

***Supplemental Materials Submitted in Support of the  
Application to the North Dakota Public Service  
Commission for a Certificate of Site Compatibility to  
Construct the Bison 3 Wind Project***

***Case #PU-11-162***

***September 2011***

***By  
Minnesota Power***



A WIND ENERGY INITIATIVE OF MINNESOTA POWER IN NORTH DAKOTA

***Prepared by Barr Engineering***



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## Appendix A

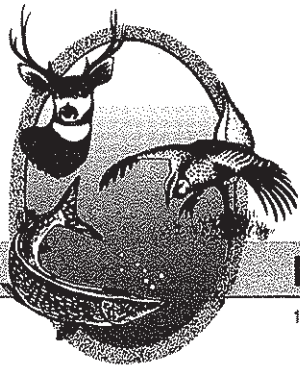
## Minnesota Power's Bison 3 Wind Energy Project

### Late-Filed Agency Correspondence and Comment Summary

Public agencies were contacted and invited to comment on the Project. A summary of comments received after the initial filing to the NDPSC in July, 2011, is below, and copies of the late-filed agency response letters are included in Appendix A.

Agency	Summary of Comments
<p>North Dakota Game and Fish Department (NDGFD)</p> <p>Letter dated July 7, 2011</p>	<p>The NDGFD's primary concern is the disturbance of native prairie by construction activities and asks that work within native prairie be avoided to the extent possible. In addition, the NDGFD indicates that wetlands exist within the proposed project area and recommends that impacts to wetlands be avoided if possible or replaced if avoidance is not possible. Finally, NDGFD recommends routine monitoring for avian and bat mortality as part of the facility maintenance plan.</p>
<p>Natural Resources Conservation Service (NRCS)</p> <p>Letter dated July 7, 2011</p>	<p>The NRCS has a responsibility under the Farmland Protection Policy Act (FPPA) to document the conversion of certain classifications of farmland to non-agricultural use for projects using federal funds. If federal funds are used for the project, a form is provided to help evaluate the classifications and conversions of farmland in the project area.</p> <p>The NRCS also recommends avoiding impacts to wetlands.</p>
<p>United States Fish and Wildlife Service (USFWS)</p> <p>Letter dated July 18, 2011</p>	<p>The USFWS provided comments in accordance with its authority under the Migratory Bird Treaty Act (MBTA); the Bald and Golden Eagle Protection Act (BGEPA); the Endangered Species Act (ESA); and the National Wildlife Refuge System Improvement Act (NWRSI).</p> <p>USFWS encourages the project to conduct a Potential Impact Index (PII) analysis to assist in the selection of wind power sites that minimizes impacts to migratory birds.</p> <p>The MBTA prohibits the taking of migratory birds, and the Office of Law Enforcement focuses its resources on investigating and prosecuting individuals and companies that take migratory birds without regard for their actions or without following USFWS recommendations to avoid takings. The USFWS strongly encourages wind developers to investigate the formulation of an Avian Protection Plan (APP) or Avian and Bat Protection Plan (ABPP).</p> <p>The USFWS recommends that overhead power lines be constructed in accordance with the "2006 Suggested Practices for Avian Protection on Power Lines." The agency also recommends construction during late summer, fall and early winter to avoid the breeding season for migratory birds.</p> <p>The USFWS recommends pre-construction wildlife surveys to quantify</p>

	<p>bird and bat use of the project area. In addition, they recommend up to three years of post-construction collision monitoring studies.</p> <p>The USFWS also has authority under the Bald and Golden Eagle Protection Act (BGEPA) and the Endangered Species Act (ESA). Species that could occur in the project area include the whooping crane (endangered), the piping plover (threatened), and the Sprague's pipit (candidate species).</p> <p>The USFWS also recommends avoiding native prairie, wetlands, and other high value wildlife habitat.</p>
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"VARIETY IN HUNTING AND FISHING"

**NORTH DAKOTA GAME AND FISH DEPARTMENT**

100 NORTH BISMARCK EXPRESSWAY BISMARCK, NORTH DAKOTA 58501-5095 PHONE 701-328-6300 FAX 701-328-6352

RECEIVED

JUL 11 2011

BARR  
ENGINEERING CO.

July 7, 2011

Daniel Flo  
Environmental Scientist  
Barr Engineering Co.  
4700 West 77<sup>th</sup> Street, Suite 200  
Minneapolis, MN 55435

Dear Mr. Flo:

RE: Minnesota Power – Bison 3 Wind Energy Project

The North Dakota Game and Fish Department has reviewed this project for wildlife concerns.

Our primary concern with wind power development is the disturbance of native prairie associated with construction of turbines, access roads, and other associated facilities. We ask that work within native prairie be avoided to the extent possible. This could include micro-siting turbines onto adjacent previously disturbed land, locating access roads on existing section line trails rather than across undisturbed native prairie, etc.

The National Wetland Inventory indicates numerous wetlands within the proposed project area. We recommend that any unavoidable wetland impacts be replaced in kind, above-ground appurtenances not be placed in wetland areas, and no alterations be made to existing drainage patterns.

We also recommend that routine monitoring for avian and bat mortality be included as part of the facility maintenance plan for the life of the project. We would appreciate being kept informed as this project progresses, and if possible, we would like the GPS coordinates for each turbine after the site has been established.

Sincerely,

Paul Schadewald  
Chief  
Conservation & Communication Division

js



Natural Resources Conservation Service  
P.O. Box 1458  
Bismarck, ND 58502-1458

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July 11, 2011

Daniel Flo  
BARR Engineering Co.  
4700 West 77<sup>th</sup> Street, Suite 200  
Minneapolis, MN 55435

RE: Minnesota Power's Bison 3 Wind Energy Project  
Morton and Oliver Counties, ND

Dear Mr. Flo:

The Natural Resources Conservation Service (NRCS) has reviewed your letter dated June 10, 2011, concerning a plan to construct a wind energy conversion facility – the Bison 3 Wind Energy Project – in Morton and Oliver Counties, North Dakota.

*Important Farmlands* - NRCS has a major responsibility with (Farmland Protection Policy Act) FPPA in documenting conversion of farmland (i.e., prime, statewide, and local importance) to non-agricultural use when the project utilizes federal funds. Your proposed project consists of activities that are subject to FPPA. New transmission towers may remove farmland from production; therefore, these sites may be subject to FPPA, and an AD-1006 must be completed. Activities that do not enact FPPA include the burying of electrical lines or activities within city limits. Below are instructions for completing the AD-1006 for those areas affected by FPPA, provided federal funds are used.

For those areas subject to FPPA, the following form must be completed. You may utilize a fillable, web based form at [http://www.nrcs.usda.gov/Programs/fppa/pdf\\_files/AD1006.PDF](http://www.nrcs.usda.gov/Programs/fppa/pdf_files/AD1006.PDF) to record the following. Please complete Part I and Part III and return to Fred Aziz, Area Resource Soil Scientist, 208 2<sup>nd</sup> Avenue SW, PO Box 2096, Jamestown, ND, 58402-2096 or call 701-252-1460 ext.115. If applicable, you may email the information to [fred.aziz@nd.usda.gov](mailto:fred.aziz@nd.usda.gov). We will also need a map of the site at an appropriate scale so we can accurately assess the area (e.g., 1:20,000 or 1:24,000). If the farmland (i.e., prime, statewide, and local importance) is determined to be subject to the FPPA, we will then complete Parts II and IV. NRCS will measure the relative value of the site as farmland on a scale of 0 to 100, according to the information sources listed in CFR, Sec. 658.5(a). If FPPA applies to this site, Form AD-1006 will be returned to your agency for completion of Part VI, Site Assessment Criteria.

Mr. Flo  
Page 2

NRCS is monitoring Farmland Conversion Impact Ratings (Form AD-1006, Form AD-106) and are concerned with how some of the forms are being completed, particularly Part IV – Site Assessment Criteria, which is being scored below 60 points. As a general rule, if FPPA applies and the site is in agricultural production, rarely will it be appropriate for it to have a score of less than 60 points. If you have questions concerning the Farmland Conversion Impact Ratings or assessment factors, please call Steve Sieler, State Soil Liaison, NRCS, Bismarck, ND, (701) 530-2019.

*Wetlands* – The Wetland Conservation Provisions of the 1985 Food Security Act, as amended, provide that if a USDA participant converts a wetland for the purpose of, or to have the effect of, making agricultural production possible, loss of USDA benefits could occur. NRCS has developed the following guidelines for the installation of buried utilities. If these guidelines are followed, the impacts to the wetland(s) will be considered minimal allowing USDA participants to continue to receive USDA benefits. Following are the requirements: 1) Disturbance to the wetland(s) must be temporary, 2) no drainage of the wetland(s) is allowed (temporary or permanent), 3) mechanized landscaping necessary for installation is kept to a minimum and preconstruction contours are maintained, 4) temporary side cast material must be placed in such a manner not to be dispersed in the wetland, and 5) all trenches must be backfilled to the original wetland bottom elevation.

NRCS would recommend that impacts to wetlands be avoided. If the alignment of the project requires passage through a wetland, NRCS can complete a certified wetland determination, if requested by the landowner/operator.

Sincerely,



JEROME SCHAAR

State Soil Scientist/MO 7 Leader

Enclosure

cc:

Fred Aziz, ARSS, NRCS, Jamestown, ND

cc: w/o encl.

Michele Doyle, DC, NRCS, Mandan, ND

David Pfliiger, DC, NRCS, Center, ND

Stuart Blotter, ASTC (FO), NRCS, Jamestown, ND



U.S. Department of Agriculture

**FARMLAND CONVERSION IMPACT RATING**

<b>PART I (To be completed by Federal Agency)</b>	Date Of Land Evaluation Request
Name Of Project	Federal Agency Involved
Proposed Land Use	County And State

<b>PART II (To be completed by SCS)</b>	Date Request Received By SCS		
Does the site contain prime, unique, statewide or local important farmland? <i>(If no, the FPPA does not apply – do not complete additional parts of this form).</i>	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Average Farm Size
Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %	Amount Of Farmland As Defined in FPPA Acres: %	
Name Of Land Evaluation System Used	Name Of Local Site Assessment System	Date Land Evaluation Returned By SCS	

<b>PART III (To be completed by Federal Agency)</b>	Alternative Site Rating			
	Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly				
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site				

<b>PART IV (To be completed by SCS) Land Evaluation Information</b>				
A. Total Acres Prime And Unique Farmland				
B. Total Acres Statewide And Local Important Farmland				
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted				
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value				

<b>PART V (To be completed by SCS) Land Evaluation Criterion</b>				
Relative Value Of Farmland To Be Converted <i>(Scale of 0 to 100 Points)</i>				

<b>PART VI (To be completed by Federal Agency)</b>	Maximum Points			
Site Assessment Criteria <i>(These criteria are explained in 7 CFR 658.5(b))</i>				
1. Area In Nonurban Use				
2. Perimeter In Nonurban Use				
3. Percent Of Site Being Farmed				
4. Protection Provided By State And Local Government				
5. Distance From Urban Builtup Area				
6. Distance To Urban Support Services				
7. Size Of Present Farm Unit Compared To Average				
8. Creation Of Nonfarmable Farmland				
9. Availability Of Farm Support Services				
10. On-Farm Investments				
11. Effects Of Conversion On Farm Support Services				
12. Compatibility With Existing Agricultural Use				
<b>TOTAL SITE ASSESSMENT POINTS</b>	<b>160</b>			

<b>PART VII (To be completed by Federal Agency)</b>				
Relative Value Of Farmland <i>(From Part V)</i>	100			
Total Site Assessment <i>(From Part VI above or a local site assessment)</i>	160			
<b>TOTAL POINTS <i>(Total of above 2 lines)</i></b>	<b>260</b>			

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes <input type="checkbox"/> No <input type="checkbox"/>
Reason For Selection:		



# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

Ecological Services  
3425 Miriam Avenue  
Bismarck, North Dakota 58501



JUL 18 2011

Mr. Daniel Flo  
Environmental Scientist  
Barr Engineering Co.  
4700 West 77<sup>th</sup> Street, Suite 200  
Minneapolis, Minnesota 55435

Re: Minnesota Power's Bison 3 Wind Energy Project

Dear Mr. Flo:

This is in response to your letter dated June 10, 2011, requesting environmental information in relation to an investigation into a potential wind energy development project in Morton and Oliver Counties, North Dakota. Minnesota Power proposes to construct and operate the 105 MW Bison 3 Wind Energy Project. You indicate your company has been retained by Minnesota Power to assist with the environmental permitting process for the project. The proposed project will interconnect with the 230kV Bison Substation and then the Square Butte Substation. The wind-generated electricity will be transmitted to Minnesota Power's transmission system via an existing 250kV DC Line and existing AC transmission system as available and is intended to be used to meet Minnesota Power's share of State of Minnesota renewable energy and Integrated Resource Plan requirements. No information was provided as to the specific type or location of wind turbines that may be constructed. Therefore, our comments are general in nature.

Minnesota Power will seek a Certificate of Site Compatibility from the North Dakota Public Service Commission (Commission) pursuant to Chapter 49-22 of the North Dakota Century Code and Article 69-06 of the North Dakota Administrative Code. Minnesota Power plans to file the Certificate application in June 2011, in order to obtain Commission approval by the fall of 2011. Minnesota Power plans to begin construction in the spring of 2012.

The location for the proposed project is approximately 7 miles northwest of New Salem, North Dakota, in the following sections:

- T. 140 N., R. 85 W., Sections 5 and 8
- T. 140 N., R. 86 W., Sections 2-5, 7-11, 15-20, and 30
- T. 140 N., R. 87 W., Sections 2-5, 9-15, 22-25, and 27
- T. 141 N., R. 85 W., Sections 29-34
- T. 141 N., R. 86 W., Sections 25, 26, 35, and 36
- T. 141 N., R. 87 W., Sections 35 and 36

We offer the following comments under the authority of and in accordance with the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703 et seq.), Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d, 54 Stat. 250), the Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.), and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

### **General Comments**

The U.S. Fish and Wildlife Service (Service) holds certain resources in trust and manages them for the benefit of the American people. These resources include migratory birds, inter-jurisdictional fish, federally-listed threatened and endangered species of plants and animals and their habitats, and units of the National Wildlife Refuge system. One goal of Service policy is that conservation of fish and wildlife resources receive equal consideration with other features of resource development, and that conservation actions are coordinated with those other forms of development. Another goal is to conserve, protect, and enhance fish and wildlife and their habitats to facilitate the balanced development of the Nation's natural resources.

Adequate consideration for avian and other wildlife resources early in the site evaluation process can help to minimize impacts and facilitate project review. Informed site selection is possibly the most important step in avoiding and minimizing impacts to wildlife. Although current wind turbine technology and proper siting can help to minimize the incidence of avian and bat deaths due to blade, aerial line, and turbine strikes, the potential for direct mortality of some migratory birds and bats will remain. Wind power developers, in concert with the Service, can help to ensure that projects proceed with as little impact to migratory birds as possible. This can be accomplished by gathering information on avian resources as they relate to project siting and by implementing measures to minimize impacts to migratory birds from the construction and operation of the wind facility. The Service's Interim Wind Turbine Siting Guidelines are enclosed to assist in project planning (enclosure 1). We encourage the project proponents to conduct a Potential Impact Index (PII) analysis on several potential sites within wind resource areas to assist in the selection of a wind power site that minimizes the potential to impact migratory birds. Please inform this office whether or not you plan to use the Service's 2003 Guidelines in selecting your site and if not, whether you intend to use a different method to assess potential impacts to avian and other wildlife resources, and if so, what that method consists of.

### **Migratory Birds**

The MBTA prohibits the taking, killing, possession, and transportation (among other actions), of migratory birds, their eggs, parts, and nests, except when specifically permitted. While the Act has no provision for allowing unintentional take, the Service realizes that some birds may be killed during wind project construction and operation, even if all known reasonable and effective measures to protect birds are used. The Service's Office of Law Enforcement (OLE) carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and agencies that have taken effective steps to avoid take of migratory birds and by encouraging others to implement measures to avoid take of

migratory birds. It is not possible to absolve individuals, companies, or agencies from liability even if they implement bird mortality avoidance or other similar protective measures. However, OLE focuses its resources on investigating and prosecuting individuals, companies, and agencies that take migratory birds without identifying and implementing all reasonable, prudent and effective measures to avoid that take. Companies are encouraged to work closely with Service biologists to identify available protective measures when developing project plans and/or avian protection plans, and to implement those measures prior to/during project construction and operation.

The Service has coordinated with the Avian Power Line Interaction Committee (APLIC) to develop guidelines to assist companies in formulating Avian Protection Plans (APP). The guidelines can be accessed from APLIC's website at <http://www.aplic.org/>. These plans are utility specific and designed to reduce operational risks that result from avian interactions with electric utility facilities, but we suggest they may be adapted to wind energy facilities. Wind energy projects have the potential to negatively affect bats, as well as avian species. Therefore, we encourage project developers to formulate an Avian and Bat Protection Plan (ABPP) if bats migrate through or may be present in the project area.

Some of the things that the Service looks for in an APP or ABPP are typically a statement of company policy confirming the company's commitment to work cooperatively towards the protection of migratory birds and bats; identification of the process under which the company will obtain and comply with all necessary permits, including, but not limited to, nest relocation, temporary possession, depredation, salvage/disposal, and scientific collection; discussion of the company's plan for monitoring and reporting all incidents of avian or bat injury or mortality; a commitment to make all reasonable efforts to construct and modify infrastructure to reduce the incidence of avian and bat mortality; a mechanism to review existing practices, ensuring quality control and allowing for adaptive management; and a plan for providing adequate training for all appropriate utility personnel. An APP or ABPP reporting system is important to help the company pinpoint areas of concern by tracking both the specific locations where mortalities may be occurring, as well as the extent of such mortalities and the remedial actions taken/planned to address identified problem areas. Following the 2003 voluntary Guidelines and involving the Service prior to selecting a project site are key components to obtaining prosecutorial discretion in the event of bird injuries and mortalities due to project construction and operation.

To minimize the electrocution hazard to birds, the Service, with support from the Rural Utilities Service, recommends that new or updated overhead power lines be constructed in accordance with the current guidelines for preventing raptor electrocutions. The recommended guidelines can be found in "2006 Suggested Practices for Avian Protection on Power Lines". To increase power line visibility and reduce bird fatalities resulting from collisions with power lines, the Service recommends all new power lines that cross or run adjacent to rivers or large wetlands be modified according to "Mitigating Bird Collisions with Power Lines: The State of the Art in 1994". Both publications can be obtained by writing or calling the Edison Electric Institute, P.O. Box 266, Waldorf, Maryland 20604-0266, (1-800-334-5453) or visiting their website at [www.eei.org](http://www.eei.org).

To the extent practicable, construction should be scheduled for late summer or fall/early winter so as not to disrupt waterfowl or other wildlife during the breeding season (February 1 to July 15). If work is proposed to take place during the breeding season or at any other time which may result in the take of migratory birds, their eggs, or active nests, the Service recommends that the project proponent take all practicable measures to avoid and minimize take, such as maintaining adequate buffers to protect the birds until the young have fledged. The Service further recommends that if field surveys for nesting birds are contemplated, that survey plans be shared with and coordinated with this office, and that if surveys are conducted with the intent of avoiding take, that any documentation of the presence of migratory birds, eggs, and active nests, along with information regarding the qualifications of the biologist(s) performing the surveys and any avoidance measures implemented at the project site be maintained. Should surveys or other available information indicate a significant impact to migratory birds, the Service requests that this office be contacted for further consultation on the extent of the impact and the long-term implications of the intended use of the project on migratory bird populations.

### **Bald and Golden Eagles**

The BGEPA prohibits anyone without a permit issued by the Secretary of the Interior from taking bald or golden eagles, including their parts, nests, or eggs. The Act provides criminal and civil penalties for persons who take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle or any golden eagle, alive or dead, or any part, nest, or egg thereof. The Act defines take as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available; 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously-used nest site during a time when eagles are not present; if, upon the eagles return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause a loss of productivity or nest abandonment. A permit is required for any take of bald or golden eagles or their nests. Permits to take eagles or their nests are available only for legitimate emergencies or as part of a program to protect eagles.

### **Threatened, Endangered, and Candidate Species**

A list of federally threatened and endangered species, and candidate species that may occur within the proposed project's potential area of influence is enclosed, i.e. a list of threatened, endangered, and candidate species for Morton and Oliver Counties (enclosure 2). This list fulfills requirements of the Service under the ESA.

Section 10(a)(1)(B) of the ESA allows non-Federal parties planning activities that have no Federal nexus, but which could result in the incidental taking of listed animals, to apply for an incidental

take permit. (A Federal nexus exists whenever an activity is conducted, funded, or licensed or permitted by a Federal agency). The application must include a habitat conservation plan (HCP) laying out the proposed actions, determining the effects of those actions on federally-listed plant and wildlife species and their habitats (and may include proposed or candidate species), and defining measures to minimize and mitigate adverse effects.

If a Federal agency authorizes, funds, or carries out a proposed action, the responsible Federal agency, or its delegated agent, is required to evaluate whether the action "may affect" listed species or critical habitat. If the Federal agency or its designated agent determines the action "may affect, is likely to adversely affect" listed species or result in destruction or adverse modification of critical habitat, the responsible Federal agency shall request formal section 7 consultation with this office. If the evaluation shows a "no effect" determination for listed species or critical habitat, further consultation is not necessary. If a private entity receives Federal funding for a construction project or if any Federal permit or license is required, the Federal agency may designate the fund recipient or permittee as its agent for purposes of informal section 7 consultation. The funding, permitting, or licensing Federal agency is responsible to ensure that its actions comply with the ESA, including obtaining concurrence from the Service for any action that may affect a threatened or endangered species or designated critical habitat.

The Aransas Wood Buffalo Population (AWBP) of whooping cranes is the only self sustaining migratory population of whooping cranes remaining in the wild. These birds breed in the wetlands of Wood Buffalo National Park in Alberta and the Northwest Territories of northern Canada, and overwinter on the Texas coast. Whooping cranes in the AWBP annually migrate through North Dakota during their spring and fall migrations.

Endangered whooping cranes have been documented using stopover habitat throughout North Dakota. The proposed project site is located within the whooping crane migration corridor that includes 95% of all confirmed whooping crane sightings in North Dakota (enclosure 3). Wind energy projects in this wind resource area have the potential to affect whooping cranes during their annual spring and fall migrations. Potential effects may be direct (e.g. collision mortality) or indirect (e.g. avoidance of the site resulting in cranes seeking alternate habitat). The best available information indicates that whooping cranes avoid stopover habitat that is developed with wind energy appurtenances, particularly wind turbines. This avoidance may deny them the use of important habitat, and thus may result in an adverse effect in the form of harm by significant habitat modification. Whooping cranes use migration stopover habitat opportunistically and may not use the same stopovers annually. Whooping cranes often stop wherever they happen to be late in the day when they find conditions no longer suitable for migration. This tendency can make for a very unpredictable pattern of stopover use, depending on daily weather conditions. The loss of such habitat due to the presence of wind turbines is a substantial indirect impact that is anticipated to increase with the growth in wind energy development in the whooping crane migration corridor.

The interactions of whooping cranes with wind turbines and wind facilities are currently not fully known, although it is expected that these large birds with relatively low maneuverability are

susceptible to mortality via collisions with turbines. Other species of large birds such as raptors, white pelicans, and sandhill cranes have been documented colliding with wind turbine blades. Direct mortality or injury of whooping cranes may occur as they encounter turbines in bad weather or low-light conditions at the beginning or end of migration flights, or when flying between roosts and foraging areas at stopover sites. The highest known source of direct mortality to fledged whooping cranes is from striking power lines. Currently, collisions with power lines have accounted for the death or serious injury of at least 46 whooping cranes since 1956.

Minnesota Power is currently participating in the Great Plains Wind Energy (GPWE) Programmatic Habitat Conservation Plan (HCP). The preliminary proposed plan area for that HCP includes the potential project site described above. Given that project-specific HCPs are costly and time-consuming both for the project proponent and the Service, if Minnesota Power believes that incidental take of any federally-listed species, including the whooping crane, piping plover, or interior least tern is likely to occur, we suggest that Minnesota Power seek coverage (i.e. incidental take permit) under the GPWE HCP.

### **Fish and Wildlife Service Property Interests**

The Service administers Waterfowl Production Areas owned in fee title, as well as wetland and grassland easements throughout North Dakota. A review of Service realty records for the proposed project area indicates no Service property interests are located in the proposed project area.

### **High Value Habitat Avoidance**

High value wildlife habitat types in North Dakota include native prairie, wetlands, wooded draws and riparian forests. We recommend that construction of wind towers and appurtenant facilities in these habitat types be avoided whenever possible.

Our review of NWI maps indicates that wetland areas are located within the project area. NWI data can be accessed directly by visiting their website at ([wetlands.fws.gov](http://wetlands.fws.gov)). Section 404 of the Clean Water Act regulates placement of fill materials in certain wetlands. A Corps of Engineers' 404 permit may be required if fill material will be placed in aquatic sites including wetlands. The project proponent should contact Mr. Dan Cimarosti, Regulatory Office, Corps of Engineers, 1513 South 12th Street, Bismarck, North Dakota 58504 (701-255-0015), to determine their permit requirements. If a 404 permit is required, the Service will also provide recommendations on this project to the Corps.

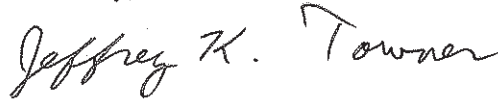
### **Research, Monitoring, and Assessment**

We recommend project proponents, in coordination with the Service, implement pre-construction wildlife surveys to quantify bird and bat use of the project area. Up to 3 years of post-construction collision monitoring studies are recommended (based on the level of risk identified during pre-construction surveys) to determine the effect of several factors, such as site

selection, turbine designs, the layout of wind plants, wind plant operations, habitat alteration, and changes in available perching and nesting sites, on bird and bat deaths. Annual reports outlining the results of these monitoring studies should be submitted to this office. The Avian Subcommittee of the National Wind Coordinating Committee (NWCC) has developed a guidance document to assist wind energy developers in designing studies that will produce credible and comparable results of avian interaction with wind power plants. The NWCC document, "Studying Wind Energy/Bird Interactions: A Guidance Document. Metrics and methods for determining or monitoring potential impacts on birds at existing and proposed wind energy sites," can be obtained by contacting the National Wind Coordination Committee, c/o RESOLVE, 1255 23<sup>rd</sup> Street, Suite 275, Washington, D.C. 20037, or by visiting their website at ([www.nationalwind.org](http://www.nationalwind.org)).

If you have any questions, please contact Terry Ellsworth of my staff or myself at (701) 250-4481, or at the letterhead address.

Sincerely,



Jeffrey K. Towner  
Field Supervisor  
North Dakota Field Office

Enclosures (3)

cc: N. Dakota Public Service Commission  
North Dakota Game and Fish Department (Attn: John Schumacher)



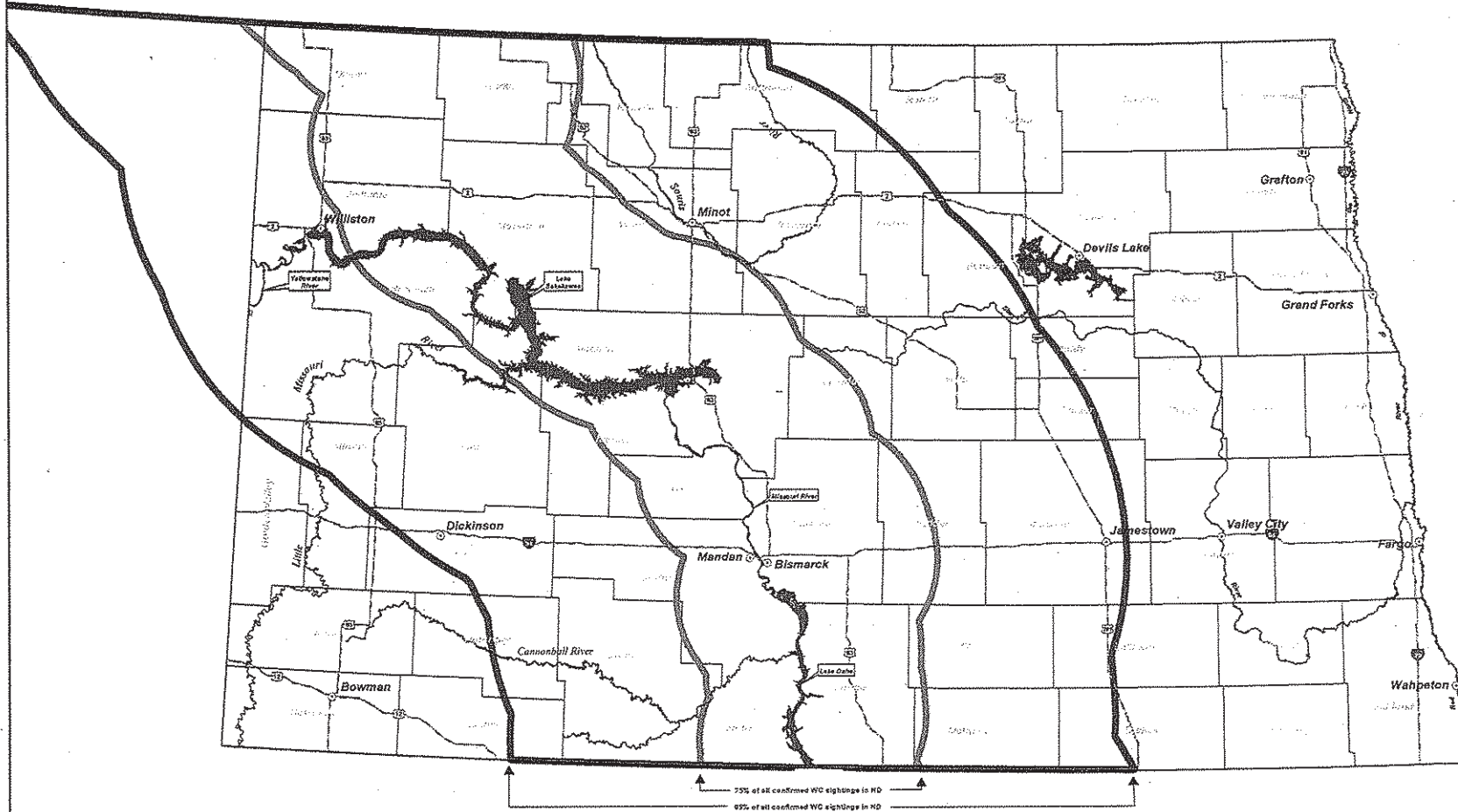
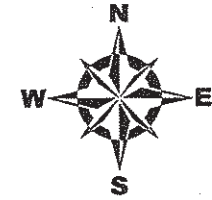
**U. S. Fish and Wildlife Service Interim Guidelines For  
Communications Tower Siting, Construction, Operation, and Decommissioning**

1. We strongly encourage any company/applicant/licensee proposing to construct a new communications tower 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, we strongly encourage communications service providers 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., 128pp.* Copies can be obtained via the Internet at <http://www.eei.org/resources/pubcat/enviro/>, or by calling 1-800-334-5433).

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 is 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 are 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, and 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.



# North Dakota Whooping Crane Migration Corridor



**DISCLAIMER:**

The USFWS makes no claim as to the accuracy or completeness of the displayed information. Species occurrence and habitat information is provided for illustrative purposes only. Federal action agencies and project proponents should contact the USFWS North Dakota Field Office for more detailed species information and technical assistance in evaluating potential project impacts to fish and wildlife resources.

Map produced 04/21/2010 by USFWS Ecological Services, Bismarck, ND.

-  75% Whooping Crane Migration Corridor
-  95% Whooping Crane Migration Corridor



FEDERAL THREATENED, ENDANGERED, AND CANDIDATE SPECIES  
AND DESIGNATED CRITICAL HABITAT FOUND IN  
MORTON AND OLIVER COUNTIES, NORTH DAKOTA

**ENDANGERED SPECIES**

Birds

Interior least tern (*Sterna antillarum*): Nests along midstream sandbars of the Missouri and Yellowstone Rivers.

Whooping crane (*Grus Americana*): Aransas-Wood Buffalo Population (264 birds) occurs in North Dakota counties during spring and fall migration between breeding and wintering areas. Whooping cranes prefer to roost overnight in shallow open water wetland habitat with good visibility during migration stopovers.

Fish

Pallid sturgeon (*Scaphirhynchus albus*): Known only from the Missouri and Yellowstone Rivers. No reproduction has been documented in 15 years.

Mammals

Black-footed ferret (*Mustela nigripes*): Exclusively associated with prairie dog towns. No records of occurrence in recent years, although there is potential for reintroduction in the future.

Gray wolf (*Canis lupus*): Occasional visitor in North Dakota. Most frequently observed in the Turtle Mountains area.

**THREATENED SPECIES**

Birds

Piping plover (*Charadrius melodus*): Nests on midstream sandbars of the Missouri and Yellowstone Rivers and along shorelines of saline wetlands. More nest in North Dakota than any other state.

## CANDIDATE SPECIES

### Birds

Sprague's Pipit (Anthus spragueii): Nests in native and planted grassland. Prefers patches of grassland at least 72 acres (29 hectares).

### Invertebrates

Dakota skipper (Hesperia dacotae): Found in native prairie containing a high diversity of wildflowers and grasses. Habitat includes two prairie types: 1) low (wet) prairie dominated by bluestem grasses, wood lily, harebell, and smooth camas; 2) upland (dry) prairie on ridges and hillsides dominated by bluestem grasses, needlegrass, pale purple and upright coneflowers and blanketflower.

## DESIGNATED CRITICAL HABITAT

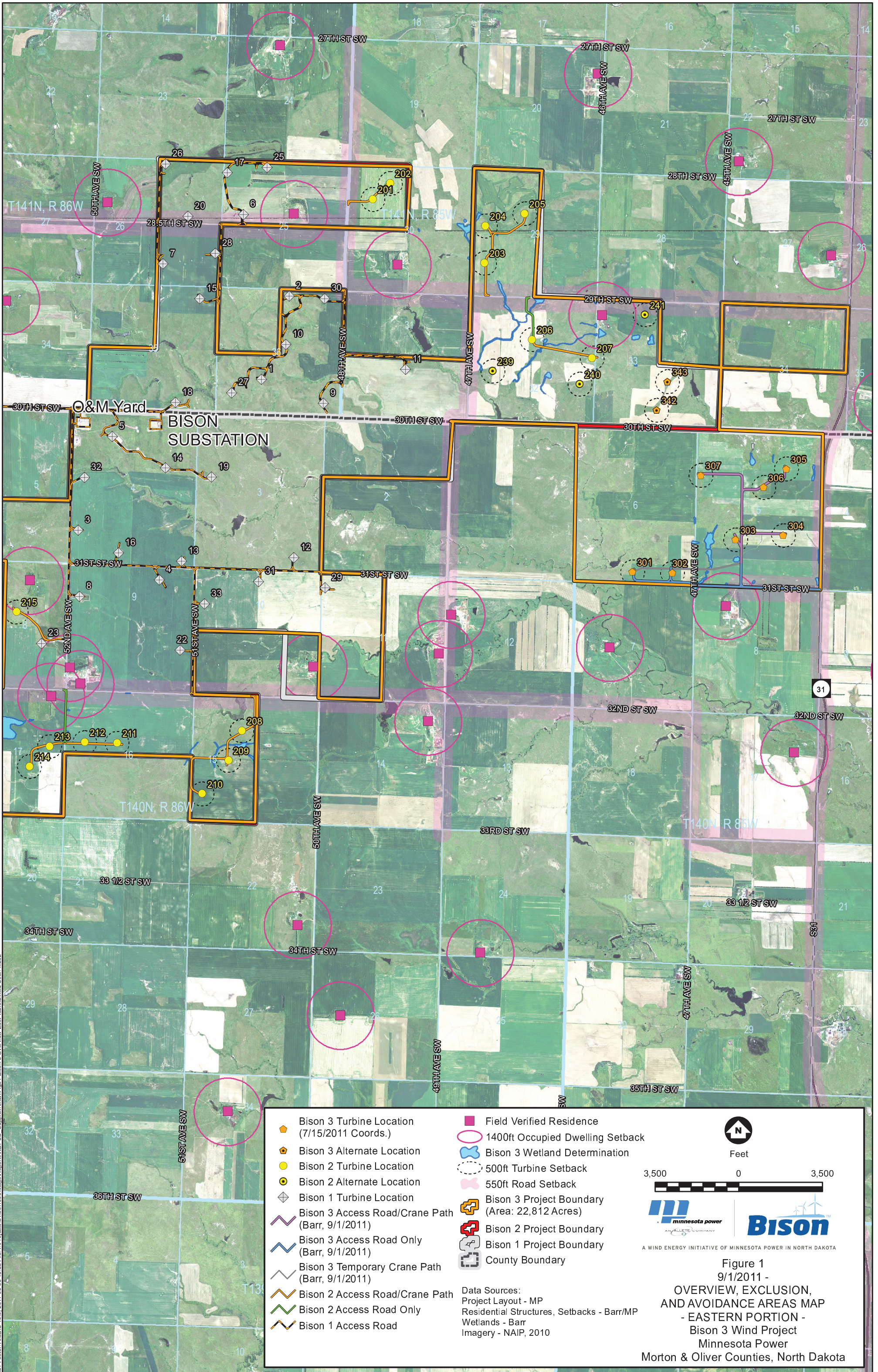
### Birds

Piping Plover - Alkali Lakes and Wetlands - Critical habitat includes: (1) shallow, seasonally to permanently flooded, mixosaline to hypersaline wetlands with sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats; (2) springs and fens along edges of alkali lakes and wetlands; and (3) adjacent uplands 200 feet (61 meters) above the high water mark of the alkali lake or wetland.

Piping Plover - Missouri River - Critical habitat includes sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.

Piping Plover - Lake Sakakawea and Oahe - Critical habitat includes sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies.

## Appendix B



- Bison 3 Turbine Location (7/15/2011 Coords.)
- Bison 3 Alternate Location
- Bison 2 Turbine Location
- Bison 2 Alternate Location
- Bison 1 Turbine Location
- Bison 3 Access Road/Crane Path (Barr, 9/1/2011)
- Bison 3 Access Road Only (Barr, 9/1/2011)
- Bison 3 Temporary Crane Path (Barr, 9/1/2011)
- Bison 2 Access Road/Crane Path
- Bison 2 Access Road Only
- Bison 1 Access Road

- Field Verified Residence
- 1400ft Occupied Dwelling Setback
- Bison 3 Wetland Determination
- 500ft Turbine Setback
- 550ft Road Setback
- Bison 3 Project Boundary (Area: 22,812 Acres)
- Bison 2 Project Boundary
- Bison 1 Project Boundary
- County Boundary

Data Sources:  
 Project Layout - MP  
 Residential Structures, Setbacks - Barr/MP  
 Wetlands - Barr  
 Imagery - NAIP, 2010

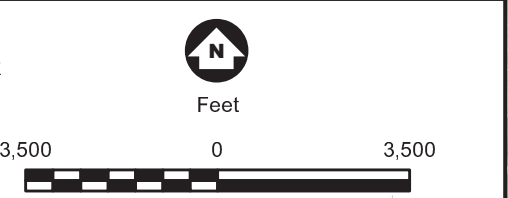
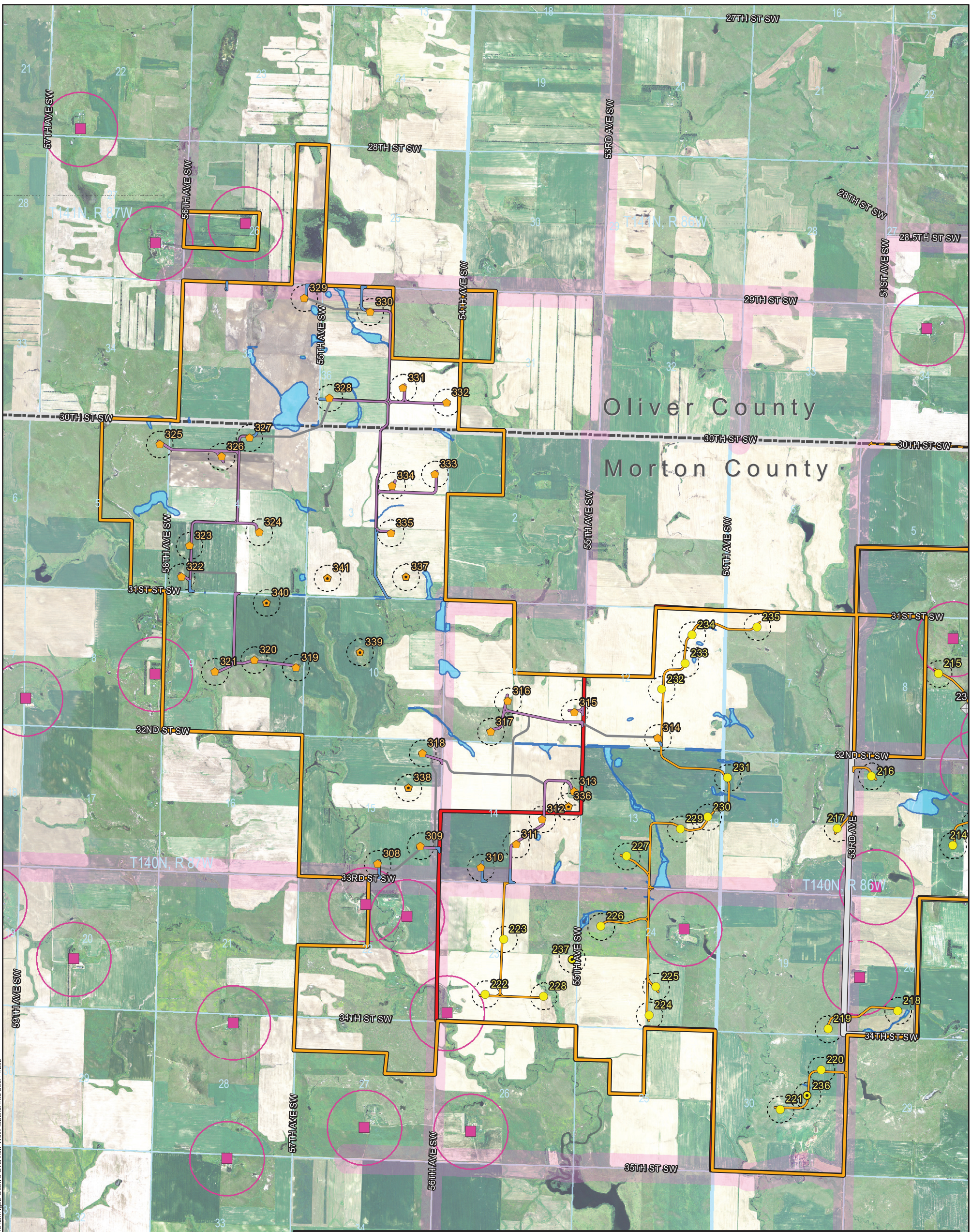


Figure 1  
 9/1/2011 -  
 OVERVIEW, EXCLUSION,  
 AND AVOIDANCE AREAS MAP  
 - EASTERN PORTION -  
 Bison 3 Wind Project  
 Minnesota Power  
 Morton & Oliver Counties, North Dakota



<ul style="list-style-type: none"> <li> Bison 3 Turbine Location (7/15/2011 Coords.)</li> <li> Bison 3 Alternate Location</li> <li> Bison 2 Turbine Location</li> <li> Bison 2 Alternate Location</li> <li> Bison 1 Turbine Location</li> <li> Bison 3 Access Road/Crane Path (Barr, 9/1/2011)</li> <li> Bison 3 Access Road Only (Barr, 9/1/2011)</li> <li> Bison 3 Temporary Crane Path (Barr, 9/1/2011)</li> <li> Bison 2 Access Road/Crane Path</li> <li> Bison 2 Access Road Only</li> <li> Bison 1 Access Road</li> </ul>	<ul style="list-style-type: none"> <li> Field Verified Residence</li> <li> 1400ft Occupied Dwelling Setback</li> <li> Bison 3 Wetland Determination</li> <li> 500ft Turbine Setback</li> <li> 550ft Road Setback</li> <li> Bison 3 Project Boundary (Area: 22,812 Acres)</li> <li> Bison 2 Project Boundary</li> <li> Bison 1 Project Boundary</li> <li> County Boundary</li> </ul>	<p style="text-align: center;">             Feet            3,500      0      3,500         </p> <p style="text-align: center;">   <b>minnesota power</b>  <small>AN ALLETE COMPANY</small> </p> <p style="text-align: center;">   <b>BISON</b>  <small>A WIND ENERGY INITIATIVE OF MINNESOTA POWER IN NORTH DAKOTA</small> </p>
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Data Sources:  
 Project Layout - MP  
 Residential Structures, Setbacks - Barr/MP  
 Wetlands - Barr  
 Imagery - NAIP, 2010

**Figure 2**  
 9/1/2011 -  
**OVERVIEW, EXCLUSION,  
 AND AVOIDANCE AREAS MAP**  
 - WESTERN PORTION -  
 Bison 3 Wind Project  
 Minnesota Power  
 Morton & Oliver Counties, North Dakota

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## Appendix C

## Technical Memorandum

**To:** Jim Atkinson, Minnesota Power  
**From:** Cheryl Feigum, Mike Strong  
**Subject:** Wetland Determination Methods for the Bison 3 Wind Energy Project  
**Date:** September 6, 2011  
**Project:** 34301006.00  
**c:** Dan Flo, John Wachtler

The purpose of this memorandum is to identify jurisdictional wetlands that will be impacted by the Minnesota Power (MP) Bison 3 Wind Energy Project (Bison 2) (Figure 1). The U.S. Army Corps of Engineers (Corps) regulates the placement of dredge or fill material into wetlands that are hydraulically connected or adjacent to a navigable water or interstate water under the authority of Section 404 of the Clean Water Act. Wetlands were evaluated for the jurisdiction determination using both off-site and on-site review methods.

### Conclusions:

Our wetland review evaluated the potential impacts of the proposed and alternate locations for the wind turbines, combined permanent crane paths/access roads, permanent access roads and temporary crane paths (Figure 2). Based on the project design (on September 1, 2011), there will be six crossings where wetlands will be permanently impacted by combined permanent crane paths/ access roads; however, two of the six crossings are isolated, non-jurisdictional wetlands. Two additional wetlands will be crossed by temporary crane paths and will result in no permanent wetland impacts. The permanent wetland impacts are less than 4,281 square feet per jurisdictional wetland crossing.

### Wetland Review:

Wetlands were identified within the proposed project area using a two-phased approach. The first phase was an off-site review of wetland areas using public and private geographic digital datasets. The second phase involved the on-site review of wetlands and subsequent revisions of the wetland boundaries.

### **Phase I: Off-site Determination Methods**

For the off-site wetland determinations, wetland boundaries were estimated and mapped using ArcView 9.3<sup>©</sup> and 10.0<sup>©</sup> Geographic Information System (GIS) software to display environmental data (soils, hydrography, topography) for the study area. The following datasets were obtained and reviewed for the Bison 3 project area; each dataset was examined at its maximum resolution.

- U.S. Geological Survey (USGS) 7.5-minute (1:24,000 scale) quadrangle map
- USGS 7.5-minute (1:100,000 scale) quadrangle map
- U.S. Department of Agriculture (USDA) - Farm Services Administration (FSA) true color aerial photographs 2010, 2006, 2005, 2004, 2003, 1995-1998 Statewide
- USDA-FSA true color aerial photographs (1:3600) from 2003, 2005, 2009, 2010 for Morton and Oliver counties
- USDA-FSA color infrared (CIR) aerial photographs 2009 and 2010 Statewide
- LiDAR aerial true color imagery provided by MP
- LiDAR topography data (two-foot contour intervals) partial coverage of the project area provided by MP
- Five-foot topography data (5-ft contour intervals) provided by MP
- United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) Data
- Natural Resources Conservation Service (NRCS) SSURGO Soil Survey Data for Morton and Oliver counties including attributes for the hydric soil map units
- USGS Linear Hydrologic Features (1:100,000) compilation of perennial/intermittent flow types for rivers, streams, ditches, etc.
- USGS Aerial Hydrologic Features (1:100,000) compilation of major rivers, lakes, ponds, etc.
- USGS Gap Analysis Program (GAP) data 2004
- USGS National Land Cover Dataset (NLCD) 2001

Using the GIS data described above, the 22,812-acre project area was evaluated for wetlands, typically at a scale of 1:2000. All areas within the Bison 3 boundary were reviewed; however, the following areas were given higher priority during the off-site review:

- Areas previously mapped as NWI wetlands (Figure 3)
- Areas exhibiting a signature for inundation or surface saturation
- Low-lying areas adjacent to fluvial features, such as rivers, ditches, and perennial streams
- Depressional areas with concave slopes, either linear or fully enclosed features (potholes, swales, etc.)
- Areas upstream and downstream of stock ponds
- Areas where the topographic contours indicated minimal slopes (contour lines are widely spaced) or a flow line

The public datasets (mapped at a smaller scale), such as the GAP and NLCD data, were useful for identifying large or open-water wetlands, but were not sufficient for many of the smaller, less obvious wetland areas. The most useful datasets were the high-resolution topography (two-foot contour lines) and aerial imagery data created using the lidar information. However, the high-resolution topography data were not available for all areas of the Bison 3 project area. For those areas, the five-foot contours were used. Using GIS, wetland polygons were created for use in the on-site field review within the Bison 3 project boundary.

#### **Phase II: On-site Determination Methods**

Field review was completed during on-site visits May 4-5 and May 17-18, and June 22, 2011. The purpose of the site visits was to evaluate the potential locations for the turbine sites, access roads and crane paths for wetlands. Alternative locations were also reviewed in order to avoid wetland impacts. Field maps were prepared at a scale of 1:12,000 and included the following layers: wetlands identified from the off-site review, two-foot or five-foot contour intervals, linear flow lines and hydric soil map units. The week before the first May site visit, there was a blizzard that deposited significant snow. During the field visit, most of the snow had melted, but standing water remained on the landscape. The day before the June site visit, there was a 2- to 3-inch rainfall event, so there was a lot of water left on the landscape again. As a result of the snowmelt and rainfall, the wetland boundaries for the project are

conservative. Based on the field review, the impacts to wetlands were avoided and minimized to the extent feasible.

During the field review, approximately 7,523 acres were evaluated (the “wetland survey extents area”) for wetlands within the 22,812-acre project area. The jurisdictional status of the wetlands was reviewed in the field as well. Originally, the NWI identified 15 acres of wetland within the wetland survey extents area. After completion of fieldwork, the wetland boundaries were adjusted using GIS, resulting in approximately 217 acres of wetland identified within the wetland survey extents area (Figure 4). The delineated wetlands were classified using the U.S. Fish and Wildlife Service Circular 39 Classification System (Types 1, 2, 3, etc.; Shaw and Fredine, 1956) and the U.S. Fish and Wildlife Service Cowardin System (PEMB, PSSC, PFOB, etc.; Cowardin et. al., 1979).

**Wetland Summary**

There were 7,523 acres evaluated within the wetland survey extents area for Bison 3. Of these, approximately 217 acres were identified as wetland (Figure 4) and are classified as temporarily flooded basins (Type 1; PFOA), saturated wet meadows (Type 2; PEMB), seasonally flooded shallow marshes (Type 3; PEMC), semipermanently flooded deep marshes (Type 4; PEMF) and deep-water wetlands (Type 5; PUBG/H).

**Table 1. Wetland summary for the wetland survey extents area**

Wetland Type	Number of Wetlands	Number of Ponds	Number of Basins	Number of Marshes	Number of Deep Water Wetlands
Temporarily flooded basins (Type 1; PFOA)	1	0	0	0	0
Saturated wet meadows (Type 2; PEMB)	1	0	0	0	0
Seasonally flooded shallow marshes (Type 3; PEMC)	1	0	0	0	0
Semipermanently flooded deep marshes (Type 4; PEMF)	1	0	0	0	0
Deep-water wetlands (Type 5; PUBG/H)	1	0	0	0	0
<b>Total</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Wet meadows (69 percent) and temporarily flooded basins (25 percent) were the dominant wetland types present in the survey extents area. Other wetland types included shallow marsh, deep marsh, and deep water. Representative photographs of wetland types are shown in Appendix A.

There were no wetlands identified within the proposed or alternate wind turbine locations (Figures 5). Based on the project design (on September 1, 2011), there will be six crossings where wetlands will be permanently impacted by combined permanent crane paths/access roads; however, two of the six crossings are isolated, non-jurisdictional wetlands. Two additional wetlands will be crossed by temporary crane paths and will result in no permanent wetland impacts.

The road surface width will be 37 feet for the combined permanent crane paths/access roads and temporary crane paths. The road surface will be 20 feet wide for the permanent access roads. Construction of these roads requires shoulders and tie-in fill so the total width of the roads will range from approximately 45 to 55 feet. Table 2 identifies the wetland crossings and the wetland impact per crossing (in square feet).

**Table 2. Summary of wetland crossings**

Location	Wetland Type	Wetland Area (sq ft)	Impact Area (sq ft)	Impact Type	Impact Area (sq ft)	Impact Type
1. Crane Path 1	Wetland Type 1	1,200	1,200	Permanent	1,200	Permanent
2. Crane Path 2	Wetland Type 2	3,500	3,500	Permanent	3,500	Permanent
3. Crane Path 3	Wetland Type 1	1,200	1,200	Permanent	1,200	Permanent
4. Crane Path 4	Wetland Type 1	1,200	1,200	Permanent	1,200	Permanent
5. Crane Path 5	Wetland Type 1	1,200	1,200	Permanent	1,200	Permanent
6. Crane Path 6	Wetland Type 1	1,200	1,200	Permanent	1,200	Permanent
7. Crane Path 7	Wetland Type 1	1,200	1,200	Temporary	0	None
8. Crane Path 8	Wetland Type 1	1,200	1,200	Temporary	0	None

Wetland types that will be impacted include temporarily flooded basins (Type 1; PFOA) and saturated wet meadows (Type 2; PEMB). Two crane paths will have temporary impacts during construction; however, there will be no permanent wetland impacts at these crossings. There were six wetland crossings that will permanently impact less than 4,281 square feet of jurisdictional wetland per crossing.

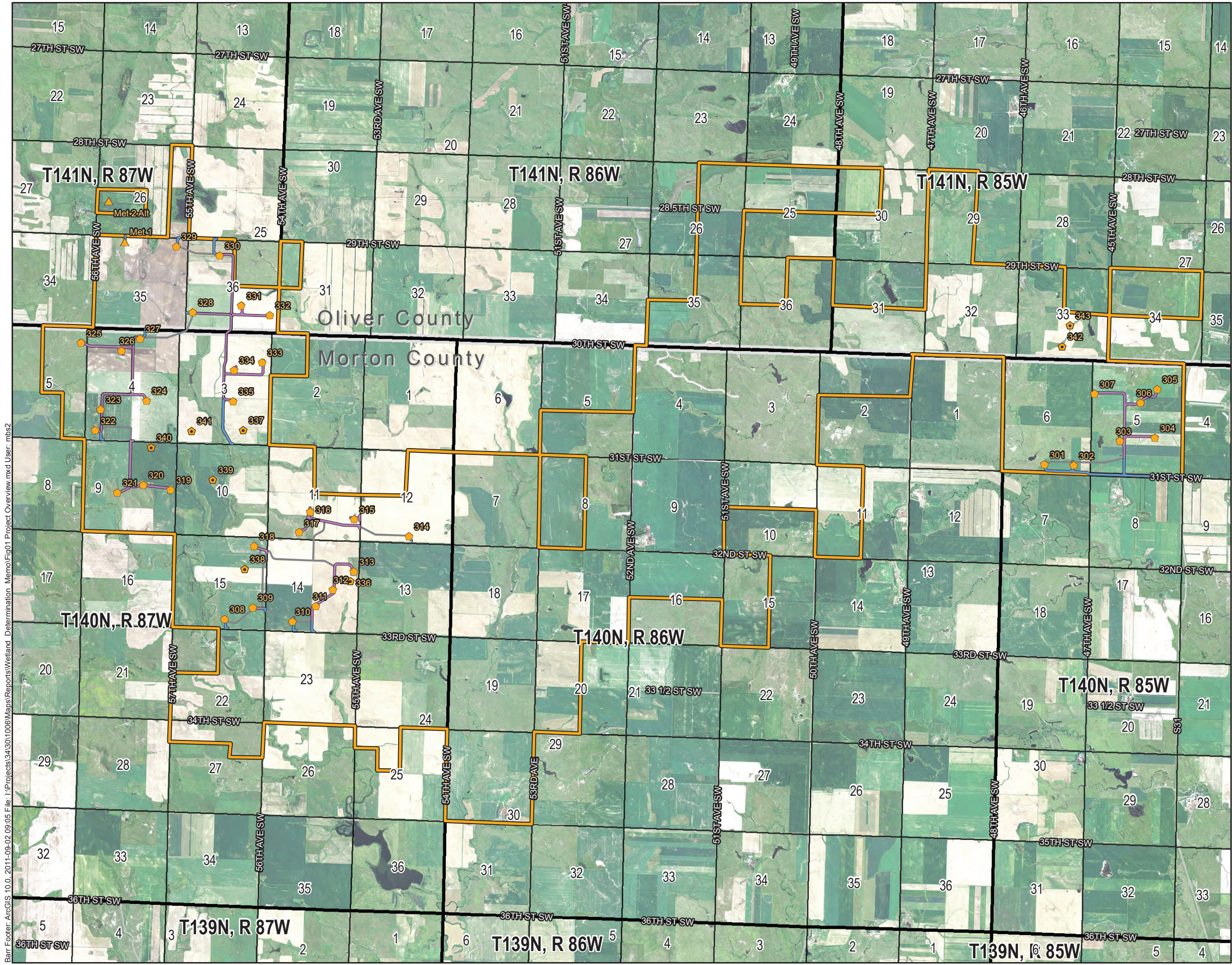
**To:** Jim Atkinson, Minnesota Power  
**Date:** September 6, 2011  
**Page:** 6 of 5












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## References

Cowardin, L.M., V. Carter, F.C. Golet, R.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Fish and Wildlife Service, FWS/OBS079/31, 103 pp.

U.S. Fish and Wildlife Service. 1956. *Wetlands of the United States Circular 39*. U.S. Government Printing Office, Washington, D.C.



