduce the index for any other purpose, please contact me to request written permission. **The full-record printout includes more detailed locational information, and is for your personal use only. If you wish to reprint the full-record printouts for any purpose, please contact me to request written permission.**

Please be aware that review by the Natural Heritage and Nongame Research Program focuses only on *rare natural features*. It does not constitute review or approval by the Department of Natural Resources as a whole. If you require further information on the environmental review process for other natural resource-related issues, you may contact your Regional Environmental Assessment Ecologist, Mike North, at (218) 828-2433.

An invoice in the amount of $193.09 will be mailed to you under separate cover within two weeks of the date of this letter. You are being billed for map and database search and staff scientist review. Thank you for consulting us on this matter, and for your interest in preserving Minnesota's rare natural resources.

Sincerely,

Sarah D. Hoffmann
Endangered Species Environmental Review Coordinator

encl: Database search results
Rare Feature Database Print-Outs: An Explanation of Fields
Fact sheets: Blanding's Turtle

Copyright 2005 State of Minnesota DNR

TWP	RNG	PRIMARY SECTION	FED STATUS	MN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
T102N	R14W	32		NON		BARTRAMIA LONGICAUDA (UPLAND SANDPIPER) #19	CARTNEY WMA
T102N	R14W	32		THR		EMYDOIDEA BLANDINGII (BLANDING'S TURTLE) #1017	

RECORDS PRINTED = 2

T102N R14W SE32 MOWER COUNTY, MN
Element: BARTRAMIA LONGICAUDA (UPLAND SANDPIPER) #19
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: CARTNEY WMA NHR
Ownership: MN DNR Wildlife (Wildlife Management Area)
Managed Area(s): CARTNEY WMA
Source: MOU FILES HEATHER,J.
POSITIVE NESTING. 1 NEST WITH 4 EGGS FOUND ON CARTNEY WMA.

Last Observed Date: 19 May 1981
Quad Map: LE ROY (X19D)
Latitude: 43 35' 27" Long: 92 32' 10"
Precision: within 0.25 mile, confirmed
Voucher: Verification: verified

DNR Region: 5
Wildlife Area: 505
Forestry District: 541

T102N R14W NESW32 MOWER COUNTY, MN
Element: EMYDOIDEA BLANDINGII (BLANDING'S TURTLE) #1017
State Status: THREATENED
EO Size: EO Rank: Current Status: Intended Status:
Site: BENNINGTON 32
Ownership: Private
Managed Area(s): not managed or no record
Source: STEGEN,T.
ONE BLANDING'S TURTLE OBSERVED ON FARM WITHIN 100 FEET OF CARTNEY SLOUGH WMA, NEAR A BEAVER POND.

Last Observed Date: 09 May 2000
Quad Map: LE ROY (X19D)
Latitude: 43 35' 39" Long: 92 32' 29"
Precision: within 0.25 mile, confirmed
Voucher: Verification: sight or sound rec.

DNR Region: 5
Wildlife Area: 505
Forestry District: 541

Rare Features Database Print-outs: An Explanation of Fields

The Rare Features database is part of the Natural Heritage Information System,
and is maintained by the Natural Heritage and Nongame Research Program,
a unit within the Division of Ecological Services,
Minnesota Department of Natural Resources (DNR).

Please note that the print-outs are copyrighted and may not be reproduced without permission

Field Name: [Full (non-abreviated) field name, if different]. Further explanation of field.

-C-

CBS Site: [County Biological Survey site number]. In each county, the numbering system begins with 1.
CLASS: A code which classifies features by broad taxonomic group: NC = natural community; SA = special animal; SP = special plant; GP = geologic process; GT = geologic time; OT = other (e.g. colonial waterbird colonies, bat hibernacula).
Cty: [County]. Minnesota counties (ordered alphabetically) are numbered from 1 (Aitkin) to 87 (Yellow Medicine).
CURRENT STATUS: Present protection status, from 0 (owner is not aware of record) to 9 (dedicated as a Scientific and Natural Area).

-D-

DNR Region: 1=NW, 2=NE, 3=E Central, 4=SW, 5=SE, 6= Minneapolis/St. Paul Metro.
DNR Quad: [DNR Quadrangle code]. DNR-assigned code of the U.S. Geologic Survey topographic map on which the rare feature occurs.

-E-

ELEMENT or Element: See AElement Name (Common Name)@
Element Name (Common Name): The name of the rare feature. For plant and animal species records, this field holds the scientific name, followed by the common name in parentheses; for all other elements (such as plant communities, which have no scientific name) it is solely the element name.
EO RANK: [Element Occurrence Rank]. An evaluation of the quality and condition of natural communities from A (highest) to D (lowest).
EO Size: [Element Occurrence Size]. The size in acres (often estimated) of natural communities.

-F-

FED STATUS: [Federal Status]. Status of species under the Federal Endangered Species Law: LE=endangered, LT=threatened, C=species which have been proposed for federal listing.
Federal Status: See AFED STATUS@
Forestry District: The Minnesota DNR=s Division of Forestry district number.

-G-

GLOBAL RANK: The abundance of an element globally, from G1 (critically imperiled due to extreme rarity on a world-wide basis) to G5 (demonstrably secure, though perhaps rare in parts of its range). Global ranks are determined by the Conservation Science Division of The Nature Conservancy.

-I-

INTENDED STATUS: Desired protection status. See also ACURRENT STATUS.@ If a complete list of protection status codes is needed, please contact the Natural Heritage Program.

-L-

LAST OBSERVED or Last Observed Date or Last Observation: Date of the most recent record of the element at the location.
Latitude: The location at which the occurrence is mapped on Natural Heritage Program maps. NOTE: There are various levels of precision in the original information, but this is not reflected in the latitude/longitude data. For some of the data, particularly historical records, it was not possible to determine exactly where the original observation was made (e.g. "Fort Snelling", or "the south shore of Lake Owasso"). Thus the latitude/longitude reflect the mapped location, and not necessarily the observation location.
Legal: Township, range and section numbers.
Long: [Longitude]. See NOTE under ALatitude@

-M-

MANAGED AREA or Managed Area(s): Name of the federally, state, locally, or privately managed park, forest, preserve, etc., containing the occurrence, if any. If this field is blank, the element probably occurs on private land. If "(STATUTORY BOUNDARY)" occurs after the name of a managed area, the location may be a private inholding within the statutory boundary of a state forest or park.
Map Sym: [Map Symbol].
MN STATUS: [Minnesota Status]. Legal status of plant and animal species under the Minnesota endangered species law:

END=endangered, THR=threatened, SPC=special concern, NON=no legal status, but tracked. This field is blank for natural communities and colonial waterbird nesting sites, which have no legal status in Minnesota, but are tracked by the database.

-N-

NC Rank: [Natural Community Rank].

-O-

Occ #: [Occurrence Number]. The occurrence number, in combination with the element name, uniquely identifies each record.

OCCURRENCE NUMBER: See AOcc #@

OF OCCURS: The number of records existent in the database for each element within the area searched.

Ownership: Indicates whether the site is publicly or privately owned; for publicly owned land, the agency with management responsibility is listed.

-P-

Precision: Precision of locational information of occurrence: C (confirmed) = known within 1/4 mile radius, U (unconfirmed) = known within 1/2 mile, N (non-specific) = known within 1 mile, G (general) = occurs within the general region, X (unmappable)=location is unmappable on USGS topographic quadrangles (often known only to the nearest county), O (obscure/gone)=element no longer exists at the location.

PS: [Primary Section]. The section containing all or the greatest part of the occurrence.

-Q-

Quad Map: See ADNR Quad@

-R-

Rec #: [Record number].

RNG or Rng: [Range number].

-S-

SECTION or Section: [Section number(s)]. Some records are given only to the nearest section (s), but most are given to the nearest quarter-section or quarter-quarter-section (e.g., SWNW32 denotes the SW1/4 of the NW1/4 of section 32). A "0" is used as a place holder when a half-section is specified (e.g., 0N03 refers to the north 1/2 of section 3). When a occurrence crosses section boundaries, both sections are listed, without punctuation (e.g., the NE1/4 of section 19 and NW1/4 of section 20 is displayed as ANE19NW20").

Site: A name which refers to the geographic area within which the occurrence lies. If no name for the area exists (a locally used name, for example), one is assigned by the County Biological Survey or the Natural Heritage Program.

Source: The collector or observer of the rare feature occurrence.

S RANK: [State Rank]. A rank assigned to the natural community type which reflects the known extent and condition of that community in Minnesota. Ranks range from 1 (in greatest need of conservation action in the state) to 5 (secure under present conditions). A "?" following a rank indicates little information is available to rank the community. Communities for which information is especially scarce are given a "U", for Arank undetermined@. The ranks do not represent a legal status. They are used by the Minnesota Department of Natural Resources to set priorities for research, inventory and conservation planning. The state ranks are updated as inventory information becomes available.

State Status: See AMN STATUS@

-T-

TWP or Twp: [Township number].

-V-

Verification: A reflection of the reliability of the information on which the record is based. The highest level of reliability is "verified," which usually indicates a collection was made or, in the case of bird records, nesting was observed. Plant records based on collections made before 1970 are unverified.

Voucher: The museum or herbarium where specimens are maintained, and the accession number assigned by the repository. In the case of bald eagles, this is the breeding area number.

-W-

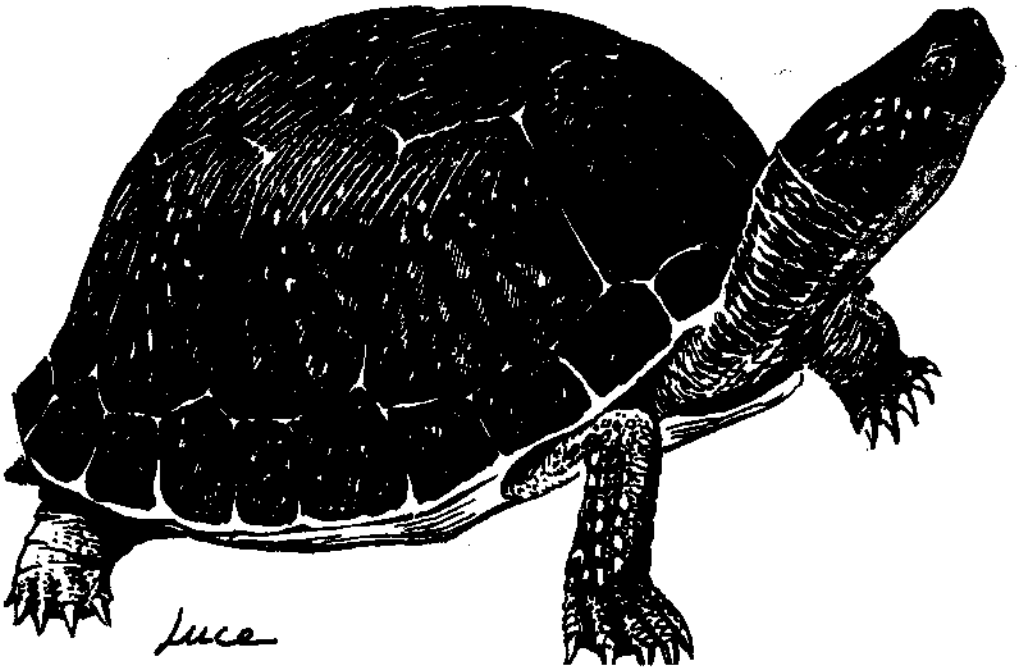
Wildlife Area: The Minnesota DNR=s Division of Wildlife administrative number.

Data Security

Locations of some rare features must be treated as sensitive information because widespread knowledge of these locations could result in harm to the rare features. For example, wildflowers such as orchids and economically valuable plants such as ginseng are vulnerable to exploitation by collectors; other species, such as bald eagles, are sensitive to disturbance by observers. For this reason, we prefer that publications not identify the precise locations of vulnerable species. We suggest describing the location only to the nearest section. If this is not acceptable for your purposes, please call and discuss this issue with the Environmental Review Specialist for the Natural Heritage and Nongame Research Program at 651/296-7863.

Revised 9/2002

CAUTION



BLANDING'S TURTLES

MAY BE ENCOUNTERED IN THIS AREA

The unique and rare Blanding's turtle has been found in this area. Blanding's turtles are a State Threatened species and are protected under Minnesota Statute 84.095, Protection of Threatened and Endangered Species. Please be careful of turtles on roads and in construction sites. For additional information on turtles, or to report a Blanding's turtle sighting, contact the DNR Nongame Specialist nearest you: Bemidji (218-755-2976); Brainerd (218-828-2228); New Ulm (507-359-6033); Rochester (507-280-5070); or St. Paul (651-259-5110).

DESCRIPTION: The Blanding's turtle is a medium to large turtle (5 to 10 inches) with a black or dark blue, dome-shaped shell with muted yellow spots and bars. The bottom of the shell is hinged across the front third, enabling the turtle to pull the front edge of the lower shell firmly against the top shell to provide additional protection when threatened. The head, legs, and tail are dark brown or blue-gray with small dots of light brown or yellow. A distinctive field mark is the bright yellow chin and neck.

Illustration by Don Luce, from Turtles in Minnesota, Natural History Leaflet No. 9, June 1989, James Ford Bell Museum of Natural History

SUMMARY OF RECOMMENDATIONS FOR AVOIDING AND MINIMIZING IMPACTS TO BLANDING'S TURTLE POPULATIONS

(see Environmental Review Fact Sheet Series for full recommendations)

- A flyer with an illustration of an adult Blanding's turtle should be given to all contractors working in the area. Homeowners should also be informed of the presence of Blanding's turtles in the area.
- Turtles which are in imminent danger should be moved, by hand, out of harms way. Turtles which are not in imminent danger should be left undisturbed to continue their travel among wetlands and/or nest sites.
- If a Blanding's turtle nests in your yard, do not disturb the nest, and do not allow pets near the nest.
- Blanding's turtles do not make good pets. It is illegal to keep this threatened species in captivity.
- Silt fencing should be set up to keep turtles out of construction areas. It is critical that silt fencing be removed after the area has been revegetated.
- Small, vegetated temporary wetlands should not be dredged, deepened, or filled.
- All wetlands should be protected from pollution; use of fertilizers and pesticides should be avoided, and run-off from lawns and streets should be controlled. Erosion should be prevented to keep sediment from reaching wetlands and lakes.
- Roads should be kept to minimum standards on widths and lanes.
- Roads should be ditched, not curbed or below grade. If curbs must be used, 4" high curbs at a 3:1 slope are preferred.
- Culverts under roads crossing wetland areas, between wetland areas, or between wetland and nesting areas should be at least 36 in. diameter and flat-bottomed or elliptical.
- Culverts under roads crossing streams should be oversized (at least twice as wide as the normal width of open water) and flat-bottomed or elliptical.
- Utility access and maintenance roads should be kept to a minimum.
- Below-ground utility construction sites should be returned to original grade.
- Terrain should be left with as much natural contour as possible.
- Graded areas should be revegetated with native grasses and forbs.
- Vegetation management in infrequently mowed areas -- such as in ditches, along utility access roads, and under power lines -- should be done mechanically (chemicals should not be used). Work should occur fall through spring (after October 1st and before June 1st).

Compiled by the Minnesota Department of Natural Resources Natural Heritage and Nongame Research Program, August, 2001
Endangered Species Environmental Review Coordinator, 500 Lafayette Rd., Box 25, St. Paul, MN 55155 / 651-259-5107

Endangered, Threatened, and Special Concern Species of Minnesota

Blanding's Turtle

(Emydoidea blandingii)

Minnesota Status:	Threatened	State Rank[1]:	S2
Federal Status:	none	Global Rank[1]:	G4

HABITAT USE

Blanding's turtles need both wetland and upland habitats to complete their life cycle. The types of wetlands used include ponds, marshes, shrub swamps, bogs, and ditches and streams with slow-moving water. In Minnesota, Blanding's turtles are primarily marsh and pond inhabitants. Calm, shallow water bodies (Type 1-3 wetlands) with mud bottoms and abundant aquatic vegetation (cattails, water lilies, etc.) are preferred, and extensive marshes bordering rivers provide excellent habitat. Small temporary wetlands (those that dry up in the late summer or fall) are frequently used in spring and summer -- these fishless pools are amphibian and invertebrate breeding habitat, which provides an important food source for Blanding's turtles. Also, the warmer water of these shallower areas probably aids in the development of eggs within the female turtle. Nesting occurs in open (grassy or brushy) sandy uplands, often some distance from water bodies. Frequently, nesting occurs in traditional nesting grounds on undeveloped land. Blanding's turtles have also been known to nest successfully on residential property (especially in low density housing situations), and to utilize disturbed areas such as farm fields, gardens, under power lines, and road shoulders (especially of dirt roads). Although Blanding's turtles may travel through woodlots during their seasonal movements, shady areas (including forests and lawns with shade trees) are not used for nesting. Wetlands with deeper water are needed in times of drought, and during the winter. Blanding's turtles overwinter in the muddy bottoms of deeper marshes and ponds, or other water bodies where they are protected from freezing.

LIFE HISTORY

Individuals emerge from overwintering and begin basking in late March or early April on warm, sunny days. The increase in body temperature which occurs during basking is necessary for egg development within the female turtle. Nesting in Minnesota typically occurs during June, and females are most active in late afternoon and at dusk. Nesting can occur as much as a mile from wetlands. The nest is dug by the female in an open sandy area and 6-15 eggs are laid. The female turtle returns to the marsh within 24 hours of laying eggs. After a development period of approximately two months, hatchlings leave the nest from mid-August through early-October. Nesting females and hatchlings are often at risk of being killed while crossing roads between wetlands and nesting areas. In addition to movements associated with nesting, all ages and both sexes move between wetlands from April through November. These movements peak in June and July and again in September and October as turtles move to and from overwintering sites. In late autumn (typically November), Blanding's turtles bury themselves in the substrate (the mud at the bottom) of deeper wetlands to overwinter.

IMPACTS / THREATS / CAUSES OF DECLINE

- loss of wetland habitat through drainage or flooding (converting wetlands into ponds or lakes)
- loss of upland habitat through development or conversion to agriculture
- human disturbance, including collection for the pet trade* and road kills during seasonal movements
- increase in predator populations (skunks, racoons, etc.) which prey on nests and young

*It is illegal to possess this threatened species.

RECOMMENDATIONS FOR AVOIDING AND MINIMIZING IMPACTS

These recommendations apply to typical construction projects and general land use within Blanding's turtle habitat, and are provided to help local governments, developers, contractors, and homeowners minimize or avoid detrimental impacts to Blanding's turtle populations. **List 1** describes minimum measures which we recommend to prevent harm to Blanding's turtles during construction or other work within Blanding's turtle habitat. **List 2** contains recommendations which offer even greater protection for Blanding's turtles populations; this list should be used *in addition to the first list* in areas which are known to be of state-wide importance to Blanding's turtles (contact the DNR's Natural Heritage and Nongame Research Program if you wish to determine if your project or home is in one of these areas), or in any other area where greater protection for Blanding's turtles is desired.

List 1. Recommendations for all areas inhabited by Blanding's turtles.	**List 2. *Additional* recommendations for areas known to be of state-wide importance to Blanding's turtles.**
GENERAL	
A flyer with an illustration of a Blanding's turtle should be given to all contractors working in the area. Homeowners should also be informed of the presence of Blanding's turtles in the area.	Turtle crossing signs can be installed adjacent to road-crossing areas used by Blanding's turtles to increase public awareness and reduce road kills.
Turtles which are in imminent danger should be moved, by hand, out of harms way. Turtles which are not in imminent danger should be left undisturbed.	Workers in the area should be aware that Blanding's turtles nest in June, generally after 4pm, and should be advised to minimize disturbance if turtles are seen.
If a Blanding's turtle nests in your yard, do not disturb the nest.	If you would like to provide more protection for a Blanding's turtle nest on your property, see "Protecting Blanding's Turtle Nests" on page 3 of this fact sheet.
Silt fencing should be set up to keep turtles out of construction areas. It is critical that silt fencing be removed after the area has been revegetated.	Construction in potential nesting areas should be limited to the period between September 15 and June 1 (this is the time when activity of adults and hatchlings in upland areas is at a minimum).
WETLANDS	
Small, vegetated temporary wetlands (Types 2 & 3) should not be dredged, deepened, filled, or converted to storm water retention basins (these wetlands provide important habitat during spring and summer).	Shallow portions of wetlands should not be disturbed during prime basking time (mid morning to mid- afternoon in May and June). A wide buffer should be left along the shore to minimize human activity near wetlands (basking Blanding's turtles are more easily disturbed than other turtle species).
Wetlands should be protected from pollution; use of fertilizers and pesticides should be avoided, and run-off from lawns and streets should be controlled. Erosion should be prevented to keep sediment from reaching wetlands and lakes.	Wetlands should be protected from road, lawn, and other chemical run-off by a vegetated buffer strip at least 50' wide. This area should be left unmowed and in a natural condition.
ROADS	
Roads should be kept to minimum standards on widths and lanes (this reduces road kills by slowing traffic and reducing the distance turtles need to cross).	Tunnels should be considered in areas with concentrations of turtle crossings (more than 10 turtles per year per 100 meters of road), and in areas of lower density if the level of road use would make a safe crossing impossible for turtles. Contact your DNR Regional Nongame Specialist for further information on wildlife tunnels.
Roads should be ditched, not curbed or below grade. If curbs must be used, 4 inch high curbs at a 3:1 slope are preferred (Blanding's turtles have great difficulty climbing traditional curbs; curbs and below grade roads trap turtles on the road and can cause road kills).	Roads should be ditched, not curbed or below grade.

ROADS cont.	
Culverts between wetland areas, or between wetland areas and nesting areas, should be 36 inches or greater in diameter, and elliptical or flat-bottomed.	Road placement should avoid separating wetlands from adjacent upland nesting sites, or these roads should be fenced to prevent turtles from attempting to cross them (contact your DNR Nongame Specialist for details).
Wetland crossings should be bridged, or include raised roadways with culverts which are 36 in or greater in diameter and flat-bottomed or elliptical (raised roadways discourage turtles from leaving the wetland to bask on roads).	Road placement should avoid bisecting wetlands, or these roads should be fenced to prevent turtles from attempting to cross them (contact your DNR Nongame Specialist for details). This is especially important for roads with more than 2 lanes.
Culverts under roads crossing streams should be oversized (at least twice as wide as the normal width of open water) and flat-bottomed or elliptical.	Roads crossing streams should be bridged.
UTILITIES	
Utility access and maintenance roads should be kept to a minimum (this reduces road-kill potential).	
Below-ground utility construction sites should be returned to original grade (trenches can trap turtles).	
LANDSCAPING AND VEGETATION MANAGEMENT	
Terrain should be left with as much natural contour as possible.	As much natural landscape as possible should be preserved (installation of sod or wood chips, paving, and planting of trees within nesting habitat can make that habitat unusable to nesting Blanding's turtles).
Graded areas should be revegetated with native grasses and forbs (some non-natives form dense patches through which it is difficult for turtles to travel).	Open space should include some areas at higher elevations for nesting. These areas should be retained in native vegetation, and should be connected to wetlands by a wide corridor of native vegetation.
Vegetation management in infrequently mowed areas -- such as in ditches, along utility access roads, and under power lines -- should be done mechanically (chemicals should not be used). Work should occur fall through spring (after October 1st and before June 1st).	Ditches and utility access roads should not be mowed or managed through use of chemicals. If vegetation management is required, it should be done mechanically, as infrequently as possible, and fall through spring (mowing can kill turtles present during mowing, and makes it easier for predators to locate turtles crossing roads).

Protecting Blanding's Turtle Nests: Most predation on turtle nests occurs within 48 hours after the eggs are laid. After this time, the scent is gone from the nest and it is more difficult for predators to locate the nest. Nests more than a week old probably do not need additional protection, unless they are in a particularly vulnerable spot, such as a yard where pets may disturb the nest. Turtle nests can be protected from predators and other disturbance by covering them with a piece of wire fencing (such as chicken wire), secured to the ground with stakes or rocks. The piece of fencing should measure at least 2 ft. x 2 ft., and should be of medium sized mesh (openings should be about 2 in. x 2 in.). It is ***very important*** that the fencing be **removed <u>before August 1st</u>** so the young turtles can escape from the nest when they hatch!

REFERENCES

[1]Association for Biodiversity Information. "Heritage Status: Global, National, and Subnational Conservation Status Ranks." NatureServe. Version 1.3 (9 April 2001). http://www.natureserve.org/ranking.htm (15 April 2001).

Coffin, B., and L. Pfannmuller. 1988. Minnesota's Endangered Flora and Fauna. University of Minnesota Press, Minneapolis, 473 pp.

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Moriarty, J. J., and M. Linck. 1994. Suggested guidelines for projects occurring in Blanding's turtle habitat. Unpublished report to the Minnesota DNR. 8 pp.

Oldfield, B., and J. J. Moriarty. 1994. Amphibians and Reptiles Native to Minnesota. University of Minnesota Press, Minneapolis, 237 pp.

Sajwaj, T. D., and J. W. Lang. 2000. Thermal ecology of Blanding's turtle in central Minnesota. Chelonian Conservation and Biology 3(4):626-636.

TETRA TECH, INC.

618 South 25th Street (59101)
P.O. Box 30615 (59107-0615)
Billings, MT
Office 406.248.9161
Fax 406.248.9282

November 23, 2005

Craig Oscarson, County Coordinator
Mower County
201 1st Street NE
Austin, MN 55912

RE: Project Area Environmental Scan
Maxim Project No. 6550922.100

Dear Mr. Oscarson:

Maxim Technologies, a division Tetra Tech, has been retained by a private company to conduct an investigation of the below referenced tracts in Mower County as potential locations of a wind-powered energy facility. While the project is still in the planning and development stage, it is estimated that the facility will consist of approximately 43, 2.3 MW turbines, a new collector substation and transmission line, and will be connected to an existing substation.

We are consulting Mower County representatives for assistance in identifying environmental properties, concerns or issues within the boundaries of the tracts listed that would influence a decision regarding the use of the land for wind electric generation or transmission. We are specifically interested in information relating to county planning and coordination issues or any other county regulations that you feel would influence the project area.

While many details, including the exact location of wind turbines and precise route of the transmission line, have yet to be determined, the area shown in the attached figure is the primary focus of our investigation. The project area includes the following tracts:

Township	Range	Sections
101N	15W	2, 3, 4, 5, 6, 7, 8, 9, 18
102N	14W	3, 4, 5, 6, 7, 8, 17, 18, 19, 20, 21, 28, 29,
102N	15W	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36,
102N	16W	1, 12, 13, 14, 23, 24, 25,
103N	15W	26, 27, 33, 34, 35
Development will not occur in areas located within the city limits of Taopi or Elkton		

This information will be used as an initial step to help guide project development in a manner that identifies and avoids impacts to sensitive resources where practicable. If you are able, we would appreciate a preliminary scan of the identified parcels by December 2, 2005. Please contact me at 406-248-9161 if you have any questions.

Thank you for your assistance.

Respectfully submitted,

Maxim Technologies
A DIVISION OF TETRA TECH, INC.

Jeffrey Rice
Project Manager,
Natural Resources

JRR(JS)rr

cc: Judd Stark (Maxim, Billings)
Stacy Pease (Maxim, Missoula)
Aileen Giovanello (TtEC, Boston)

Enclosure

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TETRA TECH, INC.

618 South 25th Street (59101)
P.O. Box 30615 (59107-0615)
Billings, MT
Office 406.248.9161
Fax 406.248.9282

November 23, 2005

Daryl Franklin
Mower County Planning and Zoning
1105 ½ 8th Avenue NE
Austin, MN 55912

RE: Project Area Environmental Scan
Maxim Project No. 6550922.100

Dear Mr. Franklin:

Maxim Technologies, a division of Tetra Tech, has been retained by a private company to conduct an investigation of the below referenced tracts in Mower County as potential locations of a wind-powered energy facility. While the project is still in the planning and development stage, it is estimated that the facility will consist of approximately 43, 2.3 MW turbines, a new collector substation and transmission line, and will be connected to an existing substation.

We are consulting the Mower County Planning and Zoning board for assistance in identifying environmental properties, concerns or issues within the boundaries of the tracts listed that would influence a decision regarding the use of the land for wind electric generation or transmission. We are specifically interested in such information relating to planning or zoning issues, county regulations, planned infrastructure improvements, or any other issues you may be aware of within the project area.

While many details, including the exact location of wind turbines and precise route of the transmission line, have yet to be determined, the area shown in the attached figure is the primary focus of our investigation. The project area includes portions of the following tracts:

Township	Range	Sections
101N	15W	2, 3, 4, 5, 6, 7, 8, 9, 18
102N	14W	3, 4, 5, 6, 7, 8, 17, 18, 19, 20, 21, 28, 29,
102N	15W	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36,
102N	16W	1, 12, 13, 14, 23, 24, 25,
103N	15W	26, 27, 33, 34, 35
Development will not occur in areas located within the city limits of Taopi or Elkton		

This information will be used as an initial step to help guide project development in a manner that identifies and avoids impacts to sensitive resources where practicable. If you are able, we would appreciate a preliminary scan of parcels in your district by December 2, 2005. Please contact me at 406-248-9161 if you have any questions.

Thank you for your assistance.

Respectfully submitted,

Maxim Technologies
A DIVISION OF TETRA TECH, INC.

Jeffrey Rice
Project Manager,
Natural Resources

JRR(JS)rr

cc: Judd Stark (Maxim, Billings)
Stacy Pease (Maxim, Missoula)
Aileen Giovanello (TtEC, Boston)

Enclosure

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Mower County
MINNESOTA

Environmental Services
1105 ½ 8TH Ave. NE
Austin, Minnesota 55912
Phone: (507) 437-9527

November 29, 2005

Jeffrey Rice
Tetra Tech, Inc.
618 South 25th Street
P.O. Box 30615
Billings, MT 59107-0615

RECEIVED
DEC 02 2005

RE: Project Area – Environmental Scan
Maxim Project No. #6550922.100

Dear Mr. Rice:

Per your letter of November 23, 2005, I understand you are looking for a preliminary scan of parcels regarding the above project. The most important item is the maintaining of the integrity of the microwave beam paths, based on the starting point in Clayton Township and the other endpoints with the latitude and longitude. We are also informing the Minnesota Environmental Quality Board and Larry Hartman of our Ordinance for protecting these pathways.

I have enclosed the following information regarding your interest in wind-powered energy in Mower County:

- Mower County Plat Book
- Geological Atlas of Mower County (Part A & Part B)
- Contributions to the Geology of Mower County, Minnesota
- Section 14-18.5 and Section 14-18.6 Special Requirements for Wind Energy Conversion (from the Mower County Zoning Ordinance)

The entire Mower County Zoning Ordinance and Mower County Comprehensive Plan can be found on the Mower County Website at: www.co.mower.mn.us You should click on the Plan & Zoning link to find these documents.

Feel free to contact myself at 507-437-9560 if you have any questions.

Sincerely,

Daryl W. Franklin, Director
Mower County Environmental Services

DWF:km

Enclosures

SECTION 14-18.6 SPECIAL REQUIREMENTS FOR WIND ENERGY CONVERSION SYSTEM

Purpose
The purpose of this section is to set forth a process for permitting wind energy facilities with a rated capacity of greater than 100 kW but less than 5 MW.

(a) Definitions.

D→Rotor Diameter – diameter of the disk transcribed by the rotating rotor blades
H→Hub Height – heights of the center of rotation of the rotor above the local ground level
T→Total Height (H + ½ D) – height of the tip of a blade extended at the apex of rotation above the local ground level
Residence – means any dwelling for habitation either seasonally, meaning all or a portion of the months of November through April, or permanently by one or more persons. A residence may be part of a multidwelling or multipurpose building, but shall not include buildings such as hotels, hospitals, motels, dormitories, sanitariums, nursing homes, schools or other buildings used for educational purposes, or correctional institutions. A manufactured home as defined in section 168.011, subdivision 8, shall be a residence for purposes of this section.

(b) Conditional Use Permit Required. A conditional use permit shall be required in the Agricultural, Rural Management, Freeway Interchange, Business & Industrial zoned areas. All proposed wind energy facilities must fill out a conditional use permit application provided by the Mower County Environmental Services Office, as regulated in Section 14-51, 14-56 and 14-83.

(1) Setback Standards

Object	Setback – measured from center of tower
Residence or previously platted subdivision	750 feet
Project Boundary/Property Line	400 feet or 1 Total Height (T) whichever is greater (unless turbine is a joint venture between adjoining property owner then setback may be reduced to zero) or unless a signed wind easement is provided.
Public Roads or Railroad right-of-way	400 feet or 1 Total Height (T)
Other Structures on Owner's Same Parcel	1 rotor diameter

(2) Criteria Standards

(a) All wind power towers, turbines and apparatuses shall be in compliance with all other applicable State and Federal Regulatory Standards.

- Uniform Building Code as adopted by the State of Minnesota.
- The National Electrical Code as adopted by the State of Minnesota.
- Comply with FAA Requirements – Form 7460-1 (submit recommendations from FAA to Mower County and the MN Environmental Quality Board)
- MPCA/EPA Regulations.

(b) Complete and submit to Mower County Environmental Services an Acoustic Analysis to assure compliance with the Minnesota Noise Rules as defined in Minnesota Rules Chapter 7030.

(c) All turbine towers shall be marked with a visible identification number and petitioner will be required to provide the latitude and longitude of each tower and the elevation of the ground and tower height to the Environmental Services Office.

(d) All turbine towers must be of tubular construction.

(e) The Petitioner shall be responsible for obtaining 9-1-1 rural address from the Mower County Engineer and for obtaining proper signage for the property. Any and all costs associated with 9-1-1 addressing and signage are the responsibility of the Petitioner.

(f) The Permittee shall prepare a fire protection plan in consultation with the fire department having jurisdiction over the area prior to construction.

(g) Wind turbines and all associated facilities, including foundations, access roads, underground cable, and transformers, shall not be placed in public waters or wetlands, as defined in Minnesota Statutes section 103G.005 subp. 15a.

(h) Project developer is responsible for remediation of damaged roads upon completion of project or maintenance of turbines.

(i) All solid waste and hazardous waste shall be removed from the site and managed in a manner consistent with all appropriate rules and regulations.

The Permittee shall not operate a turbine so as to cause microwave, television, radio, telecommunications or navigation interference contrary to Federal Communications Commission (FCC) regulations or other law. In the event the turbine and its associated facilities or its operations cause such interference, the Permittee shall take timely measures necessary to correct the problem.

(j) The Permittee shall conduct an assessment of television signal reception prior to construction and an assessment of television reception degradation after construction of the turbines, to determine if the television signal is affected by the presence of the wind turbine and associated facilities. The Permittee shall provide the Environmental Services Office a copy of these studies.

(k) A professional engineer registered in the State of Minnesota shall certify that the tower and foundation are compatible with and appropriate for the turbine to be installed and that the specific soils at the site can support the apparatus.

(3) Decommissioning. Provisions shall ensure that facilities are properly decommissioned upon end of project life or facility abandonment. Decommissioning shall include: removal of all structures and debris to a depth of 3 feet, restoration of the soil; and restoration of vegetation (consistent and compatible with surrounding vegetation) shall also be required. The decommissioning plan shall include a $3,000 non-refundable fee per turbine to be held in escrow by Mower County. This money would be held in escrow by the County and could only be withdrawn with accumulated interest upon a successful implementation of a decommissioning plan. Should the implementation of decommissioning plan fail to meet the goals and objectives of said plan, then the County can use all or a portion of the money in escrow to implement or finish said plan. If the cost of the decommissioning exceeds the escrow amount, the County has the right to collect or assess the cost to the property owner through property taxes or a special assessment.

The owner or operator must inform Mower County in writing if a wind turbine(s) has been idle for one year. The County shall send a certified letter to property owner or turbine owner. The letter shall ask for details of implementation of a decommissioning plan and allow property owner or turbine owner 60 days to respond. Should the owner not respond or respond but not fulfill the decommissioning plan the County, upon County Board approval, can use the money in escrow to pay for the removal of the structures.

(4) Signage. Signs shall be regulated as set forth in Article V of this ordinance.

(5) Aesthetics. The following items are recommended standards to mitigate visual impacts:

- Coatings and colorings: Non-reflective unobtrusive color.
- Lighting: Projects shall utilize minimal lighting. No tower lighting, other than normal security lighting, shall be permitted, except as may be required by the FAA. It may be appropriate for permits to allow for some infra-red lights or heat lamps to prevent icing of sensors.

(6) Permit Application. The following information shall be required with the conditional use permit application:

- A description of the project, including the number and capacity of turbines, height and rotor diameter and turbine color.
- A site plan detailing the location of the project area boundaries, turbines, roads, transformers, power lines, interconnection point with transmission lines, and other ancillary facilities or structures.
- Topographic map of the project site and surrounding area.
- Current land use on the site and surrounding area.
- Decommissioning plan

(7) Prohibited Locations for Wind Turbines and Associated Electrical Lines Serving Wind Turbines or Wind Farms. These aisles are based on a 500 foot aisle on either side of the center line. In addition, electrical lines that serve wind turbines or wind farms are not allowed in Sections 6 and 7 of Clayton Township and Sections 1 and 12 of Marshall Township.

CENTER POINT
Mower: Elkton 400 Final 020505 (Central Radio Tower)
43 39 30.10 N
92 41 19.30 W

END POINTS
Mower: Racine Water Tank
43 46 28.20 N
92 28 52.00 W
Mower: Waltham Water Tank
43 49 16.00 N
92 52 36.70 W
Mower: Lyle Tank
43 30 27.60 N
92 56 40.90 W
Mower: Leroy Tank
43 30 39.10 N
92 30 16.10 W
Mower: Austn 14th Street Tank
43 40 7.10 N (See Attached Map)
92 59 32.20 W
Each Aisle is Center Point to End Point

Freeborn County - MN Department of Transportation Tower:

The end points are as follows: Oakland Woods: 43-39-43, 21N 93-06-51.49W

Olmsted County – MN Department of Transportation Tower:

Rock Dell: 43-56-4.86N 92-37-2.45W

SECTION 14-18.61 STATE REGULATED WIND TURBINES & WIND FARMS

Wind farms and wind turbines over 5 MV regulated by the State of Minnesota are also prohibited from locating wind turbines within these designated aisle ways.