-  Bison 3 Turbine Location (7/15/2011 Coords.)
-  Bison 3 Alternate Location
-  Bison 3 Met Tower Location
-  Bison 3 Access Road/Crane Path (Barr, 9/1/2011)
-  Bison 3 Access Road Only (Barr, 9/1/2011)
-  Bison 3 Temporary Crane Path (Barr, 9/1/2011)
-  Local Road
-  Public Land Survey Township
-  Public Land Survey Section
-  Bison 3 Project Boundary
-  County Boundary

Imagery Source: NAIP, 2010

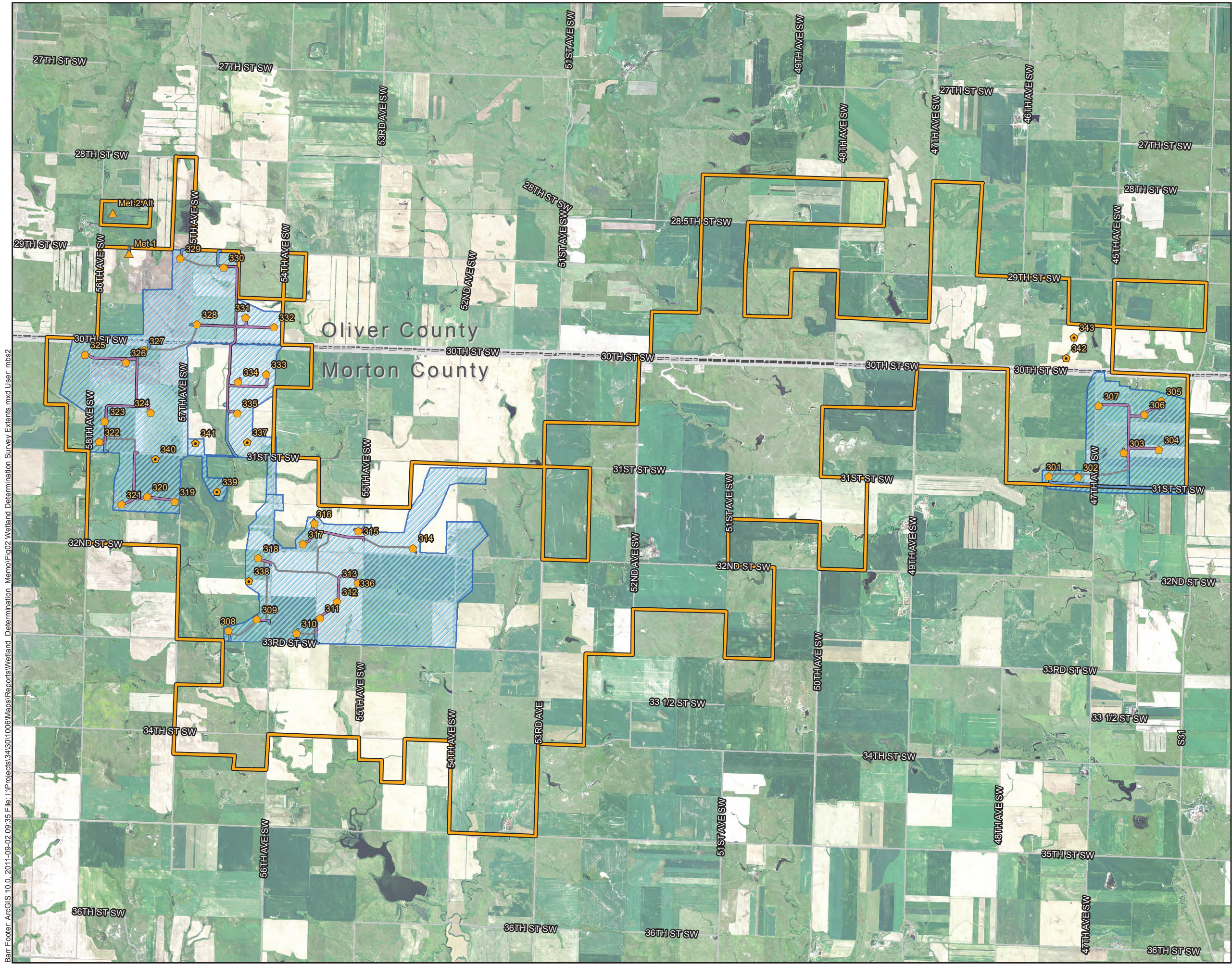











Figure 1

PROJECT OVERVIEW  
 Wetland Determination Methods  
 Bison 3 Wind Project  
 MN Power  
 Morton & Oliver Counties, ND

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-  Bison 3 Turbine Location (7/15/2011 Coords.)
-  Bison 3 Alternate Location
-  Bison 3 Met Tower Location
-  Bison 3 Access Road/Crane Path (Barr, 9/1/2011)
-  Bison 3 Access Road Only (Barr, 9/1/2011)
-  Bison 3 Temporary Crane Path (Barr, 9/1/2011)
-  Local Road
-  Wetland Survey Extents
-  County Boundary

Imagery Source: NAIP, 2010

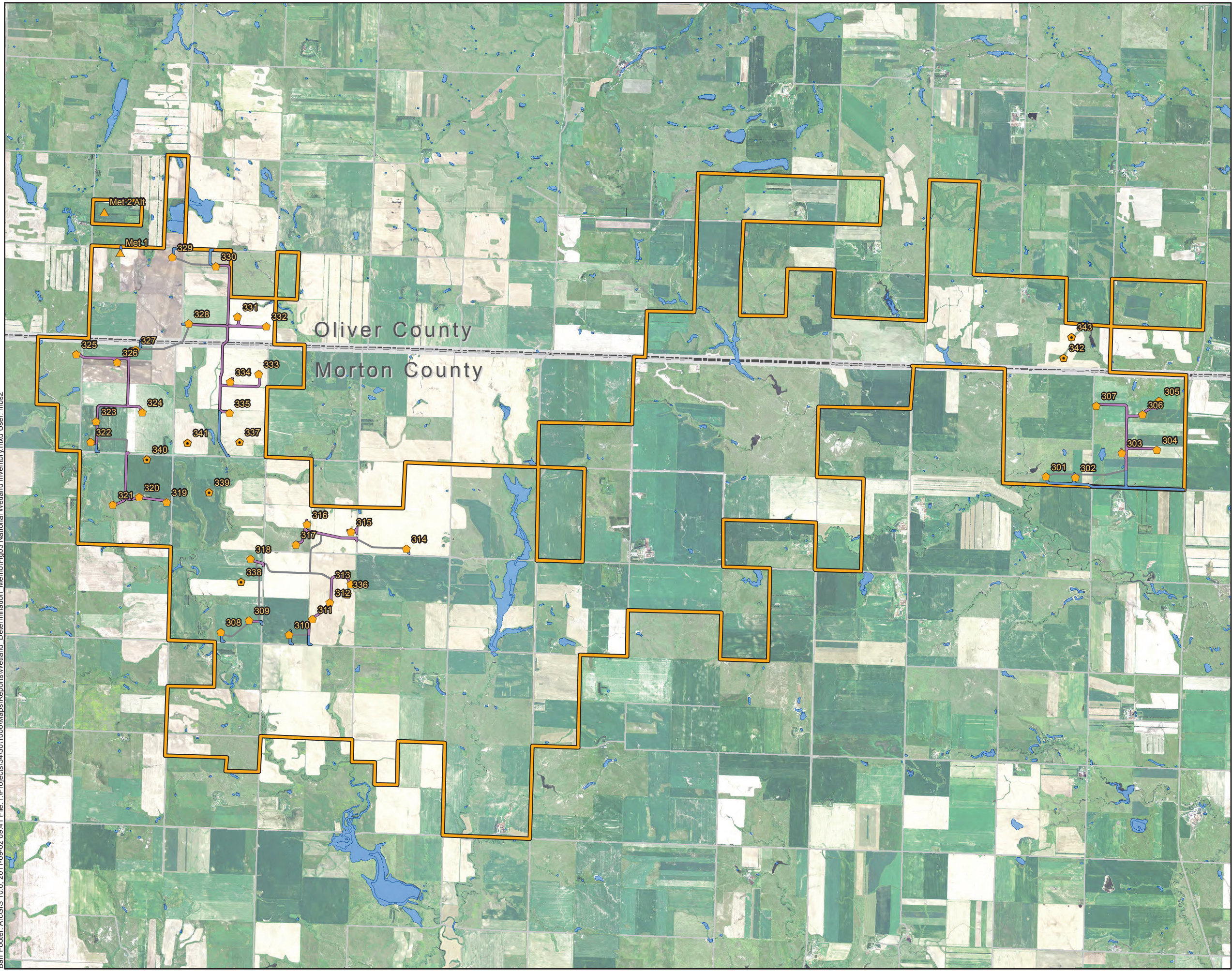












Figure 2

WETLAND DETERMINATION SURVEY EXTENTS  
 Wetland Determination Methods  
 Bison 3 Wind Project  
 MN Power  
 Morton & Oliver Counties, ND

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Barr Footer: ArcGIS 10.0\_2011-09-02 09:41 File: I:\Projects\34301006\Maps\Reports\Wetland\_Determination\_Memo\Fig03 National Wetland Inventory.mxd User: mbs2



-  Bison 3 Turbine Location (7/15/2011 Coords.)
-  Bison 3 Alternate Location
-  Bison 3 Met Tower Location
-  Bison 3 Access Road/Crane Path (Barr, 9/1/2011)
-  Bison 3 Access Road Only (Barr, 9/1/2011)
-  Bison 3 Temporary Crane Path (Barr, 9/1/2011)
-  Local Road
-  National Wetland Inventory
-  Bison 3 Project Boundary
-  County Boundary

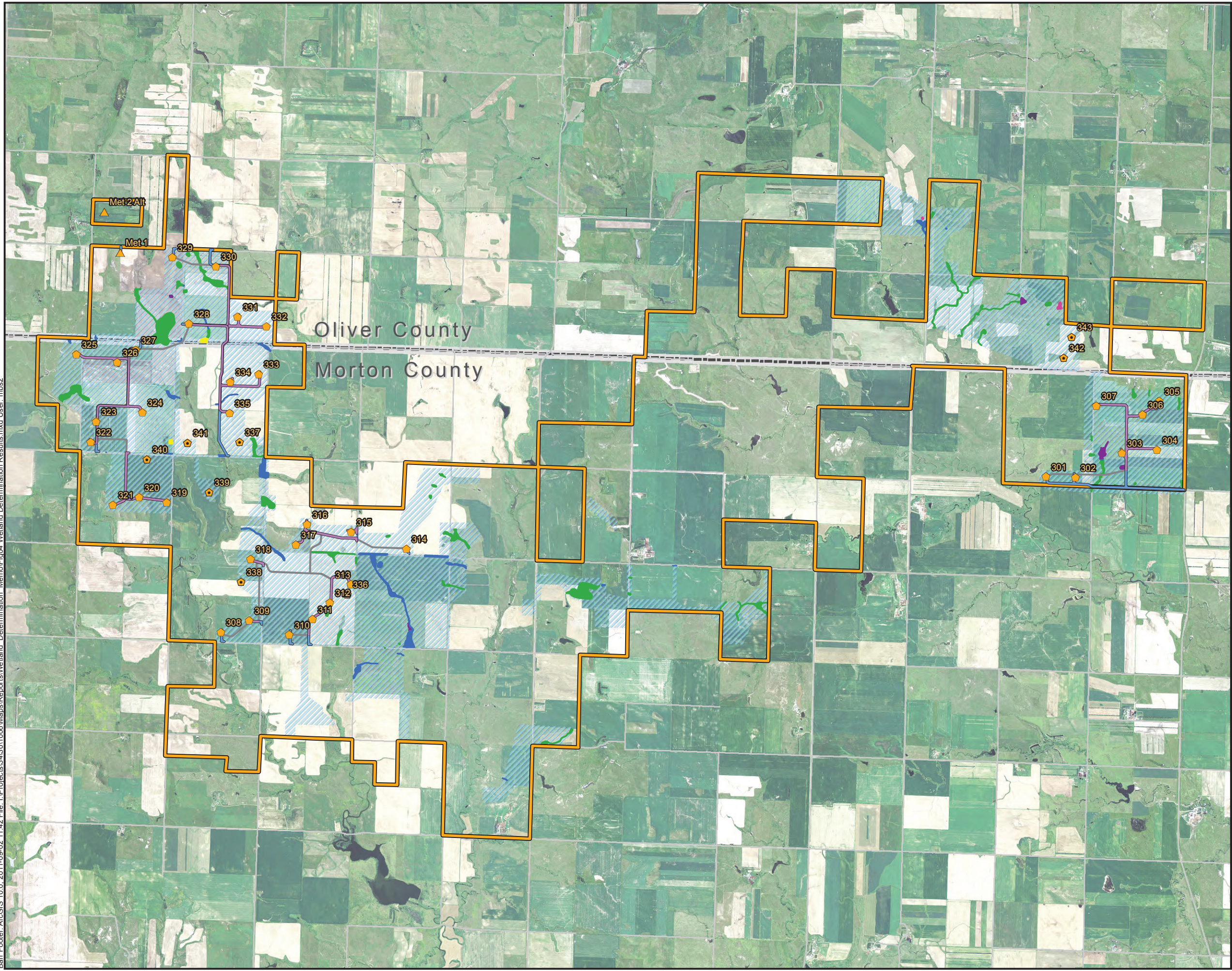
Imagery Source: NAIP, 2010  
NWI Source: USFWS



Figure 3

NATIONAL WETLAND INVENTORY  
Wetland Determination Methods  
Bison 3 Wind Project  
MN Power  
Morton & Oliver Counties, ND

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- Bison 3 Turbine Location (7/15/2011 Coords.)
- Bison 3 Alternate Location
- Bison 3 Met Tower Location
- Bison 3 Access Road/Crane Path (Barr, 9/1/2011)
- Bison 3 Access Road Only (Barr, 9/1/2011)
- Bison 3 Temporary Crane Path (Barr, 9/1/2011)
- Local Road
- Wetland Survey Extents
- Wetland Determination Results**
- Type 1, PEMA
- Type 2, PEMB
- Type 3, PEMC
- Type 4, PEMF
- Type 5, PUBG/H
- Bison 3 Project Boundary
- County Boundary

Note: Only wetlands within Barr wetland survey extents are shown on this figure.

Imagery Source: NAIP, 2010

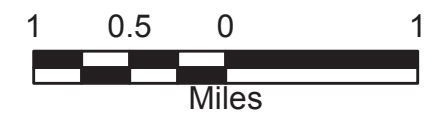
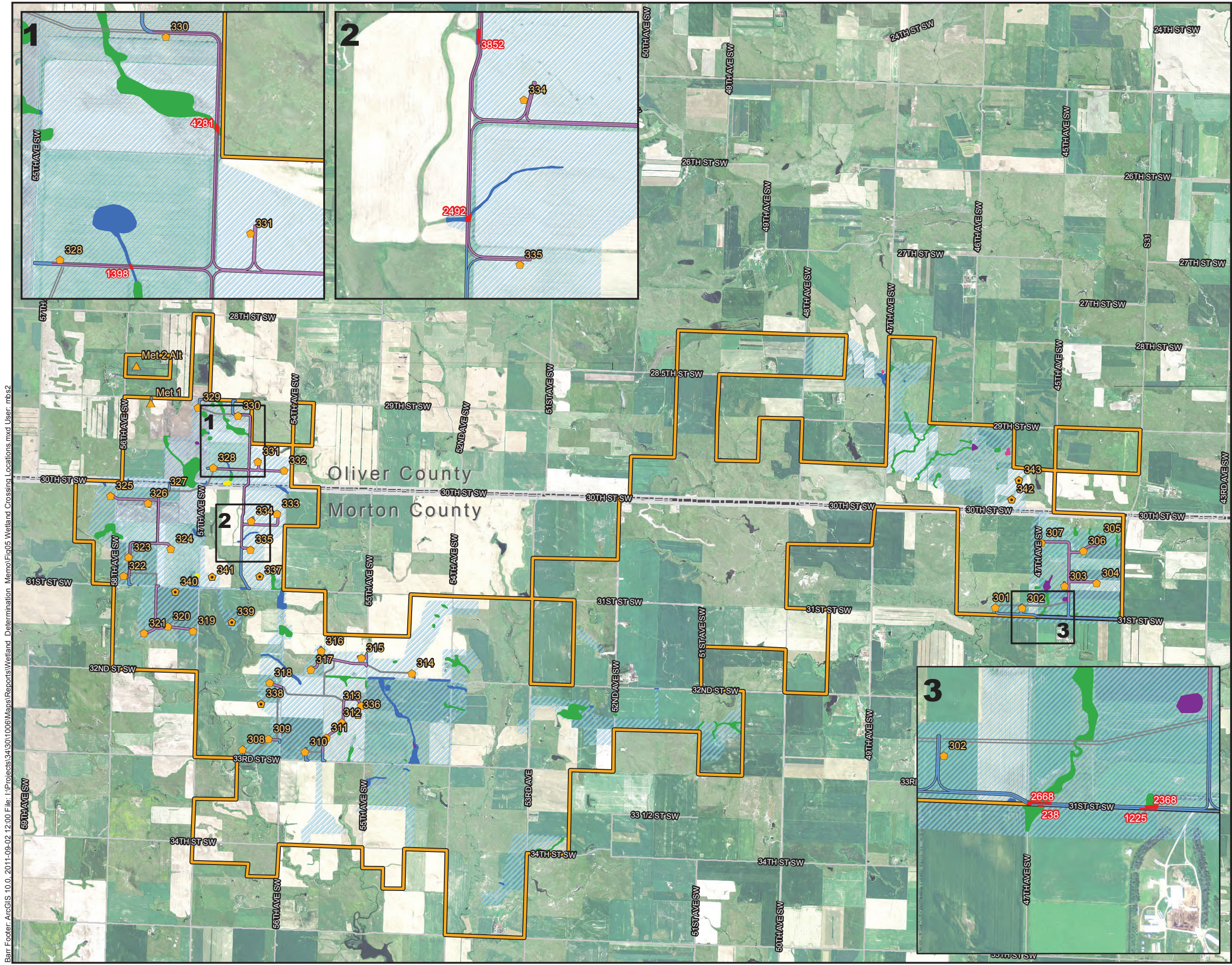


Figure 4

**WETLAND DETERMINATION RESULTS**  
 Wetland Determination Methods  
 Bison 3 Wind Project  
 MN Power  
 Morton & Oliver Counties, ND



- Bison 3 Turbine Location (7/15/2011 Coords.)
- Bison 3 Alternate Location
- Bison 3 Met Tower Location
- Bison 3 Access Road/Crane Path (Barr, 9/1/2011)
- Bison 3 Access Road Only (Barr, 9/1/2011)
- Bison 3 Temporary Crane Path (Barr, 9/1/2011)
- Local Road
- Wetland Crossing Extent (Labeled in Square Feet)
- Wetland Survey Extents
- Wetland Determination Results**
- Type 1, PEMA
- Type 2, PEMB
- Type 3, PEMC
- Type 4, PEMF
- Type 5, PUBG/H
- Bison 3 Project Boundary
- County Boundary

Note: Only wetlands within Barr wetland survey extents are shown on this figure.

Imagery Source: NAIP, 2010

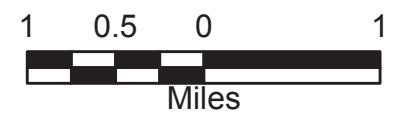


Figure 5  
 WETLAND CROSSING LOCATIONS  
 Wetland Determination Methods  
 Bison 3 Wind Project  
 MN Power  
 Morton & Oliver Counties, ND

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**Appendix A:**  
Wetland Photographs

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Seasonally Flooded Basin/Flat (Type 1)



Seasonally Flooded Basin/Flat (Type 1)



Wet Meadow (Type 2)



Wet Meadow (Type 2)



Deep Marsh (Type 4)



Deep Marsh (Type 4)





Open Water Wetland (Type 5)



Open Water Wetland (Type 5)

## Appendix E

**Pending**

## Appendix F



August 1, 2011

Ms. Dawn Rhone  
Morton County Auditor  
Morton County Courthouse  
210 2nd Ave. NW  
Mandan, ND 58554

**Re: Minnesota Power's Bison 3 Wind Energy Project  
Special Use Permit Application**

Dear Ms. Rhone:

Minnesota Power is planning to construct a wind energy conversion facility—the Bison 3 Wind Energy Project—in Morton and Oliver Counties in North Dakota. Minnesota Power has retained Barr Engineering Co. (Barr) to assist with the environmental permitting process for the project.

Enclosed please find an application and supporting materials for a Morton County Special Use Permit for the Bison 3 Project. Barr Engineering is submitting this application on behalf of Jim Atkinson, Supervisor, Environmental Siting and Permitting at Minnesota Power (Allete). The 105 MW Bison 3 Wind Energy Project will interconnect with the existing 230kV Bison Substation and then the Square Butte Substation. The wind-generated electricity will then be transmitted to Minnesota Power's transmission system via an existing 250kV DC Line and existing AC transmission system as available and is intended to be used to meet Minnesota Power's share of State of Minnesota renewable energy requirements.

Leases from landowners have been obtained within the preliminary Project boundary. The Project site encompasses approximately 22,812 acres (36 mi<sup>2</sup>) and is located approximately 10 miles northwest of the City of New Salem. The turbines will be placed throughout the Project site and in compliance with Morton County Planning and Zoning Resolutions, Appendix I, Wind Energy Facilities. The Project's location is shown in Exhibit 1 and the preliminary Project boundary, with aerial photo and topographical map backgrounds, is shown in Exhibit 2 and Exhibit 3, respectively. Applicable setbacks are shown in Exhibit 4. Detailed locations of wind turbine generators, access roads, and collector lines will be provided to Morton County upon request. However, of the 22,812 acres within the preliminary Project boundary, approximately 22,716 acres will be untouched by the project, or, if temporarily disturbed for such uses as crane paths, will be allowed to revert to their former condition after project construction. In all, only .1 percent of the land within the preliminary Project boundary will be permanently occupied by Bison 3 wind turbines and access roads.

Minnesota Power has submitted an application for a Certificate of Site Compatibility to the North Dakota Public Service Commission (Commission) pursuant to Chapter 49-22 of the North Dakota Century Code and Article 69-06 of the North Dakota Administrative Code. Minnesota Power plans to obtain Commission approval by September, 2011 and to begin construction in the fall of 2011, with turbine construction and project completion in 2012.

If you have comments regarding this Special Use Permit application, you are encouraged to contact Jim Atkinson at 218-355-3561, or Daniel Flo at the address listed below, by e-mail (dflo@barr.com), or by phone (952-832-2975).

Sincerely,

A handwritten signature in black ink, appearing to read "Daniel Flo". The signature is stylized with large, overlapping loops and a cursive style.

Daniel Flo  
Environmental Scientist

Enclosures

**MORTON COUNTY**  
**UNIFIED DEVELOPMENT APPLICATION**

**Application submitted for (check all that apply):**

- Preliminary Plat    
 Final Plat    
 Plat Vacation    
 Road Vacation  
 Zoning Change    
 Variance    
 Special Use Permit    
 Lot Split

**PROPERTY INFORMATION**

Name of plat: NA

Legal description of property (lot, block, addition):

County	Township	Range	Section
Morton	140N	85W	5, 6
		86W	2, 3, 4, 5, 8, 7, 8, 9, 10, 11, 15, 16, 17, 18, 19, 20, 30
		87W	2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15, 22, 23, 24, 25, 27

Street address of property: NA

Existing Zoning: \_\_\_\_\_ Proposed Zoning: \_\_\_\_\_

Acreeage: 37.5 acres for project facilities     Number of Lots: \_\_\_\_\_

Description of development proposal, including reason(s) for the request: Construction of a utility scale (105MW) wind project in Morton and Oliver Counties, North Dakota. Out of 35 total turbines, 30 turbines (90 MW) are proposed for Morton County. See Exhibit 1 for the project area and Exhibit 2 for the preliminary project boundary.

**APPLICANT/DEVELOPER**

Name: Minnesota Power – Jim Atkinson     Mailing Address: 30 W. Superior St., Duluth, MN 55803

Telephone number: (218) 355-3561     FAX#: (218) 723-3916

E-mail address: [jbatkinson@allete.com](mailto:jbatkinson@allete.com)

**PROPERTY OWNER (IF DIFFERENT THAN APPLICANT/DEVELOPER)**

Name: See attached landowner list     Mailing Address: \_\_\_\_\_

Telephone number: \_\_\_\_\_     FAX#: \_\_\_\_\_

E-mail address: \_\_\_\_\_

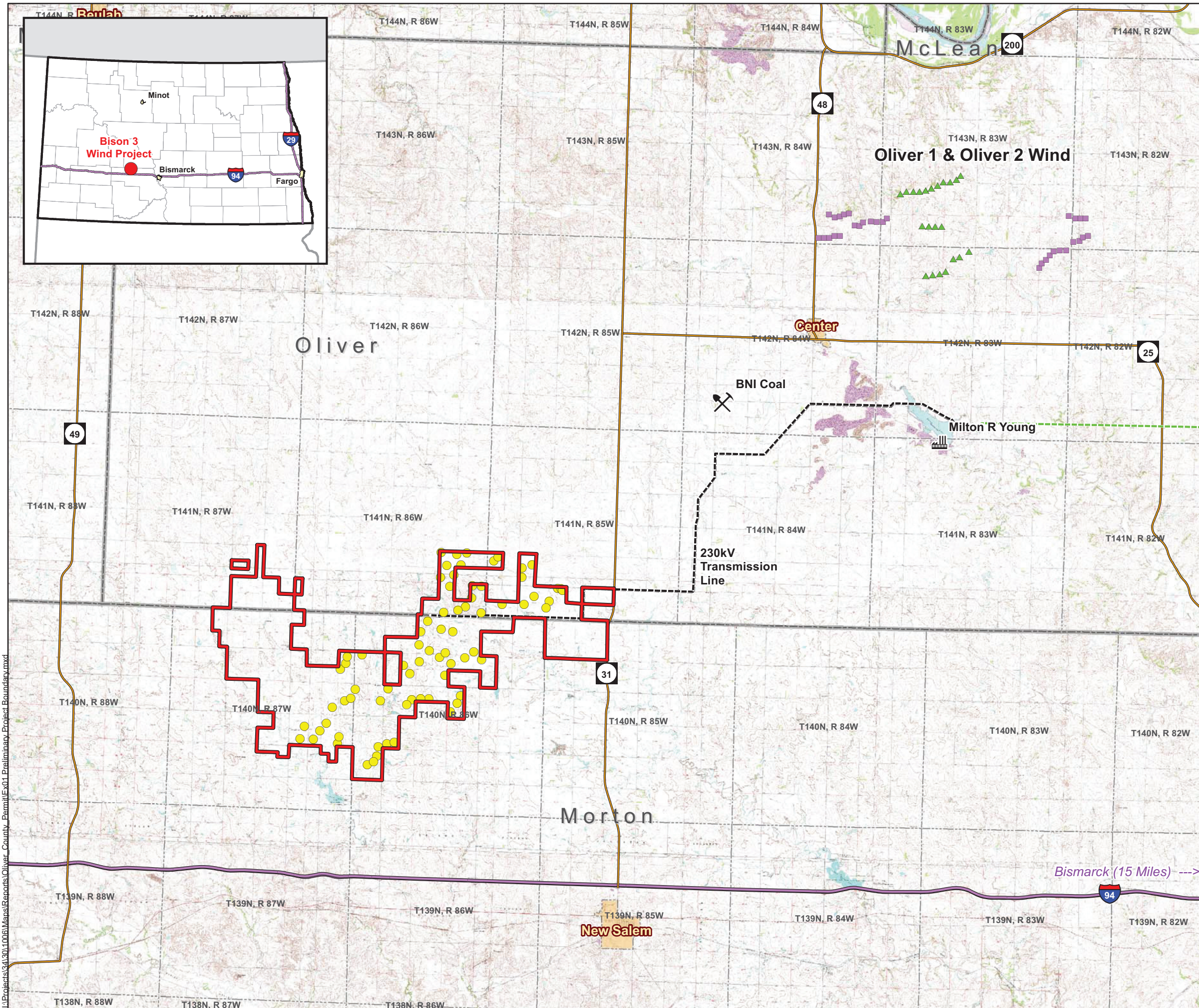
**CONTACT PERSON/AGENT:**

Name/Firm: Daniel Flo, Barr Engineering Co.     Mailing Address: 4700 W. 77<sup>th</sup> St., Mpls, MN 55435

Telephone number: (952) 832-2975     FAX#: \_\_\_\_\_

E-mail address: [dflo@barr.com](mailto:dflo@barr.com)

**NOTE: APPLICATIONS ARE NOT COMPLETE UNTIL ALL REQUIRED SUBMITTALS HAVE BEEN RECEIVED**



- Bison 1/Bison 2 Turbine Location
- ▲ Oliver 1 Wind Project Turbine Location
- Oliver 2 Wind Project Turbine Location
- BNI Coal Mine
- Milton R. Young Generation Station
- 230kV Transmission Line
- DC Transmission Line
- Interstate Highway
- State Highway
- Preliminary Bison 3 Project Boundary
- Municipality
- County Boundary

Data Sources:  
 Project Boundary - Minnesota Power  
 Utilities - Minnesota Power  
 Roads, Administrative Boundaries - ND DOT  
 Topo Map - USGS DRG

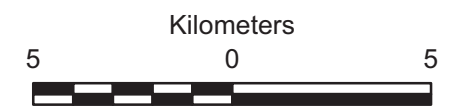
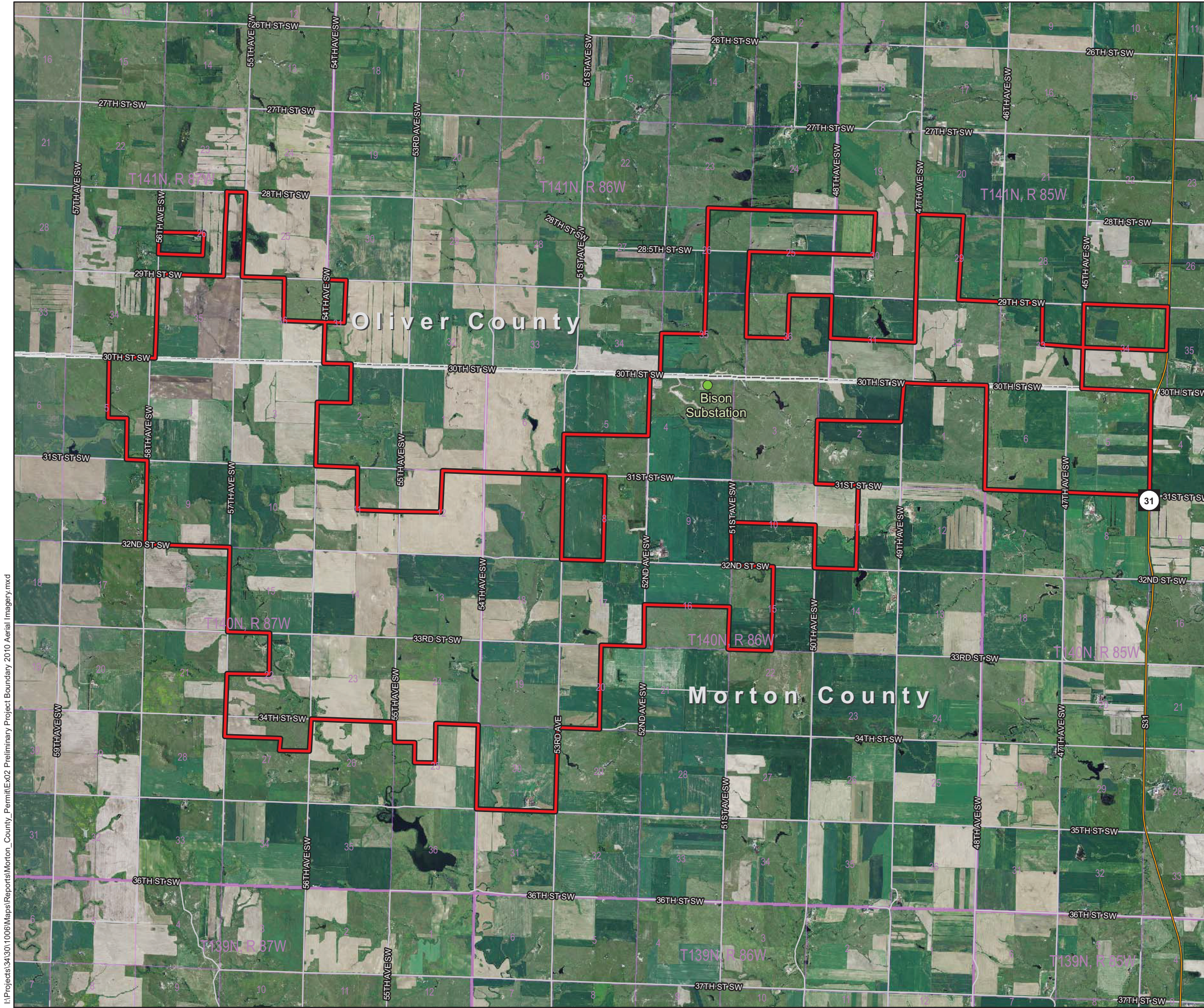









Exhibit 1  
**PROJECT LOCATION**  
 Bison 3 Wind Project  
 Minnesota Power  
 Morton & Oliver Counties, North Dakota

I:\Projects\24130\10061\Maps\Reports\Oliver\_County\_Permit\Ex01\_Preliminary\_Project\_Boundary.mxd





-  Bison Substation
-  Preliminary Bison 3 Project Boundary
-  State Highway
-  Local Road
-  Public Land Survey Township
-  Public Land Survey Section
-  County Boundary

Data Sources:  
 Preliminary Project Data - Minnesota Power  
 Roads, Administrative Boundaries - ND DOT  
 Imagery - NAIP, 2010

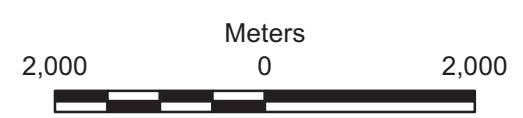
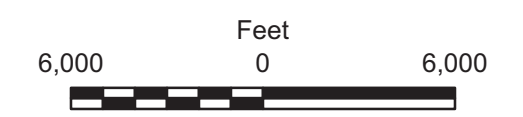
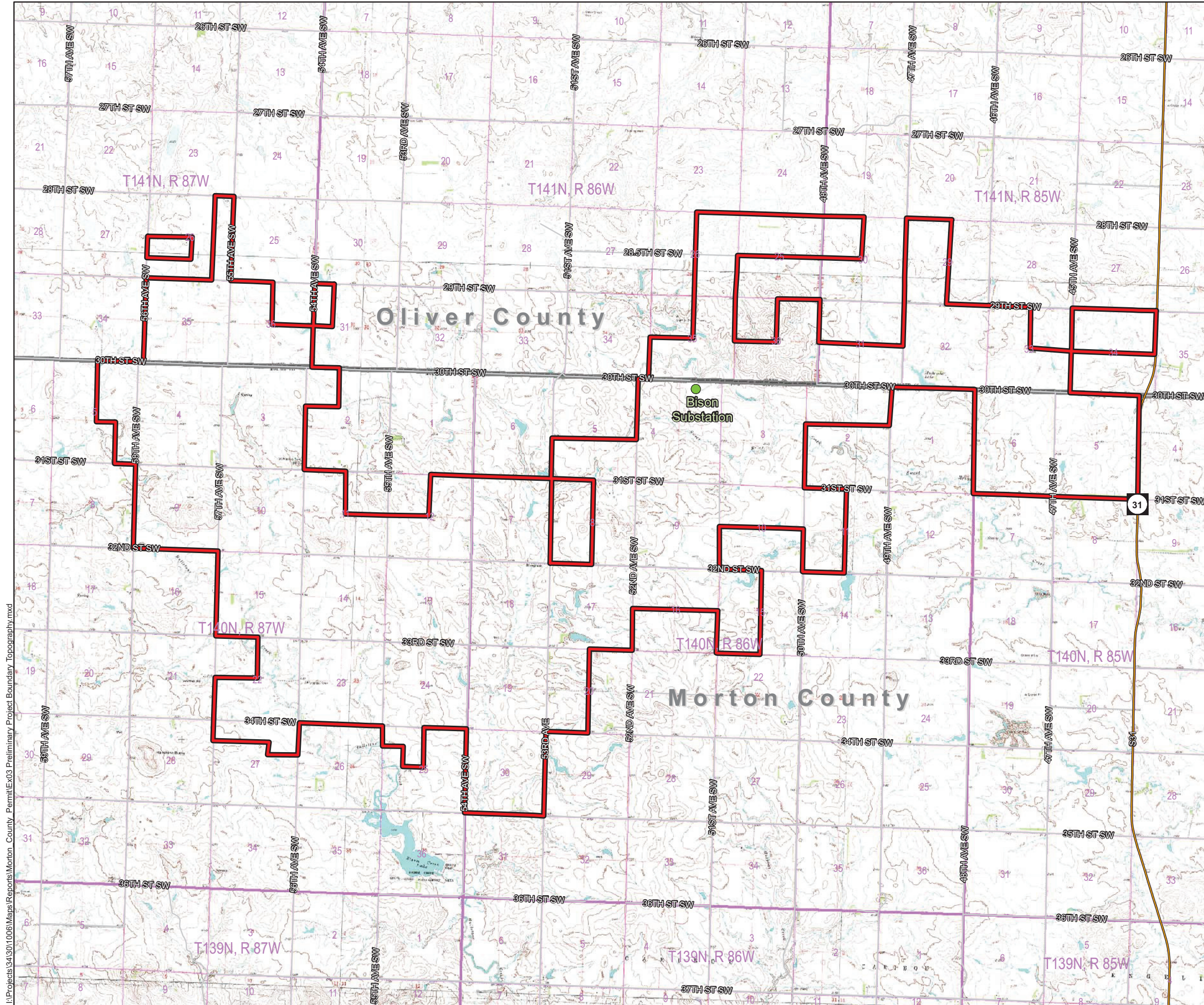









Exhibit 2

PRELIMINARY PROJECT  
 BOUNDARY (2010 IMAGERY)  
 Bison 3 Wind Project  
 Minnesota Power  
 Morton & Oliver Counties, North Dakota

I:\Projects\3413011006\Maps\Reports\Morton\_County\_Permit\Ex02\_Preliminary Project Boundary 2010 Aerial Imagery.mxd



-  Bison Substation
-  Preliminary Bison 3 Project Boundary
-  Local Road
-  State Highway
-  Public Land Survey Section
-  Public Land Survey Township
-  County Boundary

Data Sources:  
 Preliminary Project Data - Minnesota Power  
 Roads, Administrative Boundaries - ND DOT  
 Topography - USGS DRG

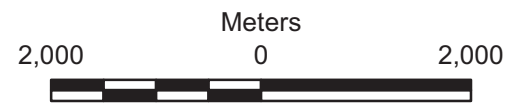
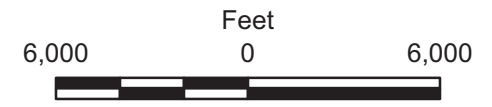
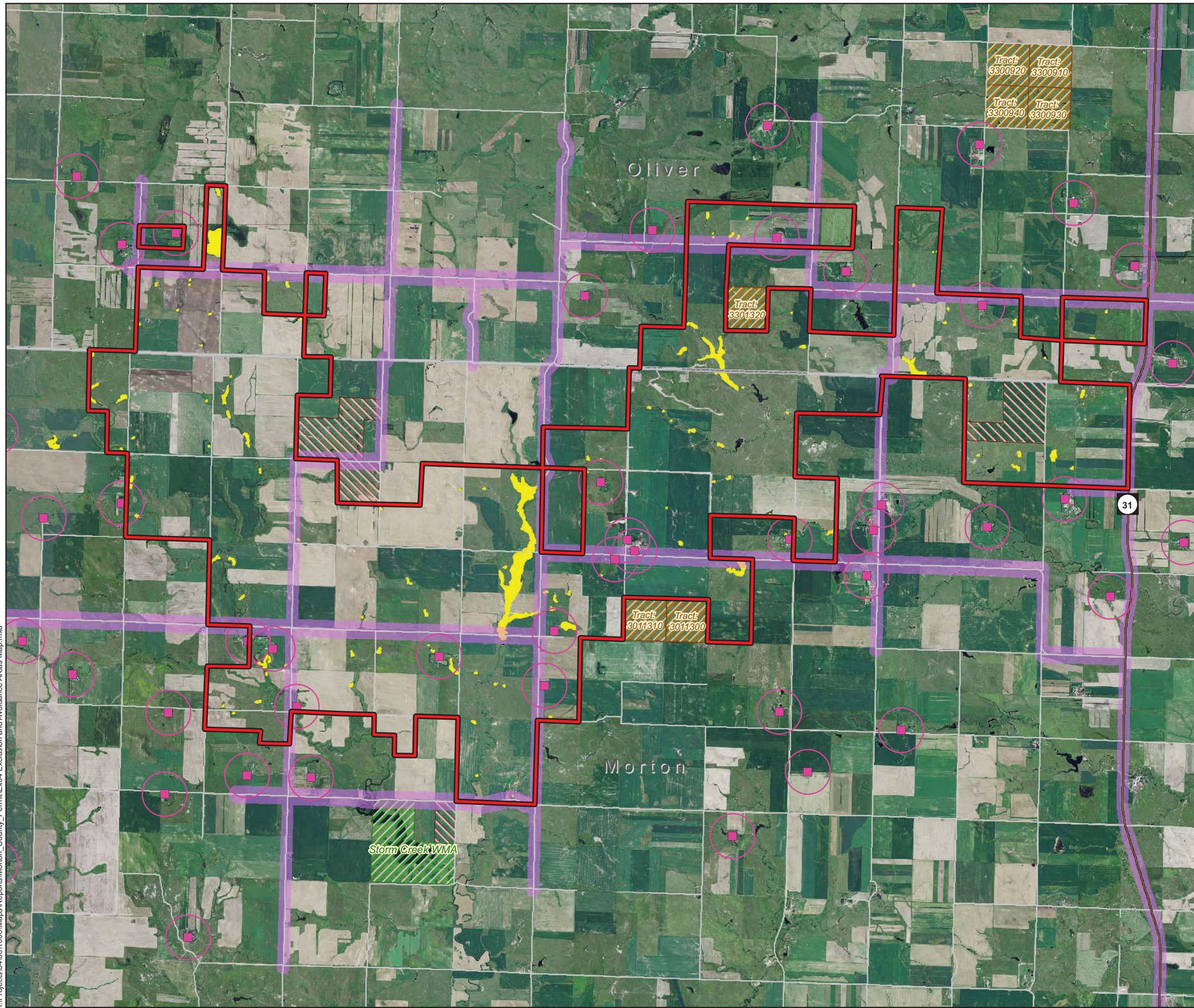


Exhibit 3

PRELIMINARY PROJECT  
 BOUNDARY (TOPOGRAPHY)  
 Bison 3 Wind Project  
 Minnesota Power  
 Morton & Oliver Counties, North Dakota

I:\Projects\3413011006\Maps\Reports\Morton\_County\_Permit\Ex03\_Preliminary Project Boundary\_Topography.mxd

I:\Projects\34\3011006\Maps\Reports\Morton\_County\_Permit\Ex04 Exclusion and Avoidance Areas Map.mxd



- Occupied Dwelling (Field Verified)
- ⬮ Preliminary Bison 3 Project Boundary
- 🟡 National Wetland Inventory (USFWS)
- 1400ft Occupied Dwelling Setback\*
- 🟪 Maintained Road 550ft Setback
- 🟩 ND Fish and Game Wildlife Management Area
- 🟨 ND State Land Department Administered Property
- 🟪 Private Land Open to Sportsmen (PLOTS)
- 🗺️ County Boundary

Data Sources:  
 Preliminary Project Data - Minnesota Power  
 Residential Structures - Minnesota Power  
 Setbacks - Barr Engineering  
 Wetlands - USFWS  
 Roads - NDOT, Minnesota Power  
 Administrative Boundaries - NDSL, NDFG  
 Imagery - NAIP, 2010

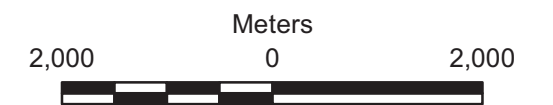
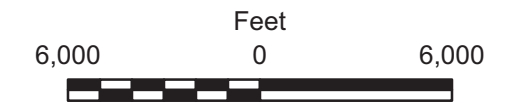


Exhibit 4

EXCLUSION AND AVOIDANCE AREAS MAP  
 Bison 3 Wind Project  
 Minnesota Power  
 Morton & Oliver Counties, North Dakota

MORTON COUNTY LANDOWNER LIST – BISON 3 WIND ENERGY PROJECT

Hilda Peltz 210 South E Street Glen Ullin, ND 58631	Ronald & Martha Peltz 3390 County Road 87 New Salem, ND 58563 (701) 226-2341	Roger and Elaine Kulsman 1710 Ash Avenue New Salem, ND 58563 (701) 843-8542
David Klusman 4670 31 <sup>st</sup> Street New Salem, ND 58563 (701) 843-7439	Hoffman Family Lt. Partnership 4600 N 68 <sup>th</sup> St, Unit 331 Scottsdale, AZ 85251 (701) 222-2234	Terrance and Diane Mosbrucker 2952 Highway 31 New Salem, ND 58563 (701) 843-7248
Kevin Opp 605 West Ash Ave. Glen Ullin, ND 58631 (701) 391-6868	Ross & Cheryl Schroeder 311 Lake Street New Salem, ND 58563 (701) 843-8276	Daryl & Brenda Winckler 5620 County Road 140 New Salem, ND 58563 (701) 391-5463
Jeffery and Julie Schroeder 206 N 8 <sup>th</sup> Street New Salem, ND 58563 (701) 843-8659	Mary Lou Peltz 206 E. St. S Glen Ullin, ND 58631	Lyle and Linda Peltz 6455 Hwy 49 Glen Ullin, ND 58631
James and Darlene Swenson 1941 62 <sup>nd</sup> Ave. SW Beulah, ND 58523 (701) 873-5720	Trent and Dawn Martin 1943 62 <sup>nd</sup> Ave SW Beulah, ND 58523 (701) 873-4130	Andrew and Heidi Peltz 5870 County Rd 140 New Salem, ND 58561 (701) 843-7312
Daniel and Shana Peltz 3190 59 <sup>th</sup> Ave New Salem, ND 58561 (701) 843-7312		

## Appendix G



August 1, 2011

Mr. John Wicklund  
Oliver County Zoning Administrator  
Oliver County Courthouse  
P.O. Box 188  
Center, ND 58530

**Re: Minnesota Power's Bison 3 Wind Energy Project  
Conditional Use Permit Application**

Dear Mr. Wicklund:

Minnesota Power is planning to construct a wind energy conversion facility—the Bison 3 Wind Energy Project—in Morton and Oliver Counties in North Dakota. Minnesota Power has retained Barr Engineering Co. (Barr) to assist with the environmental permitting process for the project.

Enclosed please find an application and supporting materials for an Oliver County Conditional Use Permit for the Bison 3 Project. Barr Engineering is submitting this application on behalf of Jim Atkinson, Supervisor, Environmental Siting and Permitting at Minnesota Power (Allete). The 105 MW Bison 3 Wind Energy Project will interconnect with the existing 230kV Bison Substation and then the Square Butte Substation. The wind-generated electricity will then be transmitted to Minnesota Power's transmission system via an existing 250kV DC Line and existing AC transmission system as available and is intended to be used to meet Minnesota Power's share of State of Minnesota renewable energy requirements.

Leases from landowners have been obtained within the preliminary Project boundary. The Project site encompasses approximately 22,812 acres (36 mi<sup>2</sup>) and is located approximately 10 miles northwest of the City of New Salem. The turbines will be placed throughout the Project site. The Project's location is shown in Exhibit 1 and the preliminary Project boundary, with aerial photo and topographical map backgrounds, is shown in Exhibit 2 and Exhibit 3, respectively. Detailed locations of wind turbine generators, access roads, and collector lines will be provided to Oliver County upon request. However, of the 22,812 acres within the preliminary Project boundary, approximately 22,716 acres will be untouched by the project, or, if temporarily disturbed for such uses as crane paths, will be allowed to revert to their former condition after project construction. In all, only .1 percent of the land within the preliminary Project boundary will be permanently occupied by Bison 3 wind turbines and access roads.

Minnesota Power has submitted an application for a Certificate of Site Compatibility to the North Dakota Public Service Commission (Commission) pursuant to Chapter 49-22 of the North Dakota Century Code and Article 69-06 of the North Dakota Administrative Code. Minnesota Power plans to obtain Commission approval by September, 2011 and to begin construction in the fall of 2011, with turbine construction and project completion in 2012.

If you have comments regarding this Conditional Use Permit application, you are encouraged to contact Jim Atkinson at 218-355-3561, or Daniel Flo at the address listed below, by e-mail (dflo@barr.com), or by phone (952-832-2975).

Sincerely,

A handwritten signature in black ink, appearing to read "Daniel Flo". The signature is fluid and cursive, with the first name "Daniel" and last name "Flo" clearly distinguishable.

Daniel Flo  
Environmental Scientist

Enclosures

**OLIVER COUNTY: CONDITIONAL USE PERMIT APPLICATION**

1. NAME OF APPLICANT: Minnesota Power, an operating division of Allete, Inc.
2. MAILING ADDRESS: 30 W. Superior St., Duluth, MN 55803
3. TELEPHONE NUMBER: Jim Atkinson (218) 355-3561
4. PROPERTY IS LOCATED IN:

County	Township	Range	Section
Oliver	141N	85W	29, 30, 31, 32, 33, 34
		86W	25, 26, 31, 35, 36
		87W	26, 35, 36

5. CONDITIONAL USE REQUESTED: Construction of a utility scale (105MW) wind project in Morton and Oliver Counties. Out of 35 total turbines, 5 turbines (15 MW) will be located in Oliver County. See Exhibit 1 for the project area and Exhibit 2 for the preliminary project boundary.
6. PRESENT LAND USE: Rural/agricultural used primarily for cultivated crops and grazing cattle
7. PROPOSED LAND USE: Overall land use would remain unchanged. Approximately 12.5 acres will be converted to access roads and turbine foundations in Oliver County.
8. ADJACENT LANDOWNERS DESCRIPTION  
See attached landowner list.
9. ADDITIONAL INFORMATION (TO BE ATTACHED)
  - A. MAP OF THE AREA (see Exhibit 1, attached)
  - B. BOUNDARY LINE SURVEY OR ACCURATE PLAT OF SITE (see Exhibit 2, attached)
  - C. DESCRIPTION OF SURROUNDING AREA (see Cover Letter)
  - D. PRELIMINARY MAP SHOWING LOCATION OF THE STRUCTURES TO BE DEVELOPED ON THE SITE AND DISTANCES BETWEEN STRUCTURES (To be provided in fall, 2011)
  - E. TOPOGRAPHICAL MAP IN FIVE (5) FOOT CONTOURS OF SITE (see Exhibit 3, attached)
  - F. GENERAL SOILS OF THE SITE (see Exhibit 4, Attached)
  - G. LOCATION OF EXISTING UTILITIES AND PROPOSED UTILITY EXTENSIONS AND/OR ALTERATIONS (see Exhibit 1, attached)
  - H. PARKING PLAN SHOWING OFF-STREET PARKING AREA, LOADING AREAS AND/OR TRANSFER STATIONS (n/a)
  - I. A TIMING SCHEDULE INDICATING ANTICIPATED STARTING AND COMPLETION DATES OF THE SITE (see Cover Letter)
  - J. WRITTEN APPROVAL OF RESPECTIVE HIGHWAY AUTHORITY FOR NEW ACCESS ROADS AND/OR APPROACHES (To be provided in fall, 2011)
  - K. ANY ADDITIONAL INFORMATION THE PLANNING AND ZONING COMMISSION DEEMS NECESSARY

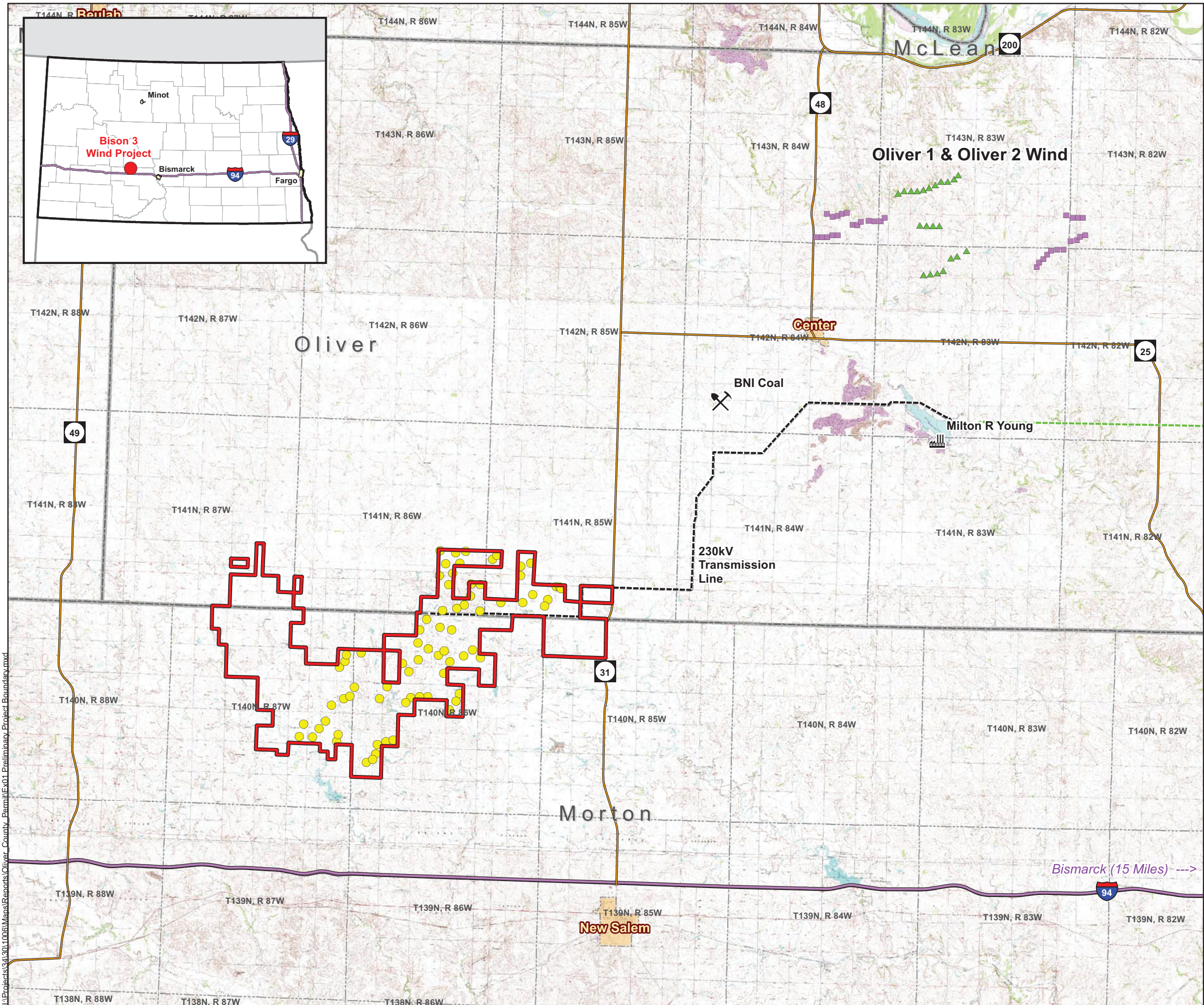


A handwritten signature in black ink, appearing to be 'Jim Atkinson', written in a cursive style.

for Jim Atkinson, Minnesota Power

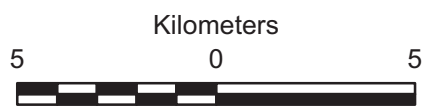
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(SIGNATURE OF APPLICANT)



- Bison 1/Bison 2 Turbine Location
- ▲ Oliver 1 Wind Project Turbine Location
- Oliver 2 Wind Project Turbine Location
- BNI Coal Mine
- Milton R. Young Generation Station
- 230kV Transmission Line
- DC Transmission Line
- Interstate Highway
- State Highway
- Preliminary Bison 3 Project Boundary
- Municipality
- County Boundary

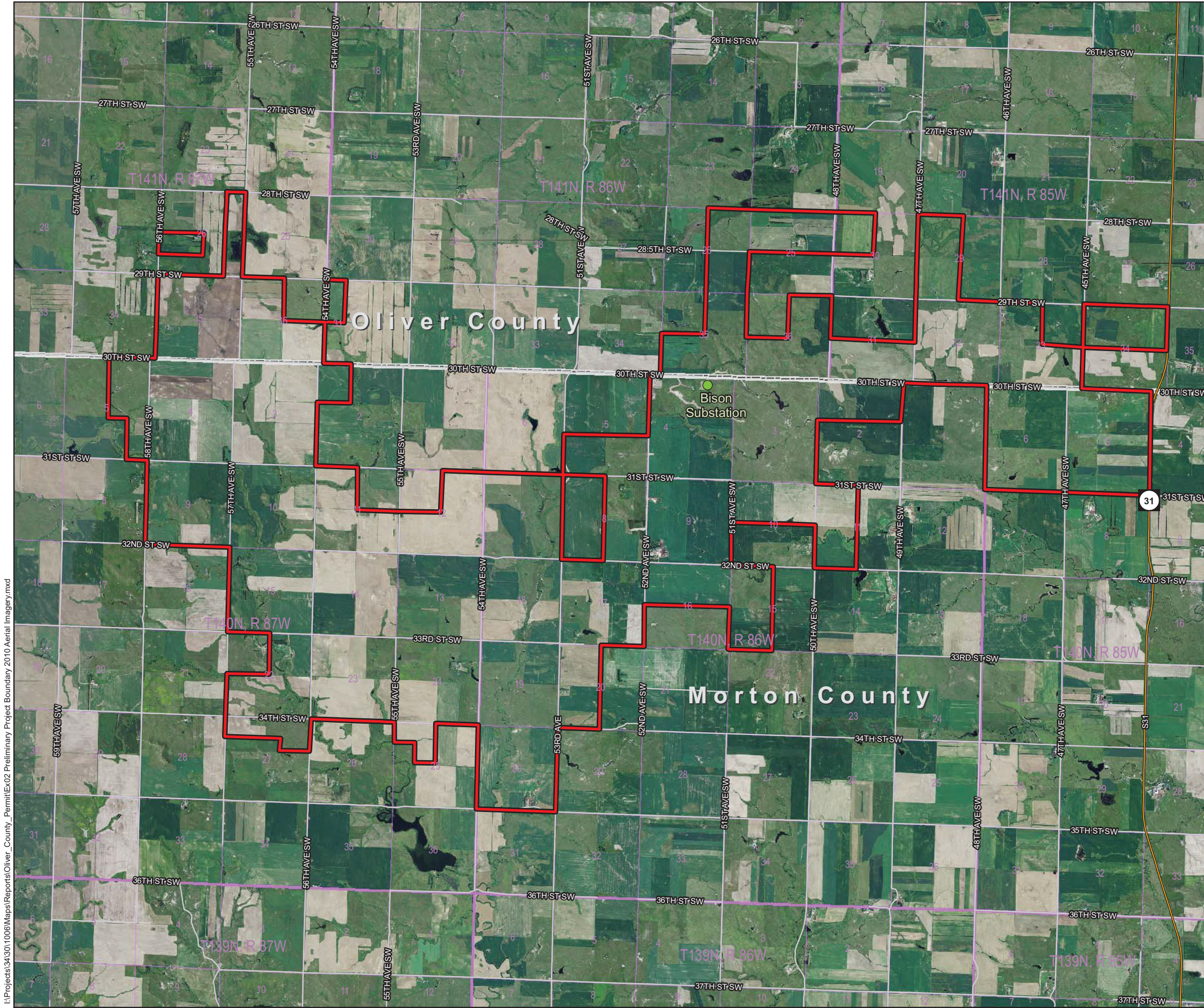
Data Sources:  
 Project Boundary - Minnesota Power  
 Utilities - Minnesota Power  
 Roads, Administrative Boundaries - ND DOT  
 Topo Map - USGS DRG










Bismarck (15 Miles) --->

Exhibit 1  
 PROJECT LOCATION  
 Bison 3 Wind Project  
 Minnesota Power  
 Morton & Oliver Counties, North Dakota

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-  Bison Substation
-  Preliminary Bison 3 Project Boundary
-  State Highway
-  Local Road
-  Public Land Survey Township
-  Public Land Survey Section
-  County Boundary

Data Sources:  
 Preliminary Project Data - Minnesota Power  
 Roads, Administrative Boundaries - ND DOT  
 Imagery - NAIP, 2010

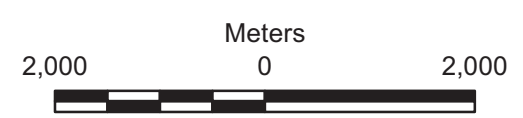
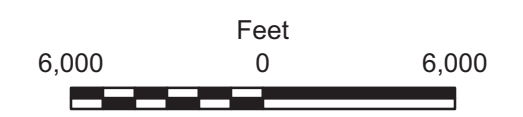
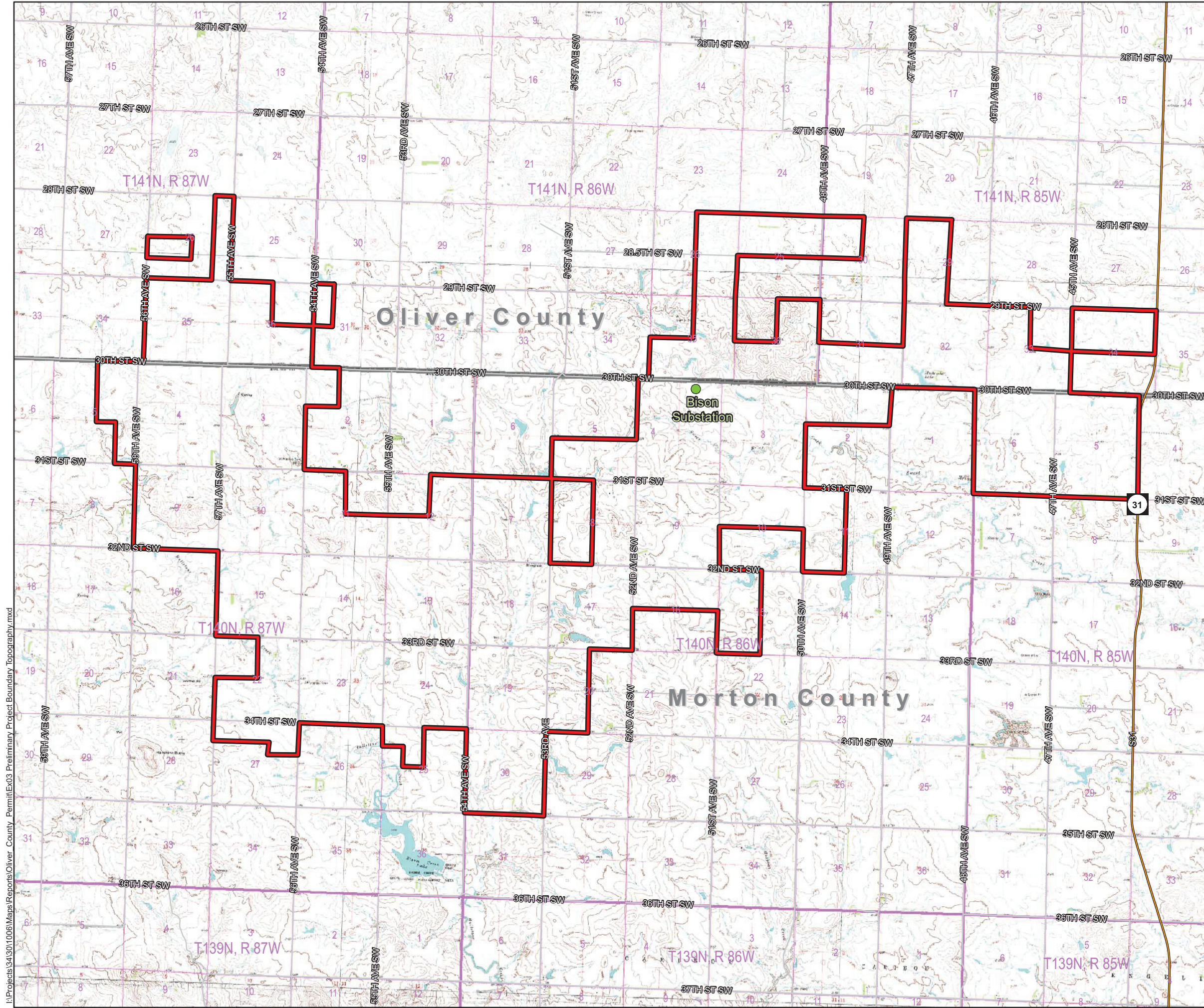









Exhibit 2

PRELIMINARY PROJECT  
 BOUNDARY (2010 IMAGERY)  
 Bison 3 Wind Project  
 Minnesota Power  
 Morton & Oliver Counties, North Dakota

I:\Projects\3413011006\Maps\Reports\Oliver\_County\_Permit\Ex02 Preliminary Project Boundary 2010 Aerial Imagery.mxd



-  Bison Substation
-  Preliminary Bison 3 Project Boundary
-  Local Road
-  State Highway
-  Public Land Survey Section
-  Public Land Survey Township
-  County Boundary

Data Sources:  
 Preliminary Project Data - Minnesota Power  
 Roads, Administrative Boundaries - ND DOT  
 Topography - USGS DRG

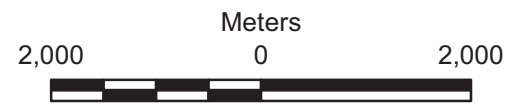
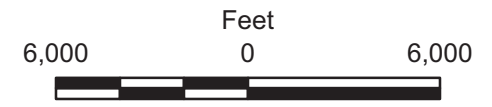
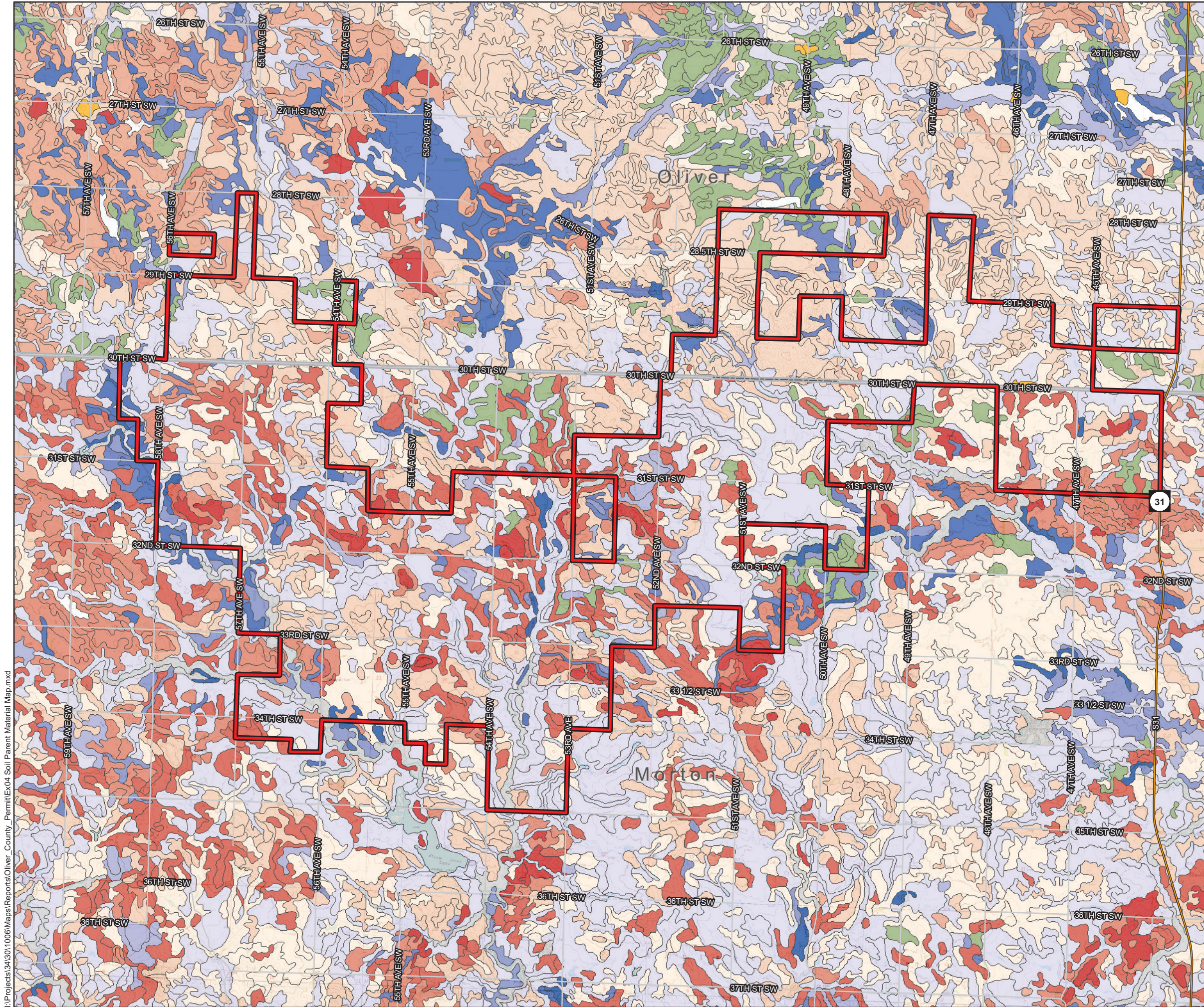


Exhibit 3

PRELIMINARY PROJECT  
 BOUNDARY (TOPOGRAPHY)  
 Bison 3 Wind Project  
 Minnesota Power  
 Morton & Oliver Counties, North Dakota

I:\Projects\343011006\Maps\Reports\Oliver County\_PermitEx03 Preliminary Project Boundary Topography.mxd



-  Preliminary Bison 3 Project Boundary
-  County Boundary
- Soil Parent Material**
-  Unknown
-  Eolian Deposits
-  Fine-Loamy Till
-  Clayey Alluvium
-  Fine-Silty Alluvium
-  Fine-Loamy Alluvium
-  Loamy Alluvium
-  Coarse-Loamy Alluvium
-  Sandy and Gravelly Alluvium
-  Clayey Residuum
-  Fine-Silty Residuum
-  Fine-Loamy Residuum
-  Coarse-Loamy Residuum
-  Coarse-Loamy Residuum From Sandstone
-  Loamy Residuum
-  Sandy Residuum
-  Fine-Loamy Residuum From Sandstone

Data Sources:  
 Preliminary Project Data - Minnesota Power  
 Soil Parent Material - USDA NRCS SSURGO Soils Database  
 Roads, Administrative Boundaries - NDDOT  
 Topography - USGS DRG

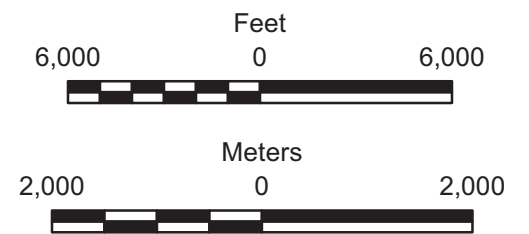


Exhibit 4

SOIL PARENT MATERIAL MAP  
 Bison 3 Wind Project  
 Minnesota Power  
 Morton & Oliver Counties, North Dakota

OLIVER COUNTY LANDOWNER LIST – BISON 3 WIND PROJECT

Gary and Carol Hicks 7511 Keystone Drive Bismarck, ND 58503 (701) 223-1713	Keith and Shannon Becher 850 North Randolph, Apt 320 Ballston, VA 22203 (571)389-0858	William L. Chase Living Trust 116 E 8 <sup>th</sup> Street Newberg, OR 97132 (206) 484-0070
Emma Peltz 409 D Street South Glen Ullin, ND 58631 (701) 348-3011	Tim and Jeanne Peltz 13564 Hunters Crossing Bath, MI 48808 (517) 641-6195	Steven and Cheryl Pletz 1020 Laurel St Broomfield, CO 80020 (303) 465-4125
Verlyn and Joyce Dalbak 5078 South Old Oak Way Springfield, MO 65810 (417) 883-9715	Greg and Jeanne Voegele 2860 56 <sup>th</sup> Ave New Salem, ND 58563 (701) 843-7094	

## Appendix H

Project:

**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

EAPC does not warrant, guarantee, or make any such representations regarding the contents of this report. EAPC cannot be held liable for erroneous results caused by errors or omissions in the delivered data, or inaccuracy, limitations, or malfunctioning of models or software used. For any claim whatsoever related to the subject matter of this report, the liability of EAPC for actual damages, regardless of the form of action, shall be limited to the total amount paid to EAPC for the services provided as part of this consultancy service.

Printed/Page

6/21/2011 8:45 AM / 1

Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Main Result**

**Calculation:** BISON 3 Shadow Flicker (with existing BISON 1, 2)

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]  
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

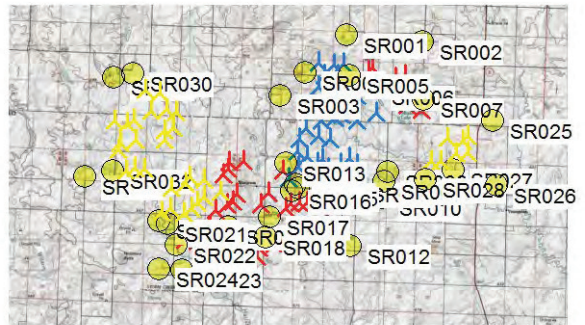
Operational hours are calculated from WTGs in calculation and wind distribution:

SDO for PARK 8643

Operational time  
 N NNE NE ENE E ESE SE SSE S SSW SW WSW  
 460 248 266 220 303 505 763 770 523 378 415 371

W WNW NW NNW Sum  
 577 907 1,032 796 8,534

Idle start wind speed: Cut in wind speed from power curve



A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values.

A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: 20110421\_BISON\_nested\_HCLs\_v2\_re

Obstacles not used in calculation

Eye height: 1.5 m

Grid resolution: 10 m

Scale 1:400,000  
 New WTG (red triangle)  
 Shadow receptor (yellow circle)

**WTGs**

UTM WGS84 Zone: 14				WTG type		Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]
East	North	Z	Row data/Description	Valid								
UTM WGS84 Zone: 14				[m]								
1	308,045	5,206,621	710.2	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
2	308,398	5,207,681	712.8	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
3	305,708	5,204,697	697.2	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
4	306,742	5,204,066	684.1	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
5	306,144	5,205,889	687.5	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
6	307,814	5,208,723	699.8	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
7	306,789	5,208,091	697.9	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
8	305,723	5,203,854	694.7	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
9	308,835	5,206,312	686.8	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
10	308,356	5,207,066	704.4	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
11	309,883	5,206,747	665.7	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
12	308,458	5,204,347	662.0	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
13	307,026	5,204,302	678.5	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
14	306,821	5,205,492	674.2	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
15	307,258	5,207,647	696.1	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
16	306,222	5,204,408	682.6	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
17	307,611	5,209,252	691.9	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
18	306,948	5,206,325	663.9	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
19	307,408	5,205,372	666.1	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
20	307,108	5,208,697	698.3	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
22	307,008	5,203,168	670.0	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
23	305,241	5,203,255	705.6	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0	
25	308,117	5,209,319	675.4	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
26	306,823	5,209,364	689.1	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	

To be continued on next page...



Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Main Result**

**Calculation:** BISON 3 Shadow Flicker (with existing BISON 1, 2)

...continued from previous page

UTM WGS84 Zone: 14				WTG type		Type-generator	Power, rated	Rotor diameter	Hub height	RPM	
East	North	Z	Row data/Description	Valid	Manufact.						
UTM WGS84 Zone: 14			[m]			[kW]	[m]	[m]	[RPM]		
27	307,666	5,206,450	684.1	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
28	307,454	5,208,223	699.8	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
29	308,855	5,203,961	659.6	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0
30	308,850	5,207,651	682.8	BISON 1B	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
31	308,007	5,204,045	659.6	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0
32	305,787	5,205,371	676.0	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0
33	310,319	5,208,760	676.0	BISON 1A	Yes	Siemens	SWT-2.3-101-2,300	2,300	101.0	80.0	16.0
201	309,464	5,208,918	677.3	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
202	309,685	5,209,120	676.7	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
203	310,887	5,208,104	665.3	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
204	310,897	5,208,576	676.0	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
205	311,399	5,208,734	691.6	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
206	311,493	5,207,129	663.0	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
207	312,259	5,206,895	682.4	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
208	307,794	5,202,144	666.4	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
209	307,622	5,201,766	676.7	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
210	307,287	5,201,341	678.5	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
211	306,204	5,201,988	691.0	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
212	305,792	5,201,997	687.0	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
213	305,343	5,201,946	685.8	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
214	305,086	5,201,688	683.4	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
215	304,921	5,203,659	700.3	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
216	304,151	5,202,483	677.3	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
217	303,760	5,201,883	670.6	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
218	304,453	5,199,790	684.6	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
219	303,654	5,199,579	680.9	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
220	303,574	5,199,109	668.2	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
221	303,104	5,198,656	658.4	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
222	299,716	5,199,978	657.8	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
223	299,930	5,200,609	665.1	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
224	301,600	5,199,737	677.0	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
225	301,676	5,200,064	678.5	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
226	301,044	5,200,758	684.0	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
227	301,339	5,201,562	683.4	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
228	300,385	5,199,954	656.5	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
229	301,958	5,201,876	689.4	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
230	302,272	5,202,012	695.0	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
231	302,500	5,202,464	685.2	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
232	301,742	5,203,479	692.5	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
233	302,013	5,203,777	696.8	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
234	302,093	5,204,102	699.8	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
235	302,838	5,204,194	681.1	BISON 2	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
301	312,774	5,204,170	646.1	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
302	313,282	5,204,157	646.2	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
303	314,088	5,204,579	658.4	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
304	314,697	5,204,634	658.4	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
305	314,736	5,205,482	658.4	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
306	314,446	5,205,246	670.6	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
307	313,645	5,205,400	663.9	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
308	298,480	5,201,477	664.5	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
309	298,972	5,201,680	670.6	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
310	299,665	5,201,434	671.2	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
311	300,072	5,201,700	677.3	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0
312	300,370	5,201,989	679.7	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

## SHADOW - Main Result

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2)

...continued from previous page

UTM WGS84 Zone: 14				WTG type		Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
East	North	Z	Row data/Description									
UTM WGS84 Zone: 14				[m]				[kW]	[m]	[m]	[RPM]	
313	300,736	5,202,308	705.3	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
314	301,586	5,202,532	685.2	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
315	300,740	5,203,215	690.7	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
316	299,975	5,203,346	696.8	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
317	299,780	5,202,993	707.7	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
318	298,996	5,202,746	677.9	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
319	297,558	5,203,763	688.2	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
320	297,064	5,203,816	701.0	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
321	296,612	5,203,683	688.8	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
322	296,227	5,204,772	688.8	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
323	296,321	5,205,129	688.8	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
324	297,120	5,205,284	690.3	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
325	295,979	5,206,293	691.9	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
326	296,688	5,206,154	701.0	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
327	297,008	5,206,367	690.9	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
328	297,927	5,206,824	694.9	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
329	297,639	5,207,972	701.0	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
330	298,396	5,207,813	694.9	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
331	298,772	5,206,941	701.0	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
332	299,272	5,206,774	694.9	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
333	299,137	5,205,950	701.6	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
334	298,647	5,205,816	693.1	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	
335	298,632	5,205,272	684.6	BISON 3	Yes	Siemens	SWT-3.0-101-3,000	3,000	101.0	80.0	16.0	

## Shadow receptor-Input

UTM WGS84 Zone: 14											
No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode	
		[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]		
SR001	SR001	308,281	5,210,878	684.7	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR002	SR002	312,331	5,210,518	667.5	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR003	SR003	304,789	5,207,620	679.2	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR004	SR004	306,077	5,208,878	691.7	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR005	SR005	308,456	5,208,732	677.3	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR006	SR006	309,777	5,208,086	658.4	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR007	SR007	312,386	5,207,439	674.5	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR008	SR008	310,463	5,203,623	650.0	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR009	SR009	310,303	5,203,128	643.1	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR010	SR010	310,167	5,202,263	676.7	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR011	SR011	308,704	5,202,962	655.3	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR012	SR012	308,504	5,199,667	674.6	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR013	SR013	305,091	5,204,059	680.2	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR014	SR014	305,600	5,202,951	680.3	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR015	SR015	305,735	5,202,742	681.1	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR016	SR016	305,362	5,202,580	681.3	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR017	SR017	304,204	5,201,211	671.2	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR018	SR018	304,015	5,200,169	672.6	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR019	SR019	302,002	5,200,728	663.3	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR020	SR020	298,345	5,201,007	658.4	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR021	SR021	298,817	5,200,870	660.0	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR022	SR022	299,277	5,199,763	649.2	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR023	SR023	299,548	5,198,404	658.4	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	
SR024	SR024	298,327	5,198,450	669.3	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode	

To be continued on next page...

Project:

**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

## SHADOW - Main Result

**Calculation:** BISON 3 Shadow Flicker (with existing BISON 1, 2)

...continued from previous page

**UTM WGS84 Zone: 14**

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
SR025	SR025	316,022	5,206,330	640.9	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode
SR026	SR026	316,240	5,202,903	634.0	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode
SR027	SR027	313,965	5,203,735	643.0	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode
SR028	SR028	312,483	5,203,203	631.2	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode
SR029	SR029	295,930	5,208,602	690.1	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode
SR030	SR030	296,963	5,208,823	695.5	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode
SR031	SR031	294,437	5,203,372	677.0	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode
SR032	SR032	295,924	5,203,653	667.5	1.0	1.0	1.0	-180.0	90.0	<input type="checkbox"/> Green house mode

## Calculation Results

Shadow receptor

No.	Name	Shadow <input type="checkbox"/> worst case			Shadow <input type="checkbox"/> expected values	
		Shadow hours per year	Shadow days per year	Max shadow hours per day	Shadow hours per year	
		[h/year]	[days/year]	[h/day]	[h/year]	
SR001	SR001	0:00	0	0:00	0:00	
SR002	SR002	0:00	0	0:00	0:00	
SR003	SR003	0:00	0	0:00	0:00	
SR004	SR004	12:26	54	0:22	4:50	
SR005	SR005	63:53	199	0:36	27:02	
SR006	SR006	34:08	137	0:24	12:14	
SR007	SR007	7:54	32	0:23	2:21	
SR008	SR008	0:00	0	0:00	0:00	
SR009	SR009	0:00	0	0:00	0:00	
SR010	SR010	0:00	0	0:00	0:00	
SR011	SR011	8:15	34	0:18	1:54	
SR012	SR012	0:00	0	0:00	0:00	
SR013	SR013	58:27	127	0:46	18:31	
SR014	SR014	2:11	18	0:11	0:53	
SR015	SR015	3:31	25	0:13	1:27	
SR016	SR016	23:52	93	0:24	8:19	
SR017	SR017	15:05	51	0:24	5:56	
SR018	SR018	47:18	92	0:42	16:35	
SR019	SR019	10:04	32	0:25	4:21	
SR020	SR020	5:05	28	0:17	2:06	
SR021	SR021	12:08	55	0:20	4:24	
SR022	SR022	43:53	89	0:46	17:42	
SR023	SR023	0:00	0	0:00	0:00	
SR024	SR024	0:00	0	0:00	0:00	
SR025	SR025	0:00	0	0:00	0:00	
SR026	SR026	0:00	0	0:00	0:00	
SR027	SR027	25:58	85	0:30	13:24	
SR028	SR028	0:00	0	0:00	0:00	
SR029	SR029	0:00	0	0:00	0:00	
SR030	SR030	0:00	0	0:00	0:00	
SR031	SR031	0:00	0	0:00	0:00	
SR032	SR032	28:31	49	0:50	12:01	

Project:

**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Main Result****Calculation:** BISON 3 Shadow Flicker (with existing BISON 1, 2)

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	BISON 1B	0:00	0:00
2	BISON 1B	4:43	1:29
3	BISON 1A	0:00	0:00
4	BISON 1A	0:00	0:00
5	BISON 1A	0:00	0:00
6	BISON 1B	22:12	9:28
7	BISON 1B	5:18	1:40
8	BISON 1A	20:41	8:35
9	BISON 1B	0:00	0:00
10	BISON 1B	0:00	0:00
11	BISON 1B	0:00	0:00
12	BISON 1A	0:00	0:00
13	BISON 1A	0:00	0:00
14	BISON 1A	0:00	0:00
15	BISON 1B	0:00	0:00
16	BISON 1A	6:50	2:49
17	BISON 1B	17:29	9:06
18	BISON 1A	0:00	0:00
19	BISON 1A	0:00	0:00
20	BISON 1B	11:13	4:54
22	BISON 1A	5:41	2:20
23	BISON 1A	0:00	0:00
25	BISON 1B	0:00	0:00
26	BISON 1B	0:00	0:00
27	BISON 1B	0:00	0:00
28	BISON 1B	8:50	2:20
29	BISON 1A	0:00	0:00
30	BISON 1B	10:25	2:53
31	BISON 1A	0:00	0:00
32	BISON 1A	0:00	0:00
33	BISON 1A	0:00	0:00
201	BISON 2	8:09	3:17
202	BISON 2	4:56	2:02
203	BISON 2	6:17	2:39
204	BISON 2	12:42	5:12
205	BISON 2	0:00	0:00
206	BISON 2	7:54	2:21
207	BISON 2	0:00	0:00
208	BISON 2	8:15	1:54
209	BISON 2	0:00	0:00
210	BISON 2	0:00	0:00
211	BISON 2	11:57	4:09
212	BISON 2	8:09	2:33
213	BISON 2	0:00	0:00
214	BISON 2	15:05	5:56
215	BISON 2	30:56	7:24
216	BISON 2	3:46	1:34
217	BISON 2	0:00	0:00
218	BISON 2	47:18	16:35
219	BISON 2	0:00	0:00
220	BISON 2	0:00	0:00
221	BISON 2	0:00	0:00
222	BISON 2	43:38	17:01
223	BISON 2	5:31	2:15
224	BISON 2	0:00	0:00
225	BISON 2	0:00	0:00

*To be continued on next page...*

Project:

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 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000

wind@eapc.net

Calculated:

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**SHADOW - Main Result****Calculation:** BISON 3 Shadow Flicker (with existing BISON 1, 2)

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
226	BISON 2	10:04	4:21
227	BISON 2	0:00	0:00
228	BISON 2	6:52	2:47
229	BISON 2	0:00	0:00
230	BISON 2	0:00	0:00
231	BISON 2	0:00	0:00
232	BISON 2	0:00	0:00
233	BISON 2	0:00	0:00
234	BISON 2	0:00	0:00
235	BISON 2	0:00	0:00
301	BISON 3	5:14	2:35
302	BISON 3	20:44	10:48
303	BISON 3	0:00	0:00
304	BISON 3	0:00	0:00
305	BISON 3	0:00	0:00
306	BISON 3	0:00	0:00
307	BISON 3	0:00	0:00
308	BISON 3	0:00	0:00
309	BISON 3	0:00	0:00
310	BISON 3	5:04	2:06
311	BISON 3	0:00	0:00
312	BISON 3	0:00	0:00
313	BISON 3	0:00	0:00
314	BISON 3	0:00	0:00
315	BISON 3	0:00	0:00
316	BISON 3	0:00	0:00
317	BISON 3	0:00	0:00
318	BISON 3	0:00	0:00
319	BISON 3	0:00	0:00
320	BISON 3	7:53	3:20
321	BISON 3	20:58	8:49
322	BISON 3	0:00	0:00
323	BISON 3	0:00	0:00
324	BISON 3	0:00	0:00
325	BISON 3	0:00	0:00
326	BISON 3	0:00	0:00
327	BISON 3	0:00	0:00
328	BISON 3	0:00	0:00
329	BISON 3	0:00	0:00
330	BISON 3	0:00	0:00
331	BISON 3	0:00	0:00
332	BISON 3	0:00	0:00
333	BISON 3	0:00	0:00
334	BISON 3	0:00	0:00
335	BISON 3	0:00	0:00

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power
Frank Frederickson
30 West Superior Street
Duluth, MN 55802-2093

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EAPC Wind Energy
3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated: 6/17/2011 12:07 PM/2.7.486

SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR001 - SR001

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

Operational time
N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for each day of the month, showing sun rise and set times (hh:mm) and minutes with flicker.

Table layout: [checkbox] for each day in each month the following matrix [checkbox] apply

Summary table with columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time)

Project:

**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
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**SHADOW - Calendar**

**Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR002 - SR002**

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:32 17:07	08:12 17:48	07:28 18:29	07:27 20:14	06:32 20:55	05:56 21:32	05:55 21:45	06:25 21:21	07:05 20:29	07:44 19:29	07:28 17:31	08:11 17:00
2	08:32 17:08	08:11 17:50	07:26 18:31	07:25 20:15	06:30 20:56	05:55 21:33	05:55 21:45	06:26 21:20	07:06 20:27	07:46 19:27	07:30 17:30	08:12 16:59
3	08:32 17:09	08:10 17:51	07:24 18:32	07:23 20:16	06:29 20:57	05:54 21:34	05:56 21:45	06:27 21:19	07:07 20:25	07:47 19:25	07:31 17:28	08:13 16:59
4	08:32 17:10	08:08 17:53	07:22 18:34	07:21 20:18	06:27 20:59	05:54 21:35	05:57 21:45	06:29 21:17	07:09 20:24	07:48 19:23	07:33 17:27	08:14 16:58
5	08:32 17:11	08:07 17:54	07:20 18:35	07:19 20:19	06:26 21:00	05:53 21:36	05:57 21:44	06:30 21:16	07:10 20:22	07:50 19:21	07:34 17:25	08:15 16:58
6	08:32 17:13	08:06 17:56	07:18 18:37	07:17 20:20	06:24 21:02	05:53 21:37	05:58 21:44	06:31 21:14	07:11 20:20	07:51 19:19	07:36 17:24	08:17 16:58
7	08:32 17:14	08:04 17:58	07:16 18:38	07:15 20:22	06:23 21:03	05:52 21:37	05:59 21:44	06:32 21:13	07:13 20:18	07:52 19:18	07:37 17:22	08:18 16:58
8	08:32 17:15	08:03 17:59	07:14 18:40	07:13 20:23	06:21 21:04	05:52 21:38	06:00 21:43	06:34 21:11	07:14 20:16	07:54 19:16	07:39 17:21	08:19 16:57
9	08:31 17:16	08:01 18:01	08:12 19:41	07:11 20:25	06:20 21:05	05:52 21:39	06:00 21:43	06:35 21:10	07:15 20:14	07:55 19:14	07:40 17:20	08:20 16:57
10	08:31 17:17	08:00 18:01	08:11 19:43	07:09 20:26	06:18 21:07	05:51 21:40	06:01 21:42	06:36 21:08	07:17 20:12	07:57 19:12	07:42 17:18	08:21 16:57
11	08:30 17:18	07:58 18:02	08:09 19:44	07:07 20:27	06:17 21:08	05:51 21:40	06:02 21:42	06:37 21:07	07:18 20:10	07:58 19:10	07:43 17:17	08:22 16:57
12	08:30 17:20	07:57 18:04	08:07 19:45	07:06 20:29	06:16 21:09	05:51 21:41	06:03 21:41	06:39 21:05	07:19 20:08	07:59 19:08	07:45 17:16	08:23 16:57
13	08:29 17:21	07:55 18:05	08:05 19:47	07:04 20:30	06:14 21:11	05:51 21:42	06:04 21:40	06:40 21:03	07:20 20:06	08:01 19:06	07:46 17:15	08:23 16:57
14	08:29 17:22	07:54 18:07	08:03 19:48	07:02 20:31	06:13 21:12	05:51 21:42	06:05 21:40	06:41 21:02	07:22 20:04	08:02 19:04	07:47 17:14	08:24 16:57
15	08:28 17:24	07:52 18:08	08:01 19:50	07:00 20:33	06:12 21:13	05:51 21:43	06:06 21:39	06:43 21:00	07:23 20:02	08:04 19:02	07:49 17:12	08:25 16:57
16	08:28 17:25	07:50 18:10	07:59 19:51	06:58 20:34	06:11 21:14	05:51 21:43	06:07 21:38	06:44 20:58	07:24 20:00	08:05 19:00	07:50 17:11	08:26 16:58
17	08:27 17:26	07:49 18:11	07:57 19:53	06:56 20:36	06:09 21:16	05:51 21:43	06:08 21:37	06:45 20:57	07:26 19:58	08:06 18:57	07:52 17:10	08:27 16:58
18	08:26 17:28	07:47 18:13	07:55 19:54	06:54 20:37	06:08 21:17	05:51 21:44	06:09 21:37	06:47 20:55	07:27 19:56	08:08 18:55	07:53 17:09	08:27 16:58
19	08:26 17:29	07:45 18:14	07:53 19:55	06:53 20:38	06:07 21:18	05:51 21:44	06:10 21:36	06:48 20:53	07:28 19:54	08:09 18:53	07:55 17:08	08:28 16:59
20	08:25 17:30	07:44 18:16	07:51 19:57	06:51 20:40	06:06 21:19	05:51 21:45	06:11 21:35	06:49 20:52	07:30 19:52	08:11 18:51	07:56 17:07	08:29 16:59
21	08:24 17:32	07:42 18:17	07:49 19:58	06:49 20:41	06:05 21:21	05:51 21:45	06:12 21:34	06:50 20:50	07:31 19:50	08:12 18:49	07:57 17:06	08:29 16:59
22	08:23 17:33	07:40 18:19	07:47 20:00	06:47 20:42	06:04 21:22	05:51 21:45	06:13 21:33	06:52 20:48	07:32 19:47	08:14 18:48	07:59 17:06	08:30 17:00
23	08:22 17:35	07:38 18:21	07:45 20:01	06:45 20:44	06:03 21:23	05:51 21:45	06:14 21:32	06:53 20:46	07:34 19:45	08:15 18:46	08:00 17:05	08:30 17:00
24	08:21 17:36	07:37 18:22	07:43 20:02	06:44 20:45	06:02 21:24	05:52 21:45	06:15 21:31	06:54 20:44	07:35 19:43	08:16 18:44	08:02 17:04	08:31 17:01
25	08:20 17:38	07:35 18:24	07:41 20:04	06:42 20:47	06:01 21:25	05:52 21:46	06:16 21:30	06:56 20:42	07:36 19:41	08:18 18:43	08:03 17:03	08:31 17:02
26	08:19 17:39	07:33 18:25	07:39 20:05	06:40 20:48	06:00 21:26	05:52 21:46	06:18 21:29	06:57 20:41	07:38 19:39	08:19 18:41	08:04 17:02	08:31 17:02
27	08:18 17:41	07:31 18:26	07:37 20:07	06:38 20:49	05:59 21:27	05:53 21:46	06:19 21:27	06:58 20:39	07:39 19:37	08:21 18:39	08:06 17:02	08:32 17:03
28	08:17 17:42	07:29 18:28	07:35 20:08	06:37 20:51	05:58 21:28	05:54 21:46	06:20 21:26	07:00 20:37	07:40 19:35	08:22 18:38	08:07 17:01	08:32 17:04
29	08:16 17:44	07:33 18:29	07:33 20:09	06:35 20:52	05:58 21:29	05:54 21:46	06:21 21:25	07:01 20:35	07:42 19:33	08:24 18:36	08:08 17:01	08:32 17:05
30	08:15 17:45	07:31 18:34	07:31 20:11	06:34 20:53	05:57 21:30	05:54 21:46	06:22 21:24	07:02 20:33	07:43 19:31	08:25 18:34	08:09 17:00	08:32 17:05
31	08:14 17:47	07:29 18:31	07:29 20:12	06:33 20:53	05:56 21:31	05:52 21:46	06:24 21:23	07:04 20:31	07:44 19:33	08:27 18:33	08:08 17:06	08:32 17:06
Potential sun hours	279	287	368	407	466	475	480	441	378	338	282	266
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout:  or each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)		Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:

**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Calendar**

**Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR003 - SR003**

**Assumptions for shadow calculations**

Maximum distance for influence **1,500 m**  
 Minimum sun height over horizon for influence **3 °**  
 Day step for calculation **1 days**  
 Time step for calculation **1 minutes**

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:33 17:08	08:13 17:49	07:28 18:30	07:27 20:14	06:32 20:55	05:56 21:33	05:55 21:46	06:25 21:22	07:05 20:30	07:45 19:30	07:29 17:32	08:11 17:00
2	08:33 17:09	08:11 17:50	07:26 18:31	07:25 20:15	06:31 20:56	05:55 21:33	05:56 21:45	06:27 21:20	07:07 20:28	07:46 19:28	07:30 17:30	08:12 17:00
3	08:33 17:10	08:10 17:52	07:24 18:33	07:23 20:17	06:29 20:58	05:55 21:34	05:57 21:45	06:28 21:19	07:08 20:26	07:47 19:26	07:31 17:29	08:13 16:59
4	08:33 17:11	08:09 17:53	07:22 18:34	07:21 20:18	06:28 20:59	05:54 21:35	05:57 21:45	06:29 21:17	07:09 20:24	07:49 19:24	07:33 17:27	08:15 16:59
5	08:32 17:12	08:07 17:55	07:20 18:36	07:19 20:19	06:26 21:00	05:54 21:36	05:58 21:45	06:30 21:16	07:10 20:22	07:50 19:22	07:34 17:26	08:16 16:58
6	08:32 17:13	08:06 17:56	07:19 18:37	07:18 20:21	06:25 21:02	05:53 21:37	05:59 21:44	06:32 21:15	07:12 20:20	07:51 19:20	07:36 17:24	08:17 16:58
7	08:32 17:14	08:05 17:58	07:17 18:39	07:16 20:22	06:23 21:03	05:53 21:38	05:59 21:44	06:33 21:13	07:13 20:18	07:53 19:18	07:37 17:23	08:18 16:58
8	08:32 17:15	08:03 18:00	07:15 18:40	07:14 20:24	06:22 21:04	05:53 21:39	06:00 21:44	06:34 21:12	07:14 20:16	07:54 19:16	07:39 17:22	08:19 16:58
9	08:31 17:16	08:02 18:00	07:12 18:43	07:12 20:25	06:20 21:06	05:52 21:39	06:01 21:43	06:35 21:10	07:16 20:14	07:56 19:14	07:40 17:20	08:20 16:58
10	08:31 17:18	08:00 18:01	07:11 19:43	07:10 20:26	06:19 21:07	05:52 21:40	06:02 21:43	06:37 21:09	07:17 20:12	07:57 19:12	07:42 17:19	08:21 16:58
11	08:31 17:19	07:59 18:03	07:09 19:44	07:08 20:28	06:17 21:08	05:52 21:41	06:03 21:42	06:38 21:07	07:18 20:10	07:58 19:10	07:43 17:18	08:22 16:58
12	08:30 17:20	07:57 18:04	07:07 19:46	07:06 20:29	06:16 21:10	05:51 21:41	06:03 21:41	06:39 21:05	07:20 20:08	08:00 19:08	07:45 17:16	08:23 16:58
13	08:30 17:21	07:56 18:06	07:05 19:47	07:04 20:30	06:15 21:11	05:51 21:42	06:04 21:41	06:40 21:04	07:21 20:06	08:01 19:06	07:46 17:15	08:24 16:58
14	08:29 17:23	07:54 18:07	07:03 19:49	07:02 20:32	06:14 21:12	05:51 21:42	06:05 21:40	06:42 21:02	07:22 20:04	08:02 19:04	07:48 17:14	08:25 16:58
15	08:29 17:24	07:52 18:09	07:01 19:50	07:00 20:33	06:12 21:14	05:51 21:43	06:06 21:39	06:43 21:00	07:23 20:02	08:04 19:03	07:49 17:13	08:25 16:58
16	08:28 17:25	07:51 18:10	07:00 19:52	06:59 20:35	06:11 21:15	05:51 21:43	06:07 21:39	06:44 20:59	07:25 20:00	08:05 19:01	07:51 17:12	08:26 16:58
17	08:27 17:27	07:49 18:12	07:00 19:53	06:57 20:36	06:10 21:16	05:51 21:44	06:08 21:38	06:46 20:57	07:26 19:58	08:07 18:57	07:52 17:11	08:27 16:58
18	08:27 17:28	07:47 18:13	07:00 19:54	06:55 20:37	06:09 21:17	05:51 21:44	06:09 21:37	06:47 20:55	07:27 19:56	08:08 18:55	07:54 17:10	08:28 16:59
19	08:26 17:29	07:46 18:15	07:00 19:56	06:53 20:39	06:08 21:18	05:51 21:45	06:10 21:36	06:48 20:54	07:29 19:54	08:10 18:53	07:55 17:09	08:28 16:59
20	08:25 17:31	07:44 18:16	07:00 19:57	06:51 20:40	06:06 21:20	05:51 21:45	06:11 21:35	06:50 20:52	07:30 19:52	08:11 18:52	07:56 17:08	08:29 16:59
21	08:24 17:32	07:42 18:18	07:00 19:59	06:49 20:41	06:05 21:21	05:52 21:45	06:12 21:34	06:51 20:50	07:31 19:50	08:12 18:50	07:58 17:07	08:29 17:00
22	08:23 17:34	07:41 18:19	07:00 20:00	06:48 20:43	06:04 21:22	05:52 21:45	06:14 21:33	06:52 20:48	07:33 19:48	08:14 18:48	07:59 17:06	08:30 17:00
23	08:22 17:35	07:39 18:21	07:00 20:01	06:46 20:44	06:03 21:23	05:52 21:46	06:15 21:32	06:53 20:46	07:34 19:46	08:15 18:46	08:01 17:05	08:30 17:01
24	08:22 17:37	07:37 18:22	07:00 20:03	06:44 20:46	06:02 21:24	05:52 21:46	06:16 21:31	06:55 20:45	07:35 19:44	08:17 18:45	08:02 17:04	08:31 17:02
25	08:21 17:38	07:35 18:24	07:00 20:04	06:42 20:47	06:01 21:25	05:53 21:46	06:17 21:30	06:56 20:43	07:37 19:42	08:18 18:43	08:03 17:04	08:31 17:02
26	08:19 17:40	07:33 18:25	07:00 20:06	06:41 20:49	06:01 21:26	05:53 21:46	06:18 21:29	06:57 20:41	07:38 19:40	08:20 18:41	08:05 17:03	08:32 17:03
27	08:18 17:41	07:32 18:27	07:00 20:07	06:39 20:50	06:00 21:28	05:53 21:46	06:19 21:28	06:59 20:39	07:39 19:38	08:21 18:40	08:06 17:02	08:32 17:04
28	08:17 17:43	07:30 18:28	07:00 20:08	06:37 20:51	05:59 21:29	05:54 21:46	06:20 21:27	07:00 20:37	07:41 19:36	08:23 18:38	08:07 17:02	08:32 17:04
29	08:16 17:44	07:33 18:20	07:00 20:10	06:36 20:52	05:58 21:30	05:54 21:46	06:22 21:25	07:01 20:35	07:42 19:34	08:24 18:36	08:09 17:01	08:32 17:05
30	08:15 17:46	07:31 18:21	07:00 20:11	06:34 20:54	05:57 21:31	05:55 21:46	06:23 21:24	07:03 20:33	07:43 19:32	08:26 18:35	08:10 17:01	08:32 17:06
31	08:14 17:47	07:29 18:13	07:00 20:13	06:32 20:54	05:57 21:32	05:57 21:46	06:24 21:23	07:04 20:32	07:44 19:33	08:27 18:33	08:11 17:01	08:33 17:07
Potential sun hours	279	287	368	407	466	475	480	441	378	338	282	266
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout:  for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)		Last time (hh:mm) with flicker	(WTG causing flicker last time)



Project: Minnesota Power - BISON Wind Energy Center

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Licensed user: EAPC Wind Energy
3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated: 6/17/2011 12:07 PM/2.7.486

SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR004 - SR004

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

Operational time
N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for days (1 to 31). Each cell contains a time range (e.g., 08:33-17:08) and a numerical value (e.g., 10). A summary table at the bottom shows 'Potential sun hours' and 'Total, worst case' for each month.

Table layout: for each day in each month the following matrix apply

Table with 4 columns: Day in month, Sun rise (hh:mm) / Sun set (hh:mm), Minutes with flicker, and First/Last time (hh:mm) with flicker (WTG causing flicker first/last time).

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR005 - SR005

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:33 17:08	08:12 17:49	17:11 (28) 07:28 17:22 (28) 18:30	07:27 20:14	19:00 (6) 06:32 19:36 (6) 20:55	06:54 (202) 05:56 07:03 (202) 21:32
2	08:33 17:09	08:11 17:50	17:09 (28) 07:26 17:23 (28) 18:31	07:25 20:15	18:59 (6) 06:31 19:35 (6) 20:56	06:53 (202) 05:55 07:04 (202) 21:33
3	08:33 17:10	08:10 17:52	17:09 (28) 07:24 17:25 (28) 18:33	07:23 20:16	18:59 (6) 06:29 19:35 (6) 20:58	06:51 (202) 05:55 07:03 (202) 21:34
4	08:32 17:11	08:09 17:53	17:09 (28) 07:22 17:27 (28) 18:34	07:21 20:18	18:59 (6) 06:27 19:34 (6) 20:59	06:50 (202) 05:54 07:04 (202) 21:35
5	08:32 17:12	08:07 17:55	17:08 (28) 07:20 17:28 (28) 18:36	07:19 20:19	18:59 (6) 06:26 19:34 (6) 21:00	06:48 (202) 05:54 07:03 (202) 21:36
6	08:32 17:13	08:06 17:56	17:08 (28) 07:18 17:29 (28) 18:37	07:17 20:21	19:00 (6) 06:24 19:33 (6) 21:02	06:47 (202) 05:53 07:03 (202) 21:37
7	08:32 17:14	08:04 17:58	17:08 (28) 07:16 17:29 (28) 18:38	07:15 20:22	19:00 (6) 06:23 19:32 (6) 21:03	06:46 (202) 05:53 07:02 (202) 21:38
8	08:32 17:15	08:03 17:59	17:08 (28) 08:15 17:30 (28) 18:40	07:13 20:23	19:01 (6) 06:21 19:31 (6) 21:04	06:46 (202) 05:52 07:01 (202) 21:38
9	08:31 17:16	08:02 18:01	17:08 (28) 08:13 17:29 (28) 19:41	07:12 20:25	19:02 (6) 06:20 19:30 (6) 21:06	06:48 (202) 05:52 07:00 (202) 21:39
10	08:31 17:17	08:00 18:01	17:09 (28) 08:11 17:29 (28) 19:43	07:10 20:26	19:03 (6) 06:19 19:28 (6) 21:07	06:48 (202) 05:52 06:58 (202) 21:40
11	08:31 17:19	07:59 18:02	17:09 (28) 08:09 17:28 (28) 19:44	07:08 20:28	19:05 (6) 06:17 19:26 (6) 21:08	06:52 (202) 05:51 06:55 (202) 21:40
12	08:30 17:20	07:57 18:04	17:10 (28) 08:07 17:27 (28) 19:46	07:06 20:29	19:07 (6) 06:16 19:23 (6) 21:10	06:51 (202) 05:51 21:41
13	08:30 17:21	07:55 18:05	17:11 (28) 08:05 17:27 (28) 19:47	07:04 20:30	07:25 (201) 06:15 19:20 (6) 21:11	06:51 (202) 05:51 21:42
14	08:29 17:22	07:54 18:07	17:13 (28) 08:03 17:25 (28) 19:49	07:02 20:32	07:23 (201) 06:13 07:29 (201) 21:12	06:51 (202) 05:51 21:42
15	08:29 17:24	07:52 18:09	17:16 (28) 08:01 17:23 (28) 19:50	07:00 20:33	07:21 (201) 06:12 07:30 (201) 21:13	06:51 (202) 05:51 21:43
16	08:28 17:25	07:51 18:10	17:17 (28) 08:00 19:51	06:58 20:34	07:20 (201) 06:11 07:32 (201) 21:15	06:51 (202) 05:51 21:43
17	08:27 17:26	07:49 18:12	17:18 (28) 08:00 19:53	06:56 20:36	07:18 (201) 06:10 07:32 (201) 21:16	06:51 (202) 05:51 21:44
18	08:26 17:28	07:47 18:13	17:19 (28) 08:00 19:54	06:55 20:37	07:16 (201) 06:08 07:32 (201) 21:17	06:51 (202) 05:51 21:44
19	08:26 17:29	07:46 18:15	17:20 (28) 08:00 19:56	06:53 20:39	07:14 (201) 06:07 07:32 (201) 21:18	06:51 (202) 05:51 21:44
20	08:25 17:31	07:44 18:16	17:21 (28) 08:00 19:57	06:51 20:40	07:12 (201) 06:06 07:32 (201) 21:19	06:51 (202) 05:51 21:45
21	08:24 17:32	07:42 18:18	17:22 (28) 08:00 19:58	06:49 20:41	07:11 (201) 06:05 07:32 (201) 21:21	06:51 (202) 05:51 21:45
22	08:23 17:34	07:40 18:19	17:23 (28) 08:00 20:00	06:47 20:42	07:09 (201) 06:04 07:31 (201) 21:22	06:51 (202) 05:51 21:45
23	08:22 17:35	07:39 18:21	17:24 (28) 08:00 20:01	06:46 20:43	07:09 (201) 06:03 07:30 (201) 21:23	06:52 (202) 05:52 21:45
24	08:21 17:36	07:37 18:22	17:25 (28) 08:00 20:03	06:44 20:45	07:10 (201) 06:02 07:30 (201) 21:24	06:52 (202) 05:52 21:46
25	08:20 17:38	07:35 18:24	17:26 (28) 08:00 20:04	06:42 20:47	07:10 (201) 06:01 07:29 (201) 21:25	06:52 (202) 05:52 21:46
26	08:19 17:39	07:33 18:25	17:27 (28) 08:00 20:05	06:40 20:48	07:10 (201) 06:00 07:27 (201) 21:26	20:55 (17) 05:53 21:00 (17) 21:46
27	08:18 17:41	07:31 18:27	17:28 (28) 08:00 20:06	06:39 20:49	07:12 (201) 06:00 07:26 (201) 21:27	20:53 (17) 05:53 21:00 (17) 21:46
28	08:17 17:42	07:30 18:28	17:29 (28) 08:00 20:07	06:37 20:50	06:59 (202) 05:59 07:24 (201) 21:28	20:51 (17) 05:54 21:01 (17) 21:46
29	08:16 17:44	07:29 18:29	17:30 (28) 08:00 20:08	06:35 20:51	06:57 (202) 05:58 07:24 (201) 21:28	20:50 (17) 05:54 21:02 (17) 21:46
30	08:15 17:45	17:14 (28) 07:28 17:18 (28) 07:30	17:31 (28) 08:00 20:09	06:34 20:52	06:56 (202) 05:57 07:02 (202) 21:29	20:50 (17) 05:55 21:02 (17) 21:46
31	08:14 17:47	17:12 (28) 07:28 17:20 (28) 07:30	17:32 (28) 08:00 20:10	06:33 20:53	06:56 (202) 05:57 07:03 (202) 21:30	20:49 (17) 05:55 21:03 (17) 21:46
Potential sun hours	279	287	368	407	466	475
Total, worst case	12	255	354	629	195	692
Sun reduction	0.55	0.50	0.63	0.59	0.68	0.71
Oper. time red.	0.97	0.97	0.97	0.97	0.97	0.97
Wind dir. red.	0.57	0.57	0.67	0.66	0.65	0.74
Total reduction	0.30	0.27	0.41	0.38	0.43	0.51
Total, real	4	70	145	236	83	352

Table layout: for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
	Sun set (hh:mm)					

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR005 - SR005

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

July		August		September		October		November		December	
1	05:55 21:46	23	20:53 (17) 21:16 (17)	20:25 21:21		21	07:05 19:04 (6)	07:28 19:04 (6)	16:38 (28) 17:31	20	08:11 16:58 (28)
2	05:56 21:45	24	20:53 (17) 21:17 (17)	06:26 21:20	6 07:01 (202)	25	07:06 19:01 (6)	07:30 19:26 (6)	17:00 17:30	21	08:12 16:59 (28)
3	05:56 21:45	23	20:53 (17) 21:16 (17)	06:28 21:19	11 06:58 (202)	28	07:08 19:07 (6)	07:31 19:27 (6)	17:28 17:28	21	08:13 16:59 (28)
4	05:57 21:45	22	20:54 (17) 21:16 (17)	06:29 21:17	13 06:57 (202)	29	07:09 19:10 (202)	07:33 19:28 (6)	17:27 17:27	22	08:14 16:59 (28)
5	05:58 21:45	22	20:54 (17) 21:16 (17)	06:30 21:16	15 06:57 (202)	32	07:10 19:12 (202)	07:34 19:29 (6)	17:26 17:26	21	08:16 16:59 (28)
6	05:58 21:44	21	20:54 (17) 21:15 (17)	06:31 21:14	16 06:56 (202)	33	07:12 19:12 (202)	07:36 19:29 (6)	17:24 17:24	19	08:17 16:58 (28)
7	05:59 21:44	20	20:55 (17) 21:15 (17)	06:33 21:13	15 06:57 (202)	35	07:13 19:12 (202)	07:37 19:29 (6)	17:23 17:23	17	08:18 16:56 (28)
8	06:00 21:43	19	20:56 (17) 21:15 (17)	06:34 21:11	14 06:58 (202)	35	07:14 19:12 (202)	07:39 19:29 (6)	17:21 17:21	15	08:19 16:55 (28)
9	06:01 21:43	18	20:56 (17) 21:14 (17)	06:35 21:10	13 06:59 (202)	36	07:15 19:12 (202)	07:40 19:29 (6)	17:20 17:20	13	08:20 16:53 (28)
10	06:01 21:42	17	20:56 (17) 21:13 (17)	06:36 21:08	12 07:01 (202)	36	07:17 19:13 (202)	07:42 19:29 (6)	17:19 17:19	10	08:21 16:52 (28)
11	06:02 21:42	16	20:57 (17) 21:13 (17)	06:38 21:07	10 07:02 (202)	36	07:18 19:13 (202)	07:43 19:28 (6)	17:17 17:17	7	08:22 16:50 (28)
12	06:03 21:41	15	20:57 (17) 21:12 (17)	06:39 21:05	9 07:03 (202)	36	07:19 19:14 (202)	07:45 19:28 (6)	17:16 17:16	3	08:23 16:50 (28)
13	06:04 21:41	14	20:58 (17) 21:12 (17)	06:40 21:04	7 07:04 (202)	35	07:21 19:15 (202)	07:46 19:27 (6)	17:15 17:15		08:24 16:57
14	06:05 21:40	12	20:59 (17) 21:11 (17)	06:42 21:02	9 07:06 (202)	34	07:22 19:16 (202)	07:48 19:26 (6)	17:14 17:14		08:24 16:58
15	06:06 21:39	11	21:00 (17) 21:11 (17)	06:43 21:00	13 07:07 (202)	33	07:23 19:17 (202)	07:49 19:26 (6)	17:13 17:13		08:25 16:58
16	06:07 21:38	8	21:02 (17) 21:10 (17)	06:44 20:59	14 07:19 (201)	32	07:25 19:18 (202)	07:50 19:25 (6)	17:12 17:12		08:26 16:58
17	06:08 21:38	7	21:03 (17) 21:10 (17)	06:45 20:57	17 07:17 (201)	32	07:26 19:19 (202)	07:52 19:25 (20)	17:11 17:11		08:27 16:58
18	06:09 21:37	3	21:06 (17) 21:09 (17)	06:47 20:55	20 07:15 (201)	33	07:27 19:20 (202)	07:53 19:26 (20)	17:10 17:10		08:27 16:58
19	06:10 21:36		06:48 20:53	06:48 20:53	21 07:15 (201)	32	07:29 19:21 (202)	07:55 19:27 (20)	17:09 17:09		08:28 16:59
20	06:11 21:35		06:49 20:52	06:49 20:52	22 07:14 (201)	30	07:30 19:22 (202)	07:56 19:28 (20)	17:08 17:08		08:29 16:59
21	06:12 21:34		06:51 20:50	06:51 20:50	22 07:14 (201)	26	07:31 19:23 (202)	07:58 19:24 (20)	17:07 17:07		08:29 17:00
22	06:13 21:33		06:52 20:48	06:52 20:48	21 07:15 (201)	19	07:32 19:24 (202)	07:59 19:03 (6)	17:06 17:06		08:30 17:00
23	06:14 21:32		06:53 20:46	06:53 20:46	21 07:17 (201)	11	07:33 19:25 (202)	08:00 19:09 (20)	17:05 17:05		08:30 17:01
24	06:16 21:31		06:55 20:44	06:55 20:44	19 07:36 (201)	8	07:34 19:26 (202)	08:02 19:09 (20)	17:04 17:04		08:31 17:01
25	06:17 21:30		06:56 20:43	06:56 20:43	18 07:36 (201)	5	07:35 19:27 (202)	08:03 19:10 (20)	17:03 17:03		08:31 17:02
26	06:18 21:29		06:57 20:41	06:57 20:41	16 07:35 (201)	2	07:36 19:28 (202)	08:04 19:13 (20)	17:03 17:03		08:31 17:03
27	06:19 21:28		06:58 20:39	06:58 20:39	14 07:34 (201)		07:37 19:29 (202)	08:06 19:14 (20)	17:03 17:03		08:32 17:03
28	06:20 21:26		07:00 20:37	07:00 20:37	12 07:34 (201)	8	07:38 19:30 (202)	08:07 17:44 (28)	17:02 17:42 (28)		08:32 17:03
29	06:21 21:25		07:01 20:35	07:01 20:35	9 07:32 (201)	13	07:39 19:31 (202)	08:08 17:41 (28)	17:01 17:41 (28)		08:32 17:03
30	06:23 21:24		07:02 20:33	07:02 20:33	6 07:30 (201)	16	07:40 19:32 (202)	08:08 17:39 (28)	17:01 17:39 (28)		08:32 17:03
31	06:24 21:23		07:04 20:31	07:04 20:31	13 19:20 (6)	18	07:41 19:33 (202)	08:09 17:39 (28)	17:00 17:39 (28)		08:32 17:03
Potential sun hours	480		441	441		378	338	338	282		266
Total, worst case		295		424		714		74		189	
Sun reduction		0.75		0.73		0.69		0.52		0.43	
Oper. time red.		0.97		0.97		0.97		0.97		0.97	
Wind dir. red.		0.74		0.62		0.68		0.57		0.57	
Total reduction		0.54		0.44		0.45		0.29		0.24	
Total, real		160		186		321		21		44	

Table layout:  for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
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Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR006 - SR006

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:32	08:12	07:28	17:42 (2)	07:27	07:48 (203)
	17:08	17:48	18:30	16	17:58 (2)	20:14
2	08:32	08:11	07:26	17:43 (2)	07:25	07:46 (203)
	17:09	17:50	18:31	13	17:56 (2)	20:15
3	08:32	08:10	07:24	17:45 (2)	07:23	07:44 (203)
	17:10	17:52	18:33	11	17:56 (2)	20:16
4	08:32	08:08	17:18 (30)	07:22	17:47 (2)	07:21
	17:11	17:53	8	17:26 (30)	20:18	21
5	08:32	08:07	17:16 (30)	07:20	07:19	07:42 (203)
	17:12	17:55	12	17:28 (30)	20:19	20
6	08:32	08:06	17:15 (30)	07:18	07:17	07:43 (203)
	17:13	17:56	15	17:30 (30)	20:21	18
7	08:32	08:04	17:13 (30)	07:16	07:15	07:44 (203)
	17:14	17:58	18	17:31 (30)	20:22	15
8	08:32	08:03	17:13 (30)	08:14	07:13	07:45 (203)
	17:15	17:59	20	17:33 (30)	20:23	13
9	08:31	08:01	17:12 (30)	08:13	07:11	07:48 (203)
	17:16	18:01	22	17:34 (30)	20:25	7
10	08:31	08:00	17:12 (30)	08:11	07:10	06:19
	17:17	18:01	23	17:35 (30)	20:26	21:07
11	08:30	07:58	17:11 (30)	08:09	07:08	06:17
	17:19	18:02	24	17:35 (30)	20:27	21:08
12	08:30	07:57	17:11 (30)	08:07	07:06	06:16
	17:20	18:04	23	17:34 (30)	20:29	2
13	08:30	07:55	17:12 (30)	08:05	07:04	06:15
	17:21	18:05	23	17:35 (30)	20:30	5
14	08:29	07:54	17:12 (30)	08:03	07:02	06:13
	17:22	18:07	22	17:34 (30)	20:32	7
15	08:28	07:52	17:12 (30)	08:01	07:00	06:12
	17:24	18:09	22	17:34 (30)	20:33	9
16	08:28	07:51	17:13 (30)	07:59	06:58	06:11
	17:25	18:10	21	17:34 (30)	20:34	11
17	08:27	07:49	17:13 (30)	07:57	06:56	06:10
	17:26	18:12	20	17:33 (30)	20:36	13
18	08:26	07:47	17:14 (30)	07:55	06:55	06:08
	17:28	18:13	17	17:31 (30)	20:37	15
19	08:26	07:46	17:17 (30)	07:53	06:53	06:07
	17:29	18:15	13	17:30 (30)	20:38	16
20	08:25	07:44	17:19 (30)	07:51	06:51	06:06
	17:31	18:16	8	17:27 (30)	20:40	17
21	08:24	07:42	17:19 (30)	07:49	06:49	06:05
	17:32	18:18		19:58	20:41	19
22	08:23	07:40	17:48 (2)	07:47	06:47	06:04
	17:33	18:19	6	17:54 (2)	20:43	20
23	08:22	07:39	17:45 (2)	07:45	06:46	06:03
	17:35	18:21	11	17:56 (2)	20:44	21
24	08:21	07:37	17:45 (2)	07:43	06:44	06:02
	17:36	18:22	13	17:58 (2)	20:45	20
25	08:20	07:35	17:43 (2)	07:41	06:42	06:01
	17:38	18:24	16	17:59 (2)	20:47	20
26	08:19	07:33	17:43 (2)	07:39	06:40	06:00
	17:39	18:25	16	17:59 (2)	20:48	20
27	08:18	07:31	17:42 (2)	07:37	06:39	05:59
	17:41	18:27	17	17:59 (2)	20:49	20
28	08:17	07:30	17:42 (2)	07:35	07:56 (203)	06:37
	17:42	18:28	16	17:58 (2)	20:51	18
29	08:16		17:41 (2)	07:33	07:54 (203)	06:35
	17:44			20:09	07:52 (203)	06:34
30	08:15		17:40 (2)	07:31	08:03 (203)	06:33
	17:45			20:11	07:52 (203)	06:32
31	08:14		17:39 (2)	07:29	08:03 (203)	06:31
	17:47			20:12	07:50 (203)	06:30
Potential sun hours	279	287	368	407	466	475
Total, worst case		406	85	148	304	77
Sun reduction		0.50	0.63	0.59	0.68	0.71
Oper. time red.		0.97	0.97	0.97	0.97	0.97
Wind dir. red.		0.59	0.64	0.68	0.58	0.58
Total reduction		0.28	0.39	0.39	0.39	0.40
Total, real		116	33	58	117	31

Table layout: for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker
			(WTG causing flicker last time)

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR006 - SR006

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

July	August	September	October	November	December
1 05:55 21:45	06:25 21:21	07:05 20:29	07:44 19:30	07:28 17:31	16:41 (30) 17:00
2 05:56 21:45	06:26 21:20	07:06 20:27	07:46 19:28	07:30 17:30	16:42 (30) 16:59
3 05:56 21:45	06:27 21:19	07:08 20:26	7 07:45 (203) 07:47 07:52 (203) 19:26	07:31 17:28	16:42 (30) 16:59
4 05:57 21:45	06:29 21:17	07:09 20:24	12 07:43 (203) 07:48 07:55 (203) 19:24	07:33 17:27	16:43 (30) 16:59
5 05:58 21:44	4 06:44 (204) 06:30 21:16	07:10 20:22	16 07:41 (203) 07:50 07:57 (203) 19:22	07:34 17:25	16:45 (30) 16:58
6 05:58 21:44	7 06:49 (204) 06:31 21:14	07:11 20:20	18 07:39 (203) 07:51 07:57 (203) 19:20	07:36 17:24	16:46 (30) 16:58
7 05:59 21:44	9 06:41 (204) 06:33 21:13	07:13 20:18	19 07:38 (203) 07:53 07:57 (203) 19:18	07:37 17:23	16:49 (30) 16:58
8 06:00 21:43	10 06:41 (204) 06:34 21:11	07:14 20:16	21 07:37 (203) 07:54 07:58 (203) 19:16	07:39 17:21	16:58 16:58
9 06:01 21:43	13 06:39 (204) 06:35 21:10	07:15 20:14	20 07:38 (203) 07:55 07:58 (203) 19:14	07:40 17:20	16:57 16:57
10 06:01 21:42	14 06:39 (204) 06:36 21:08	07:17 20:12	18 07:39 (203) 07:57 07:57 (203) 19:12	9 18:20 (2) 07:42 18:29 (2) 17:19	16:57 16:57
11 06:02 21:42	15 06:39 (204) 06:38 21:07	07:18 20:10	16 07:40 (203) 07:58 07:56 (203) 19:10	13 18:17 (2) 07:43 18:30 (2) 17:17	16:57 16:57
12 06:03 21:41	15 06:39 (204) 06:39 21:05	07:19 20:08	14 07:42 (203) 07:59 07:56 (203) 19:08	14 18:17 (2) 07:45 18:31 (2) 17:16	16:57 16:57
13 06:04 21:40	17 06:38 (204) 06:40 21:03	07:21 20:06	12 07:43 (203) 08:01 07:55 (203) 19:06	16 18:15 (2) 07:46 18:31 (2) 17:15	16:57 16:57
14 06:05 21:40	18 06:38 (204) 06:42 21:02	07:22 20:04	9 07:44 (203) 08:02 07:53 (203) 19:04	17 18:15 (2) 07:48 18:32 (2) 17:14	16:58 16:58
15 06:06 21:39	18 06:38 (204) 06:43 21:00	07:23 20:02	6 07:45 (203) 08:04 07:51 (203) 19:02	16 18:15 (2) 07:49 18:31 (2) 17:13	16:58 16:58
16 06:07 21:38	19 06:38 (204) 06:44 20:58	07:25 20:00	2 07:47 (203) 08:05 07:49 (203) 19:00	16 18:15 (2) 07:50 18:31 (2) 17:12	16:58 16:58
17 06:08 21:38	19 06:38 (204) 06:45 20:57	07:26 19:58	15 08:06 18:57 18:57 (203) 19:58	15 18:15 (2) 07:52 18:30 (2) 17:10	16:58 16:58
18 06:09 21:37	20 06:37 (204) 06:47 20:55	07:27 19:56	13 08:08 18:55 18:55 (203) 19:56	13 18:16 (2) 07:53 18:29 (2) 17:09	16:58 16:58
19 06:10 21:36	20 06:37 (204) 06:48 20:53	07:28 19:54	10 08:09 18:53 18:53 (203) 19:54	10 18:17 (2) 07:55 18:27 (2) 17:08	16:59 16:59
20 06:11 21:35	20 06:38 (204) 06:49 20:52	07:30 19:52	3 08:11 18:51 18:51 (203) 19:52	3 18:21 (2) 07:56 18:24 (2) 17:08	16:59 16:59
21 06:12 21:34	20 06:38 (204) 06:51 20:50	07:31 19:50	08:12 18:50 18:50 (203) 19:50	08:29 17:07	16:59 17:00
22 06:13 21:33	19 06:39 (204) 06:52 20:48	07:32 19:48	11 08:14 18:48 18:48 (203) 19:48	11 17:48 (30) 07:59 17:59 (30) 17:06	16:59 17:00
23 06:14 21:32	18 06:40 (204) 06:53 20:46	07:34 19:46	14 08:15 18:46 18:46 (203) 19:46	14 17:46 (30) 08:00 18:00 (30) 17:05	16:59 17:01
24 06:15 21:31	17 06:41 (204) 06:55 20:44	07:35 19:44	18 08:17 18:44 18:44 (203) 19:44	18 17:44 (30) 08:02 18:02 (30) 17:04	16:59 17:01
25 06:17 21:30	15 06:42 (204) 06:56 20:43	07:36 19:42	19 08:18 18:43 18:43 (203) 19:42	19 17:43 (30) 08:03 18:02 (30) 17:03	16:59 17:01
26 06:18 21:29	14 06:43 (204) 06:57 20:41	07:38 19:40	22 08:19 18:41 18:41 (203) 19:40	22 17:42 (30) 08:04 18:04 (30) 17:03	16:59 17:01
27 06:19 21:28	12 06:44 (204) 06:58 20:39	07:39 19:38	22 08:21 18:39 18:39 (203) 19:38	22 17:41 (30) 08:06 18:03 (30) 17:02	16:59 17:01
28 06:20 21:26	11 06:45 (204) 07:00 20:37	07:40 19:36	23 08:22 18:38 18:38 (203) 19:36	23 17:41 (30) 08:07 18:04 (30) 17:01	16:59 17:01
29 06:21 21:25	9 06:46 (204) 07:01 20:35	07:42 19:34	24 08:24 18:36 18:36 (203) 19:34	24 17:41 (30) 08:08 18:05 (30) 17:01	16:59 17:01
30 06:23 21:24	6 06:47 (204) 07:02 20:33	07:43 19:32	23 08:25 18:35 18:35 (203) 19:32	23 17:41 (30) 08:10 18:04 (30) 17:00	16:59 17:01
31 06:24 21:23	3 06:49 (204) 07:04 20:31	07:44 19:30	23 08:27 18:33 18:33 (203) 19:30	23 17:41 (30) 08:11 18:04 (30) 17:00	16:59 17:01
Potential sun hours	480	441	378	338	282
Total, worst case	382		190	341	115
Sun reduction	0.76		0.69	0.52	0.43
Oper. time red.	0.97		0.97	0.97	0.97
Wind dir. red.	0.58		0.68	0.59	0.58
Total reduction	0.43		0.45	0.30	0.24
Total, real	164		86	102	28

Table layout:  for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker
			(WTG causing flicker last time)

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) **Shadow receptor: SR007 - SR007**

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:32	08:12	07:28	07:27	06:32	05:56	05:55	06:25	07:05	07:44	07:28	08:11		
2	08:32	08:11	07:26	07:25	06:30	05:55	05:55	06:26	07:06	07:46	07:30	08:12		
3	08:32	08:10	07:24	07:23	06:29	05:54	05:56	06:27	07:07	07:47	07:31	08:13		
4	08:32	08:08	07:22	07:21	06:27	05:54	05:57	06:29	07:09	07:48	07:33	08:14		
5	08:32	08:07	07:20	07:19	06:26	05:53	05:57	06:30	07:10	07:50	07:34	08:15		
6	08:32	08:06	07:18	07:17	06:24	05:53	05:58	06:31	07:11	07:51	07:36	08:16		
7	08:32	08:04	07:16	07:15	06:23	05:53	05:59	06:32	07:13	07:52	07:37	08:18		
8	08:31	08:03	07:14	07:13	06:22	05:53	05:59	06:32	07:13	07:52	07:37	08:18		
9	08:31	08:01	07:12	07:11	06:20	05:52	06:00	06:34	07:14	07:54	07:39	08:19		
10	08:31	08:00	07:10	07:09	06:18	05:52	06:01	06:36	07:17	07:57	07:41	08:21		
11	08:30	07:58	07:08	07:07	06:17	05:51	06:02	06:38	07:18	07:58	07:43	08:22		
12	08:30	07:57	07:06	07:05	06:16	05:51	06:03	06:39	07:19	07:59	07:44	08:22		
13	08:29	07:55	17:38 (206)	08:05	07:04	06:14	05:51	06:04	06:40	07:20	08:01	07:46	08:23	
14	08:29	07:54	17:37 (206)	08:03	07:02	06:13	05:51	06:05	06:41	07:22	08:02	07:47	08:24	
15	08:28	07:52	17:35 (206)	08:01	07:00	06:12	05:51	06:06	06:43	07:23	08:03	18:14 (206)	07:47	08:24
16	08:28	07:50	17:34 (206)	07:59	06:58	06:11	05:51	06:07	06:44	07:24	08:05	18:11 (206)	07:49	08:25
17	08:27	07:49	17:32 (206)	07:57	06:56	06:09	05:51	06:08	06:45	07:26	08:06	18:09 (206)	07:50	08:26
18	08:26	07:47	17:30 (206)	07:55	06:54	06:08	05:51	06:09	06:47	07:27	08:08	18:07 (206)	07:52	08:26
19	08:25	07:45	17:28 (206)	07:53	06:53	06:07	05:51	06:10	06:48	07:28	08:09	18:05 (206)	07:53	08:27
20	08:25	07:44	17:26 (206)	07:51	06:51	06:06	05:51	06:11	06:49	07:30	08:11	18:04 (206)	07:54	08:28
21	08:24	07:42	17:24 (206)	07:49	06:49	06:05	05:51	06:12	06:50	07:31	08:12	18:03 (206)	07:55	08:28
22	08:23	07:40	17:22 (206)	07:47	06:47	06:04	05:51	06:13	06:52	07:32	08:13	18:02 (206)	07:56	08:29
23	08:22	07:38	17:20 (206)	07:45	06:45	06:03	05:52	06:14	06:53	07:34	08:15	18:01 (206)	07:57	08:29
24	08:21	07:37	17:18 (206)	07:43	06:44	06:02	05:52	06:15	06:54	07:35	08:16	18:00 (206)	07:58	08:30
25	08:20	07:35	17:16 (206)	07:41	06:42	06:01	05:52	06:17	06:56	07:36	08:18	18:00 (206)	07:59	08:30
26	08:19	07:33	17:14 (206)	07:39	06:40	06:00	05:53	06:18	06:57	07:38	08:19	18:00 (206)	07:59	08:30
27	08:18	07:31	17:12 (206)	07:37	06:39	05:59	05:53	06:19	06:58	07:39	08:21	18:00 (206)	07:59	08:30
28	08:17	07:29	17:10 (206)	07:35	06:37	05:59	05:53	06:20	07:00	07:40	08:22	18:00 (206)	07:59	08:30
29	08:16	07:27	17:08 (206)	07:33	06:35	05:58	05:54	06:21	07:01	07:42	08:24	18:00 (206)	07:59	08:30
30	08:15	07:25	17:06 (206)	07:31	06:34	05:57	05:54	06:22	07:02	07:43	08:25	18:00 (206)	07:59	08:30
31	08:13	07:23	17:04 (206)	07:29	06:32	05:56	05:56	06:23	07:03	07:44	08:26	18:00 (206)	07:59	08:30
Potential sun hours	279	287	368	407	466	475	480	441	378	338	282	266		
Total, worst case														
Sun reduction												240		
Oper. time red.												0.52		
Wind dir. red.												0.97		
Total reduction												0.60		
Total, real												0.31		
												73		

Table layout: ☐ for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Last time (hh:mm) with flicker	(WTG causing flicker last time)
	Minutes with flicker		

Project:

**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
Frank Frederickson  
30 West Superior Street  
Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
3100 DeMers Avenue  
US-GRAND FORKS, ND 58201  
+1 701 775 3000  
wind@eapc.net  
Calculated:  
6/17/2011 12:07 PM/2.7.486

## SHADOW - Calendar

**Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR008 - SR008**

### Assumptions for shadow calculations

Maximum distance for influence  m  
 Minimum sun height over horizon for influence  °  
 Day step for calculation  days  
 Time step for calculation  minutes

### Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

### Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:32 17:08	08:12 17:49	07:28 18:30	07:27 20:14	06:32 20:55	05:56 21:32	05:55 21:45	06:25 21:21	07:05 20:29	07:44 19:29	07:28 17:31	08:11 17:00
2	08:32 17:09	08:11 17:50	07:26 18:31	07:25 20:15	06:31 20:56	05:55 21:33	05:56 21:45	06:26 21:20	07:06 20:27	07:46 19:28	07:30 17:30	08:12 16:59
3	08:32 17:10	08:10 17:52	07:24 18:33	07:23 20:16	06:29 20:57	05:55 21:34	05:56 21:45	06:28 21:18	07:08 20:25	07:47 19:26	07:31 17:28	08:13 16:59
4	08:32 17:11	08:08 17:53	07:22 18:34	07:21 20:18	06:27 20:59	05:54 21:35	05:57 21:45	06:29 21:17	07:09 20:24	07:48 19:24	07:33 17:27	08:14 16:59
5	08:32 17:12	08:07 17:55	07:20 18:35	07:19 20:19	06:26 21:00	05:54 21:36	05:58 21:44	06:30 21:16	07:10 20:22	07:50 19:22	07:34 17:26	08:15 16:58
6	08:32 17:13	08:06 17:56	07:18 18:37	07:17 20:20	06:24 21:01	05:53 21:37	05:58 21:44	06:31 21:14	07:11 20:20	07:51 19:20	07:36 17:24	08:16 16:58
7	08:32 17:14	08:04 17:58	07:16 18:38	07:15 20:22	06:23 21:03	05:53 21:37	05:59 21:44	06:33 21:13	07:13 20:18	07:52 19:18	07:37 17:23	08:17 16:58
8	08:31 17:15	08:03 17:59	08:14 18:40	07:13 20:23	06:21 21:04	05:52 21:38	06:00 21:43	06:34 21:11	07:14 20:16	07:54 19:16	07:39 17:21	08:19 16:58
9	08:31 17:16	08:01 18:01	08:12 19:41	07:11 20:25	06:20 21:05	05:52 21:39	06:01 21:43	06:35 21:10	07:15 20:14	07:55 19:14	07:40 17:20	08:20 16:58
10	08:31 17:17	08:00 18:01	08:11 19:43	07:10 20:26	06:19 21:07	05:52 21:39	06:02 21:42	06:36 21:08	07:17 20:12	07:57 19:12	07:41 17:19	08:21 16:57
11	08:30 17:19	08:00 18:02	08:09 19:44	07:08 20:27	06:17 21:08	05:52 21:40	06:02 21:42	06:38 21:07	07:18 20:10	07:58 19:10	07:43 17:17	08:21 16:57
12	08:30 17:20	08:00 18:04	08:07 19:46	07:06 20:29	06:16 21:09	05:51 21:41	06:03 21:41	06:39 21:05	07:19 20:08	07:59 19:08	07:44 17:16	08:22 16:57
13	08:29 17:21	08:00 18:05	08:05 19:47	07:04 20:30	06:15 21:11	05:51 21:41	06:04 21:40	06:40 21:03	07:21 20:06	08:01 19:06	07:46 17:15	08:23 16:58
14	08:29 17:23	08:00 18:07	08:03 19:48	07:02 20:31	06:13 21:12	05:51 21:42	06:05 21:40	06:42 21:02	07:22 20:04	08:02 19:04	07:47 17:14	08:24 16:58
15	08:28 17:24	08:00 18:09	08:01 19:50	07:00 20:33	06:12 21:13	05:51 21:42	06:06 21:39	06:43 21:00	07:23 20:02	08:04 19:02	07:49 17:13	08:25 16:58
16	08:28 17:25	08:00 18:10	08:05 19:51	07:00 20:34	06:12 21:14	05:51 21:43	06:07 21:38	06:44 20:58	07:25 20:00	08:05 19:00	07:50 17:12	08:26 16:58
17	08:27 17:27	08:00 18:12	08:05 19:53	07:00 20:36	06:10 21:16	05:51 21:43	06:08 21:37	06:45 20:57	07:26 19:58	08:06 18:57	07:52 17:11	08:26 16:58
18	08:26 17:28	08:00 18:13	08:07 19:54	07:00 20:37	06:09 21:17	05:51 21:44	06:09 21:36	06:47 20:55	07:27 19:56	08:08 18:55	07:53 17:10	08:27 16:59
19	08:25 17:29	08:00 18:15	08:05 19:56	07:00 20:38	06:07 21:18	05:51 21:44	06:10 21:36	06:48 20:53	07:28 19:54	08:09 18:53	07:55 17:09	08:28 16:59
20	08:25 17:31	08:00 18:16	08:05 19:57	07:00 20:40	06:06 21:19	05:51 21:44	06:11 21:35	06:49 20:51	07:30 19:52	08:11 18:51	07:56 17:08	08:28 16:59
21	08:24 17:32	08:00 18:18	08:07 19:58	07:00 20:41	06:05 21:20	05:51 21:45	06:12 21:34	06:51 20:50	07:31 19:50	08:12 18:50	07:57 17:07	08:29 17:00
22	08:23 17:34	08:00 18:19	08:07 20:00	07:00 20:42	06:04 21:22	05:52 21:45	06:13 21:33	06:52 20:48	07:32 19:48	08:14 18:48	07:59 17:06	08:29 17:00
23	08:22 17:35	08:00 18:21	08:05 20:01	07:00 20:44	06:03 21:23	05:52 21:45	06:14 21:32	06:53 20:46	07:34 19:46	08:15 18:46	08:00 17:05	08:30 17:01
24	08:21 17:36	08:00 18:22	08:07 20:02	07:00 20:45	06:02 21:24	05:52 21:45	06:16 21:31	06:55 20:44	07:35 19:44	08:16 18:44	08:02 17:04	08:30 17:01
25	08:20 17:38	08:00 18:23	08:05 20:03	07:00 20:46	06:01 21:25	05:52 21:45	06:17 21:30	06:56 20:42	07:36 19:42	08:18 18:43	08:03 17:03	08:31 17:02
26	08:19 17:39	08:00 18:25	08:05 20:05	07:00 20:48	06:00 21:26	05:53 21:45	06:18 21:28	06:57 20:41	07:38 19:40	08:19 18:41	08:04 17:03	08:31 17:03
27	08:18 17:41	08:00 18:31	08:07 20:07	07:00 20:49	06:00 21:27	05:53 21:45	06:19 21:27	06:58 20:39	07:39 19:37	08:21 18:39	08:06 17:02	08:31 17:03
28	08:17 17:42	08:00 18:28	08:05 20:08	07:00 20:51	06:00 21:28	05:54 21:45	06:20 21:26	07:00 20:37	07:40 19:35	08:22 18:38	08:07 17:01	08:32 17:04
29	08:16 17:44	08:00 18:29	08:05 20:09	07:00 20:52	06:00 21:29	05:58 21:45	06:21 21:25	07:01 20:35	07:42 19:33	08:24 18:36	08:08 17:01	08:32 17:05
30	08:15 17:45	08:00 18:30	08:05 20:11	07:00 20:53	06:00 21:30	05:57 21:45	06:23 21:24	07:02 20:33	07:43 19:31	08:25 18:35	08:09 17:00	08:32 17:06
31	08:13 17:47	08:00 18:22	08:05 20:12	07:00 21:00	06:00 21:31	05:57 21:45	06:24 21:22	07:04 20:31	07:44 19:22	08:27 18:33	08:11 17:00	08:33 17:07
Potential sun hours	279	287	368	407	466	474	480	441	378	338	282	266
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout:  or each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)
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Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

## SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR009 - SR009

### Assumptions for shadow calculations

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]  

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time  

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:32 17:08	08:12 17:49	07:28 18:30	07:27 20:14	06:32 20:55	05:56 21:32	05:55 21:45	06:25 21:21	07:05 20:29	07:44 19:30	07:28 17:31	08:11 17:00
2	08:32 17:09	08:11 17:50	07:26 18:31	07:25 20:15	06:31 20:56	05:55 21:33	05:56 21:45	06:26 21:20	07:06 20:27	07:46 19:28	07:30 17:30	08:12 16:59
3	08:32 17:10	08:10 17:52	07:24 18:33	07:23 20:16	06:29 20:57	05:55 21:34	05:56 21:45	06:28 21:18	07:08 20:25	07:47 19:26	07:31 17:28	08:13 16:59
4	08:32 17:11	08:08 17:53	07:22 18:34	07:21 20:18	06:27 20:59	05:54 21:35	05:57 21:45	06:29 21:17	07:09 20:24	07:48 19:24	07:33 17:27	08:14 16:59
5	08:32 17:12	08:07 17:55	07:20 18:36	07:19 20:19	06:26 21:00	05:54 21:36	05:58 21:44	06:30 21:16	07:10 20:22	07:50 19:22	07:34 17:26	08:15 16:58
6	08:32 17:13	08:06 17:56	07:18 18:37	07:17 20:20	06:24 21:01	05:53 21:36	05:58 21:44	06:31 21:14	07:12 20:20	07:51 19:20	07:36 17:24	08:16 16:58
7	08:32 17:14	08:04 17:58	07:16 18:38	07:15 20:22	06:23 21:03	05:53 21:37	05:59 21:43	06:33 21:13	07:13 20:18	07:52 19:18	07:37 17:23	08:17 16:58
8	08:31 17:15	08:03 17:59	08:14 18:40	07:13 20:23	06:22 21:04	05:52 21:38	06:00 21:43	06:34 21:11	07:14 20:16	07:54 19:16	07:39 17:21	08:19 16:58
9	08:31 17:16	08:01 18:01	08:12 19:41	07:11 20:25	06:20 21:05	05:52 21:39	06:01 21:43	06:35 21:10	07:15 20:14	07:55 19:14	07:40 17:20	08:20 16:58
10	08:31 17:17	08:00 18:01	08:11 19:43	07:10 20:26	06:19 21:07	05:52 21:39	06:02 21:42	06:36 21:08	07:17 20:12	07:57 19:12	07:41 17:19	08:21 16:57
11	08:30 17:19	08:00 18:02	08:09 19:44	07:08 20:27	06:17 21:08	05:52 21:40	06:02 21:42	06:38 21:07	07:18 20:10	07:58 19:10	07:43 17:17	08:21 16:57
12	08:30 17:20	08:00 18:04	08:07 19:46	07:06 20:29	06:16 21:09	05:51 21:41	06:03 21:41	06:39 21:05	07:19 20:08	07:59 19:08	07:44 17:16	08:22 16:57
13	08:29 17:21	08:00 18:05	08:05 19:47	07:04 20:30	06:15 21:11	05:51 21:41	06:04 21:40	06:40 21:03	07:21 20:06	08:01 19:06	07:46 17:15	08:23 16:58
14	08:29 17:23	08:00 18:07	08:03 19:48	07:02 20:31	06:13 21:12	05:51 21:42	06:05 21:40	06:42 21:02	07:22 20:04	08:02 19:04	07:47 17:14	08:24 16:58
15	08:28 17:24	08:00 18:09	08:01 19:50	07:00 20:33	06:12 21:13	05:51 21:42	06:06 21:39	06:43 21:00	07:23 20:02	08:04 19:02	07:49 17:13	08:25 16:58
16	08:28 17:25	08:00 18:10	08:01 19:51	07:00 20:34	06:12 21:14	05:51 21:43	06:07 21:38	06:44 20:58	07:25 20:00	08:05 19:01	07:50 17:12	08:26 16:58
17	08:27 17:27	08:00 18:12	08:02 19:53	07:00 20:36	06:10 21:16	05:51 21:43	06:08 21:37	06:45 20:57	07:26 19:58	08:06 18:57	07:52 17:11	08:26 16:58
18	08:26 17:28	08:00 18:13	08:03 19:54	07:00 20:37	06:09 21:17	05:51 21:44	06:09 21:36	06:47 20:55	07:27 19:56	08:08 18:55	07:53 17:10	08:27 16:59
19	08:25 17:29	08:00 18:15	08:05 19:56	07:00 20:38	06:07 21:18	05:51 21:44	06:10 21:36	06:48 20:53	07:28 19:54	08:09 18:53	07:55 17:09	08:28 16:59
20	08:25 17:31	08:00 18:16	08:07 19:57	07:00 20:40	06:06 21:19	05:51 21:44	06:11 21:35	06:49 20:51	07:30 19:52	08:11 18:51	07:56 17:08	08:28 16:59
21	08:24 17:32	08:00 18:18	08:09 19:58	07:00 20:41	06:05 21:20	05:51 21:45	06:12 21:34	06:51 20:50	07:31 19:50	08:12 18:50	07:57 17:07	08:29 17:00
22	08:23 17:34	08:00 18:19	08:07 20:00	07:00 20:42	06:04 21:22	05:52 21:45	06:13 21:33	06:52 20:48	07:32 19:48	08:14 18:48	07:59 17:06	08:29 17:00
23	08:22 17:35	08:00 18:21	08:05 20:01	07:00 20:44	06:03 21:23	05:52 21:45	06:14 21:32	06:53 20:46	07:34 19:46	08:15 18:46	08:00 17:05	08:30 17:01
24	08:21 17:37	08:00 18:22	08:07 20:02	07:00 20:45	06:02 21:24	05:52 21:45	06:16 21:31	06:55 20:44	07:35 19:44	08:16 18:44	08:02 17:04	08:30 17:01
25	08:20 17:38	08:00 18:24	08:05 20:04	07:00 20:47	06:01 21:25	05:52 21:45	06:17 21:30	06:56 20:42	07:36 19:42	08:18 18:43	08:03 17:03	08:31 17:02
26	08:19 17:39	08:00 18:25	08:05 20:05	07:00 20:48	06:00 21:26	05:53 21:45	06:18 21:28	06:57 20:41	07:38 19:40	08:19 18:41	08:04 17:03	08:31 17:03
27	08:18 17:41	08:00 18:27	08:05 20:07	07:00 20:49	06:00 21:27	05:53 21:45	06:19 21:27	06:58 20:39	07:39 19:38	08:21 18:39	08:06 17:02	08:31 17:03
28	08:17 17:42	08:00 18:28	08:05 20:08	07:00 20:51	06:00 21:28	05:54 21:45	06:20 21:26	07:00 20:37	07:40 19:35	08:22 18:38	08:07 17:01	08:32 17:04
29	08:16 17:44	08:00 18:33	08:05 20:09	07:00 20:52	06:00 21:29	05:58 21:45	06:21 21:25	07:01 20:35	07:42 19:33	08:24 18:36	08:08 17:01	08:32 17:05
30	08:15 17:45	08:00 18:34	08:05 20:11	07:00 20:53	06:00 21:30	05:57 21:45	06:23 21:24	07:02 20:33	07:43 19:31	08:25 18:35	08:09 17:00	08:32 17:06
31	08:13 17:47	08:00 18:35	08:05 20:12	07:00 20:54	06:00 21:31	05:57 21:45	06:24 21:22	07:04 20:31	07:44 19:22	08:27 18:33	08:10 17:01	08:32 17:07
Potential sun hours	279	288	368	407	466	474	480	441	378	338	282	266
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout:  or each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)		Last time (hh:mm) with flicker	(WTG causing flicker last time)



Project:

Minnesota Power - BISON Wind Energy Center

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Minnesota Power
Frank Frederickson
30 West Superior Street
Duluth, MN 55802-2093

SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR010 - SR010

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Table with 12 columns for months (Jan-Dec) and values: 4.92, 5.13, 7.45, 8.03, 10.20, 11.21, 11.69, 10.35, 8.68, 5.69, 4.02, 3.69

Operational time

Table with 17 columns for wind directions (N to NNW) and Sum, with values ranging from 460 to 8,534

Idle start wind speed: Cut in wind speed from power curve

Main shadow calculation table with columns for months (January-December) and rows for each day, showing sun rise and set times in hh:mm format

Table layout: [ ] for each day in each month the following matrix apply

Summary table with columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time)

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SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR011 - SR011

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Table with 12 columns for months (Jan-Dec) and values for sunshine probability.

Operational time

Table with 17 columns for cardinal and ordinal directions and values for operational time.

Main shadow calculation table with columns for months (January to December) and rows for each day of the year (1 to 365), showing sun rise and set times.

Table layout: For each day in each month the following matrix apply

Summary table with columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time).

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SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR012 - SR012

Assumptions for shadow calculations

Maximum distance for influence: 1,500 m
Minimum sun height over horizon for influence: 3 degrees
Day step for calculation: 1 days
Time step for calculation: 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69
Operational time
N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for each day (1-31) showing sunrise and sunset times. Summary rows at the bottom show potential sun hours, total, worst case, and reductions for sun, wind, and total.

Table layout: [checkbox] for each day in each month the following matrix [checkbox] apply

Summary table with columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time)

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## SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR013 - SR013

### Assumptions for shadow calculations

Maximum distance for influence 1,500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

January	February	March	April	May	June
1 08:33	14:02 (215) 08:13	07:28	07:54 (8) 07:27	06:32	06:55 (16) 05:56
2 08:33	14:03 (215) 08:11	07:26	07:53 (8) 07:25	06:31	06:53 (16) 05:56
3 08:33	14:04 (215) 08:10	07:24	07:52 (8) 07:23	06:29	06:52 (16) 05:55
4 08:32	14:04 (215) 08:09	07:22	07:51 (8) 07:21	06:28	06:50 (16) 05:54
5 08:32	14:05 (215) 08:07	07:20	07:50 (8) 07:19	06:26	06:49 (16) 05:54
6 08:32	14:06 (215) 08:06	07:19	07:49 (8) 07:18	06:25	06:47 (16) 05:53
7 08:32	14:08 (215) 08:04	07:17	07:49 (8) 07:16	06:23	06:47 (16) 05:53
8 08:32	14:09 (215) 08:03	08:15	08:49 (8) 07:14	06:22	06:47 (16) 05:53
9 08:31	14:10 (215) 08:02	08:13	08:48 (8) 07:12	06:20	06:48 (16) 05:52
10 08:31	14:11 (215) 08:00	08:11	08:48 (8) 07:10	06:19	06:50 (16) 05:52
11 08:31	14:14 (215) 07:59	08:09	08:48 (8) 07:08	06:18	06:50 (16) 05:52
12 08:30	14:15 (215) 07:57	08:07	08:49 (8) 07:06	06:16	06:53 (16) 05:52
13 08:30	14:18 (215) 07:56	08:05	08:49 (8) 07:04	06:15	06:59 (16) 05:51
14 08:29	14:20 (215) 07:54	08:03	08:50 (8) 07:02	06:14	06:51
15 08:29	14:24 (215) 07:52	08:01	08:51 (8) 07:00	06:12	06:51
16 08:28	14:34 (215) 07:51	07:59	08:52 (8) 06:58	06:11	06:51
17 08:27	07:49	07:57	08:54 (8) 06:57	06:10	06:51
18 08:27	07:47	07:55	08:13 (8) 06:56	06:09	06:51
19 08:26	07:46	07:53	08:56 (8) 06:55	06:09	06:51
20 08:25	07:44	07:51	09:10 (8) 06:53	06:08	06:51
21 08:24	07:42	07:49	06:53	06:08	06:51
22 08:23	07:41	07:47	06:51	06:07	06:51
23 08:22	07:39	07:45	06:49	06:05	06:51
24 08:21	07:37	07:43	06:49	06:05	06:51
25 08:20	07:35	07:41	06:49	06:05	06:51
26 08:19	07:33	07:39	06:48	06:04	06:51
27 08:18	07:32	07:37	06:48	06:04	06:51
28 08:17	07:30	07:35	06:48	06:04	06:51
29 08:16	07:28	07:33	06:48	06:04	06:51
30 08:15	07:26	07:31	06:48	06:04	06:51
31 08:14	07:24	07:29	06:48	06:04	06:51
Potential sun hours	279	287	368	407	466
Total, worst case	479	76	539	27	177
Sun reduction	0.55	0.50	0.63	0.59	0.68
Oper. time red.	0.97	0.97	0.97	0.97	0.97
Wind dir. red.	0.53	0.73	0.73	0.61	0.61
Total reduction	0.28	0.35	0.44	0.35	0.40
Total, real	134	27	237	9	70

Table layout: [ ] for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
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Minnesota Power - BISON Wind Energy Center

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 30 West Superior Street  
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 wind@eapc.net  
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**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR013 - SR013

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
 460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:55 21:46	06:25 21:21	07:02 (16) 20:30	07:45 19:30	08:29 (8) 09:00 (8)	07:28 17:32
2	05:56 21:45	06:27 21:20	07:00 (16) 20:28	07:46 19:28	08:27 (8) 09:00 (8)	07:30 17:30
3	05:57 21:45	06:28 21:19	06:59 (16) 20:26	07:47 19:26	08:26 (8) 09:00 (8)	07:31 17:29
4	05:57 21:45	06:29 21:17	06:58 (16) 20:24	07:49 19:24	08:26 (8) 09:01 (8)	07:33 17:27
5	05:58 21:45	06:30 21:16	06:57 (16) 20:22	07:50 19:22	08:25 (8) 09:00 (8)	07:34 17:26
6	05:59 21:44	06:32 21:14	06:57 (16) 20:20	07:51 19:20	08:25 (8) 09:00 (8)	07:36 17:24
7	05:59 21:44	06:33 21:13	06:57 (16) 20:18	07:53 19:18	08:25 (8) 09:00 (8)	07:37 17:23
8	06:00 21:43	06:34 21:11	06:58 (16) 20:16	07:54 19:16	08:25 (8) 08:59 (8)	07:39 17:22
9	06:01 21:43	06:35 21:10	07:00 (16) 20:14	07:55 19:14	08:25 (8) 08:59 (8)	07:40 17:20
10	06:02 21:42	06:37 21:08	07:01 (16) 20:12	07:57 19:12	08:25 (8) 08:58 (8)	07:42 17:19
11	06:03 21:42	06:38 21:07	07:02 (16) 20:10	07:58 19:10	08:26 (8) 08:57 (8)	07:43 17:18
12	06:04 21:41	06:39 21:05	07:03 (16) 20:08	08:00 19:08	08:27 (8) 08:56 (8)	07:45 17:17
13	06:04 21:41	06:41 21:04	07:05 (16) 20:06	08:01 19:06	08:27 (8) 08:54 (8)	07:46 17:15
14	06:05 21:40	06:42 21:02	07:06 (16) 20:04	08:02 19:05	08:29 (8) 08:53 (8)	07:48 17:14
15	06:06 21:39	06:43 21:00	07:07 (16) 20:02	08:04 19:03	08:30 (8) 08:50 (8)	07:49 17:13
16	06:07 21:38	06:44 20:59	07:08 (16) 20:00	08:05 19:01	08:33 (8) 08:48 (8)	07:51 17:12
17	06:08 21:38	06:46 20:57	07:26 19:58	08:07 18:57	08:36 (8) 08:43 (8)	07:52 17:11
18	06:09 21:37	06:47 20:55	07:27 19:56	08:08 18:55	08:43 (8) 17:10	07:53 17:10
19	06:10 21:36	06:48 20:53	07:29 19:54	08:09 18:53	08:09 17:09	07:55 17:09
20	06:11 21:35	06:50 20:52	07:30 19:52	08:11 18:52	08:11 17:08	07:56 17:08
21	06:13 21:34	06:51 20:50	07:31 19:50	08:12 18:50	08:12 17:07	07:58 17:07
22	06:14 21:33	06:52 20:48	07:33 19:48	08:14 18:48	08:14 17:06	07:59 17:06
23	06:15 21:32	06:54 20:46	07:34 19:46	08:15 18:46	08:15 17:05	08:00 17:05
24	06:16 21:31	06:55 20:45	07:35 19:44	08:17 18:45	08:17 17:04	08:02 17:04
25	06:17 21:30	06:56 20:43	07:37 19:42	08:18 18:43	08:18 17:03	08:03 17:03
26	06:18 21:29	06:57 20:41	07:38 19:40	08:20 18:41	08:20 17:02	08:04 17:02
27	06:19 21:28	06:59 20:39	07:39 19:38	08:21 18:40	08:21 17:01	08:06 17:01
28	06:21 21:26	07:00 20:37	07:41 19:36	08:23 18:38	08:23 17:00	08:07 17:00
29	06:22 21:25	07:01 20:35	07:42 19:34	08:24 18:36	08:24 17:00	08:08 17:00
30	06:23 21:24	07:03 20:33	07:43 19:32	08:25 18:35	08:25 17:00	08:10 17:00
31	06:24 21:23	07:04 20:32	07:44 19:30	08:27 18:33	08:27 17:00	08:12 17:00
Potential sun hours	480	441	378	338	282	266
Total, worst case		206	134	492	73	1304
Sun reduction		0.73	0.69	0.52	0.43	0.43
Oper. time red.		0.97	0.97	0.97	0.97	0.97
Wind dir. red.		0.61	0.73	0.73	0.53	0.53
Total reduction		0.42	0.48	0.37	0.22	0.22
Total, real		87	65	180	16	287

Table layout:  for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
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Project:

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US-GRAND FORKS, ND 58201
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SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR014 - SR014

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

Operational time
N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534
Cut in wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for days (1-31). Each cell contains start and end times for shadow events. Summary rows at the bottom show total sun hours, reduction percentages, and real sun hours.

Table layout: [checkbox] for each day in each month the following matrix apply

Table with 4 columns: Day in month, Sun rise (hh:mm) / Sun set (hh:mm), Minutes with flicker, and Last time (hh:mm) with flicker. Includes notes about WTG causing flicker first and last time.

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 wind@eapc.net  
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**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR015 - SR015

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]  
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

Operational time  
 N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
 460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:32 17:08	08:12 17:49	07:28 18:30	07:27 20:14	06:32 20:55	06:55 (22) 21:32	05:55 21:45	06:25 21:21	06:57 (22) 07:05	07:45 19:30	07:28 17:32	08:11 17:00
2	08:33 17:09	08:11 17:50	07:26 18:31	07:25 20:15	06:31 20:56	06:53 (22) 21:33	05:56 21:45	06:27 21:20	06:54 (22) 07:07	07:46 19:28	07:30 17:30	08:12 17:00
3	08:32 17:10	08:10 17:52	07:24 18:33	07:23 20:17	06:29 20:58	06:51 (22) 21:34	05:57 21:45	06:28 21:19	06:53 (22) 07:08	07:47 19:26	07:31 17:29	08:13 16:59
4	08:32 17:11	08:09 17:53	07:22 18:34	07:21 20:18	06:28 20:59	06:50 (22) 21:35	05:57 21:45	06:29 21:17	06:54 (22) 07:09	07:49 19:24	07:33 17:27	08:14 16:59
5	08:32 17:12	08:07 17:55	07:20 18:36	07:19 20:19	06:26 21:00	06:49 (22) 21:36	05:58 21:44	06:30 21:16	06:55 (22) 07:10	07:50 19:22	07:34 17:26	08:15 16:59
6	08:32 17:13	08:06 17:56	07:18 18:37	07:18 20:21	06:25 21:02	06:47 (22) 21:37	05:59 21:44	06:32 21:14	06:56 (22) 07:12	07:51 19:20	07:36 17:24	08:17 16:58
7	08:32 17:14	08:04 17:58	07:17 18:39	07:16 20:22	06:23 21:03	06:46 (22) 21:38	05:59 21:44	06:33 21:13	06:57 (22) 07:13	07:53 19:18	07:37 17:23	08:18 16:58
8	08:32 17:15	08:03 18:00	07:15 18:40	07:14 20:23	06:22 21:04	06:44 (22) 21:38	06:00 21:43	06:34 21:11	06:58 (22) 07:14	07:54 19:16	07:39 17:22	08:19 16:58
9	08:31 17:17	08:02 18:00	07:13 19:42	07:12 20:25	06:20 21:06	06:43 (22) 21:39	06:01 21:43	06:35 21:10	07:00 (22) 07:16	07:55 19:14	07:40 17:20	08:20 16:58
10	08:31 17:18	08:00 18:01	07:11 19:43	07:10 20:26	06:19 21:07	06:44 (22) 21:40	06:02 21:42	06:37 21:08	07:01 (22) 07:17	07:57 19:12	07:42 17:19	08:21 16:58
11	08:31 17:19	07:59 18:03	07:09 19:44	07:08 20:28	06:18 21:08	06:45 (22) 21:40	06:03 21:42	06:38 21:07	07:02 (22) 07:18	07:58 19:10	07:43 17:18	08:22 16:58
12	08:30 17:20	07:57 18:04	07:07 19:46	07:06 20:29	06:16 21:10	06:42 (22) 21:41	06:04 21:41	06:39 21:05	07:03 (22) 07:20	08:00 19:08	07:45 17:17	08:23 16:58
13	08:30 17:22	07:55 18:06	07:05 19:47	07:04 20:30	06:15 21:11	06:41 (22) 21:42	06:04 21:40	06:41 21:04	07:05 (22) 07:21	08:01 19:06	07:46 17:15	08:23 16:58
14	08:29 17:23	07:54 18:07	07:03 19:49	07:02 20:32	06:14 21:12	06:40 (22) 21:42	06:05 21:40	06:42 21:02	07:22 20:04	08:02 19:04	07:48 17:14	08:24 16:58
15	08:28 17:24	07:52 18:09	07:01 19:50	07:00 20:33	06:12 21:13	06:39 (22) 21:43	06:06 21:39	06:43 21:00	07:23 20:02	08:04 19:03	07:49 17:13	08:25 16:58
16	08:28 17:25	07:51 18:10	07:00 19:52	06:58 20:34	06:11 21:15	06:38 (22) 21:43	06:07 21:38	06:44 20:59	07:25 20:00	08:05 19:01	07:50 17:12	08:26 16:58
17	08:27 17:27	07:49 18:12	07:00 19:53	06:57 20:36	06:10 21:16	06:37 (22) 21:44	06:08 21:38	06:46 20:57	07:26 19:58	08:07 18:57	07:52 17:11	08:27 16:59
18	08:26 17:28	07:47 18:13	07:00 19:54	06:55 20:37	06:09 21:17	06:36 (22) 21:44	06:09 21:37	06:47 20:55	07:27 19:56	08:08 18:55	07:53 17:10	08:27 16:59
19	08:26 17:30	07:46 18:15	07:00 19:56	06:53 20:39	06:08 21:18	06:35 (22) 21:44	06:10 21:36	06:48 20:53	07:29 19:54	08:09 18:53	07:55 17:09	08:28 16:59
20	08:25 17:31	07:44 18:16	07:01 19:57	06:51 20:40	06:07 21:19	06:34 (22) 21:45	06:11 21:35	06:50 20:52	07:30 19:52	08:11 18:52	07:56 17:08	08:29 17:00
21	08:24 17:32	07:42 18:18	07:00 19:59	06:49 20:41	06:05 21:21	06:33 (22) 21:45	06:13 21:34	06:51 20:50	07:31 19:50	08:12 18:50	07:58 17:07	08:29 17:00
22	08:23 17:34	07:40 18:19	07:00 20:00	06:48 20:43	06:04 21:22	06:32 (22) 21:45	06:14 21:33	06:52 20:48	07:33 19:48	08:14 18:48	07:59 17:06	08:30 17:01
23	08:22 17:35	07:39 18:21	07:00 20:01	06:46 20:44	06:03 21:23	06:31 (22) 21:45	06:15 21:32	06:54 20:46	07:34 19:46	08:15 18:46	08:00 17:05	08:30 17:01
24	08:21 17:37	07:37 18:22	07:00 20:03	06:44 20:45	06:03 21:24	06:30 (22) 21:45	06:16 21:31	06:55 20:45	07:35 19:44	08:17 18:45	08:02 17:04	08:31 17:02
25	08:20 17:38	07:35 18:24	07:00 20:04	06:42 20:47	06:02 21:25	06:29 (22) 21:46	06:17 21:30	06:56 20:43	07:37 19:42	08:18 18:43	08:03 17:04	08:31 17:02
26	08:19 17:40	07:33 18:25	07:00 20:06	06:41 20:48	06:01 21:26	06:28 (22) 21:46	06:18 21:29	06:57 20:41	07:38 19:40	08:20 18:41	08:04 17:03	08:31 17:03
27	08:18 17:41	07:32 18:27	07:00 20:07	06:39 20:49	06:00 21:27	06:27 (22) 21:46	06:19 21:28	06:59 20:39	07:39 19:38	08:21 18:40	08:06 17:02	08:32 17:04
28	08:17 17:43	07:30 18:28	07:00 20:08	06:37 20:51	05:59 21:28	06:26 (22) 21:46	06:21 21:26	07:00 20:37	07:41 19:36	08:22 18:38	08:07 17:02	08:32 17:04
29	08:16 17:44	07:33 18:30	07:00 20:10	06:36 20:52	05:58 21:29	06:25 (22) 21:46	06:22 21:25	07:01 20:35	07:42 19:34	08:24 18:36	08:08 17:01	08:32 17:05
30	08:15 17:46	07:31 18:31	07:00 20:11	06:34 20:54	06:56 (22) 21:30	05:58 21:46	06:23 21:24	07:03 20:33	07:43 19:32	08:25 18:35	08:10 17:01	08:32 17:06
31	08:14 17:47	07:29 18:32	07:00 20:12	06:33 20:53	06:57 (22) 21:31	05:57 21:46	06:24 21:23	07:04 20:31	07:44 19:31	08:27 18:33	08:10 17:01	08:32 17:07
Potential sun hours	279	287	368	407	466	474	480	441	378	338	282	266
Total, worst case				2	102			107				
Sun reduction				0.59	0.68			0.73				
Oper. time red.				0.97	0.97			0.97				
Wind dir. red.				0.60	0.60			0.60				
Total reduction				0.35	0.40			0.43				
Total, real				1	41			46				

Table layout:  for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
	Sun set (hh:mm)					

Project: **Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
Frank Frederickson  
30 West Superior Street  
Duluth, MN 55802-2093

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Licensed user: **EAPC Wind Energy**  
3100 DeMers Avenue  
US-GRAND FORKS, ND 58201  
+1 701 775 3000  
wind@eapc.net  
Calculated: 6/17/2011 12:07 PM/2.7.486

**SHADOW - Calendar**

**Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR016 - SR016**

**Assumptions for shadow calculations**

Maximum distance for influence: 1,500 m  
Minimum sun height over horizon for influence: 3 °  
Day step for calculation: 1 days  
Time step for calculation: 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
	460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:33 17:08	09:47 (212) 17:49	08:12 17:55	08:43 (211) 17:28	07:27 20:34	06:32 21:32
2	08:33 17:09	09:49 (212) 17:50	08:11 17:50	08:43 (211) 17:26	07:25 20:15	06:31 21:33
3	08:32 17:10	09:50 (212) 17:52	08:10 17:52	08:44 (211) 17:24	07:23 20:17	06:29 21:34
4	08:32 17:11	09:52 (212) 17:53	08:09 17:53	08:46 (211) 17:22	07:21 20:18	06:28 21:35
5	08:32 17:12	09:59 (212) 17:55	08:07 17:55	08:47 (211) 17:20	07:19 20:19	06:26 21:36
6	08:32 17:13	09:02 (211) 17:55	08:06 17:55	08:49 (211) 17:19	07:18 20:21	06:25 21:37
7	08:32 17:14	09:01 (211) 17:57	08:04 17:57	08:52 (211) 17:17	07:16 20:22	06:23 21:38
8	08:32 17:15	09:01 (211) 17:58	08:03 17:58	08:57 (211) 17:39	07:14 20:22	06:22 21:38
9	08:31 17:17	09:01 (211) 18:00	08:03 18:00	08:15 18:40	07:14 20:23	06:22 21:38
10	08:31 17:18	09:02 (211) 18:00	08:03 18:00	08:13 19:42	07:12 20:25	06:20 21:39
11	08:31 17:19	09:03 (211) 18:01	08:03 18:01	08:11 19:43	07:10 20:26	06:19 21:40
12	08:30 17:20	09:04 (211) 18:01	08:03 18:01	08:11 19:43	07:10 20:26	06:19 21:40
13	08:30 17:22	09:05 (211) 18:02	08:03 18:02	08:05 19:47	07:08 20:28	06:18 21:40
14	08:29 17:23	09:06 (211) 18:03	08:03 18:03	08:03 19:49	07:07 20:29	06:18 21:41
15	08:28 17:24	09:07 (211) 18:04	08:03 18:04	08:03 19:50	07:06 20:30	06:16 21:41
16	08:28 17:25	09:08 (211) 18:05	08:03 18:05	08:03 19:51	07:05 20:31	06:15 21:42
17	08:27 17:27	09:09 (211) 18:06	08:03 18:06	08:03 19:52	07:04 20:32	06:14 21:42
18	08:26 17:28	09:10 (211) 18:07	08:03 18:07	08:03 19:53	07:03 20:33	06:13 21:43
19	08:26 17:30	09:11 (211) 18:08	08:03 18:08	08:03 19:54	07:02 20:34	06:12 21:43
20	08:25 17:31	09:12 (211) 18:09	08:03 18:09	08:03 19:55	07:01 20:35	06:11 21:44
21	08:24 17:32	09:13 (211) 18:10	08:03 18:10	08:03 19:56	07:00 20:36	06:10 21:44
22	08:23 17:34	09:14 (211) 18:11	08:03 18:11	08:03 19:57	06:59 20:37	06:09 21:44
23	08:22 17:35	09:15 (211) 18:12	08:03 18:12	08:03 19:58	06:58 20:38	06:08 21:44
24	08:21 17:37	09:16 (211) 18:13	08:03 18:13	08:03 19:59	06:57 20:39	06:07 21:44
25	08:20 17:38	09:17 (211) 18:14	08:03 18:14	08:03 20:00	06:56 20:40	06:06 21:45
26	08:19 17:40	09:18 (211) 18:15	08:03 18:15	08:03 20:01	06:55 20:41	06:05 21:45
27	08:18 17:41	09:19 (211) 18:16	08:03 18:16	08:03 20:02	06:54 20:42	06:04 21:45
28	08:17 17:43	09:20 (211) 18:17	08:03 18:17	08:03 20:03	06:53 20:43	06:03 21:45
29	08:16 17:44	09:21 (211) 18:18	08:03 18:18	08:03 20:04	06:52 20:44	06:02 21:45
30	08:15 17:46	09:22 (211) 18:19	08:03 18:19	08:03 20:05	06:51 20:45	06:01 21:46
31	08:14 17:47	09:23 (211) 18:20	08:03 18:20	08:03 20:06	06:50 20:46	06:00 21:46
Potential sun hours	279	287	368	407	466	474
Total, worst case	290	113	110	63	63	63
Sun reduction	0.55	0.50	0.63	0.97	0.97	0.97
Oper. time red.	0.97	0.97	0.97	0.86	0.86	0.86
Wind dir. red.	0.74	0.74	0.41	0.41	0.41	0.41
Total reduction	0.40	0.36	0.41	0.41	0.41	0.41
Total, real	115	41	45	45	45	45

Table layout:  for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)		Last time (hh:mm) with flicker	(WTG causing flicker last time)



Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR016 - SR016

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:55 21:45	06:25 21:21	07:05 20:30	07:45 19:30	18:59 (216) 19:04 (216)	07:28 17:30
2	05:56 21:45	06:27 21:20	07:07 20:28	07:46 19:28	19:00 (216) 19:02 (216)	07:30 17:30
3	05:57 21:45	06:28 21:19	07:08 20:26	07:47 19:26		07:31 17:29
4	05:57 21:45	06:29 21:17	07:09 20:24	07:49 19:24		07:33 17:27
5	05:58 21:44	06:30 21:16	07:10 20:22	07:50 19:22		07:34 17:26
6	05:59 21:44	06:32 21:14	07:12 20:20	07:51 19:20		07:36 17:24
7	05:59 21:44	06:33 21:13	07:13 20:18	07:53 19:18		07:37 17:23
8	06:00 21:43	06:34 21:11	07:14 20:16	07:54 19:16		07:39 17:22
9	06:01 21:43	06:35 21:10	07:16 20:14	07:55 19:14		07:40 17:20
10	06:02 21:42	06:37 21:08	07:17 20:12	07:57 19:12		07:42 17:19
11	06:03 21:42	06:38 21:07	07:18 20:10	07:58 19:10		07:43 17:18
12	06:04 21:41	06:39 21:05	07:20 20:08	08:00 19:08		07:45 17:17
13	06:05 21:41	06:41 21:04	07:21 20:06	08:01 19:06		07:46 17:15
14	06:05 21:40	06:42 21:02	07:22 20:04	08:02 19:05		07:48 17:14
15	06:06 21:39	06:43 21:00	07:23 20:02	08:04 19:03		07:49 17:13
16	06:07 21:38	06:44 20:59	07:25 20:00	08:05 19:01		07:50 17:12
17	06:08 21:38	06:46 20:57	07:26 19:58	08:07 18:57		07:52 17:11
18	06:09 21:37	06:47 20:55	07:27 19:56	08:08 18:55		07:53 17:10
19	06:10 21:36	06:48 20:53	07:29 19:54	08:09 18:53		07:55 17:09
20	06:11 21:35	06:50 20:52	07:30 19:52	08:11 18:52		07:56 17:08
21	06:13 21:34	06:51 20:50	07:31 19:50	08:12 18:50		07:58 17:07
22	06:14 21:33	06:52 20:48	07:33 19:48	08:14 18:48		07:59 17:06
23	06:15 21:32	06:54 20:46	07:34 19:46	08:15 18:46		08:00 17:05
24	06:16 21:31	06:55 20:45	07:35 19:44	08:17 18:45		08:02 17:04
25	06:17 21:30	06:56 20:43	07:37 19:42	08:18 18:43		08:03 17:04
26	06:18 21:29	06:57 20:41	07:38 19:40	08:20 18:41		08:04 17:03
27	06:19 21:28	06:59 20:39	07:39 19:38	08:21 18:40		08:06 17:02
28	06:21 21:26	07:00 20:37	07:41 19:36	08:22 18:38		08:07 17:02
29	06:22 21:25	07:01 20:35	07:42 19:34	08:24 18:36		08:08 17:01
30	06:23 21:24	07:03 20:33	07:43 19:32	08:25 18:35		08:10 17:01
31	06:24 21:23	07:04 20:31		08:27 18:33		
Potential sun hours	480	441	378	338	282	267
Total, worst case			109	7	360	443
Sun reduction			0.69	0.52	0.43	0.43
Oper. time red.			0.97	0.97	0.97	0.97
Wind dir. red.			0.66	0.66	0.74	0.73
Total reduction			0.44	0.34	0.31	0.31
Total, real			48	2	112	136

Table layout:  for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)		Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project: Minnesota Power - BISON Wind Energy Center

Minnesota Power
Frank Frederickson
30 West Superior Street
Duluth, MN 55802-2093

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Licensed user: EAPC Wind Energy
3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated: 6/17/2011 12:07 PM/2.7.486

SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR017 - SR017

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Table with 12 columns (Jan-Dec) and 2 rows of values for sunshine probability.

Operational time

Table with 17 columns (N to Sum) and 2 rows of values for operational time.

Main shadow calculation table with columns for months (January to December) and rows for each day of the year, including sun rise/set times and shadow reduction percentages.

Table layout: [ ] for each day in each month the following matrix apply

Summary table with 4 columns: Day in month, Sun rise/set, Minutes with flicker, and Last time with flicker.

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR018 - SR018

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time																
N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:32	09:08 (218)	08:12	09:03 (218)	07:28	07:27	06:33	05:56	05:56	06:26	07:05	07:45
2	08:32	09:07 (218)	08:11	09:03 (218)	07:26	07:25	06:31	05:56	05:56	06:27	07:07	07:46
3	08:32	09:07 (218)	08:10	09:04 (218)	07:24	07:23	06:29	05:55	05:57	06:28	07:08	07:47
4	08:32	09:23 (218)	08:09	09:05 (218)	07:22	07:22	06:28	05:55	05:47	06:29	07:09	07:49
5	08:32	09:23 (218)	08:07	09:05 (218)	07:20	07:20	06:26	05:54	05:58	06:30	07:11	07:50
6	08:32	09:05 (218)	08:06	09:07 (218)	07:19	07:18	06:25	05:54	05:59	06:32	07:12	07:51
7	08:32	09:23 (218)	08:04	09:07 (218)	07:17	07:16	06:23	05:53	06:00	06:33	07:13	07:53
8	08:32	09:27 (218)	08:03	09:41 (218)	08:39	08:39	07:22	06:23	05:53	06:00	06:34	07:14
9	08:31	09:04 (218)	08:02	09:09 (218)	08:13	08:13	07:12	06:20	05:53	06:01	06:36	07:16
10	08:31	09:03 (218)	08:00	09:12 (218)	08:11	08:11	07:10	06:19	05:52	06:02	06:37	07:17
11	08:31	09:31 (218)	08:01	09:37 (218)	08:43	08:43	07:10	06:19	05:52	06:02	06:37	07:17
12	08:30	09:03 (218)	08:03	09:13 (218)	08:09	08:09	07:08	06:18	05:52	06:03	06:38	07:18
13	08:30	09:32 (218)	08:03	09:35 (218)	08:03	08:03	07:06	06:16	05:52	06:04	06:39	07:20
14	08:29	09:03 (218)	08:05	09:20 (218)	08:05	08:05	07:04	06:15	05:52	06:05	06:41	07:21
15	08:28	09:35 (218)	08:06	09:35 (218)	08:06	08:06	07:02	06:14	05:52	06:06	06:42	07:22
16	08:28	09:01 (218)	08:07	08:01	07:00	08:01	07:00	06:13	05:51	06:07	06:43	07:24
17	08:27	09:36 (218)	08:09	09:50	08:33	08:33	07:13	06:13	05:51	06:08	06:45	07:25
18	08:26	09:02 (218)	08:10	09:52	08:34	08:34	07:15	06:13	05:51	06:08	06:45	07:25
19	08:26	09:37 (218)	08:11	09:52	08:34	08:34	07:15	06:13	05:51	06:08	06:45	07:25
20	08:25	09:01 (218)	08:12	09:57	08:35	08:35	07:16	06:14	05:51	06:09	06:46	07:26
21	08:24	09:38 (218)	08:12	09:53	08:36	08:36	07:17	06:15	05:51	06:10	06:47	07:27
22	08:23	09:03 (218)	08:14	09:54	08:37	08:37	07:18	06:16	05:51	06:11	06:48	07:28
23	08:22	09:01 (218)	08:14	09:54	08:37	08:37	07:18	06:16	05:51	06:11	06:48	07:28
24	08:21	09:01 (218)	08:15	09:54	08:38	08:38	07:19	06:17	05:51	06:12	06:49	07:29
25	08:20	09:01 (218)	08:15	09:54	08:38	08:38	07:19	06:17	05:51	06:12	06:49	07:29
26	08:19	09:01 (218)	08:16	09:54	08:39	08:39	07:20	06:18	05:51	06:13	06:50	07:30
27	08:18	09:02 (218)	08:16	09:54	08:39	08:39	07:20	06:18	05:51	06:13	06:50	07:30
28	08:17	09:02 (218)	08:17	09:54	08:40	08:40	07:21	06:19	05:51	06:14	06:51	07:31
29	08:16	09:01 (218)	08:17	09:54	08:40	08:40	07:21	06:19	05:51	06:14	06:51	07:31
30	08:15	09:02 (218)	08:17	09:54	08:41	08:41	07:22	06:20	05:51	06:15	06:52	07:32
31	08:14	09:03 (218)	08:18	09:54	08:41	08:41	07:22	06:20	05:51	06:15	06:52	07:32
Potential sun hours	279	288	368	407	466	474	480	441	378	338	282	267
Total, worst case	1003	396									52	263
Sun reduction	0.55	0.50									0.52	0.43
Oper. time red.	0.97	0.97									0.97	0.97
Wind dir. red.	0.75	0.75									0.75	0.75
Total reduction	0.40	0.36									0.38	0.31
Total, real	399	144									20	82

Table layout: ☐ for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker (WTG causing flicker first time)
	Sun set (hh:mm)	Last time (hh:mm) with flicker (WTG causing flicker last time)
	Minutes with flicker	

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power
Frank Frederickson
30 West Superior Street
Duluth, MN 55802-2093

Description:

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EAPC Wind Energy
3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated:
6/17/2011 12:07 PM/2.7.486

SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR019 - SR019

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534
Idle start wind speed: Cut in wind speed from power curve

Table with 12 columns for months (January to December) and rows for days (1-31). Columns contain sun rise/set times, and rows contain minutes with flicker. Summary rows at the bottom show total sun hours and reduction percentages.

Table layout: [ ] for each day in each month the following matrix apply

Day in month Sun rise (hh:mm) Sun set (hh:mm) Minutes with flicker First time (hh:mm) with flicker Last time (hh:mm) with flicker (WTG causing flicker first time) (WTG causing flicker last time)

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net

Calculated:

6/17/2011 12:07 PM/2.7.486

### SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR020 - SR020

#### Assumptions for shadow calculations

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:33	08:13	07:28	07:28	06:33	06:55 (310)	05:57	05:56	06:26	07:00 (310)	07:06	07:45	07:29	08:11
2	08:33	08:12	07:26	07:26	06:31	06:53 (310)	05:56	05:56	06:27	07:09 (310)	07:07	07:46	07:30	08:12
3	08:33	08:10	07:25	07:24	06:30	06:52 (310)	05:55	05:57	06:28	07:10 (310)	07:08	07:48	07:32	08:14
4	08:33	08:09	07:23	07:22	06:28	06:50 (310)	05:55	05:58	06:30	07:11 (310)	07:10	07:49	07:33	08:15
5	08:33	08:08	07:21	07:20	06:27	06:49 (310)	05:54	05:58	06:31	07:12 (310)	07:11	07:50	07:35	08:16
6	08:32	08:06	07:19	07:18	06:25	06:48 (310)	05:54	05:59	06:32	07:13 (310)	07:12	07:52	07:36	08:17
7	08:32	08:05	07:17	07:16	06:24	06:46 (310)	05:54	06:00	06:33	07:14 (310)	07:13	07:53	07:38	08:18
8	08:32	08:03	07:14	07:14	06:22	06:44 (310)	05:53	06:01	06:35	07:15 (310)	07:15	07:54	07:39	08:19
9	08:32	08:02	07:12	07:12	06:21	06:42 (310)	05:53	06:01	06:36	07:16 (310)	07:16	07:56	07:41	08:20
10	08:31	08:00	07:10	07:10	06:19	06:41 (310)	05:53	06:02	06:37	07:17 (310)	07:17	07:57	07:42	08:21
11	08:31	07:59	07:08	07:08	06:18	06:40 (310)	05:52	06:03	06:38	07:18 (310)	07:19	07:59	07:44	08:22
12	08:30	07:57	07:06	07:06	06:17	06:50 (310)	05:52	06:04	06:40	07:19 (310)	07:20	08:00	07:45	08:23
13	08:30	07:56	07:04	07:04	06:15	06:57 (310)	05:52	06:05	06:41	07:20 (310)	07:21	08:01	07:46	08:24
14	08:29	07:54	07:03	07:03	06:14	06:58 (310)	05:52	06:06	06:42	07:21 (310)	07:22	08:02	07:47	08:25
15	08:29	07:53	07:01	07:01	06:13	06:59 (310)	05:52	06:07	06:44	07:22 (310)	07:23	08:03	07:48	08:25
16	08:28	07:51	06:59	06:59	06:12	07:00 (310)	05:52	06:08	06:45	07:23 (310)	07:24	08:04	07:49	08:25
17	08:27	07:49	06:57	06:57	06:10	07:01 (310)	05:52	06:09	06:46	07:24 (310)	07:25	08:05	07:50	08:26
18	08:27	07:48	06:55	06:55	06:09	07:02 (310)	05:52	06:10	06:47	07:25 (310)	07:26	08:06	07:51	08:26
19	08:26	07:46	06:53	06:53	06:08	07:03 (310)	05:52	06:11	06:49	07:26 (310)	07:27	08:07	07:52	08:27
20	08:25	07:44	06:52	06:52	06:07	07:04 (310)	05:52	06:12	06:50	07:27 (310)	07:28	08:08	07:53	08:27
21	08:24	07:43	06:50	06:50	06:06	07:05 (310)	05:52	06:13	06:51	07:28 (310)	07:29	08:09	07:54	08:28
22	08:24	07:41	06:48	06:48	06:05	07:06 (310)	05:52	06:14	06:53	07:29 (310)	07:30	08:10	07:55	08:28
23	08:23	07:39	06:46	06:46	06:04	07:07 (310)	05:52	06:15	06:54	07:30 (310)	07:31	08:11	07:56	08:29
24	08:22	07:37	06:44	06:44	06:03	07:08 (310)	05:52	06:16	06:55	07:31 (310)	07:32	08:12	07:57	08:29
25	08:21	07:36	06:42	06:43	06:02	07:09 (310)	05:52	06:17	06:57	07:32 (310)	07:33	08:13	07:58	08:29
26	08:20	07:34	06:40	06:41	06:01	07:10 (310)	05:52	06:18	06:58	07:33 (310)	07:34	08:14	07:59	08:30
27	08:19	07:32	06:38	06:39	06:00	07:11 (310)	05:52	06:19	06:59	07:34 (310)	07:35	08:15	08:00	08:30
28	08:17	07:30	06:36	06:38	05:59	07:12 (310)	05:52	06:20	06:59	07:35 (310)	07:36	08:16	08:01	08:30
29	08:16	07:29	06:34	06:36	05:58	07:13 (310)	05:52	06:21	07:00	07:36 (310)	07:37	08:17	08:02	08:31
30	08:15	07:28	06:32	06:34	05:57	07:14 (310)	05:52	06:22	07:01	07:37 (310)	07:38	08:18	08:03	08:31
31	08:14	07:27	06:30	06:32	05:56	07:15 (310)	05:52	06:23	07:02	07:38 (310)	07:39	08:19	08:04	08:31
Potential sun hours	279	288	368	407	466	474	480	441	378	338	282	267		
Total, worst case				6	145		3	151						
Sun reduction				0.59	0.68		0.76	0.73						
Oper. time red.				0.97	0.97		0.97	0.97						
Wind dir. red.				0.61	0.61		0.61	0.61						
Total reduction				0.35	0.40		0.45	0.43						
Total, real				2	58		1	65						

Table layout:  for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker
			(WTG causing flicker last time)

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/17/2011 12:07 PM/2.7.486

**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR021 - SR021

**Assumptions for shadow calculations**

Maximum distance for influence 1,500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
460	248	266	220	303	505	763	770	523	378	415	371	577	907	1,032	796	8,534

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:33	09:08 (222)	08:13	07:28	07:28	06:33	05:57	05:56	06:26	07:06	07:45	08:12 (223)	07:29	08:11
2	08:33	09:09 (222)	08:11	07:26	07:26	06:31	05:56	05:56	06:27	07:07	07:46	08:10 (223)	07:30	08:12
3	08:33	09:10 (222)	08:10	07:24	07:24	06:30	05:55	05:57	06:28	07:08	07:48	08:10 (223)	07:32	08:13
4	08:33	09:12 (222)	08:09	07:23	07:23	06:28	05:55	05:58	06:29	07:10	07:49	08:11 (223)	07:33	08:15
5	08:33	09:12 (222)	08:08	07:21	07:21	06:27	05:54	05:58	06:31	07:11	07:50	08:12 (223)	07:35	08:16
6	08:32	09:06	07:19	07:40 (223)	07:18	06:25	05:54	05:59	06:32	07:12	07:52	08:14 (223)	07:36	08:17
7	08:32	09:05	07:17	07:38 (223)	07:16	06:24	05:54	06:00	06:33	07:13	07:53	08:15 (223)	07:38	08:18
8	08:32	09:12 (222)	08:08	07:21	07:21	06:27	05:54	05:58	06:31	07:11	07:50	08:12 (223)	07:35	08:16
9	08:32	09:12 (222)	08:08	07:21	07:21	06:27	05:54	05:58	06:31	07:11	07:50	08:12 (223)	07:35	08:16
10	08:31	09:08	08:13	08:34 (223)	07:12	06:21	05:53	06:01	06:36	07:16	07:56	08:16 (223)	07:41	08:20
11	08:31	09:08	08:13	08:34 (223)	07:12	06:21	05:53	06:01	06:36	07:16	07:56	08:16 (223)	07:41	08:20
12	08:30	09:07	08:12	08:33 (223)	07:06	06:17	05:52	06:04	06:40	07:20	08:00	08:15 (223)	07:39	08:19
13	08:30	09:07	08:12	08:33 (223)	07:06	06:17	05:52	06:04	06:40	07:20	08:00	08:15 (223)	07:39	08:19
14	08:29	09:06	08:11	08:32 (223)	07:05	06:16	05:51	06:03	06:39	07:19	07:59	08:14 (223)	07:38	08:18
15	08:29	09:06	08:11	08:32 (223)	07:05	06:16	05:51	06:03	06:39	07:19	07:59	08:14 (223)	07:38	08:18
16	08:28	09:05	08:10	08:31 (223)	07:04	06:15	05:50	06:02	06:38	07:18	07:58	08:13 (223)	07:37	08:17
17	08:27	09:04	08:09	08:30 (223)	07:03	06:14	05:49	06:01	06:37	07:17	07:57	08:12 (223)	07:36	08:16
18	08:27	09:04	08:09	08:30 (223)	07:03	06:14	05:49	06:01	06:37	07:17	07:57	08:12 (223)	07:36	08:16
19	08:26	09:03	08:08	08:29 (223)	07:02	06:13	05:48	06:00	06:36	07:16	07:56	08:11 (223)	07:35	08:15
20	08:25	09:02	08:07	08:28 (223)	07:01	06:12	05:47	05:59	06:35	07:15	07:55	08:10 (223)	07:34	08:14
21	08:24	09:01	08:06	08:27 (223)	07:00	06:11	05:46	05:58	06:34	07:14	07:54	08:09 (223)	07:33	08:13
22	08:23	09:00	08:05	08:26 (223)	06:59	06:10	05:45	05:57	06:33	07:13	07:53	08:08 (223)	07:32	08:12
23	08:23	09:00	08:05	08:26 (223)	06:59	06:10	05:45	05:57	06:33	07:13	07:53	08:08 (223)	07:32	08:12
24	08:22	08:59	08:04	08:25 (223)	06:58	06:09	05:44	05:56	06:32	07:12	07:52	08:07 (223)	07:31	08:11
25	08:21	08:58	08:03	08:24 (223)	06:57	06:08	05:43	05:55	06:31	07:11	07:51	08:06 (223)	07:30	08:10
26	08:20	08:57	08:02	08:23 (223)	06:56	06:07	05:42	05:54	06:30	07:10	07:50	08:05 (223)	07:29	08:09
27	08:19	08:56	08:01	08:22 (223)	06:55	06:06	05:41	05:53	06:29	07:09	07:49	08:04 (223)	07:28	08:08
28	08:17	08:54	07:59	08:21 (223)	06:54	06:05	05:40	05:52	06:28	07:08	07:48	08:03 (223)	07:27	08:07
29	08:16	08:53	07:58	08:20 (223)	06:53	06:04	05:39	05:51	06:27	07:07	07:47	08:02 (223)	07:26	08:06
30	08:15	08:52	07:57	08:19 (223)	06:52	06:03	05:38	05:50	06:26	07:06	07:46	08:01 (223)	07:25	08:05
31	08:14	08:51	07:56	08:18 (223)	06:51	06:02	05:37	05:49	06:25	07:05	07:45	08:00 (223)	07:24	08:04
Potential sun hours	279	288	368	407	466	474	480	441	378	338	282	267		
Total, worst case	47		165					25		141		350		
Sun reduction	0.55		0.63					0.69		0.52		0.43		
Oper. time red.	0.97		0.97					0.97		0.97		0.97		
Wind dir. red.	0.75		0.72					0.72		0.72		0.75		
Total reduction	0.40		0.44					0.48		0.36		0.31		
Total, real	19		72					12		51		110		

Table layout: for each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)	
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power
Frank Frederickson
30 West Superior Street
Duluth, MN 55802-2093

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US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated: 6/17/2011 12:07 PM/2.7.486

SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR022 - SR022

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Table with 12 columns (Jan-Dec) and 1 row of values: 4.92, 5.13, 7.45, 8.03, 10.20, 11.21, 11.69, 10.35, 8.68, 5.69, 4.02, 3.69

Operational time

Table with 16 columns (N-Sum) and 1 row of values: 460, 248, 266, 220, 303, 505, 763, 770, 523, 378, 415, 371, 577, 907, 1,032, 796, 8,534

Main shadow calculation table with columns for months (January to December) and rows for each day of the month, including sunrise/set times and shadow reduction percentages.

Table layout: [ ] for each day in each month the following matrix apply

Summary table with columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time)

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power
Frank Frederickson
30 West Superior Street
Duluth, MN 55802-2093

Description:

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SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR023 - SR023

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Table with 12 columns (Jan-Dec) and 1 row of values: 4.92, 5.13, 7.45, 8.03, 10.20, 11.21, 11.69, 10.35, 8.68, 5.69, 4.02, 3.69

Operational time

Table with 17 columns (N to Sum) and 1 row of values: 460, 248, 266, 220, 303, 505, 763, 770, 523, 378, 415, 371, 577, 907, 1,032, 796, 8,534

Idle start wind speed: Cut in wind speed from power curve

Main shadow calculation table with columns for months (January to December) and rows for days (1-31) showing sun rise, set, and shadow times.

Table layout: [ ] for each day in each month the following matrix apply

Summary table with 4 columns: Day in month, Sun rise/set, Minutes with flicker, and WTG causing flicker times.





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SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR025 - SR025

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for days (1-31), showing sunrise and sunset times in HH:MM format.

Table layout: [ ] for each day in each month the following matrix apply

Day in month Sun rise (hh:mm) First time (hh:mm) with flicker (WTG causing flicker first time)
Sun set (hh:mm) Minutes with flicker Last time (hh:mm) with flicker (WTG causing flicker last time)

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SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR026 - SR026

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for each day of the month, showing sun rise and set times. Includes summary rows for Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and Total, real.

Table layout: [ ] for each day in each month the following matrix apply

Day in month Sun rise (hh:mm) First time (hh:mm) with flicker (WTG causing flicker first time)
Sun set (hh:mm) Minutes with flicker Last time (hh:mm) with flicker (WTG causing flicker last time)

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SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR027 - SR027

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69
Operational time
N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for each day of the month, showing sunrise/sunset times and shadow reduction percentages. Includes summary rows for 'Potential sun hours', 'Total, worst case', 'Sun reduction', 'Oper. time red.', 'Wind dir. red.', 'Total reduction', and 'Total, real'.

Table layout: for each day in each month the following matrix apply

Table with 4 columns: Day in month, Sun rise (hh:mm) / Sun set (hh:mm), Minutes with flicker, and Last time (hh:mm) with flicker. Includes notes about WTG causing flicker first and last time.





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SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR030 - SR030

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for days (1-31). Each cell contains a time range (sunrise to sunset) and a checkbox. Summary rows at the bottom show total sun hours and reduction percentages.

Table layout: [checkbox] or each day in each month the following matrix apply

Table with 4 columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time)

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SHADOW - Calendar

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2) Shadow receptor: SR031 - SR031

Assumptions for shadow calculations

Maximum distance for influence 1,500 m
Minimum sun height over horizon for influence 3 degrees
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69
Operational time
N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
460 248 266 220 303 505 763 770 523 378 415 371 577 907 1,032 796 8,534
Idle start wind speed: Cut in wind speed from power curve

Calendar grid showing shadow times for each day from January to December, with columns for each month and rows for each day, including a summary row for total hours and reductions.