CENTER POINT
Mower: Elkton 400 Final 020505 (Central Radio Tower)
43 39 30.10 N
92 41 19.30 W

END POINTS
Mower: Racine Water Tank
43 46 28.20 N
92 28 52.00 W
Mower: Waltham Water Tank
43 49 16.00 N
92 52 36.70 W
Mower: Lyle Tank
43 30 27.60 N
92 56 40.90 W
Mower: Leroy Tank
43 30 39.10 N
92 30 16.10 W
Mower: Austn 14th Street Tank
43 40 7.10 N
92 59 32.20 W
Each Aisle is Center Point to End Point

(See Attached Map)

Freeborn County - MN Department of Transportation Tower:

The end points are as follows: Oakland Woods: 43-39-43, 21N 93-06-51.49W

Olmsted County – MN Department of Transportation Tower:

Rock Dell: 43-56-4.86N 92-37-2.45W

TETRA TECH, INC.

618 South 25th Street (59101)
P.O. Box 30615 (59107-0615)
Billings, MT
Office 406.248.9161
Fax 406.248.9282

November 23, 2005

Mr. Dan Stinnett
U.S. Fish and Wildlife Service
Minnesota Field Supervisor
4101 American Blvd. East
Bloomington, MN 55425

RE: Project Area Environmental Scan
Maxim Project No. 6550922.100

Dear Mr. Stinnett:

Maxim Technologies, a division of Tetra Tech, has been retained by a private company to conduct an investigation of the below referenced tracts in Mower County as potential locations of a wind energy facility. While the project is still in the planning and development stage, it is estimated that the facility will consist of approximately 43, 2.3MW turbines, a new collector substation and transmission line, and will be connected to an existing substation. The area shown in the attached figure is the primary focus of our investigation.

We are consulting the U.S. Fish and Wildlife Service for assistance in identifying sites and environmental properties within the boundaries of the tracts listed that would influence a decision regarding the use of the land for wind-powered electric generation or transmission. We are specifically interested in such information as the location of known wetlands, rare species sightings, wetland or grassland easements, and any other special or sensitive environmental conditions that exist in or near the study area.

The enclosed location map depicts the following tracts:

Township	Range	Sections
101N	15W	2, 3, 4, 5, 6, 7, 8, 9, 18
102N	14W	3, 4, 5, 6, 7, 8, 17, 18, 19, 20, 21, 28, 29,
102N	15W	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36,
102N	16W	1, 12, 13, 14, 23, 24, 25,
103N	15W	26, 27, 33, 34, 35
Development will not occur in areas located within the city limits of Taopi or Elkton		

This information will be used as an initial step to help guide project development in a manner that identifies and avoids impacts to sensitive resources where practicable. If you are able, we would appreciate a preliminary scan of parcels in your district by December 2, 2005. Please contact me at 406-248-9161 if you have any questions.

Thank you for your assistance.

Respectfully submitted,

Maxim Technologies
A DIVISION OF TETRA TECH, INC.

Jeffrey Rice
Project Manager

JRR/JS/rr

cc: Judd Stark (Maxim, Billings)
Stacy Pease (Maxim, Missoula)
Aileen Giovanello (TtEC, Boston)

Enclosure

n\typing\Env-fac\6550922\Query Letters\Mower_USFWS_letter

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Twin Cities Field Office
4101 East 80th Street
Bloomington, Minnesota 55425-1665

DEC 22 2005

RECEIVED
JAN 03 2006

Mr. Jeffrey Rice
Project Manager
Tetra Tech, Inc
618 South 25th Street
Billings, Montana 59107-0615

RE: Maxim Project No. 6550922.100

Dear Mr. Rice:

This responds to your November 23, 2005, letter, requesting information on threatened and endangered species in the area of a proposed wind energy facility in Mower County, Minnesota (T101N, R15W; T102 N, R14, 15, 16W; T103N, R15W). The following information responds to potential impacts of the proposed project.

There are currently no federally endangered or threatened species known to occur at the above project locations. Therefore, this precludes the need for further action on this project as required under section 7 of the Endangered Species Act of 1973, as amended. However, if the project is modified or new information becomes available which indicates that listed species may occur in the affected area, consultation with this office should be reinitiated.

The U.S. Fish and Wildlife Service (Service) is also responsible for recommending measures to minimize project impacts to migratory birds and other wildlife resources. In 2003, the Department of Interior developed *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines*. These guidelines can be found on the Internet at http://www.fws.gov/habitatconservation/wind.pdf. We recommend that you use these guidelines in developing your project. Based on our review of National Wetland Inventory maps, wetlands are located throughout the project area. We recommend that wetlands, grasslands, wooded areas and other important habitats be avoided and that turbines be located on agricultural or other lands having minimal habitat value.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, D.C. 20240

IN REPLY REFER TO:

FWS/DFPA/BFA

MAY 13 2003

Memorandum

To: Regional Directors, Regions 1-7

From: Deputy Director

Subject: Service Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines

Wind-generated electrical energy is renewable, produces no emissions, and is considered to be generally environmentally friendly technology. Development of wind energy is strongly endorsed by the Secretary of the Interior, as expressed in the Secretary's Renewable Energy on Public Lands Initiative (May 2002). However, wind energy facilities can adversely impact wildlife, especially birds and bats, and their habitats. As more facilities with larger turbines are built, the cumulative effects of this rapidly growing industry may initiate or contribute to the decline of some wildlife populations. The potential harm to these populations from an additional source of mortality makes careful evaluation of proposed facilities essential. Due to local differences in wildlife concentration and movement patterns, habitats, area topography, facility design, and weather, each proposed development site is unique and requires detailed, individual evaluation.

Service personnel may become involved in the review of potential wind energy developments on public lands through National Environmental Policy Act review (sections 1501.6, *opportunity as a cooperating agency*, and section 1503.4, *duty to comment on federally-licensed activities for agencies with jurisdiction by law*, i.e., the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act); or because of special expertise. The National Wildlife Refuge System Improvement Act requires that any activity on Refuge lands be determined to be compatible with the Refuge system mission and Refuge purpose(s). In addition, the Service is required by the Endangered Species Act to assist other Federal agencies in ensuring that any action they authorize, implement, or fund will not jeopardize the continued existence of any federally endangered or threatened species. Service biologists have also received requests from industry for consultation on wildlife impacts of proposed wind energy developments on private lands.

The following guidance was prepared by the Service's Wind Turbine Siting Working Group. It is intended to assist Service staff in providing technical assistance to the wind energy industry to avoid or minimize impacts to wildlife and their habitats through: (1) proper evaluation of potential wind energy development sites; (2) proper location and design of turbines and

associated structures within sites selected for development; and (3) pre- and post-construction research and monitoring to identify and/or assess impacts to wildlife. This guidance is intended for terrestrial applications only; guidelines for wind energy developments in marine environments and the Great Lakes will be provided at a future date. The interim guidelines are based on current science and will be updated as new information becomes available. They will be evaluated over a two-year period, and then modified as necessary based on their performance in the field and on the latest scientific and technical discoveries developed in coordination with industry, states, academic researchers, and other Federal agencies. A Notice of Availability and request for comments will be published in the Federal Register simultaneously with the release of this guidance to Service personnel. We encourage industry use of this guidance and solicit their feedback on its efficacy.

These guidelines are not intended nor shall they be construed to limit or preclude the Service from exercising its authority under any law, statute, or regulation, and to take enforcement action against any individual, company, industry or agency or to relieve any individual, company, industry, or agency of its obligations to comply with any applicable Federal, State, or local laws, statutes, or regulations.

Implementation of Service recommendations provided in accordance with these guidelines by the wind energy industry is voluntary. Field offices have discretion in the use of these guidelines on a case-by-case basis, and may also have additional recommendations to add which are specific to their geographic area.

The Migratory Bird Treaty Act (16 U.S.C. 703-712) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the Act has no provision for allowing an unauthorized take, it must be recognized that some birds may be killed at structures such as wind turbines even if all reasonable measures to avoid it are implemented. The Service's Office of Law Enforcement carries out its mission to protect migratory birds not only through investigations and enforcement, but also through fostering relationships with individuals and industries that proactively seek to eliminate their impacts on migratory birds. While it is not possible under the Act to absolve individuals, companies, or agencies from liability if they follow these recommended guidelines, the Office of Law Enforcement and Department of Justice have used enforcement and prosecutorial discretion in the past regarding individuals, companies, or agencies who have made good faith efforts to avoid the take of migratory birds.

Please ensure that all field personnel involved in review of wind energy development proposals receive copies of this memorandum. Questions regarding this issue should be directed to Dr. Benjamin N. Tuggle, Chief, Division of Federal Program Activities, at (703) 358-2161, or Brian Millsap, Chief, Division of Migratory Bird Management, at (703) 358-1714.

Attachment

INTERIM GUIDELINES TO AVOID AND MINIMIZE WILDLIFE IMPACTS FROM WIND TURBINES

Introduction

Wind-generated electrical energy is renewable, produces no emissions, and is generally considered to be an environmentally friendly technology. Development of wind energy is strongly endorsed by the Secretary of the Interior, as expressed in the Secretary's Renewable Energy on Public Lands Initiative (May 2002). However, wind energy facilities can adversely impact wildlife, especially birds (e.g., Orloff and Flannery 1992, Leddy et al. 1999, Woodward et al. 2001, Braun et al. 2002, Hunt 2002) and bats (Keeley et al. 2001, Johnson et al. 2002, Johnson et al. 2003). As more facilities with larger turbines are built, the cumulative effects of this rapidly growing industry may initiate or contribute to the decline of some wildlife populations (Manes et al. 2002, Johnson et al. 2002, Manville 2003). The potential harm to these populations from an additional source of mortality or adverse habitat impacts makes careful evaluation of proposed facilities essential. Due to local differences in wildlife concentration and movement patterns, habitats, area topography, facility design, and weather, each proposed development site is unique and requires detailed, individual evaluation.

The following guidance was prepared by the U.S. Fish and Wildlife Service (Service). Like the Service's voluntary guidance addressing the siting, construction, operation, and decommissioning of communication towers (http://migratorybirds.fws.gov/issues/towers/comtow.html) and the voluntary guidance developed in cooperation with the electric utility industry to minimize bird strikes and electrocutions (APLIC 1994, APLIC 1996), this guidance is intended to assist the wind energy industry in avoiding or minimizing impacts to wildlife and their habitats. This is accomplished through: (1) proper evaluation of potential Wind Resource Areas (WRAs), (2) proper location and design of turbines and associated structures within WRAs selected for development, and (3) pre- and post-construction research and monitoring to identify and/or assess impacts to wildlife. These guidelines are based on current science and will be updated as new information becomes available. They are voluntary, and interim in nature. They will be evaluated over a two-year period, and then modified as necessary based on their performance in the field, on comments from the public, and on the latest scientific and technical discoveries developed in coordination with industry, states, academic researchers, and other Federal agencies. After this period, the Service plans to develop a complete operations manual for evaluation, site selection, design, construction, operation, and monitoring of wind energy facilities in both terrestrial and aquatic environments.

Data on wildlife use and mortality collected at one wind energy facility are not necessarily applicable to others; each site poses its own set of possibilities for negative effects on wildlife. In addition, the wind industry is rapidly expanding into habitats and regions that have not been well studied. The Service therefore suggests a precautionary approach to site selection and development, and will employ this approach in making recommendations and assessing impacts of wind energy developments. We encourage the wind energy industry to follow these guidelines and, in cooperation with the Service, to conduct scientific research to provide additional information on the impacts of wind energy development on wildlife. We further encourage the industry to look for opportunities to promote bird and other wildlife conservation when planning wind energy facilities (e.g., voluntary habitat acquisition or conservation easements).

The Service is guided by the Fish and Wildlife Service Mitigation Policy (Federal Register 46 (15), January 1981) in evaluating modifications to or loss of habitat caused by development. This policy follows the sequence of steps recommended in the Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA) in seeking to avoid, minimize, or compensate for negative impacts. Mitigation can involve (1) avoiding the impact of an activity by taking no action; (2) minimizing impacts by limiting the degree of activity; (3) rectifying an impact by repairing, rehabilitating, or restoring an affected environment; (4) reducing or eliminating an impact by conducting activities that preserve and maintain the resources; or (5) compensating for an impact by replacing or providing substitute resources or environments. Any mitigation recommended by the Service

for wind energy development would be voluntary on the part of the developer unless made a condition of a Federal license or permit. Mitigation does not apply to "take" of species under the Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, or Endangered Species Act. The goal of the Service under these laws is the elimination of loss of migratory birds and endangered and threatened species due to wind energy development. The Service will actively expand partnerships with regional, national, and international organizations, States, tribes, industry, and environmental groups to meet this goal.

Projects with Federal involvement may require additional analysis under the National Environmental Policy Act (http://www.fws.gov/r9esnepa), Endangered Species Act (http://endangered.fws.gov), or National Wildlife Refuge System Administration Act (http://www.fws.gov/policyMakers/mandates/index.html#adminact). This includes projects on federally-owned lands (e.g., National Wildlife Refuges, National Forests), lands where a Federal permit is required for development (e.g., BLM-administered lands), or lands where Federal funds were used for purchase or improvement (some State Wildlife Management Areas).

These guidelines are not intended nor shall they be construed to limit or preclude the Service from exercising its authority under any law, statute, or regulation, and to take enforcement action against any individual, company, or agency, or to relieve any individual, company, or agency of its obligations to comply with any applicable Federal, State, or local laws, statutes, or regulations.

The guidelines contain a site evaluation process with checklists for pre-development evaluations of potential terrestrial wind energy development sites (Appendix 1). Use of this process allows comparison of one site with another with respect to the impacts that would occur to wildlife if the area were developed. The evaluation area for a potential development site should include the "footprint" encompassing all of the turbines and associated structures planned for that proposed facility, and the adjacent wildlife habitats which may be affected by the proximity of the structures, but excluding transmission lines extending outside the footprint. All potential development sites within a geographic area should be evaluated before a site is selected for development.

Pre-development evaluations should be conducted by a team that includes Federal and/or State agency wildlife professionals with no vested interest (e.g., monetary or personal business gain) in the sites selected. Teams may also include academic and industry wildlife professionals as available. Any site evaluations conducted by teams that do not include Federal and/or State agency wildlife professionals will not be considered valid evaluations by the Service.

The pre-development evaluation may also identify additional studies needed prior to and after development. Post-construction monitoring to identify any wildlife impacts is recommended at all developed sites. Pre- and post-development studies and monitoring may be conducted by any qualified wildlife biologist without regard to his/her affiliation or interest in the site.

Additional information relevant to these guidelines is appended as follows:

Appendix 2 – Definitions Related to Wind Energy Development and Evaluation
Appendix 3 – Wildlife Laws Relevant to Wind Power Development Projects
Appendix 4 - Research Needs on the Impacts of Wind Power Development on Wildlife
Appendix 5 – Procedures for Endangered Species Evaluations and Consultations
Appendix 6 – Guidelines for Considering Wind Turbine Siting on Easement Lands Administered as Part of the National Wildlife Refuge System in Region 6 (CO, KS, MT, NE, ND, SD, UT, WY)
Appendix 7 – Known and Suspected Impacts of Wind Turbines on Wildlife
Appendix 8 – Literature Cited

Site Evaluation

The site evaluation protocol presented in Appendix 1 was developed by a team of Federal, State, university, and wind energy industry biologists to rank potential terrestrial wind energy development sites by their potential impacts on wildlife. There are two steps to follow:

1. Identify and evaluate reference sites, preferably within the general geographic area of the proposed facility. Reference sites are high-quality wildlife areas where wind development would result in the maximum negative impact on wildlife (i.e., sites selected to have the highest possible rank using the protocol). Reference sites are used to determine the comparative risks of developing other potential sites.

2. Evaluate potential development sites to determine risk to wildlife and rank sites against each other using the highest-ranking reference site as a standard. Although high-ranking sites are generally less desirable for wind energy development, a high rank does not necessarily preclude development of a site, nor does a low rank automatically eliminate the need to conduct pre-development assessments of wildlife resources or post-development assessments of impacts.

Studies to Assess and Monitor Wildlife Impacts

While ranking potential development sites, the site evaluation team referenced above may identify pre-development studies that are needed to better assess potential negative impacts to wildlife. Ranking may also suggest the extent and duration of study required. Developers are encouraged to conduct any studies suggested by the team in coordination with Service and other agency wildlife biologists.

Post-development mortality studies should be a part of any site development plan in order to determine if or to what extent mortality occurs. As with pre-development studies, ranking may suggest the extent and duration of study needed. Studies should be designed in coordination with Federal and other agency biologists.

Site Development Recommendations

The following recommendations apply to locating turbines and associated structures within WRAs selected for development of wind energy facilities:

1. Avoid placing turbines in documented locations of any species of wildlife, fish, or plant protected under the Federal Endangered Species Act.

2. Avoid locating turbines in known local bird migration pathways or in areas where birds are highly concentrated, unless mortality risk is low (e.g., birds present rarely enter the rotor-swept area). Examples of high concentration areas for birds are wetlands, State or Federal refuges, private duck clubs, staging areas, rookeries, leks, roosts, riparian areas along streams, and landfills. Avoid known daily movement flyways (e.g., between roosting and feeding areas) and areas with a high incidence of fog, mist, low cloud ceilings, and low visibility.

3. Avoid placing turbines near known bat hibernation, breeding, and maternity/nursery colonies, in migration corridors, or in flight paths between colonies and feeding areas.

4. Configure turbine locations to avoid areas or features of the landscape known to attract raptors (hawks, falcons, eagles, owls). For example, Golden Eagles, hawks, and falcons use cliff/rim edges extensively; setbacks from these edges may reduce mortality. Other examples include not locating turbines in a dip or pass in a ridge, or in or near prairie dog colonies.

5. Configure turbine arrays to avoid potential avian mortality where feasible. For example, group turbines rather than spreading them widely, and orient rows of turbines parallel to known bird movements, thereby decreasing the potential for bird strikes. Implement appropriate storm water management practices that do not create attractions for birds, and maintain contiguous habitat for area-sensitive species (e.g., Sage Grouse).

6. Avoid fragmenting large, contiguous tracts of wildlife habitat. Where practical, place turbines on lands already altered or cultivated, and away from areas of intact and healthy native habitats. If not practical, select fragmented or degraded habitats over relatively intact areas.

7. Avoid placing turbines in habitat known to be occupied by prairie grouse or other species that exhibit extreme avoidance of vertical features and/or structural habitat fragmentation. In known prairie grouse habitat, avoid placing turbines within 5 miles of known leks (communal pair formation grounds).

8. Minimize roads, fences, and other infrastructure. All infrastructure should be capable of withstanding periodic burning of vegetation, as natural fires or controlled burns are necessary for maintaining most prairie habitats.

9. Develop a habitat restoration plan for the proposed site that avoids or minimizes negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. For example, avoid attracting high densities of prey animals (rodents, rabbits, etc.) used by raptors.

10. Reduce availability of carrion by practicing responsible animal husbandry (removing carcasses, fencing out cattle, etc.) to avoid attracting Golden Eagles and other raptors.

Turbine Design and Operation Recommendations

1. Use tubular supports with pointed tops rather than lattice supports to minimize bird perching and nesting opportunities. Avoid placing external ladders and platforms on tubular towers to minimize perching and nesting. Avoid use of guy wires for turbine or meteorological tower supports. All existing guy wires should be marked with recommended bird deterrent devices (Avian Power Line Interaction Committee 1994).

2. If taller turbines (top of the rotor-swept area is >199 feet above ground level) require lights for aviation safety, the minimum amount of pilot warning and obstruction avoidance lighting specified by the Federal Aviation Administration (FAA) should be used (FAA 2000). Unless otherwise requested by the FAA, only white strobe lights should be used at night, and these should be the minimum number, minimum intensity, and minimum number of flashes per minute (longest duration between flashes) allowable by the FAA. Solid red or pulsating red incandescent lights should not be used, as they appear to attract night-migrating birds at a much higher rate than white strobe lights.

3. Where the height of the rotor-swept area produces a high risk for wildlife, adjust tower height where feasible to reduce the risk of strikes.

4. Where feasible, place electric power lines underground or on the surface as insulated, shielded wire to avoid electrocution of birds. Use recommendations of the Avian Power Line Interaction Committee (1994, 1996) for any required above-ground lines, transformers, or conductors.

5. High seasonal concentrations of birds may cause problems in some areas. If, however, power generation is critical in these areas, an average of three years monitoring data (e.g., acoustic, radar, infrared, or observational) should be collected and used to determine peak use dates for specific sites. Where feasible, turbines should be shut down during periods when birds are highly concentrated at those sites.

6. When upgrading or retrofitting turbines, follow the above guidelines as closely as possible. If studies indicate high mortality at specific older turbines, retrofitting or relocating is highly recommended.

Appendix 1

PROTOCOL TO RANK POTENTIAL TERRESTRIAL WIND ENERGY DEVELOPMENT SITES BY IMPACTS ON WILDLIFE

This protocol was developed by a team of Federal, State, university, and industry biologists to rank potential wind development sites in Montana by their potential for impacts on wildlife (USFWS 2002). It has been modified to apply nationwide. The protocol allows the user to evaluate potential development sites and rank them against a reference site. Objectives are to: (1) assist developers in deciding whether to proceed with development; (2) provide a procedure to determine pre-construction study needs to verify use of potential sites by wildlife; and (3) provide recommendations for monitoring potential sites post-construction to identify, quantify, or verify actual impacts (or lack thereof).

Although this protocol focuses on impacts to wildlife, potential impacts to fish, other aquatic life, and plants should be considered as well. Surveys for rare, threatened, or endangered plants known or suspected to occur in the geographic area should be conducted at all proposed terrestrial development sites having suitable habitat.

This protocol is intended to provide a conceptual framework for initial steps in investigating a site. It is not intended to be all-inclusive relative to objectives, methods, and analysis nor to serve as the definitive reference or directive for any step in wind power related investigations. The Physical Attributes, Species Occurrence and Status, and Ecological Attractiveness groupings in this protocol should serve as a model framework; the terrain features, species, and conditions used in these groupings will be dictated by local conditions and should be developed by wildlife biologists familiar with the region in which this protocol is being used.

Potential Impact Index (PII)

The Potential Impact Index represents a "first cut" analysis of the suitability of a site proposed for development. It does so by estimating use of the site by selected wildlife species as an indicator of potential impact. Emphasis of the PII is on initial site evaluation and is intended to provide more objectivity than simple reconnaissance surveys.

There are two steps to follow in ranking sites by their potential impact on wildlife:

1. Identify and evaluate reference sites within the general geographic area of Wind Resource Areas (WRA's) being considered for development of a facility. Reference sites are areas where wind development would result in the maximum negative impact on wildlife, resulting in a high PII score. Reference sites are used to determine the comparative risks of developing other potential sites.

2. Evaluate potential development sites to determine risk to wildlife, and rank sites against each other using the highest-ranking reference site as a standard. While high-ranking sites are generally less desirable for wind development, a high rank does not necessarily preclude development of a site, not does a low rank automatically eliminate the need to conduct pre-development assessments of wildlife use and impact potential.

The following assumptions are implicit in the PII process:

1. All WRA sites, regardless of turbine design, configuration, placement, or operation present some hazard and risk to wildlife from both an individual and population perspective.

2. Certain sites present less hazard and risk to wildlife than others.

3. No adequate and defensible information exists regarding the appropriateness of the proposed WRA site being evaluated relative to impacts to wildlife.

4. Evaluations will be conducted by qualified biologists without competitive interest in site selection, including those from State and Federal agencies who are familiar with local and regional wildlife.

The PII is designed primarily to evaluate potential impacts on aerial wildlife from collision with turbines and infrastructure. The PII is derived from the results of three checklists (forms are attached). These checklists should be developed and applied as follows:

A. The PHYSICAL ATTRIBUTE checklist considers topographic, meteorological, and site characteristics that may influence bird and bat occurrence and movements.

B. The SPECIES OCCURRENCE AND STATUS checklist includes: Birds of Conservation Concern at the Bird Conservation Region level (http://migratorybirds.fws.gov/reports/reports.html); all federally-listed Endangered, Threatened, and Candidate Species (http://endangered.fws.gov); bird species of high recreational or other value (e.g., waterfowl, prairie grouse); State Endangered, Threatened, and Species of Management Concern; and any additional species of concern listed by State Natural Heritage Programs.

C. The ECOLOGICAL ATTRACTIVENESS checklist evaluates the presence and influence of ecological magnets and other conditions that would draw birds or bats to the site or vicinity.

Each checklist has boxes to be checked for a particular attribute or species found at an evaluation site. The number of boxes in each checklist will vary from region to region due to variations in the number of physical attributes and species of concern in that region. Keep in mind that all boxes in a checklist are very unlikely to be checked at a single evaluation site, because all species and ecological physical conditions potentially occurring in the region would not exist at one site.

Each checklist should be assigned a divisor, which is developed by dividing the number of boxes in a checklist by the total number of boxes in all three checklists. This expands the spread of index values and more dramatically displays the magnitude of differences among sites. For example, if the PHYSICAL ATTRIBUTE checklist has 36 boxes and the total number of boxes in all three checklists is 144, divide 36 by 144 = 0.25, the divisor.

You can change the number of boxes in any of the checklists to fit your geographic area, habitat type, or other selected region (e.g., a state or portion of a state). Remember to recalculate the divisor if you change the number of boxes.

Boxes in a checklist are checked if the condition or species is known or strongly suspected to occur. Criteria for checklist conditions marked with an asterisk (*) are explained on the following page. Conditions that are self-explanatory are not included. Conditions are not weighted. Boxes are checked in the SPECIES OCCURRENCE AND STATUS checklist if presence of the species is unconfirmed but strongly suspected (i.e., WRA is within the range and habitat of the species). This permits more liberal assignment of potential impact, reduces the probability of missing impacts on specific species due to lack of empirical data, and focuses future study and monitoring effort. Totals for each checklist are simple column sums. The PII is calculated from the checklist totals. A completed example from Montana is provided at the end of this Appendix.

Determining Checklist Scores

Checklist scores are determined as follows:

1. Place a check in each box for which an attribute, species, or condition is present or strongly suspected.

2. After completing the three checklists for each site, add the total number of checks in a checklist for an ending sum (each box checked equals one).

Determining PII Score

The Potential Impact Index score is determined as follows:

1. Place the sums from each of the three checklists in the POTENTIAL IMPACT INDEX table sum boxes (Σ column) in the appropriate category.

2. Divide each checklist sum by the previously calculated divisor to adjust the sum for disproportionate numbers of conditions in each checklist, and place this adjusted sum in the Σ/p boxes for each checklist.

3. Add the adjusted checklist sums (Σ/p column) to produce the PII score.

Include any questions, statements, comments, or concerns regarding any checklist cell or category on the SITE SPECIFIC COMMENTS sheet. These comments are critical to determining pre-construction study needs. They will also help identify and refine questions and objectives to be addressed by follow-up study and monitoring. The nature of suspected Significant Ecological Events should be noted on the SITE SPECIFIC COMMENTS sheet.

Ranking PII Scores

PII of each site evaluated is assigned a ranking based on its proportional relationship to the reference site that has the maximum PII score, as shown in Figure 2 in the Montana example. Ranking categories (High, Low, etc.) in the example are arbitrarily set at intervals of 20 percent of maximum.

Rankings are intended as a guide to developers. They are designed to serve as indicators of relative risk to wildlife and thus provide an estimator of the level of impact that may be expected should a site be developed. A high rank does not preclude development, nor does a low rank automatically eliminate the need to conduct pre-development assessments of impacts on wildlife. More intensive pre-construction studies may be needed for both scenarios if development of the site is pursued. Rankings may also suggest the extent of additional study needed.

In the case of federally listed threatened, endangered, or candidate species of wildlife, fish, or plants, consultation with the Fish and Wildlife Service under the Endangered Species Act is required, and may preclude development of a site regardless of its PII score. See Appendix 5 for procedures for obtaining lists of these species that may be present, and for consulting with the Fish and Wildlife Service if species or their habitats are found.

Determining Pre-construction Study Needs

The goals of pre-construction studies are to estimate impacts of proposed wind power development on wildlife by addressing areas of concern identified during the PII process. Objectives, intensity, duration, and methods of pre-construction studies are likely to be site specific, but may be independent of ranking. Regardless of ranking, studies should be designed to address (1) verification of use of WRAs by all species recorded in the "SPECIES OCCURRENCE AND STATUS" checklist, (2) verification of natural conditions (e.g., under "Significant Ecological Events", the magnitude, timing, and location of suspected bird/bat migration), or (3) questions noted in the SITE SPECIFIC COMMENTS sheet for that site. The SITE SPECIFIC COMMENTS sheet may also indicate conditions that need not be investigated. As a result, a site with a low rank may require radar surveillance (e.g., important songbird migration site) while a site with a high rank may require only a single season visual survey (e.g., site potentially contains autumn Whooping Crane habitat). The process should involve a feedback mechanism within an adaptive management strategy (Figure 1). Timely review of study results will determine if data are

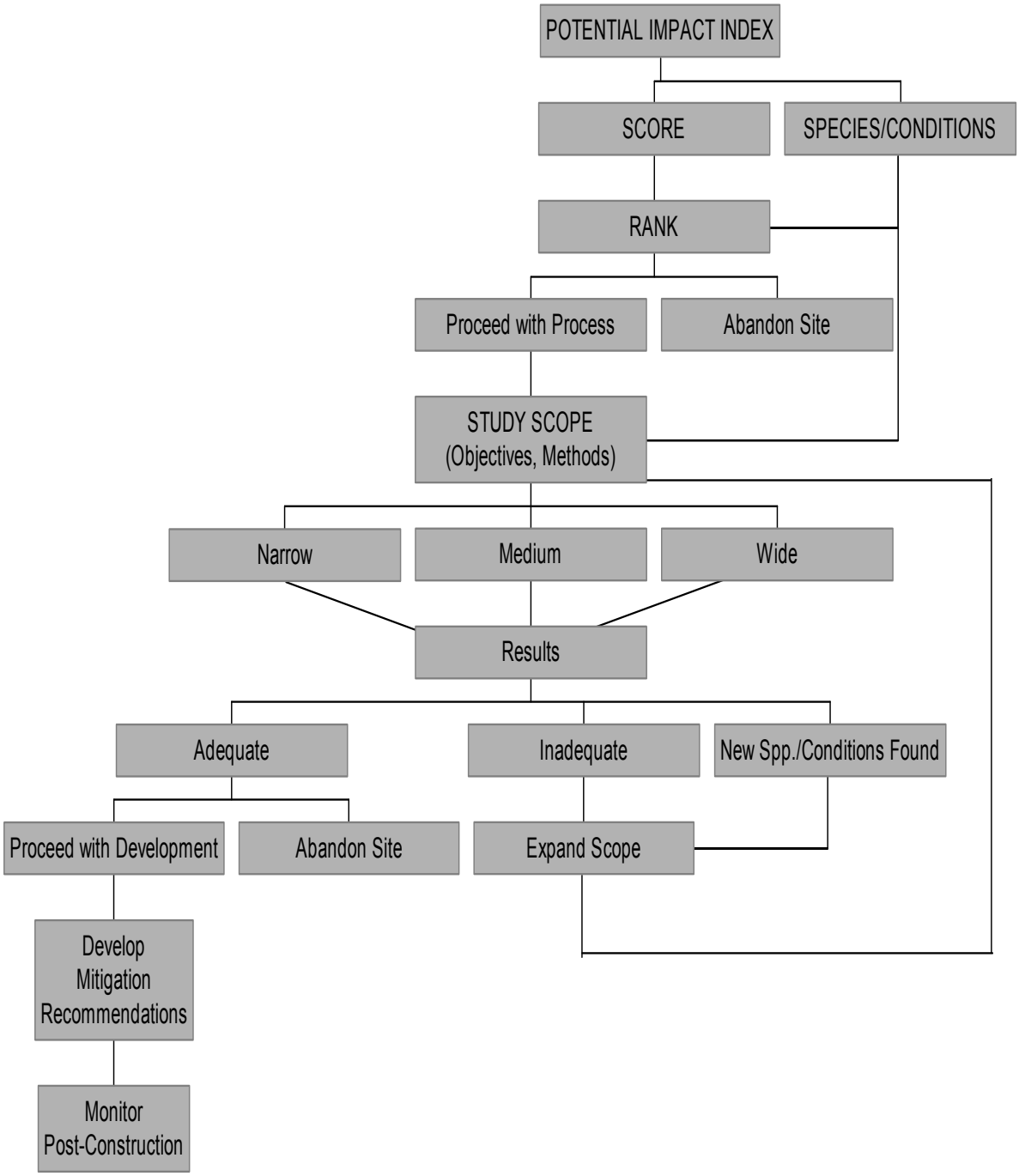


Figure 1. A suggested decision tree for assessing potential development sites. Begin by developing a PII score.

adequate, if conclusions are defensible (Anderson et al. 1999), and if additional investigational effort is required (e.g., if Black-footed Ferrets are found on Mountain Plover searches). Projects with Federal involvement may require additional analysis under the National Environmental Policy Act (http://www.fws.gov/r9esnepa), Endangered Species Act (http://endangered.fws.gov), or National Wildlife Refuge System Administration Act (http://www.fws.gov/policyMakers/mandates/index.html#adminact). Also, the mere existence of a pre-construction study, whether in progress or completed, does not imply Federal sanction for development of a site.

Post-construction Studies

The Service recommends that all sites be monitored for impacts on wildlife after construction is completed. Some sites may be so obviously benign that little more than simple reconnaissance study may be needed and any impact will be revealed during post-construction monitoring. Otherwise, pre-construction studies should be designed to explicitly consider post-construction monitoring that permits statistically valid evaluation of actual impacts. Accordingly, studies should be conducted as much as possible within a Before-After-Control-Impact (BACI) study design (Green 1979). Such design requires investigation of at least two sites (Impact [proposed site] and Control) simultaneously, both pre-construction (Before) and post-construction (After). Because true "Control" sites are seldom available, other sites may be substituted, including reference sites used in developing the PII ranking. In the case of radar surveillance studies, sites within the proposed WRA boundaries may be acceptable (e.g., Harmata et al. 1998). Structuring pre-construction studies within a hypotheses-testing framework will help identify appropriate metrics, focus effort, and permit comparisons with post-construction conditions or other WRAs.

Where feasible, post-construction studies should also be utilized to test measures that may eliminate or reduce impacts on wildlife. See Appendix 4, Research Needs on the Impacts of Wind Power Development on Wildlife.

Metrics and Methods

Metrics and methods are specific tools used to assess wildlife populations and their status (e.g., point counts, line transects, nest success studies, radar surveys, mortality rates, and risk). They can provide important information about birds, bats, and other wildlife at proposed development sites. Metrics and methods may be selected to collect seasonal, group, guild, or habitat specific information, based on data and comments in the SPECIES OCCURRENCE AND STATUS checklist and SITE SPECIFIC COMMENTS sheet. For example, a proposed WRA may be in a narrow north-south oriented valley of relatively monotypic habitat. These conditions suggest a heavy seasonal avian migration corridor but little avian breeding habitat. Accordingly, study emphasis should be on defining use and mortality of migratory birds during autumn or spring or both, with little effort directed at defining use and mortality of breeding birds. Conversely, a potential WRA on a flat plain in diverse habitat would indicate the exact opposite in study emphasis.

While metrics represent specific measurements, concepts, and relationships, methods refer to observational or manipulative study techniques that may be used to verify the location of birds and other wildlife, estimate their numbers, and document their use and behavior (Anderson et al. 1999). Table 1 depicts some commonly used metrics and methods for wildlife studies.

Table 1. Examples of metrics and methods associated with evaluating use and mortality of wildlife at proposed Wind Resource Areas in Montana.

Data Need	Metric	Methods
Use Profile	Individuals/Count	Point Counts (birds) Winter Raptor Surveys Lek Counts (grouse) Migration Counts Ungulate Surveys Spotlight Surveys

	Species/Count	Species/guild/group List Point Counts (birds) Raptor Nesting Surveys Raptor Migration Counts Winter Raptor Surveys Acoustic Surveillance (bats) Pellet Counts Bait Stations Track Boards
	Use per unit of time (e.g., hour, season)	Radar Migration Counts Raptors/watch Area Searches
	Individuals/capture effort	Various techniques for capture
	Productivity	Nests/area Raptor Nesting Surveys Nest Success Ungulate Surveys
	Events/height category (Altitude Profile)	Radar
	Events/distance category (Spatial Profile)	Radar
Mortality	Dead/injured individuals/unit	Transects Spot Searches Carcass Removal Study Observer Detection Efficiency Study

Studies should also strive to generate information to mitigate impacts by properly locating, configuring, or operating turbines (Johnson et al. 2000). Every effort should be made to choose metrics and methods that allow comparisons of pre-construction studies with post-construction studies, other WRAs, and other regions.

Interpreting Metrics

It may be difficult to establish empirically exactly what constitutes high use (i.e., potentially high impact). When looking at the distribution and movements, and local, regional, or range-wide population estimates for particular species, the relative proportions of species, groups, or guilds of wildlife using proposed WRAs may indicate degrees of risk. If baseline population data are unknown, consult with a qualified biologist who can recommend a specific metric.

It is likely that little or no evidence of mortality will be found during pre-construction study. If, however, post-construction mortality is found, and statistical evaluation is not possible, that mortality should be assessed in regard to the species status (e.g., ESA-listed species or Birds of Conservation Concern) or the effect of the loss of individuals of that species on a local, regional, or continental population.

Determining Post-construction Monitoring Needs

Post-construction monitoring is important to the Service, industry, and public because of the limited information available on impacts of wind turbines and WRAs on wildlife. Therefore, post-construction monitoring should be designed to detect major impacts. The intended time frame for post-construction monitoring is not expected to exceed three years, however. Major impacts may be considered as statistically significant decreases in use by species of concern, or limited to statistically significant increases in mortality rates of any wildlife. Monitoring effort may be intensive or cursory, depending on results of pre-construction use and mortality studies. Simple, infrequent mortality surveys on impact and

control plots may be all that is needed at WRAs where recorded pre-construction use by wildlife is low. Documented high use of a proposed WRA may require monitoring methods identical to those employed in pre-construction studies. Anderson et al. (1999) provide specific, detailed direction in post-construction study design and monitoring. Manville (2002) developed a monitoring protocol for use by the U.S. Forest Service at three National Forests in Arizona to monitor the impact of cellular telecommunications towers on migratory birds that could be modified for use at land-based wind turbines.

POTENTIAL IMPACT INDEX CHECKLIST FORMS AND INSTRUCTIONS

PHYSICAL ATTRIBUTE CHECKLIST

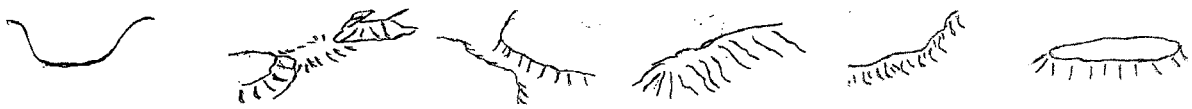
Physical Attribute				Site			
Topography	Mountain Aspect, if mountainous*	Side	W				
			E				
			N				
			S				
		Top					
		Foothill	W				
			E				
			N				
			S				
Wind* Direction	S						
	N						
	E						
	W						
	Updrafts*						
Migratory* Corridor Potential	Latitudinal (N ↔ S)						
	Longitudinal (E ↔ W)						
	Wide Approaches (>30 km)*						
	Funnel Effect	Horizontal					
		Vertical					
Site Size (acres) & Configuration*	<640						
	>640 <1000						
	>1000 <1500						
	Turbine Rows not Parallel to						
Infrastructure To Build	Transmission						
	Roads						
	Buildings*						
	Maintenance						
	Daily Activity						
	Substation						
Increased Activity*							
Totals							

∗ Criteria on following page

PHYSICAL ATTRIBUTE CRITERIA - categories, max Σ = , (p =).

Topography - Terrain characteristic within the ecological influence of the proposed wind development site, generally, but not restricted to ± 5 mi. Some examples are:

Valley Pass Gap Ridgetop Bluff Butte



Mountain Aspect - Aspect of topography for site of proposed development. Multiple categories may be checked.

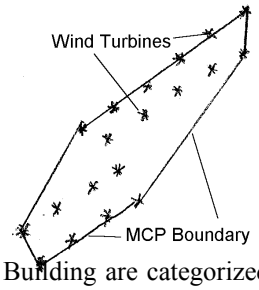
Wind Direction - Compass direction *from* which prevailing winds approach. Multiple categories may be checked.

Updrafts - Do updrafts/upslope winds prevail?

Migratory Corridor Potential - Subjective estimate of area to be a potential avian/bat migratory corridor based strictly on topographical characteristics. Multiple categories may be checked.

- Wide (>20 mi) - Terrain characteristics of approaches to site from each migratory direction, i.e., a large plain, river corridor, long valley. The larger the area that migrant birds/bats are drawn from, the more may be at risk
- Funnel Effect - Is the site in or near an area where migrant birds/bats may be funneled (concentrated) into a smaller area, either altitudinally, laterally, or both?

Site Size & Configuration – Size is estimated as if a minimum convex polygon (MCP) were drawn around peripheral turbines.



Successive boxes are checked to convey relationship of larger size = increased impact to birds/bats, *e.g.*, a 700 acre site will have 2 categories checked while a 1,200 acre site will have all 3 categories checked.

Configuration of turbine rows is usually perpendicular to prevailing wind direction. Rows aligned perpendicular or oblique to route of migration intuitively presents more risk to birds than rows aligned parallel to movement.

Buildings – Building are categorized by relative size and visitation frequency, *i.e.,* structures that are visited daily are usually larger and present more impact than those that are not. If a "Daily Activity" building is required, all Building categories are checked. If a maintenance structure is required, Substation is also checked.

Increased Activity - Will any type of human activity increase? Sites in urban-suburban or otherwise developed areas (oil, gas, mines) will have less impact on wildlife than those in remote or undeveloped areas.

Avian Species of Concern Checklist
(Complete prior to SPECIES OCCURRENCE & STATUS Checklist)

	Site											
Birds (n =)												
Occurrence	B	M/W	Σ	B	M/W	Σ	B	M/W	Σ	B	M/W	Σ

Column totals of this list are added to appropriate cells in the SPECIES OCCURRENCE & STATUS checklist. Consult Birds of Conservation Concern (http://migratorybirds.fws.gov/reports/reports.html) and Threatened/Endangered Species list (http://endangered.fws.gov), and list other species of high value or management concern such as migratory waterfowl and prairie grouse. Appropriate avian field guides and species accounts should be consulted for confirmation of species distribution and habitat associations. State Natural Heritage Programs may also provide species accounts that include additional information useful in completing checklists.

In addition to species lists (rows), season of occurrence is also indicated (columns). "B" indicates breeding or summer occurrence and "M/W" indicates presence during migration or as wintering species. If occurrence within or in the vicinity of a proposed site is confirmed or suspected, an "X" is entered.

Bat Species Of Concern Checklist
(Complete prior to SPECIES OCCURRENCE & STATUS Checklist)

	Site											
Bats (n =)												
Occurrence	B	M/W	Σ	B	M/W	Σ	B	M/W	Σ	B	M/W	Σ
Subtotals												
Total												

Bat Species Of Concern Checklist (species, max Σ =).

Column totals of this list are added to appropriate cells in the SPECIES OCCURRENCE & STATUS checklist. Appropriate bat field guides and references (Barbour and Davis 1969) should be consulted for confirmation of species distribution and habitat associations. State Natural Heritage Programs may also provide species accounts that include additional information useful in completing checklists.

In addition to species lists (rows), season of occurrence is also indicated (columns). "B" indicates breeding or summer occurrence and "M/W" indicates presence during migration or as wintering species. If occurrence within or in the vicinity of a proposed site is confirmed or suspected, an "X" is entered.

SPECIES OCCURRENCE & STATUS CHECKLIST

Species		Site											
	Occurrence	B	M/W	Σ	B	M/W	Σ	B	M/W	Σ	B	M/W	Σ
Threatened & Endangered (includes wildlife, fish, and plants)													
Candidate*													
Special Concern*	Birds (max Σ=)												
	Bats (max Σ=)												
	Subtotals												
	Total												

∗ Criteria on following page

SPECIES OCCURRENCE & STATUS Checklist (categories, max Σ = , (p =).

Checklist totals for each column in "Avian Species of Concern List" and "Bat Species of Concern List" are inserted in this checklist.

Threatened & Endangered Species - Species on the Federal List of Endangered and Threatened Species (http://endangered.fws.gov).

Candidate Species - Species being investigated for inclusion in the Federal List of Endangered and Threatened Species (http://endangered.fws.gov).

Species of Special Concern - Species listed in Birds of Conservation Concern; by Natural Heritage Programs that are known or suspected to be rare, endemic, disjunct, threatened or endangered; and species of high value such as migratory or other game birds.

Golden Eagles may be included in this checklist because of special protective status afforded under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). Other species (e.g., Sage Grouse) may be included because of recent concern over population declines range wide. Bats (other than bat Species of Special Concern) should be included due to generally unknown impacts of wind farms on individuals and populations.

ECOLOGICAL ATTRACTIVENESS CHECKLIST

Ecological Attractor			Site			
Migration Route*	Local					
	Continental*	N				
		S				
		E				
		W				
Ecological Magnets*	Lotic System					
	Lentic System					
	Wetlands					
	Native Grassland					
	Forest					
	Food Concentrated					
	Energetic Foraging					
	Vegetation/ Habitat	Unique				
		Diverse				
Significant Ecological Event*						
Site of Special Conservation Status*						
Total						

∗ Criteria on following page

ECOLOGICAL ATTRACTIVENESS CRITERIA - categories, max Σ = , (p =).

Migration Route - Indicates predominate direction of movement of seasonal migrations. Multiple categories may be checked.

Local - Some avian populations move only altitudinally & direction may be East-West (Sage Grouse, owls, Bald Eagles).

Continental - Some migratory corridors experience mass movements in only one season/direction annually (e.g., Bridger Mountains autumn eagle migration).

Ecological Magnets - Special, unique, unusual, or super ordinary habitats or conditions within the vicinity of the site that may attract wildlife. Lotic systems include small perennial or seasonal creeks to major rivers. Lentic systems include stock ponds to lakes to marine environments. Multiple categories may be checked.

Vegetation/Habitat - Unique or exceptionally diverse vegetation or habitat in the vicinity may indicate exceptional diversity and abundance of avian species or bats.

Significant Ecological Event - Special, unique, unusual, or super ordinary events that occur or are suspected to occur in the vicinity of the site, e.g., up to one third of the Continental population of Trumpeter Swans visit Ennis Lake, < 2.5 miles from a proposed Wind Resource Area; the Continental migration of shorebirds passes over (many stop) at Benton Lake National Wildlife Refuge) and up to 2,000 Golden Eagles pass over the Bridger Mountains in autumn. If unknown but suspected a "?" is entered. Specifics regarding the cell are then addressed in the appropriate box of the SITE SPECIFIC COMMENTS sheet to focus follow-up investigation and assist in definition of study objectives.

Site of Special Conservation Status - Any existing or proposed covenants, conservation easements, or other land development limitations intended to conserve, protect, or enhance wildlife or habitat. This criterion is weighted (2 entered if true) because of previous financial or other investment in ecological values. Specifics regarding the easement are then addressed in the appropriate box of the SITE SPECIFIC COMMENTS sheet to focus follow-up attention.

POTENTIAL IMPACT INDEX

	Site							
Checklist (p)[1]	Σ	Σ/p	Σ	Σ/p	Σ	Σ/p	Σ	Σ/p
Physical ( )								
Species Occurrence & Status ( )								
Ecological ( )								
Totals								

[1]Proportion of total checklist categories.

Determining PII Score

A. Place the sums from each of the three checklists in the POTENTIAL IMPACT INDEX table sum boxes (Σ column) in the appropriate category.

B. Divide each checklist sum by the previously calculated divisor to adjust the sum for disproportionate numbers of conditions in each checklist, and place this adjusted sum in the Σ/p boxes for each checklist.

C. Add the Σ/p boxes for the three checklists to obtain a total score.

SITE SPECIFIC COMMENTS

Checklist	Site			
Physical				
Species Occurrence				
Ecological				

EXAMPLE SITE ASSESSMENT AND
CALCULATION OF POTENTIAL IMPACT INDEX (PII)
FROM MONTANA

POTENTIAL IMPACT INDEX CHECKLISTS

Calculating Divisors

A. Each checklist should be assigned a divisor, which is developed by dividing the number of boxes in a checklist by the total number of boxes in all three checklists. In this example, the total number of boxes in all three checklists is 143.

B. Physical Attribute checklist: 36 boxes ÷ 143 = 0.25; Species Occurrence and Status checklist: 91 boxes ÷ 143 = 0.63; Ecological Attractiveness checklist: 16 boxes ÷ 143 = 0.11.

Determining Checklist Scores

A. Place a check in each box for which an attribute, species, or condition is present or strongly suspected.

B. After completing the three checklists for each site, add the total number of checks in a checklist for an ending sum (each box checked equals 1).

PHYSICAL ATTRIBUTE CHECKLIST

Physical Attribute				Site: Snowy Mtn.Range			
Topography	Mountain Aspect	Side	W	X			
			E				
			N				
			S				
		Top					
		Foothill	W	X			
			E				
			N				
			S				
	Valley			X			
	Pass						
	Gap						
	Ridge			X			
	Bluff						
	Butte						
Wind Direction	S						
	N			X			
	E						
	W						
	Updrafts			X			
Migratory Corridor Potential	Latitudinal (N ↔ S)						
	Longitudinal (E ↔ W)			X			
	Wide Approaches (>30 km)						
	Funnel Effect	Horizontal		X			
		Vertical					
Site Size (acres) & Configuration	<640			X			
	>640 <1000			X			
	>1000 <1500			X			
	Turbine Rows not Parallel to						
Infrastructure To Build	Transmission			X			
	Roads			X			
	Buildings			X			
	Maintenance			X			
	Daily Activity			X			
	Substation			X			
Increased Activity				X			
Totals				18			

Avian Species of Concern Checklist
(Complete prior to SPECIES OCCURRENCE & STATUS Checklist)

	Site											
Birds (n = 12)	Snowy Mtn. R.											
Occurrence	B	M/W	∑	B	M/W	Σ	B	M/W	Σ	B	M/W	Σ
Nelson's Sharptailed Sparrow	X	X	2									
LeConte's Sparrow	X	X	2									
Baird's Sparrow	X	X	2									
Dickcissel	X		1									
Cassion's Kingbird	X		1									
Blackbacked Woodpecker	X		1									
Yellow-billed Cuckoo	X		1									
Peregrine Falcon	X		1									
Northern Goshawk		X	1									
Ferruginous Hawk		X	1									
Clark's Grebe	X		1									
Common Loon	X		1									
Subtotals	10	5	15									
Total			15									

Bat Species Of Concern Checklist
(Complete prior to SPECIES OCCURRENCE & STATUS Checklist)

Bats (n = 2)	Site											
	Snowy Mtn. Range											
Occurrence	B	M/W	∑	B	M/W	Σ	B	M/W	Σ	B	M/W	Σ
Fringed Myotis	X		1									
Spotted Bat	X		1									
Subtotals	2		2									
Total			2									

SPECIES OCCURRENCE & STATUS CHECKLIST

	Species	Site: Snow Mtn. R.											
	Occurrence	B	M/W	∑	B	M/W	Σ	B	M/W	Σ	B	M/W	Σ
Threatened & Endangered	Bald Eagle		X	1									
Candidate	Columbian Sharp-tailed Grouse	X	X	2									
Special Concern	Birds (max ∑=)			15									
	Bats (max ∑=)			2									
	Subtotals			20									
	Total			20									

ECOLOGICAL ATTRACTIVENESS CHECKLIST

Ecological Attractor			Site: Snowy Mtn. Range			
Migration Route	Local					
	Continental	N	X			
		S	X			
		E				
		W				
Ecological Magnets	Lotic System					
	Lentic System					
	Wetlands		X			
	Native Grassland		X			
	Forest		X			
	Food Concentrated					
	Energetic Foraging		X			
	Vegetation/ Habitat	Unique				
		Diverse	X			
Significant Ecological Event						
Site of Special Conservation Status						
Total			7			

POTENTIAL IMPACT INDEX

	Site							
Checklist (p)[1]	Σ	Σ/p	Σ	Σ/p	Σ	Σ/p	Σ	Σ/p
Physical (0.25) 15÷.25=60	15	60						
Species Occurrence & Status (0.63) 20÷.63=32	20	32						
Ecological (0.11) 7÷.11=64	7	64						
Totals	42	**156**						

[1]Proportion of total checklist categories.

Score is 156, compared to the highest reference site score of 244 (Figure 2).

Determining PII Score

A. Place the sums from each of the three checklists in the POTENTIAL IMPACT INDEX table sum boxes (Σ column) in the appropriate category.

B. Divide each checklist sum by the previously calculated divisor to adjust the sum for disproportionate numbers of conditions in each checklist, and place this adjusted sum in the Σ/p boxes for each checklist.

C. Add the Σ/p boxes for the three checklists to obtain a total score.

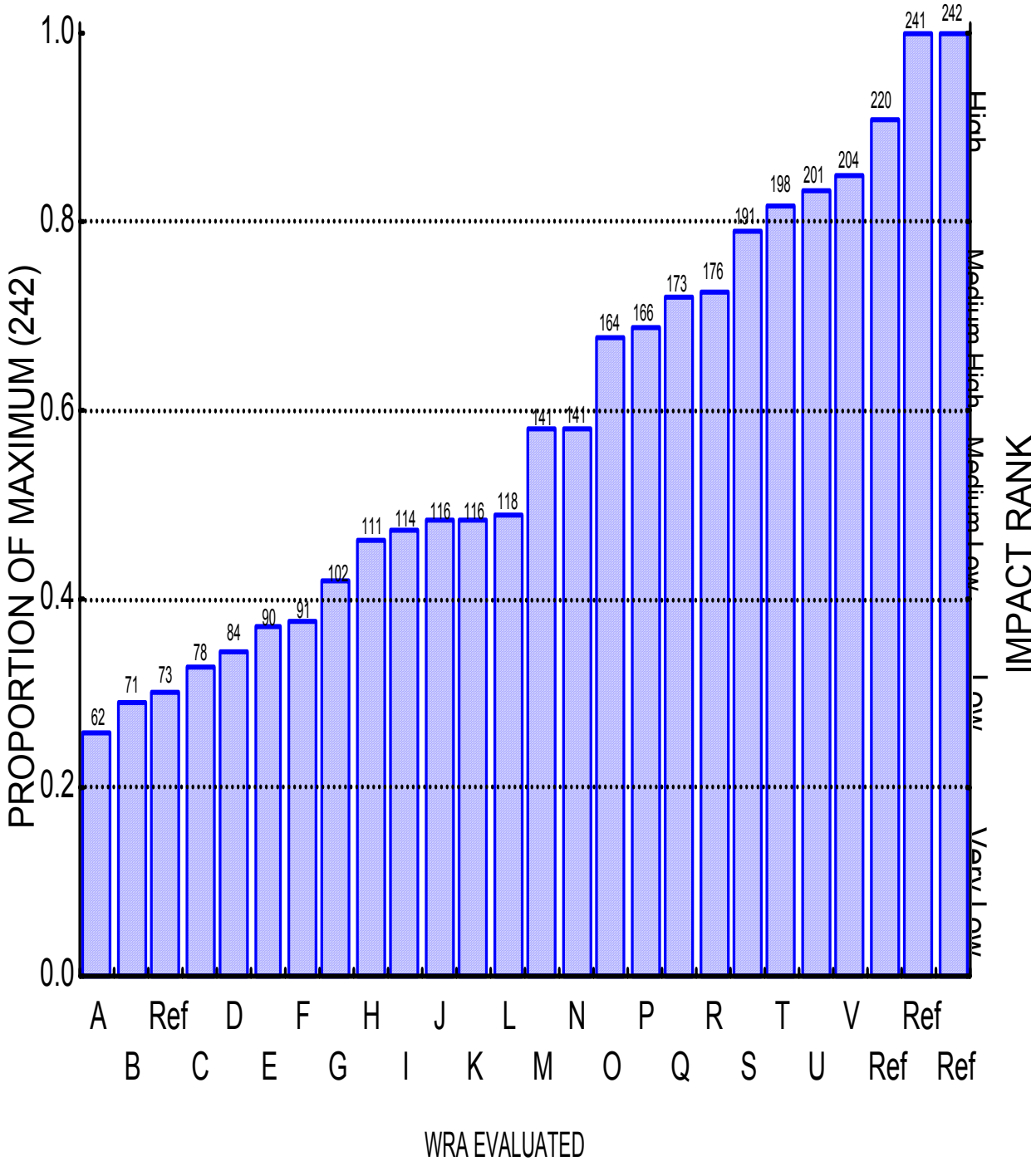


Figure 2. Impact ranks of proposed Wind Resource Areas in Montana. The number above each bar is the PII score. Rank is a function of the proportional relationship of proposed development sites to the maximum score of 4 Reference Sites evaluated.

Appendix 2

DEFINITIONS RELATED TO WIND ENERGY DEVELOPMENT AND EVALUATION

AGL: height above ground level in feet.

Breco Bird Scaring Buoy: a device developed to disperse seabirds at oil spills, which emits some 30 different sounds (including alert calls) up to 130 dB, generally effective in scaring birds at distances up to 200 yards, but may deter birds to 0.5 mile radius. The floating device can be used daytime or night, in fog, wind or storms.

Deterrent Devices: specific equipment, devices, or techniques which are intended to be seen or heard to alert and deter birds from contacting turbine towers, rotors, guy wires, or related equipment. These include diverters installed on turbine or meteorological tower guy wires, dark (e.g., black) paint on single turbine blades or portions of a blade, or noise-making devices that alert (e.g., infrasound) or frighten (e.g., Breco Buoys) birds.

Fish and Wildlife: any member of the animal kingdom, including any bird (including any migratory, non-migratory, or endangered bird for which protection is afforded), mammal, fish, amphibian, reptile, mollusk, crustacean, arthropod, or other invertebrate. Unless otherwise indicated, the Fish and Wildlife Service is particularly concerned about the impacts of wind turbines on birds and bats.

Flyway: a concentrated, predictable flight path of migratory bird species (e.g., particularly water birds such as ducks, geese, large waders, and shorebirds, but also raptors, and sometimes songbirds) from their breeding ground to wintering area. Except along coast lines, the flyway concept may not generally apply to songbirds because they tend to migrate in broad fronts rather than down specific flyways. The term "corridors" has sometimes been used. These frontal movements of songbirds can change within and between seasons and years – as can, for example, movements of waterfowl – making specific designations more difficult. The concept applies both biologically and administratively. For administrative purposes, for example, there are four waterfowl flyways (Atlantic, Pacific, Central, and Pacific and three shorebird flyways (East, Central, and Pacific). "Daily flyways" may also exist between roosting, breeding, and feeding areas.

Lek: A traditional site used year after year by males of certain species of birds (in North America, Greater and Lesser Prairie-chickens, Sage and Sharp-tailed grouse, and Buff-breasted Sandpiper), within which the males display communally to compete for female mates. Dominant males secure the majority of all the matings. Pair bonds are not formed; females leave to nest and raise the young, and males do not take part in parental care.

Passerines: a scientific term for the order of songbirds, many of which winter in tropical areas.

Precautionary Approach: a conservative, scientific approach to conserving and managing habitats and species. Absent definitive data, the approach suggests taking the best steps available to initiate appropriate conservation actions. Those actions should then be refined through the use of principles of adaptive management and sound science. The absence of complete or definitive scientific information should not be used as a reason for postponing or failing to take measures to conserve target species, associated or dependent species, or non-target species and their environments. Specifically, developers should apply a precautionary approach widely to conservation and management of birds, bats, other fauna, flora, and affected habitats. This will protect the resources and preserve Wind Resource Areas by taking account of the best scientific evidence available.

Reference Site: an area of high wildlife value which is used to evaluate the suitability of other areas for wind energy development. Reference sites are selected by biologists familiar with the wildlife in the geographic area and habitat types where wind energy development is contemplated, and evaluated using the Ranking Protocol in Appendix 1. The reference site having the highest score, i.e., the area where wind energy development would have the greatest negative impact on wildlife, is used as the standard against which potential wind energy development sites are ranked.

Riparian Area: The vegetation, habitats, or ecosystems that are associated with streams, rivers, or lakes, or are dependent upon the existence of perennial, intermittent, or ephemeral surface or subsurface water drainage. Relative to other habitats, riparian habitats have a disproportionately high wildlife value in the drier western states due to the

presence of surface water and/or lush vegetation that is typically surrounded by harsher, arid or semi-arid environments.

Rookery: the breeding place of a colony of gregarious birds (e.g., herons) or mammals (e.g., bats).

Rotor-swept Area: generally the vertical airspace within which the turbine blades (usually 3) rotate on a pivot point or drive train rotor. The Area will vary in location depending on the direction of the prevailing wind. While "slower" turbines may operate at speeds less than 30 revolutions per minute (RPMs), turbine speeds at the blade tips can still exceed 220 miles per hour in stiff winds. Recent studies indicate that birds appear unable to recognize blade presence at rotor tips during high blade speed, referred to as the "smear effect."

Staging Area: a traditional site where migratory birds of one or more species congregate in spring and fall for varying periods of time to forage and build up fat reserves prior to launching migratory flights. The term may be used on both the breeding and wintering grounds, as well as at intermediate stopover sites used at any point along the migration route.

Turbine Position within a Row/String: the specific position of a turbine within a string or row of turbines. It may be designated as an end-row, mid-row, or lone row turbine (one not located within a row).

Wind Resource Area: the geographic area or footprint within which wind turbines are located and operated, such as the Altamont Pass, California, WRA, or where location and operation of turbines are anticipated. The term may be used to describe an existing facility, or a general area in which development of a facility is proposed. Existing facilities are known variously as "wind farms," "wind parks," or "energy parks." WRAs are selected based primarily on the reliability and availability of sufficient wind. These areas are designated by the *United States Wind Resource Map*, published by the National Renewable Energy Laboratory, Department of Energy (http://rredc.nrel.gov). The *Map* delineates wind power classifications from "marginal" to "superb" based on a Weibull wind speed index.

Appendix 3

WILDLIFE LAWS RELEVANT TO WIND POWER DEVELOPMENT PROJECTS

The Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA), which is administered by the Fish and Wildlife Service (FWS), is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute wherein proof of intent is not an element of a taking violation. Wording is clear in that most actions that result in a "taking" or possession (permanent or temporary) of a protected species can be a violation. Specifically, the MBTA states:

"Unless and except as permitted by regulations … it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import … transport or cause to be transported … any migratory bird, any part, nest, or eggs of any such bird … (The Act) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior." The word "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect."

A 1972 amendment to the MBTA resulted in inclusion of Bald Eagles and other birds of prey in the definition of a migratory bird. The MBTA provides criminal penalties for persons who, by any means or in any manner, pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird (including Bald Eagles) as well as possessing Bald Eagles, their parts, nests, or eggs without a permit. A violation of the MBTA by an individual can result in a fine of up to $15,000, and/or imprisonment for up to 6 months, for a misdemeanor, and up to $250,000 and/or imprisonment for up to 2 years for a felony. Fines are doubled for organizations. Penalties increase greatly for offenses involving commercialization and/or the sale of migratory birds and/or their parts. Under authority of the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; BGEPA), Bald and Golden Eagles are afforded additional legal protection. Penalties for violations of the BGEPA are up to $250,000 and/or 2 years imprisonment for a felony, with fines doubled for an organization.

While these Acts have no provision for allowing unauthorized take, the FWS realizes that some birds may be killed even if all reasonable measures to avoid the take are implemented. The FWS Office of Law Enforcement carries out its mission to protect migratory birds not only through investigations and enforcement, but also through fostering relationships with individuals, companies, and industries who seek to eliminate their impacts on migratory birds. Unless the activity is authorized, it is not possible to absolve individuals, companies, or agencies from liability even if they implement avian mortality avoidance or similar conservation measures. However, the Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented.

The Endangered Species Act (16 U.S.C. 1531-1544; ESA) was passed by Congress in 1973 in recognition that many of our Nation's native plants and animals were in danger of becoming extinct. The purposes of the Act are to protect these endangered and threatened species and to provide a means to conserve their ecosystems. To this end, Federal agencies are directed to utilize their authorities to conserve listed species, as well as "Candidate" species which may be listed in the near future, and make sure that their actions do not jeopardize the continued existence of these species. The law is administered by the Interior Department's FWS and the Commerce Department's National Marine Fisheries Service (NMFS). The FWS has primary responsibility for terrestrial and freshwater organisms, while the NMFS has responsibility for marine species such as whales and salmon. These two agencies work with other agencies to plan or modify Federal projects so that they will have minimal impact on listed species and their habitats. Protection of species is also achieved through partnerships with the States, with Federal financial assistance and a system of incentives available to encourage State participation. The FWS also works with private landowners, providing financial and technical assistance for management actions on their lands to benefit both listed and non-listed species.

Section 9 of the ESA makes it unlawful for a person to "take" a listed species. Take means ". . . to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." The Secretary

of the Interior, through regulations, defined the term "harm" as "an act which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." However, permits for "incidental take" can be obtained from the FWS for take which would occur as a result of an otherwise legal activity, such as construction of wind turbines, and which would not jeopardize the species.

Section 10 of the ESA allows for the development of "Habitat Conservation Plans" for endangered species on private lands. This provision is designed to assist private landowners in incorporating conservation measures for listed species with their land and/or water development plans. Private landowners who develop and implement an approved habitat conservation plan can receive an incidental take permit that allows their development to go forward.

The National Environmental Policy Act of 1969 (42 U.S.C. 4371 et seq.; NEPA) requires that Federal agencies prepare an environmental impact statement (EIS) for Federal actions significantly affecting the quality of the human environment. "Federal Actions" are those actions in which a Federal agency is conducting the activity, providing funding for the activity, or licensing or permitting the activity. An EIS must describe the proposed action, present detailed analyses of the impacts of the proposed action and alternatives to that action, and include public involvement in the decision making process on how to proceed to accomplish the purpose of the action. The purpose of NEPA is to allow better environmental decisions to be made. The Council on Environmental Quality, established by NEPA, has promulgated regulations in 40 CFR 1500-1508 that include provisions for 1) preparing EISs and Environmental Assessments, 2) considering categorical exclusions from NEPA documentation requirements for certain agency actions, and 3) developing cooperating agency agreements between Federal agencies.

Other Federal agencies may be required by NEPA to review and comment on proposed activities as a cooperating agency with the action agency under Section 1501.6, or because of a duty to comment on federally-licensed activities for which the agency has jurisdiction by law (Section 1503.4). For the FWS, this would be the MBTA and BGEPA. Other agencies may also be called on for review and comment because of special expertise.

The National Wildlife Refuge System Administration Act (16 U.S.C. 668dd), as amended, serves as the "organic act" for the National Wildlife Refuge System. It consolidates the various categories of lands administered by the Secretary of the Interior (Secretary) through the FWS into a single National Wildlife Refuge System. The Act establishes a unifying mission for the Refuge System, a process for determining compatible uses of refuges, and a requirement for preparing comprehensive conservation plans. The Act states first and foremost that the mission of the National Wildlife Refuge System will be focused singularly on wildlife conservation.

The Act identifies six priority wildlife-dependent recreation uses; clarifies the Secretary's authority to accept donations of money for land acquisition; and places restrictions on the transfer, exchange, or other disposal of lands within the Refuge System. Most importantly, the Act reinforces and expands the "compatibility standard" of the Refuge Recreation Act, authorizing the Secretary, under such regulations as he may prescribe, to "permit the use of any area within the System for any purpose, including but not limited to hunting, fishing, public recreation and accommodations, and access whenever he determines that such uses are compatible with the major purposes for which such areas were established." This section applies to any proposed development of wind energy on Refuge System lands; such development must be compatible with the major purpose for which that Refuge was established.

The National Historic Preservation Act of 1966 (16 U.S.C. 470-470b, 470c-470n) approved October 15, 1966 and repeatedly amended, provides for preservation of significant historical features (buildings, objects, and sites) through a grant-in-aid program to the States. It established a National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. 468-468d). The Act also requires Federal agencies to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register. Thus, the Act functions similarly to NEPA, requiring a determination of the presence of any such items or sites, and an evaluation of the effects of proposed developments (such as wind energy facilities) on them, if the facility would be built, funded, licensed or permitted by a Federal agency. This includes State lands purchased or improved with Federal Aid in Wildlife Restoration funds.

Appendix 4

RESEARCH NEEDS ON THE IMPACTS OF WIND POWER DEVELOPMENT ON WILDLIFE

Representatives of the Fish and Wildlife Service's Wind Turbine Siting Working Group have suggested the following research needs:

- Effects of inclement weather in attracting birds and bats to lighted turbines, e.g., drawing birds and bats to within rotor-swept area of turbines, particularly for passerines during spring and fall migrations.

- Localized effects of turbines on wildlife: habitat fragmentation and loss; effects of noise on both aquatic and terrestrial wildlife; habituation.

- Effects of wind turbine string configuration on mortality, e.g., end of row turbine effect, turbines in dips or passes or draws, setbacks from rim/cliff edges.

- Effectiveness of deterrents: alternating colors on blades (particularly, effect of black/white and UV gel coats on the smear effect); lights (e.g., color, duration, and intensity of pilot warning lights; lasers); infrasound (Breco Buoys, other noisemakers such as predator and distress calls if not irritating to humans, other wildlife, or domestic animals); visual markers on guy wires.

- Utility of acoustic, infrared, and radar technologies to detect bird species presence, abundance, location height, and movement.

- Accuracy of mortality counts: estimate of the number of carcasses (especially of passerines) lost because they have been fragmented and lost to collision momentum and the wind; size and shape of dead bird search areas; possibility of recording collisions acoustically or with radar or infrared monitoring.

- Annual variability (temporal and spatial) in migratory pathways; what is the utility of Geographic Information System to assess migratory pathways and stopovers, particularly for passerines and bats.

- Effectiveness of seasonal wind turbine shutdowns at preventing mortalities, including the feasibility of using "self-erecting" turbines that are easily erected and dismantled without cranes, and taking them down during critical periods such as migrations.

- Impacts of larger turbines versus smaller models.

- Changes in predator-prey relationships due to placing potential perching sites in prairie habitats.

Appendix 5

PROCEDURES FOR ENDANGERED SPECIES EVALUATIONS AND CONSULTATIONS

The Endangered Species Act (ESA) directs all Federal agencies to participate in endangered species conservation. Specifically, section 7(a)(1) of the ESA charges Federal agencies to aid in the conservation of listed species. Section 7 (a)(2) requires Federal agencies to consult with the Fish and Wildlife Service (FWS) to ensure that actions that they fund, authorize, permit, or otherwise carry out will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats. The FWS has developed a handbook describing the consultation process in detail. It is available on the FWS web site at http://endangered.fws.gov/consultations. Consultation may be informal or formal, depending upon the presence of listed species and the potential for the proposed project to affect them.

Before initiating an action, the Federal action agency (the agency authorizing a specific action) or its non-Federal permit applicant, must ask the FWS to provide a list of threatened, endangered, proposed, and candidate species and designated critical habitats that may be present in the project area. This initiates the informal consultation process. If the FWS answers that no species or critical habitats are present, then the Federal action agency or permit applicant has no further ESA obligation under section 7(a)(2), and consultation is concluded. If listed species or critical habitats are present, then the action agency or applicant must determine whether the project may affect those species (known as a *may affect* determination), and informal consultation continues. If the action agency or applicant determines, and the FWS agrees, that the project does not adversely affect any listed species, then the consultation is concluded and the decision is put in writing.

If the action agency or applicant determines that a project *may adversely affect* a listed species or designated critical habitat, the action agency/applicant prepares a *Biological Assessment* and requests formal consultation. There is a designated period of time in which to consult (90 days), and beyond that, another set period of time for the FWS to prepare a *biological opinion* (45 days). An analysis of whether or not the proposed action would be likely to jeopardize the species or adversely modify its critical habitat is determined in the biological opinion. If a *jeopardy* or *adverse modification* determination is made, the biological opinion must identify any reasonable and prudent alternatives that could allow the project to move forward.

The biological opinion will contain an "incidental take statement." "Take" is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting or attempting to engage in any such conduct. "Harm" is further defined to include significant habitat modification or degradation that results in death or injury to a listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, an otherwise lawful activity. If the FWS issues a *jeopardy* opinion, the incidental take statement will simply state that no take is authorized. If the FWS issues a nonjeopardy opinion, the FWS will anticipate the take that may result from the proposed project and describe that take in the incidental take statement. The statement will contain clear terms and conditions designed to reduce the impact of the anticipated take to the species; these terms are non-discretionary on the action agency or applicant.

When non-Federal activities will result in take of threatened or endangered species, an *incidental take permit* is required under section 10 of the ESA. A habitat conservation plan or "HCP" must accompany an application for an incidental take permit. The habitat conservation plan associated with the permit is to ensure that there are adequate conservation measures to avoid jeopardy to the species.

Examples:

1. **No Effect** – The appropriate conclusion when the action agency or applicant determines that its proposed action will not affect a listed species or designated critical habitat.

   Example: A permit applicant contacts the FWS to request information on listed species. The FWS provides a species list containing 3 plants, 1 fish, and 1 butterfly. The proposed project would be constructed at an upland site on clay soils. The 3 plants are found only on sandy soils. The butterfly's habitat is one of the plants on sandy soil. The nearest sandy soils are 10 miles from the proposed project. The fish is in a stream 5 miles from the proposed project. Conclusion: No effects from the project, either

direct or indirect. Justification: No construction is proposed in listed species habitat or in an area that may affect listed species. In addition, the project proponent has charted a route for heavy equipment moving onto the construction site that avoids listed species habitat.

2. **May Affect, but Not Likely to Adversely Affect** – The appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not (a) be able to meaningfully measure, detect, or evaluate insignificant effects, or (b) expect discountable effects to occur.

   Example: The applicant contacts the FWS to request information on listed species. The FWS provides a species list containing 2 birds and 1 fish. The proposed project would be constructed at an upland site, 200 yards from the stream (fish habitat) and adjoining riparian vegetation (bird habitat). The migratory birds use the riparian vegetation to nest between April 15 and August 15. The uplands are highly erodible soils. The project proponent agrees not to construct during the nesting season. He flags the riparian vegetation to indicate an avoidance zone and installs silt fencing between the riparian vegetation and the construction site. He states that he will plant the disturbed soils surrounding the project with native vegetation after construction. He also agrees to monitor the vegetation planted for 3 years to assure that it establishes sufficiently to prevent any additional erosion in the project area caused by construction. Conclusion: Although the project proponent is working in very close proximity to listed species habitat, the action is not likely to adversely affect listed species. Justification: The proponent has incorporated sufficient avoidance and other mitigation measures into the project that any effects to listed species would be discountable. The project proponent prepares a Biological Assessment that includes a complete description of the project, all proposed avoidance and other mitigation measures, and the resulting effects of the project on the listed species. The Biological Assessment is sent to the FWS to request concurrence that the project is not likely to adversely affect listed species.