Table layout: [checkbox] or each day in each month the following matrix apply

Table with 4 columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time)





Project:

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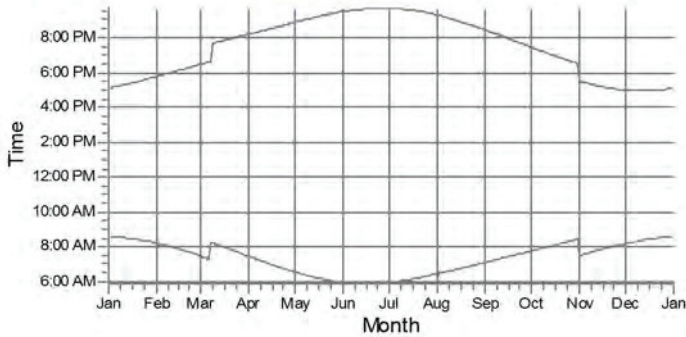
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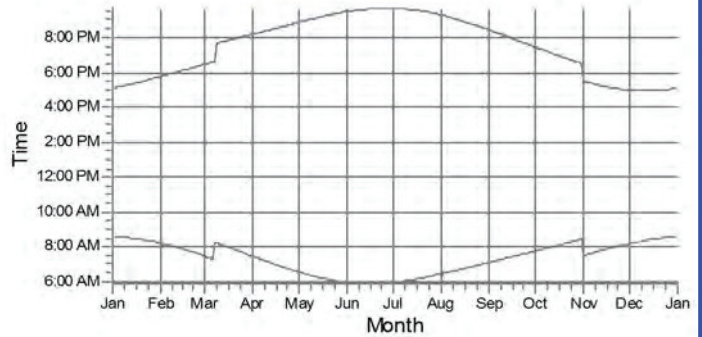
**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2)

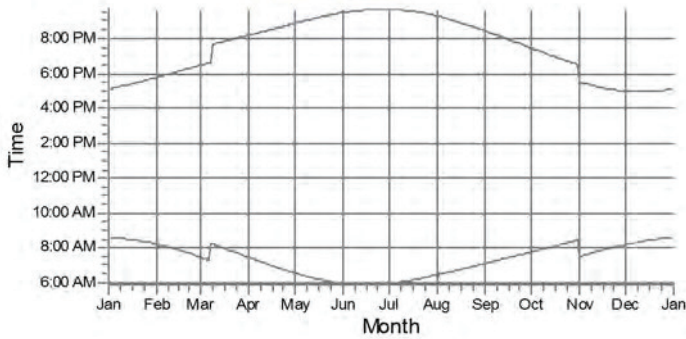
SR001: SR001



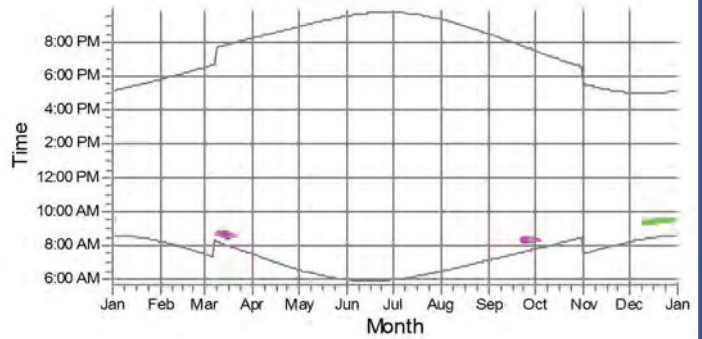
SR002: SR002



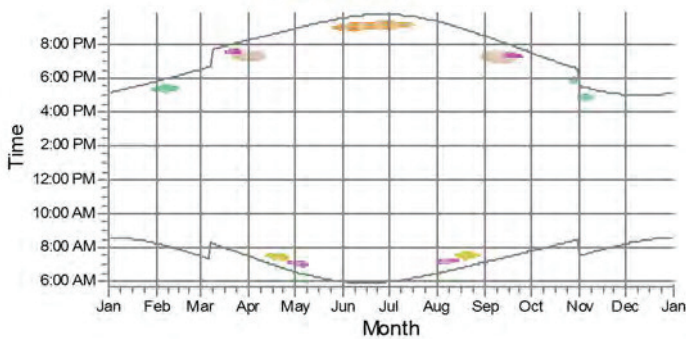
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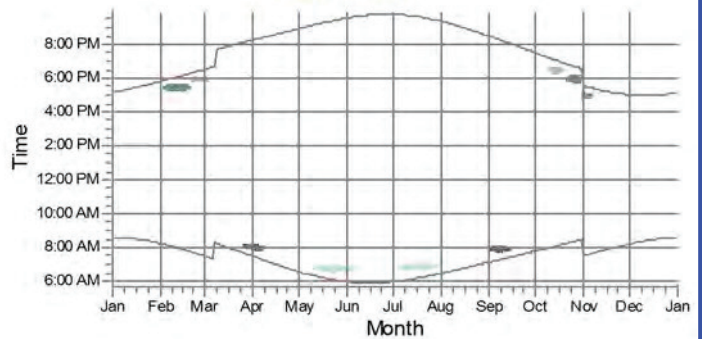
SR004: SR004



SR005: SR005



SR006: SR006



WTGs

- 2: BISON 1B
- 7: BISON 1B
- 20: BISON 1B
- 30: BISON 1B
- 202: BISON 2
- 204: BISON 2
- 6: BISON 1B
- 17: BISON 1B
- 28: BISON 1B
- 201: BISON 2
- 203: BISON 2

Project:

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 US-GRAND FORKS, ND 58201  
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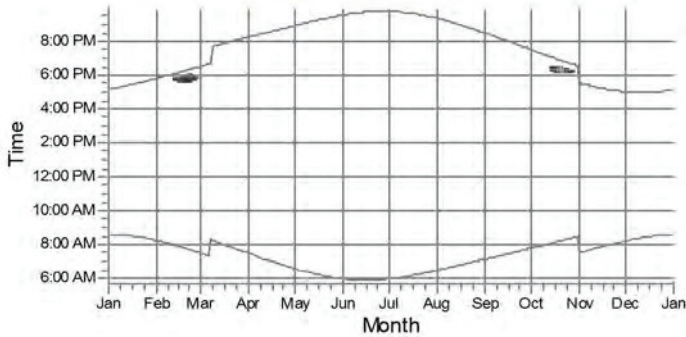
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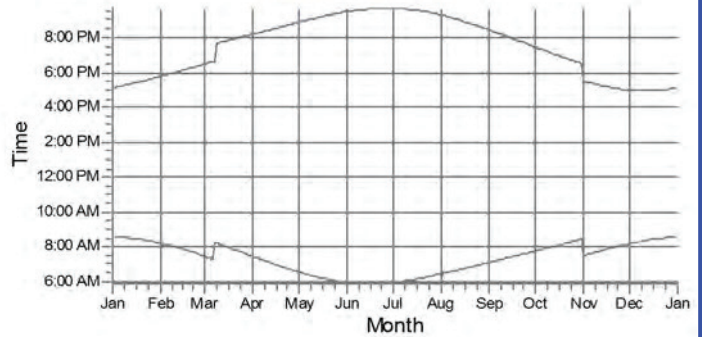
**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2)

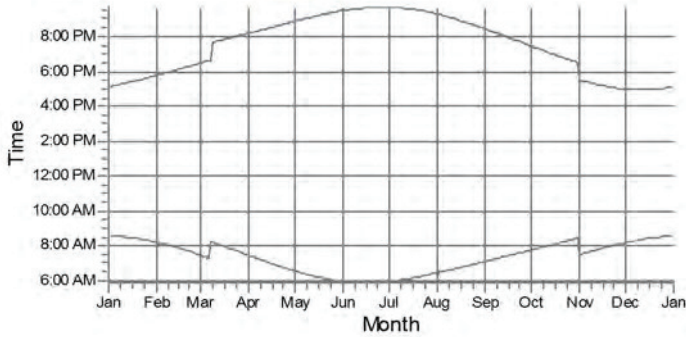
SR007: SR007



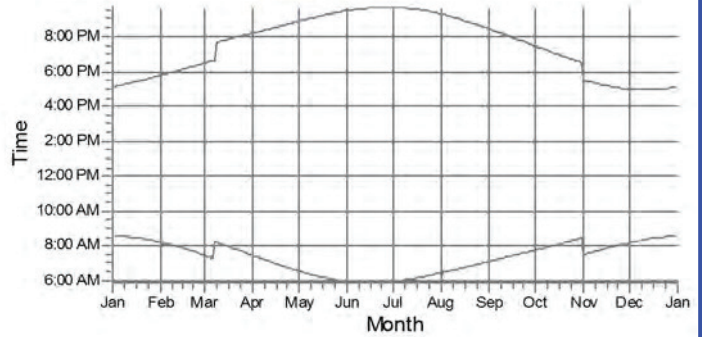
SR008: SR008



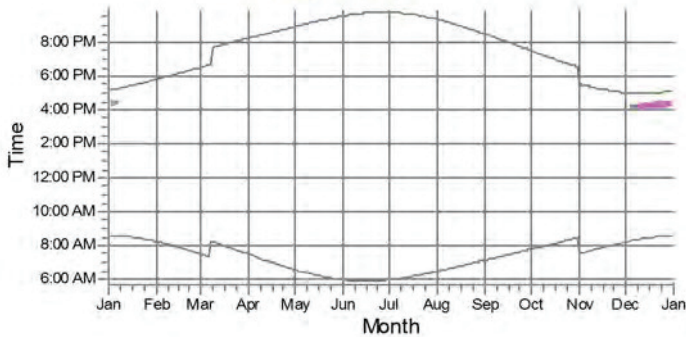
SR009: SR009



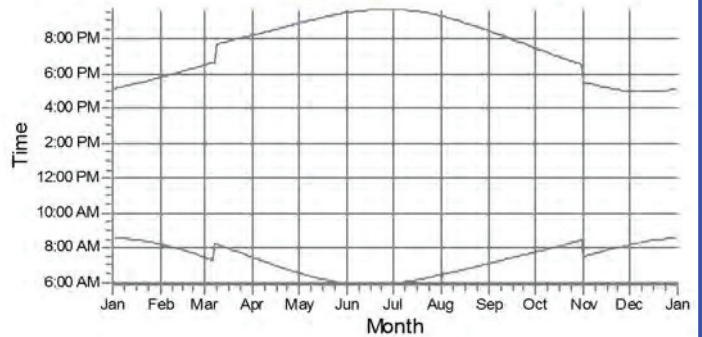
SR010: SR010



SR011: SR011



SR012: SR012



WTGs

206: BISON 2      208: BISON 2

Project:

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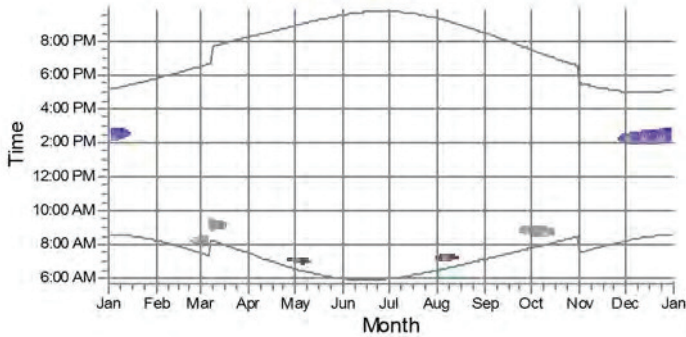
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 US-GRAND FORKS, ND 58201  
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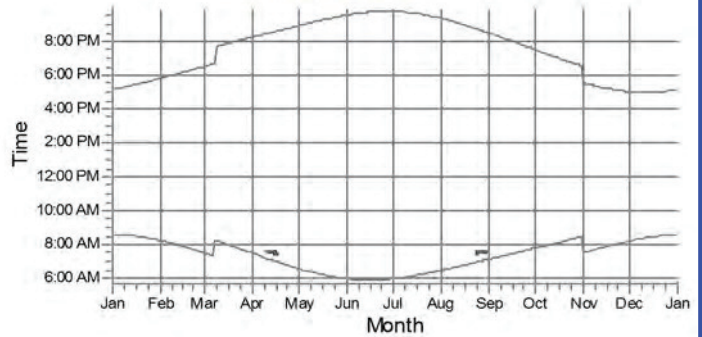
**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2)

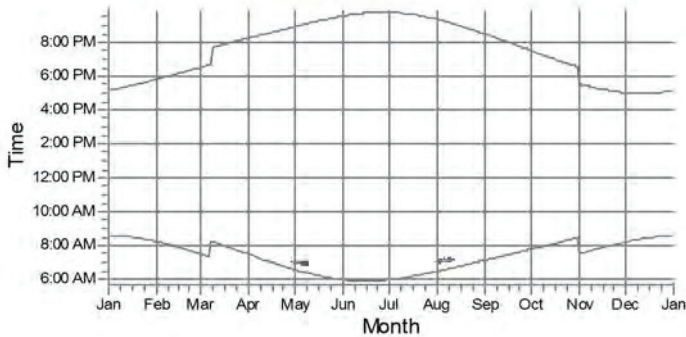
SR013: SR013



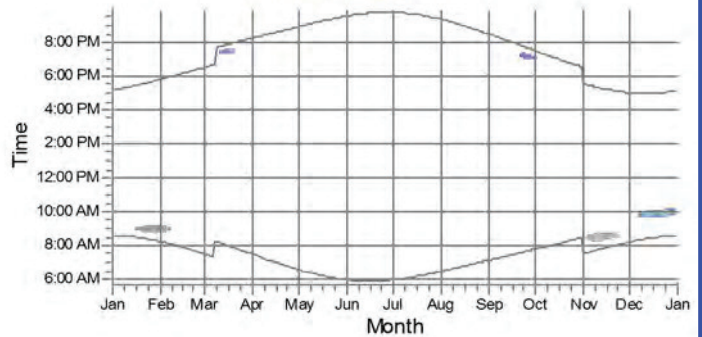
SR014: SR014



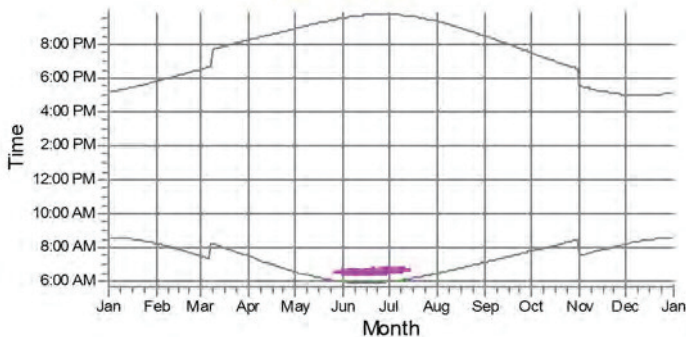
SR015: SR015



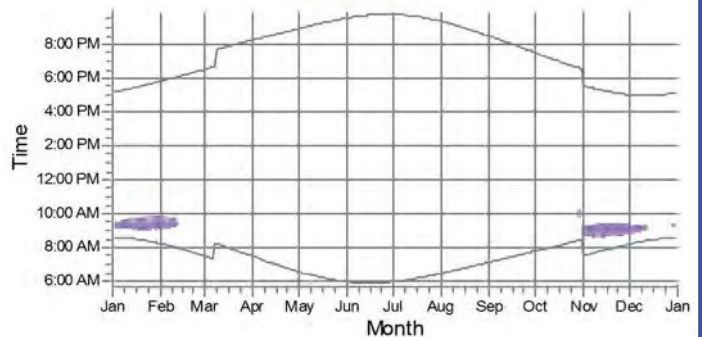
SR016: SR016



SR017: SR017



SR018: SR018



WTGs

- 8: BISON 1A
- 16: BISON 1A
- 22: BISON 1A
- 211: BISON 2
- 212: BISON 2
- 214: BISON 2
- 215: BISON 2
- 216: BISON 2
- 218: BISON 2

Project:

**Minnesota Power - BISON Wind Energy Center**

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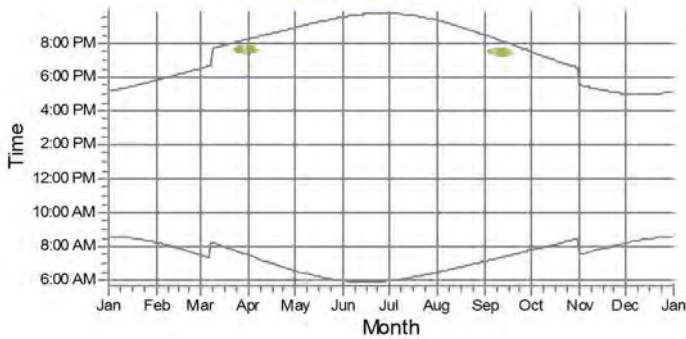
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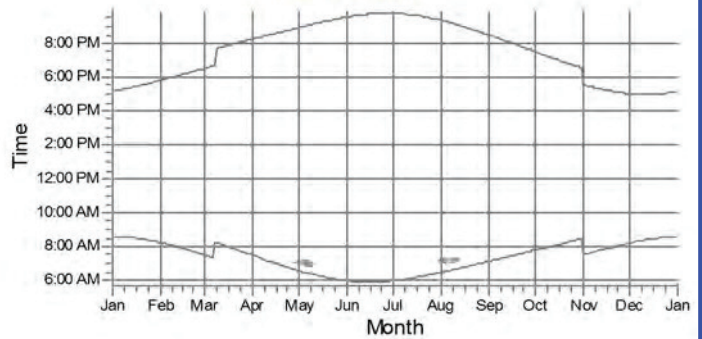
**SHADOW - Calendar**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2)

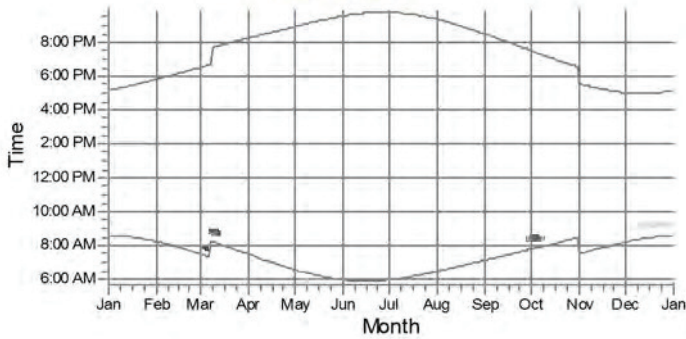
SR019: SR019



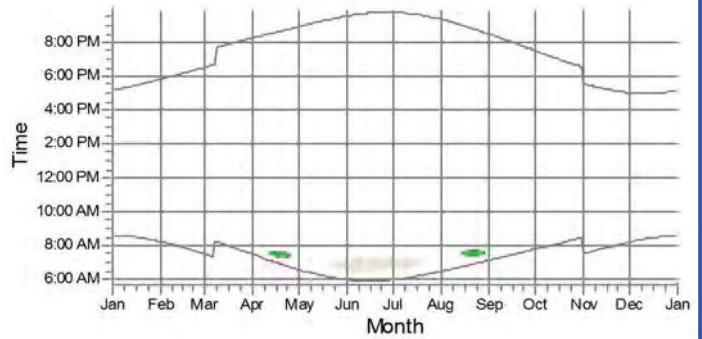
SR020: SR020



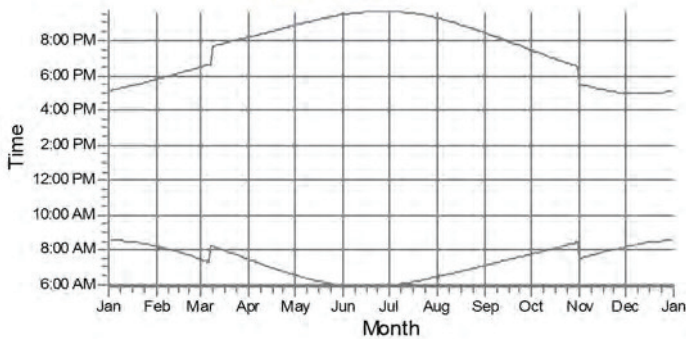
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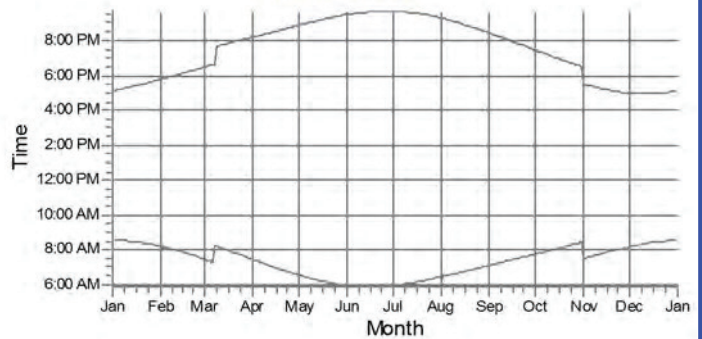
SR022: SR022



SR023: SR023



SR024: SR024



WTGs

- 222: BISON 2
- 223: BISON 2
- 226: BISON 2
- 228: BISON 2
- 310: BISON 3

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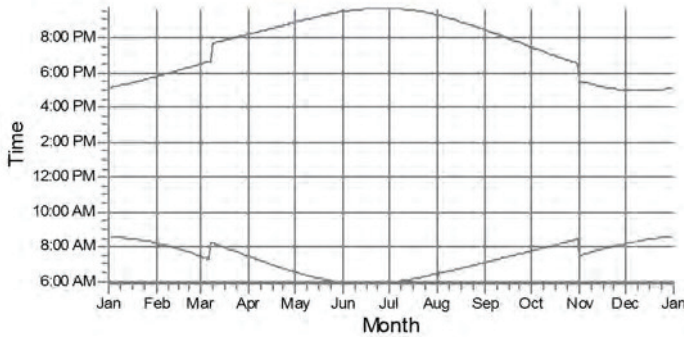
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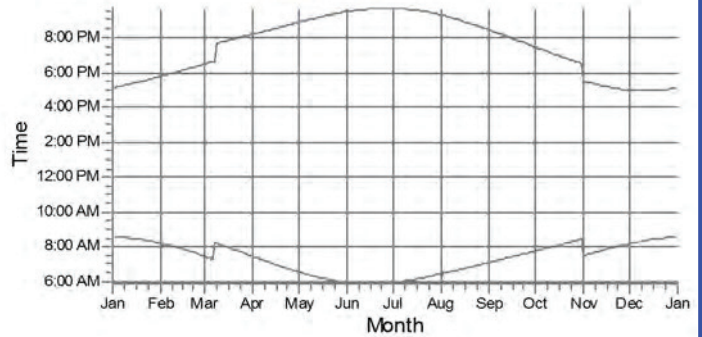
**SHADOW - Calendar**  graphical

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2)

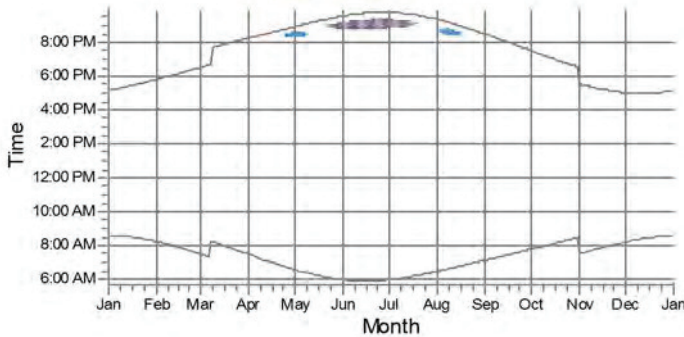
SR025: SR025



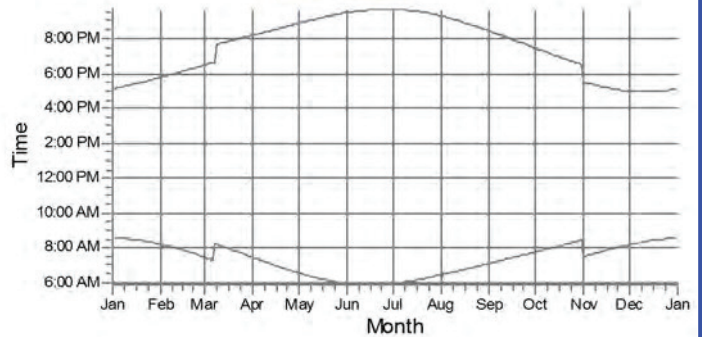
SR026: SR026



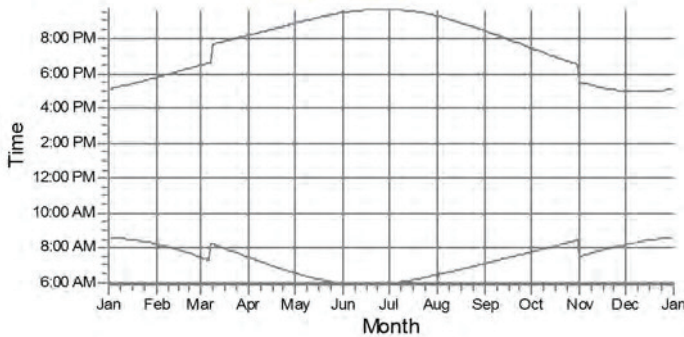
SR027: SR027



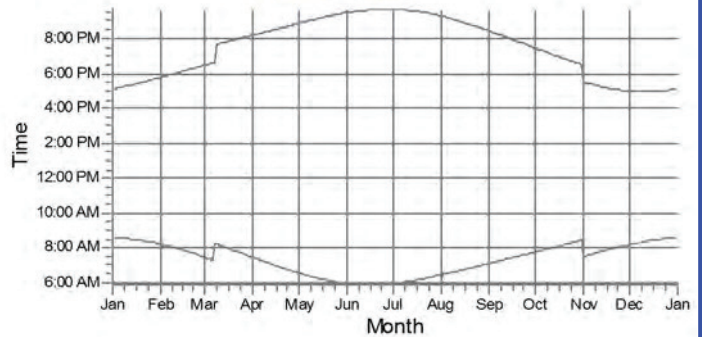
SR028: SR028



SR029: SR029



SR030: SR030



WTGs

301: BISON 3    302: BISON 3

Project:

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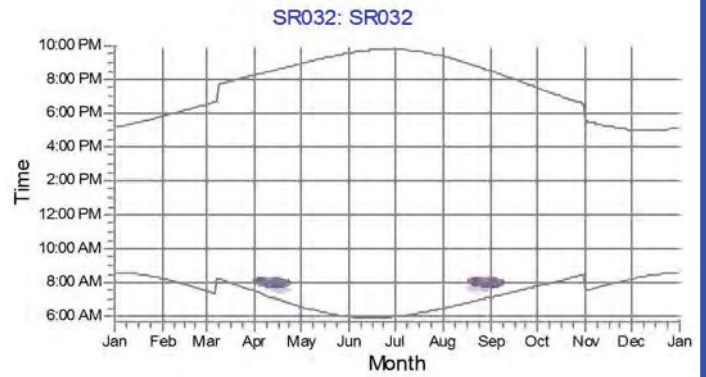
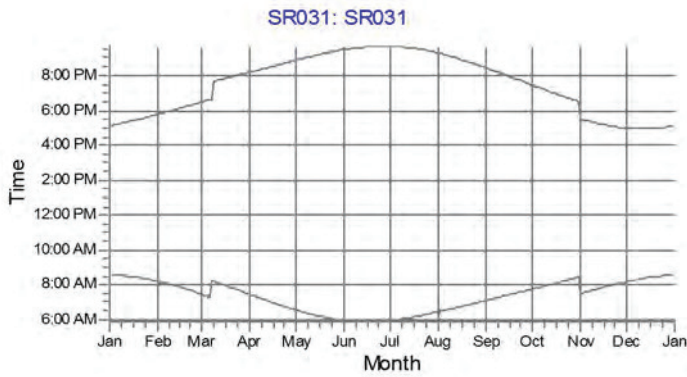
wind@eapc.net

Calculated:

6/17/2011 12:07 PM/2.7.486

**SHADOW - Calendar graphical**

Calculation: BISON 3 Shadow Flicker (with existing BISON 1, 2)



WTGs

320: BISON 3 321: BISON 3

## Appendix I



Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power
Frank Frederickson
30 West Superior Street
Duluth, MN 55802-2093

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DECIBE - Main Result

Calculation: BISON 3 Noise (with existing BISON 1, 2)

Noise calculation model:

ISO 9613-2 General

Wind speed:

8.0 m/s

Ground attenuation:

General, Ground factor: 0.5

Meteorological coefficient:

0.0 dB

Type of demand in calculation:

1: WTG noise is compared to demand (DK, DE, SE, NL etc.)

Noise values in calculation:

All noise values are mean values (Lwa) (Normal)

Pure tones:

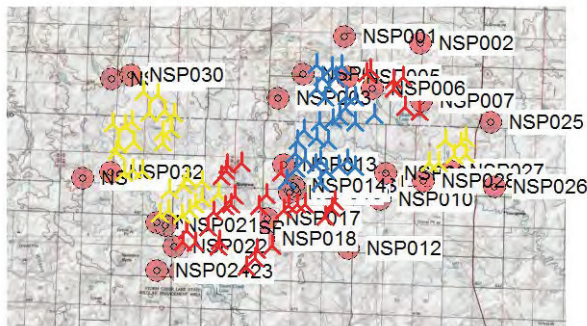
Pure and Impulse tone penalty are added to WTG source noise

Height above ground level when noise value in NSA object:

0.0 m Don't allow override of model height with height from NSA object

Deviation from official noise demands Negative is more restrictive positive is less restrictive:

0.0 dB(A)



Scale 1:400,000

New WTG

Noise sensitive area

WTGs

Table with columns: UTM WGS84 Zone: 14 East, North, Z, Row data/Description, WTG type (Valid, Manufact.), Type-generator, Power, Rotor diameter, Hub height, Noise data (Creator, Name), Wind speed, Hub height, Lwa,ref, Pure tones, Octave data. The table lists 26 wind turbine units with their respective specifications.

To be continued on next page...





Project:

Minnesota Power - BISON Wind Energy Center

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US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
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DECIBE - Main Result

Calculation: BISON 3 Noise (with existing BISON 1, 2)

...continued from previous page

Table with columns WTG, NSP001-NSP022 and rows 208-335. This is a large data table containing noise calculation results for various wind turbine locations.

Summary table with columns WTG, NSP023-NSP032 and rows 1-13. This table provides a condensed view of the noise calculation results for specific turbine locations.

To be continued on next page...

Project:

**Minnesota Power - BISON Wind Energy Center**

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 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
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**DECIBE □ - Main Result**

**Calculation: BISON 3 Noise (with existing BISON 1, 2)**

...continued from previous page

WTG	NSP023	NSP024	NSP025	NSP026	NSP027	NSP028	NSP029	NSP030	NSP031	NSP032
14	10156	11033	9239	9768	7357	6107	11326	10406	12564	11051
15	12036	12820	8862	10158	7764	6859	11368	10362	13515	12017
16	8977	9891	9987	10130	7772	6376	11114	10258	11830	10326
17	13516	14243	8904	10713	8415	7767	11699	10657	14427	12959
18	10840	11676	9074	9902	7480	6355	11251	10293	12855	11343
19	10504	11418	8667	9171	6758	5519	11924	11000	13124	11612
20	12771	13495	9223	10815	8464	7686	11178	10146	13744	12269
22	8851	9880	9553	9236	6980	5475	12339	11527	12573	11095
23	7479	8420	11211	11005	8737	7242	10737	9976	10805	9325
25	13877	14628	8451	10351	8086	7514	12208	11165	14917	13445
26	13155	13831	9686	11420	9094	8366	10920	9875	13759	12305
27	11430	12297	8357	9279	6859	5809	11932	10963	13582	12071
28	12606	13372	8775	10271	7908	7106	11530	10508	13892	12403
29	10840	11883	7548	7460	5115	3706	13733	12848	14430	12935
30	13116	13978	7293	8784	6442	5743	12955	11945	15035	13530
31	10167	11181	8334	8312	5966	4555	12908	12033	13587	12089
32	9352	10176	10280	10740	8340	7038	10373	9475	11525	10012
33	9438	10443	9075	8962	6646	5194	12376	11527	12888	11395
201	14452	15284	7050	9061	6865	6463	13538	12501	16018	14528
202	14751	15584	6924	9034	6879	6545	13765	12726	16295	14807
203	14922	15842	5433	7464	5345	5155	14965	13943	17117	15611
204	15241	16142	5595	7793	5731	5602	14967	13937	17263	15762
205	15721	16632	5211	7578	5619	5636	15470	14436	17789	16288
206	14792	15769	4599	6355	4199	4048	15632	14628	17465	15952
207	15286	16292	3805	5638	3591	3699	16418	15417	18167	16654
208	9054	10162	9232	8480	6373	4807	13507	12724	13413	11965
209	8746	9869	9560	8692	6641	5069	13544	12784	13283	11850
210	8278	9415	10059	9088	7094	5519	13480	12750	13010	11596
211	7559	8635	10736	10078	7956	6396	12218	11494	11848	10413
212	7204	8265	11110	10488	8356	6799	11869	11159	11437	10005
213	6791	7838	11544	10939	8806	7250	11528	10840	10999	9572
214	6439	7495	11880	11220	9111	7550	11473	10812	10782	9371
215	7516	8403	11418	11345	9045	7576	10260	9486	10487	8997
216	6151	7085	12478	12096	9893	8363	10248	9585	9755	8310
217	5463	6427	13043	12522	10372	8822	10318	9714	9441	8034
218	5097	6270	13290	12192	10298	8726	12259	11734	10637	9363
219	4271	5446	14090	13017	11117	9544	11878	11411	9967	8738
220	4087	5288	14391	13223	11375	9805	12188	11750	10082	8898
221	3565	4782	15025	13805	11990	10423	12263	11878	9867	8748
222	1582	2065	17500	16781	14736	13168	9419	9264	6276	5281
223	2237	2689	17079	16471	14379	12818	8938	8734	6149	5031
224	2447	3517	15858	14979	12996	11422	10523	10201	8032	6896
225	2699	3718	15655	14838	12826	11254	10292	9947	7959	6780
226	2789	3565	15981	15346	13259	11697	9364	9039	7106	5882
227	3630	4330	15438	14961	12812	11264	8878	8478	7135	5805
228	1762	2549	16887	16127	14096	12526	9728	9506	6860	5795
229	4226	4992	14753	14319	12150	10609	9032	8556	7668	6290
230	4521	5315	14412	13997	11820	10281	9146	8635	7952	6556
231	5020	5790	14064	13747	11536	10011	8991	8432	8114	6682
232	5529	6079	14562	14509	12226	10744	7747	7169	7306	5821
233	5912	6478	14240	14254	11952	10486	7764	7139	7587	6090
234	6240	6791	14106	14198	11878	10429	7631	6972	7691	6185
235	6659	7304	13356	13464	11136	9696	8195	7480	8441	6935
301	14428	15538	3901	3691	1268	1010	17417	16481	18354	16858
302	14890	16007	3497	3213	803	1244	17912	16973	18861	17365
303	15797	16911	2609	2728	853	2114	18598	17643	19688	18187
304	16380	17499	2152	2319	1160	2636	19182	18222	20299	18799

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

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 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000

wind@eapc.net

Calculated:

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**DECIBE □ - Main Result****Calculation:** BISON 3 Noise (with existing BISON 1, 2)

...continued from previous page

WTG	NSP023	NSP024	NSP025	NSP026	NSP027	NSP028	NSP029	NSP030	NSP031	NSP032
305	16756	17852	1541	2986	1910	3205	19063	18084	20408	18900
306	16395	17494	1912	2951	1586	2834	18818	17846	20097	18591
307	15738	16821	2552	3601	1695	2485	18002	17030	19315	17807
308	3253	3031	18201	17817	15649	14109	7568	7501	4465	3357
309	3326	3294	17672	17311	15133	13596	7561	7420	4841	3631
310	3032	3270	17074	16640	14484	12940	8083	7868	5576	4350
311	3337	3689	16608	16212	14041	12501	8050	7773	5878	4585
312	3678	4086	16243	15897	13707	12174	7965	7636	6092	4747
313	4081	4548	15806	15515	13306	11781	7919	7529	6388	4997
314	4603	5223	14927	14659	12437	10918	8297	7807	7198	5772
315	4956	5341	15596	15503	13235	11743	7222	6761	6305	4836
316	4960	5166	16322	16271	13995	12509	6632	6251	5538	4063
317	4595	4769	16582	16461	14205	12705	6803	6475	5356	3912
318	4377	4348	17399	17244	15001	13494	6610	6408	4602	3203
319	5717	5369	18641	18702	16407	14935	5105	5095	3146	1638
320	5955	5513	19124	19198	16902	15432	4918	5008	2664	1151
321	6041	5507	19590	19644	17353	15879	4966	5152	2197	688
322	7182	6661	19856	20100	17768	16331	3842	4117	2273	1159
323	7459	6974	19738	20043	17699	16277	3495	3749	2576	1529
324	7296	6940	18931	19268	16916	15503	3525	3543	3295	2022
325	8658	8187	20043	20542	18167	16790	2310	2715	3303	2640
326	8261	7876	19335	19821	17446	16068	2563	2683	3578	2615
327	8358	8026	19014	19541	17160	15795	2482	2456	3947	2923
328	8575	8384	18102	18728	16333	15000	2674	2219	4909	3751
329	9756	9547	18456	19279	16867	15591	1822	1087	5605	4647
330	9479	9363	17688	18507	16094	14822	2590	1754	5949	4839
331	8572	8503	17261	17929	15528	14212	3292	2610	5615	4350
332	8375	8378	16756	17404	15004	13685	3809	3087	5912	4577
333	7558	7544	16889	17372	14993	13626	4161	3603	5361	3950
334	7466	7373	17383	17833	15459	14081	3891	3446	4868	3477
335	6929	6829	17422	17766	15409	14004	4289	3924	4606	3155

Project:

Minnesota Power - BISON Wind Energy Center

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 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
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### DECIBEL - Detailed results

Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s

#### Assumptions

Calculated L(DW) = LWA,ref + K + Dc - (Adiv + Aatm + Agr + Abar + Amisc) - Cmet  
 (when calculated with ground attenuation, then Dc = Domega)

- LWA,ref: Sound pressure level at WTG
- K: Pure tone
- Dc: Directivity correction
- Adiv: the attenuation due to geometrical divergence
- Aatm: the attenuation due to atmospheric absorption
- Agr: the attenuation due to ground effect
- Abar: the attenuation due to a barrier
- Amisc: the attenuation due to miscellaneous other effects
- Cmet: Meteorological correction

#### Calculation Results

Noise sensitive area: NSP 1 NSP 1

WTG

Wind speed: 8 m/s

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	4,264	4,265	14	108.0	0.00	83.60	-	-	0.00	0.00	-	0.00
2	3,199	3,201	18.41	108.0	0.00	81.11	-	-	0.00	0.00	-	0.00
3	6,695	6,696		107.0	0.00	87.52	-	-	0.00	0.00	-	0.00
4	6,984	6,984		107.0	0.00	87.88	-	-	0.00	0.00	-	0.00
5	5,427	5,428	1	107.0	0.00	85.69	-	-	0.00	0.00	-	0.00
6	2,205	2,207		108.0	0.00	77.88	-	-	0.00	0.00	-	0.00
7	3,161	3,163	18	108.0	0.00	81.00	-	-	0.00	0.00	-	0.00
8	7,475	7,476	11	107.0	0.00	88.47	-	-	0.00	0.00	-	0.00
9	4,600	4,600	1	108.0	0.00	84.26	-	-	0.00	0.00	-	0.00
10	3,813	3,814	1	108.0	0.00	82.63	-	-	0.00	0.00	-	0.00
11	4,431	4,431	14.4	108.0	0.00	83.93	-	-	0.00	0.00	-	0.00
12	6,533	6,534	8.4	107.0	0.00	87.30	-	-	0.00	0.00	-	0.00
13	6,695	6,695		107.0	0.00	87.52	-	-	0.00	0.00	-	0.00
14	5,580	5,581	8	107.0	0.00	85.93	-	-	0.00	0.00	-	0.00
15	3,389	3,390	1	108.0	0.00	81.60	-	-	0.00	0.00	-	0.00
16	6,790	6,790		107.0	0.00	87.64	-	-	0.00	0.00	-	0.00
17	1,759	1,761	4	108.0	0.00	75.91	-	-	0.00	0.00	-	0.00
18	4,744	4,745	11.8	107.0	0.00	84.52	-	-	0.00	0.00	-	0.00
19	5,575	5,575	8	107.0	0.00	85.93	-	-	0.00	0.00	-	0.00
20	2,476	2,478	1	108.0	0.00	78.88	-	-	0.00	0.00	-	0.00
22	7,814	7,815	4	107.0	0.00	88.86	-	-	0.00	0.00	-	0.00
23	8,207	8,207	4	107.0	0.00	89.28	-	-	0.00	0.00	-	0.00
25	1,568	1,569		108.0	0.00	74.91	-	-	0.00	0.00	-	0.00
26	2,102	2,104	4	108.0	0.00	77.46	-	-	0.00	0.00	-	0.00
27	4,471	4,471	14	108.0	0.00	84.01	-	-	0.00	0.00	-	0.00
28	2,781	2,782		108.0	0.00	79.89	-	-	0.00	0.00	-	0.00
29	6,941	6,941		107.0	0.00	87.83	-	-	0.00	0.00	-	0.00
30	3,277	3,278	18.1	108.0	0.00	81.31	-	-	0.00	0.00	-	0.00
31	6,839	6,839		107.0	0.00	87.70	-	-	0.00	0.00	-	0.00
32	6,045	6,046	8.8	107.0	0.00	86.63	-	-	0.00	0.00	-	0.00
33	7,183	7,183		107.0	0.00	88.13	-	-	0.00	0.00	-	0.00
201	2,289	2,290	1	108.0	0.00	78.20	-	-	0.00	0.00	-	0.00
202	2,250	2,251	4	108.0	0.00	78.05	-	-	0.00	0.00	-	0.00
203	3,806	3,806	1	108.0	0.00	82.61	-	-	0.00	0.00	-	0.00
204	3,485	3,486	1	108.0	0.00	81.85	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
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**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

WTG		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
205	3,784	3,785	141	108.0	0.00	82.56	-	-	0.00	0.00	-	0.00
206	4,937	4,937	144	108.0	0.00	84.87	-	-	0.00	0.00	-	0.00
207	5,629	5,630	114	108.0	0.00	86.01	-	-	0.00	0.00	-	0.00
208	8,747	8,747	44	108.0	0.00	89.84	-	-	0.00	0.00	-	0.00
209	9,136	9,136	41	108.0	0.00	90.22	-	-	0.00	0.00	-	0.00
210	9,588	9,589	11	108.0	0.00	90.64	-	-	0.00	0.00	-	0.00
211	9,129	9,130	44	108.0	0.00	90.21	-	-	0.00	0.00	-	0.00
212	9,223	9,223	44	108.0	0.00	90.30	-	-	0.00	0.00	-	0.00
213	9,403	9,403	41	108.0	0.00	90.47	-	-	0.00	0.00	-	0.00
214	9,729	9,729	44	108.0	0.00	90.76	-	-	0.00	0.00	-	0.00
215	7,962	7,963	44	108.0	0.00	89.02	-	-	0.00	0.00	-	0.00
216	9,355	9,356	44	108.0	0.00	90.42	-	-	0.00	0.00	-	0.00
217	10,067	10,067	44	108.0	0.00	91.06	-	-	0.00	0.00	-	0.00
218	11,731	11,731	44	108.0	0.00	92.39	-	-	0.00	0.00	-	0.00
219	12,209	12,210	44	108.0	0.00	92.73	-	-	0.00	0.00	-	0.00
220	12,676	12,676	-44	108.0	0.00	93.06	-	-	0.00	0.00	-	0.00
221	13,273	13,273	-88	108.0	0.00	93.46	-	-	0.00	0.00	-	0.00
222	13,863	13,863	-144	108.0	0.00	93.84	-	-	0.00	0.00	-	0.00
223	13,236	13,237	-84	108.0	0.00	93.44	-	-	0.00	0.00	-	0.00
224	12,991	12,991	-44	108.0	0.00	93.27	-	-	0.00	0.00	-	0.00
225	12,672	12,672	-14	108.0	0.00	93.06	-	-	0.00	0.00	-	0.00
226	12,441	12,442	8	108.0	0.00	92.90	-	-	0.00	0.00	-	0.00
227	11,619	11,619	11	108.0	0.00	92.30	-	-	0.00	0.00	-	0.00
228	13,479	13,479	-111	108.0	0.00	93.59	-	-	0.00	0.00	-	0.00
229	11,001	11,001	144	108.0	0.00	91.83	-	-	0.00	0.00	-	0.00
230	10,710	10,711	44	108.0	0.00	91.60	-	-	0.00	0.00	-	0.00
231	10,209	10,209	44	108.0	0.00	91.18	-	-	0.00	0.00	-	0.00
232	9,874	9,875	48	108.0	0.00	90.89	-	-	0.00	0.00	-	0.00
233	9,471	9,472	44	108.0	0.00	90.53	-	-	0.00	0.00	-	0.00
234	9,177	9,177	44	108.0	0.00	90.25	-	-	0.00	0.00	-	0.00
235	8,620	8,620	44	108.0	0.00	89.71	-	-	0.00	0.00	-	0.00
301	8,073	8,073	8	108.0	0.00	89.14	-	-	0.00	0.00	-	0.00
302	8,378	8,378	8	108.0	0.00	89.46	-	-	0.00	0.00	-	0.00
303	8,567	8,567	44	108.0	0.00	89.66	-	-	0.00	0.00	-	0.00
304	8,953	8,953	44	108.0	0.00	90.04	-	-	0.00	0.00	-	0.00
305	8,413	8,413	44	108.0	0.00	89.50	-	-	0.00	0.00	-	0.00
306	8,350	8,351	44	108.0	0.00	89.43	-	-	0.00	0.00	-	0.00
307	7,667	7,667	11	108.0	0.00	88.69	-	-	0.00	0.00	-	0.00
308	13,581	13,581	-144	108.0	0.00	93.66	-	-	0.00	0.00	-	0.00
309	13,087	13,087	-44	108.0	0.00	93.34	-	-	0.00	0.00	-	0.00
310	12,784	12,784	-44	108.0	0.00	93.13	-	-	0.00	0.00	-	0.00
311	12,314	12,314	44	108.0	0.00	92.81	-	-	0.00	0.00	-	0.00
312	11,900	11,900	44	108.0	0.00	92.51	-	-	0.00	0.00	-	0.00
313	11,418	11,418	144	108.0	0.00	92.15	-	-	0.00	0.00	-	0.00
314	10,700	10,700	11	108.0	0.00	91.59	-	-	0.00	0.00	-	0.00
315	10,751	10,752	44	108.0	0.00	91.63	-	-	0.00	0.00	-	0.00
316	11,213	11,213	144	108.0	0.00	91.99	-	-	0.00	0.00	-	0.00
317	11,595	11,596	11	108.0	0.00	92.29	-	-	0.00	0.00	-	0.00
318	12,342	12,342	44	108.0	0.00	92.83	-	-	0.00	0.00	-	0.00
319	12,869	12,869	-44	108.0	0.00	93.19	-	-	0.00	0.00	-	0.00
320	13,255	13,255	-8	108.0	0.00	93.45	-	-	0.00	0.00	-	0.00
321	13,709	13,709	-144	108.0	0.00	93.74	-	-	0.00	0.00	-	0.00
322	13,512	13,512	-11	108.0	0.00	93.61	-	-	0.00	0.00	-	0.00
323	13,270	13,270	-88	108.0	0.00	93.46	-	-	0.00	0.00	-	0.00
324	12,484	12,485	44	108.0	0.00	92.93	-	-	0.00	0.00	-	0.00

To be continued on next page...



Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
325	13,128	13,129	-000	108.0	0.00	93.36	-	-	0.00	0.00	-	0.00
326	12,519	12,519	-001	108.0	0.00	92.95	-	-	0.00	0.00	-	0.00
327	12,142	12,142	044	108.0	0.00	92.69	-	-	0.00	0.00	-	0.00
328	11,119	11,120	104	108.0	0.00	91.92	-	-	0.00	0.00	-	0.00
329	11,031	11,032	180	108.0	0.00	91.85	-	-	0.00	0.00	-	0.00
330	10,349	10,349	080	108.0	0.00	91.30	-	-	0.00	0.00	-	0.00
331	10,292	10,292	088	108.0	0.00	91.25	-	-	0.00	0.00	-	0.00
332	9,900	9,900	040	108.0	0.00	90.91	-	-	0.00	0.00	-	0.00
333	10,387	10,388	004	108.0	0.00	91.33	-	-	0.00	0.00	-	0.00
334	10,883	10,884	000	108.0	0.00	91.74	-	-	0.00	0.00	-	0.00
335	11,159	11,159	100	108.0	0.00	91.95	-	-	0.00	0.00	-	0.00
Sum	34.15											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP NSP**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	5,793	5,794	1000	108.0	0.00	86.26	-	-	0.00	0.00	-	0.00
2	4,849	4,851	1000	108.0	0.00	84.72	-	-	0.00	0.00	-	0.00
3	8,818	8,818	000	107.0	0.00	89.91	-	-	0.00	0.00	-	0.00
4	8,536	8,537	400	107.0	0.00	89.63	-	-	0.00	0.00	-	0.00
5	7,727	7,728	008	107.0	0.00	88.76	-	-	0.00	0.00	-	0.00
6	4,861	4,862	1000	108.0	0.00	84.74	-	-	0.00	0.00	-	0.00
7	6,050	6,051	1000	108.0	0.00	86.64	-	-	0.00	0.00	-	0.00
8	9,385	9,385	010	107.0	0.00	90.45	-	-	0.00	0.00	-	0.00
9	5,469	5,470	1100	108.0	0.00	85.76	-	-	0.00	0.00	-	0.00
10	5,265	5,266	1000	108.0	0.00	85.43	-	-	0.00	0.00	-	0.00
11	4,496	4,497	1400	108.0	0.00	84.06	-	-	0.00	0.00	-	0.00
12	7,286	7,286	044	107.0	0.00	88.25	-	-	0.00	0.00	-	0.00
13	8,172	8,173	400	107.0	0.00	89.25	-	-	0.00	0.00	-	0.00
14	7,458	7,458	014	107.0	0.00	88.45	-	-	0.00	0.00	-	0.00
15	5,829	5,830	1080	108.0	0.00	86.31	-	-	0.00	0.00	-	0.00
16	8,640	8,641	400	107.0	0.00	89.73	-	-	0.00	0.00	-	0.00
17	4,887	4,888	1010	108.0	0.00	84.78	-	-	0.00	0.00	-	0.00
18	6,823	6,824	000	107.0	0.00	87.68	-	-	0.00	0.00	-	0.00
19	7,122	7,122	004	107.0	0.00	88.05	-	-	0.00	0.00	-	0.00
20	5,531	5,532	1100	108.0	0.00	85.86	-	-	0.00	0.00	-	0.00
22	9,075	9,075	000	107.0	0.00	90.16	-	-	0.00	0.00	-	0.00
23	10,150	10,151	010	107.0	0.00	91.13	-	-	0.00	0.00	-	0.00
25	4,381	4,382	1400	108.0	0.00	83.83	-	-	0.00	0.00	-	0.00
26	5,628	5,629	1104	108.0	0.00	86.01	-	-	0.00	0.00	-	0.00
27	6,190	6,190	1000	108.0	0.00	86.83	-	-	0.00	0.00	-	0.00
28	5,390	5,391	1101	108.0	0.00	85.63	-	-	0.00	0.00	-	0.00
29	7,421	7,422	001	107.0	0.00	88.41	-	-	0.00	0.00	-	0.00
30	4,510	4,511	1400	108.0	0.00	84.08	-	-	0.00	0.00	-	0.00
31	7,784	7,785	000	107.0	0.00	88.82	-	-	0.00	0.00	-	0.00
32	8,326	8,326	400	107.0	0.00	89.41	-	-	0.00	0.00	-	0.00
33	8,414	8,414	408	107.0	0.00	89.50	-	-	0.00	0.00	-	0.00
201	3,283	3,285	1811	108.0	0.00	81.33	-	-	0.00	0.00	-	0.00
202	2,993	2,994	1018	108.0	0.00	80.52	-	-	0.00	0.00	-	0.00
203	2,812	2,814	1080	108.0	0.00	79.99	-	-	0.00	0.00	-	0.00
204	2,414	2,415	0100	108.0	0.00	78.66	-	-	0.00	0.00	-	0.00
205	2,013	2,016	0000	108.0	0.00	77.09	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

No.	Distance [m]	Sound distance [m]	Wind speed: 8 m/s		Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
			Calculated [dB(A)]	LwA,ref [dB(A)]								
206	3,492	3,492	1008	108.0	0.00	81.86	-	-	0.00	0.00	-	0.00
207	3,624	3,625	1000	108.0	0.00	82.19	-	-	0.00	0.00	-	0.00
208	9,524	9,524	401	108.0	0.00	90.58	-	-	0.00	0.00	-	0.00
209	9,939	9,939	000	108.0	0.00	90.95	-	-	0.00	0.00	-	0.00
210	10,471	10,472	000	108.0	0.00	91.40	-	-	0.00	0.00	-	0.00
211	10,503	10,503	008	108.0	0.00	91.43	-	-	0.00	0.00	-	0.00
212	10,741	10,741	000	108.0	0.00	91.62	-	-	0.00	0.00	-	0.00
213	11,060	11,060	180	108.0	0.00	91.88	-	-	0.00	0.00	-	0.00
214	11,421	11,422	100	108.0	0.00	92.15	-	-	0.00	0.00	-	0.00
215	10,097	10,098	010	108.0	0.00	91.08	-	-	0.00	0.00	-	0.00
216	11,466	11,466	100	108.0	0.00	92.19	-	-	0.00	0.00	-	0.00
217	12,167	12,167	041	108.0	0.00	92.70	-	-	0.00	0.00	-	0.00
218	13,310	13,311	-000	108.0	0.00	93.48	-	-	0.00	0.00	-	0.00
219	13,962	13,963	-104	108.0	0.00	93.90	-	-	0.00	0.00	-	0.00
220	14,383	14,383	-008	108.0	0.00	94.16	-	-	0.00	0.00	-	0.00
221	15,028	15,028	-004	108.0	0.00	94.54	-	-	0.00	0.00	-	0.00
222	16,439	16,439	-400	108.0	0.00	95.32	-	-	0.00	0.00	-	0.00
223	15,874	15,874	-000	108.0	0.00	95.01	-	-	0.00	0.00	-	0.00
224	15,212	15,212	-000	108.0	0.00	94.64	-	-	0.00	0.00	-	0.00
225	14,927	14,928	-004	108.0	0.00	94.48	-	-	0.00	0.00	-	0.00
226	14,921	14,922	-004	108.0	0.00	94.48	-	-	0.00	0.00	-	0.00
227	14,179	14,179	-180	108.0	0.00	94.03	-	-	0.00	0.00	-	0.00
228	15,947	15,947	-000	108.0	0.00	95.05	-	-	0.00	0.00	-	0.00
229	13,502	13,502	-114	108.0	0.00	93.61	-	-	0.00	0.00	-	0.00
230	13,173	13,174	-000	108.0	0.00	93.39	-	-	0.00	0.00	-	0.00
231	12,709	12,710	-004	108.0	0.00	93.08	-	-	0.00	0.00	-	0.00
232	12,715	12,715	-004	108.0	0.00	93.09	-	-	0.00	0.00	-	0.00
233	12,325	12,325	000	108.0	0.00	92.82	-	-	0.00	0.00	-	0.00
234	12,083	12,083	001	108.0	0.00	92.64	-	-	0.00	0.00	-	0.00
235	11,407	11,407	100	108.0	0.00	92.14	-	-	0.00	0.00	-	0.00
301	6,363	6,363	000	108.0	0.00	87.07	-	-	0.00	0.00	-	0.00
302	6,432	6,432	004	108.0	0.00	87.17	-	-	0.00	0.00	-	0.00
303	6,193	6,193	1000	108.0	0.00	86.84	-	-	0.00	0.00	-	0.00
304	6,342	6,342	000	108.0	0.00	87.04	-	-	0.00	0.00	-	0.00
305	5,580	5,581	1140	108.0	0.00	85.93	-	-	0.00	0.00	-	0.00
306	5,680	5,681	1100	108.0	0.00	86.09	-	-	0.00	0.00	-	0.00
307	5,284	5,285	1010	108.0	0.00	85.46	-	-	0.00	0.00	-	0.00
308	16,541	16,541	-418	108.0	0.00	95.37	-	-	0.00	0.00	-	0.00
309	16,018	16,018	-000	108.0	0.00	95.09	-	-	0.00	0.00	-	0.00
310	15,587	15,587	-000	108.0	0.00	94.86	-	-	0.00	0.00	-	0.00
311	15,101	15,101	-081	108.0	0.00	94.58	-	-	0.00	0.00	-	0.00
312	14,691	14,691	-040	108.0	0.00	94.34	-	-	0.00	0.00	-	0.00
313	14,207	14,208	-100	108.0	0.00	94.05	-	-	0.00	0.00	-	0.00
314	13,388	13,388	-101	108.0	0.00	93.53	-	-	0.00	0.00	-	0.00
315	13,700	13,700	-100	108.0	0.00	93.73	-	-	0.00	0.00	-	0.00
316	14,287	14,287	-108	108.0	0.00	94.10	-	-	0.00	0.00	-	0.00
317	14,634	14,635	-004	108.0	0.00	94.31	-	-	0.00	0.00	-	0.00
318	15,434	15,434	-014	108.0	0.00	94.77	-	-	0.00	0.00	-	0.00
319	16,244	16,244	-001	108.0	0.00	95.21	-	-	0.00	0.00	-	0.00
320	16,673	16,674	-400	108.0	0.00	95.44	-	-	0.00	0.00	-	0.00
321	17,141	17,141	-400	108.0	0.00	95.68	-	-	0.00	0.00	-	0.00
322	17,098	17,098	-408	108.0	0.00	95.66	-	-	0.00	0.00	-	0.00
323	16,893	16,893	-400	108.0	0.00	95.55	-	-	0.00	0.00	-	0.00
324	16,086	16,087	-000	108.0	0.00	95.13	-	-	0.00	0.00	-	0.00
325	16,889	16,889	-440	108.0	0.00	95.55	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
326	16,241	16,241	-001	108.0	0.00	95.21	-	-	0.00	0.00	-	0.00
327	15,875	15,875	-000	108.0	0.00	95.01	-	-	0.00	0.00	-	0.00
328	14,870	14,871	-008	108.0	0.00	94.45	-	-	0.00	0.00	-	0.00
329	14,911	14,911	-000	108.0	0.00	94.47	-	-	0.00	0.00	-	0.00
330	14,195	14,195	-180	108.0	0.00	94.04	-	-	0.00	0.00	-	0.00
331	14,023	14,023	-100	108.0	0.00	93.94	-	-	0.00	0.00	-	0.00
332	13,585	13,586	-100	108.0	0.00	93.66	-	-	0.00	0.00	-	0.00
333	13,962	13,963	-104	108.0	0.00	93.90	-	-	0.00	0.00	-	0.00
334	14,470	14,470	-010	108.0	0.00	94.21	-	-	0.00	0.00	-	0.00
335	14,669	14,669	-008	108.0	0.00	94.33	-	-	0.00	0.00	-	0.00
Sum	30.70											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP NSP**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	3,406	3,408	1000	108.0	0.00	81.65	-	-	0.00	0.00	-	0.00
2	3,610	3,611	1008	108.0	0.00	82.15	-	-	0.00	0.00	-	0.00
3	3,064	3,066	1001	107.0	0.00	80.73	-	-	0.00	0.00	-	0.00
4	4,055	4,056	1080	107.0	0.00	83.16	-	-	0.00	0.00	-	0.00
5	2,198	2,200	1110	107.0	0.00	77.85	-	-	0.00	0.00	-	0.00
6	3,220	3,221	1804	108.0	0.00	81.16	-	-	0.00	0.00	-	0.00
7	2,055	2,057	0001	108.0	0.00	77.26	-	-	0.00	0.00	-	0.00
8	3,880	3,881	1400	107.0	0.00	82.78	-	-	0.00	0.00	-	0.00
9	4,252	4,253	1400	108.0	0.00	83.57	-	-	0.00	0.00	-	0.00
10	3,610	3,611	1008	108.0	0.00	82.15	-	-	0.00	0.00	-	0.00
11	5,168	5,169	1040	108.0	0.00	85.27	-	-	0.00	0.00	-	0.00
12	4,917	4,917	1144	107.0	0.00	84.83	-	-	0.00	0.00	-	0.00
13	4,002	4,002	1400	107.0	0.00	83.05	-	-	0.00	0.00	-	0.00
14	2,942	2,943	1008	107.0	0.00	80.38	-	-	0.00	0.00	-	0.00
15	2,469	2,471	0100	108.0	0.00	78.86	-	-	0.00	0.00	-	0.00
16	3,517	3,518	1000	107.0	0.00	81.93	-	-	0.00	0.00	-	0.00
17	3,260	3,261	1810	108.0	0.00	81.27	-	-	0.00	0.00	-	0.00
18	2,518	2,518	1040	107.0	0.00	79.02	-	-	0.00	0.00	-	0.00
19	3,451	3,452	1000	107.0	0.00	81.76	-	-	0.00	0.00	-	0.00
20	2,557	2,559	0004	108.0	0.00	79.16	-	-	0.00	0.00	-	0.00
22	4,974	4,975	1100	107.0	0.00	84.94	-	-	0.00	0.00	-	0.00
23	4,388	4,390	1080	107.0	0.00	83.85	-	-	0.00	0.00	-	0.00
25	3,737	3,737	1000	108.0	0.00	82.45	-	-	0.00	0.00	-	0.00
26	2,679	2,681	0040	108.0	0.00	79.57	-	-	0.00	0.00	-	0.00
27	3,106	3,107	1800	108.0	0.00	80.85	-	-	0.00	0.00	-	0.00
28	2,732	2,734	0001	108.0	0.00	79.74	-	-	0.00	0.00	-	0.00
29	5,470	5,470	1010	107.0	0.00	85.76	-	-	0.00	0.00	-	0.00
30	4,061	4,062	1004	108.0	0.00	83.17	-	-	0.00	0.00	-	0.00
31	4,810	4,810	1100	107.0	0.00	84.64	-	-	0.00	0.00	-	0.00
32	2,461	2,462	1000	107.0	0.00	78.82	-	-	0.00	0.00	-	0.00
33	4,615	4,616	1000	107.0	0.00	84.29	-	-	0.00	0.00	-	0.00
201	4,852	4,852	1000	108.0	0.00	84.72	-	-	0.00	0.00	-	0.00
202	5,121	5,121	1000	108.0	0.00	85.19	-	-	0.00	0.00	-	0.00
203	6,117	6,118	1000	108.0	0.00	86.73	-	-	0.00	0.00	-	0.00
204	6,183	6,183	1008	108.0	0.00	86.82	-	-	0.00	0.00	-	0.00
205	6,703	6,704	8000	108.0	0.00	87.53	-	-	0.00	0.00	-	0.00
206	6,722	6,722	8040	108.0	0.00	87.55	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

No.	Distance [m]	Sound distance [m]	Wind speed: 8 m/s										
			WTG	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
207	7,505	7,506	41	108.0	0.00	88.51	-	-	0.00	0.00	-	0.00	
208	6,246	6,246	4	108.0	0.00	86.91	-	-	0.00	0.00	-	0.00	
209	6,504	6,504		108.0	0.00	87.26	-	-	0.00	0.00	-	0.00	
210	6,758	6,758	8 8	108.0	0.00	87.60	-	-	0.00	0.00	-	0.00	
211	5,807	5,807	1	108.0	0.00	86.28	-	-	0.00	0.00	-	0.00	
212	5,711	5,712	11 14	108.0	0.00	86.14	-	-	0.00	0.00	-	0.00	
213	5,701	5,702	11 1	108.0	0.00	86.12	-	-	0.00	0.00	-	0.00	
214	5,939	5,940	1	108.0	0.00	86.48	-	-	0.00	0.00	-	0.00	
215	3,963	3,964	1 84	108.0	0.00	82.96	-	-	0.00	0.00	-	0.00	
216	5,176	5,177	1 4	108.0	0.00	85.28	-	-	0.00	0.00	-	0.00	
217	5,829	5,829	1 8	108.0	0.00	86.31	-	-	0.00	0.00	-	0.00	
218	7,838	7,838	8	108.0	0.00	88.88	-	-	0.00	0.00	-	0.00	
219	8,121	8,121		108.0	0.00	89.19	-	-	0.00	0.00	-	0.00	
220	8,598	8,598	48	108.0	0.00	89.69	-	-	0.00	0.00	-	0.00	
221	9,121	9,121	4	108.0	0.00	90.20	-	-	0.00	0.00	-	0.00	
222	9,173	9,173	4	108.0	0.00	90.25	-	-	0.00	0.00	-	0.00	
223	8,531	8,531		108.0	0.00	89.62	-	-	0.00	0.00	-	0.00	
224	8,504	8,504	4	108.0	0.00	89.59	-	-	0.00	0.00	-	0.00	
225	8,173	8,173	1	108.0	0.00	89.25	-	-	0.00	0.00	-	0.00	
226	7,817	7,818	8	108.0	0.00	88.86	-	-	0.00	0.00	-	0.00	
227	6,972	6,973	8 4	108.0	0.00	87.87	-	-	0.00	0.00	-	0.00	
228	8,841	8,841	8	108.0	0.00	89.93	-	-	0.00	0.00	-	0.00	
229	6,404	6,405		108.0	0.00	87.13	-	-	0.00	0.00	-	0.00	
230	6,147	6,148	1 1	108.0	0.00	86.77	-	-	0.00	0.00	-	0.00	
231	5,641	5,642	11 1	108.0	0.00	86.03	-	-	0.00	0.00	-	0.00	
232	5,141	5,142	1	108.0	0.00	85.22	-	-	0.00	0.00	-	0.00	
233	4,741	4,742	1 8	108.0	0.00	84.52	-	-	0.00	0.00	-	0.00	
234	4,433	4,434	14 44	108.0	0.00	83.94	-	-	0.00	0.00	-	0.00	
235	3,943	3,943	1	108.0	0.00	82.92	-	-	0.00	0.00	-	0.00	
301	8,698	8,698		108.0	0.00	89.79	-	-	0.00	0.00	-	0.00	
302	9,172	9,172	4	108.0	0.00	90.25	-	-	0.00	0.00	-	0.00	
303	9,783	9,783		108.0	0.00	90.81	-	-	0.00	0.00	-	0.00	
304	10,348	10,348	8	108.0	0.00	91.30	-	-	0.00	0.00	-	0.00	
305	10,174	10,174		108.0	0.00	91.15	-	-	0.00	0.00	-	0.00	
306	9,945	9,945	8	108.0	0.00	90.95	-	-	0.00	0.00	-	0.00	
307	9,130	9,130	4	108.0	0.00	90.21	-	-	0.00	0.00	-	0.00	
308	8,806	8,806	14	108.0	0.00	89.90	-	-	0.00	0.00	-	0.00	
309	8,314	8,314		108.0	0.00	89.40	-	-	0.00	0.00	-	0.00	
310	8,033	8,033	4	108.0	0.00	89.10	-	-	0.00	0.00	-	0.00	
311	7,570	7,570		108.0	0.00	88.58	-	-	0.00	0.00	-	0.00	
312	7,158	7,159	8	108.0	0.00	88.10	-	-	0.00	0.00	-	0.00	
313	6,682	6,682		108.0	0.00	87.50	-	-	0.00	0.00	-	0.00	
314	6,013	6,013	1 4	108.0	0.00	86.58	-	-	0.00	0.00	-	0.00	
315	5,983	5,984	1	108.0	0.00	86.54	-	-	0.00	0.00	-	0.00	
316	6,438	6,438		108.0	0.00	87.18	-	-	0.00	0.00	-	0.00	
317	6,819	6,820	8 4	108.0	0.00	87.68	-	-	0.00	0.00	-	0.00	
318	7,570	7,570		108.0	0.00	88.58	-	-	0.00	0.00	-	0.00	
319	8,195	8,196	1	108.0	0.00	89.27	-	-	0.00	0.00	-	0.00	
320	8,611	8,611	4	108.0	0.00	89.70	-	-	0.00	0.00	-	0.00	
321	9,076	9,076	4 1	108.0	0.00	90.16	-	-	0.00	0.00	-	0.00	
322	9,023	9,023	4	108.0	0.00	90.11	-	-	0.00	0.00	-	0.00	
323	8,827	8,827	11	108.0	0.00	89.92	-	-	0.00	0.00	-	0.00	
324	8,017	8,017	48	108.0	0.00	89.08	-	-	0.00	0.00	-	0.00	
325	8,909	8,909	4	108.0	0.00	90.00	-	-	0.00	0.00	-	0.00	
326	8,233	8,233	1	108.0	0.00	89.31	-	-	0.00	0.00	-	0.00	