3. **May Affect, and Likely to Adversely Affect** – The appropriate finding in a Biological Assessment (or conclusion during informal consultation) if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. In the event the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action "is likely to adversely affect" the listed species. If incidental take is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" determination should be made. This determination requires the initiation of formal section 7 consultation.

   Example: The applicant contacts the FWS to request information on listed species. The FWS provides a species list containing 10 birds. The proposed project would be constructed at an upland site within a significant migratory bird corridor that is utilized by the 10 listed birds. Construction will permanently alter the character of the corridor and will likely cause take of listed birds every year during the migration periods. Conclusion: Formal consultation will be required. The project proponent prepares a Biological Assessment to submit to the action agency to accompany their request to initiate formal consultation. Justification: The project is likely to cause take of listed birds every year during their migration periods.

Appendix 6

GUIDELINES FOR CONSIDERING WIND TURBINE SITING ON EASEMENT LANDS ADMINISTERED AS PART OF THE NATIONAL WILDLIFE REFUGE SYSTEM IN REGION 6

Grassland easements are acquired to protect native and planted grasslands essential for grassland dependent migratory birds and other wildlife. Healthy grasslands provide both nesting and migration habitat necessary to maintain these important populations. Wind energy could severely impact this important program if not developed carefully with as little impact to migratory birds and their habitat as possible.

The following guidelines are to be used when making compatibility determinations for the siting of wind turbines and associated facilities on lands encumbered by U.S. Fish and Wildlife Service (Service) grassland easements and USDA conservation easements administered by the Service in Region 6, particularly in North Dakota, South Dakota, and Montana. These guidelines are intended to provide guidance for considering compatibility determinations during the period while the Service and the wind power industry monitor potential impacts to migratory birds as a result of turbine construction, maintenance, and operation. The following guidelines will be incorporated into rights-of-way permits issued for the construction of turbines, access roads, and other associated activities necessary to make the turbines operational. The intention of these guidelines is to minimize impacts to migratory birds and protect the habitat covered by the easement. The guidelines pertain only to permits issued for the alteration or destruction of grassland habitat as a result of turbine and other associated construction on lands encumbered by Service easements.

Refuge Managers and Wetland District Managers shall use these guidelines for site-by-site consideration of compatibility determinations for individual right-of-way requests for wind turbines on easement lands. These guidelines may be incorporated as needed as right-of-way or permit stipulations.

These guidelines may be revised and modified as a result of the findings of research and monitoring conducted in the future. Wind turbine rights-of-way applications will be reviewed according to these guidelines in conjunction with the Service's compatibility policy and in accordance with 50 CFR 29.21 and the Service Realty Manual. Future right-of-way applications will be reviewed using the guidelines in effect at the time of application. The Service will not make changes to previously issued rights-of-way or easement permits issued under these guidelines.

1) The Service may permit up to one turbine per 160 acres on an individual easement tract. No more than one turbine may be allowed on an individual easement tract of less than 160 acres. Current biological information (Attachment 2) indicates that this density of turbines would not have any significant impact to grassland habitat and its value to migratory birds or other wildlife. This is the upper limit for the density of turbines on easements. However, consideration may be given to clump or consolidate towers within an easement tract(s) to minimize the disturbance to the remaining habitat, i.e., two turbines may be clumped on a tract of 320 acres. Information available at this time indicates that turbine densities at this level will not materially interfere with or detract from the purposes of the easement (Attachment 2). Wind power industry turbine spacing recommendations are 2,000 feet between wind turbines and 2,000 feet from an occupied building. This constraint may limit the ability to clump turbines.

2) Turbines shall not be constructed in wetlands, including lakes, ponds, marshes, sloughs, swales, swamps, or potholes. Similarly, turbine locations should avoid obvious "duck passes" between large (20 acres or greater), semi-permanent (type 4, or cattail/bulrush) wetlands or sloughs. In addition, known migratory bird corridors or flight paths and environmentally sensitive areas such as colonial bird nesting areas or upland game bird leks, should be avoided.

3) Siting recommendations made by the Service for turbines and access roads and turbine lighting recommendations shall be consistent with all general siting and mitigating measures for tower and transmission line construction (Director's September 14, 2000 memorandum, attachment 3, APLIC 1996, and APLIC 1994).

4) Priority should be given to siting turbines on tame, planted, or seeded grasslands in preference to unbroken native prairie when such options are available on a given easement tract.

5) Spoil material from the excavated turbine pad shall not be deposited in wetlands and must be stored or deposited off easement lands using established roads to transport the material off site.

6) Turbines shall be sited as close to existing roads or the edge of the grassland tract as practical. Disturbance of grassland to construct and maintain a wind turbine shall be done in such a manner as to minimize the destruction or alteration of the habitat. Use of existing roads as a means of accessing a turbine within protected habitats is strongly encouraged. Conservation measures shall be used to avoid the impacts of erosion and sedimentation in order to protect grasslands and wetlands during the construction of the access road. Buried transmission lines, electric lines, and other cables shall be co-located on the access road when practical. Turbine construction should be encouraged to occur outside the breeding season for migratory birds when practical.

7) Regardless of a Service permit the developer is responsible for adhering to all local, state, and federal regulations in siting turbine location and construction. In the event that location and construction criteria conflict between the various levels of government, the criteria providing the maximum protection to the habitat shall be the criteria used during turbine location and construction.

8) In the event that a turbine is no longer utilized for power generation and has been abandoned for that purpose, the turbine owner shall remove the turbine at his/her own expense from the easement tract. The turbine site and associated facilities shall be reclaimed by the turbine owner by planting these areas to a grass mixture consistent with the surrounding grassland or such mixture as is mutually agreed upon by the Service and the turbine owner.

9) The turbine owner must update bird strike avoidance equipment on turbines and implement techniques that reduce the disturbance to nesting birds at turbine sites as future research and evaluation by the Service and the industry indicate.

These guidelines provide flexibility for the Service Refuge Manager in evaluating compatibility determinations and to negotiate with the energy company and the easement landowner to allow wind turbine development consistent with the purposes of the conservation easements. Where development is found to be compatible with easement purposes the guidelines will be used to negotiate siting, lighting, and other restrictions to grant rights-of-way and easement permits for wind turbines.

References:

Avian Power Line Interaction Committee (APLIC). 1994. Mitigating bird collisions with power lines: The state of the art in 1994.

Avian Power Line Interaction Committee (APLIC). 1996. Suggested practices for raptor protection on power lines: the state of the art in 1996.

Attachment 2

Potential Effect of Wind Turbine Presence on Numbers of Breeding Grassland Birds and Nesting Ducks on Grassland Easement Properties in North and South Dakota.

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Recently, companies that develop wind-powered electricity generation have begun operations in areas of South Dakota and North Dakota where the U.S. Fish and Wildlife Service has purchased or intends to purchase conservation easements on grasslands. Questions have been raised within the FWS as to whether the placement of wind towers on easement tracts would violate terms of the easement contract, and whether the Service would consider purchasing easements on lands after towers are in place. Before allowing turbines on easement lands, the Service must address the issue of whether placement of wind turbines on grassland easements is compatible with the

goals and purpose of refuge lands as defined by the Refuge Improvement Act, which states that, "A Compatible use means . . . any other use of a National Wildlife Refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes(s) of the National Wildlife Refuge." If birds avoid the area surrounding wind turbines because of noise, disruption of habitat, or disturbance, the biological value of an easement may be compromised. At this time, we do not know if wind turbines are compatible with the purpose of grassland easements, because we do not know if turbines reduce the attractiveness of a site to birds or if turbines affect avian reproductive success. The issue is complicated partly because, if, the FWS restricts certain alternative uses on easements, this may reduce the willingness of landowners to offer to sell easements to the FWS in the future. For example, some landowners believe the potential income derived from wind generators will exceed the income from selling grass easements to the FWS or other conservation organizations. In this respect, the future success of the easement program could be compromised if these restrictions are unnecessary.

Little is known about bird avoidance of grasslands near wind turbines, as previous avian research at wind towers has focused primarily on bird strikes. In one study that did consider avoidance, density of grassland birds was reduced in the immediate vicinity of wind turbines at Buffalo Ridge, Minnesota, (Leddy et al. 1999), although at larger scales no differences were detected (Johnson et al. 2000). However, in the Buffalo Ridge study, wind turbines were placed primarily in Conservation Reserve Program fields with few wetlands and much higher densities of breeding birds than are typically found in native prairie where grassland easements are targeted in the Dakotas, and therefore results from Leddy et al. (1999) may not be applicable here. In the absence of specific data on the effect of wind turbines on birds in North and South Dakota, we used two approaches to assess the potential impact; 1) existing data (Igl and Johnson 1997, D. H. Johnson, unpublished data) was used to estimate the potential impact of wind turbine placement on grassland bird use in quarter-section (160 acre) parcels, and 2) a Mallard productivity model (Cowardin et al. 1988) was used to predict changes in nesting and recruitment rate of ducks on grassland areas with wind turbines in place.

Grassland birds. For the first assessment, abundance of grassland birds, standardized to 160 acres of grassland habitat, was estimated from data gathered on 128 quarter sections in North Dakota during summers of 1992 and 1993 (Igl and Johnson 1997, D. H. Johnson, unpublished data). We estimated the potential impact of wind turbines at two scales representing a five-acre and two-acre loss of habitat for each wind tower, with one wind tower per quarter section. We estimated the two-acre potential area of impact as approximately 4 times the area of road and tower pad (Appendix 1); the five-acre area of impact was estimated using the 80-m reported zone of reduced bird density surrounding towers at Buffalo Ridge (Leddy et al. 1999, Appendix 1). For purposes of our analysis, we assumed that no grassland birds would be present in the area immediately surrounding the tower, which is a worst-case scenario, because (Leddy et al. 1999) showed that birds are present immediately adjacent to turbines, but at reduced densities. Thus, our methods guaranteed we would predict a reduction in birds using easements, however, our intent was to put this change into perspective relative to bird use on the entire easement. Given the high variance associated with the grassland bird data we used, it would be impossible to detect a statistically significant decrease in grassland bird numbers, because the lower 95% confidence limit for population estimates was less than zero for each species (D. H. Johnson, unpublished data). Therefore, we estimated the impact of tower presence by calculating the density of each grassland bird species per 160-acre tract, and then calculating the mean reduction in the number of pairs if 2 acre and 5 acre areas of habitat were considered as unused (Table 1).

Expected reductions were estimated at approximately 1% and 3% of the number of individuals present for each species. As expected, greatest reductions in number of pairs occurred with common species such as the chestnut-collared longspur and horned lark; where, at the 5 acres level, a reduction of less than 1 pair per 160-acre tract would be expected. For all species combined, we estimated the expected maximum reduction would be about 2 pairs per 160 acre area, or about 3 percent of the total population. As mentioned previously, based on variation observed in the existing data set, these levels of change would not be statistically significant. Additionally, because we would expect some bird use of the area near the tower, the actual change would likely be less than the numbers presented in table 1.

Table 1. Mean number of breeding pairs of grassland birds found per 160 acres of grassland and expected reduction in pairs with loss of 5 acres and 2 acres of habitat. Data based on surveys of 128 160-acre parcels in North Dakota during summers of 1992 and 1993 (Igl and Johnson 1997, D. H. Johnson, unpublished data).

	Mean Number (pairs)		Mean Reduction (pairs)	
Species	1992	1993	5 acre	2 acre
Baird's Sparrow	1.424	2.464	0.06075	0.0243
Bobolink	0.336	0.784	0.0175	0.007

Brewer's Sparrow	0	0	0	0
Brown-headed Cowbird	2.88	3.632	0.10175	0.0407
Chestnut-collared Longspur	15.584	19.696	0.55125	0.2205
Clay-colored Sparrow	2.08	1.92	0.0625	0.025
Common Yellowthroat	0.144	0.112	0.004	0.0016
Dickcissel	0.304	0.32	0.00975	0.0039
Ferruginous Hawk	0.032	0.24	0.00425	0.0017
Field Sparrow	0.24	0	0.00375	0.0015
Grasshopper Sparrow	6.368	8.928	0.239	0.0956
Gray Catbird	0	0	0	0
Gray Partridge	0.16	0.128	0.0045	0.0018
Horned Lark	6.88	12.544	0.3035	0.1214
Killdeer	0.544	0.848	0.02175	0.0087
Lark Bunting	8.416	4.16	0.1965	0.0786
Lark Sparrow	0.448	0.128	0.009	0.0036
Le Conte's Sparrow	0	0.192	0.003	0.0012
Northern Harrier	0.304	0.512	0.01275	0.0051
Red-winged Blackbird	1.616	1.248	0.04475	0.0179
Ring-necked Pheasant	0.16	0.368	0.00825	0.0033
Savannah Sparrow	1.184	2.144	0.052	0.0208
Sedge Wren	0.16	0	0.0025	0.001
Sharp-tailed Grouse	0.432	0.464	0.014	0.0056
Sharp-tailed Sparrow	0.032	0	0.0005	0.0002
Short-eared Owl	0.032	0.032	0.001	0.0004
Sprague's Pipit	0.256	0.576	0.013	0.0052
Swainson's Hawk	0.032	0.16	0.003	0.0012
Upland Sandpiper	1.52	1.552	0.048	0.0192
Vesper Sparrow	1.312	0.976	0.03575	0.0143
Western Meadowlark	7.088	11.184	0.2855	0.1142
SUM	**59.97**	**75.31**	**2.11**	**0.85**

Ducks. To assess the impact of wind turbines on ducks, we used the Mallard Productivity Model (Cowardin et al. 1988). The Mallard Model is particularly useful for this exercise because it allowed us to predict any "net" change in nest site selection and recruitment that might occur as a result of simulating the reduction of grasslands available to nesting hens due to the placement of wind turbines. For example, if grassland availability is reduced as a result of disturbance, displaced hens may select other habitat types (e.g., cropland, hayland etc.) in the area for nesting, or they may elect to nest elsewhere in the grasslands protected by easement. If other habitats are selected, this could result in reduced recruitment because, most other habitats are characterized by lower nest success compared to grass habitats. However, if these hens select nest sites in the remaining grasslands outside the influence of the wind turbines, nest success will not change materially and recruitment rate will be the same with-or-without turbines. For this exercise, we selected six study areas from Four Square Mile plots used for breeding population and production surveys (Cowardin et al. 1995) in the Kulm Wetland Management District in North Dakota. Plots were selected that had ≥160 acres of grassland in one unit, and were accessible to ≥60 breeding duck pairs (≥12 mallard pairs) based on the "thunderstorm map" (HAPET 2000) for North Dakota. These criteria are consistent with those used by FWS Realty Office, Bismarck, ND for focusing grassland easements, and the Kulm WMD is representative of areas where the grassland easement program is being targeted. For the purpose of our assessment, all grasslands on study plots selected were treated as protected by easement. This was done to obtain sample acreage similar to easement acreage being purchased. We ran the model on plots with-and-without wind turbines in place and compared the response by mallard hens. The area of influence for turbines was set at 5 acres and was converted to barren habitat which simulated eliminating all nesting activity in that area. To reduce variability, and thus increase the precision of our estimates we conducted eight model runs (1000 hens each) and then scaled the average results to the estimated mallard population on each study plot.

Neither nests initiated or recruitment rates differed significantly between treatment and control model runs (Table 2). The variation shown in nests initiated and recruitment rate between treatment and control runs is due to variation inherent in the biological system being examined. The model predicts that hens displaced by the presence of wind turbines will select nesting sites in the remaining available grass habitat and that recruitment rates will not be influenced.

Summary. Using data collected in North Dakota and South Dakota for grassland birds and ducks, we were able to estimate the magnitude of change that would likely be observed if similar data were collected on grassland easement properties. For some species of grassland birds that have restricted distributions the changes predicted could be underestimated on some sites, but it is unlikely these would be of a different order of magnitude. For ducks, the changes predicted account for differences in geographic distribution. Based on our assessment, the expected impact of wind turbines on grassland nesting species would be negligible with the density of one turbine per 160 acre area.

Table 2. Mallard nests initiated and recruitment rate estimates on six study plots with-and-without wind turbines, based on Mallard Model predictions. ( ) standard errors.

			Without Wind Turbines			With Wind Turbines			
Study plot	Pop. Estimate	Grass Acres	Init. Nests	Recr. Rate	SE	No. Turbines	Init.Nests	Recr. Rate	SE
153	55	761	21	0.67	(.0115)	2	21	0.64	(.0090)
178	60	205	14	0.53	(.0094)	1	13	0.52	(.0064)
329	45	1496	59	0.57	(.0055)	3	59	0.59	(.0124)
330	35	1810	51	0.55	(.0163)	8	52	0.55	(.0118)
331	26	1310	18	0.62	(.0104)	2	18	0.59	(.0120)
332	70	1312	58	0.58	(.0166	2	60	0.58	(.0072)

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APPENDIX 1. Calculations of potential area of impact for wind towers on grassland easements in North Dakota and South Dakota.

Two-acre impact:

40 foot by 40 foot pad for tower		1,600 ft^2
16.5 foot by 1320 foot access road		21,780 ft^2
	total	23,380

Physical disruption of site is approximately 0.54 acre; we multiplied this by four to estimate a zone of potential impact.

Five-acre impact:
80-m zone of reduced density surrounding tower

80 m * 80 m * 3.14	2.0 ha
˜ 2.5 acres per ha	5.0 acres

Attachment 3

Memorandum

To: Regional Directors, Regions 1-7

From: Director

Subject: Service Guidance on the Siting, Construction, Operation and Decommissioning of Communications Towers

Construction of communications towers (including radio, television, cellular, and microwave) in the United States has been growing at an exponential rate, increasing at an estimated 6 percent to 8 percent annually. According to the Federal Communication Commission=s *2000 Antenna Structure Registry*, the number of lighted towers greater than 199 feet above ground level currently number over 45,000 and the total number of towers over 74,000. By 2003, all television stations must be digital, adding potentially 1,000 new towers exceeding 1,000 feet AGL.

The construction of new towers creates a potentially significant impact on migratory birds, especially some 350 species of night-migrating birds. Communications towers are estimated to kill 4-5 million birds per year, which violates the spirit and the intent of the Migratory Bird Treaty Act and the Code of Federal Regulations at Part 50 designed to implement the MBTA. Some of the species affected are also protected under the Endangered Species Act and Bald and Golden Eagle Act.

Service personnel may become involved in the review of proposed tower sitings and/or in the evaluation of tower impacts on migratory birds through National Environmental Policy Act review; specifically, sections 1501.6, opportunity to be a cooperating agency, and 1503.4, duty to comment on federally-licensed activities for agencies with jurisdiction by law, in this case the MBTA, or because of special expertise. Also, the National Wildlife Refuge System Improvement Act requires that any activity on Refuge lands be determined as compatible with the Refuge system mission and the Refuge purpose(s). In addition, the Service is required by the ESA to assist other Federal agencies in ensuring that any action they authorize, implement, or fund will not jeopardize the continued existence of any federally endangered or threatened species.

A Communication Tower Working Group composed of government agencies, industry, academic researchers and NGO=s has been formed to develop and implement a research protocol to determine the best ways to construct and operate towers to prevent bird strikes. Until the research study is completed, or until research efforts uncover significant new mitigation measures, all Service personnel involved in the review of proposed tower sitings and/or the evaluation of the impacts of towers on migratory birds should use the attached interim guidelines when making recommendations to all companies, license applicants, or licensees proposing new tower sitings. These guidelines were developed by Service personnel from research conducted in several eastern, midwestern, and southern States, and have been refined through Regional review. They are based on the best information available at this time, and are the most prudent and effective measures for avoiding bird strikes at towers. We believe that they will provide significant protection for migratory birds pending completion of the Working Group=s recommendations. As new information becomes available, the guidelines will be updated accordingly.

Implementation of these guidelines by the communications industry is voluntary, and our recommendations must be balanced with Federal Aviation Administration requirements and local community concerns where necessary. Field

offices have discretion in the use of these guidelines on a case by case basis, and may also have additional recommendations to add which are specific to their geographic area.

Also attached is a Tower Site Evaluation Form which may prove useful in evaluating proposed towers and in streamlining the evaluation process. Copies may be provided to consultants or tower companies who regularly submit requests for consultation, as well as to those who submit individual requests that do not contain sufficient information to allow adequate evaluation. This form is for discretionary use, and may be modified as necessary.

The Migratory Bird Treaty Act (16 U.S.C. 703-712) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the Act has no provision for allowing an unauthorized take, it must be recognized that some birds may be killed at structures such as communications towers even if all reasonable measures to avoid it are implemented. The Service=s Division of Law Enforcement carries out its mission to protect migratory birds not only through investigations and enforcement, but also through fostering relationships with individuals and industries that proactively seek to eliminate their impacts on migratory birds. While it is not possible under the Act to absolve individuals or companies from liability if they follow these recommended guidelines, the Division of Law Enforcement and Department of Justice have used enforcement and prosecutorial discretion in the past regarding individuals or companies who have made good faith efforts to avoid the take of migratory birds.

Please ensure that all field personnel involved in review of FCC licensed communications tower proposals receive copies of this memorandum. Questions regarding this issue should be directed to Dr. Benjamin N. Tuggle, Chief, Division of Habitat Conservation, at (703)358-2161, or

Jon Andrew, Chief, Division of Migratory Bird Management, at (703)358-1714. These guidelines will be incorporated in a Director=s Order and placed in the Fish and Wildlife Service Manual at a future date.

Attachment

cc: 3012-MIB-FWS/Directorate Reading File
3012-MIB-FWS/CCU Files
3245-MIB-FWS/AFHC Reading Files
840-ARLSQ-FWS/AF Files
400-ARLSQ-FWS/DHC Files
400-ARLSQ-FWS/DHC/BFA Files
400-ARLSQ-FWS/DHC/BFA Staff
520-ARLSQ-FWS/LE Files
634-ARLSQ-FWS/MBMO Files (Jon Andrew)

FWS/DHC/BFA/RWillis:bg:08/09/00:(703)358-2183
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Service Interim Guidelines For Recommendations On
Communications Tower Siting, Construction, Operation, and Decommissioning

1. Any company/applicant/licensee proposing to construct a new communications tower should be strongly encouraged to collocate the communications equipment on an existing communication tower or other structure (e.g., billboard, water tower, or building mount). Depending on tower load factors, from 6 to 10 providers may collocate on an existing tower.

2. If collocation is not feasible and a new tower or towers are to be constructed, communications service providers should be strongly encouraged to construct towers no more than 199 feet above ground level, using construction techniques which do not require guy wires (e.g., use a lattice structure, monopole, etc.). Such towers should be unlighted if Federal Aviation Administration regulations permit.

3. If constructing multiple towers, providers should consider the cumulative impacts of all of those towers to migratory birds and threatened and endangered species as well as the impacts of each individual tower.

4. If at all possible, new towers should be sited within existing "antenna farms" (clusters of towers). Towers should not be sited in or near wetlands, other known bird concentration areas (e.g., State or Federal refuges, staging areas, rookeries), in known migratory or daily movement flyways, or in habitat of threatened or endangered species. Towers should not be sited in areas with a high incidence of fog, mist, and low ceilings.

5. If taller (>199 feet AGL) towers requiring lights for aviation safety must be constructed, the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA should be used. Unless otherwise required by the FAA, only white (preferable) or red strobe lights should be used at night, and these should be the minimum number, minimum intensity, and minimum number of flashes per minute (longest duration between flashes) allowable by the FAA. The use of solid red or pulsating red warning lights at night should be avoided. Current research indicates that solid or pulsating (beacon) red lights attract night-migrating birds at a much higher rate than white strobe lights. Red strobe lights have not yet been studied.

6. Tower designs using guy wires for support which are proposed to be located in known raptor or waterbird concentration areas or daily movement routes, or in major diurnal migratory bird movement routes or stopover sites, should have daytime visual markers on the wires to prevent collisions by these diurnally moving species. (For guidance on markers, see *Avian Power Line Interaction Committee (APLIC). 1994. Mitigating Bird Collisions with Power Lines: The State of the Art in 1994. Edison Electric Institute, Washington, D.C., 78 pp*, and *Avian Power Line Interaction Committee (APLIC). 1996. Suggested Practices for Raptor Protection on Power Lines. Edison Electric Institute/Raptor Research Foundation, Washington, D.C., 128 pp.* Copies can be obtained via the Internet at http://www.eei.org/resources/pubcat/enviro/, or by calling 1-800/334-5453).

7. Towers and appendant facilities should be sited, designed and constructed so as to avoid or minimize habitat loss within and adjacent to the tower "footprint"@ However, a larger tower footprint is preferable to the use of guy wires in construction. Road access and fencing should be minimized to reduce or prevent habitat fragmentation and disturbance, and to reduce above ground obstacles to birds in flight.

8. If significant numbers of breeding, feeding, or roosting birds are known to habitually use the proposed tower construction area, relocation to an alternate site should be recommended. If this is not an option, seasonal restrictions on construction may be advisable in order to avoid disturbance during periods of high bird activity.

9. In order to reduce the number of towers needed in the future, providers should be encouraged to design new towers structurally and electrically to accommodate the applicant/licensee's antennas and comparable antennas for at least two additional users (minimum of three users for each tower structure), unless this design would require the addition of lights or guy wires to an otherwise unlighted and/or unguyed tower.

10. Security lighting for on-ground facilities and equipment should be down-shielded to keep light within the boundaries of the site.

11. If a tower is constructed or proposed for construction, Service personnel or researchers from the Communication Tower Working Group should be allowed access to the site to evaluate bird use, conduct dead-bird searches, to place net catchments below the towers but above the ground, and to place radar, Global Positioning

System, infrared, thermal imagery, and acoustical monitoring equipment as necessary to assess and verify bird movements and to gain information on the impacts of various tower sizes, configurations, and lighting systems.

12. Towers no longer in use or determined to be obsolete should be removed within 12 months of cessation of use.

In order to obtain information on the extent to which these guidelines are being implemented, and to identify any recurring problems with their implementation which may necessitate modifications, letters provided in response to requests for evaluation of proposed towers should contain the following request:

> "In order to obtain information on the usefulness of these guidelines in preventing bird strikes, and to identify any recurring problems with their implementation which may necessitate modifications, please advise us of the final location and specifications of the proposed tower, and which of the measures recommended for the protection of migratory birds were implemented. If any of the recommended measures can not be implemented, please explain why they were not feasible."

Appendix 7

KNOWN AND SUSPECTED IMPACTS OF WIND TURBINES ON WILDLIFE

While wind-generated electrical energy is renewable, emission-free, and generally environmentally clean (American Wind Energy Association [AWEA] unpubl. data, <http://www.awea.org>), it does have one significant downside -- rotor blades kill birds, especially raptors (Hunt 2002) and bats. Birds can strike the towers; electrocutions can occur if designs are poor; and wind farms may impact bird movements, breeding, and habitat use.

Wind turbine technology is not new to the United States. In the 1800s, Cape Cod supported over 1,000 working wind turbines (Ferdinand 2002). In the late 1930s, Vermont boasted the world's then-largest turbine, which was likely disabled by high winds due to design flaws. But wind turbine 'farms' and their impacts to birds are a recent phenomenon compared to power lines and communication towers, where mortality has been documented for decades or longer (Boeker and Nickerson 1975, Olendorff et al. 1981, APLIC 1994, APLIC 1996, Harness 1997, Ainley et al. 2001, Manville 2001). The problem in the U.S. surfaced in the late 1980s and early 1990s at the Altamont Pass Wind Resource Area, a facility then containing some 6,500 turbines on 73 mi^2 of gently rolling hills just east of San Francisco Bay, California (Davis 1995). Orloff and Flannery (1992) estimated that several hundred raptors were killed each year due to turbine collisions, guy wire strikes, and electrocutions. The most common fatalities were those of Red-tailed Hawks (*Buteo jamaicensis*), American Kestrels (*Falco sparvarius*) and Golden Eagles (*Aquila chrysaetos*), with fewer mortalities of Turkey Vultures (*Cathartes aura*), Common Ravens (*Corvus corax*), and Barn Owls (*Tyto alba*). The impacts of this wind farm were of most concern to the population of Golden Eagles, which was showing a "disturbing source of mortality" to a disproportionately large segment of the population (Southern Niagara Escarpment [WI] Wind Resource Area unpubl. report). More recent studies indicate that a model previously used to assess Golden Eagle mortality was defective, and that nonbreeding Golden Eagles representing a "floater" population were likely suffering less mortality based on a new model (Hunt 2002). Research continues at this time to further assess the impacts of Altamont turbines on raptors. The Altamont turbines are still estimated to kill 40-60 subadult and adult Golden Eagles each year, as well as several hundred Red-tailed Hawks and American Kestrels – a continuing concern for the FWS. Of the variety of wind turbines at the site, the smaller, faster moving, Kenetech-built, lattice-supported turbines caused most of the mortality. As part of a re-powering effort, these turbines are now being replaced with slower moving, tubular-supported turbines. While Europeans have used tubular towers almost exclusively, the U.S. has almost solely used lattice support, at least until recently (Berg 1996).

Colson (1995) indicated that some 16,000 wind turbines operated in California, making the State the largest concentration of wind energy development in the world. Since 1995, that statistic has changed. While California still boasts the greatest number of turbines in the U.S., many smaller turbines are being replaced by fewer but larger models. Worldwide, an estimated 50,000 turbines are generating power (AWEA unpubl. data; Ferdinand 2002), of which over 15,000 are currently in 29 states in the U.S. Turbine numbers are often difficult to track since statistics are generally presented in megawatts (MW) of electricity produced rather than number of turbines present. The latter statistic is of greater concern to ornithologists. In 1998, for example, Germany was the greatest producer with 2,874 MW of electricity produced by turbines, followed by the U.S. (1,884), and Denmark (1,450); (AWEA unpubl. data). While some project that the number of wind turbines in the U.S. may increase by another 16,000 in the next 10 years, current trends indicate an even greater potential growth. Although the U.S. presently produces less than 1% of its electrical energy from turbines – compared, for example, to Norway's 15% – 2001 was a banner year for U.S. turbine technology, doubling the previous record for installed wind production. Companies installed 1,898 turbines in 26 states, which will produce nearly 1,700 MW, at a cost of $1.7 billion for the new equipment (J. Cadogan, U.S. Department of Energy, 2002, pers. comm.). Over the past decade, wind power has been the fastest growing energy industry in the world. By 2020, the AWEA (unpubl. data) predicts that wind will provide 6% of this nation's electricity, serving as many as 25 million households. Enron Wind Corporation constructed some 1,500 of the 1,898 turbines installed in the U.S. in 2001. Although Enron is now bankrupt, General Electric purchased the company and is now producing wind turbines.

In March 2002, President Bush signed the Job Creation and Worker Assistance Act, extending the production tax credit to the wind industry for another two years. There are presently attempts in Congress to amend the reauthorization of this legislation for five or more years. However, even with a bright future for growth, and with low speed tubular-constructed wind turbine technology now being stressed, larger and slower moving turbines still kill raptors, passerines, waterbirds, other avian species, and bats. Low wind speed turbine technology requires much larger rotors, blade tips often extending more than 420 ft. above ground, and blade tips can reach speeds in excess of 200 mph under windy conditions (J. Cadogan, U.S. Department of Energy, 2002, pers. comm.). When birds

approach spinning turbine blades, "motion smear" – the inability of the bird's retina to process high speed motion stimulation – occurs primarily at the tips of the blades, making the blades deceptively transparent at high velocities. This increases the likelihood that a bird will fly through this arc, be struck by a blade, and be killed (Hodos et al. 2001).

What cumulative impact these larger turbines will have on birds and bats has yet to be determined. Johnson et al. 2002b raised some concerns about the impacts of newer, larger turbines on birds. Their data indicated that higher levels of mortality might be associated with the newer and larger turbines, and they indicated that wind power-related avian mortality would likely contribute to the cumulative impacts on birds. Since little research has been conducted on the impacts of large land-sited and offshore turbines on birds and bats, this newer technology is ripe for research.

Howell and Noone (1992) estimated U.S. avian mortality at 0.0 to 0.117 birds/turbine/yr., while in Europe, Winkelman (1992) estimated mortality at 0.1 to 37 birds/turbine/yr. Erickson et al. (2001) reassessed U.S. turbine impact, based on more than 15,000 turbines (some 11,500 in California), and estimated mortality in the range of 10,000 to 40,000 (mean = 33,000), with an average of 2.19 avian fatalities/turbine/yr. and 0.033 raptor fatalities/turbine/yr. This may be a considerable underestimate. As with other structural impacts, only a systematic turbine review will provide a more reliable estimate of mortality. While some have argued that turbine impacts are small (Berg 1996), especially when compared to those from communication towers and power lines, turbines can pose some unique problems, especially for birds of prey. Mortalities must be reduced, especially as turbine numbers increase. In addition to protections under the MBTA, Bald and Golden Eagles are afforded protections under the ESA for the former and the BGEPA for both raptors. As strict liability statutes, MBTA and BGEPA also provide no provisions for unauthorized "take." Wind farms can affect local populations of Golden Eagles and other raptors whose breeding and recruitment rates are naturally slow and whose populations tend to have smaller numbers of breeding adults (Davis 1995). Large raptors are also revered by Native Americans as well as by many others within the public. They are symbolic megafauna, and provide greater emotional appeal to many than do smaller avian species. Raptors also have a lower tolerance for additive mortality (Anderson et al. 1997). As with all other human-caused mortality, we have a responsibility to reverse mortality trends.

Until very recently, U.S. wind turbines have mostly been land-based. Perhaps following the European lead of siting wind turbines in estuarine and marine wetlands (van der Winden et al. 1999, van der Winden et al. 2000), and perhaps due to an assessment of a large number of potential offshore turbine locations in the U.S. (based on Weibull analyses of "good, excellent, outstanding, and superb" wind speed potentials [National Renewable Energy Laboratory 1987]), a new trend is evolving in North America. Several proposals for huge offshore sites are being submitted for locations on both Atlantic and Pacific coasts. These, at the very least, should require considerable research and monitoring to assess possible impacts to resident and migrating passerines, waterfowl, shorebirds, and seabirds. One site at Nantucket Shoals, offshore of Nantucket Island near Cape Cod, Massachusetts, is proposed by the Cape Wind Association to contain 170 turbines, many over 420 feet high, within a 25 mi^2 area (AWEA unpubl. data, Ferdinand 2002). What impacts this wind farm would have on wintering sea ducks and migrating terns, especially the Federally endangered Roseate Tern (*Sterna dougallii dougallii*), and on Northern Gannets (*Morus bassanus*), is unknown. The Long Island Power Authority is proposing a site offshore of Long Island, New York's south shore, covering as much as 314 mi^2. Other sites are being proposed for Portland, Maine, and Lake Erie. The largest proposed wind farm in North America is being planned for a 50 mi^2 area between Queen Charlotte Island, BC, and Alaska. It is being designed to contain 350 turbines, many exceeding 400 feet in height. The potential for significant offshore turbine impacts on waterbirds is great, virtually no research has been conducted in the United States to quell these concerns, and finding carcasses at sea is very challenging.

Europe presently has 10 offshore wind projects in operation, producing over 250 MW of electricity (British Wind Energy unpub. data, www.offshorewindfarms.co.uk). Many other projects are currently under review. To avoid citizen concerns regarding the "not in my backyard" complex, most European turbines are sited offshore or in estuaries, away from immediate human development (Larsen and Madsen 2000). While Europe is well ahead of the United States regarding turbine research, their study results are still generally inconclusive (T. Bowan, FWS, 2003 pers. comm.). Collision mortality, while generally unknown, is believed to be small because birds appear to avoid offshore wind farms. There are exceptions, including for Whooper Swans (*Cygnus Cygnus*; Larsen and Clausen 2002) that are susceptible to turbine strikes in the early mornings and evenings, especially in inclement weather. The collection of carcasses at offshore sites is more challenging than for land-based turbines since nets generally must be used to collect carcasses, tides and weather affect collection, and fog is a frequent problem. While habitat loss is not believed to be a serious concern, its impacts continue to be assessed. Disturbance may be problematic since some species such as Common Eiders avoid wind farms and may not return to a coastal area for several years (Guillemette and Larsen 2002). Disturbance may lead to displacement, and turbines may serve as barriers to

seaduck movements. Only a few studies have been conducted in Denmark, the Netherlands, and Sweden, so further research is needed. Studies deal mostly with wintering species (Noer et al. 2000, Percival 2001, Langstron and Pullan 2002, Christensen et al. 2002, and Bruns et al. 2002).

In an attempt to begin addressing the bird mortality issue – and ancillary to this, the issue of ESA-listed bat strikes – the National Wind Coordinating Committee was created in 1994 as part of President Clinton's Global Climate Change Action Plan (Colson 1995). Shortly following the creation of the Committee, the Avian Subcommittee (now called the Wildlife Work Group) was formed, co-founded by the Service. In 1999, the Avian Subcommittee published a *Metrics and Methods* document to study turbine impacts on birds (Anderson et al. 1999). The document provides an excellent resource for conducting research on proposed and existing turbines and wind farms.

Appendix 8

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, D.C. 20240

APR 26 2004

FWS/DHRC/BAPHC

Memorandum

To: Regional Directors, Regions 1-7

From: Director Steve Williams

Subject: Implementation of Service Voluntary Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines

On July 10, 2003, the U.S. Fish and Wildlife Service provided to the Regions and the general public our voluntary Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines. The Interim Guidelines are to be evaluated over a 2-year period, and then modified as necessary based on their performance in the field and on the latest scientific and technical discoveries developed in coordination with industry, States, academic researchers, and other Federal agencies. A Notice of Availability and request for comments was published in the Federal Register simultaneously with the release of the guidance to Service personnel. By memo to the Regions dated May 13, 2003, and attached to the guidance document released on July 10, 2003, we provided general guidance for implementation of the Interim Guidelines by our field personnel.

Comments received during the first 8 months of the 2-year comment period indicate that further explanation is needed concerning the voluntary and flexible nature of the Interim Guidelines. The purpose of this memorandum is to provide more detailed direction to Service personnel on how the Guidelines should be applied.