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
327	7,881	7,882	□□□□	108.0	0.00	88.93	-	-	0.00	0.00	-	0.00
328	6,908	6,909	8□□□	108.0	0.00	87.79	-	-	0.00	0.00	-	0.00
329	7,158	7,159	8□□□	108.0	0.00	88.10	-	-	0.00	0.00	-	0.00
330	6,395	6,396	□□□□	108.0	0.00	87.12	-	-	0.00	0.00	-	0.00
331	6,055	6,056	1□□□□	108.0	0.00	86.64	-	-	0.00	0.00	-	0.00
332	5,582	5,582	11□4□	108.0	0.00	85.94	-	-	0.00	0.00	-	0.00
333	5,893	5,894	1□□□□	108.0	0.00	86.41	-	-	0.00	0.00	-	0.00
334	6,402	6,403	□□□□	108.0	0.00	87.13	-	-	0.00	0.00	-	0.00
335	6,589	6,590	□□1	108.0	0.00	87.38	-	-	0.00	0.00	-	0.00
Sum	33.93											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP □4 NSP □4**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	2,995	2,996	1□18	108.0	0.00	80.53	-	-	0.00	0.00	-	0.00
2	2,611	2,613	□□□1	108.0	0.00	79.34	-	-	0.00	0.00	-	0.00
3	4,197	4,198	1□41	107.0	0.00	83.46	-	-	0.00	0.00	-	0.00
4	4,858	4,858	11□□□	107.0	0.00	84.73	-	-	0.00	0.00	-	0.00
5	2,990	2,991	1□□□□	107.0	0.00	80.52	-	-	0.00	0.00	-	0.00
6	1,744	1,746	□□44	108.0	0.00	75.84	-	-	0.00	0.00	-	0.00
7	1,061	1,065	□1□□□	108.0	0.00	71.55	-	-	0.00	0.00	-	0.00
8	5,036	5,037	11□14	107.0	0.00	85.04	-	-	0.00	0.00	-	0.00
9	3,767	3,768	1□4□	108.0	0.00	82.52	-	-	0.00	0.00	-	0.00
10	2,912	2,913	1□□□□	108.0	0.00	80.29	-	-	0.00	0.00	-	0.00
11	4,362	4,362	14□□□	108.0	0.00	83.79	-	-	0.00	0.00	-	0.00
12	5,119	5,119	1□□4	107.0	0.00	85.18	-	-	0.00	0.00	-	0.00
13	4,673	4,674	1□□8	107.0	0.00	84.39	-	-	0.00	0.00	-	0.00
14	3,467	3,467	1□□4	107.0	0.00	81.80	-	-	0.00	0.00	-	0.00
15	1,706	1,708	□□□□	108.0	0.00	75.65	-	-	0.00	0.00	-	0.00
16	4,472	4,473	1□□□□	107.0	0.00	84.01	-	-	0.00	0.00	-	0.00
17	1,579	1,581	□□□□	108.0	0.00	74.98	-	-	0.00	0.00	-	0.00
18	2,698	2,698	18□□□	107.0	0.00	79.62	-	-	0.00	0.00	-	0.00
19	3,750	3,751	14□□□	107.0	0.00	82.48	-	-	0.00	0.00	-	0.00
20	1,047	1,050	□11□	108.0	0.00	71.43	-	-	0.00	0.00	-	0.00
22	5,785	5,786	□□□□	107.0	0.00	86.25	-	-	0.00	0.00	-	0.00
23	5,685	5,686	□□1	107.0	0.00	86.10	-	-	0.00	0.00	-	0.00
25	2,087	2,088	□□□□	108.0	0.00	77.39	-	-	0.00	0.00	-	0.00
26	890	894	□□8□	108.0	0.00	70.02	-	-	0.00	0.00	-	0.00
27	2,902	2,903	1□□4	108.0	0.00	80.26	-	-	0.00	0.00	-	0.00
28	1,525	1,527	□□□8	108.0	0.00	74.68	-	-	0.00	0.00	-	0.00
29	5,648	5,648	□□□□	107.0	0.00	86.04	-	-	0.00	0.00	-	0.00
30	3,032	3,033	1□□□□	108.0	0.00	80.64	-	-	0.00	0.00	-	0.00
31	5,204	5,204	1□□□□	107.0	0.00	85.33	-	-	0.00	0.00	-	0.00
32	3,519	3,520	1□□□□	107.0	0.00	81.93	-	-	0.00	0.00	-	0.00
33	5,267	5,267	1□□8	107.0	0.00	85.43	-	-	0.00	0.00	-	0.00
201	3,387	3,388	1□□4	108.0	0.00	81.60	-	-	0.00	0.00	-	0.00
202	3,616	3,617	1□□□□	108.0	0.00	82.17	-	-	0.00	0.00	-	0.00
203	4,872	4,872	1□□□□	108.0	0.00	84.75	-	-	0.00	0.00	-	0.00
204	4,830	4,830	1□□□□	108.0	0.00	84.68	-	-	0.00	0.00	-	0.00
205	5,324	5,325	1□□8	108.0	0.00	85.53	-	-	0.00	0.00	-	0.00
206	5,691	5,692	11□1□	108.0	0.00	86.10	-	-	0.00	0.00	-	0.00
207	6,492	6,493	□41	108.0	0.00	87.25	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
208	6,949	6,949	8.48	108.0	0.00	87.84	-	-	0.00	0.00	-	0.00
209	7,278	7,279	8.4	108.0	0.00	88.24	-	-	0.00	0.00	-	0.00
210	7,633	7,634	8.1	108.0	0.00	88.65	-	-	0.00	0.00	-	0.00
211	6,891	6,891	8.0	108.0	0.00	87.77	-	-	0.00	0.00	-	0.00
212	6,886	6,887	8.0	108.0	0.00	87.76	-	-	0.00	0.00	-	0.00
213	6,971	6,971	8.44	108.0	0.00	87.87	-	-	0.00	0.00	-	0.00
214	7,258	7,258	8.88	108.0	0.00	88.22	-	-	0.00	0.00	-	0.00
215	5,345	5,346	1.0	108.0	0.00	85.56	-	-	0.00	0.00	-	0.00
216	6,678	6,679	0.0	108.0	0.00	87.49	-	-	0.00	0.00	-	0.00
217	7,369	7,369	0.0	108.0	0.00	88.35	-	-	0.00	0.00	-	0.00
218	9,232	9,233	4.4	108.0	0.00	90.31	-	-	0.00	0.00	-	0.00
219	9,609	9,610	8.88	108.0	0.00	90.65	-	-	0.00	0.00	-	0.00
220	10,085	10,085	1.8	108.0	0.00	91.07	-	-	0.00	0.00	-	0.00
221	10,646	10,646	0.8	108.0	0.00	91.54	-	-	0.00	0.00	-	0.00
222	10,940	10,940	1.8	108.0	0.00	91.78	-	-	0.00	0.00	-	0.00
223	10,304	10,304	8.0	108.0	0.00	91.26	-	-	0.00	0.00	-	0.00
224	10,179	10,179	0.4	108.0	0.00	91.15	-	-	0.00	0.00	-	0.00
225	9,852	9,852	0.0	108.0	0.00	90.87	-	-	0.00	0.00	-	0.00
226	9,553	9,554	0.0	108.0	0.00	90.60	-	-	0.00	0.00	-	0.00
227	8,717	8,717	0.0	108.0	0.00	89.81	-	-	0.00	0.00	-	0.00
228	10,585	10,585	4.0	108.0	0.00	91.49	-	-	0.00	0.00	-	0.00
229	8,124	8,124	0.0	108.0	0.00	89.20	-	-	0.00	0.00	-	0.00
230	7,850	7,850	8.0	108.0	0.00	88.90	-	-	0.00	0.00	-	0.00
231	7,344	7,345	0.1	108.0	0.00	88.32	-	-	0.00	0.00	-	0.00
232	6,924	6,924	8.0	108.0	0.00	87.81	-	-	0.00	0.00	-	0.00
233	6,522	6,522	0.0	108.0	0.00	87.29	-	-	0.00	0.00	-	0.00
234	6,220	6,220	1.0	108.0	0.00	86.88	-	-	0.00	0.00	-	0.00
235	5,695	5,695	11.18	108.0	0.00	86.11	-	-	0.00	0.00	-	0.00
301	8,186	8,186	1.8	108.0	0.00	89.26	-	-	0.00	0.00	-	0.00
302	8,614	8,614	4.0	108.0	0.00	89.70	-	-	0.00	0.00	-	0.00
303	9,091	9,091	4.8	108.0	0.00	90.17	-	-	0.00	0.00	-	0.00
304	9,608	9,608	8.88	108.0	0.00	90.65	-	-	0.00	0.00	-	0.00
305	9,301	9,301	4.0	108.0	0.00	90.37	-	-	0.00	0.00	-	0.00
306	9,123	9,124	4.0	108.0	0.00	90.20	-	-	0.00	0.00	-	0.00
307	8,329	8,329	0.4	108.0	0.00	89.41	-	-	0.00	0.00	-	0.00
308	10,606	10,606	4.4	108.0	0.00	91.51	-	-	0.00	0.00	-	0.00
309	10,114	10,114	1.0	108.0	0.00	91.10	-	-	0.00	0.00	-	0.00
310	9,825	9,825	0.0	108.0	0.00	90.85	-	-	0.00	0.00	-	0.00
311	9,359	9,359	4.0	108.0	0.00	90.42	-	-	0.00	0.00	-	0.00
312	8,946	8,947	4.1	108.0	0.00	90.03	-	-	0.00	0.00	-	0.00
313	8,467	8,467	0.0	108.0	0.00	89.56	-	-	0.00	0.00	-	0.00
314	7,775	7,775	0.1	108.0	0.00	88.81	-	-	0.00	0.00	-	0.00
315	7,782	7,782	0.0	108.0	0.00	88.82	-	-	0.00	0.00	-	0.00
316	8,236	8,237	0.0	108.0	0.00	89.32	-	-	0.00	0.00	-	0.00
317	8,619	8,620	4.0	108.0	0.00	89.71	-	-	0.00	0.00	-	0.00
318	9,366	9,367	4.0	108.0	0.00	90.43	-	-	0.00	0.00	-	0.00
319	9,936	9,937	0.0	108.0	0.00	90.94	-	-	0.00	0.00	-	0.00
320	10,337	10,338	8.0	108.0	0.00	91.29	-	-	0.00	0.00	-	0.00
321	10,797	10,797	1.8	108.0	0.00	91.67	-	-	0.00	0.00	-	0.00
322	10,671	10,672	0.0	108.0	0.00	91.56	-	-	0.00	0.00	-	0.00
323	10,452	10,452	0.0	108.0	0.00	91.38	-	-	0.00	0.00	-	0.00
324	9,651	9,651	8.0	108.0	0.00	90.69	-	-	0.00	0.00	-	0.00
325	10,423	10,424	0.0	108.0	0.00	91.36	-	-	0.00	0.00	-	0.00
326	9,776	9,777	0.0	108.0	0.00	90.80	-	-	0.00	0.00	-	0.00
327	9,410	9,410	4.18	108.0	0.00	90.47	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
328	8,405	8,405	81	108.0	0.00	89.49	-	-	0.00	0.00	-	0.00
329	8,486	8,487		108.0	0.00	89.57	-	-	0.00	0.00	-	0.00
330	7,754	7,755		108.0	0.00	88.79	-	-	0.00	0.00	-	0.00
331	7,557	7,558	1	108.0	0.00	88.57	-	-	0.00	0.00	-	0.00
332	7,123	7,123	14	108.0	0.00	88.05	-	-	0.00	0.00	-	0.00
333	7,532	7,533		108.0	0.00	88.54	-	-	0.00	0.00	-	0.00
334	8,037	8,037	44	108.0	0.00	89.10	-	-	0.00	0.00	-	0.00
335	8,272	8,272		108.0	0.00	89.35	-	-	0.00	0.00	-	0.00
Sum	38.90											

Sum 38.90

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP NSP**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	2,151	2,154		108.0	0.00	77.66	-	-	0.00	0.00	-	0.00
2	1,053	1,059	1	108.0	0.00	71.50	-	-	0.00	0.00	-	0.00
3	4,882	4,883	11	107.0	0.00	84.77	-	-	0.00	0.00	-	0.00
4	4,971	4,972	11	107.0	0.00	84.93	-	-	0.00	0.00	-	0.00
5	3,664	3,666	1	107.0	0.00	82.28	-	-	0.00	0.00	-	0.00
6	642	650	4	108.0	0.00	67.26	-	-	0.00	0.00	-	0.00
7	1,786	1,789	1	108.0	0.00	76.05	-	-	0.00	0.00	-	0.00
8	5,591	5,592	8	107.0	0.00	85.95	-	-	0.00	0.00	-	0.00
9	2,450	2,451	1	108.0	0.00	78.79	-	-	0.00	0.00	-	0.00
10	1,669	1,672	4	108.0	0.00	75.47	-	-	0.00	0.00	-	0.00
11	2,445	2,446	1	108.0	0.00	78.77	-	-	0.00	0.00	-	0.00
12	4,385	4,386	1	107.0	0.00	83.84	-	-	0.00	0.00	-	0.00
13	4,655	4,656	1	107.0	0.00	84.36	-	-	0.00	0.00	-	0.00
14	3,629	3,630	1	107.0	0.00	82.20	-	-	0.00	0.00	-	0.00
15	1,616	1,619	1	108.0	0.00	75.19	-	-	0.00	0.00	-	0.00
16	4,867	4,868	11	107.0	0.00	84.75	-	-	0.00	0.00	-	0.00
17	992	997	1	108.0	0.00	70.97	-	-	0.00	0.00	-	0.00
18	2,840	2,841	18	107.0	0.00	80.07	-	-	0.00	0.00	-	0.00
19	3,520	3,520	1	107.0	0.00	81.93	-	-	0.00	0.00	-	0.00
20	1,348	1,352	8	108.0	0.00	73.62	-	-	0.00	0.00	-	0.00
22	5,749	5,750	4	107.0	0.00	86.19	-	-	0.00	0.00	-	0.00
23	6,351	6,352	8	107.0	0.00	87.06	-	-	0.00	0.00	-	0.00
25	678	682		108.0	0.00	67.68	-	-	0.00	0.00	-	0.00
26	1,751	1,753		108.0	0.00	75.88	-	-	0.00	0.00	-	0.00
27	2,415	2,416	1	108.0	0.00	78.66	-	-	0.00	0.00	-	0.00
28	1,124	1,129		108.0	0.00	72.05	-	-	0.00	0.00	-	0.00
29	4,788	4,788	11	107.0	0.00	84.60	-	-	0.00	0.00	-	0.00
30	1,151	1,154	1	108.0	0.00	72.24	-	-	0.00	0.00	-	0.00
31	4,708	4,709	11	107.0	0.00	84.46	-	-	0.00	0.00	-	0.00
32	4,292	4,293	1	107.0	0.00	83.65	-	-	0.00	0.00	-	0.00
33	5,100	5,101	1	107.0	0.00	85.15	-	-	0.00	0.00	-	0.00
201	1,025	1,028	1	108.0	0.00	71.24	-	-	0.00	0.00	-	0.00
202	1,289	1,291	8	108.0	0.00	73.22	-	-	0.00	0.00	-	0.00
203	2,511	2,512	1	108.0	0.00	79.00	-	-	0.00	0.00	-	0.00
204	2,446	2,448	1	108.0	0.00	78.77	-	-	0.00	0.00	-	0.00
205	2,943	2,945	1	108.0	0.00	80.38	-	-	0.00	0.00	-	0.00
206	3,434	3,435	1	108.0	0.00	81.72	-	-	0.00	0.00	-	0.00
207	4,224	4,224	1	108.0	0.00	83.52	-	-	0.00	0.00	-	0.00
208	6,621	6,621	1	108.0	0.00	87.42	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

WTG		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
209	7,016	7,017	8	108.0	0.00	87.92	-	-	0.00	0.00	-	0.00
210	7,482	7,483	4	108.0	0.00	88.48	-	-	0.00	0.00	-	0.00
211	7,110	7,111	8	108.0	0.00	88.04	-	-	0.00	0.00	-	0.00
212	7,242	7,243		108.0	0.00	88.20	-	-	0.00	0.00	-	0.00
213	7,466	7,467	48	108.0	0.00	88.46	-	-	0.00	0.00	-	0.00
214	7,808	7,809	8	108.0	0.00	88.85	-	-	0.00	0.00	-	0.00
215	6,183	6,184	1	108.0	0.00	86.83	-	-	0.00	0.00	-	0.00
216	7,588	7,588		108.0	0.00	88.60	-	-	0.00	0.00	-	0.00
217	8,304	8,305	8	108.0	0.00	89.39	-	-	0.00	0.00	-	0.00
218	9,798	9,798		108.0	0.00	90.82	-	-	0.00	0.00	-	0.00
219	10,336	10,336	8	108.0	0.00	91.29	-	-	0.00	0.00	-	0.00
220	10,791	10,791	1	108.0	0.00	91.66	-	-	0.00	0.00	-	0.00
221	11,409	11,409	1	108.0	0.00	92.15	-	-	0.00	0.00	-	0.00
222	12,370	12,371	1	108.0	0.00	92.85	-	-	0.00	0.00	-	0.00
223	11,776	11,777		108.0	0.00	92.42	-	-	0.00	0.00	-	0.00
224	11,310	11,311	4	108.0	0.00	92.07	-	-	0.00	0.00	-	0.00
225	11,005	11,005	1	108.0	0.00	91.83	-	-	0.00	0.00	-	0.00
226	10,887	10,887		108.0	0.00	91.74	-	-	0.00	0.00	-	0.00
227	10,103	10,103	1	108.0	0.00	91.09	-	-	0.00	0.00	-	0.00
228	11,924	11,925	1	108.0	0.00	92.53	-	-	0.00	0.00	-	0.00
229	9,446	9,447	4	108.0	0.00	90.51	-	-	0.00	0.00	-	0.00
230	9,132	9,133	4	108.0	0.00	90.21	-	-	0.00	0.00	-	0.00
231	8,647	8,647	4	108.0	0.00	89.74	-	-	0.00	0.00	-	0.00
232	8,525	8,525		108.0	0.00	89.61	-	-	0.00	0.00	-	0.00
233	8,128	8,128	8	108.0	0.00	89.20	-	-	0.00	0.00	-	0.00
234	7,869	7,870	4	108.0	0.00	88.92	-	-	0.00	0.00	-	0.00
235	7,222	7,222	4	108.0	0.00	88.17	-	-	0.00	0.00	-	0.00
301	6,281	6,281	8	108.0	0.00	86.96	-	-	0.00	0.00	-	0.00
302	6,650	6,650		108.0	0.00	87.46	-	-	0.00	0.00	-	0.00
303	6,997	6,997	8	108.0	0.00	87.90	-	-	0.00	0.00	-	0.00
304	7,466	7,466	48	108.0	0.00	88.46	-	-	0.00	0.00	-	0.00
305	7,071	7,071	8	108.0	0.00	87.99	-	-	0.00	0.00	-	0.00
306	6,931	6,931	8	108.0	0.00	87.82	-	-	0.00	0.00	-	0.00
307	6,167	6,167	1	108.0	0.00	86.80	-	-	0.00	0.00	-	0.00
308	12,335	12,335	1	108.0	0.00	92.82	-	-	0.00	0.00	-	0.00
309	11,818	11,819	84	108.0	0.00	92.45	-	-	0.00	0.00	-	0.00
310	11,426	11,426	1	108.0	0.00	92.16	-	-	0.00	0.00	-	0.00
311	10,943	10,943	1	108.0	0.00	91.78	-	-	0.00	0.00	-	0.00
312	10,529	10,529		108.0	0.00	91.45	-	-	0.00	0.00	-	0.00
313	10,043	10,044	4	108.0	0.00	91.04	-	-	0.00	0.00	-	0.00
314	9,254	9,255	4	108.0	0.00	90.33	-	-	0.00	0.00	-	0.00
315	9,486	9,486	4	108.0	0.00	90.54	-	-	0.00	0.00	-	0.00
316	10,047	10,047		108.0	0.00	91.04	-	-	0.00	0.00	-	0.00
317	10,403	10,403		108.0	0.00	91.34	-	-	0.00	0.00	-	0.00
318	11,194	11,195	1	108.0	0.00	91.98	-	-	0.00	0.00	-	0.00
319	11,977	11,978		108.0	0.00	92.57	-	-	0.00	0.00	-	0.00
320	12,408	12,408	1	108.0	0.00	92.87	-	-	0.00	0.00	-	0.00
321	12,876	12,876	4	108.0	0.00	93.20	-	-	0.00	0.00	-	0.00
322	12,854	12,854	4	108.0	0.00	93.18	-	-	0.00	0.00	-	0.00
323	12,659	12,659	18	108.0	0.00	93.05	-	-	0.00	0.00	-	0.00
324	11,849	11,849	8	108.0	0.00	92.47	-	-	0.00	0.00	-	0.00
325	12,713	12,713	4	108.0	0.00	93.09	-	-	0.00	0.00	-	0.00
326	12,047	12,048		108.0	0.00	92.62	-	-	0.00	0.00	-	0.00
327	11,689	11,690	1	108.0	0.00	92.36	-	-	0.00	0.00	-	0.00
328	10,701	10,701	1	108.0	0.00	91.59	-	-	0.00	0.00	-	0.00

To be continued on next page...



Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

### DECIBEL - Detailed results

Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
329	10,843	10,844	11	108.0	0.00	91.70	-	-	0.00	0.00	-	0.00
330	10,102	10,102	1	108.0	0.00	91.09	-	-	0.00	0.00	-	0.00
331	9,848	9,849		108.0	0.00	90.87	-	-	0.00	0.00	-	0.00
332	9,390	9,391	4	108.0	0.00	90.45	-	-	0.00	0.00	-	0.00
333	9,725	9,726	1	108.0	0.00	90.76	-	-	0.00	0.00	-	0.00
334	10,234	10,234		108.0	0.00	91.20	-	-	0.00	0.00	-	0.00
335	10,415	10,415	1	108.0	0.00	91.35	-	-	0.00	0.00	-	0.00
Sum	42.73											

- Data undefined due to calculation with octave data

Noise sensitive area: NSP NSP

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	2,269	2,272	1	108.0	0.00	78.13	-	-	0.00	0.00	-	0.00
2	1,437	1,444		108.0	0.00	74.19	-	-	0.00	0.00	-	0.00
3	5,295	5,297	1	107.0	0.00	85.48	-	-	0.00	0.00	-	0.00
4	5,037	5,038	11	107.0	0.00	85.05	-	-	0.00	0.00	-	0.00
5	4,246	4,247	1	107.0	0.00	83.56	-	-	0.00	0.00	-	0.00
6	2,064	2,067	4	108.0	0.00	77.31	-	-	0.00	0.00	-	0.00
7	2,988	2,990	1	108.0	0.00	80.51	-	-	0.00	0.00	-	0.00
8	5,860	5,862		107.0	0.00	86.36	-	-	0.00	0.00	-	0.00
9	2,009	2,012	8	108.0	0.00	77.07	-	-	0.00	0.00	-	0.00
10	1,749	1,754		108.0	0.00	75.88	-	-	0.00	0.00	-	0.00
11	1,343	1,346	8	108.0	0.00	73.58	-	-	0.00	0.00	-	0.00
12	3,965	3,966	14	107.0	0.00	82.97	-	-	0.00	0.00	-	0.00
13	4,678	4,679	1	107.0	0.00	84.40	-	-	0.00	0.00	-	0.00
14	3,933	3,934	14	107.0	0.00	82.90	-	-	0.00	0.00	-	0.00
15	2,557	2,560	4	108.0	0.00	79.16	-	-	0.00	0.00	-	0.00
16	5,115	5,116	1	107.0	0.00	85.18	-	-	0.00	0.00	-	0.00
17	2,460	2,463	1	108.0	0.00	78.83	-	-	0.00	0.00	-	0.00
18	3,332	3,333	1	107.0	0.00	81.46	-	-	0.00	0.00	-	0.00
19	3,603	3,604	1	107.0	0.00	82.13	-	-	0.00	0.00	-	0.00
20	2,738	2,741	18	108.0	0.00	79.76	-	-	0.00	0.00	-	0.00
22	5,644	5,645	1	107.0	0.00	86.03	-	-	0.00	0.00	-	0.00
23	6,627	6,628		107.0	0.00	87.43	-	-	0.00	0.00	-	0.00
25	2,068	2,070	4	108.0	0.00	77.32	-	-	0.00	0.00	-	0.00
26	3,219	3,220	18	108.0	0.00	81.16	-	-	0.00	0.00	-	0.00
27	2,671	2,673	4	108.0	0.00	79.54	-	-	0.00	0.00	-	0.00
28	2,327	2,330		108.0	0.00	78.35	-	-	0.00	0.00	-	0.00
29	4,227	4,228	1	107.0	0.00	83.52	-	-	0.00	0.00	-	0.00
30	1,024	1,029	1	108.0	0.00	71.25	-	-	0.00	0.00	-	0.00
31	4,412	4,412	1	107.0	0.00	83.89	-	-	0.00	0.00	-	0.00
32	4,826	4,827	11	107.0	0.00	84.67	-	-	0.00	0.00	-	0.00
33	4,976	4,977	11	107.0	0.00	84.94	-	-	0.00	0.00	-	0.00
201	889	894	8	108.0	0.00	70.03	-	-	0.00	0.00	-	0.00
202	1,038	1,043	1	108.0	0.00	71.36	-	-	0.00	0.00	-	0.00
203	1,110	1,114	1	108.0	0.00	71.94	-	-	0.00	0.00	-	0.00
204	1,223	1,227	4	108.0	0.00	72.78	-	-	0.00	0.00	-	0.00
205	1,747	1,750	4	108.0	0.00	75.86	-	-	0.00	0.00	-	0.00
206	1,965	1,967	4	108.0	0.00	76.87	-	-	0.00	0.00	-	0.00
207	2,753	2,755	1	108.0	0.00	79.80	-	-	0.00	0.00	-	0.00
208	6,264	6,265		108.0	0.00	86.94	-	-	0.00	0.00	-	0.00
209	6,678	6,678		108.0	0.00	87.49	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
210	7,189	7,190	81	108.0	0.00	88.13	-	-	0.00	0.00	-	0.00
211	7,068	7,069	84	108.0	0.00	87.99	-	-	0.00	0.00	-	0.00
212	7,277	7,278	84	108.0	0.00	88.24	-	-	0.00	0.00	-	0.00
213	7,574	7,575	88	108.0	0.00	88.59	-	-	0.00	0.00	-	0.00
214	7,933	7,934		108.0	0.00	88.99	-	-	0.00	0.00	-	0.00
215	6,571	6,572		108.0	0.00	87.35	-	-	0.00	0.00	-	0.00
216	7,940	7,940	1	108.0	0.00	89.00	-	-	0.00	0.00	-	0.00
217	8,642	8,642	41	108.0	0.00	89.73	-	-	0.00	0.00	-	0.00
218	9,858	9,858	1	108.0	0.00	90.88	-	-	0.00	0.00	-	0.00
219	10,481	10,482	1	108.0	0.00	91.41	-	-	0.00	0.00	-	0.00
220	10,912	10,913		108.0	0.00	91.76	-	-	0.00	0.00	-	0.00
221	11,552	11,552	18	108.0	0.00	92.25	-	-	0.00	0.00	-	0.00
222	12,922	12,922	-48	108.0	0.00	93.23	-	-	0.00	0.00	-	0.00
223	12,364	12,365	1	108.0	0.00	92.84	-	-	0.00	0.00	-	0.00
224	11,687	11,687	1	108.0	0.00	92.35	-	-	0.00	0.00	-	0.00
225	11,401	11,402	1	108.0	0.00	92.14	-	-	0.00	0.00	-	0.00
226	11,400	11,401	1	108.0	0.00	92.14	-	-	0.00	0.00	-	0.00
227	10,666	10,667		108.0	0.00	91.56	-	-	0.00	0.00	-	0.00
228	12,423	12,423	1	108.0	0.00	92.88	-	-	0.00	0.00	-	0.00
229	9,985	9,986		108.0	0.00	90.99	-	-	0.00	0.00	-	0.00
230	9,655	9,656	81	108.0	0.00	90.70	-	-	0.00	0.00	-	0.00
231	9,196	9,197	4	108.0	0.00	90.27	-	-	0.00	0.00	-	0.00
232	9,262	9,263	4 41	108.0	0.00	90.33	-	-	0.00	0.00	-	0.00
233	8,879	8,880		108.0	0.00	89.97	-	-	0.00	0.00	-	0.00
234	8,656	8,657		108.0	0.00	89.75	-	-	0.00	0.00	-	0.00
235	7,956	7,957		108.0	0.00	89.01	-	-	0.00	0.00	-	0.00
301	4,931	4,931	1	108.0	0.00	84.86	-	-	0.00	0.00	-	0.00
302	5,265	5,266	1	108.0	0.00	85.43	-	-	0.00	0.00	-	0.00
303	5,557	5,557	11	108.0	0.00	85.90	-	-	0.00	0.00	-	0.00
304	6,010	6,011	1	108.0	0.00	86.58	-	-	0.00	0.00	-	0.00
305	5,601	5,601	11 41	108.0	0.00	85.97	-	-	0.00	0.00	-	0.00
306	5,465	5,466	11	108.0	0.00	85.75	-	-	0.00	0.00	-	0.00
307	4,709	4,710	1	108.0	0.00	84.46	-	-	0.00	0.00	-	0.00
308	13,088	13,088	-	108.0	0.00	93.34	-	-	0.00	0.00	-	0.00
309	12,561	12,561	-	108.0	0.00	92.98	-	-	0.00	0.00	-	0.00
310	12,104	12,104	4	108.0	0.00	92.66	-	-	0.00	0.00	-	0.00
311	11,617	11,618	1	108.0	0.00	92.30	-	-	0.00	0.00	-	0.00
312	11,211	11,211	1	108.0	0.00	91.99	-	-	0.00	0.00	-	0.00
313	10,729	10,730		108.0	0.00	91.61	-	-	0.00	0.00	-	0.00
314	9,897	9,897	4	108.0	0.00	90.91	-	-	0.00	0.00	-	0.00
315	10,266	10,267		108.0	0.00	91.23	-	-	0.00	0.00	-	0.00
316	10,888	10,889		108.0	0.00	91.74	-	-	0.00	0.00	-	0.00
317	11,220	11,221	1	108.0	0.00	92.00	-	-	0.00	0.00	-	0.00
318	12,030	12,031	8	108.0	0.00	92.61	-	-	0.00	0.00	-	0.00
319	12,961	12,961	-	108.0	0.00	93.25	-	-	0.00	0.00	-	0.00
320	13,411	13,412	-1	108.0	0.00	93.55	-	-	0.00	0.00	-	0.00
321	13,882	13,883	-1	108.0	0.00	93.85	-	-	0.00	0.00	-	0.00
322	13,949	13,949	-1	108.0	0.00	93.89	-	-	0.00	0.00	-	0.00
323	13,777	13,778	-1 44	108.0	0.00	93.78	-	-	0.00	0.00	-	0.00
324	12,963	12,964	-	108.0	0.00	93.25	-	-	0.00	0.00	-	0.00
325	13,914	13,914	-1	108.0	0.00	93.87	-	-	0.00	0.00	-	0.00
326	13,231	13,232	-84	108.0	0.00	93.43	-	-	0.00	0.00	-	0.00
327	12,884	12,884	-44	108.0	0.00	93.20	-	-	0.00	0.00	-	0.00
328	11,917	11,918		108.0	0.00	92.52	-	-	0.00	0.00	-	0.00
329	12,138	12,139	4	108.0	0.00	92.68	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
330	11,384	11,384	14	108.0	0.00	92.13	-	-	0.00	0.00	-	0.00
331	11,064	11,065	18	108.0	0.00	91.88	-	-	0.00	0.00	-	0.00
332	10,587	10,587	4	108.0	0.00	91.50	-	-	0.00	0.00	-	0.00
333	10,852	10,853	1	108.0	0.00	91.71	-	-	0.00	0.00	-	0.00
334	11,360	11,360	4	108.0	0.00	92.11	-	-	0.00	0.00	-	0.00
335	11,494	11,495	1	108.0	0.00	92.21	-	-	0.00	0.00	-	0.00

Sum 40.47

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP NSP**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	4,417	4,419	14.48	108.0	0.00	83.91	-	-	0.00	0.00	-	0.00
2	3,995	3,997	14	108.0	0.00	83.03	-	-	0.00	0.00	-	0.00
3	7,219	7,220		107.0	0.00	88.17	-	-	0.00	0.00	-	0.00
4	6,575	6,576		107.0	0.00	87.36	-	-	0.00	0.00	-	0.00
5	6,432	6,432	8.4	107.0	0.00	87.17	-	-	0.00	0.00	-	0.00
6	4,749	4,750	1	108.0	0.00	84.53	-	-	0.00	0.00	-	0.00
7	5,635	5,636	11	108.0	0.00	86.02	-	-	0.00	0.00	-	0.00
8	7,566	7,567		107.0	0.00	88.58	-	-	0.00	0.00	-	0.00
9	3,726	3,727	1	108.0	0.00	82.43	-	-	0.00	0.00	-	0.00
10	4,047	4,049	1.8	108.0	0.00	83.15	-	-	0.00	0.00	-	0.00
11	2,597	2,598	8	108.0	0.00	79.29	-	-	0.00	0.00	-	0.00
12	4,999	4,999	11.4	107.0	0.00	84.98	-	-	0.00	0.00	-	0.00
13	6,211	6,211	8.4	107.0	0.00	86.86	-	-	0.00	0.00	-	0.00
14	5,896	5,896	1	107.0	0.00	86.41	-	-	0.00	0.00	-	0.00
15	5,132	5,133	1	108.0	0.00	85.21	-	-	0.00	0.00	-	0.00
16	6,869	6,869		107.0	0.00	87.74	-	-	0.00	0.00	-	0.00
17	5,108	5,109	1	108.0	0.00	85.17	-	-	0.00	0.00	-	0.00
18	5,551	5,551		107.0	0.00	85.89	-	-	0.00	0.00	-	0.00
19	5,390	5,391	1	107.0	0.00	85.63	-	-	0.00	0.00	-	0.00
20	5,426	5,427	11.8	108.0	0.00	85.69	-	-	0.00	0.00	-	0.00
22	6,868	6,868		107.0	0.00	87.74	-	-	0.00	0.00	-	0.00
23	8,280	8,281	4	107.0	0.00	89.36	-	-	0.00	0.00	-	0.00
25	4,665	4,665	1	108.0	0.00	84.38	-	-	0.00	0.00	-	0.00
26	5,887	5,887	1.4	108.0	0.00	86.40	-	-	0.00	0.00	-	0.00
27	4,823	4,823	1	108.0	0.00	84.67	-	-	0.00	0.00	-	0.00
28	4,994	4,995	1.1	108.0	0.00	84.97	-	-	0.00	0.00	-	0.00
29	4,956	4,957	11.4	107.0	0.00	84.90	-	-	0.00	0.00	-	0.00
30	3,542	3,543	1.1	108.0	0.00	81.99	-	-	0.00	0.00	-	0.00
31	5,540	5,541	4	107.0	0.00	85.87	-	-	0.00	0.00	-	0.00
32	6,915	6,916	1	107.0	0.00	87.80	-	-	0.00	0.00	-	0.00
33	6,262	6,262	8	107.0	0.00	86.93	-	-	0.00	0.00	-	0.00
201	3,275	3,276	18.14	108.0	0.00	81.31	-	-	0.00	0.00	-	0.00
202	3,181	3,182	18.48	108.0	0.00	81.05	-	-	0.00	0.00	-	0.00
203	1,640	1,641	1	108.0	0.00	75.30	-	-	0.00	0.00	-	0.00
204	1,873	1,875	4.1	108.0	0.00	76.46	-	-	0.00	0.00	-	0.00
205	1,628	1,631		108.0	0.00	75.25	-	-	0.00	0.00	-	0.00
206	946	948		108.0	0.00	70.54	-	-	0.00	0.00	-	0.00
207	559	566		108.0	0.00	66.05	-	-	0.00	0.00	-	0.00
208	7,009	7,009	8	108.0	0.00	87.91	-	-	0.00	0.00	-	0.00
209	7,408	7,409		108.0	0.00	88.39	-	-	0.00	0.00	-	0.00
210	7,948	7,949		108.0	0.00	89.01	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
211	8,242	8,243	8	108.0	0.00	89.32	-	-	0.00	0.00	-	0.00
212	8,550	8,550		108.0	0.00	89.64	-	-	0.00	0.00	-	0.00
213	8,932	8,933	4	108.0	0.00	90.02	-	-	0.00	0.00	-	0.00
214	9,293	9,293	4	108.0	0.00	90.36	-	-	0.00	0.00	-	0.00
215	8,368	8,368	8	108.0	0.00	89.45	-	-	0.00	0.00	-	0.00
216	9,611	9,611	88	108.0	0.00	90.66	-	-	0.00	0.00	-	0.00
217	10,260	10,261		108.0	0.00	91.22	-	-	0.00	0.00	-	0.00
218	11,021	11,021	188	108.0	0.00	91.84	-	-	0.00	0.00	-	0.00
219	11,748	11,749		108.0	0.00	92.40	-	-	0.00	0.00	-	0.00
220	12,127	12,127	4	108.0	0.00	92.67	-	-	0.00	0.00	-	0.00
221	12,779	12,779		108.0	0.00	93.13	-	-	0.00	0.00	-	0.00
222	14,704	14,704	-41	108.0	0.00	94.35	-	-	0.00	0.00	-	0.00
223	14,206	14,206	-1	108.0	0.00	94.05	-	-	0.00	0.00	-	0.00
224	13,254	13,254	-8	108.0	0.00	93.45	-	-	0.00	0.00	-	0.00
225	13,004	13,004	-8	108.0	0.00	93.28	-	-	0.00	0.00	-	0.00
226	13,163	13,164		108.0	0.00	93.39	-	-	0.00	0.00	-	0.00
227	12,513	12,514	-1	108.0	0.00	92.95	-	-	0.00	0.00	-	0.00
228	14,144	14,144	-18	108.0	0.00	94.01	-	-	0.00	0.00	-	0.00
229	11,819	11,820	84	108.0	0.00	92.45	-	-	0.00	0.00	-	0.00
230	11,478	11,479	18	108.0	0.00	92.20	-	-	0.00	0.00	-	0.00
231	11,068	11,068	181	108.0	0.00	91.88	-	-	0.00	0.00	-	0.00
232	11,357	11,357	14	108.0	0.00	92.11	-	-	0.00	0.00	-	0.00
233	11,000	11,001	1	108.0	0.00	91.83	-	-	0.00	0.00	-	0.00
234	10,821	10,821	14	108.0	0.00	91.69	-	-	0.00	0.00	-	0.00
235	10,084	10,085	18	108.0	0.00	91.07	-	-	0.00	0.00	-	0.00
301	3,292	3,292	188	108.0	0.00	81.35	-	-	0.00	0.00	-	0.00
302	3,402	3,403	1	108.0	0.00	81.64	-	-	0.00	0.00	-	0.00
303	3,328	3,328	1	108.0	0.00	81.44	-	-	0.00	0.00	-	0.00
304	3,634	3,635	1	108.0	0.00	82.21	-	-	0.00	0.00	-	0.00
305	3,058	3,058	184	108.0	0.00	80.71	-	-	0.00	0.00	-	0.00
306	3,009	3,010	11	108.0	0.00	80.57	-	-	0.00	0.00	-	0.00
307	2,396	2,397	1	108.0	0.00	78.59	-	-	0.00	0.00	-	0.00
308	15,130	15,130	-84	108.0	0.00	94.60	-	-	0.00	0.00	-	0.00
309	14,598	14,598	-1	108.0	0.00	94.29	-	-	0.00	0.00	-	0.00
310	14,067	14,068	-1	108.0	0.00	93.96	-	-	0.00	0.00	-	0.00
311	13,585	13,586	-1	108.0	0.00	93.66	-	-	0.00	0.00	-	0.00
312	13,195	13,195	-8	108.0	0.00	93.41	-	-	0.00	0.00	-	0.00
313	12,730	12,730		108.0	0.00	93.10	-	-	0.00	0.00	-	0.00
314	11,863	11,863		108.0	0.00	92.48	-	-	0.00	0.00	-	0.00
315	12,388	12,389	14	108.0	0.00	92.86	-	-	0.00	0.00	-	0.00
316	13,068	13,069		108.0	0.00	93.32	-	-	0.00	0.00	-	0.00
317	13,367	13,368		108.0	0.00	93.52	-	-	0.00	0.00	-	0.00
318	14,188	14,188	-188	108.0	0.00	94.04	-	-	0.00	0.00	-	0.00
319	15,277	15,277		108.0	0.00	94.68	-	-	0.00	0.00	-	0.00
320	15,745	15,745	-44	108.0	0.00	94.94	-	-	0.00	0.00	-	0.00
321	16,215	16,216	-88	108.0	0.00	95.20	-	-	0.00	0.00	-	0.00
322	16,377	16,378	-4	108.0	0.00	95.28	-	-	0.00	0.00	-	0.00
323	16,230	16,231		108.0	0.00	95.21	-	-	0.00	0.00	-	0.00
324	15,417	15,418	-1	108.0	0.00	94.76	-	-	0.00	0.00	-	0.00
325	16,447	16,447	-41	108.0	0.00	95.32	-	-	0.00	0.00	-	0.00
326	15,751	15,751	-4	108.0	0.00	94.95	-	-	0.00	0.00	-	0.00
327	15,415	15,415	-1	108.0	0.00	94.76	-	-	0.00	0.00	-	0.00
328	14,472	14,472	-18	108.0	0.00	94.21	-	-	0.00	0.00	-	0.00
329	14,756	14,757	-4	108.0	0.00	94.38	-	-	0.00	0.00	-	0.00
330	13,995	13,995	-1	108.0	0.00	93.92	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:  
**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:  
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 Licensed user:  
**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
331	13,623	13,624	-1	108.0	0.00	93.69	-	-	0.00	0.00	-	0.00
332	13,131	13,131	-	108.0	0.00	93.37	-	-	0.00	0.00	-	0.00
333	13,332	13,333	-	108.0	0.00	93.50	-	-	0.00	0.00	-	0.00
334	13,835	13,835	-1	108.0	0.00	93.82	-	-	0.00	0.00	-	0.00
335	13,923	13,923	-1	108.0	0.00	93.87	-	-	0.00	0.00	-	0.00
Sum	40.00											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP 8 NSP 8**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	3,852	3,854	1	108.0	0.00	82.72	-	-	0.00	0.00	-	0.00
2	4,553	4,555	14	108.0	0.00	84.17	-	-	0.00	0.00	-	0.00
3	4,875	4,876	11	107.0	0.00	84.76	-	-	0.00	0.00	-	0.00
4	3,747	3,749	14	107.0	0.00	82.48	-	-	0.00	0.00	-	0.00
5	4,877	4,879	11	107.0	0.00	84.77	-	-	0.00	0.00	-	0.00
6	5,747	5,748	11	108.0	0.00	86.19	-	-	0.00	0.00	-	0.00
7	5,785	5,786	1	108.0	0.00	86.25	-	-	0.00	0.00	-	0.00
8	4,746	4,747	11	107.0	0.00	84.53	-	-	0.00	0.00	-	0.00
9	3,143	3,146	18	108.0	0.00	80.95	-	-	0.00	0.00	-	0.00
10	4,037	4,039	1	108.0	0.00	83.12	-	-	0.00	0.00	-	0.00
11	3,177	3,179	18	108.0	0.00	81.05	-	-	0.00	0.00	-	0.00
12	2,132	2,134	1	107.0	0.00	77.58	-	-	0.00	0.00	-	0.00
13	3,503	3,505	1	107.0	0.00	81.89	-	-	0.00	0.00	-	0.00
14	4,094	4,095	1	107.0	0.00	83.24	-	-	0.00	0.00	-	0.00
15	5,144	5,146	1	108.0	0.00	85.23	-	-	0.00	0.00	-	0.00
16	4,313	4,315	1	107.0	0.00	83.70	-	-	0.00	0.00	-	0.00
17	6,310	6,311	8	108.0	0.00	87.00	-	-	0.00	0.00	-	0.00
18	4,433	4,434	1	107.0	0.00	83.94	-	-	0.00	0.00	-	0.00
19	3,520	3,522	1	107.0	0.00	81.93	-	-	0.00	0.00	-	0.00
20	6,083	6,084	1	108.0	0.00	86.68	-	-	0.00	0.00	-	0.00
22	3,485	3,486	1	107.0	0.00	81.85	-	-	0.00	0.00	-	0.00
23	5,235	5,237	1	107.0	0.00	85.38	-	-	0.00	0.00	-	0.00
25	6,160	6,161	1	108.0	0.00	86.79	-	-	0.00	0.00	-	0.00
26	6,798	6,799	8	108.0	0.00	87.65	-	-	0.00	0.00	-	0.00
27	3,977	3,978	1	108.0	0.00	82.99	-	-	0.00	0.00	-	0.00
28	5,497	5,498	11	108.0	0.00	85.80	-	-	0.00	0.00	-	0.00
29	1,643	1,646	4	107.0	0.00	75.33	-	-	0.00	0.00	-	0.00
30	4,339	4,340	14	108.0	0.00	83.75	-	-	0.00	0.00	-	0.00
31	2,492	2,494	1	107.0	0.00	78.94	-	-	0.00	0.00	-	0.00
32	4,992	4,993	11	107.0	0.00	84.97	-	-	0.00	0.00	-	0.00
33	3,147	3,149	1	107.0	0.00	80.96	-	-	0.00	0.00	-	0.00
201	5,388	5,389	11	108.0	0.00	85.63	-	-	0.00	0.00	-	0.00
202	5,552	5,553	11	108.0	0.00	85.89	-	-	0.00	0.00	-	0.00
203	4,501	4,502	14	108.0	0.00	84.07	-	-	0.00	0.00	-	0.00
204	4,972	4,973	1	108.0	0.00	84.93	-	-	0.00	0.00	-	0.00
205	5,196	5,197	1	108.0	0.00	85.32	-	-	0.00	0.00	-	0.00
206	3,654	3,655	1	108.0	0.00	82.26	-	-	0.00	0.00	-	0.00
207	3,732	3,734	1	108.0	0.00	82.44	-	-	0.00	0.00	-	0.00
208	3,051	3,053	18	108.0	0.00	80.69	-	-	0.00	0.00	-	0.00
209	3,394	3,396	1	108.0	0.00	81.62	-	-	0.00	0.00	-	0.00
210	3,910	3,912	1	108.0	0.00	82.85	-	-	0.00	0.00	-	0.00
211	4,562	4,564	14	108.0	0.00	84.19	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
212	4,946	4,948	1	108.0	0.00	84.89	-	-	0.00	0.00	-	0.00
213	5,388	5,389	11	108.0	0.00	85.63	-	-	0.00	0.00	-	0.00
214	5,714	5,715	11.14	108.0	0.00	86.14	-	-	0.00	0.00	-	0.00
215	5,543	5,544	11.4	108.0	0.00	85.88	-	-	0.00	0.00	-	0.00
216	6,414	6,415	8	108.0	0.00	87.14	-	-	0.00	0.00	-	0.00
217	6,925	6,926	8	108.0	0.00	87.81	-	-	0.00	0.00	-	0.00
218	7,129	7,130	8.1	108.0	0.00	88.06	-	-	0.00	0.00	-	0.00
219	7,919	7,920	8	108.0	0.00	88.97	-	-	0.00	0.00	-	0.00
220	8,237	8,237	8	108.0	0.00	89.32	-	-	0.00	0.00	-	0.00
221	8,878	8,879	8	108.0	0.00	89.97	-	-	0.00	0.00	-	0.00
222	11,348	11,349	1.44	108.0	0.00	92.10	-	-	0.00	0.00	-	0.00
223	10,956	10,956	1	108.0	0.00	91.79	-	-	0.00	0.00	-	0.00
224	9,678	9,678	8	108.0	0.00	90.72	-	-	0.00	0.00	-	0.00
225	9,480	9,481	4	108.0	0.00	90.54	-	-	0.00	0.00	-	0.00
226	9,845	9,846	8	108.0	0.00	90.86	-	-	0.00	0.00	-	0.00
227	9,354	9,355	4	108.0	0.00	90.42	-	-	0.00	0.00	-	0.00
228	10,725	10,725	8	108.0	0.00	91.61	-	-	0.00	0.00	-	0.00
229	8,683	8,684	4	108.0	0.00	89.77	-	-	0.00	0.00	-	0.00
230	8,348	8,349	8	108.0	0.00	89.43	-	-	0.00	0.00	-	0.00
231	8,047	8,048	4	108.0	0.00	89.11	-	-	0.00	0.00	-	0.00
232	8,722	8,723	8	108.0	0.00	89.81	-	-	0.00	0.00	-	0.00
233	8,451	8,452	8	108.0	0.00	89.54	-	-	0.00	0.00	-	0.00
234	8,384	8,385	8.4	108.0	0.00	89.47	-	-	0.00	0.00	-	0.00
235	7,646	7,647	1.4	108.0	0.00	88.67	-	-	0.00	0.00	-	0.00
301	2,375	2,376	1	108.0	0.00	78.52	-	-	0.00	0.00	-	0.00
302	2,869	2,870	1	108.0	0.00	80.16	-	-	0.00	0.00	-	0.00
303	3,749	3,750	1	108.0	0.00	82.48	-	-	0.00	0.00	-	0.00
304	4,353	4,354	1.4	108.0	0.00	83.78	-	-	0.00	0.00	-	0.00
305	4,660	4,660	1.81	108.0	0.00	84.37	-	-	0.00	0.00	-	0.00
306	4,302	4,303	1.8	108.0	0.00	83.67	-	-	0.00	0.00	-	0.00
307	3,645	3,646	1.8	108.0	0.00	82.24	-	-	0.00	0.00	-	0.00
308	12,174	12,174	4	108.0	0.00	92.71	-	-	0.00	0.00	-	0.00
309	11,654	11,654	1	108.0	0.00	92.33	-	-	0.00	0.00	-	0.00
310	11,018	11,018	1.88	108.0	0.00	91.84	-	-	0.00	0.00	-	0.00
311	10,567	10,568	4	108.0	0.00	91.48	-	-	0.00	0.00	-	0.00
312	10,225	10,226	8	108.0	0.00	91.19	-	-	0.00	0.00	-	0.00
313	9,815	9,816	8	108.0	0.00	90.84	-	-	0.00	0.00	-	0.00
314	8,944	8,945	4	108.0	0.00	90.03	-	-	0.00	0.00	-	0.00
315	9,732	9,732	8	108.0	0.00	90.76	-	-	0.00	0.00	-	0.00
316	10,492	10,492	8	108.0	0.00	91.42	-	-	0.00	0.00	-	0.00
317	10,702	10,703	1	108.0	0.00	91.59	-	-	0.00	0.00	-	0.00
318	11,500	11,501	1	108.0	0.00	92.21	-	-	0.00	0.00	-	0.00
319	12,906	12,906	-4	108.0	0.00	93.22	-	-	0.00	0.00	-	0.00
320	13,401	13,401	-1	108.0	0.00	93.54	-	-	0.00	0.00	-	0.00
321	13,852	13,852	-1	108.0	0.00	93.83	-	-	0.00	0.00	-	0.00
322	14,282	14,282	-1.8	108.0	0.00	94.10	-	-	0.00	0.00	-	0.00
323	14,222	14,223	-1	108.0	0.00	94.06	-	-	0.00	0.00	-	0.00
324	13,446	13,447	-1.8	108.0	0.00	93.57	-	-	0.00	0.00	-	0.00
325	14,728	14,728	-4.4	108.0	0.00	94.36	-	-	0.00	0.00	-	0.00
326	14,006	14,006	-1	108.0	0.00	93.93	-	-	0.00	0.00	-	0.00
327	13,732	13,732	-1	108.0	0.00	93.75	-	-	0.00	0.00	-	0.00
328	12,938	12,939	-	108.0	0.00	93.24	-	-	0.00	0.00	-	0.00
329	13,541	13,542	-1.18	108.0	0.00	93.63	-	-	0.00	0.00	-	0.00
330	12,773	12,774	-1.1	108.0	0.00	93.13	-	-	0.00	0.00	-	0.00
331	12,153	12,154	4	108.0	0.00	92.69	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

### DECIBEL - Detailed results

Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s

...continued from previous page

**WTG** Wind speed: 8 m/s

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
332	11,626	11,627	100	108.0	0.00	92.31	-	-	0.00	0.00	-	0.00
333	11,563	11,563	110	108.0	0.00	92.26	-	-	0.00	0.00	-	0.00
334	12,018	12,019	100	108.0	0.00	92.60	-	-	0.00	0.00	-	0.00
335	11,945	11,945	108	108.0	0.00	92.54	-	-	0.00	0.00	-	0.00

Sum 33.51

- Data undefined due to calculation with octave data

### Noise sensitive area: NSP NSP

**WTG** Wind speed: 8 m/s

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	4,159	4,162	104	108.0	0.00	83.39	-	-	0.00	0.00	-	0.00
2	4,935	4,938	100	108.0	0.00	84.87	-	-	0.00	0.00	-	0.00
3	4,855	4,857	110	107.0	0.00	84.73	-	-	0.00	0.00	-	0.00
4	3,682	3,684	101	107.0	0.00	82.33	-	-	0.00	0.00	-	0.00
5	4,992	4,994	110	107.0	0.00	84.97	-	-	0.00	0.00	-	0.00
6	6,124	6,125	101	108.0	0.00	86.74	-	-	0.00	0.00	-	0.00
7	6,081	6,083	100	108.0	0.00	86.68	-	-	0.00	0.00	-	0.00
8	4,637	4,639	101	107.0	0.00	84.33	-	-	0.00	0.00	-	0.00
9	3,506	3,508	100	108.0	0.00	81.90	-	-	0.00	0.00	-	0.00
10	4,393	4,395	140	108.0	0.00	83.86	-	-	0.00	0.00	-	0.00
11	3,643	3,645	108	108.0	0.00	82.23	-	-	0.00	0.00	-	0.00
12	2,211	2,214	104	107.0	0.00	77.90	-	-	0.00	0.00	-	0.00
13	3,481	3,483	100	107.0	0.00	81.84	-	-	0.00	0.00	-	0.00
14	4,209	4,210	100	107.0	0.00	83.49	-	-	0.00	0.00	-	0.00
15	5,449	5,451	110	108.0	0.00	85.73	-	-	0.00	0.00	-	0.00
16	4,277	4,279	101	107.0	0.00	83.63	-	-	0.00	0.00	-	0.00
17	6,690	6,691	100	108.0	0.00	87.51	-	-	0.00	0.00	-	0.00
18	4,634	4,635	1018	107.0	0.00	84.32	-	-	0.00	0.00	-	0.00
19	3,663	3,664	100	107.0	0.00	82.28	-	-	0.00	0.00	-	0.00
20	6,420	6,422	100	108.0	0.00	87.15	-	-	0.00	0.00	-	0.00
22	3,295	3,297	104	107.0	0.00	81.36	-	-	0.00	0.00	-	0.00
23	5,064	5,066	110	107.0	0.00	85.09	-	-	0.00	0.00	-	0.00
25	6,566	6,567	100	108.0	0.00	87.35	-	-	0.00	0.00	-	0.00
26	7,141	7,142	81	108.0	0.00	88.08	-	-	0.00	0.00	-	0.00
27	4,241	4,243	140	108.0	0.00	83.55	-	-	0.00	0.00	-	0.00
28	5,837	5,839	108	108.0	0.00	86.33	-	-	0.00	0.00	-	0.00
29	1,670	1,673	401	107.0	0.00	75.47	-	-	0.00	0.00	-	0.00
30	4,751	4,752	100	108.0	0.00	84.54	-	-	0.00	0.00	-	0.00
31	2,472	2,474	100	107.0	0.00	78.87	-	-	0.00	0.00	-	0.00
32	5,042	5,044	111	107.0	0.00	85.05	-	-	0.00	0.00	-	0.00
33	3,050	3,052	100	107.0	0.00	80.69	-	-	0.00	0.00	-	0.00
201	5,850	5,852	108	108.0	0.00	86.35	-	-	0.00	0.00	-	0.00
202	6,024	6,025	104	108.0	0.00	86.60	-	-	0.00	0.00	-	0.00
203	5,011	5,012	108	108.0	0.00	85.00	-	-	0.00	0.00	-	0.00
204	5,480	5,482	110	108.0	0.00	85.78	-	-	0.00	0.00	-	0.00
205	5,712	5,713	1114	108.0	0.00	86.14	-	-	0.00	0.00	-	0.00
206	4,174	4,175	100	108.0	0.00	83.41	-	-	0.00	0.00	-	0.00
207	4,244	4,246	1408	108.0	0.00	83.56	-	-	0.00	0.00	-	0.00
208	2,695	2,697	100	108.0	0.00	79.62	-	-	0.00	0.00	-	0.00
209	3,007	3,009	101	108.0	0.00	80.57	-	-	0.00	0.00	-	0.00
210	3,505	3,507	100	108.0	0.00	81.90	-	-	0.00	0.00	-	0.00
211	4,255	4,257	140	108.0	0.00	83.58	-	-	0.00	0.00	-	0.00
212	4,651	4,653	108	108.0	0.00	84.35	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
213	5,099	5,101	1004	108.0	0.00	85.15	-	-	0.00	0.00	-	0.00
214	5,412	5,413	1180	108.0	0.00	85.67	-	-	0.00	0.00	-	0.00
215	5,409	5,410	1180	108.0	0.00	85.66	-	-	0.00	0.00	-	0.00
216	6,185	6,186	1000	108.0	0.00	86.83	-	-	0.00	0.00	-	0.00
217	6,660	6,661	0000	108.0	0.00	87.47	-	-	0.00	0.00	-	0.00
218	6,736	6,737	801	108.0	0.00	87.57	-	-	0.00	0.00	-	0.00
219	7,537	7,537	0000	108.0	0.00	88.54	-	-	0.00	0.00	-	0.00
220	7,838	7,839	080	108.0	0.00	88.89	-	-	0.00	0.00	-	0.00
221	8,475	8,475	0000	108.0	0.00	89.56	-	-	0.00	0.00	-	0.00
222	11,046	11,046	184	108.0	0.00	91.86	-	-	0.00	0.00	-	0.00
223	10,675	10,675	004	108.0	0.00	91.57	-	-	0.00	0.00	-	0.00
224	9,341	9,341	400	108.0	0.00	90.41	-	-	0.00	0.00	-	0.00
225	9,155	9,156	408	108.0	0.00	90.23	-	-	0.00	0.00	-	0.00
226	9,557	9,558	0000	108.0	0.00	90.61	-	-	0.00	0.00	-	0.00
227	9,100	9,101	400	108.0	0.00	90.18	-	-	0.00	0.00	-	0.00
228	10,413	10,414	001	108.0	0.00	91.35	-	-	0.00	0.00	-	0.00
229	8,439	8,440	0000	108.0	0.00	89.53	-	-	0.00	0.00	-	0.00
230	8,108	8,110	0000	108.0	0.00	89.18	-	-	0.00	0.00	-	0.00
231	7,831	7,832	081	108.0	0.00	88.88	-	-	0.00	0.00	-	0.00
232	8,568	8,569	0000	108.0	0.00	89.66	-	-	0.00	0.00	-	0.00
233	8,315	8,316	0000	108.0	0.00	89.40	-	-	0.00	0.00	-	0.00
234	8,268	8,269	004	108.0	0.00	89.35	-	-	0.00	0.00	-	0.00
235	7,541	7,542	004	108.0	0.00	88.55	-	-	0.00	0.00	-	0.00
301	2,682	2,683	004	108.0	0.00	79.57	-	-	0.00	0.00	-	0.00
302	3,152	3,153	1800	108.0	0.00	80.97	-	-	0.00	0.00	-	0.00
303	4,054	4,055	1000	108.0	0.00	83.16	-	-	0.00	0.00	-	0.00
304	4,645	4,646	1084	108.0	0.00	84.34	-	-	0.00	0.00	-	0.00
305	5,019	5,020	1080	108.0	0.00	85.01	-	-	0.00	0.00	-	0.00
306	4,654	4,655	1080	108.0	0.00	84.36	-	-	0.00	0.00	-	0.00
307	4,041	4,042	1000	108.0	0.00	83.13	-	-	0.00	0.00	-	0.00
308	11,938	11,938	0000	108.0	0.00	92.54	-	-	0.00	0.00	-	0.00
309	11,423	11,423	1000	108.0	0.00	92.16	-	-	0.00	0.00	-	0.00
310	10,772	10,773	001	108.0	0.00	91.65	-	-	0.00	0.00	-	0.00
311	10,330	10,330	080	108.0	0.00	91.28	-	-	0.00	0.00	-	0.00
312	9,999	9,999	0000	108.0	0.00	91.00	-	-	0.00	0.00	-	0.00
313	9,602	9,603	080	108.0	0.00	90.65	-	-	0.00	0.00	-	0.00
314	8,737	8,738	0000	108.0	0.00	89.83	-	-	0.00	0.00	-	0.00
315	9,563	9,564	0000	108.0	0.00	90.61	-	-	0.00	0.00	-	0.00
316	10,330	10,331	080	108.0	0.00	91.28	-	-	0.00	0.00	-	0.00
317	10,524	10,525	0000	108.0	0.00	91.44	-	-	0.00	0.00	-	0.00
318	11,313	11,314	140	108.0	0.00	92.07	-	-	0.00	0.00	-	0.00
319	12,761	12,761	-000	108.0	0.00	93.12	-	-	0.00	0.00	-	0.00
320	13,257	13,258	-080	108.0	0.00	93.45	-	-	0.00	0.00	-	0.00
321	13,703	13,703	-100	108.0	0.00	93.74	-	-	0.00	0.00	-	0.00
322	14,171	14,172	-180	108.0	0.00	94.03	-	-	0.00	0.00	-	0.00
323	14,125	14,125	-181	108.0	0.00	94.00	-	-	0.00	0.00	-	0.00
324	13,358	13,359	-008	108.0	0.00	93.52	-	-	0.00	0.00	-	0.00
325	14,669	14,670	-008	108.0	0.00	94.33	-	-	0.00	0.00	-	0.00
326	13,947	13,948	-100	108.0	0.00	93.89	-	-	0.00	0.00	-	0.00
327	13,684	13,684	-104	108.0	0.00	93.72	-	-	0.00	0.00	-	0.00
328	12,916	12,917	-048	108.0	0.00	93.22	-	-	0.00	0.00	-	0.00
329	13,559	13,559	-100	108.0	0.00	93.64	-	-	0.00	0.00	-	0.00
330	12,795	12,796	-004	108.0	0.00	93.14	-	-	0.00	0.00	-	0.00
331	12,145	12,146	044	108.0	0.00	92.69	-	-	0.00	0.00	-	0.00
332	11,618	11,619	110	108.0	0.00	92.30	-	-	0.00	0.00	-	0.00

To be continued on next page...