Please ensure that all field personnel involved in review of wind energy development proposals receive copies of this memorandum. For further information or to provide comments on the Interim Guidelines, contact Dr. Benjamin N. Tuggle, Chief, Division of Habitat and Resource Conservation, at (703)358-2161, or Brian Millsap, Chief, Division of Migratory Bird Management, at (703)358-1714.

Attachment

Attachment

Instructions for Implementation of Service Voluntary Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines

General

The guidance is intended to be general in nature and applied with local interpretation based on local conditions. This is necessary because the guidance is national in scope, and because of the great variance in geography and habitats in which wind energy developments may be proposed as well as the variable nature of potential impacts to trust resources. The Interim Guidelines are not to be construed as rigid requirements, which are applicable to every situation, nor should they be read literally. Recommendations made under the Interim Guidelines should be based on locally applicable scientific data, local knowledge and expertise, technological feasibility, and a reasonable interpretation of the available information. The teams of professionals recommended for pre-development site evaluations should make recommendations on site selection, pre-development data collection, site design, and post-construction monitoring based on local conditions, using the Interim Guidelines as a general guide. Field personnel providing recommendations on projects that are at other stages of development should do likewise. Service personnel should be able to provide a rationale for their recommendations. Likewise, project proponents should be expected to provide supporting documentation if Service recommendations are deemed infeasible for technological reasons.

Site Evaluation and Ranking

The guidance recommends that all potential wind energy development sites within a geographic area be evaluated and ranked prior to selecting a site for development, using the site evaluation process provided. This recommendation does not apply where a site was leased for development prior to the availability of the Interim Guidelines. Potential wind energy development sites have a number of pre-requisites, including sufficient wind, availability through lease, and access to the transmission grid. Evaluation of sites, which do not possess these attributes, should not be recommended. An exception would be in situations where the evaluation of a single such site is needed to provide a reference site for use in the ranking system, and no site with true potential for development is adequate. The size of the geographic area in which all potential development sites should be evaluated will vary depending on the above attributes, the continuity of similar habitat, and the wildlife species potentially impacted. It may be an entire State, a small portion of a State, or a few thousand acres. In the case of small projects where only a single site is available, such as some Native Alaskan bush communities, evaluation and ranking of multiple sites would not be applicable.

Release of Site Evaluation Data Under the Freedom of Information Act (FOIA)

The wind energy industry has expressed concern regarding the possible release of information on potential development sites under a FOIA request, citing the intense competition within the industry for developable locations. Service personnel should make every effort to protect the companies they work with from any sort of competitive harm. Customarily, government agencies protect proprietary information that is voluntarily provided by industry and identified by them as having the potential to cause competitive harm if released, though the Service is not authorized to make any guarantees under FOIA. Such information may be protected under exemption 4 of FOIA (confidential business information). When working with the industry, Service staff should request that companies identify any and all such information up front, and provide a brief explanation as to why the information is deemed 'confidential business information' and what competitive harm could ensue through release. If an employee receives a request (whether FOIA or any other type of request) for such information, they should alert the appropriate FOIA staff and the Office of the Solicitor prior to responding. Though release of this type of information is unlikely under FOIA, companies may also file a reverse FOIA suit to prevent any such release. Service personnel should note that they may be subjected to litigation through inappropriate release of information identified as 'confidential business information'.

Pre- and Post-Construction Studies

Where information is considered insufficient to make informed decisions about development of a site, recommendations for collection of additional information should be based on the local situation. As an example, the guidance recommends 3 years of data as a standard for determining the presence and/or magnitude of bird and bat migration in areas of high seasonal concentrations. This recommendation is not intended to be a strict requirement for all areas, or if a shorter collection period can be expected to yield sufficient data. Likewise, recommending the use of acoustic, radar, and infrared detection equipment as mentioned in the guidance is not a strict requirement at all locations and under all conditions. However, where risk is considered sufficiently high, and available data and/or local knowledge indicate that weather variations, changing flight paths, or variable timing of migration warrant it, 3 years of data collection using the most appropriate tools available should remain the standard. The guidance states that the intended time frame for post-construction monitoring (recommended at all sites) is not expected to exceed 3 years. This does not mean that 3 years of monitoring should be recommended at all sites. A single year of monitoring through all seasons may indicate that 1 year is sufficient, or that additional monitoring is needed. Again, professional evaluation of the local situation is required.

Small Wind Energy Developments Funded Through the Farm Bill

The U.S. Department of Agriculture is currently providing grants for development of small, single-owner or cooperative wind energy facilities through Section 9006 of the Farm Security and Rural Investment Act of 2002. The purpose of this program is to help agricultural producers and rural small businesses purchase renewable energy systems and make energy efficiency improvements. Most of the proposed wind power facilities funded under this program are for single or a few turbines with limited siting options. Being federally funded, they must also

undergo a National Environmental Policy Act evaluation. Recommendations on siting and studies for such facilities under the Interim Guidelines should not suggest team-based evaluation of multiple potential development sites (the ranking system), pre-development studies beyond a basic site evaluation for wetlands, migratory birds and bats, endangered/threatened species, etc., or post-development monitoring programs. Recommendations on site development and turbine design and operation should be appropriate to the location and size of the proposed facility. Any large-scale, multi-turbine facilities proposed under section 9006 should be evaluated in the same manner as those proposed by wind energy companies.

Summary

Development of wind energy is a priority of the Secretary of the Interior. When properly sited and designed, wind energy development has the potential to reduce the loss of trust resources and their habitats by replacing other, more disruptive forms of energy development. The intent of the Service is to have professional biologists and professional wind engineers working together at the local level to develop this energy source in a manner that protects trust resources. This should be accomplished through flexible application of the voluntary Interim Guidelines based on local conditions, local knowledge, locally applicable scientific data, and technological feasibility. Please make every effort to accommodate requests for assistance in evaluating potential development sites and providing recommendations for site design and operation within the constraints of your budget and other commitments. Any problems encountered or recommendations for improvement should be noted and provided to the Regional and Washington offices for use in developing final guidelines at the conclusion of the 2-year public comment period in July 2005.

Evaluation of wind energy development is a new challenge in most areas of the country, and the Interim Guidelines are a work in progress. We are in the process of planning a series of multi-stakeholder workshops on the use of the Interim Guidelines in the coming months. The workshop conducted in Region 5 in September of 2003 was considered a great success. We encourage all Regions to provide the opportunity for their field personnel to participate when a workshop is held in your area.

Revised:04/23/2004:ClintRiley:ce:202-208-6394

TETRA TECH, INC.

618 South 25th Street (59101)
P O Box 30615
Billings, MT 59107
Telephone: (406) 248-9161
Fax: (406) 248-9282

November 23, 2005

Tom Cinadr, MN SHPO
Minnesota Historical Society
345 Kellogg Blvd. W.
St. Paul, MN 55102-1903

RE: Project Area Environmental Scan
Maxim Project No. 6550922.100

Dear Mr. Cinadr:

Maxim Technologies, a division of Tetra Tech, has been retained by a private company to conduct an investigation of the below referenced tracts in Mower County as potential locations for a wind-powered electrical generation facility. While the project is still in the planning and development stage, it is estimated that the facility will consist of approximately 43, 2.3 MW turbines, a new collector substation and transmission line, and will be connected to an existing substation. The area shown in the attached figure is the primary focus of our investigation.

We are hoping that your office can tell us if there are any historical sites within the boundaries of the tracts listed that would influence a decision about use of the land for wind power generation. We, of course, are not requesting the name or exact location of the site(s) beyond that which you would normally provide to the public, just an indication of the location and whether the site would preclude development in a particular location. Formal investigations including Class I and Class III inventories have been scheduled and will be initiated in the very near future, weather permitting.

The enclosed location map depicts the following tracts:

Township	Range	Sections
101N	15W	2, 3, 4, 5, 6, 7, 8, 9, 18
102N	14W	3, 4, 5, 6, 7, 8, 17, 18, 19, 20, 21, 28, 29,
102N	15W	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36,
102N	16W	1, 12, 13, 14, 23, 24, 25,
103N	15W	26, 27, 33, 34, 35
Development will not occur in areas located within the city limits of Taopi or Elkton		

We would appreciate this preliminary scan and any input you can provide by December 2, 2005. Please contact me at 406-248-9161 if you have any questions.

Thank you for your assistance.

Maxim Technologies
A DIVISION OF TETRA TECH, INC.

Jeffrey Rice
Project Manager, Natural Resources

JRR(JS)rr

cc: Judd Stark (Maxim, Billings)
Stacy Pease (Maxim, Missoula)
Aileen Giovanello (TtEC, Boston)

Enclosure

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History/Architecture

PROPERTY NAME	ADDRESS	Twp	Range	Sec	Quarters	USGS	Report	NRHP	CEF	DOE	Inventory Number
COUNTY	**Mower**										
CITY/TOWNSHIP:	**Bennington Twp.**										
school	off Twp. Rd.	102	14	18	NE-NE-NE	Grand Meadow	MW-85-1H				MW-BEN-001
CITY/TOWNSHIP:	**Clayton Twp.**										
Clayton Town Hall	off Co. Hwy. 4	102	15	28	SE-SE-SE	Adams	MW-85-1H				MW-CLA-001
Marshall Norwegian Lutheran Church		102	15	31	SW-SW-NW	Adams	MW-85-1H				MW-CLA-002
CITY/TOWNSHIP:	**Elkton**										
Elkton Post Office	xxx Main St.	102	16	1	SW-NW-SW	Elkton	MW-85-1H				MW-ELK-001
commercial block		102	16	1	SW-NW-SW	Elkton	MW-85-1H				MW-ELK-002
CITY/TOWNSHIP:	**Taopi**										
Boomtown Style Store	xxx Railway St.	101	15	9	SW-SE-SW	Adams	MW-85-1H				MW-TAO-001
Taopi Post Office		101	15	9	SW-SE-SW	Adams	MW-85-1H				MW-TAO-002
Taopi Covenant Church	NW corner Walnut St. & 1st St.	101	15	9	SW-SE-SW	Adams	MW-85-1H				MW-TAO-003

TETRA TECH, INC.

618 South 25th Street (59101)
P.O. Box 30615 (59107-0615)
Billings, MT
Office 406.248.9161
Fax 406.248.9282

November 23, 2005

Chief Robert Whiting
US Army Corp of Engineers
Regulatory Division
190 Fifth Street East
St. Paul, MN 55101-1638

RE: Project Area Environmental Scan
Maxim Project No. 6550922.100

Dear Mr. Whiting:

Maxim Technologies has been retained by a private company to conduct an investigation of the below referenced tracts in Mower County as potential locations of a wind-powered energy facility. While the project is still in the planning and development stage, it is estimated that the facility will consist of approximately 43, 2.3 MW turbines, a new collector substation and transmission line, and will be connected to an existing substation.

We are consulting the US Army Corp of Engineers for assistance in identifying environmental properties, concerns or issues within the boundaries of the tracts listed that would influence a decision regarding the use of the land for wind electric generation or transmission. We are specifically interested in such information as the location of wetland resources and any other special or sensitive environmental conditions that exist in or near the study area.

While many details, including the exact location of wind turbines and precise route of the transmission line, have yet to be determined, the area shown in the attached figure is the primary focus of our investigation. The project area includes portions of the following tracts:

Township	Range	Sections
101N	15W	2, 3, 4, 5, 6, 7, 8, 9, 18
102N	14W	3, 4, 5, 6, 7, 8, 17, 18, 19, 20, 21, 28, 29,
102N	15W	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36,
102N	16W	1, 12, 13, 14, 23, 24, 25,
103N	15W	26, 27, 33, 34, 35
Development will not occur in areas located within the city limits of Taopi or Elkton		

This information will be used as an initial step to help guide project development in a manner that identifies and avoids impacts to sensitive resources where practicable. We have sent similar query letters to other agencies including the U.S. Fish and Wildlife Service. We will also

conduct a site survey of areas proximal to proposed facilities in order to preliminarily determine the presence of wetlands.

If you are able, we would appreciate a preliminary scan of parcels in your district by December 2, 2005. Please contact me at 406-248-9161 if you have any questions.

Thank you for your assistance.

Respectfully submitted,

Maxim Technologies
A DIVISION OF TETRA TECH, INC.

Jeffrey Rice
Project Manager,
Natural Resources

JRR(JS)rr

cc: Judd Stark (Maxim, Billings)
Stacy Pease (Maxim, Missoula)
Aileen Giovanello (TtEC, Boston)

Enclosure

n\typing\Env-fac\6550992\Query letters\Mower_COE

MAXIM Technologies Inc®

A TETRA TECH COMPANY

TELEPHONE CONVERSATION RECORD

To: Don Nelson, DNR

From: Stacy Pease, Maxim

Date: Nov. 29, 2005

Time [AM] or [PM]: 10:00

Don.Nelson@DNR.State.MN.US

Phone No.: 507-280-5060

Project Name: High Prairie Wind

Project No.:

Subtask No.:

Subject: Wildlife Species in Mower County, MN

Discussion: I called Don to see if he could provide info regarding wildlife species occurrence in Mower County. He suggested I review their web site for info on Roadside Surveys and Harvest data. In Mower County there are a few shallow wetland areas, but the majority of it has been drained. The Stream/River Systems will be the major migration route in that County. Areas mainly Row Crop agriculture. Game species in County include: Wild Turkey, Pheasant, Hens, Mourning Dove, Mig/Res Geese, WT Deer, CT Rabbit, Gray & Fox Squirrels, Beaver & Muskrat.

Employee Signature: (required)

Date: 11-29-2005

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11-29-05

Cont. Don Nelson

Don did not have any concerns at this time however he would like to see more consideration of the proximity & impacts to State lands, & Wildlife Mng. Areas.

MAXIM Technologies Inc®

A TETRA TECH COMPANY

TELEPHONE CONVERSATION RECORD

To: Phil Delphey, USFWS

From: Stacy Pease, Maxim

Date: 11-29-05

Time [AM] or [PM]: 10:45

Phone No.: 612-725-3548

Project Name: High Prairie Wind

Project No.:

Subtask No.:

Subject: T&E Species to occur in Mower County

Discussion:

Of the T&E and Candidate Species to occur in Minnesota, only two are believed to occur in Mower County. They are Plant Species:

Prairie Bush Clover

Western Fringed Orchid

Employee Signature: Stacy Pease (required)

Date: 11-29-05

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Phase 1a Archaeological Investigation
for
The High Prairie Wind Farm
in
Mower County,
Minnesota

McFarlane Consulting
A Limited Liability Company
318 Goodhue Street #1
Saint Paul, Minnesota 55102

Joe McFarlane, Project Manager

Richard Rothaus, Principal Investigator

December, 2005

Prepared for Tetra Tech EC, Inc.
133 Federal Street - 6th Floor
Boston MA 02110

Executive Summary

In November 2005, Tetra Tech EC, Inc. contracted McFarlane Consulting, LLC to perform a Phase 1A archaeological investigation of a proposed wind farm in Mower County, Minnesota. The proposed undertaking, known as the High Prairie Wind Farm, will consist of a substation, 43 wind turbine generators and transmission lines disbursed over 26 sections of land in Lodi, Clayton and Bennington townships, collectively defined as the Study Area. The Study Area includes sections 2, 3, 4, 5, 6, 7, 8, and 18 in Lodi Township (T101N, R15W); sections 13, 14, 23, 24, 25, 26, 27, 32, 33, 34, 35, and 36 in Clayton Township (T102N, R15W) and sections 18, 19, 20, 21, 28, and 29 in Bennington Township (T102N, R14W).

The purpose of a Phase 1A is to identify known historic and prehistoric properties within the Study Area. The Phase 1A results will then be used to micro-site the project facilities. Once the facilities are laid out, the Area of Potential Effect (APE) will be defined. This Phase 1A will define the areas within the Study Area that warrant Phase I level field investigation. The Phase 1A was performed in December 2005 through a literature search, background research and GIS analysis of existing datasets. Joseph McFarlane served as project director, Richard Rothaus served as Principal Investigator.

Summary of Findings and Recommendations:

No known archaeological sites are documented in the project Study Area. One historic property (21MW-BEN-001) is recorded as existing in the NE corner of T102N, R14, Sec. 18 (Cinadr 2005). No structure is, however, apparent in aerial photographs or maps (Map 2 and 4). Analysis of the Andreas 1874 Atlas indicates several potential historic archaeological sites in or adjoining the Study Area (Map 16).

The absence of recorded archaeological sites within the project Study Area is not surprising considering no known archaeological surveys have been conducted there. There are, however, thirty (30) known archaeological sites within a twelve mile search ring of the project center (T102N, R15W, Section 35 center). The close proximity of these known archaeological sites raises the probability that unidentified archaeological sites exist within the project Study Area. We therefore recommend conducting a comprehensive Phase I level investigation of the project as outlined in "Recommendations" on page 14.

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Project Description

Overview:

High Prairie Wind Farm, LLC (HPWFI) is planning to construct a wind farm in Southeastern Minnesota (Maps 1 - 4). The proposed undertaking, known as the High Prairie Wind Farm, will consist of a substation and approximately 80 turbine generators and transmission lines disbursed over 26 sections of land in Lodi, Clayton and Bennington townships in Mower County Minnesota. These include sections 2, 3, 4, 5, 6, 7, 8, and 18 in Lodi Township (T101N, R15W); sections 13, 14, 23, 24, 25, 26, 27, 32, 33, 34, 35, and 36 in Clayton Township (T102N, R15W) and sections 18, 19, 20, 21, 28, and 29 in Bennington Township (T102N, R14W). The High Prairie Wind Farm project is subject to review by the Minnesota State Historic Preservation Office (SHPO).

Tetra Tech EC, Inc. contracted McFarlane Consulting, LLC to perform a Phase 1A archaeological investigation of the High Prairie Wind Farm Project. The contract included:

1) Historic and Prehistoric background research.
2) Identifying areas that warrant Phase I level investigation.

Joe McFarlane of McFarlane Consulting, LLC served as Project Coordinator and Richard Rothaus of Rothaus Consulting, LLC served as Principal Investigator.

Environmental Setting:

The High Prairie Wind Farm will be situated on an elevated plain. This area is currently used for cropland, with some pockets of shrubs and woodland. See Map 5 for current land use. See below, Environmental Context of Project for detailed information.

Research Design

Objectives:

Background research and evaluation of existing datasets has been conducted to identify and explicate known areas of archaeological concern, and to identify and provide a framework for investigating areas that warrant Phase I level field investigation.

Methodology:

Standard background research including, but not limited to: literature review of known archaeological sites and previous archaeological research as documented in the Minnesota State Historic Preservation Office records; investigation of known archaeological sites and previous archaeological research as documented in published sources; location and analysis of available historic maps; location and analysis of current and historical environmental information; comparison of environmental context of the Study Area to context of closest known archaeological sites; induction of basic information into GIS system for analysis.

Background Research

Environmental Context of Project:

Factors such as the climate, vegetation, wildlife, geographic and geological characteristics of a landscape influence patterns of human activity. Understanding a region's natural history greatly enhances an archaeological study by providing indications of the availability of local resources, such as animal and vegetable food sources, water, shelter, or lithic raw materials throughout time.

Mower County lies within the Minnesota and NE Iowa Morainal section of the state (Map 7). This area is marked by glacial end moraines and outwash plains, and corresponds to a transitional zone from the prairie (to the southwest) and the woods (to the northeast). While the predominant vegetation type of this section is Eastern Broadleaf Forest, there are many prairie openings, including the one in which the High Prairie Wind Farm will be situated. More specifically, Mower County lies within the Oak Savannah subsection (Map 8). The area includes loess plain over bedrock or till, end moraines, and outwash plains, and the terrain is usually gently rolling. Lakes are infrequent (Maps 9 and 10).

The Study Area is predominately situated on glacial till of unknown origin, with southeast and south central areas that include some fluvial sediment. Soil belongs to the Tripoli-Readlyn-Kasson Association and is primarily sandy loam over loamy sand and gravel (USDA-SCS, 1983). The Study Area is closely buffered to the northeast by an area of dissected bedrock with fluvial sediments (the Grand Meadows area) (Map 11). This area has a high concentration of known archaeological sites. The Study Area is till dominated, and the Grand Meadows area is bedrock dominated (Map 12). This may represent differently available lithic resources for prehistoric usage, and is worthy of further investigation.

The Study Area is the highest "plateau" in the area and has limited hydrological resources. Of particular note are, however, the two headwaters in the southern part of the Study Area. The Upper Iowa River has its source in a perennial stream in T102 R15 Sec 35, and this stream is fed by additional

intermittent streams to the north. The North Branch of the Iowa River has its source in a perennial stream in T101 R15 Sec 4 (Map 2).

Vegetative History:

The original Public Land Survey mapped this area in 1853 (Map 13). The survey noted few lakes and some small streams. Prairie was noted as the predominant vegetation type. The Trygg Map (1850), derived from the public land survey, note the Study Area as an area "Good for Grass," and the area just south of the Study Area as "Good" to "Excellent Farming Land" (Map 14)." Both the Public Land Survey and the Trygg map note some areas of marsh along the headwater of the Upper Iowa River. The 1895 Marschner Map, derived primarily from the Public Land Survey notes and maps, is too generalized to be of much use, but notes prairie and wet prairie in the Study Area (Map 15). The Study Area has probably been prairie since approximately A.D. 300.

Climate History:

The environmental setting of Mower County for past peoples has been defined not just by geology, but also by climate. The climate of Minnesota has experienced minor, but important, variations in the past 10,000 years, and the importance of these variations is amplified in the transitional zone of Minnesota and NE Iowa Morainal section. Relatively minor shifts in temperature and wetness can cause habitats to shift, and the vegetation types of the project area may have changed significantly in the past. The below chart represents a model of climate change and vegetation history (Anfinson and Wright 1990; Bradbury and Dean 1993; Rothaus, et al. 2004; Webb, et al. 1983; Wright H.E. 1992).

Date	Mower County Climate and Vegetation	Cultural Periods (see below)
10,000-6000 B.C.	Climate cooler and wetter than present. A mix of Deciduous trees and Prairie.	Paleoindian
6000-2000 B.C.	Climate slightly warmer and drier than present. Predominately Prairie.	Archaic
2000 B.C. - A.D. 300	Climate slightly cooler and wetter than present. Prairie with a mix of Oak Savannah and Eastern Broadleaf forest.	Archaic, Initial Woodland
A.D. 300-present	Climate similar to present. Predominately Prairie.	Terminal Woodland, Early EuroAmerican, EuroAmerican.

Previous Archaeological Work:

No known archaeological research has been conducted within the project Study Area. Archaeological research in Mower County has been limited. The earliest professional investigations date to the late nineteenth century when Theodore H. Lewis and Alfred Hill of the Northwestern Archaeological Survey conducted an exhaustive survey of American Indian burial mounds and earthworks throughout the upper Midwest. In 1911, Newton H. Winchell synthesized his own research, as well as the work of Hill, Lewis and others in *The Aborigines of Minnesota* (Winchell 1911). In the late 1930s and early 1950s, L. A. Wilford of the University of Minnesota, conducted a number of field investigations in Mower County (Wilford, 1939, 1951, 1952). In 1977, the Minnesota Legislature created the Minnesota Statewide Archaeological Survey. The program systematically sampled portions of Mower County between 1977 and 1980, locating a substantial number of previously unknown archaeological sites including the Grand Meadow Quarry Site (21 MW 8). Compliance based cultural resource survey and evaluation work began in the late 1970s and continues to the present. The compliance surveys have been conducted by both private firms and public agencies. The Minnesota Historical Society County-Municipal HWY and State-Trunk HWY programs conducted numerous Mower County investigations during the 1980s and 1990s. The Minnesota Department of Natural Resources Trails and Waterways, Parks and Recreation, and State Forestry Cultural Resource Programs continue to conduct compliance based investigations in their respective jurisdictions.

Recorded Archaeological Sites:

Map 6 illustrates the known archaeological sites in the region. None of these sites fall within the project Study Area. One historical structure, a School House (MW-BEN-001), may be located in the NE corner of T102N, R14, Sec. 18 (Cinadr 2005). No structure is, however, apparent in aerial photographs or maps (Map 2 and 4). Because of the limited information on this structure we have noted this area in our probability map as a safeguard (Map 17).

Known Archaeological Sites within a twelve (12) mile radius of the project center, T102N, R15W, Section 35 center (Maps 18, 19, and 20):*

21MW001: **The Sleeper Site.** Prehistoric artifact scatter with potential burial mounds.
UTM: 15 05 40 450 east, 48 44 270 north (approximate).
T103N, R14W, Section 3, NW-SE.
USGS: Stewartville Quadrangle.

* UTM locations are in NAD 27.

21MW002: **No Name.** Prehistoric mound group.
UTM: 15 05 20 100 east. 48 20 725 north (approximate).
T101N, R16W, Section 21, S1/2-NE-NE.
USGS: Rose Creek Quadrangle (1982).

21MW003: **No Name.** Prehistoric habitation site.
UTM: 15 05 40 400 east, 48 44 480 north (approximate).
T103N, R14W, Section 3, center.
USGS: Stewartville Quadrangle.

21MW004: **No Name.** Prehistoric habitation site.
UTM: 15 05 37 225 east, 48 43 720 north (approximate).
T103N, R14W, Section 5, SW-SE.
USGS: Grand Meadow Quadrangle (1965).

21MW008: **The Grand Meadow Quarry Archaeological District**. A prehistoric chert quarry used from 8000 B.C. – A.D. 1600. Approximately 170 acres.
UTM vertices: 15 05 32 295 east, 48 41 820 north
15 05 33 605 east, 48 41 695 north
15 05 33 475 east, 48 40 960 north
15 05 32 800 east, 48 41 325 north
T103N, R15W, Section 13 & 14
USGS: Grand Meadow Quadrangle (1965).

21MW009: **Merle J. Site**. Prehistoric lithic workshop.
UTM: 15 05 34 150 east, 48 41 390 north.
T103N, R15W, Section 13 SW-NE and SE-NE
USGS: Grand Meadow Quadrangle (1965).

21MW010: **Finbar's Workshop.** Lithic scatter.
UTM: 15 05 33 680 east, 48 41 560 north.
T103N, R15W, Section 13: NW-NE-SE-NW
USGS: Grand Meadow Quadrangle (1965).

21MW011: **Dexter.** Archaic-Woodland artifact scatter.
UTM: 15 05 18 375, 48 35 710.
T103N, R16W, Section 32: SW-SE & SE-SE
USGS Quadrangle: Austin Quadrangle.

21MW012: **Jahns.** Archaic, undetermined Woodland.
UTM: 15 05 39 340 east, 48 40 765 north.
T103N, R14, NE-NW-SW & NE-SW & SE-SW, Section 16;
NE-NE-NE & SE-NE-NE, Section 21;
NW-NW-NW, Section 22
USGS: Grand Meadow Quadrangle (1965).

21MW013: **Unknown.**
UTM: 15 05 32 765 east, 48 47 543 north.
T104N, R15W, Section 26, N ½ of SE ¼.
USGS: High Forest Quadrangle (1974).

21MW014: **Wahl.** Habitation, quarry site.
UTM: 15 05 34 985 east, 48 43 030 north.
T103N, R14W, SW-NW Section 7.
USGS: Grand Meadow Quadrangle (1965).

21MW015: **Ready.** Prehistoric lithic scatter.
UTM: 15 05 39 735 east, 48 43 767 north.
T103N, R14W, SW-SW-SW Section 3.
USGS: Grand Meadow Quadrangle (1965).

21MW016: **North Fork Bear Creek.** Prehistoric artifact scatter.
UTM: 15 05 33 060, 48 43 560.
T103N, R15W, NW-NW-NW-NW Section 12.
USGS: Grand Meadow Quadrangle (1965).

21MW017: **Sample.** Prehistoric artifact scatter.
UTM: 15 05 43 650 east, 48 32 520 north.
T102N, R14W, SW-SW-SE, Section 12.
USGS:

21MW019: **Bear Creek Findspot.** Prehistoric lithic scatter.
UTM: 15 05 34 705 east, 48 41 615 north.
T103N, R14W, SW-SW-NW-NW Section 18.
USGS: Grand Meadow Quadrangle (1965).

21MW020: **No Name.** Prehistoric lithic scatter.
UTM: 15 05 42 725 east, 48 43 715 north.
T103N, R14W, SE-SE-SE-SE Section 2.
USGS: Spring Valley Quadrangle (1965).

21MW021: **No Name.** Prehistoric lithic scatter.
UTM: 15 05 35 720 east, 48 38 580 north.
T103N, R14W, NW-NE Section 30.
USGS: Grand Meadow Quadrangle (1965).

21MW030: **Shooting Star #1** Prehistoric lithic scatter.
UTM: 15 05 39 300 east, 48 18 740 north.
T101N, R14W, SW-SW-SE-NE Section 28.
USGS: LeRoy Quadrangle (1965).

21MW031: **Shooting Star #2**. Woodland artifact scatter.
UTM: 15 05 39 360 east, 48 18 600 north.
T101N, R14W, NW-NW-NE-SE Section 28.
USGS: LeRoy Quadrangle (1965).

21MW032: **Shooting Star #3.** Prehistoric artifact scatter.
UTM: 15 05 39 420 east, 48 18 530 north.
T101N, R14W, SE-NW-NW-SE Section 28.
USGS: LeRoy Quadrangle (1965).

21MW033: **Lake Louise Site.** Archaic artifact scatter.
UTM: 15 05 39 140 east, 48 19 040 north.
T101N, R14W, NW-NE-SW-NE Section 28.
USGS: LeRoy Quadrangle (1965).

21MW034: **LeRoy Mill Site**. A historic grain mill built during the Early Agriculture and River Settlement era (1840-1870). Potentially eligible for NRHP nomination.
UTM: 15 05 39 220 east, 48 18 890 north.
T101N, R14W, Section 28, SW-SE-NE-SW-NE.
USGS: LeRoy Quadrangle (1965).

MW-BEN-1: **Historic School House.**
UTM: 15 05 36 275 east, 48 32 300 north.
T102N, R14, Sec. 18, NE-NE-NE
USGS: Grand Meadow Quadrangle (1965).

21MWb: **No Name**. Isolated find. Unevaluated.
UTM: 15 05 16 270 east. 48 20 971 north.
T101N, R16W, Section 19, NE-NE-NE-NW.
USGS: Rose Creek Quadrangle (1982).

21MWe: **Gilligan Site.** Lithic scatter (numerous points). Unevaluated.
UTM: 15 05 20 732 east. 48 20 655 north (approximate).
T101N, R16W, Section 22, NW-NW.
USGS:Rose Creek Quadrangle (1982).

21MWg: **No Name.** Lithic quarry. Unevaluated.
UTM: 15 05 38 720 east. 48 43 240 north.
T103N, R14W, Section 9, N1/2.
USGS: USGS: Grand Meadow Quadrangle (1965).

21MWh: **No Name.** Lithic scatter (numerous points). Unevaluated.
UTM: 15 05 39 397 east. 48 43 563 north.
T103N, R14W, Section 9, N1/2 of NE-NE.
USGS: Grand Meadow Quadrangle (1965).

21MWi: **No Name.** Artifact scatter/habitation. Unevaluated.
UTM: 15 05 40 740 east. 48 43 816 north.
T103N, R14W, Section 3, S1/2 of SE & Section 2, SW-SW & Section 11, N1/2-NW.
USGS: Spring Valley Quadrangle (1965).

21MWj: **No Name.** Artifact scatter/habitation. Unevaluated.
UTM: 15 05 33 272 east. 48 47 526 north.
T104N, R15W, Section 25, NW-SW and SW-NW
USGS: High Forest Quadrangle (1974).

21MWk: **No Name.** Artifact scatter/habitation. Unevaluated.
UTM: 15 05 38 127 east. 48 39 815 north.
T103N, R14W, Section 21, W ½ of NW ¼.
USGS: Grand Meadow Quadrangle (1965).

21MWl: **No Name.** Artifact scatter/habitation. Unevaluated.
UTM: 15 05 32 333 east. 48 44 478 north.
T103N, R15W, Section 2, NE ¼ and NE-NW and NE-NW-NW
USGS: High Forest Quadrangle (1974).

Cultural Context of Project:

Minnesota Prehistory and History is generally divided into six periods (Mather 2000; Rothaus, et al. 2004):

Date	Period	Cultural Traits
10,000-6000 B.C.	Paleoindian	Small semi-nomadic population, generally involved in large game hunting (bison and mammoths), as well as utilization of smaller games and other natural resources. The Paleoindians are characterized by their large projectile points, and they did not use ceramic technology.
6000-200 B.C.	Archaic	Large game hunting continued with an increasing emphasis on diverse strategies of hunting, trapping, and resource exploitation.

		The Archaic peoples are more closely adapted to the local environment and locally identifiable cultures and traditions appear. Chipped as well as ground stone tools are characteristic of this period, as well as the use of cold-hammered copper. The Archaic peoples did not use ceramic technology
200 B.C. - A.D. 500	Initial Woodland	Ceramic technology is first used, and new styles of stone tools are developed. The earliest examples of mound building date to this period. A hunting-gathering tradition continues, but people are more sedentary and increasingly distinctive local and regional cultures develop. Minnesota's Initial Woodland populations presumably included the ancestors of the some of the Dakota.
A.D. 500-1680	Terminal Woodland	The patterns of the Initial Woodland continue, but there is a marked increase in the use of harvested and domesticated plants, including wild rice and corn. This more sedentary lifestyle is matched by the appearance of villages. Ojibwa movement into Minnesota begins in this period.
A.D 1680-1800	Early Euroamerican	Ceramic and stone tool technologies begin to disappear and be replaced with metal trade goods.
A.D. 1800-present	Euroamerican	Euroamerican settlements begin and Euroamerican material culture becomes dominant.

This periodization scheme is, of course, an oversimplification, and during the Initial and especially Terminal Woodland period extensive and intricate local and regional cultures developed within Minnesota, some with their own unique ceramic and lithic traditions.

Prehistoric Period:

A variety of lithic materials used by prehistoric peoples are found in southeastern Minnesota. Lithic materials derived from glacial till are common throughout the glaciated parts of Minnesota. In southeastern Minnesota the unique till-derived lithic materials include Swan River chert, Red River chert and Tongue River Silicified sediment. Other lithic materials are derived from bedrock outcrops and lag deposits: Prairie du Chien chert, Galena chert, Maquoketa chert, and Grand Meadow chert.

The Study Area is in close proximity to the Grand Meadows quarry (21MW8). This site, although heavily disturbed by agricultural usage, includes several hundred acres of quarry pits, of which 80 remain. These pits are, on average, 1-2m deep and 5m wide. The chert material is typically located in a layer 1m below the surface at a contact interface with the bedrock. Grand Meadow chert is arguably the highest quality chert material to be found in Minnesota, and it is well documented as being used across a wide-region. While a variety of lithic materials from southeastern Minnesota are known, only

Grand Meadows chert has been associated with a quarry site. The discovery of this one quarry site is quite unusual, but there is no reason to think that the discovered quarry was the only source for the material. Secondary deposits of this material have been noted along the Root River in Fillmore County. The natural distribution of this raw material remains unknown. Grand Meadow chert is similar to Hampton chert from Northern Iowa, and the two may be geologically related. (Bakken 1995; Gonsior 1992; Romano 1993; Trow 1981).

Historic Period:

The first Euro-American settlers in Mower County arrived in 1853, and by years end just under twenty families were in residence. Population growth increased after 1855, with the county population swelling to 500 inhabitants, and by 1959 the population had reached 3,700 (Andreas 1874). The current county population is just under 40,000.

Analysis of the Andreas 1874 Atlas indicates several potential historic archaeological sites in or adjoining the Study Area (Map 16). Comparison of the Andreas Atlas to more heavily occupied areas of Mower County shows a strong correlation to current structures and structures indicated in the atlas, and we believe that this Atlas was quite accurate. Potential 19th century structures and archaeological features within the Study Area are listed below:

Historic Site (Map 16)	Location	Airphoto Interpretation (Map 4)
Schoolhouse	T102 R15 Sec. 28, SE.	Modern farm on site.
House (B. Kennedy)	T102 R15 Sec. 27, SE.	Anomaly in field. Modern farm 0.14m to west.
House (J.C. Miller)	T102 R15 Sec. 34, SW.	Possible anomaly in field.
F. Bullis Property	T101 R15 Sec. 9, NW.	No indications.
HA & FA Wales Property	T102 R14 Sec. 29, NE.	Modern farm on site.
EW Road	T102 R15 Sec. 31.	Road clearly visible in field.
EW Road	T102 R15 Sec. 35-36.	Traces of road visible in field.

Probability of Archaeological Resources in the Study Area (Map 17):

Prehistoric Period:

Local archaeological sites in the Plains tend to be small and randomly dispersed, with a high-number of temporary locations, making probability mapping difficult and less than reliable. Moreover, unlike the lake-filled areas of northern Minnesota, sites in southeastern Minnesota do not cluster around water sources (Gibbon, et al. 1995). This is of particular importance to note for this project; while we

have identified some areas of high probability for prehistoric sites (Map 17), this identification is a suggested "place to start", and in no way alleviates the need to conduct Phase I fieldwork throughout the Study Area.

In the Study Area the only areas that can be singled-out for high probability are the headwaters of the Upper Iowa River and the North Branch of the Iowa River. These two areas are the most obvious sources of water in the area, and likewise provide the highest potential for exposures of lithic raw materials.

The area holds forth moderate to high potential for lithic procurement and reduction sites associated with some of the widely-traded lithic raw materials of the area. While there is currently no evidence of quarrying or lithic activity in the Study Area, this may largely be due to the Study Area never having been subjected to survey. The Study Area does not contain exposed or near surface bedrock as the nearby Grand Meadows site (21MW8), and this reduces the probability of major lithic procurement sites in the area (Map 12). The Study Area is however in Glacial till, which also provided lithic raw materials. Of equal or perhaps greater concern is the location of the Grand Meadows site in proximity to the Study Area. This proximity suggests that the Study Area was heavily trafficked in prehistoric times, and creates a very high probability for small temporary campsites, as well as a variety lithic reduction sites and scatters.