Project:  
**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:  
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 Licensed user:  
**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
333	11,517	11,518	1	108.0	0.00	92.23	-	-	0.00	0.00	-	0.00
334	11,962	11,963		108.0	0.00	92.56	-	-	0.00	0.00	-	0.00
335	11,866	11,866	8	108.0	0.00	92.49	-	-	0.00	0.00	-	0.00
Sum	33.17											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP 1 NSP 1**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	4,847	4,848	1	108.0	0.00	84.71	-	-	0.00	0.00	-	0.00
2	5,699	5,701	11.1	108.0	0.00	86.12	-	-	0.00	0.00	-	0.00
3	5,080	5,081	11	107.0	0.00	85.12	-	-	0.00	0.00	-	0.00
4	3,871	3,872	14.4	107.0	0.00	82.76	-	-	0.00	0.00	-	0.00
5	5,416	5,417	1	107.0	0.00	85.67	-	-	0.00	0.00	-	0.00
6	6,875	6,876	8	108.0	0.00	87.75	-	-	0.00	0.00	-	0.00
7	6,736	6,737	8.1	108.0	0.00	87.57	-	-	0.00	0.00	-	0.00
8	4,720	4,721	11	107.0	0.00	84.48	-	-	0.00	0.00	-	0.00
9	4,262	4,263	14	108.0	0.00	83.60	-	-	0.00	0.00	-	0.00
10	5,133	5,134	1	108.0	0.00	85.21	-	-	0.00	0.00	-	0.00
11	4,493	4,493	14	108.0	0.00	84.05	-	-	0.00	0.00	-	0.00
12	2,695	2,696	18	107.0	0.00	79.61	-	-	0.00	0.00	-	0.00
13	3,745	3,746	14.81	107.0	0.00	82.47	-	-	0.00	0.00	-	0.00
14	4,650	4,651	1.14	107.0	0.00	84.35	-	-	0.00	0.00	-	0.00
15	6,120	6,120	1	108.0	0.00	86.74	-	-	0.00	0.00	-	0.00
16	4,490	4,491	1	107.0	0.00	84.05	-	-	0.00	0.00	-	0.00
17	7,442	7,442		108.0	0.00	88.43	-	-	0.00	0.00	-	0.00
18	5,183	5,183	1.8	107.0	0.00	85.29	-	-	0.00	0.00	-	0.00
19	4,157	4,157	1	107.0	0.00	83.38	-	-	0.00	0.00	-	0.00
20	7,124	7,125	8.1	108.0	0.00	88.06	-	-	0.00	0.00	-	0.00
22	3,286	3,287	1.8	107.0	0.00	81.34	-	-	0.00	0.00	-	0.00
23	5,025	5,026	11.1	107.0	0.00	85.02	-	-	0.00	0.00	-	0.00
25	7,348	7,348		108.0	0.00	88.32	-	-	0.00	0.00	-	0.00
26	7,849	7,849	8	108.0	0.00	88.90	-	-	0.00	0.00	-	0.00
27	4,877	4,878	1	108.0	0.00	84.76	-	-	0.00	0.00	-	0.00
28	6,548	6,549		108.0	0.00	87.32	-	-	0.00	0.00	-	0.00
29	2,146	2,147	1.4	107.0	0.00	77.64	-	-	0.00	0.00	-	0.00
30	5,547	5,547	11	108.0	0.00	85.88	-	-	0.00	0.00	-	0.00
31	2,800	2,801	18	107.0	0.00	79.95	-	-	0.00	0.00	-	0.00
32	5,371	5,371	1	107.0	0.00	85.60	-	-	0.00	0.00	-	0.00
33	3,217	3,218	1	107.0	0.00	81.15	-	-	0.00	0.00	-	0.00
201	6,692	6,693		108.0	0.00	87.51	-	-	0.00	0.00	-	0.00
202	6,874	6,874	8	108.0	0.00	87.74	-	-	0.00	0.00	-	0.00
203	5,886	5,886	1.4	108.0	0.00	86.40	-	-	0.00	0.00	-	0.00
204	6,355	6,356		108.0	0.00	87.06	-	-	0.00	0.00	-	0.00
205	6,587	6,588	1	108.0	0.00	87.37	-	-	0.00	0.00	-	0.00
206	5,043	5,043	1	108.0	0.00	85.05	-	-	0.00	0.00	-	0.00
207	5,082	5,083	1.8	108.0	0.00	85.12	-	-	0.00	0.00	-	0.00
208	2,376	2,377	1	108.0	0.00	78.52	-	-	0.00	0.00	-	0.00
209	2,593	2,594		108.0	0.00	79.28	-	-	0.00	0.00	-	0.00
210	3,023	3,025	1	108.0	0.00	80.61	-	-	0.00	0.00	-	0.00
211	3,973	3,974	1.81	108.0	0.00	82.98	-	-	0.00	0.00	-	0.00
212	4,383	4,384	1.4.8	108.0	0.00	83.84	-	-	0.00	0.00	-	0.00
213	4,835	4,836	1	108.0	0.00	84.69	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

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 Frank Frederickson  
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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

WTG		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
214	5,113	5,114	1001	108.0	0.00	85.17	-	-	0.00	0.00	-	0.00
215	5,429	5,430	1180	108.0	0.00	85.70	-	-	0.00	0.00	-	0.00
216	6,020	6,020	1044	108.0	0.00	86.59	-	-	0.00	0.00	-	0.00
217	6,418	6,419	0000	108.0	0.00	87.15	-	-	0.00	0.00	-	0.00
218	6,227	6,227	0008	108.0	0.00	86.89	-	-	0.00	0.00	-	0.00
219	7,044	7,045	8000	108.0	0.00	87.96	-	-	0.00	0.00	-	0.00
220	7,309	7,310	0008	108.0	0.00	88.28	-	-	0.00	0.00	-	0.00
221	7,931	7,931	0000	108.0	0.00	88.99	-	-	0.00	0.00	-	0.00
222	10,698	10,698	0001	108.0	0.00	91.59	-	-	0.00	0.00	-	0.00
223	10,370	10,370	0000	108.0	0.00	91.32	-	-	0.00	0.00	-	0.00
224	8,932	8,932	4004	108.0	0.00	90.02	-	-	0.00	0.00	-	0.00
225	8,771	8,771	0000	108.0	0.00	89.86	-	-	0.00	0.00	-	0.00
226	9,246	9,246	4444	108.0	0.00	90.32	-	-	0.00	0.00	-	0.00
227	8,856	8,856	0000	108.0	0.00	89.95	-	-	0.00	0.00	-	0.00
228	10,051	10,051	0000	108.0	0.00	91.04	-	-	0.00	0.00	-	0.00
229	8,219	8,219	0100	108.0	0.00	89.30	-	-	0.00	0.00	-	0.00
230	7,899	7,900	0000	108.0	0.00	88.95	-	-	0.00	0.00	-	0.00
231	7,670	7,670	0100	108.0	0.00	88.70	-	-	0.00	0.00	-	0.00
232	8,512	8,513	0000	108.0	0.00	89.60	-	-	0.00	0.00	-	0.00
233	8,293	8,294	0000	108.0	0.00	89.38	-	-	0.00	0.00	-	0.00
234	8,281	8,282	0000	108.0	0.00	89.36	-	-	0.00	0.00	-	0.00
235	7,579	7,580	0000	108.0	0.00	88.59	-	-	0.00	0.00	-	0.00
301	3,230	3,230	1800	108.0	0.00	81.18	-	-	0.00	0.00	-	0.00
302	3,646	3,646	1008	108.0	0.00	82.24	-	-	0.00	0.00	-	0.00
303	4,554	4,554	1410	108.0	0.00	84.17	-	-	0.00	0.00	-	0.00
304	5,113	5,114	1001	108.0	0.00	85.17	-	-	0.00	0.00	-	0.00
305	5,589	5,589	1140	108.0	0.00	85.95	-	-	0.00	0.00	-	0.00
306	5,217	5,217	1004	108.0	0.00	85.35	-	-	0.00	0.00	-	0.00
307	4,684	4,684	1004	108.0	0.00	84.41	-	-	0.00	0.00	-	0.00
308	11,713	11,714	0008	108.0	0.00	92.37	-	-	0.00	0.00	-	0.00
309	11,210	11,210	1000	108.0	0.00	91.99	-	-	0.00	0.00	-	0.00
310	10,535	10,535	0004	108.0	0.00	91.45	-	-	0.00	0.00	-	0.00
311	10,110	10,111	0140	108.0	0.00	91.10	-	-	0.00	0.00	-	0.00
312	9,801	9,802	0000	108.0	0.00	90.83	-	-	0.00	0.00	-	0.00
313	9,431	9,431	4100	108.0	0.00	90.49	-	-	0.00	0.00	-	0.00
314	8,585	8,586	0000	108.0	0.00	89.68	-	-	0.00	0.00	-	0.00
315	9,475	9,475	4008	108.0	0.00	90.53	-	-	0.00	0.00	-	0.00
316	10,249	10,250	0004	108.0	0.00	91.21	-	-	0.00	0.00	-	0.00
317	10,413	10,414	0001	108.0	0.00	91.35	-	-	0.00	0.00	-	0.00
318	11,181	11,181	1000	108.0	0.00	91.97	-	-	0.00	0.00	-	0.00
319	12,698	12,698	-0000	108.0	0.00	93.07	-	-	0.00	0.00	-	0.00
320	13,195	13,196	-0080	108.0	0.00	93.41	-	-	0.00	0.00	-	0.00
321	13,630	13,630	-1008	108.0	0.00	93.69	-	-	0.00	0.00	-	0.00
322	14,164	14,164	-1800	108.0	0.00	94.02	-	-	0.00	0.00	-	0.00
323	14,140	14,140	-1800	108.0	0.00	94.01	-	-	0.00	0.00	-	0.00
324	13,392	13,393	-1000	108.0	0.00	93.54	-	-	0.00	0.00	-	0.00
325	14,749	14,749	-0040	108.0	0.00	94.38	-	-	0.00	0.00	-	0.00
326	14,030	14,030	-1001	108.0	0.00	93.94	-	-	0.00	0.00	-	0.00
327	13,784	13,784	-1400	108.0	0.00	93.79	-	-	0.00	0.00	-	0.00
328	13,062	13,063	-0004	108.0	0.00	93.32	-	-	0.00	0.00	-	0.00
329	13,767	13,768	-1400	108.0	0.00	93.78	-	-	0.00	0.00	-	0.00
330	13,013	13,014	-0000	108.0	0.00	93.29	-	-	0.00	0.00	-	0.00
331	12,318	12,318	0000	108.0	0.00	92.81	-	-	0.00	0.00	-	0.00
332	11,792	11,792	0088	108.0	0.00	92.43	-	-	0.00	0.00	-	0.00
333	11,630	11,630	1008	108.0	0.00	92.31	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

## DECIBEL - Detailed results

Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
334	12,056	12,056	□□□□	108.0	0.00	92.62	-	-	0.00	0.00	-	0.00
335	11,921	11,921	□□□□	108.0	0.00	92.53	-	-	0.00	0.00	-	0.00
Sum	32.21											

- Data undefined due to calculation with octave data

## Noise sensitive area: NSP 11 NSP 11

		Wind speed: 8 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	3,718	3,720	1□□□□	108.0	0.00	82.41	-	-	0.00	0.00	-	0.00
2	4,729	4,731	1□□□1	108.0	0.00	84.50	-	-	0.00	0.00	-	0.00
3	3,462	3,464	1□□□□	107.0	0.00	81.79	-	-	0.00	0.00	-	0.00
4	2,251	2,254	□□81	107.0	0.00	78.06	-	-	0.00	0.00	-	0.00
5	3,889	3,890	14□□□	107.0	0.00	82.80	-	-	0.00	0.00	-	0.00
6	5,829	5,831	1□8□□	108.0	0.00	86.31	-	-	0.00	0.00	-	0.00
7	5,475	5,476	11□□□	108.0	0.00	85.77	-	-	0.00	0.00	-	0.00
8	3,112	3,114	1□□□□	107.0	0.00	80.87	-	-	0.00	0.00	-	0.00
9	3,353	3,354	1□8□□	108.0	0.00	81.51	-	-	0.00	0.00	-	0.00
10	4,119	4,121	1□□□□	108.0	0.00	83.30	-	-	0.00	0.00	-	0.00
11	3,964	3,965	1□84	108.0	0.00	82.97	-	-	0.00	0.00	-	0.00
12	1,407	1,409	□□□□□	107.0	0.00	73.98	-	-	0.00	0.00	-	0.00
13	2,147	2,150	□141	107.0	0.00	77.65	-	-	0.00	0.00	-	0.00
14	3,154	3,155	1□8□□	107.0	0.00	80.98	-	-	0.00	0.00	-	0.00
15	4,903	4,905	1□1□□	108.0	0.00	84.81	-	-	0.00	0.00	-	0.00
16	2,872	2,874	1□□□□	107.0	0.00	80.17	-	-	0.00	0.00	-	0.00
17	6,384	6,385	□□4	108.0	0.00	87.10	-	-	0.00	0.00	-	0.00
18	3,794	3,795	14□□□	107.0	0.00	82.58	-	-	0.00	0.00	-	0.00
19	2,736	2,738	18□□□	107.0	0.00	79.75	-	-	0.00	0.00	-	0.00
20	5,953	5,954	1□□□□	108.0	0.00	86.50	-	-	0.00	0.00	-	0.00
22	1,708	1,711	□4□4	107.0	0.00	75.67	-	-	0.00	0.00	-	0.00
23	3,475	3,478	1□□□□	107.0	0.00	81.83	-	-	0.00	0.00	-	0.00
25	6,384	6,385	□□4	108.0	0.00	87.10	-	-	0.00	0.00	-	0.00
26	6,673	6,674	□□4	108.0	0.00	87.49	-	-	0.00	0.00	-	0.00
27	3,639	3,641	1□88	108.0	0.00	82.22	-	-	0.00	0.00	-	0.00
28	5,407	5,409	118□□	108.0	0.00	85.66	-	-	0.00	0.00	-	0.00
29	1,010	1,014	□□4	107.0	0.00	71.12	-	-	0.00	0.00	-	0.00
30	4,691	4,692	1□□□□	108.0	0.00	84.43	-	-	0.00	0.00	-	0.00
31	1,288	1,291	□□□□□	107.0	0.00	73.22	-	-	0.00	0.00	-	0.00
32	3,783	3,784	14□8	107.0	0.00	82.56	-	-	0.00	0.00	-	0.00
33	1,598	1,602	□□□□□	107.0	0.00	75.09	-	-	0.00	0.00	-	0.00
201	6,004	6,005	1□4□□	108.0	0.00	86.57	-	-	0.00	0.00	-	0.00
202	6,236	6,236	□□□□□	108.0	0.00	86.90	-	-	0.00	0.00	-	0.00
203	5,587	5,587	1144	108.0	0.00	85.94	-	-	0.00	0.00	-	0.00
204	6,027	6,028	1□4□□	108.0	0.00	86.60	-	-	0.00	0.00	-	0.00
205	6,370	6,371	□□□□□	108.0	0.00	87.08	-	-	0.00	0.00	-	0.00
206	5,014	5,014	1□8□□	108.0	0.00	85.00	-	-	0.00	0.00	-	0.00
207	5,302	5,303	1□1□□	108.0	0.00	85.49	-	-	0.00	0.00	-	0.00
208	1,224	1,227	□□44	108.0	0.00	72.78	-	-	0.00	0.00	-	0.00
209	1,613	1,616	□□□4	108.0	0.00	75.17	-	-	0.00	0.00	-	0.00
210	2,152	2,155	□□□□□	108.0	0.00	77.67	-	-	0.00	0.00	-	0.00
211	2,683	2,686	□□41	108.0	0.00	79.58	-	-	0.00	0.00	-	0.00
212	3,068	3,070	188□□	108.0	0.00	80.74	-	-	0.00	0.00	-	0.00
213	3,512	3,513	1□□1	108.0	0.00	81.91	-	-	0.00	0.00	-	0.00
214	3,835	3,837	1□□4	108.0	0.00	82.68	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

WTG		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
215	3,847	3,849	1	108.0	0.00	82.71	-	-	0.00	0.00	-	0.00
216	4,578	4,579	14	108.0	0.00	84.22	-	-	0.00	0.00	-	0.00
217	5,060	5,061	1	108.0	0.00	85.09	-	-	0.00	0.00	-	0.00
218	5,305	5,306	1	108.0	0.00	85.49	-	-	0.00	0.00	-	0.00
219	6,078	6,079	1	108.0	0.00	86.68	-	-	0.00	0.00	-	0.00
220	6,416	6,417		108.0	0.00	87.15	-	-	0.00	0.00	-	0.00
221	7,064	7,065	8	108.0	0.00	87.98	-	-	0.00	0.00	-	0.00
222	9,470	9,471	4	108.0	0.00	90.53	-	-	0.00	0.00	-	0.00
223	9,084	9,085	4	108.0	0.00	90.17	-	-	0.00	0.00	-	0.00
224	7,802	7,803	8	108.0	0.00	88.85	-	-	0.00	0.00	-	0.00
225	7,602	7,603		108.0	0.00	88.62	-	-	0.00	0.00	-	0.00
226	7,971	7,971		108.0	0.00	89.03	-	-	0.00	0.00	-	0.00
227	7,497	7,498	4	108.0	0.00	88.50	-	-	0.00	0.00	-	0.00
228	8,846	8,846		108.0	0.00	89.94	-	-	0.00	0.00	-	0.00
229	6,833	6,834	8	108.0	0.00	87.69	-	-	0.00	0.00	-	0.00
230	6,502	6,503		108.0	0.00	87.26	-	-	0.00	0.00	-	0.00
231	6,224	6,225		108.0	0.00	86.88	-	-	0.00	0.00	-	0.00
232	6,981	6,982	8	108.0	0.00	87.88	-	-	0.00	0.00	-	0.00
233	6,740	6,741	8	108.0	0.00	87.57	-	-	0.00	0.00	-	0.00
234	6,709	6,710	8	108.0	0.00	87.53	-	-	0.00	0.00	-	0.00
235	5,994	5,995	1	108.0	0.00	86.56	-	-	0.00	0.00	-	0.00
301	4,245	4,246	14	108.0	0.00	83.56	-	-	0.00	0.00	-	0.00
302	4,731	4,732	1	108.0	0.00	84.50	-	-	0.00	0.00	-	0.00
303	5,621	5,622	11	108.0	0.00	86.00	-	-	0.00	0.00	-	0.00
304	6,222	6,223		108.0	0.00	86.88	-	-	0.00	0.00	-	0.00
305	6,537	6,538		108.0	0.00	87.31	-	-	0.00	0.00	-	0.00
306	6,180	6,181	1	108.0	0.00	86.82	-	-	0.00	0.00	-	0.00
307	5,510	5,510	11	108.0	0.00	85.82	-	-	0.00	0.00	-	0.00
308	10,331	10,332	8	108.0	0.00	91.28	-	-	0.00	0.00	-	0.00
309	9,816	9,816		108.0	0.00	90.84	-	-	0.00	0.00	-	0.00
310	9,167	9,168	4	108.0	0.00	90.25	-	-	0.00	0.00	-	0.00
311	8,723	8,724		108.0	0.00	89.81	-	-	0.00	0.00	-	0.00
312	8,391	8,392	8	108.0	0.00	89.48	-	-	0.00	0.00	-	0.00
313	7,995	7,996		108.0	0.00	89.06	-	-	0.00	0.00	-	0.00
314	7,131	7,132	8	108.0	0.00	88.06	-	-	0.00	0.00	-	0.00
315	7,968	7,969		108.0	0.00	89.03	-	-	0.00	0.00	-	0.00
316	8,737	8,738		108.0	0.00	89.83	-	-	0.00	0.00	-	0.00
317	8,924	8,925	4	108.0	0.00	90.01	-	-	0.00	0.00	-	0.00
318	9,710	9,710		108.0	0.00	90.74	-	-	0.00	0.00	-	0.00
319	11,175	11,175	1	108.0	0.00	91.97	-	-	0.00	0.00	-	0.00
320	11,672	11,672	1	108.0	0.00	92.34	-	-	0.00	0.00	-	0.00
321	12,114	12,114	4	108.0	0.00	92.67	-	-	0.00	0.00	-	0.00
322	12,607	12,608	1	108.0	0.00	93.01	-	-	0.00	0.00	-	0.00
323	12,571	12,572		108.0	0.00	92.99	-	-	0.00	0.00	-	0.00
324	11,814	11,815	8	108.0	0.00	92.45	-	-	0.00	0.00	-	0.00
325	13,153	13,154		108.0	0.00	93.38	-	-	0.00	0.00	-	0.00
326	12,433	12,434		108.0	0.00	92.89	-	-	0.00	0.00	-	0.00
327	12,181	12,182		108.0	0.00	92.71	-	-	0.00	0.00	-	0.00
328	11,448	11,449	1	108.0	0.00	92.18	-	-	0.00	0.00	-	0.00
329	12,146	12,147	4	108.0	0.00	92.69	-	-	0.00	0.00	-	0.00
330	11,392	11,393	1	108.0	0.00	92.13	-	-	0.00	0.00	-	0.00
331	10,700	10,700	1	108.0	0.00	91.59	-	-	0.00	0.00	-	0.00
332	10,173	10,174		108.0	0.00	91.15	-	-	0.00	0.00	-	0.00
333	10,023	10,024		108.0	0.00	91.02	-	-	0.00	0.00	-	0.00
334	10,455	10,455		108.0	0.00	91.39	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
335	10,333	10,334	8	108.0	0.00	91.29	-	-	0.00	0.00	-	0.00
Sum			37.80									

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP1 NSP1**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	6,969	6,970	8.44	108.0	0.00	87.86	-	-	0.00	0.00	-	0.00
2	8,015	8,016	4.48	108.0	0.00	89.08	-	-	0.00	0.00	-	0.00
3	5,755	5,756	4	107.0	0.00	86.20	-	-	0.00	0.00	-	0.00
4	4,739	4,740	11	107.0	0.00	84.51	-	-	0.00	0.00	-	0.00
5	6,655	6,655	1	107.0	0.00	87.46	-	-	0.00	0.00	-	0.00
6	9,082	9,083	4	108.0	0.00	90.16	-	-	0.00	0.00	-	0.00
7	8,597	8,597	4.48	108.0	0.00	89.69	-	-	0.00	0.00	-	0.00
8	5,026	5,027	11.1	107.0	0.00	85.03	-	-	0.00	0.00	-	0.00
9	6,653	6,654	8	108.0	0.00	87.46	-	-	0.00	0.00	-	0.00
10	7,400	7,401		108.0	0.00	88.39	-	-	0.00	0.00	-	0.00
11	7,213	7,213		108.0	0.00	88.16	-	-	0.00	0.00	-	0.00
12	4,680	4,681	1	107.0	0.00	84.41	-	-	0.00	0.00	-	0.00
13	4,865	4,866	11.8	107.0	0.00	84.74	-	-	0.00	0.00	-	0.00
14	6,063	6,064	8.8	107.0	0.00	86.65	-	-	0.00	0.00	-	0.00
15	8,077	8,077		108.0	0.00	89.15	-	-	0.00	0.00	-	0.00
16	5,262	5,262	1	107.0	0.00	85.42	-	-	0.00	0.00	-	0.00
17	9,626	9,627	8	108.0	0.00	90.67	-	-	0.00	0.00	-	0.00
18	6,837	6,838		107.0	0.00	87.70	-	-	0.00	0.00	-	0.00
19	5,809	5,810	4	107.0	0.00	86.28	-	-	0.00	0.00	-	0.00
20	9,137	9,138	4.1	108.0	0.00	90.22	-	-	0.00	0.00	-	0.00
22	3,807	3,808	14.1	107.0	0.00	82.61	-	-	0.00	0.00	-	0.00
23	4,850	4,851	11.1	107.0	0.00	84.72	-	-	0.00	0.00	-	0.00
25	9,660	9,660	8	108.0	0.00	90.70	-	-	0.00	0.00	-	0.00
26	9,842	9,842		108.0	0.00	90.86	-	-	0.00	0.00	-	0.00
27	6,835	6,835	8.1	108.0	0.00	87.69	-	-	0.00	0.00	-	0.00
28	8,620	8,621	4.44	108.0	0.00	89.71	-	-	0.00	0.00	-	0.00
29	4,308	4,309	1	107.0	0.00	83.69	-	-	0.00	0.00	-	0.00
30	7,991	7,992		108.0	0.00	89.05	-	-	0.00	0.00	-	0.00
31	4,406	4,407	1.81	107.0	0.00	83.88	-	-	0.00	0.00	-	0.00
32	6,318	6,319	8	107.0	0.00	87.01	-	-	0.00	0.00	-	0.00
33	4,261	4,262	1	107.0	0.00	83.59	-	-	0.00	0.00	-	0.00
201	9,301	9,301	4	108.0	0.00	90.37	-	-	0.00	0.00	-	0.00
202	9,526	9,527	4.1	108.0	0.00	90.58	-	-	0.00	0.00	-	0.00
203	8,768	8,768		108.0	0.00	89.86	-	-	0.00	0.00	-	0.00
204	9,225	9,225	4.4	108.0	0.00	90.30	-	-	0.00	0.00	-	0.00
205	9,518	9,518	4	108.0	0.00	90.57	-	-	0.00	0.00	-	0.00
206	8,038	8,038	4.44	108.0	0.00	89.10	-	-	0.00	0.00	-	0.00
207	8,145	8,146		108.0	0.00	89.22	-	-	0.00	0.00	-	0.00
208	2,577	2,578	8	108.0	0.00	79.23	-	-	0.00	0.00	-	0.00
209	2,276	2,278	8	108.0	0.00	78.15	-	-	0.00	0.00	-	0.00
210	2,070	2,071	4	108.0	0.00	77.32	-	-	0.00	0.00	-	0.00
211	3,268	3,269	18.1	108.0	0.00	81.29	-	-	0.00	0.00	-	0.00
212	3,576	3,577	1	108.0	0.00	82.07	-	-	0.00	0.00	-	0.00
213	3,897	3,898	1	108.0	0.00	82.82	-	-	0.00	0.00	-	0.00
214	3,971	3,972	1.8	108.0	0.00	82.98	-	-	0.00	0.00	-	0.00
215	5,365	5,366	11	108.0	0.00	85.59	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

WTG		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
216	5,184	5,185	104	108.0	0.00	85.30	-	-	0.00	0.00	-	0.00
217	5,236	5,236	100	108.0	0.00	85.38	-	-	0.00	0.00	-	0.00
218	4,053	4,054	100	108.0	0.00	83.16	-	-	0.00	0.00	-	0.00
219	4,851	4,851	100	108.0	0.00	84.72	-	-	0.00	0.00	-	0.00
220	4,962	4,963	100	108.0	0.00	84.91	-	-	0.00	0.00	-	0.00
221	5,494	5,494	110	108.0	0.00	85.80	-	-	0.00	0.00	-	0.00
222	8,793	8,794	101	108.0	0.00	89.88	-	-	0.00	0.00	-	0.00
223	8,626	8,626	144	108.0	0.00	89.72	-	-	0.00	0.00	-	0.00
224	6,905	6,905	80	108.0	0.00	87.78	-	-	0.00	0.00	-	0.00
225	6,839	6,840	80	108.0	0.00	87.70	-	-	0.00	0.00	-	0.00
226	7,539	7,540	104	108.0	0.00	88.55	-	-	0.00	0.00	-	0.00
227	7,411	7,412	108	108.0	0.00	88.40	-	-	0.00	0.00	-	0.00
228	8,124	8,124	100	108.0	0.00	89.20	-	-	0.00	0.00	-	0.00
229	6,909	6,910	80	108.0	0.00	87.79	-	-	0.00	0.00	-	0.00
230	6,659	6,660	100	108.0	0.00	87.47	-	-	0.00	0.00	-	0.00
231	6,624	6,624	114	108.0	0.00	87.42	-	-	0.00	0.00	-	0.00
232	7,762	7,763	100	108.0	0.00	88.80	-	-	0.00	0.00	-	0.00
233	7,683	7,683	108	108.0	0.00	88.71	-	-	0.00	0.00	-	0.00
234	7,796	7,796	108	108.0	0.00	88.84	-	-	0.00	0.00	-	0.00
235	7,252	7,253	108	108.0	0.00	88.21	-	-	0.00	0.00	-	0.00
301	6,206	6,206	100	108.0	0.00	86.86	-	-	0.00	0.00	-	0.00
302	6,557	6,557	108	108.0	0.00	87.33	-	-	0.00	0.00	-	0.00
303	7,437	7,437	100	108.0	0.00	88.43	-	-	0.00	0.00	-	0.00
304	7,939	7,939	100	108.0	0.00	89.00	-	-	0.00	0.00	-	0.00
305	8,524	8,524	101	108.0	0.00	89.61	-	-	0.00	0.00	-	0.00
306	8,151	8,152	104	108.0	0.00	89.22	-	-	0.00	0.00	-	0.00
307	7,700	7,701	100	108.0	0.00	88.73	-	-	0.00	0.00	-	0.00
308	10,186	10,186	100	108.0	0.00	91.16	-	-	0.00	0.00	-	0.00
309	9,742	9,742	108	108.0	0.00	90.77	-	-	0.00	0.00	-	0.00
310	9,014	9,014	108	108.0	0.00	90.10	-	-	0.00	0.00	-	0.00
311	8,673	8,673	100	108.0	0.00	89.76	-	-	0.00	0.00	-	0.00
312	8,459	8,460	101	108.0	0.00	89.55	-	-	0.00	0.00	-	0.00
313	8,204	8,205	101	108.0	0.00	89.28	-	-	0.00	0.00	-	0.00
314	7,488	7,488	144	108.0	0.00	88.49	-	-	0.00	0.00	-	0.00
315	8,536	8,537	108	108.0	0.00	89.63	-	-	0.00	0.00	-	0.00
316	9,289	9,289	100	108.0	0.00	90.36	-	-	0.00	0.00	-	0.00
317	9,337	9,338	100	108.0	0.00	90.40	-	-	0.00	0.00	-	0.00
318	9,994	9,994	101	108.0	0.00	90.99	-	-	0.00	0.00	-	0.00
319	11,687	11,688	101	108.0	0.00	92.35	-	-	0.00	0.00	-	0.00
320	12,170	12,170	141	108.0	0.00	92.71	-	-	0.00	0.00	-	0.00
321	12,552	12,553	100	108.0	0.00	92.97	-	-	0.00	0.00	-	0.00
322	13,296	13,296	101	108.0	0.00	93.47	-	-	0.00	0.00	-	0.00
323	13,352	13,352	100	108.0	0.00	93.51	-	-	0.00	0.00	-	0.00
324	12,694	12,695	100	108.0	0.00	93.07	-	-	0.00	0.00	-	0.00
325	14,169	14,170	108	108.0	0.00	94.03	-	-	0.00	0.00	-	0.00
326	13,480	13,480	111	108.0	0.00	93.59	-	-	0.00	0.00	-	0.00
327	13,306	13,306	100	108.0	0.00	93.48	-	-	0.00	0.00	-	0.00
328	12,771	12,771	101	108.0	0.00	93.12	-	-	0.00	0.00	-	0.00
329	13,675	13,676	100	108.0	0.00	93.72	-	-	0.00	0.00	-	0.00
330	12,981	12,982	100	108.0	0.00	93.27	-	-	0.00	0.00	-	0.00
331	12,150	12,151	104	108.0	0.00	92.69	-	-	0.00	0.00	-	0.00
332	11,651	11,651	100	108.0	0.00	92.33	-	-	0.00	0.00	-	0.00
333	11,279	11,280	100	108.0	0.00	92.05	-	-	0.00	0.00	-	0.00
334	11,618	11,618	101	108.0	0.00	92.30	-	-	0.00	0.00	-	0.00
335	11,352	11,352	144	108.0	0.00	92.10	-	-	0.00	0.00	-	0.00

Sum 31.24

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation:** BISON 3 Noise (with existing BISON 1, 2) **Noise calculation model:** ISO 9613-2 General 8.0 m/s

**Noise sensitive area:** NSP1 NSP1

**WTG**

**Wind speed:** 8 m/s

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	3,910	3,912	1	108.0	0.00	82.85	-	-	0.00	0.00	-	0.00
2	4,905	4,906	114	108.0	0.00	84.81	-	-	0.00	0.00	-	0.00
3	888	893	1	107.0	0.00	70.02	-	-	0.00	0.00	-	0.00
4	1,651	1,653	4	107.0	0.00	75.37	-	-	0.00	0.00	-	0.00
5	2,111	2,113	1	107.0	0.00	77.50	-	-	0.00	0.00	-	0.00
6	5,401	5,402	118	108.0	0.00	85.65	-	-	0.00	0.00	-	0.00
7	4,375	4,376	141	108.0	0.00	83.82	-	-	0.00	0.00	-	0.00
8	664	671	1	107.0	0.00	67.53	-	-	0.00	0.00	-	0.00
9	4,370	4,370	14	108.0	0.00	83.81	-	-	0.00	0.00	-	0.00
10	4,439	4,440	144	108.0	0.00	83.95	-	-	0.00	0.00	-	0.00
11	5,494	5,495	11	108.0	0.00	85.80	-	-	0.00	0.00	-	0.00
12	3,379	3,380	1	107.0	0.00	81.58	-	-	0.00	0.00	-	0.00
13	1,950	1,952		107.0	0.00	76.81	-	-	0.00	0.00	-	0.00
14	2,246	2,248	8	107.0	0.00	78.03	-	-	0.00	0.00	-	0.00
15	4,192	4,193	114	108.0	0.00	83.45	-	-	0.00	0.00	-	0.00
16	1,184	1,186	8	107.0	0.00	72.49	-	-	0.00	0.00	-	0.00
17	5,772	5,773	11	108.0	0.00	86.23	-	-	0.00	0.00	-	0.00
18	2,930	2,930	1	107.0	0.00	80.34	-	-	0.00	0.00	-	0.00
19	2,663	2,664	1884	107.0	0.00	79.51	-	-	0.00	0.00	-	0.00
20	5,058	5,059	1	108.0	0.00	85.08	-	-	0.00	0.00	-	0.00
22	2,114	2,115	111	107.0	0.00	77.51	-	-	0.00	0.00	-	0.00
23	818	825	8	107.0	0.00	69.33	-	-	0.00	0.00	-	0.00
25	6,068	6,069	1	108.0	0.00	86.66	-	-	0.00	0.00	-	0.00
26	5,581	5,581	114	108.0	0.00	85.93	-	-	0.00	0.00	-	0.00
27	3,514	3,515	1	108.0	0.00	81.92	-	-	0.00	0.00	-	0.00
28	4,788	4,789	144	108.0	0.00	84.60	-	-	0.00	0.00	-	0.00
29	3,765	3,766	1444	107.0	0.00	82.52	-	-	0.00	0.00	-	0.00
30	5,199	5,200	1	108.0	0.00	85.32	-	-	0.00	0.00	-	0.00
31	2,916	2,917	1	107.0	0.00	80.30	-	-	0.00	0.00	-	0.00
32	1,485	1,487	4	107.0	0.00	74.45	-	-	0.00	0.00	-	0.00
33	2,248	2,249	84	107.0	0.00	78.04	-	-	0.00	0.00	-	0.00
201	6,537	6,537		108.0	0.00	87.31	-	-	0.00	0.00	-	0.00
202	6,835	6,836	81	108.0	0.00	87.70	-	-	0.00	0.00	-	0.00
203	7,068	7,069	84	108.0	0.00	87.99	-	-	0.00	0.00	-	0.00
204	7,356	7,357		108.0	0.00	88.33	-	-	0.00	0.00	-	0.00
205	7,852	7,852		108.0	0.00	88.90	-	-	0.00	0.00	-	0.00
206	7,100	7,100	818	108.0	0.00	88.03	-	-	0.00	0.00	-	0.00
207	7,709	7,709		108.0	0.00	88.74	-	-	0.00	0.00	-	0.00
208	3,312	3,313	1811	108.0	0.00	81.40	-	-	0.00	0.00	-	0.00
209	3,416	3,417	144	108.0	0.00	81.67	-	-	0.00	0.00	-	0.00
210	3,494	3,495	1	108.0	0.00	81.87	-	-	0.00	0.00	-	0.00
211	2,351	2,353	188	108.0	0.00	78.43	-	-	0.00	0.00	-	0.00
212	2,177	2,179	8	108.0	0.00	77.77	-	-	0.00	0.00	-	0.00
213	2,128	2,130		108.0	0.00	77.57	-	-	0.00	0.00	-	0.00
214	2,371	2,372	118	108.0	0.00	78.50	-	-	0.00	0.00	-	0.00
215	434	446	4	108.0	0.00	63.98	-	-	0.00	0.00	-	0.00
216	1,835	1,836	48	108.0	0.00	76.28	-	-	0.00	0.00	-	0.00
217	2,551	2,552	8	108.0	0.00	79.14	-	-	0.00	0.00	-	0.00
218	4,317	4,318	148	108.0	0.00	83.70	-	-	0.00	0.00	-	0.00
219	4,705	4,705	188	108.0	0.00	84.45	-	-	0.00	0.00	-	0.00
220	5,178	5,178	144	108.0	0.00	85.28	-	-	0.00	0.00	-	0.00
221	5,757	5,757	114	108.0	0.00	86.20	-	-	0.00	0.00	-	0.00
222	6,749	6,749	888	108.0	0.00	87.59	-	-	0.00	0.00	-	0.00
223	6,208	6,209	1	108.0	0.00	86.86	-	-	0.00	0.00	-	0.00
224	5,556	5,557	111	108.0	0.00	85.90	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
225	5,256	5,257	1004	108.0	0.00	85.41	-	-	0.00	0.00	-	0.00
226	5,222	5,223	1000	108.0	0.00	85.36	-	-	0.00	0.00	-	0.00
227	4,507	4,508	1400	108.0	0.00	84.08	-	-	0.00	0.00	-	0.00
228	6,245	6,245	004	108.0	0.00	86.91	-	-	0.00	0.00	-	0.00
229	3,819	3,820	1000	108.0	0.00	82.64	-	-	0.00	0.00	-	0.00
230	3,484	3,485	1040	108.0	0.00	81.84	-	-	0.00	0.00	-	0.00
231	3,043	3,044	1800	108.0	0.00	80.67	-	-	0.00	0.00	-	0.00
232	3,399	3,400	1000	108.0	0.00	81.63	-	-	0.00	0.00	-	0.00
233	3,091	3,092	1881	108.0	0.00	80.81	-	-	0.00	0.00	-	0.00
234	2,998	3,000	1010	108.0	0.00	80.54	-	-	0.00	0.00	-	0.00
235	2,257	2,258	0008	108.0	0.00	78.08	-	-	0.00	0.00	-	0.00
301	7,683	7,684	008	108.0	0.00	88.71	-	-	0.00	0.00	-	0.00
302	8,192	8,192	010	108.0	0.00	89.27	-	-	0.00	0.00	-	0.00
303	9,012	9,012	481	108.0	0.00	90.10	-	-	0.00	0.00	-	0.00
304	9,623	9,624	080	108.0	0.00	90.67	-	-	0.00	0.00	-	0.00
305	9,749	9,749	000	108.0	0.00	90.78	-	-	0.00	0.00	-	0.00
306	9,431	9,431	410	108.0	0.00	90.49	-	-	0.00	0.00	-	0.00
307	8,658	8,659	008	108.0	0.00	89.75	-	-	0.00	0.00	-	0.00
308	7,097	7,098	810	108.0	0.00	88.02	-	-	0.00	0.00	-	0.00
309	6,565	6,565	000	108.0	0.00	87.35	-	-	0.00	0.00	-	0.00
310	6,028	6,028	1040	108.0	0.00	86.60	-	-	0.00	0.00	-	0.00
311	5,546	5,546	1104	108.0	0.00	85.88	-	-	0.00	0.00	-	0.00
312	5,155	5,156	1000	108.0	0.00	85.25	-	-	0.00	0.00	-	0.00
313	4,694	4,695	1001	108.0	0.00	84.43	-	-	0.00	0.00	-	0.00
314	3,823	3,824	1008	108.0	0.00	82.65	-	-	0.00	0.00	-	0.00
315	4,432	4,433	1444	108.0	0.00	83.93	-	-	0.00	0.00	-	0.00
316	5,165	5,166	1040	108.0	0.00	85.26	-	-	0.00	0.00	-	0.00
317	5,417	5,418	1180	108.0	0.00	85.68	-	-	0.00	0.00	-	0.00
318	6,234	6,235	000	108.0	0.00	86.90	-	-	0.00	0.00	-	0.00
319	7,539	7,539	004	108.0	0.00	88.55	-	-	0.00	0.00	-	0.00
320	8,031	8,032	040	108.0	0.00	89.10	-	-	0.00	0.00	-	0.00
321	8,488	8,488	000	108.0	0.00	89.58	-	-	0.00	0.00	-	0.00
322	8,892	8,893	000	108.0	0.00	89.98	-	-	0.00	0.00	-	0.00
323	8,835	8,836	000	108.0	0.00	89.92	-	-	0.00	0.00	-	0.00
324	8,065	8,065	000	108.0	0.00	89.13	-	-	0.00	0.00	-	0.00
325	9,381	9,382	400	108.0	0.00	90.45	-	-	0.00	0.00	-	0.00
326	8,660	8,661	008	108.0	0.00	89.75	-	-	0.00	0.00	-	0.00
327	8,406	8,406	080	108.0	0.00	89.49	-	-	0.00	0.00	-	0.00
328	7,679	7,680	008	108.0	0.00	88.71	-	-	0.00	0.00	-	0.00
329	8,417	8,417	000	108.0	0.00	89.50	-	-	0.00	0.00	-	0.00
330	7,675	7,676	000	108.0	0.00	88.70	-	-	0.00	0.00	-	0.00
331	6,945	6,946	840	108.0	0.00	87.83	-	-	0.00	0.00	-	0.00
332	6,421	6,422	000	108.0	0.00	87.15	-	-	0.00	0.00	-	0.00
333	6,247	6,248	004	108.0	0.00	86.91	-	-	0.00	0.00	-	0.00
334	6,680	6,680	000	108.0	0.00	87.50	-	-	0.00	0.00	-	0.00
335	6,571	6,572	000	108.0	0.00	87.35	-	-	0.00	0.00	-	0.00

Sum 43.44

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP14 NSP14**

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	4,410	4,411	1400	108.0	0.00	83.89	-	-	0.00	0.00	-	0.00

To be continued on next page...



Project:

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 Duluth, MN 55802-2093

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
2	5,496	5,497	11	108.0	0.00	85.80	-	-	0.00	0.00	-	0.00
3	1,749	1,752		107.0	0.00	75.87	-	-	0.00	0.00	-	0.00
4	1,596	1,598		107.0	0.00	75.07	-	-	0.00	0.00	-	0.00
5	2,988	2,989	1	107.0	0.00	80.51	-	-	0.00	0.00	-	0.00
6	6,182	6,183	1	108.0	0.00	86.82	-	-	0.00	0.00	-	0.00
7	5,276	5,277	1	108.0	0.00	85.45	-	-	0.00	0.00	-	0.00
8	911	916	1	107.0	0.00	70.24	-	-	0.00	0.00	-	0.00
9	4,665	4,666	1	108.0	0.00	84.38	-	-	0.00	0.00	-	0.00
10	4,953	4,954	1	108.0	0.00	84.90	-	-	0.00	0.00	-	0.00
11	5,723	5,723	11	108.0	0.00	86.15	-	-	0.00	0.00	-	0.00
12	3,181	3,181	1	107.0	0.00	81.05	-	-	0.00	0.00	-	0.00
13	1,964	1,966		107.0	0.00	76.87	-	-	0.00	0.00	-	0.00
14	2,819	2,820	18	107.0	0.00	80.01	-	-	0.00	0.00	-	0.00
15	4,980	4,981	1	108.0	0.00	84.95	-	-	0.00	0.00	-	0.00
16	1,584	1,586	1	107.0	0.00	75.01	-	-	0.00	0.00	-	0.00
17	6,614	6,615	1	108.0	0.00	87.41	-	-	0.00	0.00	-	0.00
18	3,633	3,634	1	107.0	0.00	82.21	-	-	0.00	0.00	-	0.00
19	3,022	3,022	1	107.0	0.00	80.61	-	-	0.00	0.00	-	0.00
20	5,941	5,941	1	108.0	0.00	86.48	-	-	0.00	0.00	-	0.00
22	1,425	1,426	4	107.0	0.00	74.08	-	-	0.00	0.00	-	0.00
23	470	482	8	107.0	0.00	64.66	-	-	0.00	0.00	-	0.00
25	6,847	6,848	8	108.0	0.00	87.71	-	-	0.00	0.00	-	0.00
26	6,529	6,529	4	108.0	0.00	87.30	-	-	0.00	0.00	-	0.00
27	4,063	4,064	1	108.0	0.00	83.18	-	-	0.00	0.00	-	0.00
28	5,588	5,589	11	108.0	0.00	85.95	-	-	0.00	0.00	-	0.00
29	3,408	3,409	1	107.0	0.00	81.65	-	-	0.00	0.00	-	0.00
30	5,714	5,715	11	108.0	0.00	86.14	-	-	0.00	0.00	-	0.00
31	2,644	2,645	18	107.0	0.00	79.45	-	-	0.00	0.00	-	0.00
32	2,427	2,428	1	107.0	0.00	78.71	-	-	0.00	0.00	-	0.00
33	1,900	1,901	4	107.0	0.00	76.58	-	-	0.00	0.00	-	0.00
201	7,109	7,109	8	108.0	0.00	88.04	-	-	0.00	0.00	-	0.00
202	7,399	7,399	1	108.0	0.00	88.38	-	-	0.00	0.00	-	0.00
203	7,383	7,383	4	108.0	0.00	88.37	-	-	0.00	0.00	-	0.00
204	7,727	7,727		108.0	0.00	88.76	-	-	0.00	0.00	-	0.00
205	8,190	8,190	1	108.0	0.00	89.27	-	-	0.00	0.00	-	0.00
206	7,223	7,224	4	108.0	0.00	88.18	-	-	0.00	0.00	-	0.00
207	7,739	7,740	8	108.0	0.00	88.77	-	-	0.00	0.00	-	0.00
208	2,337	2,338	1	108.0	0.00	78.38	-	-	0.00	0.00	-	0.00
209	2,344	2,345	1	108.0	0.00	78.40	-	-	0.00	0.00	-	0.00
210	2,332	2,333	1	108.0	0.00	78.36	-	-	0.00	0.00	-	0.00
211	1,136	1,140		108.0	0.00	72.14	-	-	0.00	0.00	-	0.00
212	973	976	1	108.0	0.00	70.79	-	-	0.00	0.00	-	0.00
213	1,038	1,041	1	108.0	0.00	71.35	-	-	0.00	0.00	-	0.00
214	1,363	1,366	8	108.0	0.00	73.71	-	-	0.00	0.00	-	0.00
215	982	987	1	108.0	0.00	70.88	-	-	0.00	0.00	-	0.00
216	1,522	1,524	1	108.0	0.00	74.66	-	-	0.00	0.00	-	0.00
217	2,127	2,129	1	108.0	0.00	77.56	-	-	0.00	0.00	-	0.00
218	3,363	3,364	1	108.0	0.00	81.54	-	-	0.00	0.00	-	0.00
219	3,893	3,894	1	108.0	0.00	82.81	-	-	0.00	0.00	-	0.00
220	4,344	4,345	14	108.0	0.00	83.76	-	-	0.00	0.00	-	0.00
221	4,968	4,968	1	108.0	0.00	84.92	-	-	0.00	0.00	-	0.00
222	6,593	6,593		108.0	0.00	87.38	-	-	0.00	0.00	-	0.00
223	6,135	6,135	1	108.0	0.00	86.76	-	-	0.00	0.00	-	0.00
224	5,132	5,132	1	108.0	0.00	85.21	-	-	0.00	0.00	-	0.00
225	4,872	4,872	1	108.0	0.00	84.75	-	-	0.00	0.00	-	0.00

To be continued on next page...

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 Licensed user:  
**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
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**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
226	5,056	5,057	100	108.0	0.00	85.08	-	-	0.00	0.00	-	0.00
227	4,482	4,483	140	108.0	0.00	84.03	-	-	0.00	0.00	-	0.00
228	6,015	6,015	104	108.0	0.00	86.58	-	-	0.00	0.00	-	0.00
229	3,798	3,799	100	108.0	0.00	82.59	-	-	0.00	0.00	-	0.00
230	3,458	3,459	104	108.0	0.00	81.78	-	-	0.00	0.00	-	0.00
231	3,138	3,139	184	108.0	0.00	80.94	-	-	0.00	0.00	-	0.00
232	3,894	3,895	100	108.0	0.00	82.81	-	-	0.00	0.00	-	0.00
233	3,681	3,682	104	108.0	0.00	82.32	-	-	0.00	0.00	-	0.00
234	3,691	3,692	101	108.0	0.00	82.35	-	-	0.00	0.00	-	0.00
235	3,029	3,030	100	108.0	0.00	80.63	-	-	0.00	0.00	-	0.00
301	7,277	7,277	84	108.0	0.00	88.24	-	-	0.00	0.00	-	0.00
302	7,776	7,776	01	108.0	0.00	88.82	-	-	0.00	0.00	-	0.00
303	8,643	8,643	41	108.0	0.00	89.73	-	-	0.00	0.00	-	0.00
304	9,252	9,252	44	108.0	0.00	90.32	-	-	0.00	0.00	-	0.00
305	9,480	9,480	48	108.0	0.00	90.54	-	-	0.00	0.00	-	0.00
306	9,139	9,140	41	108.0	0.00	90.22	-	-	0.00	0.00	-	0.00
307	8,409	8,410	8	108.0	0.00	89.50	-	-	0.00	0.00	-	0.00
308	7,271	7,271	8	108.0	0.00	88.23	-	-	0.00	0.00	-	0.00
309	6,748	6,749	88	108.0	0.00	87.58	-	-	0.00	0.00	-	0.00
310	6,126	6,126	100	108.0	0.00	86.74	-	-	0.00	0.00	-	0.00
311	5,667	5,668	110	108.0	0.00	86.07	-	-	0.00	0.00	-	0.00
312	5,318	5,319	100	108.0	0.00	85.52	-	-	0.00	0.00	-	0.00
313	4,906	4,907	114	108.0	0.00	84.82	-	-	0.00	0.00	-	0.00
314	4,036	4,037	100	108.0	0.00	83.12	-	-	0.00	0.00	-	0.00
315	4,867	4,868	104	108.0	0.00	84.75	-	-	0.00	0.00	-	0.00
316	5,639	5,640	111	108.0	0.00	86.02	-	-	0.00	0.00	-	0.00
317	5,821	5,822	108	108.0	0.00	86.30	-	-	0.00	0.00	-	0.00
318	6,607	6,607	1	108.0	0.00	87.40	-	-	0.00	0.00	-	0.00
319	8,083	8,083	00	108.0	0.00	89.15	-	-	0.00	0.00	-	0.00
320	8,580	8,581	01	108.0	0.00	89.67	-	-	0.00	0.00	-	0.00
321	9,018	9,019	48	108.0	0.00	90.10	-	-	0.00	0.00	-	0.00
322	9,548	9,548	00	108.0	0.00	90.60	-	-	0.00	0.00	-	0.00
323	9,531	9,532	40	108.0	0.00	90.58	-	-	0.00	0.00	-	0.00
324	8,795	8,796	1	108.0	0.00	89.89	-	-	0.00	0.00	-	0.00
325	10,184	10,185	00	108.0	0.00	91.16	-	-	0.00	0.00	-	0.00
326	9,470	9,471	40	108.0	0.00	90.53	-	-	0.00	0.00	-	0.00
327	9,246	9,246	44	108.0	0.00	90.32	-	-	0.00	0.00	-	0.00
328	8,595	8,596	4	108.0	0.00	89.69	-	-	0.00	0.00	-	0.00
329	9,412	9,412	418	108.0	0.00	90.47	-	-	0.00	0.00	-	0.00
330	8,691	8,691	00	108.0	0.00	89.78	-	-	0.00	0.00	-	0.00
331	7,909	7,909	00	108.0	0.00	88.96	-	-	0.00	0.00	-	0.00
332	7,393	7,394	00	108.0	0.00	88.38	-	-	0.00	0.00	-	0.00
333	7,125	7,126	81	108.0	0.00	88.06	-	-	0.00	0.00	-	0.00
334	7,521	7,521	08	108.0	0.00	88.53	-	-	0.00	0.00	-	0.00
335	7,344	7,344	01	108.0	0.00	88.32	-	-	0.00	0.00	-	0.00

Sum 42.92

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP 1 NSP 1**

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	4,515	4,516	141	108.0	0.00	84.10	-	-	0.00	0.00	-	0.00
2	5,611	5,612	118	108.0	0.00	85.98	-	-	0.00	0.00	-	0.00

To be continued on next page...

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

WTG		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
3	1,955	1,958	8	107.0	0.00	76.83	-	-	0.00	0.00	-	0.00
4	1,663	1,665	4	107.0	0.00	75.43	-	-	0.00	0.00	-	0.00
5	3,173	3,175	1	107.0	0.00	81.03	-	-	0.00	0.00	-	0.00
6	6,332	6,333		108.0	0.00	87.03	-	-	0.00	0.00	-	0.00
7	5,452	5,453	11	108.0	0.00	85.73	-	-	0.00	0.00	-	0.00
8	1,112	1,116	4	107.0	0.00	71.95	-	-	0.00	0.00	-	0.00
9	4,728	4,729	1	108.0	0.00	84.50	-	-	0.00	0.00	-	0.00
10	5,056	5,057	1	108.0	0.00	85.08	-	-	0.00	0.00	-	0.00
11	5,766	5,766	11	108.0	0.00	86.22	-	-	0.00	0.00	-	0.00
12	3,161	3,161	184	107.0	0.00	81.00	-	-	0.00	0.00	-	0.00
13	2,025	2,026	1	107.0	0.00	77.13	-	-	0.00	0.00	-	0.00
14	2,957	2,958	1	107.0	0.00	80.42	-	-	0.00	0.00	-	0.00
15	5,136	5,137	1	108.0	0.00	85.21	-	-	0.00	0.00	-	0.00
16	1,736	1,738	4	107.0	0.00	75.80	-	-	0.00	0.00	-	0.00
17	6,775	6,775	8	108.0	0.00	87.62	-	-	0.00	0.00	-	0.00
18	3,783	3,783	14	107.0	0.00	82.56	-	-	0.00	0.00	-	0.00
19	3,117	3,118	1	107.0	0.00	80.88	-	-	0.00	0.00	-	0.00
20	6,111	6,112	1	108.0	0.00	86.72	-	-	0.00	0.00	-	0.00
22	1,342	1,344	1	107.0	0.00	73.57	-	-	0.00	0.00	-	0.00
23	712	720	4	107.0	0.00	68.15	-	-	0.00	0.00	-	0.00
25	6,995	6,995	8	108.0	0.00	87.90	-	-	0.00	0.00	-	0.00
26	6,711	6,711	8	108.0	0.00	87.54	-	-	0.00	0.00	-	0.00
27	4,181	4,181	18	108.0	0.00	83.43	-	-	0.00	0.00	-	0.00
28	5,744	5,745	11	108.0	0.00	86.19	-	-	0.00	0.00	-	0.00
29	3,350	3,350	1	107.0	0.00	81.50	-	-	0.00	0.00	-	0.00
30	5,814	5,814	1	108.0	0.00	86.29	-	-	0.00	0.00	-	0.00
31	2,619	2,620	1	107.0	0.00	79.37	-	-	0.00	0.00	-	0.00
32	2,629	2,631	18	107.0	0.00	79.40	-	-	0.00	0.00	-	0.00
33	1,883	1,884		107.0	0.00	76.50	-	-	0.00	0.00	-	0.00
201	7,214	7,215		108.0	0.00	88.16	-	-	0.00	0.00	-	0.00
202	7,502	7,502	41	108.0	0.00	88.50	-	-	0.00	0.00	-	0.00
203	7,436	7,437	4	108.0	0.00	88.43	-	-	0.00	0.00	-	0.00
204	7,790	7,790	88	108.0	0.00	88.83	-	-	0.00	0.00	-	0.00
205	8,245	8,246	8	108.0	0.00	89.32	-	-	0.00	0.00	-	0.00
206	7,238	7,239	1	108.0	0.00	88.19	-	-	0.00	0.00	-	0.00
207	7,734	7,734		108.0	0.00	88.77	-	-	0.00	0.00	-	0.00
208	2,144	2,145	1	108.0	0.00	77.63	-	-	0.00	0.00	-	0.00
209	2,125	2,126	11	108.0	0.00	77.55	-	-	0.00	0.00	-	0.00
210	2,091	2,092		108.0	0.00	77.41	-	-	0.00	0.00	-	0.00
211	888	892	1	108.0	0.00	70.01	-	-	0.00	0.00	-	0.00
212	747	752	4	108.0	0.00	68.52	-	-	0.00	0.00	-	0.00
213	888	892	1	108.0	0.00	70.00	-	-	0.00	0.00	-	0.00
214	1,237	1,240		108.0	0.00	72.87	-	-	0.00	0.00	-	0.00
215	1,227	1,231	41	108.0	0.00	72.80	-	-	0.00	0.00	-	0.00
216	1,605	1,606	41	108.0	0.00	75.12	-	-	0.00	0.00	-	0.00
217	2,154	2,155		108.0	0.00	77.67	-	-	0.00	0.00	-	0.00
218	3,219	3,220	18	108.0	0.00	81.16	-	-	0.00	0.00	-	0.00
219	3,786	3,787	4	108.0	0.00	82.57	-	-	0.00	0.00	-	0.00
220	4,228	4,228	4	108.0	0.00	83.52	-	-	0.00	0.00	-	0.00
221	4,860	4,860	1	108.0	0.00	84.73	-	-	0.00	0.00	-	0.00
222	6,623	6,624	14	108.0	0.00	87.42	-	-	0.00	0.00	-	0.00
223	6,185	6,185	1	108.0	0.00	86.83	-	-	0.00	0.00	-	0.00
224	5,112	5,113	1	108.0	0.00	85.17	-	-	0.00	0.00	-	0.00
225	4,863	4,864	1	108.0	0.00	84.74	-	-	0.00	0.00	-	0.00
226	5,093	5,094	1	108.0	0.00	85.14	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:  
**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:  
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 Licensed user:  
**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
227	4,552	4,553	14.1	108.0	0.00	84.17	-	-	0.00	0.00	-	0.00
228	6,033	6,033	14.1	108.0	0.00	86.61	-	-	0.00	0.00	-	0.00
229	3,875	3,876	11.1	108.0	0.00	82.77	-	-	0.00	0.00	-	0.00
230	3,539	3,541	11.1	108.0	0.00	81.98	-	-	0.00	0.00	-	0.00
231	3,247	3,248	18.4	108.0	0.00	81.23	-	-	0.00	0.00	-	0.00
232	4,060	4,061	11.4	108.0	0.00	83.17	-	-	0.00	0.00	-	0.00
233	3,863	3,864	11.1	108.0	0.00	82.74	-	-	0.00	0.00	-	0.00
234	3,888	3,889	11.8	108.0	0.00	82.80	-	-	0.00	0.00	-	0.00
235	3,240	3,241	18.1	108.0	0.00	81.21	-	-	0.00	0.00	-	0.00
301	7,182	7,182	8.1	108.0	0.00	88.13	-	-	0.00	0.00	-	0.00
302	7,679	7,679	11.1	108.0	0.00	88.71	-	-	0.00	0.00	-	0.00
303	8,552	8,553	11.1	108.0	0.00	89.64	-	-	0.00	0.00	-	0.00
304	9,160	9,160	4.1	108.0	0.00	90.24	-	-	0.00	0.00	-	0.00
305	9,409	9,409	4.1	108.0	0.00	90.47	-	-	0.00	0.00	-	0.00
306	9,064	9,065	4.1	108.0	0.00	90.15	-	-	0.00	0.00	-	0.00
307	8,345	8,345	11.1	108.0	0.00	89.43	-	-	0.00	0.00	-	0.00
308	7,364	7,365	11.1	108.0	0.00	88.34	-	-	0.00	0.00	-	0.00
309	6,846	6,846	8.1	108.0	0.00	87.71	-	-	0.00	0.00	-	0.00
310	6,209	6,210	11.1	108.0	0.00	86.86	-	-	0.00	0.00	-	0.00
311	5,758	5,758	11.4	108.0	0.00	86.21	-	-	0.00	0.00	-	0.00
312	5,418	5,419	11.84	108.0	0.00	85.68	-	-	0.00	0.00	-	0.00
313	5,018	5,019	11.8	108.0	0.00	85.01	-	-	0.00	0.00	-	0.00
314	4,154	4,155	11.1	108.0	0.00	83.37	-	-	0.00	0.00	-	0.00
315	5,017	5,018	11.8	108.0	0.00	85.01	-	-	0.00	0.00	-	0.00
316	5,791	5,792	11.1	108.0	0.00	86.26	-	-	0.00	0.00	-	0.00
317	5,961	5,962	11.1	108.0	0.00	86.51	-	-	0.00	0.00	-	0.00
318	6,739	6,739	8.1	108.0	0.00	87.57	-	-	0.00	0.00	-	0.00
319	8,240	8,241	11.1	108.0	0.00	89.32	-	-	0.00	0.00	-	0.00
320	8,738	8,738	11.1	108.0	0.00	89.83	-	-	0.00	0.00	-	0.00
321	9,172	9,172	4.1	108.0	0.00	90.25	-	-	0.00	0.00	-	0.00
322	9,722	9,722	11.1	108.0	0.00	90.76	-	-	0.00	0.00	-	0.00
323	9,712	9,713	11.1	108.0	0.00	90.75	-	-	0.00	0.00	-	0.00
324	8,982	8,983	4.8	108.0	0.00	90.07	-	-	0.00	0.00	-	0.00
325	10,382	10,382	11.1	108.0	0.00	91.33	-	-	0.00	0.00	-	0.00
326	9,669	9,670	11.1	108.0	0.00	90.71	-	-	0.00	0.00	-	0.00
327	9,450	9,450	4.1	108.0	0.00	90.51	-	-	0.00	0.00	-	0.00
328	8,811	8,811	11.1	108.0	0.00	89.90	-	-	0.00	0.00	-	0.00
329	9,638	9,639	11.84	108.0	0.00	90.68	-	-	0.00	0.00	-	0.00
330	8,920	8,920	4.1	108.0	0.00	90.01	-	-	0.00	0.00	-	0.00
331	8,131	8,132	11.8	108.0	0.00	89.20	-	-	0.00	0.00	-	0.00
332	7,618	7,618	11.1	108.0	0.00	88.64	-	-	0.00	0.00	-	0.00
333	7,337	7,337	11.1	108.0	0.00	88.31	-	-	0.00	0.00	-	0.00
334	7,726	7,727	11.1	108.0	0.00	88.76	-	-	0.00	0.00	-	0.00
335	7,540	7,540	11.4	108.0	0.00	88.55	-	-	0.00	0.00	-	0.00

Sum 42.20

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP 1 NSP 1**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	4,851	4,852	11.1	108.0	0.00	84.72	-	-	0.00	0.00	-	0.00
2	5,936	5,937	11.1	108.0	0.00	86.47	-	-	0.00	0.00	-	0.00
3	2,145	2,147	11.4	107.0	0.00	77.64	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