Historic Period:

Areas of high Historic Probability are indicated on Map 17. These areas represent the regions noted on the Andreas Atlas map, as discussed above, as well as the School House possibly located at T102N, R14, Sec. 18. As with potential prehistoric sites, these areas indicate a "place to begin."

Recommendations

Summary of Findings:

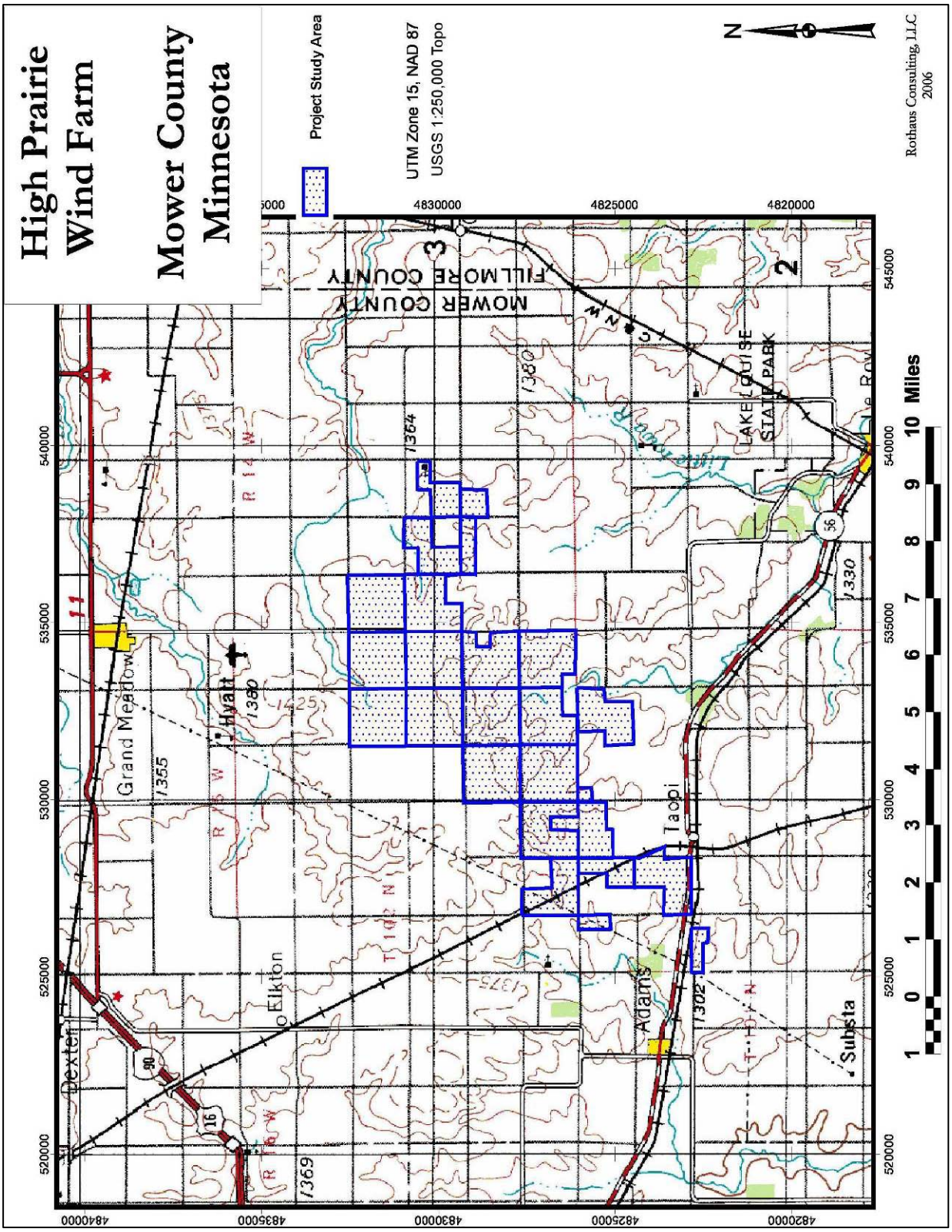
No known archaeological sites are documented in the project Study Area. While the Study Area does not seem to have the same high prehistoric archaeological potential as the nearby Grand Meadow Quarry Archaeological District, there is certainly enough potential to necessitate a Phase I Field Survey of the Study Area. Historically the Study Area has been only lightly occupied. Some areas of particular interest have been noted, and it is anticipated that the Phase I Field Survey will serve to identify any additional areas of historic interest.

Management Recommendations and Suggestions for Future Work:

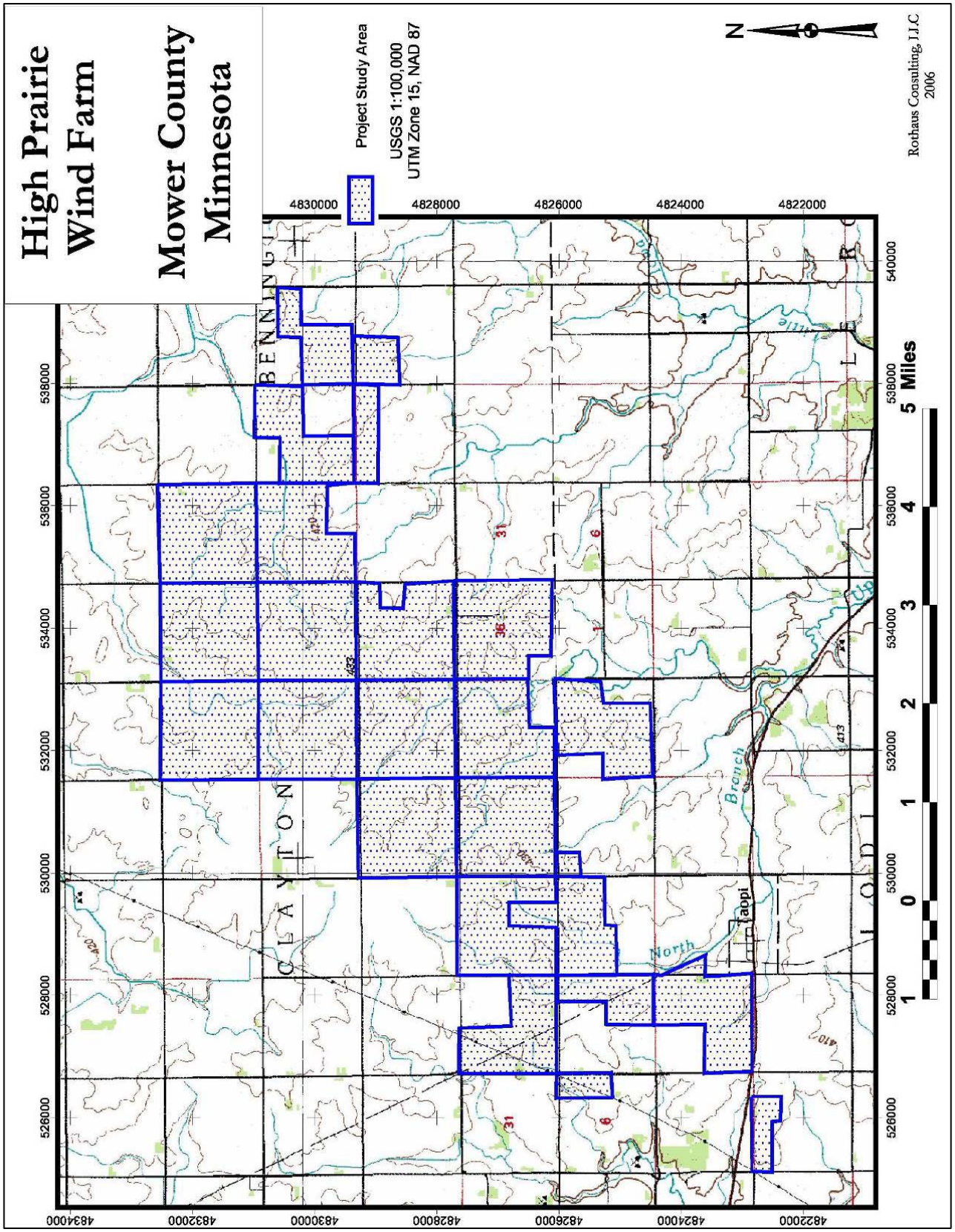
1. Phase I Archaeological Survey (Pedestrian Survey, Shovel Testing, Soil Probes) as needed throughout the Study Area.
2. The example of the nearby Grand Meadows Quarry Archaeological District, which covers 170 acres, demonstrates the need for a comprehensive Phase I study rather than a study limited to the footprints of the towers. The Study Area holds a high potential for quarrying sites, lithic reduction and tool production sites, and transient and seasonal occupation sites. Such sites are notoriously at risk for "fragmentation". For example, one lithic scatter on the Plains cannot be interpreted without being able to quantify and identify the types of lithic scatters in the region. Without the comprehensive survey enabling such interpretations, it will be difficult if not impossible to make preservation and mitigation recommendations.
3. The Study Area as currently defined is, however, quite large. We suggest a two-tiered approach to the Study Area. The footprint of the wind towers plus a reasonable buffer should receive an intensive Phase I investigation. Areas between towers can be subjected to a Phase I reconnaissance investigation. The Study Area as defined in this report is far larger than the area that will need actual Phase I field examination. The area for Phase I field examination should be more tightly defined by Proposed Turbines, Alternate turbines, MET Towers, Substations, Transfer Stations, Access Roads, and Transmission and Collector Lines.
4. Phase I investigations should begin with the high probability areas indicated in Map 17. The landform type of the Study Area has not been previously subjected to intensive archaeological research, and previous archaeological work in Mower County has not been sufficiently systematic and detailed to provide a strong context. By beginning in high probability areas the researchers will maximize the possibility if getting a strong example of the artifact assemblage likely to be encountered in the area. This will make investigation of small lithic scatters and the like in other parts of the Study Area quicker and more efficient.
5. Because prehistoric archaeological sites, especially sites represented only by lithics, tend to be small and diffuse in this area, pedestrian survey should be conducted at a spacing of 5 meters in the footprint and buffer areas, 10 meters in the areas between towers.
6. Pedestrian survey, with proper surface visibility and conducted by experienced personnel, is preferable to shovel testing for an area this large, especially as there is only moderate anticipation of intact buried soils, and as the area may contain small, diffuse lithic sites.
7. Adequate soil probes, as determined by onsite examination, must be taken throughout any area investigate by Pedestrian Survey to detect any possible buried soil horizons.

8. Shovel testing, if necessary, should be conducted on a 10m grid in the footprint and buffer areas, 15 meters in the areas between towers. In low probability areas a 30m interval should be used when possible.
9. Phase I survey should treat all eroded ravines, streambeds and exposures as high probability areas for lithic procurement activity.

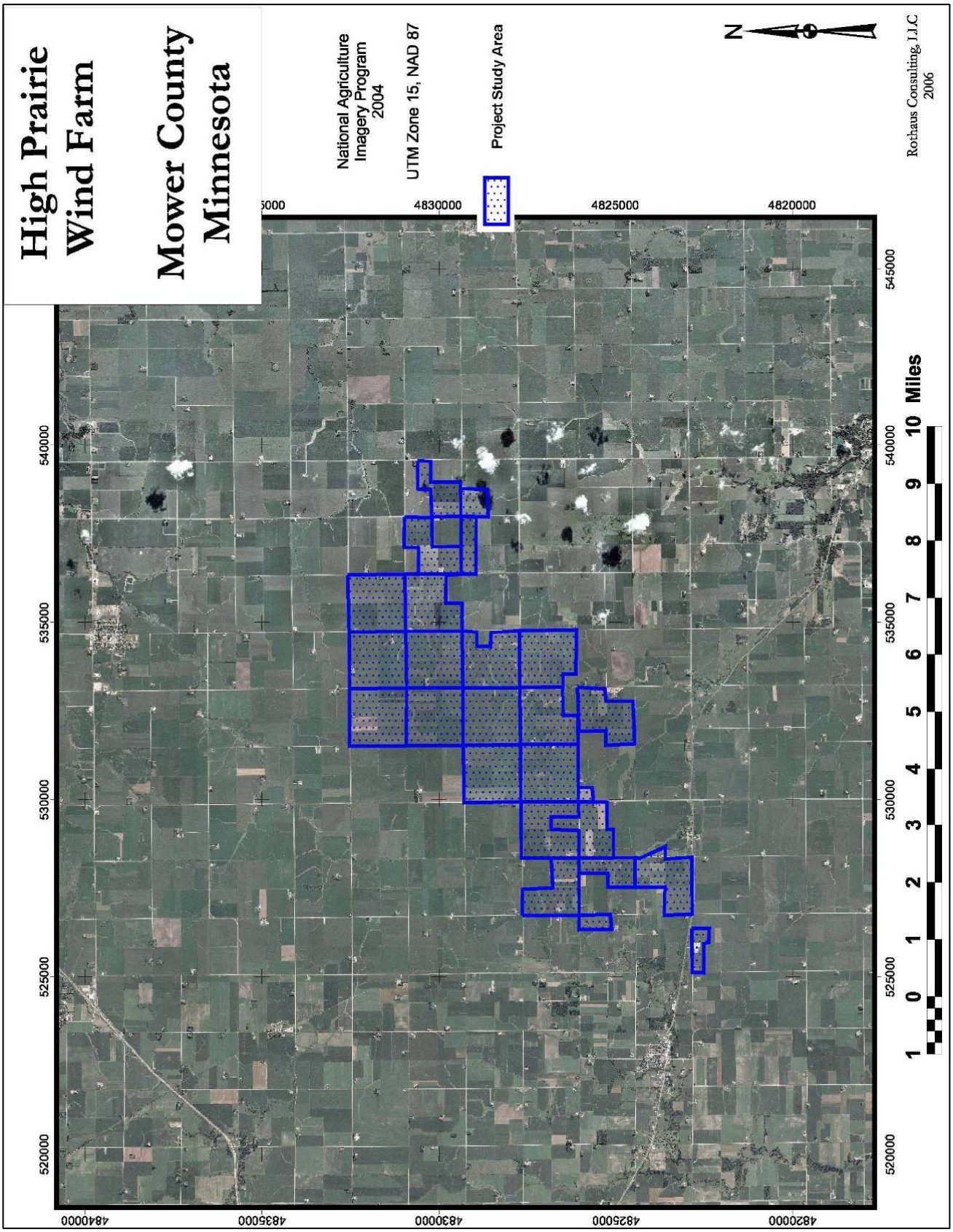
Maps



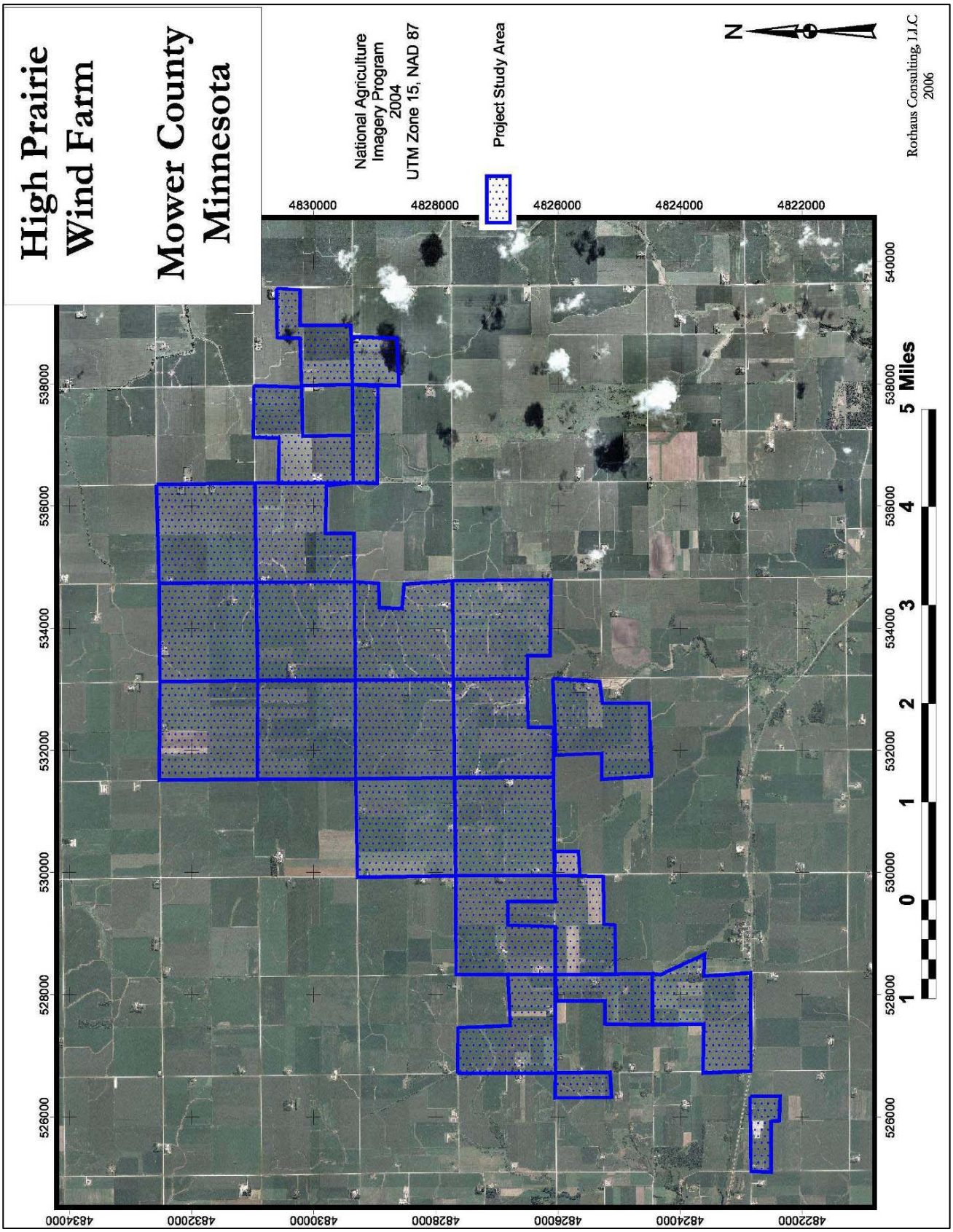
Map 1: High Prairie Wind Farm, Overview



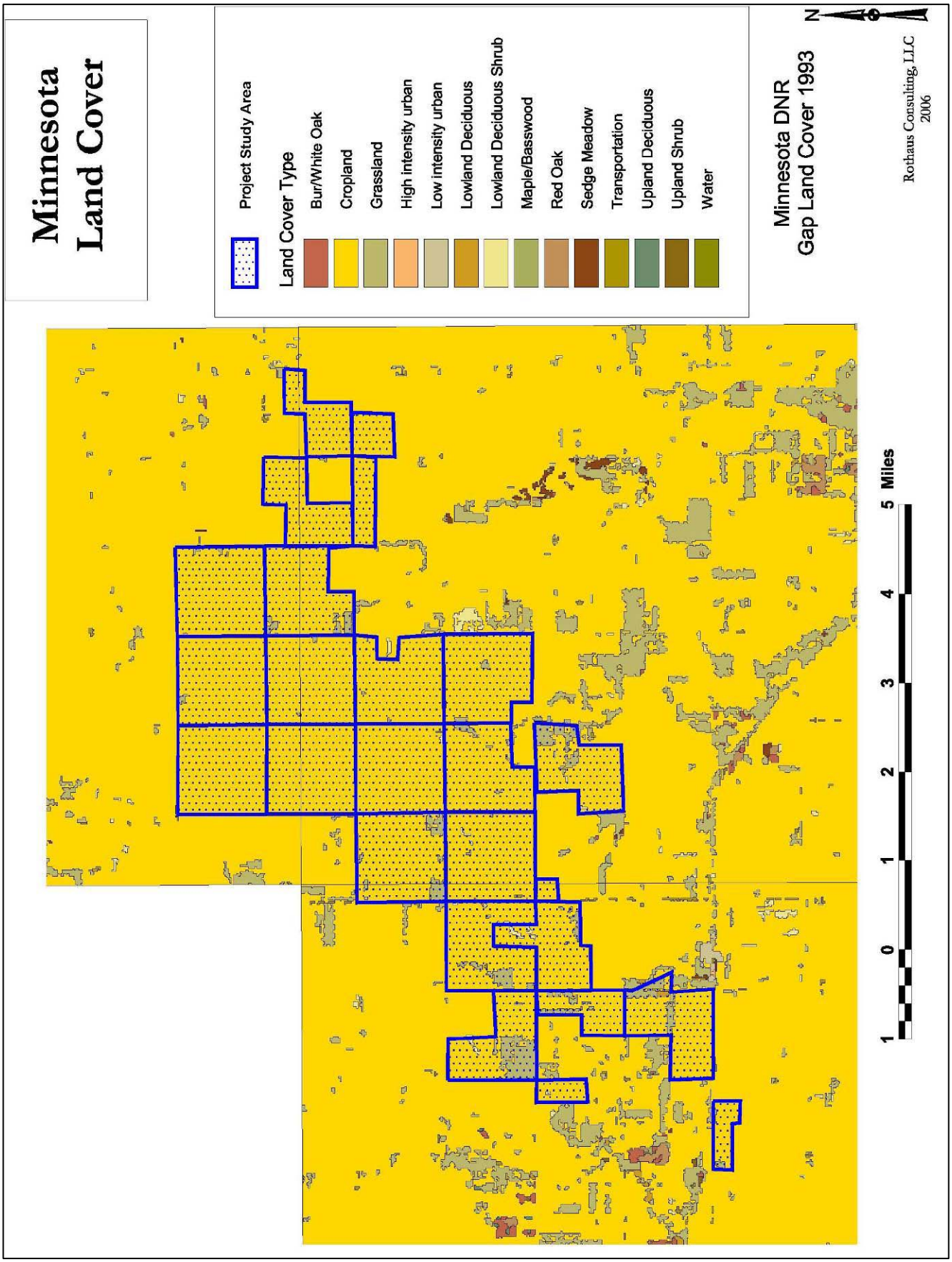
Map 2: High Prairie Wind Farm, Detail



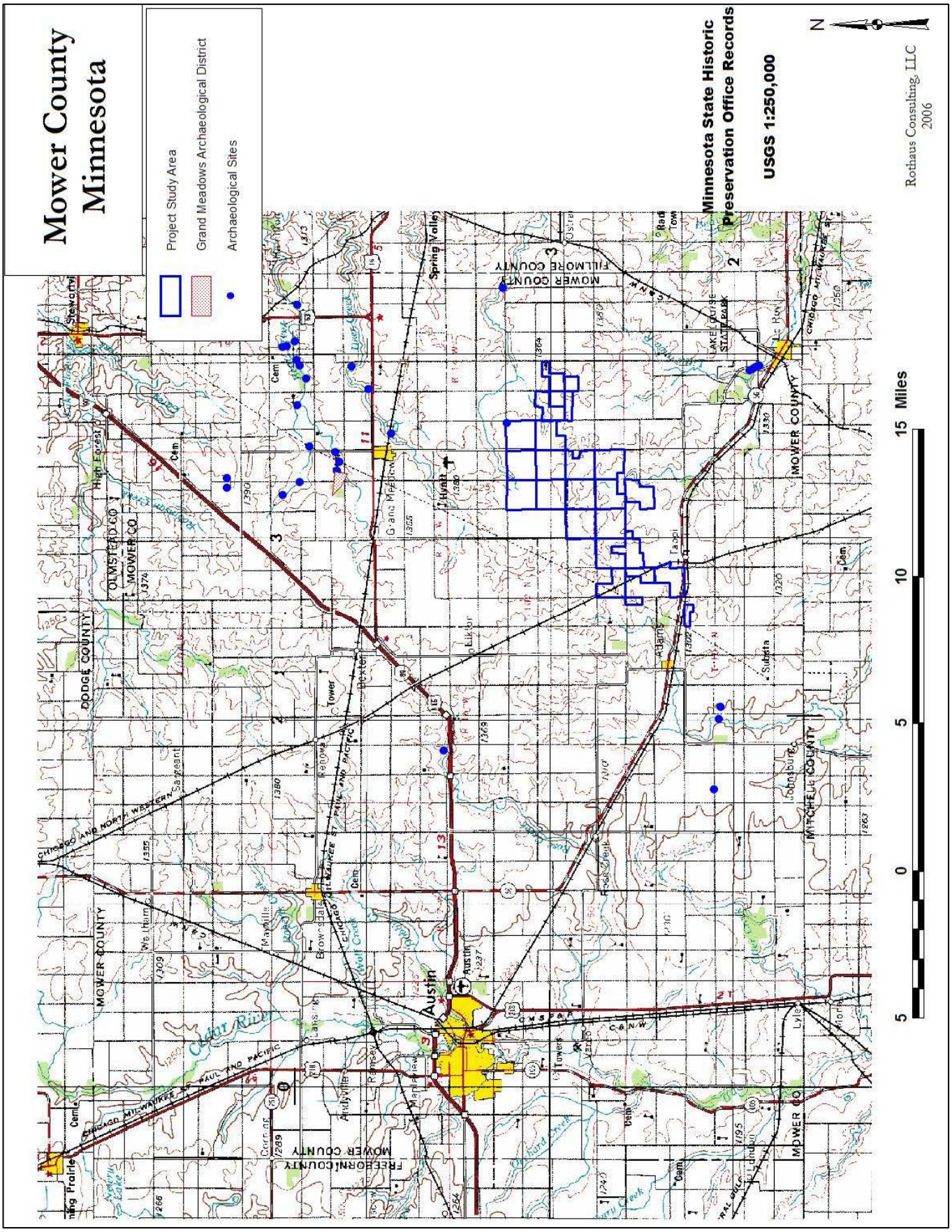
Map 3: 2004 Aerial Photo, Overview



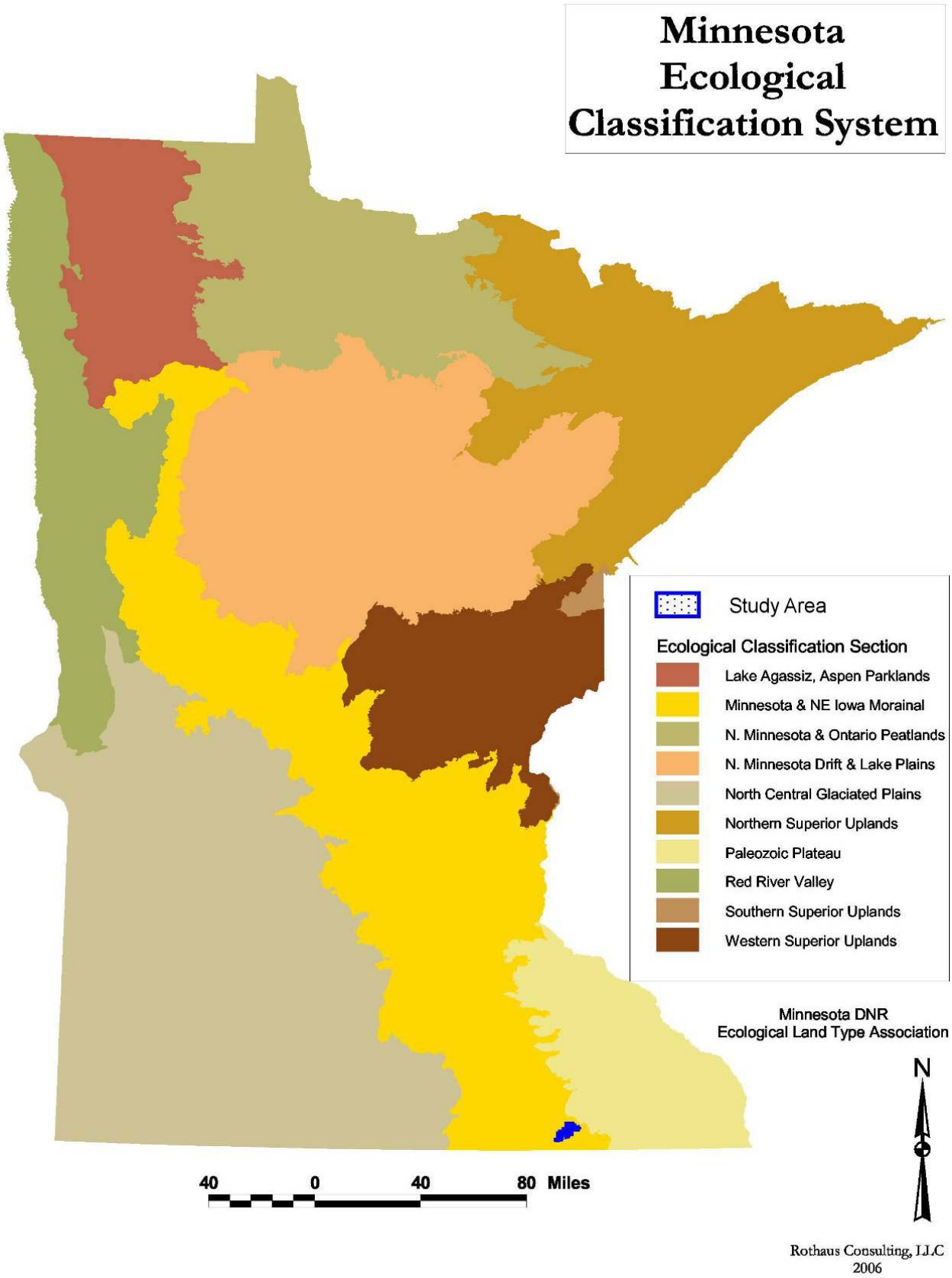
Map 4: 2004 Aerial Photo, Detail



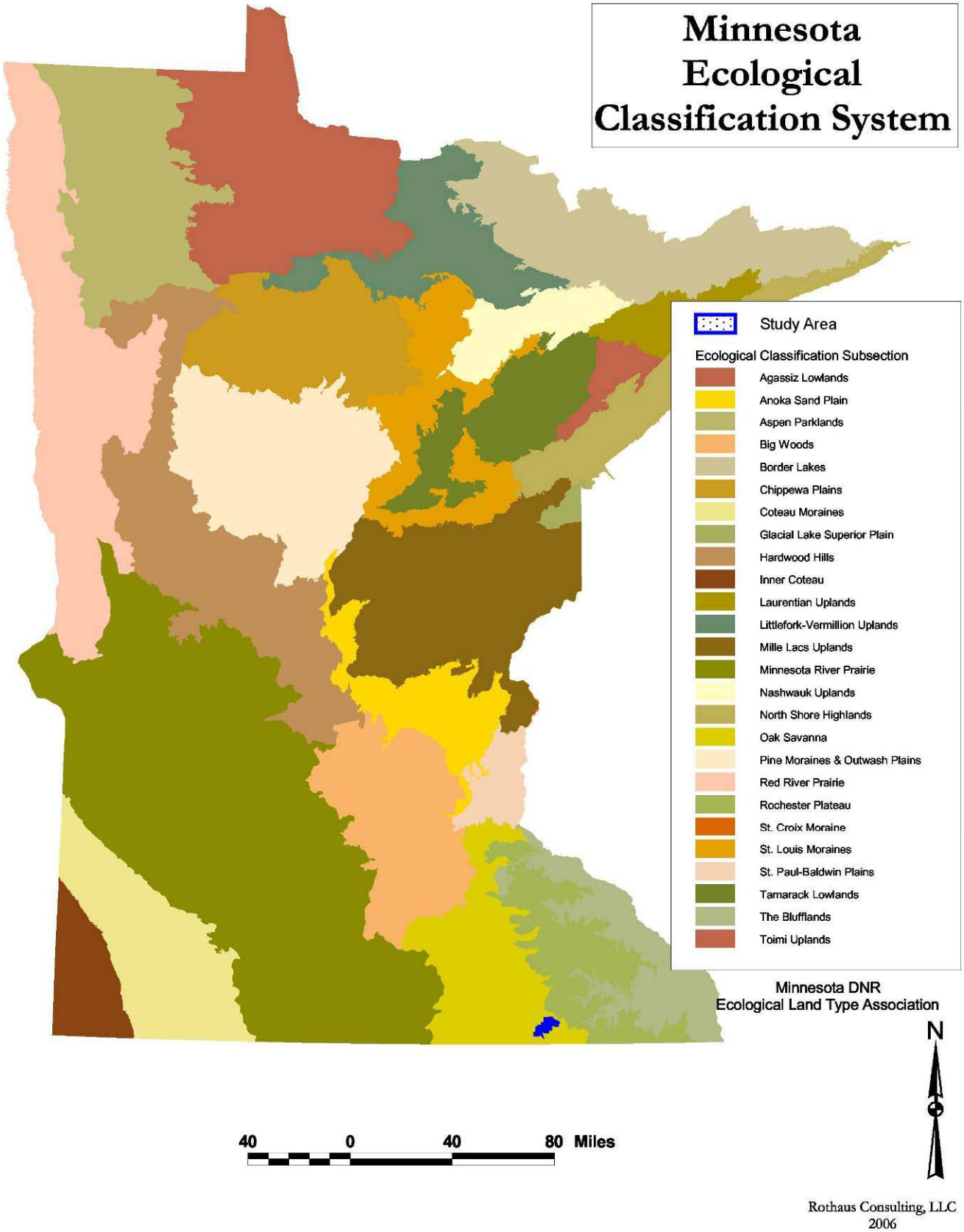
Map 5: Current Landuse



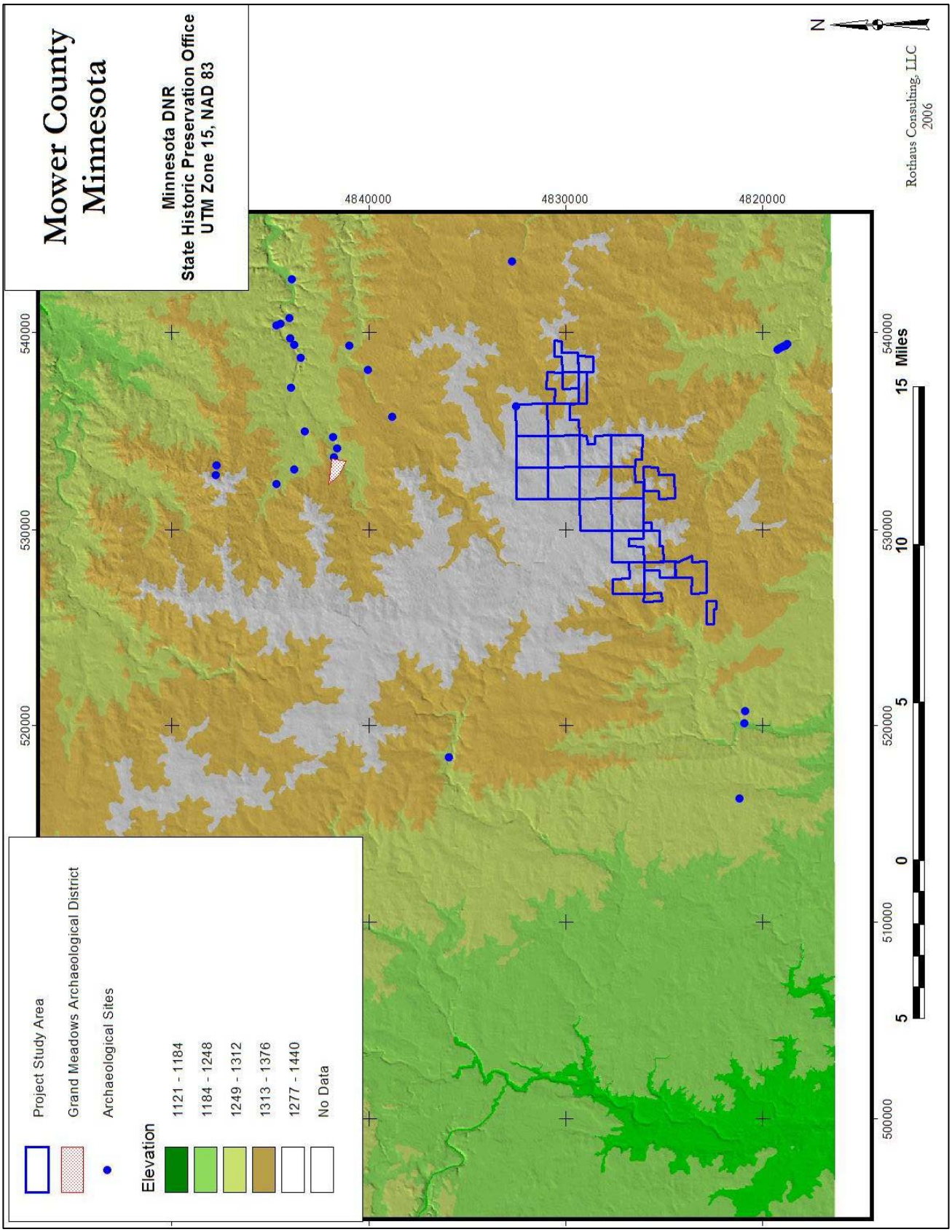
Map 6: Known Archaeological Sites



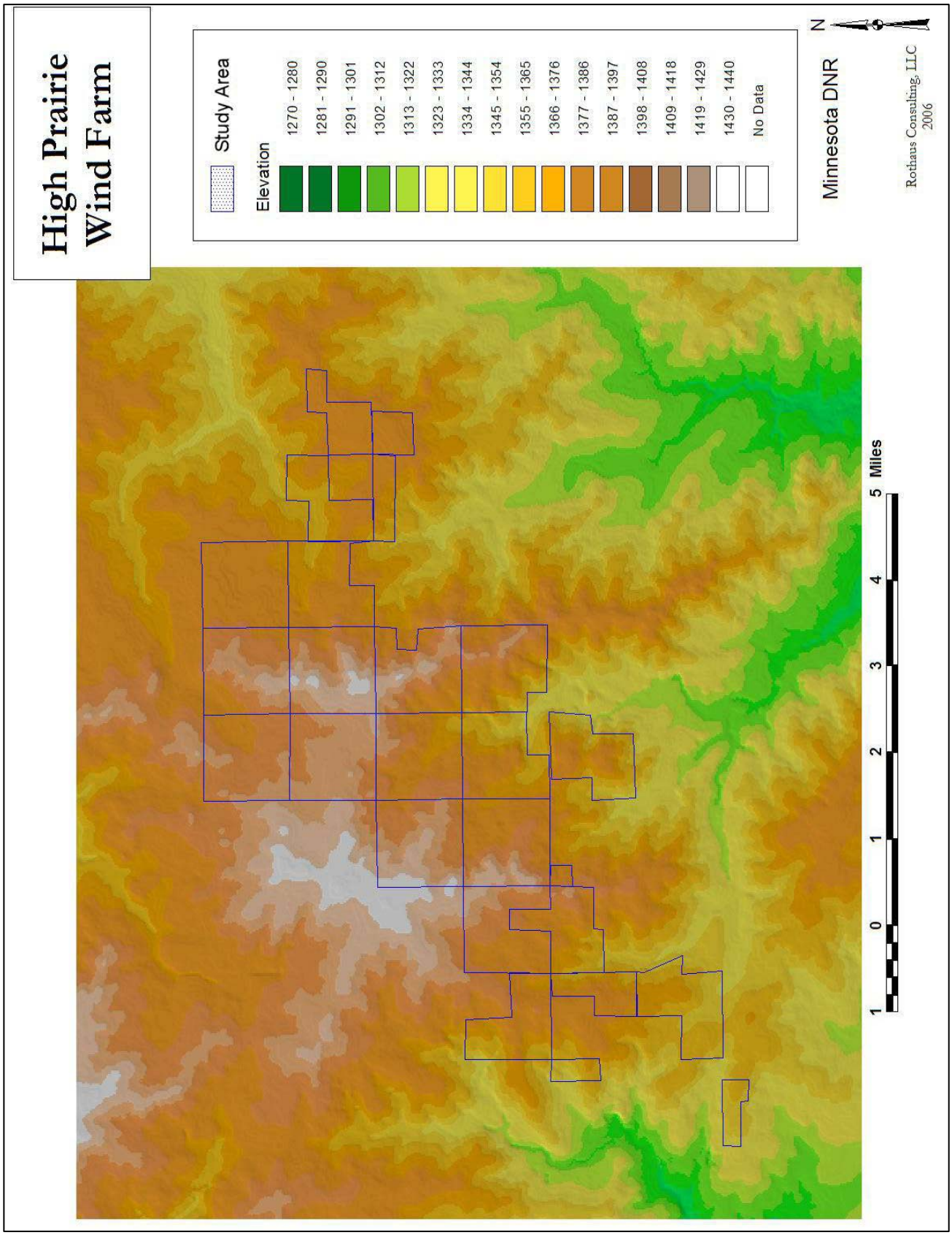
Map 7: Minnesota ECS Sections



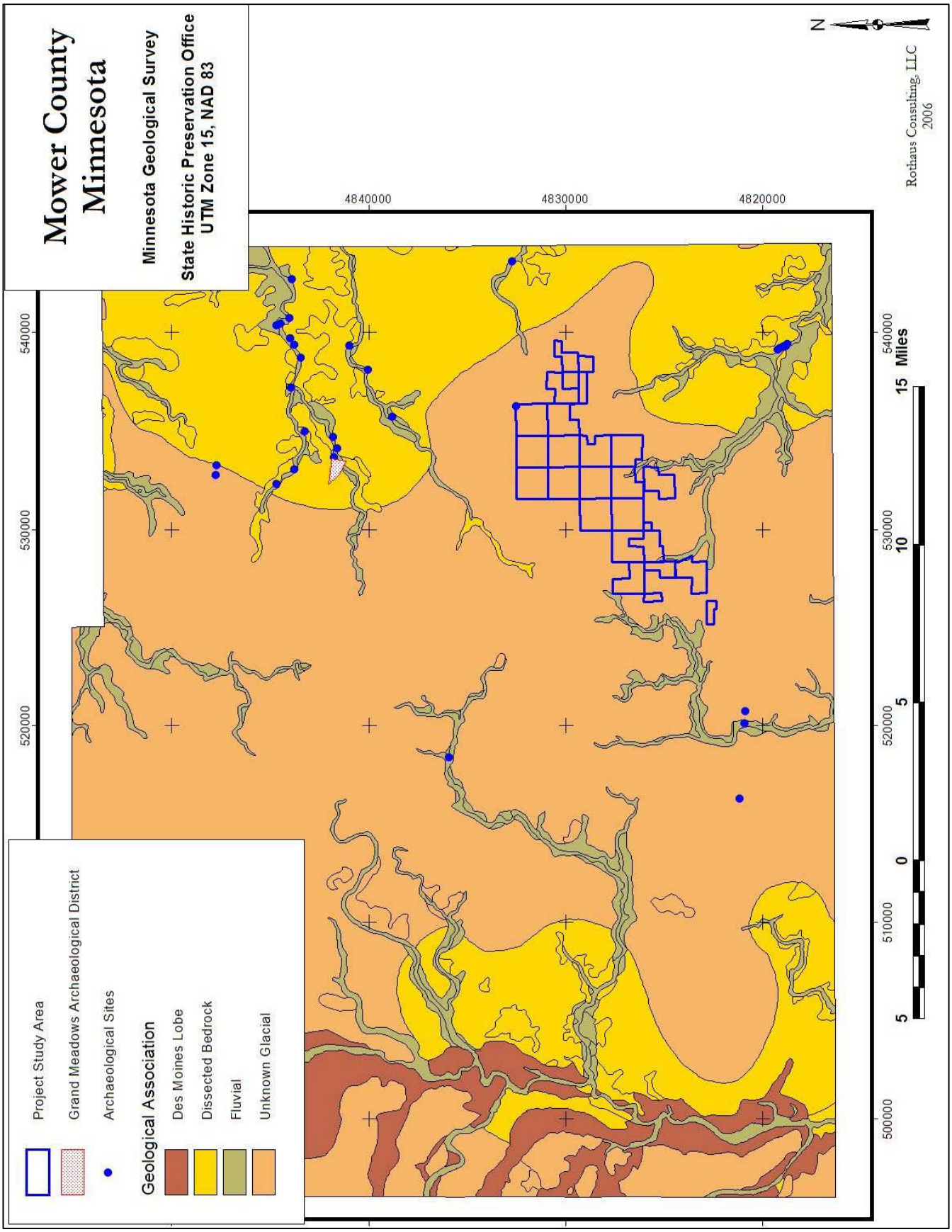
Map 8: Minnesota ECS Subsections



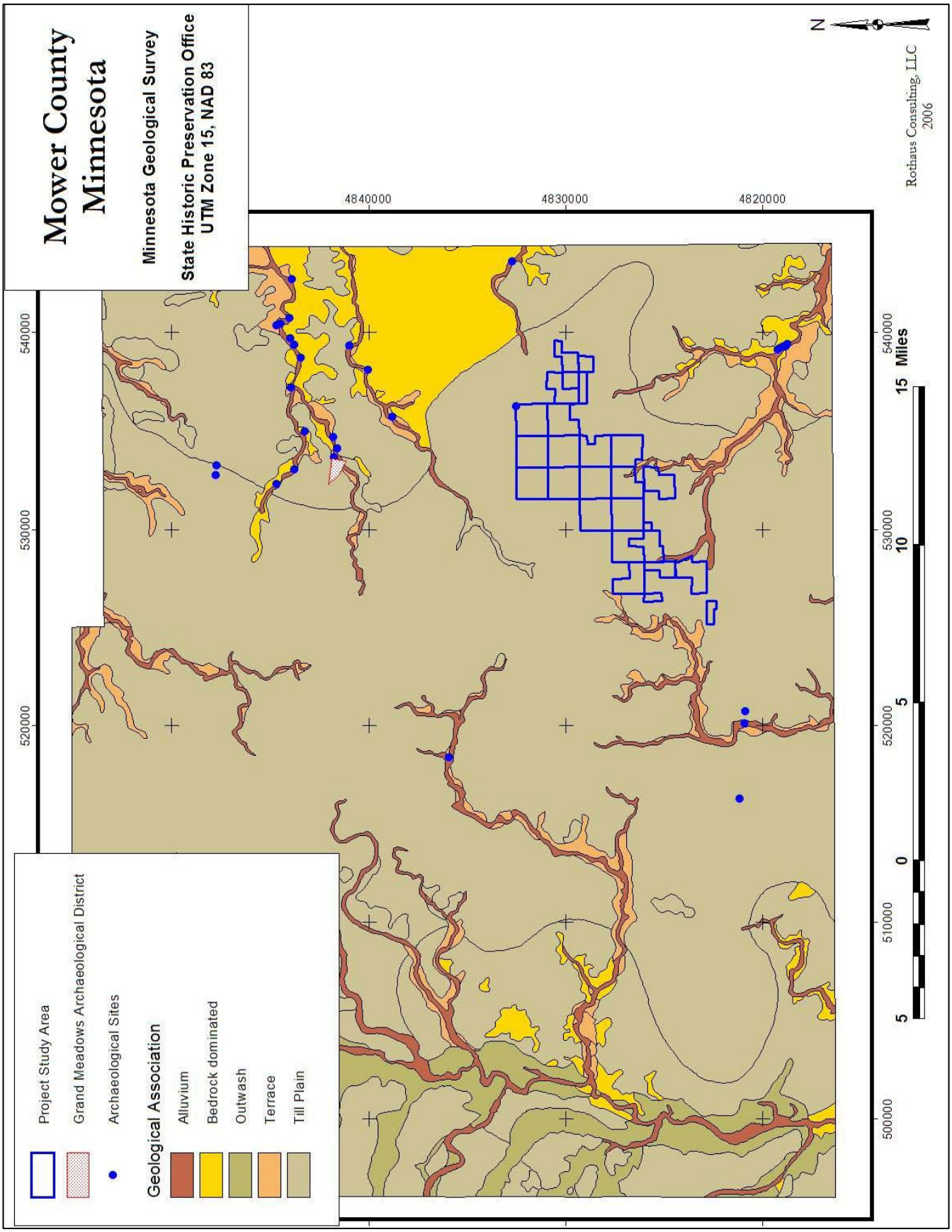
Map 9: Elevation, Overview



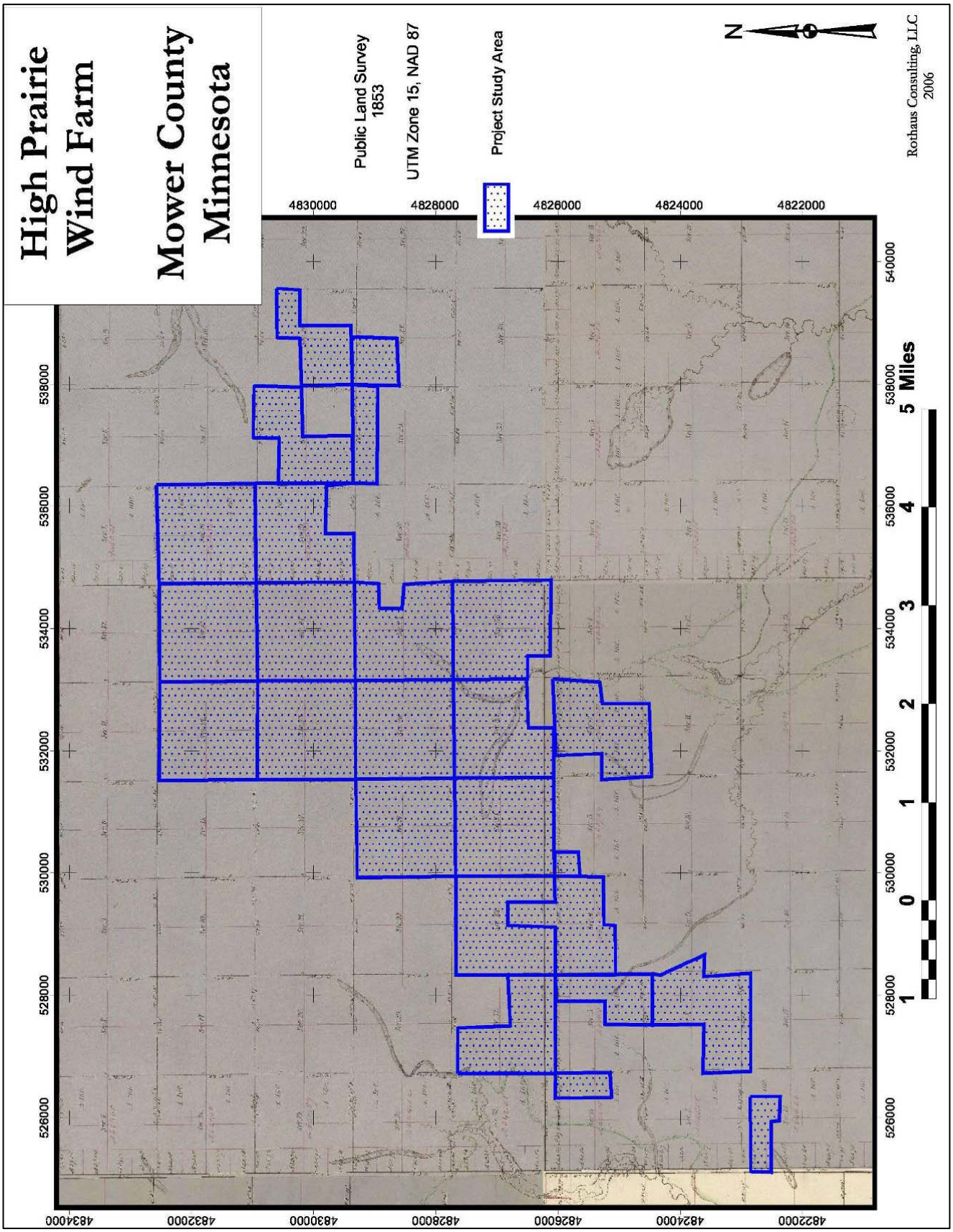
Map 10: Elevation, Detail



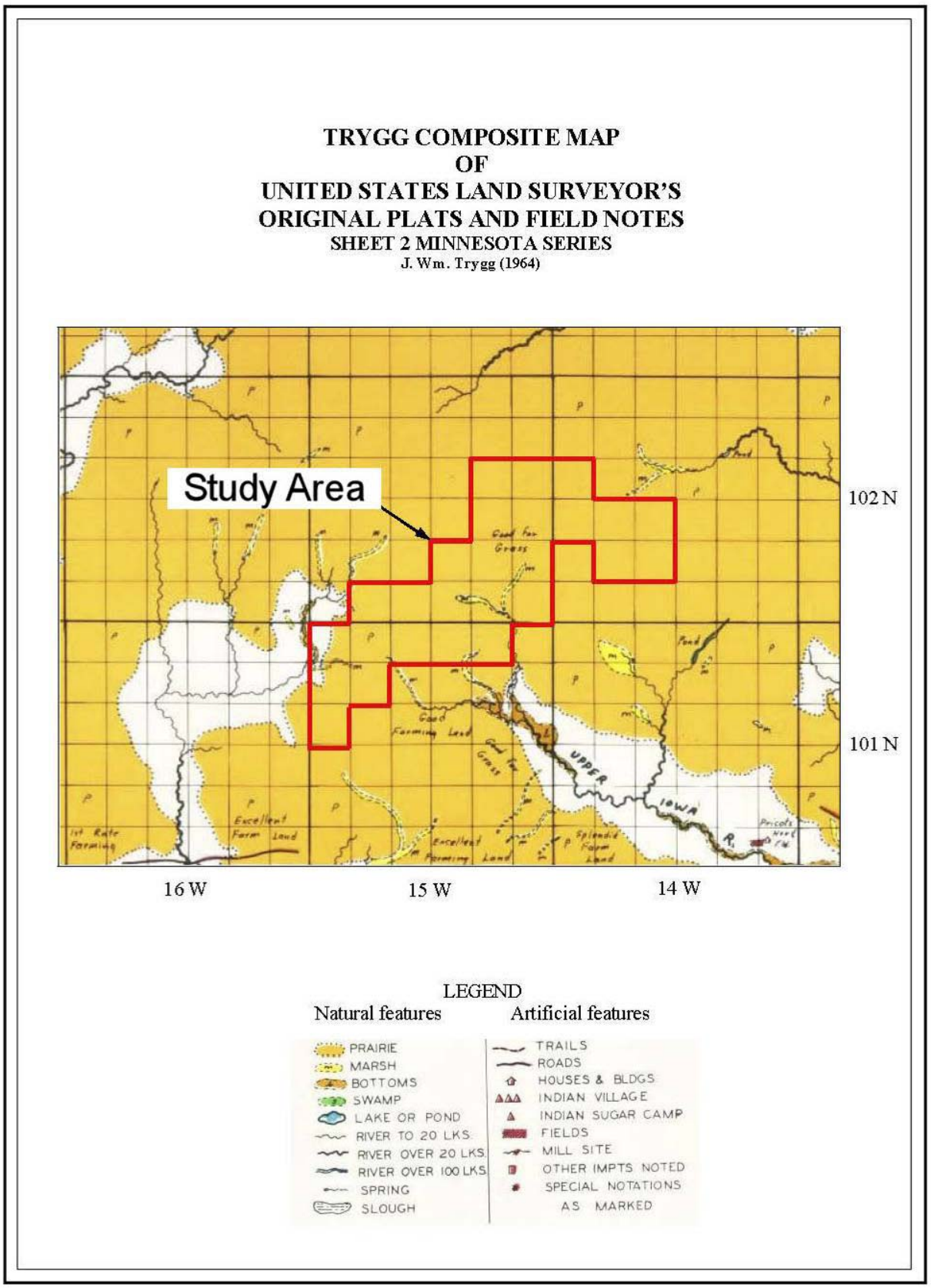
Map 11: Geological Association



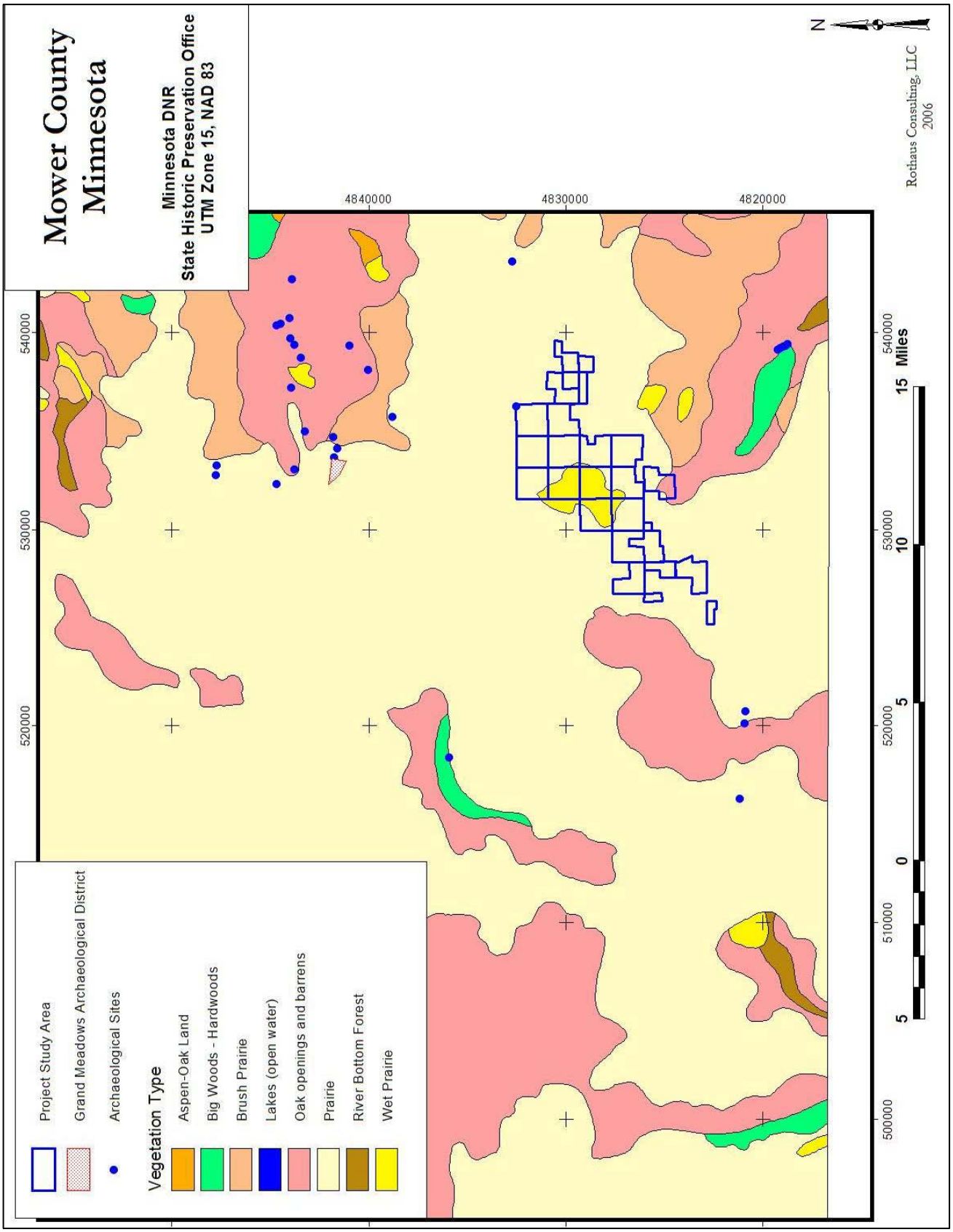
Map 12: Sediment



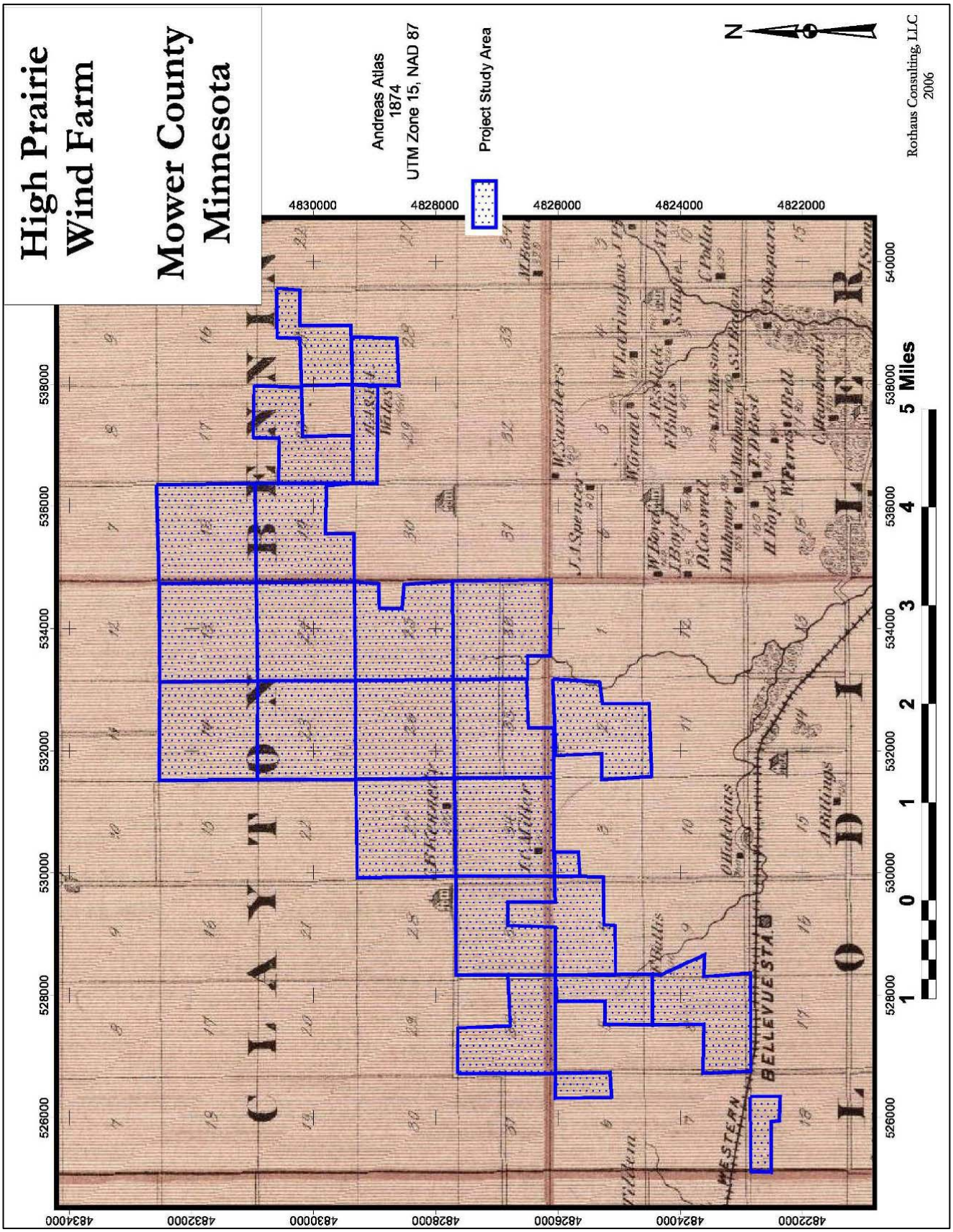
Map 13: Public Land Survey (1853)



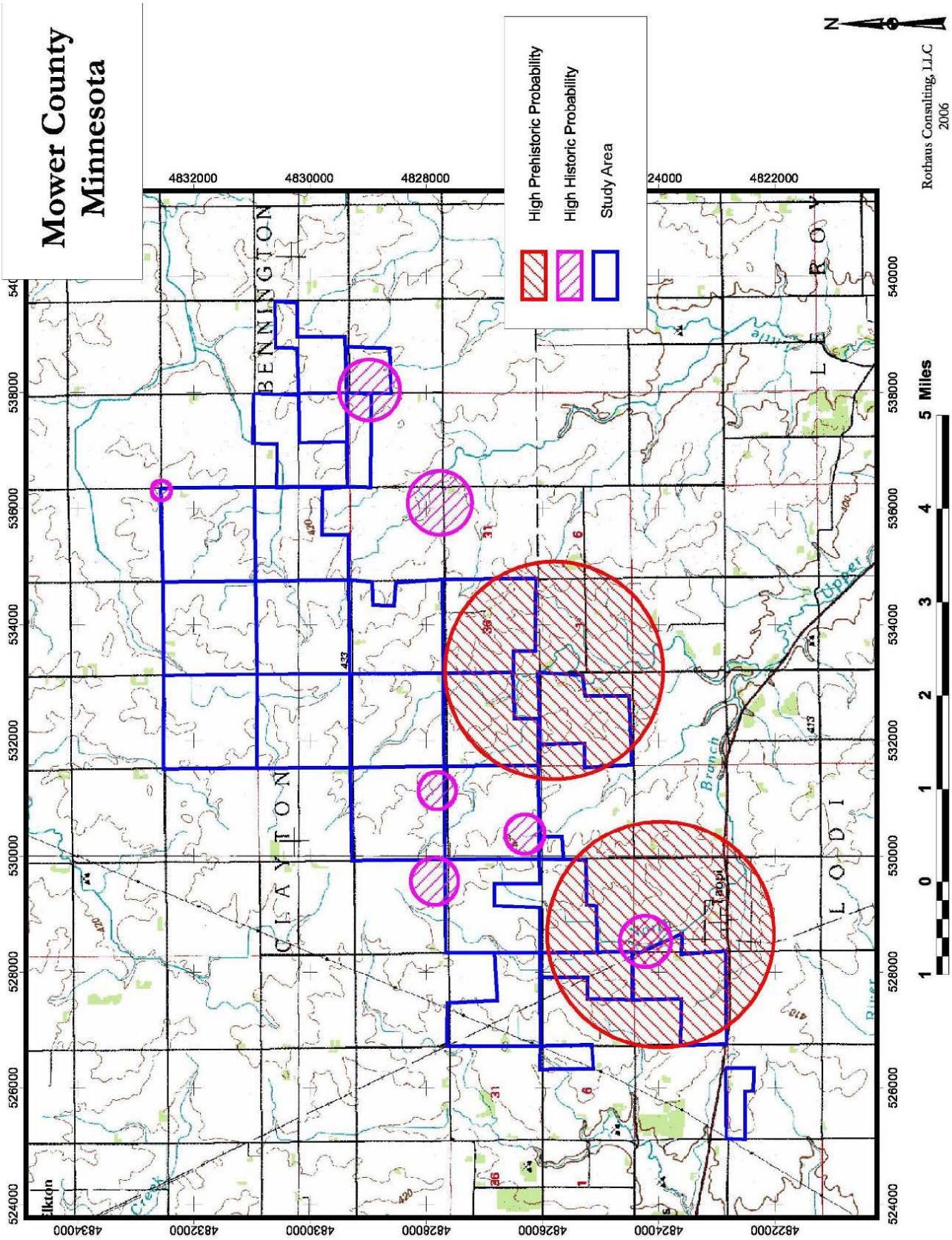
Map 14: Trygg Map (1850)



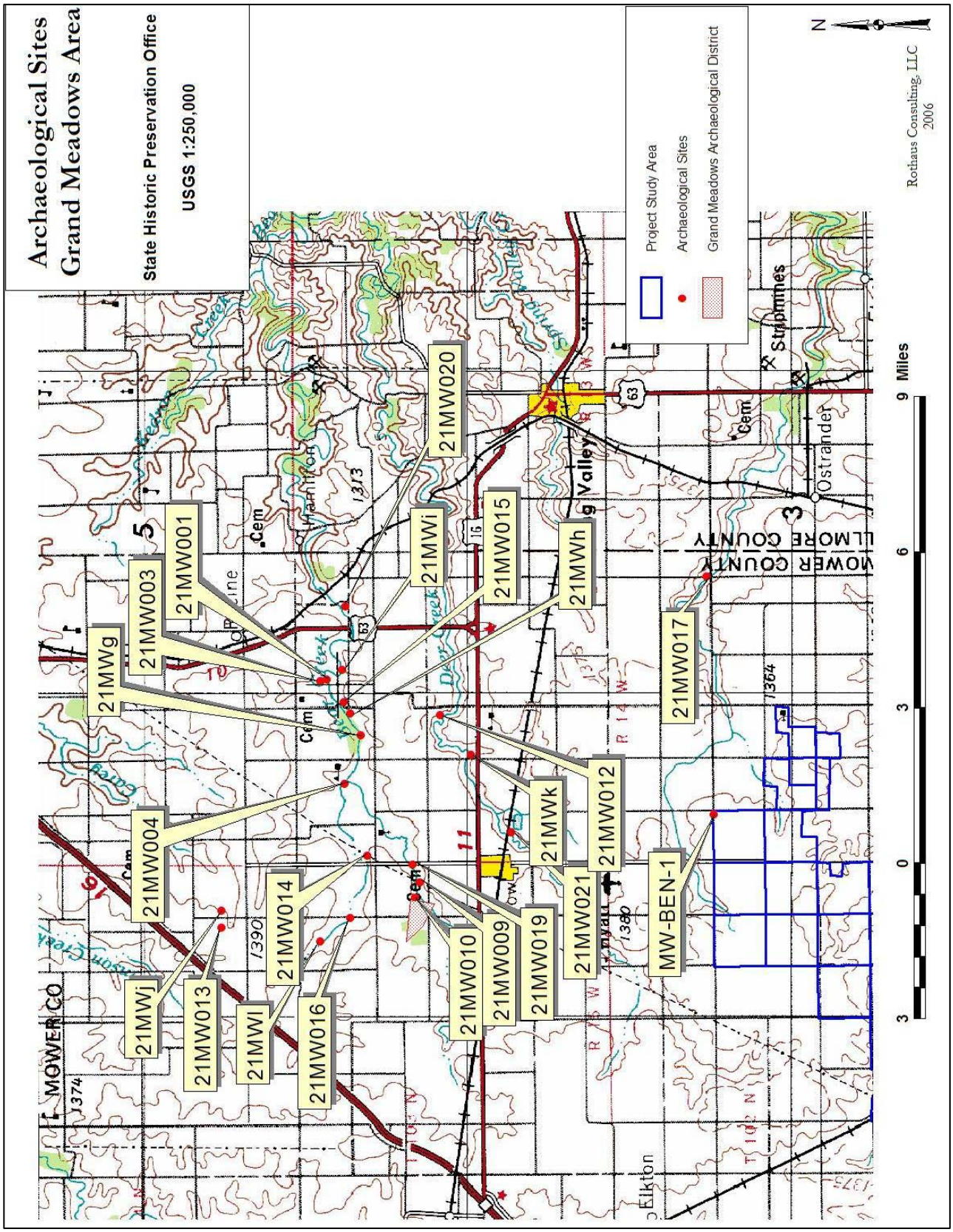
Map 15: Marschner Map (1895)



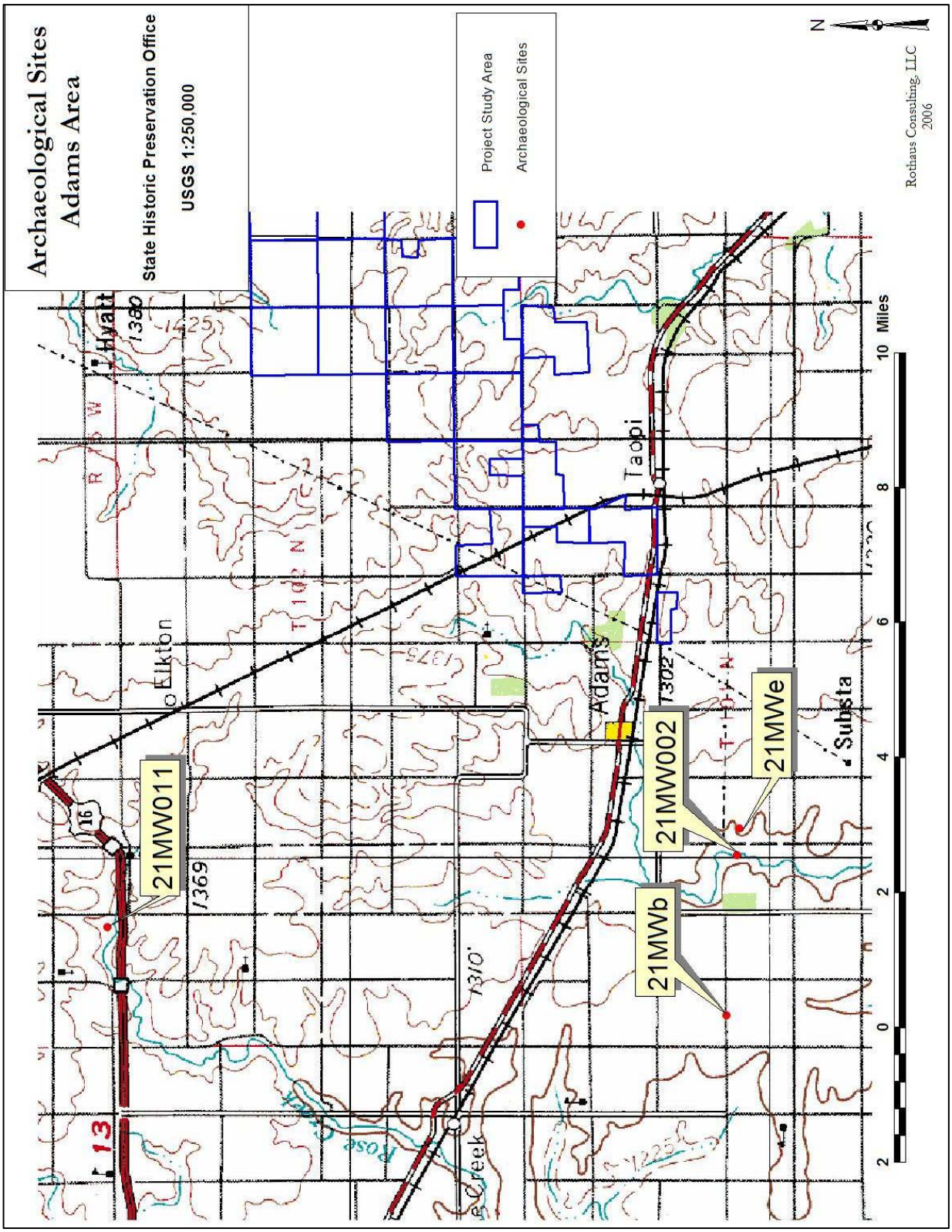
Map 16: Andreas Atlas (1874)



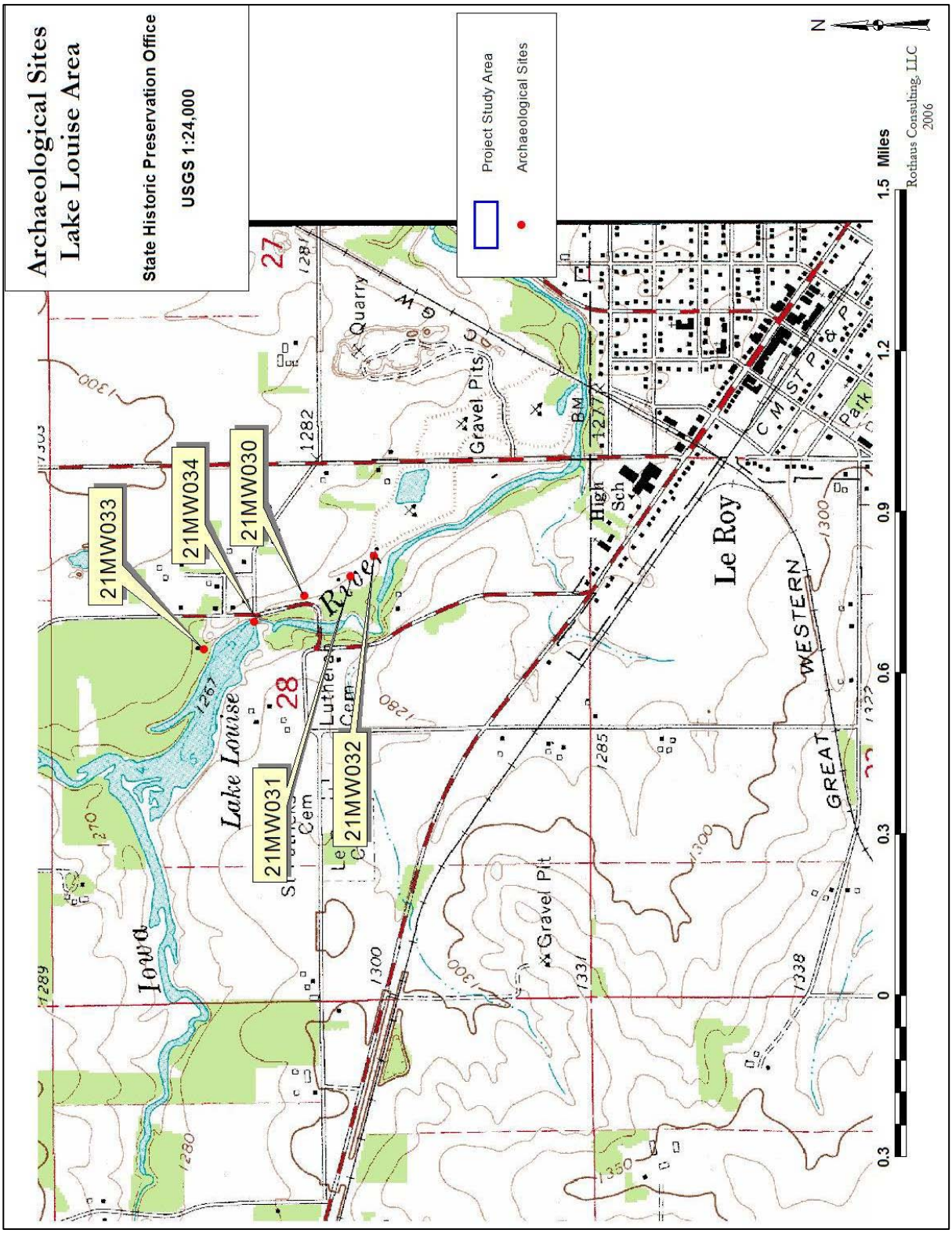
Map 17: Areas of High Probability



Map 18: Known Sites, Grand Meadow Area



Map 19: Known Sites, Adams Area



Map 20: Known Sites, Lake Louise Area

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8 March 2006

ADDENDUM TO PHASE 1A REPORT

Dear Aileen,

I have examined the attached map of the High Prairie Wind Farm, which illustrates some minor changes in facility locations from the Study Area maps included in our Phase 1a report. Our literature review and overview study considered a substantial buffer around the Wind Farm, and this area included all facilities illustrated on the attached map. These differences between the maps are not substantive and do not alter the conclusions and recommendations of our report,

I note that MET-096, Perm Met 1 and Perm Met 2 are in close proximity to water sources and have reasonably high potential for prehistoric sites. These three locations should be approached with the same management recommendations we have recommended for our Study Area.

Respectfully yours,

Richard M. Rothaus, PhD

APPENDIX 4 – Wildlife Tables

Wildlife Tables

Table 1. Resident bird species in Mower County.

Common Name	Scientific Name
American Crow	*Corvus brachyrhynocos*
Barred Owl	*Strix varia*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Common Snipe	*Gallinago gallinago*
Downy Woodpecker	*Picoides pubescens*
Eastern Screech Owl	*Otus asio*
European Starling	*Sturnus vulgaris*
Gray Partridge	*Perdix perdix*
Great Horned Owl	*Bubo virginianus*
Hairy Woodpecker	*Picoides villosus*
House Finch	*Carpodacus mexicanus*
House Sparrow	*Passer domesticus*
Long-eared Owl	*Asio otus*
Northern Bobwhite	*Colinus virginianus*
Northern Cardinal	*Cardinalis cardinalis*
Pileated Woodpecker	*Dryocopus pileatus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Ring-necked pheasant	*Phasianus colchicus*
Ruffed Grouse	*Bonasa umbellus*
White-breasted Nuthatch	*Sitta carolinensis*
Wild Turkey	*Meleagris gallopavo*
Source: Henderson 1979; Jansen 2004; Nelson 2005.	

Table 2. Migratory Bird Species in Mower County

Common Name	Scientific Name	Common Name	Scientific Name
American Coot	*Fulica americana*	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
American Golden-Plover	*Phuvialis dominica*	Orchard Oriole	*Icterus spurious*
American Goldfinch	*Carduelis tristis*	Pied-Billed Grebe	*Podilymbus podiceps*
American Kestrel	*Falco sparverius*	Prairie Falcon	*Falco mexicanus*
American Kestrel	*Falco sparverius*	Purple Martin	*Progne subis*
American Pipit	*Anthus rubescens*	Red-eyed Vireo	*Vireo olivaceus*
American Redstart	*Setophaga nuticilla*	Redhead*	*Aythya Americana*
American Robin	*Turdus migratorius*	Red-headed Woodpecker	*Melanerpes erythrocephalus*
American Tree Sparrow	*Spizella arborea*	Red-shouldered Hawk	*Buteo lineatus*
American Woodcock	*Scolopas minor*	Red-tailed Hawk	*Buteo jamaicensis*
Baird's Sandpiper	*Caldidris baindii*	Red-winged Blackbird	*Agelaius phoeniceus*
Northern Oriole	*Icterus galbula*	Rock Dove	*Columba livia*
Bank Swallow	*Riparia riparia*	Rose-breasted Grosbeak	*Pheucticus*

APPENDIX 4 – Wildlife Tables

Table 2. Migratory Bird Species in Mower County

Common Name	Scientific Name	Common Name	Scientific Name
			ludovicianus
Barn Swallow	*Hinundo rustica*	Rough-legged Hawk	*Buteo lagopus*
Bell's Vireo****	*Vireo bellii*	Ruby-throated Hummingbird	*Archilochus colubris*
Belted Kingfisher	*Megaceryle alcyon*	Ruddy Turnstone	*Arenaria interpres*
Black Tern**	*Chlidonias niger*	Savannah Sparrow	*Passerculus sandwichensis*
Black-bellied Plover	*Phuvialis squatarola*	Scarlet Tanager	*Piranga olivacea*
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Sedge Wren	*Cistothorus platensis*
Blackpoll Warbler	*Dendroica striata*	Semipalmated Plover	*Chardrius semipalmatus*
Blue-winged Teal	*Anas discors*	Short-billed Dowitcher	*Llimnodromus griseus*
Blue-winged Warbler****	*Vermivora pinus*	Snow Bunting	*Plectrophenax nivalis*
Blue-gray Gnatcatcher****	*Polioptila caerulea*	Snow Goose	*Chen caerulescens*
Bobolink	*Dolichonyx striata*	Snowy Egret	*Egretta thula*
Bonaparte's Bull	*Larus philadelphia*	Solitary Sandpiper	*Tringa solitaria*
Brewer's Blackbird	*Euphagus cyanocephalus*	Song Sparrow	*Melospiza melodia*
Brown Thrasher	*Toxostoma rufum*	Sora	*Porzana carolina*
Brown-Headed Cowbird	*Molothrus ater*	Spotted Sandpiper	*Actitis macularia*
Buff-breasted Sandpiper	*Tryngites subruficollis*	Stilt Sandpiper	*Calidris hemantopus*
Bufflehead	*Bucephala albeola*	Summer Tanager	*Pirangia rubra*
Canada Goose	*Branta canadensis*	Swainson's Hawk	*Buteo swainsoni*
Carolina Wren	*Thryothorus ludovicianus*	Swamp Sparrow	*Melospiza Georgiana*
Cattle Egret	*Bubulcus ibis*	Townsend's Solitaire	*Myadestes townsendi*
Cedar Waxwing	*Bombycilla cedrorum*	Tree Swallow	*Tacjucometa bocp;pr*
Cerulean Warbler	*Dendroica cerulea*	Tundra Swan	*Cygmus columbianus*
Chimney Swift	*Chaetura pelagica*	Turkey Vulture****	*Cathartes aura*
Chipping Sparrow	*Spizella passerina*	Upland Sandpiper	*Bartramia longicauda*
Common Moorhen	*Gillanula chloropus*	Varied Thrush	*Ixoreus naevius*
Common Nighthawk	*Chordeiles minor*	Veery	*Catharus fuscescens*
Common Yellowthroat	*Geothlypis trichas*	Vesper Sparrow	*Pooecetes gramineus*
Eastern Wood-Pewee	*Contopus virens*	Virginia Rail	*Rallus limicola*

APPENDIX 4 – Wildlife Tables

Table 2. Migratory Bird Species in Mower County

Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Gray Catbird	*Dumetella carolinensis*	Warbling Vireo	*Vireo gilvus*
Gray-cheeked Thrush	*Catharus minimus*	Western Meadowlark	*Sturnella neglecta*
Horned Lark	*Eremophila alpetris*	Western Tanager	*Piranga ludoviciana*
Killdeer	*Charadrius vociferous*	White-rumped Sandpiper	*Calidris fuscicollis*
Least Flycatcher	*Empidonax minimums*	Whip-poor-will	*Caprimulgus vociferous*
Lesser Yellowlegs	*Tringa flavipes*	Willet	*Catoptrophorus semipalmatus*
Little Blue Heron	*Egretta caerulea*	Willow Flycatcher	*Empidonax traillii*
Loggerhead Shrike	*Lanius ladovicianus*	Wood Duck	*Aix sponsa*
Long-Billed Dowitcher	*Limnodromus scolopaceus*	Wood Thrush ****	*Hylocichla mustelina*
Louisiana Waterthrush	*Seiurus motacilla*	Worm-eating Warbler	*Helmitheros vermivorus*
Mallard	*Anas platyrhynchos*	Yellow Warbler	*Dendroica petechia*
Marsh Wren	*Cistothorus palustris*	Yellow-bellied Sapsucker	*Sphyrapicus varius*
Mountain Bluebird	*Sialia currucoides*	Yellow-billed Cuckoo	*Coccyzus americanus*
Mourning Dove	*Zedaida macroura*	Yellow-breasted Chat	*Icteria virens*
Mute Swan	*Cygnus olor*	Yellow-headed Blackbird	*Xanthocephalus zanthocephalus*
Northern Flicker	*Colaptes auratus*	Yellow-throated Vireo	*Vireo flavirons*
Northern Mockingbird	*Mimus polyglottos*		

* found one county west ** found one county west and two counties east, one county north
*** accidental in state **** found one county east ***** found to the far north
Source: Henderson 1979; Jansen 2004; Nelson 2005.

APPENDIX 4 – Wildlife Tables

Table 3. Mammal species in Mower County

Common Name	Scientific Name
Badger	*Taxidea tasux*
Beaver	*Castor canadensis*
Big Brown Bat	*Eptesicus fuscus*
Coyote	*Canis latrans*
Eastern Chipmunk	*Tamias striatus*
Eastern Cottontail	*Sylvilagus floridonus*
Eastern Pipistrelli	*Pipistrellus subflavus*
Eastern Spotted Skunk	*Spilogale putorius*
Eastern/Prairie Mole	*Scalopus aquaticus*
Fox Squirrel	*Sciurus niger*
Franklin's Ground Squirrel	*Spermaphilus franklinii*
Gray Fox	*Urocyon cinereoargenteus*
Gray Squirrel	*Sciurus carolinensis*
Little Brown Bat	*Myotis lucifugus*
Long-tailed Weasel	*Mustela frenata*
Meadow Vole	*Microtus pennsylvanicus*
Mink	*Mustela vison*
Muscrat	*Ondatra zibethicus*
Plains Pocket Gopher	*Geomys bursarius*
Plains Pocket Mouse	*Perognathus flavescens*
Prairie Deer Mouse	*Peromyscus maniculatus bairdii*
Raccoon	*Procyon lotor*
Red Fox	*Vulpes vulpes*
Red Squirrel	*Tamiasciurus hudsonicus*
Short-tailed Shrew	*Blarina brevicauda*
Silver-haried Bat	*Lasionycteris noctivagans*
Star-nosed Mole	*Condylura cristata*
Striped Skunk	*Mephitis mephitis*
Thirteen-lined Ground Squirrel	*Spermaphilus tricecemlineatus*
Virginia Opossum	*Didelphis virginiana*
Western Harvest Mouse	*Reithordontomys magalotis*
White-tail Deer	*Odocoileus verginianus*
White-tailed Jack Rabbit	*Lepus townsendii*
Wood/White-footed Mouse	*Peromyscus leucopus*
Woodchuck/Groundhog	*Mormota monax*
Woodland Deer Mouse	*Peromyscus maniculatus gracilis*

Table 4. Reptile and amphibian species in Mower County.

Common Name	Scientific Name
American Toad	*Bufo americanus*
Blanding's Turtle	*Emydoidea blandingii*
Blue-spotted Salamander	*Ambystoma laterale*
Common Garter Snake	*Thamnophis sirtalis*
Green Frog	*Rana clamitans*
Northern Leopard Frog	*Rana piieans*
Painted Turtle	*Chrysemys picta*
Smooth Green Snake	*Opheodrys vernalis*

APPENDIX 4 – Wildlife Tables

Table 5. Federally-listed threatened and endangered species found in Minnesota.

Common Name	Scientific Name	Status
Mammals		
Canada Lynx	*Lynx canadensis*	Threatened
Gray Wolf	*Canis lupus*	Threatened
Birds		
Bald Eagle	*Haliaeetus leucocephalus*	Threatened
Piping Plover	*Charadrius melodus*	Threatened
Whooping Crane	*Grus americanus*	Non-essential Experimental Population
Reptiles		
Eastern Massasauga	*Sistrurus catenatus*	Candidate
Fish		
Topeka Shiner	*Notropos topeka*	Endangered
Clams (Freshwater mussels, Unionids)		
Higgins Eye Pearlymussel	*Lampsillis higginsii*	Endangered
Sheepnose	*Plethobasus cyphyus*	Candidate
Spectaclecase	*Cumberlandia monodonta*	Candidate
Winged Mapleleaf	*Quadrula fragosa*	Endangered
Insects		
Dakota Skipper	*Hesperia dacotae*	Candidate
Karner Blue Butterfly	*Lycaeides Melissa samuelis*	Endangered
Plants		
Leedy's Roseroot	*Sedum integrifolium ssp. leedyi*	Threatened
Minnesota Dwarf Trout Lily	*Erythronium propullans*	Endangered
Prairie Bush-clover	*Lespedeza leptostachya*	Threatened
Western Prairie Fringed Orchid	*Platanthera praeclara*	Threatened

Table 6. State-listed threatened and endangered mammals and birds.

Common Name	Scientific Name	Status
Eastern Spotted Skunk	*Spilogale putorius*	Threatened
Baird's Sparrow	*Ammodramus bairdii*	Endangered
Henslow's Sparrow	*Ammodramus henslowii*	Endangered
Sprague's Pipit	*Anthus spragueii*	Endangered
Chesnut-collared Longspur	*Calcarius ornatus*	Endangered
Piping Plover	*Charadrius melodus*	Endangered
King Rail	*Rallus elegans*	Endangered
Burrowing Owl	*Speotyto cunicularia*	Endangered
Trumpeter Swan	*Cygnus buccinator*	Threatened
Peregrine Falcon	*Falco peregrinus*	Threatened
Loggerhead Shrike	*Lanius ludovicianus*	Threatened
Wilson's Phalarope	*Phalaropus tricolor*	Threatened
Horned Grebe	*Podiceps auritus*	Threatened
Common Tern	*Sterna hirundo*	Threatened

APPENDIX 5 – SUMMARY OF AVIAN IMPACT STUDIES

This Appendix contains summaries the results of two studies conducted at wind energy projects to determine effects of facilities on avian species.

TOP OF IOWA

Koford, R., A. Jain, G. Zenner, A. Hancock. 2005. Avian mortality associated with the top of Iowa wind farm. ProgressReport- Calendar Year 2004. Ames, IA.

Introduction

Construction on the Top of Iowa Wind Farm near Joice in Worth County, Iowa was completed in December 2001. The facility is composed of 89 turbines mounted on 71.6 m (235-foot) high tubular towers. Each turbine is equipped with three 25.9 m (85-foot) blades. Blade speed at the tips is approximately 337 km/h (130 mph).

Due to the presence of three large state-owned Wildlife Management Areas (WMAs) which provided a wide variety of habitat under state management (wetland, grassland and forest habitat), the project area has exhibited historically high bird use. Migrant and resident shorebirds, rails, raptors, sparrows and icterids historically moved freely between the WMAs, with their movements routinely taking them through the area that is now occupied by the windfarm. These three WMAs include: Rice Lake (~2,500 acres), Elk Creek (~2,500 acres) and Hanlontown Slough (~1,000 acres) WMAs. The proximity of these WMAs provides attractive habitat for migrating birds in an otherwise intensively farmed region of northern Iowa. In addition, the Rice Lake – Elk Creek – Hanlontown Slough complex (RL-EC-HS) provides important avian breeding habitat, particularly for wetland and grassland bird species. The quality of the habitat, coupled with the location of the a portion of the windfarm in an area that has been closed to Canada goose hunting for 30 years, results in high Canada goose usage. Two of the adjacent WMA's also contain waterfowl refuges that attract up to 40,000 Canada geese and 20,000 ducks to the area each year, resulting in 2.5 million waterfowl-use days in the vicinity of the wind farm. No other existing wind farm site in Iowa with exhibits higher potential bird use.

Study Objectives:

1) Determine bird and bat mortality resulting from impacts with wind-generator towers and turbine blades, with emphasis on mortality during the spring and fall migration periods;
2) Determine bird and bat species composition, relative abundance, habitat use, flight patterns and the relative mortality risk at turbine sites versus non-turbine sites; and,
3) Determine impacts of the wind turbines on waterfowl use of croplands by comparing waterfowl use of quarter sections containing wind turbines to similar quarter sections without turbines during the fall, with emphasis on Canada goose use of the area closed to Canada goose hunting around the Rice Lake WMA.

Project Design

Mortality

Evidence of collision-induced mortality was investigated in the vicinity of 26 randomly-selected wind turbines. Six 3 meter (m) wide transects were maintained free of vegetation, using a combination of herbicide treatments and manual weeding techniques, on each 76m x 76 m (250 ft by 250 ft) search plot under each of the 26 randomly selected towers. Transects were placed parallel to existing corn/soybean rows. Access roads and construction pads under turbines were also searched. The average total area searched under each tower comprised approximately 30 percent (1,742m^2 or 18,750 ft^2) of each 5,776m^2 (62,170 ft^2) search plot. Standardized searches of all mortality transects began April 15, 2003.

The search frequency was once every three days. From June 13, 2003, the search pattern was standardized to once every two days, in order to increase accuracy of the searches. Starting March 15, 2004, the search frequency was changed to once every two days.

Removal rates of carcasses by scavengers were measured during spring, summer, and fall by placing birds of three sizes (house sparrow, mallard/pigeon and Canada goose) on mortality transects under each of the 26 monitored wind towers. Carcasses were monitored daily for two weeks and evidence of scavenging was noted. Carcass status was reported as intact, partially scavenged, or completely removed.

Search efficiency was measured for each observer by having an independent Iowa Department of Natural Resource (IDNR) wildlife technician place small birds, such as house sparrows, on transects without the knowledge of the investigator. All evidence of bird or bat collisions discovered, including evidence planted by the IDNR wildlife technician were recorded if found. Recorded planted evidence of collisions was later removed from the database and a search efficiency rate calculated for each investigator.

Bird and Bat Species Composition and Activity.

Relative avian abundance and activity were estimated using fixed radius (100m or 328 ft) point counts from May 1, 2003 to December 1, 2003 and from March 24, 2004 to December 14, 2004. Standardized point counting techniques were used to reduce variance between observers. Observers recorded species, activity, and location of all birds within a 100m radius of the point count site. The duration of each point count was 10 minutes. Point counts were conducted in the morning from one-half hour after sunrise until 4.5 hours after sunrise, during mid-day from 11 AM to 2:00 PM, in the evening from 4:00 PM to 7:30 PM, and at night from half an hour before sunset to an hour and a half after sunset. Times were periodically adjusted to account for changes in daylight hours. Point counts were conducted at turbine location without mortality transects, as well as wind towers with mortality transects and in adjacent fields without turbines. Point counts were also conducted in crop fields approximately 4 miles southwest of the windfarm to contrast bird activity at similar sites outside the windfarm. Each site was visited approximately once every six days for each of the four time periods (morning, mid-day, evening and night). To improve the study design in 2004, point counts in the area southwest of the windfarm were restricted to the morning hours. It was determined that in order to contrast bird abundance on the windfarm with abundance at similar sites off the windfarm, the accepted methodology was to conduct only morning point counts, since bird activity is highest at that time.

Each 100 m fixed-radius point count was divided by species and season (i.e., Summer 2003 and Spring and Summer 2004) and analyzed each species-season combination separately. The seven most common bird species observed were included in the analysis.

Remote bat monitoring at turbine location was initiated in September 2003. Prior to that time, bat activity was monitored in conjunction with evening and night point counts. Anabat ultrasonic bat detectors were used to monitor bat activity from September 4, 2003 to October 9, 2003 and from May 26, 2004 to September 24, 2004. Monitors were placed at turbine sites as well as in adjacent fields without turbines.

Waterfowl Behavior and Activity

Waterfowl activity was monitored in the fall, from September 15 to December 25, 2003 and from September 27 to December 22, 2004. Waterfowl use within the area closed to Canada goose hunting around Rice Lake was estimated twice weekly. Agricultural crops and tillage practices and turbine activity were recorded during each count along with any observations that may have influenced waterfowl use. Additional relevant parameters noted were field area, distance from Rice Lake and presence/absence of wind turbines in each field. In addition, available waste grain was estimated in a number of fields with and without wind turbines in the area closed to Canada

goose hunting. Data was used to estimate the relative amounts of grain available for foraging waterfowl in the fields to determine if the fields with turbines had similar amounts of waste grain in them, making them more or less attractive to feeding geese. Waterfowl behavior was observed during morning and evening foraging periods in the same area. Behavior noted was time spent foraging (stationary and mobile) versus time spent vigilant (stationary and mobile) using scan sampling techniques A flock was scanned for two minutes, and each bird observed was assigned a combination of behaviors (foraging, vigilant, mobile, stationary or other). Observations were made in a similar manner to the foraging activity study.

Results

Point counts conducted on and near the windfarm were used to compare bird activity in fields with and without turbines. In order to estimate bird flight in the region, the following is an approximation of birds seen and heard during point counts conducted at turbine locations. An approximate abundance number of observed birds during the morning point counts in the summer of 2003 and 2004 was 1.76 birds and 1.95 birds every ten minutes of observation. The approximate abundance number of birds observed during the morning point counts in the fall of 2003 was 19 birds for every ten minutes of observation. These high numbers were primarily driven by rare sightings of large flocks of blackbirds (with numbers as high as 1000 and 5000 birds in one sighting). An approximate abundance number of birds seen during the morning point counts in the spring of 2004 was 1.6 birds for every ten minutes of observation.

The 2003 pilot study using Anabat ultrasonic bat detectors indicated there was no significant difference between bat activity at wind turbine sites and adjacent crop fields without turbines. The 2004 study (May to September 2004) found no significant difference between bat activity at wind turbine locations when compared to activity at adjacent crop fields without turbines.

Waterfowl use of the adjacent WMA's was below average for both ducks and geese in 2003 and 2004 compared to historical counts due to a late summer drought in 2003 and an unusual migration in 2004.

Waterfowl activity and behavior was monitored in the fall. Approximately 1.2 million total goose-use days and 194,000 total duck-use days were recorded in the WMA's, from September 15 to December 25, 2003, and 904,200 total goose-use days and 66,300 total duck-use days were recorded from September 27 to December 22, 2004.

Fall waterfowl use observations were analyzed for the 447 (2003) and 587 (2004) flocks of geese that were observed foraging in fields with and without wind turbines. Multiple Subset model selection was performed to determine the effect of the presence or absence of wind turbines on Canada goose use of fields. In 2003 a field with a wind turbine was 0.04 ± 0.3573 less likely to be used by Canada geese as a forage site than a non-turbine field. In 2004, a field with a wind turbine was 0.1326 ± 0.3271 less likely to used by Canada geese as a forage site than a non-turbine field. Confidence intervals for these estimates crossed zero, indicating that the effects can be considered negligible.

Spring and summer searches, both efficiency and scavenger rates were evaluated. Observers found 77% of bird carcasses in 2003 and 70% of bird carcasses in 2004. In scavenging trials, scavengers removed 5% and 8% of carcasses in 2003 and 2004 respectively.

Bat detectors were used to compare bat activity at turbine versus adjacent non-turbine sites. No consistent significant differences were found between relative bird and bat activity at turbine, turbine with transect and non-turbine sites.

Canada goose foraging behavior was monitored for a total of 447 flocks in 2003 and 587 flocks in 2004 and the presence of wind towers on goose activity was estimated to have a negligible effect.

APPENDIX 5 – SUMMARY OF AVIAN IMPACT STUDIES

Mortality

In 2003, the study resulted in the discovery of two birds (a yellow-throated vireo and a tree swallow) and 30 bats (hoary, red, little brown, big brown and silver-haired bats). In 2004, five bird carcasses (yellow-headed blackbird, red-tailed hawk, golden-crowned kinglet and two carcasses of unidentifiable bird species) and 44 bats (hoary, red, little brown, big brown, silver-haired and eastern pipistrelle bats) were found. Apparently, mortality resulted from collisions with wind turbines.

Based on the evidence collected in the study, the investigators stated that avian mortality at the TOI site was minimal. The investigators also stated that bat mortality during the fall migratory period was substantial, and may indicate cause for concern.

BUFFALO RIDGE

Western EcoSystems Technology, Inc. (WEST). 2000. Avian monitoring studies at the Buffalo Ridge, Minnesota wind resource area: results of a 4-year study. September. Northern States Power.

Introduction

Buffalo Ridge is a segment of the 62-mile-long Bemis Moraine, which is located in Lincoln and Pipestone Counties in southwest Minnesota and Brookings County, South Dakota. Habitats in the study area were characterized as being primarily agricultural crops including corn, soybeans, small grains, hay and pasture and Conservation Reserve Program (CRP) set-asides. Three major phases (P1, P2 and P3) of wind generation development have occurred within the Buffalo Ridge Wind Resource Area (BRWRA). In addition to those study sites within the BRWRA, a permanent reference area not scheduled for windpower development was selected along Buffalo Ridge northwest of the BRWRA in Brookings County, South Dakota.

Current knowledge of wildlife interactions with wind farms facilities suggests that a variety of factors contribute to avian mortality resulting at windfarm faculties. These factors include avian abundance and composition, geographic area, prey abundance and wind plant characteristics, weather and location of windfarm developments in migration corridors.

The study of avian and bat resources within the Buffalo Ridge Study was initiated with the performance of a biological reconnaissance of the BRWRA prior to windpower development. The conclusions of the pre-construction investigation indicated that there was relatively low potential for avian mortality to occur on at Buffalo Ridge based on the following:

1) Buffalo Ridge was not in a major waterfowl staging area or migration route;
2) Passerines usually migrate at altitudes above the turbine blades;
3) Radar studies of nocturnal avian migrants showed that abundance of migrants was relatively lower on Buffalo Ridge than other areas sampled in west-central and southwestern Minnesota; and,
4) Results of pilot avian monitoring studies conducted by South Dakota State University in 1994 and 1995 following construction of the first phase of wind plant development indicated that avian and bat mortality within the wind development area was relatively low.

Project Design

In 1996, Western EcoSystems Technology (WEST, Inc.), under contract to Northern States Power Company (NSP), developed an avian monitoring protocol for the Buffalo Ridge Wind Resource Area and implemented the protocol beginning with the 1996 field season. The primary goals of the study were to evaluate risk to birds from each phase of development and the cumulative risk to birds from future windpower developments in the BRWRA. Secondarily, the study was to provide information that can be used to reduce the risk to birds from any subsequent developments.

This monitoring study used the before/after and control/impact (BACI) design. The design and analysis used a "weight of evidence" approach to assess effects of the project on species of concern. Study design included one hundred meter radius point count surveys conducted to estimate species composition, relative abundance, habitat use, and flight behavior and relative risk during 1996 to 1999 at turbine locations and at randomly selected stations. Raptor and other large bird (RLB) 0.8-km radius-point-count surveys were also conducted at randomly located points throughout the BRWRA. Carcass searches were performed at turbine locations and at randomly non-turbine plots to estimate number of avian and bat mortalities attributable to wind turbine interactions and to relate the mortalities by species to the relative abundance of each

species, turbine characteristics, habitat and other parameters thereby determining relative risk to that species. Estimates of the total number of avian and bat fatalities in each phase of the wind development area were developed for each of three phases of the windfarm.

Results

During the four-year study, researchers documented 218 species of birds in the study area. Six of the observed species were listed as threatened by the State of Minnesota and/or U.S. Fish and Wildlife Service. Observations of threatened species included: six peregrine falcons, 51 bald eagles, three Wilson's phalaropes, 16 loggerhead shrikes, two horned grebes and one common tern. Most of these birds were observed during the spring or fall migration and were most likely migrants. Two breeding pairs of loggerhead shrikes were documented in the study area.

Point-count surveys accounted for the identification of 164 species totaling 70,727 birds. Species richness for species observed during point-count surveys was highest in the summer (1 June - 15 August), followed by spring (15 March - 31 May) and fall (16 August - 15 November), while avian abundance was highest in the fall and lowest in the summer. Avian groups with the highest abundance during the spring were blackbirds, longspurs, and sparrows. Blackbirds, sparrows and swallows were most abundant in summer, with blackbirds, longspurs, and sparrows most abundant in during the fall.

Observations of mean flight height of 15,247 flying flocks comprised of 55,607 birds indicated that mean flight heights were lowest for wrens (1.8 m), upland gamebirds (2.3 m) and sparrows (6.0 m). Waterfowl (46.9 m), waterbirds (44.3 m) and blackbirds (17.2 m) exhibited the highest mean flight heights. Due to differences in turbine heights present within the windfarm, 20.1% of flying birds were within the rotor-swept height of 19.5-52.5 m, and 11.3% were observed flying within the rotor-swept height of 26-74 m. Avian groups which were most often observed flying within the rotor-swept height were waterbirds, waterfowl, longspurs, raptors, and corvids. No significant differences in flight height as a function of habitat or presence or absence of turbines were noted.

Raptor and large bird (RLB) surveys accounted for identification of sixty-two species; totaling 20,035 birds. RLB species richness was highest in the spring, whereas RLB abundance was highest in the fall. The most abundant RLB groups during the spring were waterfowl, waterbirds, and shorebirds. In summer, the three most abundant groups were raptors, waterbirds, and waterfowl, and in fall, the three most abundant groups were waterbirds, waterfowl and corvids.

Observations of 3,156 flying flocks comprised of 18,144 birds were made during the RLB surveys. Mean flight height was highest for waterfowl (73.4 m), followed by waterbirds (36.3 m), raptors (26.6 m), shorebirds (21.5 m) and corvids (13.5 m). Forty-five percent of flying birds were within the rotor-swept height of 19.5-52.5 m, and 36% were within the rotor-swept height of 26-74 m. Avian groups most often observed flying within the rotor-swept height during RLB surveys were shorebirds, waterbirds, raptors and waterfowl. Flight height data collected during daylight hours indicate the larger rotor-sweep height may pose less risk to some groups of birds.

Species-specific turbine exposure indices were developed for all species observed during surveys. These indices were based on mean abundance, adjusted for visibility bias, proportion of daily activity budget spent flying, and proportion of flight heights within the rotor-swept height of turbines. This analysis was based on observations of birds during the daylight period and did not consider flight behavior or abundance of nocturnal migrants. Additionally, the analysis did not account for detection and avoidance differences among species, habitat selection, turbine characteristics, or other factors that may influence exposure to turbines. Thus, actual risk may be higher or lower than predicted by these indices.

Species identified during point count survey data with the highest seasonally-dependent exposure indices were Lapland longspur, red-winged blackbird, horned lark, cliff swallow, barn swallow,

and European starling. During the RLB surveys, species with the highest seasonally-dependent exposure indices were mallard, Franklin's gull, Canada goose, and double-crested cormorant.

Point count survey data indicated that avian use was highest in woodland habitat, followed by wetland, pasture, hayfields, CRP and croplands. Relative use of woodland and wetland was significantly higher than cropland and CRP; differences in use were not significant among CRP, pasture, and hayfields.

For birds recorded during RLB surveys, highest use occurred in wetlands, followed by crop fields, pasture and CRP; however, differences in use among habitats was not significant. Stepwise linear regression was used to model effects of distance to the nearest wetland and woodland on avian use. This analysis indicated a significant relationship between avian use and distance to the nearest wetland for waterfowl, upland gamebirds, sparrows and finches. A significant relationship between avian use at the plot and distance to the nearest woodland was found for several groups, including doves, woodpeckers, swallows, blackbirds, wrens, corvids, vireos/warblers, and thrushes.

BACI analysis of both point count and RLB survey data indicated that use of the wind development areas following construction was lower than expected for several groups and species of birds. Seven of 22 species of grassland breeders showed reduced use near turbines. The area of reduced use most often occurred in close proximity (i.e., < 100 m) to turbines; however, the area of reduced use was larger for certain avian groups during some seasons. Within the entire BRWRA, reduced use by birds associated with windpower development appeared to be relatively minor and would not likely have any large-scale population consequences.

A positive effect of reduced avian use around turbines would be reduced potential for collision mortality. Lower avian use where turbines are present may be due to avoidance of turbine noise, maintenance activities, and less available habitat due to the presence of maintenance roads and cleared gravel pads surrounding turbines. Another potential factor in the lowered avian use noted at turbine plots is that turbine noise may reduce observer detection rates of birds, especially those that observers detected by sound only.

Mortality

A total of 5,322 fatality searches were conducted on study plots, 2,482 (46.6%) of which were conducted on reference plots (without turbines) to estimate reference mortality in the study area, and 2,840 (53.4%) were conducted on plots associated with operational turbines. Thirty-one avian fatalities comprised of 15 species were found on reference plots during the study period, and 55 avian fatalities comprised of at least 31 species were found associated with operational wind plant features. Avian fatalities associated with turbines were comprised of 76.4% passerines, 9.1% waterfowl, 5.5% waterbirds, 5.5% upland gamebirds, 1.8% raptors and 1.8% shorebirds.

A total of 184 bat fatalities were found in 1998 and 1999 within the Buffalo Ridge windfarm. All bat mortalities were found in association with turbines and appeared to be turbine-related. Most bats were tree bats, with hoary bat being the most common fatality.

Based on the number of turbine-related casualties (adjusted for searcher efficiency and scavenger removal rates) per search, total avian mortality in the P1 wind development area was estimated to average 72 for the 8-month field season during the study. The resulting estimated annual mean fatality rate was 0.98 birds per turbine. The P2 study area avian mortality was estimated to be 265 in 1998 and 383 in 1999, resulting in a 2-year average of 2.27 fatalities per turbine. In the P3 wind plant, total avian mortality in 1999 was estimated to be 613, or 4.45 fatalities per turbine. The mean number of avian fatalities found per study plot per year was 1.10 for all reference plots combined. In the P1 study area, the estimated mean number of bird

fatalities per turbine per year was lower than the estimated mean number of bird fatalities per reference plot per year. In the P2 study area, the estimated mean, per turbine avian fatalities were approximately 2.1 times that of the reference plot mortality, and the estimated mean number of avian fatalities per turbine per year in the P3 study area was approximately 4.0 times that of expected reference plot mortality in the study area.

Total bat mortality in the P1 study area was estimated to be 19 in 1999 (0.26/turbine). In the P2 study area, total bat mortality was estimated to be 231 in 1998 and 277 in 1999, or a 2-year average of 1.78 bats per turbine. The bat fatality estimate for the P3 wind plant in 1999 was 282 (2.04/turbine).

The occurrence of avian mortalities resulting from interaction from windfarm infrastructure appeared to be strongly related the weather conditions within the windfarm. Out of the 55 bird fatalities found associated with windfarm features during the study, 48 were estimated to have been dead for less than one week, which allowed for weather conditions at the estimated time of death to be recorded. Thirty-one of the mortalities may have occurred in association with thunderstorms, six may have occurred in association with fog, four may have occurred in association with strong, gusty winds, and four possibly occurred in association with rain. Three fatalities apparently occurred when weather conditions were not a factor. Numerous studies of windfarm/avian interactions and mortalities have identified inclement weather as contributing to avian collisions with other obstacles, including power lines, buildings, and communications towers.

The largest single avian mortality event during this study occurred when 14 fresh birds (11 warblers, two flycatchers, and one vireo) were found underneath two adjacent turbines in the P3 portion of the study area. Severe thunderstorms the previous night may have forced these birds to fly at lower than normal altitudes while migrating. The tendency of migrant birds is to fly at lower altitudes during high winds, low clouds, and rain.

Presence of FAA lighting on turbines did not appear to be highly related to mortality.

Five of the 34 windpower-related mortalities (15%) whose age could be determined were juvenile birds. Immature birds may be more susceptible to turbine collisions than adults because they may not be as experienced at flying and maneuvering to avoid objects. During studies of avian mortality at a California wind development area, juvenile birds (mostly raptors) comprised a much higher proportion of turbine fatalities than expected based on the relative abundance of juveniles. Other California studies have found no relationship between age and susceptibility to collision. Most avian fatalities on Buffalo Ridge occurred during the spring migration when passerines would be considered adults.