WTG		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
4	2,028	2,030	111	107.0	0.00	77.15	-	-	0.00	0.00	-	0.00
5	3,400	3,401	111	107.0	0.00	81.63	-	-	0.00	0.00	-	0.00
6	6,614	6,615	111	108.0	0.00	87.41	-	-	0.00	0.00	-	0.00
7	5,693	5,694	111	108.0	0.00	86.11	-	-	0.00	0.00	-	0.00
8	1,324	1,327	111	107.0	0.00	73.46	-	-	0.00	0.00	-	0.00
9	5,098	5,099	114	108.0	0.00	85.15	-	-	0.00	0.00	-	0.00
10	5,393	5,394	111	108.0	0.00	85.64	-	-	0.00	0.00	-	0.00
11	6,148	6,149	111	108.0	0.00	86.78	-	-	0.00	0.00	-	0.00
12	3,565	3,565	141	107.0	0.00	82.04	-	-	0.00	0.00	-	0.00
13	2,395	2,396	114	107.0	0.00	78.59	-	-	0.00	0.00	-	0.00
14	3,257	3,258	114	107.0	0.00	81.26	-	-	0.00	0.00	-	0.00
15	5,410	5,411	118	108.0	0.00	85.67	-	-	0.00	0.00	-	0.00
16	2,020	2,022	118	107.0	0.00	77.11	-	-	0.00	0.00	-	0.00
17	7,041	7,041	81	108.0	0.00	87.95	-	-	0.00	0.00	-	0.00
18	4,067	4,067	118	107.0	0.00	83.19	-	-	0.00	0.00	-	0.00
19	3,461	3,462	111	107.0	0.00	81.79	-	-	0.00	0.00	-	0.00
20	6,361	6,362	111	108.0	0.00	87.07	-	-	0.00	0.00	-	0.00
22	1,748	1,749	111	107.0	0.00	75.86	-	-	0.00	0.00	-	0.00
23	686	694	41	107.0	0.00	67.82	-	-	0.00	0.00	-	0.00
25	7,280	7,281	81	108.0	0.00	88.24	-	-	0.00	0.00	-	0.00
26	6,940	6,940	81	108.0	0.00	87.83	-	-	0.00	0.00	-	0.00
27	4,504	4,505	144	108.0	0.00	84.07	-	-	0.00	0.00	-	0.00
28	6,018	6,019	144	108.0	0.00	86.59	-	-	0.00	0.00	-	0.00
29	3,756	3,757	141	107.0	0.00	82.50	-	-	0.00	0.00	-	0.00
30	6,155	6,155	114	108.0	0.00	86.78	-	-	0.00	0.00	-	0.00
31	3,024	3,024	111	107.0	0.00	80.61	-	-	0.00	0.00	-	0.00
32	2,823	2,824	181	107.0	0.00	80.02	-	-	0.00	0.00	-	0.00
33	2,285	2,286	111	107.0	0.00	78.18	-	-	0.00	0.00	-	0.00
201	7,550	7,550	111	108.0	0.00	88.56	-	-	0.00	0.00	-	0.00
202	7,840	7,840	111	108.0	0.00	88.89	-	-	0.00	0.00	-	0.00
203	7,813	7,813	84	108.0	0.00	88.86	-	-	0.00	0.00	-	0.00
204	8,160	8,161	111	108.0	0.00	89.23	-	-	0.00	0.00	-	0.00
205	8,621	8,621	144	108.0	0.00	89.71	-	-	0.00	0.00	-	0.00
206	7,634	7,634	111	108.0	0.00	88.66	-	-	0.00	0.00	-	0.00
207	8,136	8,136	111	108.0	0.00	89.21	-	-	0.00	0.00	-	0.00
208	2,470	2,471	111	108.0	0.00	78.86	-	-	0.00	0.00	-	0.00
209	2,402	2,404	111	108.0	0.00	78.62	-	-	0.00	0.00	-	0.00
210	2,289	2,291	111	108.0	0.00	78.20	-	-	0.00	0.00	-	0.00
211	1,029	1,033	111	108.0	0.00	71.28	-	-	0.00	0.00	-	0.00
212	724	729	111	108.0	0.00	68.25	-	-	0.00	0.00	-	0.00
213	634	640	114	108.0	0.00	67.12	-	-	0.00	0.00	-	0.00
214	933	937	118	108.0	0.00	70.43	-	-	0.00	0.00	-	0.00
215	1,166	1,170	111	108.0	0.00	72.37	-	-	0.00	0.00	-	0.00
216	1,215	1,217	111	108.0	0.00	72.71	-	-	0.00	0.00	-	0.00
217	1,747	1,748	114	108.0	0.00	75.85	-	-	0.00	0.00	-	0.00
218	2,935	2,936	141	108.0	0.00	80.36	-	-	0.00	0.00	-	0.00
219	3,453	3,454	111	108.0	0.00	81.77	-	-	0.00	0.00	-	0.00
220	3,905	3,906	111	108.0	0.00	82.83	-	-	0.00	0.00	-	0.00
221	4,527	4,528	141	108.0	0.00	84.12	-	-	0.00	0.00	-	0.00
222	6,217	6,217	111	108.0	0.00	86.87	-	-	0.00	0.00	-	0.00
223	5,779	5,779	111	108.0	0.00	86.24	-	-	0.00	0.00	-	0.00
224	4,716	4,716	111	108.0	0.00	84.47	-	-	0.00	0.00	-	0.00
225	4,463	4,464	141	108.0	0.00	83.99	-	-	0.00	0.00	-	0.00
226	4,686	4,687	111	108.0	0.00	84.42	-	-	0.00	0.00	-	0.00
227	4,150	4,151	111	108.0	0.00	83.36	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
228	5,627	5,627	114	108.0	0.00	86.01	-	-	0.00	0.00	-	0.00
229	3,476	3,478	14	108.0	0.00	81.83	-	-	0.00	0.00	-	0.00
230	3,142	3,143	18	108.0	0.00	80.95	-	-	0.00	0.00	-	0.00
231	2,865	2,866	18	108.0	0.00	80.15	-	-	0.00	0.00	-	0.00
232	3,730	3,731	18	108.0	0.00	82.44	-	-	0.00	0.00	-	0.00
233	3,556	3,558	11	108.0	0.00	82.02	-	-	0.00	0.00	-	0.00
234	3,606	3,607	1	108.0	0.00	82.14	-	-	0.00	0.00	-	0.00
235	2,996	2,997	11	108.0	0.00	80.53	-	-	0.00	0.00	-	0.00
301	7,580	7,580		108.0	0.00	88.59	-	-	0.00	0.00	-	0.00
302	8,076	8,076	8	108.0	0.00	89.14	-	-	0.00	0.00	-	0.00
303	8,952	8,952	4	108.0	0.00	90.04	-	-	0.00	0.00	-	0.00
304	9,559	9,559		108.0	0.00	90.61	-	-	0.00	0.00	-	0.00
305	9,813	9,813	8	108.0	0.00	90.84	-	-	0.00	0.00	-	0.00
306	9,468	9,468	4.1	108.0	0.00	90.53	-	-	0.00	0.00	-	0.00
307	8,750	8,750		108.0	0.00	89.84	-	-	0.00	0.00	-	0.00
308	6,970	6,970	8.44	108.0	0.00	87.86	-	-	0.00	0.00	-	0.00
309	6,453	6,453		108.0	0.00	87.20	-	-	0.00	0.00	-	0.00
310	5,811	5,812	1	108.0	0.00	86.29	-	-	0.00	0.00	-	0.00
311	5,362	5,363	11	108.0	0.00	85.59	-	-	0.00	0.00	-	0.00
312	5,027	5,028	1	108.0	0.00	85.03	-	-	0.00	0.00	-	0.00
313	4,634	4,635	1	108.0	0.00	84.32	-	-	0.00	0.00	-	0.00
314	3,776	3,777	1	108.0	0.00	82.54	-	-	0.00	0.00	-	0.00
315	4,665	4,666	1	108.0	0.00	84.38	-	-	0.00	0.00	-	0.00
316	5,441	5,442	11	108.0	0.00	85.72	-	-	0.00	0.00	-	0.00
317	5,598	5,598	11.41	108.0	0.00	85.96	-	-	0.00	0.00	-	0.00
318	6,368	6,368	8	108.0	0.00	87.08	-	-	0.00	0.00	-	0.00
319	7,893	7,894		108.0	0.00	88.95	-	-	0.00	0.00	-	0.00
320	8,390	8,391	8	108.0	0.00	89.48	-	-	0.00	0.00	-	0.00
321	8,820	8,820	1	108.0	0.00	89.91	-	-	0.00	0.00	-	0.00
322	9,394	9,394	4	108.0	0.00	90.46	-	-	0.00	0.00	-	0.00
323	9,394	9,394	4	108.0	0.00	90.46	-	-	0.00	0.00	-	0.00
324	8,674	8,675		108.0	0.00	89.77	-	-	0.00	0.00	-	0.00
325	10,090	10,091	1	108.0	0.00	91.08	-	-	0.00	0.00	-	0.00
326	9,382	9,382	4	108.0	0.00	90.45	-	-	0.00	0.00	-	0.00
327	9,172	9,172	4	108.0	0.00	90.25	-	-	0.00	0.00	-	0.00
328	8,561	8,562	4	108.0	0.00	89.65	-	-	0.00	0.00	-	0.00
329	9,419	9,419	4.1	108.0	0.00	90.48	-	-	0.00	0.00	-	0.00
330	8,712	8,713		108.0	0.00	89.80	-	-	0.00	0.00	-	0.00
331	7,903	7,903	8	108.0	0.00	88.96	-	-	0.00	0.00	-	0.00
332	7,395	7,395	1	108.0	0.00	88.38	-	-	0.00	0.00	-	0.00
333	7,079	7,080	8	108.0	0.00	88.00	-	-	0.00	0.00	-	0.00
334	7,454	7,455		108.0	0.00	88.45	-	-	0.00	0.00	-	0.00
335	7,248	7,248	8	108.0	0.00	88.20	-	-	0.00	0.00	-	0.00

Sum 42.89

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP 1 NSP 1**

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	6,635	6,636	11	108.0	0.00	87.44	-	-	0.00	0.00	-	0.00
2	7,710	7,711		108.0	0.00	88.74	-	-	0.00	0.00	-	0.00
3	3,797	3,798	14	107.0	0.00	82.59	-	-	0.00	0.00	-	0.00
4	3,820	3,821	14	107.0	0.00	82.64	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
5	5,064	5,065	11	107.0	0.00	85.09	-	-	0.00	0.00	-	0.00
6	8,334	8,335		108.0	0.00	89.42	-	-	0.00	0.00	-	0.00
7	7,350	7,350		108.0	0.00	88.33	-	-	0.00	0.00	-	0.00
8	3,048	3,050	1	107.0	0.00	80.69	-	-	0.00	0.00	-	0.00
9	6,890	6,890	8	108.0	0.00	87.76	-	-	0.00	0.00	-	0.00
10	7,178	7,179	8	108.0	0.00	88.12	-	-	0.00	0.00	-	0.00
11	7,931	7,931		108.0	0.00	88.99	-	-	0.00	0.00	-	0.00
12	5,285	5,285	14	107.0	0.00	85.46	-	-	0.00	0.00	-	0.00
13	4,185	4,186	144	107.0	0.00	83.44	-	-	0.00	0.00	-	0.00
14	5,018	5,018	11.1	107.0	0.00	85.01	-	-	0.00	0.00	-	0.00
15	7,124	7,125	8.1	108.0	0.00	88.06	-	-	0.00	0.00	-	0.00
16	3,781	3,782	14	107.0	0.00	82.55	-	-	0.00	0.00	-	0.00
17	8,733	8,734		108.0	0.00	89.82	-	-	0.00	0.00	-	0.00
18	5,804	5,804		107.0	0.00	86.27	-	-	0.00	0.00	-	0.00
19	5,252	5,252	1	107.0	0.00	85.41	-	-	0.00	0.00	-	0.00
20	8,030	8,030	4	108.0	0.00	89.09	-	-	0.00	0.00	-	0.00
22	3,419	3,420	1	107.0	0.00	81.68	-	-	0.00	0.00	-	0.00
23	2,292	2,295	8	107.0	0.00	78.22	-	-	0.00	0.00	-	0.00
25	9,003	9,003	4.8	108.0	0.00	90.09	-	-	0.00	0.00	-	0.00
26	8,563	8,564	4	108.0	0.00	89.65	-	-	0.00	0.00	-	0.00
27	6,280	6,280	8	108.0	0.00	86.96	-	-	0.00	0.00	-	0.00
28	7,729	7,729		108.0	0.00	88.76	-	-	0.00	0.00	-	0.00
29	5,403	5,404	1	107.0	0.00	85.65	-	-	0.00	0.00	-	0.00
30	7,941	7,941	1	108.0	0.00	89.00	-	-	0.00	0.00	-	0.00
31	4,743	4,743	11.8	107.0	0.00	84.52	-	-	0.00	0.00	-	0.00
32	4,451	4,452	1	107.0	0.00	83.97	-	-	0.00	0.00	-	0.00
33	4,025	4,026	1	107.0	0.00	83.10	-	-	0.00	0.00	-	0.00
201	9,331	9,331	4.1	108.0	0.00	90.40	-	-	0.00	0.00	-	0.00
202	9,623	9,623	8	108.0	0.00	90.67	-	-	0.00	0.00	-	0.00
203	9,601	9,602	8	108.0	0.00	90.65	-	-	0.00	0.00	-	0.00
204	9,952	9,953		108.0	0.00	90.96	-	-	0.00	0.00	-	0.00
205	10,410	10,410	1	108.0	0.00	91.35	-	-	0.00	0.00	-	0.00
206	9,388	9,389	4	108.0	0.00	90.45	-	-	0.00	0.00	-	0.00
207	9,859	9,859	1	108.0	0.00	90.88	-	-	0.00	0.00	-	0.00
208	3,709	3,710	1	108.0	0.00	82.39	-	-	0.00	0.00	-	0.00
209	3,463	3,464	14.8	108.0	0.00	81.79	-	-	0.00	0.00	-	0.00
210	3,086	3,087	18.8	108.0	0.00	80.79	-	-	0.00	0.00	-	0.00
211	2,145	2,148		108.0	0.00	77.64	-	-	0.00	0.00	-	0.00
212	1,772	1,774		108.0	0.00	75.98	-	-	0.00	0.00	-	0.00
213	1,355	1,359	8.1	108.0	0.00	73.66	-	-	0.00	0.00	-	0.00
214	1,003	1,008	1	108.0	0.00	71.07	-	-	0.00	0.00	-	0.00
215	2,551	2,553		108.0	0.00	79.14	-	-	0.00	0.00	-	0.00
216	1,273	1,276	1	108.0	0.00	73.12	-	-	0.00	0.00	-	0.00
217	805	809	4	108.0	0.00	69.16	-	-	0.00	0.00	-	0.00
218	1,443	1,446	1	108.0	0.00	74.20	-	-	0.00	0.00	-	0.00
219	1,722	1,724		108.0	0.00	75.73	-	-	0.00	0.00	-	0.00
220	2,195	2,196		108.0	0.00	77.83	-	-	0.00	0.00	-	0.00
221	2,782	2,783		108.0	0.00	79.89	-	-	0.00	0.00	-	0.00
222	4,654	4,655	1.8	108.0	0.00	84.36	-	-	0.00	0.00	-	0.00
223	4,316	4,317	14.8	108.0	0.00	83.70	-	-	0.00	0.00	-	0.00
224	2,993	2,994	1.18	108.0	0.00	80.52	-	-	0.00	0.00	-	0.00
225	2,776	2,777	4	108.0	0.00	79.87	-	-	0.00	0.00	-	0.00
226	3,192	3,193	18.44	108.0	0.00	81.09	-	-	0.00	0.00	-	0.00
227	2,887	2,888	1	108.0	0.00	80.21	-	-	0.00	0.00	-	0.00
228	4,020	4,021	1	108.0	0.00	83.09	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
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**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
229	2,343	2,345	100	108.0	0.00	78.40	-	-	0.00	0.00	-	0.00
230	2,092	2,094	100	108.0	0.00	77.42	-	-	0.00	0.00	-	0.00
231	2,115	2,117	100	108.0	0.00	77.52	-	-	0.00	0.00	-	0.00
232	3,348	3,349	108	108.0	0.00	81.50	-	-	0.00	0.00	-	0.00
233	3,374	3,376	108	108.0	0.00	81.57	-	-	0.00	0.00	-	0.00
234	3,580	3,581	108	108.0	0.00	82.08	-	-	0.00	0.00	-	0.00
235	3,281	3,282	118	108.0	0.00	81.32	-	-	0.00	0.00	-	0.00
301	9,066	9,066	400	108.0	0.00	90.15	-	-	0.00	0.00	-	0.00
302	9,544	9,544	100	108.0	0.00	90.59	-	-	0.00	0.00	-	0.00
303	10,442	10,442	100	108.0	0.00	91.38	-	-	0.00	0.00	-	0.00
304	11,037	11,038	118	108.0	0.00	91.86	-	-	0.00	0.00	-	0.00
305	11,365	11,365	114	108.0	0.00	92.11	-	-	0.00	0.00	-	0.00
306	11,009	11,009	118	108.0	0.00	91.83	-	-	0.00	0.00	-	0.00
307	10,329	10,329	108	108.0	0.00	91.28	-	-	0.00	0.00	-	0.00
308	5,730	5,731	111	108.0	0.00	86.16	-	-	0.00	0.00	-	0.00
309	5,253	5,253	100	108.0	0.00	85.41	-	-	0.00	0.00	-	0.00
310	4,545	4,545	141	108.0	0.00	84.15	-	-	0.00	0.00	-	0.00
311	4,160	4,161	100	108.0	0.00	83.38	-	-	0.00	0.00	-	0.00
312	3,913	3,914	100	108.0	0.00	82.85	-	-	0.00	0.00	-	0.00
313	3,637	3,639	108	108.0	0.00	82.22	-	-	0.00	0.00	-	0.00
314	2,932	2,934	104	108.0	0.00	80.35	-	-	0.00	0.00	-	0.00
315	4,002	4,003	100	108.0	0.00	83.05	-	-	0.00	0.00	-	0.00
316	4,737	4,738	100	108.0	0.00	84.51	-	-	0.00	0.00	-	0.00
317	4,770	4,771	100	108.0	0.00	84.57	-	-	0.00	0.00	-	0.00
318	5,429	5,430	118	108.0	0.00	85.70	-	-	0.00	0.00	-	0.00
319	7,119	7,120	814	108.0	0.00	88.05	-	-	0.00	0.00	-	0.00
320	7,601	7,602	100	108.0	0.00	88.62	-	-	0.00	0.00	-	0.00
321	7,985	7,985	100	108.0	0.00	89.05	-	-	0.00	0.00	-	0.00
322	8,735	8,736	100	108.0	0.00	89.83	-	-	0.00	0.00	-	0.00
323	8,803	8,804	114	108.0	0.00	89.89	-	-	0.00	0.00	-	0.00
324	8,171	8,172	100	108.0	0.00	89.25	-	-	0.00	0.00	-	0.00
325	9,668	9,668	100	108.0	0.00	90.71	-	-	0.00	0.00	-	0.00
326	8,996	8,997	408	108.0	0.00	90.08	-	-	0.00	0.00	-	0.00
327	8,852	8,853	100	108.0	0.00	89.94	-	-	0.00	0.00	-	0.00
328	8,421	8,421	108	108.0	0.00	89.51	-	-	0.00	0.00	-	0.00
329	9,424	9,424	410	108.0	0.00	90.48	-	-	0.00	0.00	-	0.00
330	8,793	8,793	100	108.0	0.00	89.88	-	-	0.00	0.00	-	0.00
331	7,896	7,897	100	108.0	0.00	88.95	-	-	0.00	0.00	-	0.00
332	7,435	7,435	104	108.0	0.00	88.43	-	-	0.00	0.00	-	0.00
333	6,938	6,939	800	108.0	0.00	87.83	-	-	0.00	0.00	-	0.00
334	7,217	7,218	100	108.0	0.00	88.17	-	-	0.00	0.00	-	0.00
335	6,894	6,895	800	108.0	0.00	87.77	-	-	0.00	0.00	-	0.00

Sum 39.87

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP 18 NSP 18**

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	7,607	7,608	100	108.0	0.00	88.63	-	-	0.00	0.00	-	0.00
2	8,697	8,698	100	108.0	0.00	89.79	-	-	0.00	0.00	-	0.00
3	4,834	4,835	110	107.0	0.00	84.69	-	-	0.00	0.00	-	0.00
4	4,756	4,757	118	107.0	0.00	84.55	-	-	0.00	0.00	-	0.00
5	6,103	6,104	801	107.0	0.00	86.71	-	-	0.00	0.00	-	0.00

To be continued on next page...



Project:

Minnesota Power - BISON Wind Energy Center

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 Frank Frederickson  
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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

WTG		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
6	9,360	9,360	4	108.0	0.00	90.43	-	-	0.00	0.00	-	0.00
7	8,394	8,394	8	108.0	0.00	89.48	-	-	0.00	0.00	-	0.00
8	4,062	4,063	181	107.0	0.00	83.18	-	-	0.00	0.00	-	0.00
9	7,808	7,809	8	108.0	0.00	88.85	-	-	0.00	0.00	-	0.00
10	8,149	8,150	4	108.0	0.00	89.22	-	-	0.00	0.00	-	0.00
11	8,815	8,815	1	108.0	0.00	89.90	-	-	0.00	0.00	-	0.00
12	6,099	6,099	8	107.0	0.00	86.71	-	-	0.00	0.00	-	0.00
13	5,113	5,114	1	107.0	0.00	85.18	-	-	0.00	0.00	-	0.00
14	6,017	6,018	88	107.0	0.00	86.59	-	-	0.00	0.00	-	0.00
15	8,151	8,152	4	108.0	0.00	89.22	-	-	0.00	0.00	-	0.00
16	4,779	4,780	118	107.0	0.00	84.59	-	-	0.00	0.00	-	0.00
17	9,769	9,769	4	108.0	0.00	90.80	-	-	0.00	0.00	-	0.00
18	6,819	6,819		107.0	0.00	87.67	-	-	0.00	0.00	-	0.00
19	6,212	6,212	84	107.0	0.00	86.86	-	-	0.00	0.00	-	0.00
20	9,072	9,072	41	108.0	0.00	90.15	-	-	0.00	0.00	-	0.00
22	4,237	4,238	1	107.0	0.00	83.54	-	-	0.00	0.00	-	0.00
23	3,321	3,323	1	107.0	0.00	81.43	-	-	0.00	0.00	-	0.00
25	10,027	10,028		108.0	0.00	91.02	-	-	0.00	0.00	-	0.00
26	9,614	9,615	8	108.0	0.00	90.66	-	-	0.00	0.00	-	0.00
27	7,265	7,266	8	108.0	0.00	88.23	-	-	0.00	0.00	-	0.00
28	8,757	8,758		108.0	0.00	89.85	-	-	0.00	0.00	-	0.00
29	6,149	6,149	8	107.0	0.00	86.78	-	-	0.00	0.00	-	0.00
30	8,908	8,909	4	108.0	0.00	90.00	-	-	0.00	0.00	-	0.00
31	5,564	5,565	8	107.0	0.00	85.91	-	-	0.00	0.00	-	0.00
32	5,495	5,496	14	107.0	0.00	85.80	-	-	0.00	0.00	-	0.00
33	4,880	4,880	114	107.0	0.00	84.77	-	-	0.00	0.00	-	0.00
201	10,307	10,307	8	108.0	0.00	91.26	-	-	0.00	0.00	-	0.00
202	10,596	10,596	4	108.0	0.00	91.50	-	-	0.00	0.00	-	0.00
203	10,497	10,498		108.0	0.00	91.42	-	-	0.00	0.00	-	0.00
204	10,865	10,865	8	108.0	0.00	91.72	-	-	0.00	0.00	-	0.00
205	11,308	11,309	1	108.0	0.00	92.07	-	-	0.00	0.00	-	0.00
206	10,215	10,216		108.0	0.00	91.19	-	-	0.00	0.00	-	0.00
207	10,640	10,640		108.0	0.00	91.54	-	-	0.00	0.00	-	0.00
208	4,264	4,265	14	108.0	0.00	83.60	-	-	0.00	0.00	-	0.00
209	3,945	3,946	1	108.0	0.00	82.92	-	-	0.00	0.00	-	0.00
210	3,476	3,477	14	108.0	0.00	81.82	-	-	0.00	0.00	-	0.00
211	2,846	2,848	1	108.0	0.00	80.09	-	-	0.00	0.00	-	0.00
212	2,549	2,551	8	108.0	0.00	79.13	-	-	0.00	0.00	-	0.00
213	2,218	2,220		108.0	0.00	77.93	-	-	0.00	0.00	-	0.00
214	1,859	1,861	4	108.0	0.00	76.40	-	-	0.00	0.00	-	0.00
215	3,606	3,608	1	108.0	0.00	82.14	-	-	0.00	0.00	-	0.00
216	2,318	2,320		108.0	0.00	78.31	-	-	0.00	0.00	-	0.00
217	1,733	1,735		108.0	0.00	75.78	-	-	0.00	0.00	-	0.00
218	579	586		108.0	0.00	66.36	-	-	0.00	0.00	-	0.00
219	691	697	1	108.0	0.00	67.86	-	-	0.00	0.00	-	0.00
220	1,149	1,151	14	108.0	0.00	72.22	-	-	0.00	0.00	-	0.00
221	1,766	1,767		108.0	0.00	75.95	-	-	0.00	0.00	-	0.00
222	4,303	4,304	148	108.0	0.00	83.68	-	-	0.00	0.00	-	0.00
223	4,109	4,109	1	108.0	0.00	83.28	-	-	0.00	0.00	-	0.00
224	2,454	2,455	1	108.0	0.00	78.80	-	-	0.00	0.00	-	0.00
225	2,341	2,343	14	108.0	0.00	78.39	-	-	0.00	0.00	-	0.00
226	3,029	3,030	1	108.0	0.00	80.63	-	-	0.00	0.00	-	0.00
227	3,017	3,018	1	108.0	0.00	80.59	-	-	0.00	0.00	-	0.00
228	3,636	3,637	18	108.0	0.00	82.21	-	-	0.00	0.00	-	0.00
229	2,673	2,675	4	108.0	0.00	79.55	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:  
**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

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 Licensed user:  
**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
230	2,537	2,539	100	108.0	0.00	79.09	-	-	0.00	0.00	-	0.00
231	2,750	2,752	100	108.0	0.00	79.79	-	-	0.00	0.00	-	0.00
232	4,015	4,017	100	108.0	0.00	83.08	-	-	0.00	0.00	-	0.00
233	4,126	4,127	100	108.0	0.00	83.31	-	-	0.00	0.00	-	0.00
234	4,377	4,379	100	108.0	0.00	83.83	-	-	0.00	0.00	-	0.00
235	4,194	4,194	100	108.0	0.00	83.45	-	-	0.00	0.00	-	0.00
301	9,629	9,630	100	108.0	0.00	90.67	-	-	0.00	0.00	-	0.00
302	10,089	10,089	100	108.0	0.00	91.08	-	-	0.00	0.00	-	0.00
303	10,996	10,996	100	108.0	0.00	91.82	-	-	0.00	0.00	-	0.00
304	11,578	11,578	100	108.0	0.00	92.27	-	-	0.00	0.00	-	0.00
305	11,965	11,965	100	108.0	0.00	92.56	-	-	0.00	0.00	-	0.00
306	11,602	11,602	100	108.0	0.00	92.29	-	-	0.00	0.00	-	0.00
307	10,959	10,959	100	108.0	0.00	91.80	-	-	0.00	0.00	-	0.00
308	5,687	5,688	100	108.0	0.00	86.10	-	-	0.00	0.00	-	0.00
309	5,264	5,265	100	108.0	0.00	85.43	-	-	0.00	0.00	-	0.00
310	4,530	4,531	100	108.0	0.00	84.12	-	-	0.00	0.00	-	0.00
311	4,229	4,230	100	108.0	0.00	83.53	-	-	0.00	0.00	-	0.00
312	4,074	4,075	100	108.0	0.00	83.20	-	-	0.00	0.00	-	0.00
313	3,915	3,916	100	108.0	0.00	82.86	-	-	0.00	0.00	-	0.00
314	3,389	3,390	100	108.0	0.00	81.60	-	-	0.00	0.00	-	0.00
315	4,473	4,474	100	108.0	0.00	84.01	-	-	0.00	0.00	-	0.00
316	5,139	5,140	100	108.0	0.00	85.22	-	-	0.00	0.00	-	0.00
317	5,090	5,092	100	108.0	0.00	85.14	-	-	0.00	0.00	-	0.00
318	5,642	5,642	100	108.0	0.00	86.03	-	-	0.00	0.00	-	0.00
319	7,390	7,390	100	108.0	0.00	88.37	-	-	0.00	0.00	-	0.00
320	7,850	7,851	100	108.0	0.00	88.90	-	-	0.00	0.00	-	0.00
321	8,195	8,196	100	108.0	0.00	89.27	-	-	0.00	0.00	-	0.00
322	9,046	9,047	100	108.0	0.00	90.13	-	-	0.00	0.00	-	0.00
323	9,155	9,155	100	108.0	0.00	90.23	-	-	0.00	0.00	-	0.00
324	8,585	8,586	100	108.0	0.00	89.68	-	-	0.00	0.00	-	0.00
325	10,103	10,104	100	108.0	0.00	91.09	-	-	0.00	0.00	-	0.00
326	9,461	9,461	100	108.0	0.00	90.52	-	-	0.00	0.00	-	0.00
327	9,355	9,355	100	108.0	0.00	90.42	-	-	0.00	0.00	-	0.00
328	9,020	9,020	100	108.0	0.00	90.10	-	-	0.00	0.00	-	0.00
329	10,076	10,077	100	108.0	0.00	91.07	-	-	0.00	0.00	-	0.00
330	9,487	9,487	100	108.0	0.00	90.54	-	-	0.00	0.00	-	0.00
331	8,565	8,565	100	108.0	0.00	89.65	-	-	0.00	0.00	-	0.00
332	8,132	8,132	100	108.0	0.00	89.20	-	-	0.00	0.00	-	0.00
333	7,564	7,565	100	108.0	0.00	88.58	-	-	0.00	0.00	-	0.00
334	7,792	7,792	100	108.0	0.00	88.83	-	-	0.00	0.00	-	0.00
335	7,417	7,418	100	108.0	0.00	88.41	-	-	0.00	0.00	-	0.00
Sum	41.27											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP 1 NSP 1**

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	8,441	8,442	100	108.0	0.00	89.53	-	-	0.00	0.00	-	0.00
2	9,447	9,448	100	108.0	0.00	90.51	-	-	0.00	0.00	-	0.00
3	5,430	5,431	100	107.0	0.00	85.70	-	-	0.00	0.00	-	0.00
4	5,797	5,798	100	107.0	0.00	86.27	-	-	0.00	0.00	-	0.00
5	6,618	6,618	100	107.0	0.00	87.41	-	-	0.00	0.00	-	0.00
6	9,884	9,885	100	108.0	0.00	90.90	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

WTG		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
7	8,782	8,783	118	108.0	0.00	89.87	-	-	0.00	0.00	-	0.00
8	4,860	4,861	111	107.0	0.00	84.73	-	-	0.00	0.00	-	0.00
9	8,824	8,825	111	108.0	0.00	89.91	-	-	0.00	0.00	-	0.00
10	8,975	8,975	48	108.0	0.00	90.06	-	-	0.00	0.00	-	0.00
11	9,917	9,917	4	108.0	0.00	90.93	-	-	0.00	0.00	-	0.00
12	7,401	7,402	4	107.0	0.00	88.39	-	-	0.00	0.00	-	0.00
13	6,166	6,166	88	107.0	0.00	86.80	-	-	0.00	0.00	-	0.00
14	6,776	6,777	8	107.0	0.00	87.62	-	-	0.00	0.00	-	0.00
15	8,689	8,690		108.0	0.00	89.78	-	-	0.00	0.00	-	0.00
16	5,599	5,600	81	107.0	0.00	85.96	-	-	0.00	0.00	-	0.00
17	10,204	10,204		108.0	0.00	91.18	-	-	0.00	0.00	-	0.00
18	7,469	7,470	1	107.0	0.00	88.47	-	-	0.00	0.00	-	0.00
19	7,127	7,127		107.0	0.00	88.06	-	-	0.00	0.00	-	0.00
20	9,464	9,465	41	108.0	0.00	90.52	-	-	0.00	0.00	-	0.00
22	5,569	5,570	88	107.0	0.00	85.92	-	-	0.00	0.00	-	0.00
23	4,108	4,110	1	107.0	0.00	83.28	-	-	0.00	0.00	-	0.00
25	10,545	10,545		108.0	0.00	91.46	-	-	0.00	0.00	-	0.00
26	9,891	9,891	4	108.0	0.00	90.90	-	-	0.00	0.00	-	0.00
27	8,051	8,052	4	108.0	0.00	89.12	-	-	0.00	0.00	-	0.00
28	9,268	9,269	44	108.0	0.00	90.34	-	-	0.00	0.00	-	0.00
29	7,577	7,578	4	107.0	0.00	88.59	-	-	0.00	0.00	-	0.00
30	9,738	9,738		108.0	0.00	90.77	-	-	0.00	0.00	-	0.00
31	6,860	6,861		107.0	0.00	87.73	-	-	0.00	0.00	-	0.00
32	5,990	5,991	8	107.0	0.00	86.55	-	-	0.00	0.00	-	0.00
33	6,121	6,121	88	107.0	0.00	86.74	-	-	0.00	0.00	-	0.00
201	11,080	11,080	18	108.0	0.00	91.89	-	-	0.00	0.00	-	0.00
202	11,378	11,378	14	108.0	0.00	92.12	-	-	0.00	0.00	-	0.00
203	11,548	11,548	11	108.0	0.00	92.25	-	-	0.00	0.00	-	0.00
204	11,863	11,863		108.0	0.00	92.48	-	-	0.00	0.00	-	0.00
205	12,345	12,345		108.0	0.00	92.83	-	-	0.00	0.00	-	0.00
206	11,447	11,448	1	108.0	0.00	92.17	-	-	0.00	0.00	-	0.00
207	11,968	11,969		108.0	0.00	92.56	-	-	0.00	0.00	-	0.00
208	5,962	5,963	1	108.0	0.00	86.51	-	-	0.00	0.00	-	0.00
209	5,715	5,716	1114	108.0	0.00	86.14	-	-	0.00	0.00	-	0.00
210	5,321	5,322	1	108.0	0.00	85.52	-	-	0.00	0.00	-	0.00
211	4,386	4,388	14	108.0	0.00	83.84	-	-	0.00	0.00	-	0.00
212	3,997	3,998	1	108.0	0.00	83.04	-	-	0.00	0.00	-	0.00
213	3,556	3,557	1	108.0	0.00	82.02	-	-	0.00	0.00	-	0.00
214	3,230	3,232	18	108.0	0.00	81.19	-	-	0.00	0.00	-	0.00
215	4,137	4,138	1	108.0	0.00	83.34	-	-	0.00	0.00	-	0.00
216	2,775	2,777	4	108.0	0.00	79.87	-	-	0.00	0.00	-	0.00
217	2,104	2,105		108.0	0.00	77.47	-	-	0.00	0.00	-	0.00
218	2,624	2,626		108.0	0.00	79.39	-	-	0.00	0.00	-	0.00
219	2,012	2,015		108.0	0.00	77.08	-	-	0.00	0.00	-	0.00
220	2,257	2,258	8	108.0	0.00	78.08	-	-	0.00	0.00	-	0.00
221	2,347	2,348	1	108.0	0.00	78.41	-	-	0.00	0.00	-	0.00
222	2,406	2,407	1	108.0	0.00	78.63	-	-	0.00	0.00	-	0.00
223	2,076	2,077		108.0	0.00	77.35	-	-	0.00	0.00	-	0.00
224	1,070	1,074	1	108.0	0.00	71.62	-	-	0.00	0.00	-	0.00
225	740	746	48	108.0	0.00	68.46	-	-	0.00	0.00	-	0.00
226	958	963	8	108.0	0.00	70.68	-	-	0.00	0.00	-	0.00
227	1,065	1,070		108.0	0.00	71.59	-	-	0.00	0.00	-	0.00
228	1,793	1,794	1	108.0	0.00	76.08	-	-	0.00	0.00	-	0.00
229	1,149	1,154	1	108.0	0.00	72.24	-	-	0.00	0.00	-	0.00
230	1,312	1,317	8	108.0	0.00	73.39	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
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Description:

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
231	1,806	1,809	108.0	108.0	0.00	76.15	-	-	0.00	0.00	-	0.00
232	2,764	2,766	108.8	108.0	0.00	79.84	-	-	0.00	0.00	-	0.00
233	3,049	3,051	18.0	108.0	0.00	80.69	-	-	0.00	0.00	-	0.00
234	3,375	3,377	108.8	108.0	0.00	81.57	-	-	0.00	0.00	-	0.00
235	3,565	3,567	101.0	108.0	0.00	82.05	-	-	0.00	0.00	-	0.00
301	11,308	11,308	108.0	108.0	0.00	92.07	-	-	0.00	0.00	-	0.00
302	11,790	11,790	88.0	108.0	0.00	92.43	-	-	0.00	0.00	-	0.00
303	12,685	12,685	-10.1	108.0	0.00	93.07	-	-	0.00	0.00	-	0.00
304	13,283	13,283	-8.0	108.0	0.00	93.47	-	-	0.00	0.00	-	0.00
305	13,592	13,592	-10.4	108.0	0.00	93.67	-	-	0.00	0.00	-	0.00
306	13,239	13,240	-8.0	108.0	0.00	93.44	-	-	0.00	0.00	-	0.00
307	12,545	12,546	-10.4	108.0	0.00	92.97	-	-	0.00	0.00	-	0.00
308	3,601	3,602	101.0	108.0	0.00	82.13	-	-	0.00	0.00	-	0.00
309	3,176	3,177	18.0	108.0	0.00	81.04	-	-	0.00	0.00	-	0.00
310	2,441	2,443	10.4	108.0	0.00	78.76	-	-	0.00	0.00	-	0.00
311	2,160	2,162	101.0	108.0	0.00	77.70	-	-	0.00	0.00	-	0.00
312	2,063	2,065	10.4	108.0	0.00	77.30	-	-	0.00	0.00	-	0.00
313	2,024	2,028	108.8	108.0	0.00	77.14	-	-	0.00	0.00	-	0.00
314	1,851	1,854	40.4	108.0	0.00	76.36	-	-	0.00	0.00	-	0.00
315	2,789	2,791	108.8	108.0	0.00	79.91	-	-	0.00	0.00	-	0.00
316	3,311	3,313	18.0	108.0	0.00	81.40	-	-	0.00	0.00	-	0.00
317	3,173	3,176	18.0	108.0	0.00	81.04	-	-	0.00	0.00	-	0.00
318	3,620	3,622	108.4	108.0	0.00	82.18	-	-	0.00	0.00	-	0.00
319	5,382	5,383	11.0	108.0	0.00	85.62	-	-	0.00	0.00	-	0.00
320	5,825	5,826	108.8	108.0	0.00	86.31	-	-	0.00	0.00	-	0.00
321	6,147	6,148	101.0	108.0	0.00	86.77	-	-	0.00	0.00	-	0.00
322	7,050	7,050	8.8	108.0	0.00	87.96	-	-	0.00	0.00	-	0.00
323	7,187	7,187	8.1	108.0	0.00	88.13	-	-	0.00	0.00	-	0.00
324	6,678	6,678	108.0	108.0	0.00	87.49	-	-	0.00	0.00	-	0.00
325	8,200	8,201	10.0	108.0	0.00	89.28	-	-	0.00	0.00	-	0.00
326	7,595	7,596	10.4	108.0	0.00	88.61	-	-	0.00	0.00	-	0.00
327	7,532	7,533	108.0	108.0	0.00	88.54	-	-	0.00	0.00	-	0.00
328	7,333	7,333	108.0	108.0	0.00	88.31	-	-	0.00	0.00	-	0.00
329	8,456	8,457	108.0	108.0	0.00	89.54	-	-	0.00	0.00	-	0.00
330	7,949	7,950	108.0	108.0	0.00	89.01	-	-	0.00	0.00	-	0.00
331	7,003	7,004	8.0	108.0	0.00	87.91	-	-	0.00	0.00	-	0.00
332	6,634	6,635	10.0	108.0	0.00	87.44	-	-	0.00	0.00	-	0.00
333	5,957	5,958	108.8	108.0	0.00	86.50	-	-	0.00	0.00	-	0.00
334	6,095	6,096	108.0	108.0	0.00	86.70	-	-	0.00	0.00	-	0.00
335	5,657	5,658	11.0	108.0	0.00	86.05	-	-	0.00	0.00	-	0.00

Sum 41.22

- Data undefined due to calculation with octave data

Noise sensitive area: NSP NSP

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	11,207	11,208	108.0	108.0	0.00	91.99	-	-	0.00	0.00	-	0.00
2	12,067	12,067	108.0	108.0	0.00	92.63	-	-	0.00	0.00	-	0.00
3	8,236	8,237	4.8	107.0	0.00	89.32	-	-	0.00	0.00	-	0.00
4	8,937	8,937	108.0	107.0	0.00	90.02	-	-	0.00	0.00	-	0.00
5	9,201	9,202	41.0	107.0	0.00	90.28	-	-	0.00	0.00	-	0.00
6	12,215	12,215	108.0	108.0	0.00	92.74	-	-	0.00	0.00	-	0.00
7	11,022	11,023	1.8	108.0	0.00	91.85	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
8	7,908	7,909	8	107.0	0.00	88.96	-	-	0.00	0.00	-	0.00
9	11,755	11,756		108.0	0.00	92.40	-	-	0.00	0.00	-	0.00
10	11,702	11,702		108.0	0.00	92.37	-	-	0.00	0.00	-	0.00
11	12,887	12,887	-44	108.0	0.00	93.20	-	-	0.00	0.00	-	0.00
12	10,650	10,651	148	107.0	0.00	91.55	-	-	0.00	0.00	-	0.00
13	9,285	9,286		107.0	0.00	90.36	-	-	0.00	0.00	-	0.00
14	9,589	9,590	8	107.0	0.00	90.64	-	-	0.00	0.00	-	0.00
15	11,114	11,115	1	108.0	0.00	91.92	-	-	0.00	0.00	-	0.00
16	8,580	8,580	4	107.0	0.00	89.67	-	-	0.00	0.00	-	0.00
17	12,403	12,404	1	108.0	0.00	92.87	-	-	0.00	0.00	-	0.00
18	10,114	10,114	1	107.0	0.00	91.10	-	-	0.00	0.00	-	0.00
19	10,059	10,060	4	107.0	0.00	91.05	-	-	0.00	0.00	-	0.00
20	11,659	11,659	14	108.0	0.00	92.33	-	-	0.00	0.00	-	0.00
22	8,928	8,929	8	107.0	0.00	90.02	-	-	0.00	0.00	-	0.00
23	7,253	7,254		107.0	0.00	88.21	-	-	0.00	0.00	-	0.00
25	12,829	12,829	-8	108.0	0.00	93.16	-	-	0.00	0.00	-	0.00
26	11,904	11,905	4	108.0	0.00	92.51	-	-	0.00	0.00	-	0.00
27	10,794	10,794	18	108.0	0.00	91.66	-	-	0.00	0.00	-	0.00
28	11,621	11,621	1	108.0	0.00	92.31	-	-	0.00	0.00	-	0.00
29	10,917	10,918	11	107.0	0.00	91.76	-	-	0.00	0.00	-	0.00
30	12,430	12,430		108.0	0.00	92.89	-	-	0.00	0.00	-	0.00
31	10,128	10,129	1	107.0	0.00	91.11	-	-	0.00	0.00	-	0.00
32	8,627	8,628	4	107.0	0.00	89.72	-	-	0.00	0.00	-	0.00
33	9,387	9,387	1	107.0	0.00	90.45	-	-	0.00	0.00	-	0.00
201	13,646	13,646	-1	108.0	0.00	93.70	-	-	0.00	0.00	-	0.00
202	13,943	13,944	-1	108.0	0.00	93.89	-	-	0.00	0.00	-	0.00
203	14,411	14,411	-11	108.0	0.00	94.17	-	-	0.00	0.00	-	0.00
204	14,658	14,658		108.0	0.00	94.32	-	-	0.00	0.00	-	0.00
205	15,170	15,170	-88	108.0	0.00	94.62	-	-	0.00	0.00	-	0.00
206	14,503	14,503	-1	108.0	0.00	94.23	-	-	0.00	0.00	-	0.00
207	15,109	15,109	-8	108.0	0.00	94.58	-	-	0.00	0.00	-	0.00
208	9,517	9,517	4	108.0	0.00	90.57	-	-	0.00	0.00	-	0.00
209	9,308	9,309	44	108.0	0.00	90.38	-	-	0.00	0.00	-	0.00
210	8,949	8,949	41	108.0	0.00	90.04	-	-	0.00	0.00	-	0.00
211	7,920	7,920		108.0	0.00	88.97	-	-	0.00	0.00	-	0.00
212	7,512	7,513		108.0	0.00	88.52	-	-	0.00	0.00	-	0.00
213	7,060	7,061	8	108.0	0.00	87.98	-	-	0.00	0.00	-	0.00
214	6,776	6,777	88	108.0	0.00	87.62	-	-	0.00	0.00	-	0.00
215	7,090	7,091	8	108.0	0.00	88.01	-	-	0.00	0.00	-	0.00
216	5,991	5,992	1	108.0	0.00	86.55	-	-	0.00	0.00	-	0.00
217	5,485	5,486	118	108.0	0.00	85.79	-	-	0.00	0.00	-	0.00
218	6,228	6,229	8	108.0	0.00	86.89	-	-	0.00	0.00	-	0.00
219	5,498	5,499	11	108.0	0.00	85.81	-	-	0.00	0.00	-	0.00
220	5,563	5,563	11	108.0	0.00	85.91	-	-	0.00	0.00	-	0.00
221	5,308	5,309	111	108.0	0.00	85.50	-	-	0.00	0.00	-	0.00
222	1,715	1,716	4	108.0	0.00	75.69	-	-	0.00	0.00	-	0.00
223	1,634	1,636	1	108.0	0.00	75.28	-	-	0.00	0.00	-	0.00
224	3,494	3,495	1	108.0	0.00	81.87	-	-	0.00	0.00	-	0.00
225	3,462	3,464	148	108.0	0.00	81.79	-	-	0.00	0.00	-	0.00
226	2,711	2,713		108.0	0.00	79.67	-	-	0.00	0.00	-	0.00
227	3,045	3,047	188	108.0	0.00	80.68	-	-	0.00	0.00	-	0.00
228	2,296	2,297	1	108.0	0.00	78.22	-	-	0.00	0.00	-	0.00
229	3,716	3,717	1	108.0	0.00	82.40	-	-	0.00	0.00	-	0.00
230	4,053	4,055	1	108.0	0.00	83.16	-	-	0.00	0.00	-	0.00
231	4,403	4,404	14	108.0	0.00	83.88	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
232	4,201	4,203	111	108.0	0.00	83.47	-	-	0.00	0.00	-	0.00
233	4,597	4,598	108	108.0	0.00	84.25	-	-	0.00	0.00	-	0.00
234	4,860	4,862	108	108.0	0.00	84.74	-	-	0.00	0.00	-	0.00
235	5,509	5,510	110	108.0	0.00	85.82	-	-	0.00	0.00	-	0.00
301	14,771	14,771	-48	108.0	0.00	94.39	-	-	0.00	0.00	-	0.00
302	15,266	15,266	-8	108.0	0.00	94.67	-	-	0.00	0.00	-	0.00
303	16,143	16,143	-8	108.0	0.00	95.16	-	-	0.00	0.00	-	0.00
304	16,750	16,750	-4	108.0	0.00	95.48	-	-	0.00	0.00	-	0.00
305	16,991	16,991	-4	108.0	0.00	95.60	-	-	0.00	0.00	-	0.00
306	16,650	16,650	-4	108.0	0.00	95.43	-	-	0.00	0.00	-	0.00
307	15,918	15,918	-1	108.0	0.00	95.04	-	-	0.00	0.00	-	0.00
308	489	497	8	108.0	0.00	64.92	-	-	0.00	0.00	-	0.00
309	920	925		108.0	0.00	70.32	-	-	0.00	0.00	-	0.00
310	1,387	1,390	8	108.0	0.00	73.86	-	-	0.00	0.00	-	0.00
311	1,861	1,864	4	108.0	0.00	76.41	-	-	0.00	0.00	-	0.00
312	2,250	2,252	4	108.0	0.00	78.05	-	-	0.00	0.00	-	0.00
313	2,722	2,725		108.0	0.00	79.71	-	-	0.00	0.00	-	0.00
314	3,582	3,583	1	108.0	0.00	82.09	-	-	0.00	0.00	-	0.00
315	3,257	3,259	18	108.0	0.00	81.26	-	-	0.00	0.00	-	0.00
316	2,851	2,853	1	108.0	0.00	80.11	-	-	0.00	0.00	-	0.00
317	2,450	2,453	1	108.0	0.00	78.79	-	-	0.00	0.00	-	0.00
318	1,857	1,860	4	108.0	0.00	76.39	-	-	0.00	0.00	-	0.00
319	2,866	2,869	1	108.0	0.00	80.15	-	-	0.00	0.00	-	0.00
320	3,088	3,090	18	108.0	0.00	80.80	-	-	0.00	0.00	-	0.00
321	3,188	3,190	18	108.0	0.00	81.08	-	-	0.00	0.00	-	0.00
322	4,319	4,321	14	108.0	0.00	83.71	-	-	0.00	0.00	-	0.00
323	4,592	4,594	1	108.0	0.00	84.24	-	-	0.00	0.00	-	0.00
324	4,449	4,450	14	108.0	0.00	83.97	-	-	0.00	0.00	-	0.00
325	5,791	5,792	1	108.0	0.00	86.26	-	-	0.00	0.00	-	0.00
326	5,407	5,408	11	108.0	0.00	85.66	-	-	0.00	0.00	-	0.00
327	5,524	5,525	11	108.0	0.00	85.85	-	-	0.00	0.00	-	0.00
328	5,832	5,833	1	108.0	0.00	86.32	-	-	0.00	0.00	-	0.00
329	7,001	7,002	8	108.0	0.00	87.90	-	-	0.00	0.00	-	0.00
330	6,806	6,807	8	108.0	0.00	87.66	-	-	0.00	0.00	-	0.00
331	5,950	5,951	1	108.0	0.00	86.49	-	-	0.00	0.00	-	0.00
332	5,841	5,842	1	108.0	0.00	86.33	-	-	0.00	0.00	-	0.00
333	5,006	5,008	1	108.0	0.00	84.99	-	-	0.00	0.00	-	0.00
334	4,818	4,820	1	108.0	0.00	84.66	-	-	0.00	0.00	-	0.00
335	4,275	4,276	14	108.0	0.00	83.62	-	-	0.00	0.00	-	0.00

Sum 41.36

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP 1 NSP 1**

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	10,873	10,874		108.0	0.00	91.73	-	-	0.00	0.00	-	0.00
2	11,755	11,756		108.0	0.00	92.41	-	-	0.00	0.00	-	0.00
3	7,882	7,883	4	107.0	0.00	88.93	-	-	0.00	0.00	-	0.00
4	8,545	8,546	4	107.0	0.00	89.64	-	-	0.00	0.00	-	0.00
5	8,881	8,882	8	107.0	0.00	89.97	-	-	0.00	0.00	-	0.00
6	11,942	11,943		108.0	0.00	92.54	-	-	0.00	0.00	-	0.00
7	10,756	10,757		108.0	0.00	91.63	-	-	0.00	0.00	-	0.00
8	7,523	7,524		107.0	0.00	88.53	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
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**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
9	11,401	11,401	118	108.0	0.00	92.14	-	-	0.00	0.00	-	0.00
10	11,375	11,375	141	108.0	0.00	92.12	-	-	0.00	0.00	-	0.00
11	12,530	12,530	-111	108.0	0.00	92.96	-	-	0.00	0.00	-	0.00
12	10,249	10,249	111	107.0	0.00	91.21	-	-	0.00	0.00	-	0.00
13	8,898	8,898	88	107.0	0.00	89.99	-	-	0.00	0.00	-	0.00
14	9,243	9,243	111	107.0	0.00	90.32	-	-	0.00	0.00	-	0.00
15	10,825	10,825	114	108.0	0.00	91.69	-	-	0.00	0.00	-	0.00
16	8,207	8,207	411	107.0	0.00	89.28	-	-	0.00	0.00	-	0.00
17	12,149	12,149	141	108.0	0.00	92.69	-	-	0.00	0.00	-	0.00
18	9,791	9,792	111	107.0	0.00	90.82	-	-	0.00	0.00	-	0.00
19	9,699	9,700	111	107.0	0.00	90.73	-	-	0.00	0.00	-	0.00
20	11,402	11,402	111	108.0	0.00	92.14	-	-	0.00	0.00	-	0.00
22	8,507	8,508	441	107.0	0.00	89.60	-	-	0.00	0.00	-	0.00
23	6,852	6,854	111	107.0	0.00	87.72	-	-	0.00	0.00	-	0.00
25	12,565	12,565	-111	108.0	0.00	92.98	-	-	0.00	0.00	-	0.00
26	11,672	11,673	111	108.0	0.00	92.34	-	-	0.00	0.00	-	0.00
27	10,461	10,462	114	108.0	0.00	91.39	-	-	0.00	0.00	-	0.00
28	11,343	11,344	141	108.0	0.00	92.10	-	-	0.00	0.00	-	0.00
29	10,503	10,503	111	107.0	0.00	91.43	-	-	0.00	0.00	-	0.00
30	12,110	12,110	148	108.0	0.00	92.66	-	-	0.00	0.00	-	0.00
31	9,723	9,723	118	107.0	0.00	90.76	-	-	0.00	0.00	-	0.00
32	8,297	8,298	411	107.0	0.00	89.38	-	-	0.00	0.00	-	0.00
33	8,980	8,980	111	107.0	0.00	90.07	-	-	0.00	0.00	-	0.00
201	13,346	13,347	-111	108.0	0.00	93.51	-	-	0.00	0.00	-	0.00
202	13,645	13,645	-111	108.0	0.00	93.70	-	-	0.00	0.00	-	0.00
203	14,072	14,072	-111	108.0	0.00	93.97	-	-	0.00	0.00	-	0.00
204	14,329	14,329	-111	108.0	0.00	94.12	-	-	0.00	0.00	-	0.00
205	14,837	14,838	-111	108.0	0.00	94.43	-	-	0.00	0.00	-	0.00
206	14,137	14,137	-181	108.0	0.00	94.01	-	-	0.00	0.00	-	0.00
207	14,731	14,731	-144	108.0	0.00	94.36	-	-	0.00	0.00	-	0.00
208	9,067	9,067	411	108.0	0.00	90.15	-	-	0.00	0.00	-	0.00
209	8,851	8,851	111	108.0	0.00	89.94	-	-	0.00	0.00	-	0.00
210	8,484	8,484	111	108.0	0.00	89.57	-	-	0.00	0.00	-	0.00
211	7,471	7,472	141	108.0	0.00	88.47	-	-	0.00	0.00	-	0.00
212	7,065	7,066	811	108.0	0.00	87.98	-	-	0.00	0.00	-	0.00
213	6,614	6,615	111	108.0	0.00	87.41	-	-	0.00	0.00	-	0.00
214	6,323	6,323	111	108.0	0.00	87.02	-	-	0.00	0.00	-	0.00
215	6,711	6,712	811	108.0	0.00	87.54	-	-	0.00	0.00	-	0.00
216	5,573	5,574	1141	108.0	0.00	85.92	-	-	0.00	0.00	-	0.00
217	5,046	5,047	1118	108.0	0.00	85.06	-	-	0.00	0.00	-	0.00
218	5,738	5,739	1118	108.0	0.00	86.18	-	-	0.00	0.00	-	0.00
219	5,007	5,008	1188	108.0	0.00	84.99	-	-	0.00	0.00	-	0.00
220	5,072	5,073	1111	108.0	0.00	85.11	-	-	0.00	0.00	-	0.00
221	4,825	4,826	1111	108.0	0.00	84.67	-	-	0.00	0.00	-	0.00
222	1,267	1,269	1111	108.0	0.00	73.07	-	-	0.00	0.00	-	0.00
223	1,143	1,146	1111	108.0	0.00	72.19	-	-	0.00	0.00	-	0.00
224	3,004	3,006	1114	108.0	0.00	80.56	-	-	0.00	0.00	-	0.00
225	2,971	2,972	1111	108.0	0.00	80.46	-	-	0.00	0.00	-	0.00
226	2,230	2,233	1111	108.0	0.00	77.98	-	-	0.00	0.00	-	0.00
227	2,615	2,617	1111	108.0	0.00	79.36	-	-	0.00	0.00	-	0.00
228	1,816	1,818	1411	108.0	0.00	76.19	-	-	0.00	0.00	-	0.00
229	3,298	3,300	1811	108.0	0.00	81.37	-	-	0.00	0.00	-	0.00
230	3,639	3,640	1188	108.0	0.00	82.22	-	-	0.00	0.00	-	0.00
231	4,013	4,014	1118	108.0	0.00	83.07	-	-	0.00	0.00	-	0.00
232	3,920	3,921	1111	108.0	0.00	82.87	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:  
**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:  
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 Licensed user:  
**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
233	4,320	4,322	14	108.0	0.00	83.71	-	-	0.00	0.00	-	0.00
234	4,602	4,603	1	108.0	0.00	84.26	-	-	0.00	0.00	-	0.00
235	5,217	5,218	1	108.0	0.00	85.35	-	-	0.00	0.00	-	0.00
301	14,342	14,342	-	108.0	0.00	94.13	-	-	0.00	0.00	-	0.00
302	14,834	14,834	-	108.0	0.00	94.43	-	-	0.00	0.00	-	0.00
303	15,715	15,715	-	108.0	0.00	94.93	-	-	0.00	0.00	-	0.00
304	16,320	16,320	-	108.0	0.00	95.25	-	-	0.00	0.00	-	0.00
305	16,573	16,574	-	108.0	0.00	95.39	-	-	0.00	0.00	-	0.00
306	16,231	16,231	-	108.0	0.00	95.21	-	-	0.00	0.00	-	0.00
307	15,505	15,505	-	108.0	0.00	94.81	-	-	0.00	0.00	-	0.00
308	694	699	4	108.0	0.00	67.89	-	-	0.00	0.00	-	0.00
309	825	830	4	108.0	0.00	69.38	-	-	0.00	0.00	-	0.00
310	1,018	1,022	1	108.0	0.00	71.19	-	-	0.00	0.00	-	0.00
311	1,505	1,508	1	108.0	0.00	74.57	-	-	0.00	0.00	-	0.00
312	1,914	1,916	4	108.0	0.00	76.65	-	-	0.00	0.00	-	0.00
313	2,398	2,401	1	108.0	0.00	78.61	-	-	0.00	0.00	-	0.00
314	3,229	3,231	1	108.0	0.00	81.19	-	-	0.00	0.00	-	0.00
315	3,033	3,035	1	108.0	0.00	80.64	-	-	0.00	0.00	-	0.00
316	2,733	2,736	1	108.0	0.00	79.74	-	-	0.00	0.00	-	0.00
317	2,331	2,334	1	108.0	0.00	78.36	-	-	0.00	0.00	-	0.00
318	1,885	1,887	4	108.0	0.00	76.52	-	-	0.00	0.00	-	0.00
319	3,155	3,157	1	108.0	0.00	80.99	-	-	0.00	0.00	-	0.00
320	3,429	3,431	1	108.0	0.00	81.71	-	-	0.00	0.00	-	0.00
321	3,575	3,576	1	108.0	0.00	82.07	-	-	0.00	0.00	-	0.00
322	4,683	4,684	1	108.0	0.00	84.41	-	-	0.00	0.00	-	0.00
323	4,937	4,938	1	108.0	0.00	84.87	-	-	0.00	0.00	-	0.00
324	4,729	4,730	1	108.0	0.00	84.50	-	-	0.00	0.00	-	0.00
325	6,120	6,121	1	108.0	0.00	86.74	-	-	0.00	0.00	-	0.00
326	5,697	5,698	1	108.0	0.00	86.11	-	-	0.00	0.00	-	0.00
327	5,787	5,788	1	108.0	0.00	86.25	-	-	0.00	0.00	-	0.00
328	6,020	6,021	1	108.0	0.00	86.59	-	-	0.00	0.00	-	0.00
329	7,199	7,200	1	108.0	0.00	88.15	-	-	0.00	0.00	-	0.00
330	6,955	6,956	8	108.0	0.00	87.85	-	-	0.00	0.00	-	0.00
331	6,071	6,073	1	108.0	0.00	86.67	-	-	0.00	0.00	-	0.00
332	5,922	5,923	1	108.0	0.00	86.45	-	-	0.00	0.00	-	0.00
333	5,090	5,092	1	108.0	0.00	85.14	-	-	0.00	0.00	-	0.00
334	4,949	4,950	1	108.0	0.00	84.89	-	-	0.00	0.00	-	0.00
335	4,406	4,407	1	108.0	0.00	83.88	-	-	0.00	0.00	-	0.00

Sum 40.93

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP NSP**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	11,131	11,132	1	108.0	0.00	91.93	-	-	0.00	0.00	-	0.00
2	12,078	12,079	1	108.0	0.00	92.64	-	-	0.00	0.00	-	0.00
3	8,106	8,107	1	107.0	0.00	89.18	-	-	0.00	0.00	-	0.00
4	8,616	8,617	4	107.0	0.00	89.71	-	-	0.00	0.00	-	0.00
5	9,202	9,203	4	107.0	0.00	90.28	-	-	0.00	0.00	-	0.00
6	12,376	12,377	1	108.0	0.00	92.85	-	-	0.00	0.00	-	0.00
7	11,215	11,216	1	108.0	0.00	92.00	-	-	0.00	0.00	-	0.00
8	7,635	7,636	8	107.0	0.00	88.66	-	-	0.00	0.00	-	0.00
9	11,586	11,587	1	108.0	0.00	92.28	-	-	0.00	0.00	-	0.00

To be continued on next page...



Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
10	11,652	11,652	1	108.0	0.00	92.33	-	-	0.00	0.00	-	0.00
11	12,699	12,699	-	108.0	0.00	93.08	-	-	0.00	0.00	-	0.00
12	10,262	10,262	1	107.0	0.00	91.22	-	-	0.00	0.00	-	0.00
13	8,980	8,981		107.0	0.00	90.07	-	-	0.00	0.00	-	0.00
14	9,473	9,473		107.0	0.00	90.53	-	-	0.00	0.00	-	0.00
15	11,218	11,219	1	108.0	0.00	92.00	-	-	0.00	0.00	-	0.00
16	8,355	8,356	4	107.0	0.00	89.44	-	-	0.00	0.00	-	0.00
17	12,629	12,630	-	108.0	0.00	93.03	-	-	0.00	0.00	-	0.00
18	10,095	10,095	1	107.0	0.00	91.08	-	-	0.00	0.00	-	0.00
19	9,878	9,878	4	107.0	0.00	90.89	-	-	0.00	0.00	-	0.00
20	11,880	11,881		108.0	0.00	92.50	-	-	0.00	0.00	-	0.00
22	8,448	8,448	4	107.0	0.00	89.54	-	-	0.00	0.00	-	0.00
23	6,911	6,912	1	107.0	0.00	87.79	-	-	0.00	0.00	-	0.00
25	13,018	13,018	-	108.0	0.00	93.29	-	-	0.00	0.00	-	0.00
26	12,212	12,212		108.0	0.00	92.74	-	-	0.00	0.00	-	0.00
27	10,728	10,729		108.0	0.00	91.61	-	-	0.00	0.00	-	0.00
28	11,766	11,767	1	108.0	0.00	92.41	-	-	0.00	0.00	-	0.00
29	10,458	10,458	1	107.0	0.00	91.39	-	-	0.00	0.00	-	0.00
30	12,404	12,405	1	108.0	0.00	92.87	-	-	0.00	0.00	-	0.00
31	9,724	9,724	8	107.0	0.00	90.76	-	-	0.00	0.00	-	0.00
32	8,592	8,593	4	107.0	0.00	89.68	-	-	0.00	0.00	-	0.00
33	8,981	8,981		107.0	0.00	90.07	-	-	0.00	0.00	-	0.00
201	13,696	13,697	-	108.0	0.00	93.73	-	-	0.00	0.00	-	0.00
202	13,996	13,996	-	108.0	0.00	93.92	-	-	0.00	0.00	-	0.00
203	14,296	14,296	-	108.0	0.00	94.10	-	-	0.00	0.00	-	0.00
204	14,584	14,585	-	108.0	0.00	94.28	-	-	0.00	0.00	-	0.00
205	15,081	15,081	-	108.0	0.00	94.57	-	-	0.00	0.00	-	0.00
206	14,265	14,265	-	108.0	0.00	94.09	-	-	0.00	0.00	-	0.00
207	14,812	14,813	-	108.0	0.00	94.41	-	-	0.00	0.00	-	0.00
208	8,843	8,844	8	108.0	0.00	89.93	-	-	0.00	0.00	-	0.00
209	8,582	8,583	1	108.0	0.00	89.67	-	-	0.00	0.00	-	0.00
210	8,165	8,165		108.0	0.00	89.24	-	-	0.00	0.00	-	0.00
211	7,275	7,276	8	108.0	0.00	88.24	-	-	0.00	0.00	-	0.00
212	6,887	6,888	8	108.0	0.00	87.76	-	-	0.00	0.00	-	0.00
213	6,447	6,448	1	108.0	0.00	87.19	-	-	0.00	0.00	-	0.00
214	6,120	6,121	1	108.0	0.00	86.74	-	-	0.00	0.00	-	0.00
215	6,858	6,859	8	108.0	0.00	87.73	-	-	0.00	0.00	-	0.00
216	5,582	5,583	1	108.0	0.00	85.94	-	-	0.00	0.00	-	0.00
217	4,959	4,960	1	108.0	0.00	84.91	-	-	0.00	0.00	-	0.00
218	5,176	5,177	1	108.0	0.00	85.28	-	-	0.00	0.00	-	0.00
219	4,381	4,383	1	108.0	0.00	83.83	-	-	0.00	0.00	-	0.00
220	4,346	4,347	1	108.0	0.00	83.76	-	-	0.00	0.00	-	0.00
221	3,984	3,985	1	108.0	0.00	83.01	-	-	0.00	0.00	-	0.00
222	489	497	8	108.0	0.00	64.92	-	-	0.00	0.00	-	0.00
223	1,068	1,073		108.0	0.00	71.61	-	-	0.00	0.00	-	0.00
224	2,323	2,325		108.0	0.00	78.33	-	-	0.00	0.00	-	0.00
225	2,418	2,420	1	108.0	0.00	78.68	-	-	0.00	0.00	-	0.00
226	2,028	2,031		108.0	0.00	77.16	-	-	0.00	0.00	-	0.00
227	2,736	2,738	1	108.0	0.00	79.75	-	-	0.00	0.00	-	0.00
228	1,125	1,128		108.0	0.00	72.05	-	-	0.00	0.00	-	0.00
229	3,413	3,415	1	108.0	0.00	81.67	-	-	0.00	0.00	-	0.00
230	3,745	3,747	1	108.0	0.00	82.47	-	-	0.00	0.00	-	0.00
231	4,205	4,206	1	108.0	0.00	83.48	-	-	0.00	0.00	-	0.00
232	4,460	4,461	1	108.0	0.00	83.99	-	-	0.00	0.00	-	0.00
233	4,858	4,860	1	108.0	0.00	84.73	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
234	5,172	5,174	104	108.0	0.00	85.28	-	-	0.00	0.00	-	0.00
235	5,685	5,686	111	108.0	0.00	86.10	-	-	0.00	0.00	-	0.00
301	14,198	14,198	-18	108.0	0.00	94.04	-	-	0.00	0.00	-	0.00
302	14,678	14,678	-	108.0	0.00	94.33	-	-	0.00	0.00	-	0.00
303	15,574	15,574	-8	108.0	0.00	94.85	-	-	0.00	0.00	-	0.00
304	16,171	16,172	-84	108.0	0.00	95.18	-	-	0.00	0.00	-	0.00
305	16,483	16,483	-41	108.0	0.00	95.34	-	-	0.00	0.00	-	0.00
306	16,130	16,130	-8	108.0	0.00	95.15	-	-	0.00	0.00	-	0.00
307	15,434	15,434	-14	108.0	0.00	94.77	-	-	0.00	0.00	-	0.00
308	1,890	1,893	4	108.0	0.00	76.54	-	-	0.00	0.00	-	0.00
309	1,941	1,943	418	108.0	0.00	76.77	-	-	0.00	0.00	-	0.00
310	1,715	1,718	-	108.0	0.00	75.70	-	-	0.00	0.00	-	0.00
311	2,094	2,096	8	108.0	0.00	77.43	-	-	0.00	0.00	-	0.00
312	2,479	2,482	18	108.0	0.00	78.90	-	-	0.00	0.00	-	0.00
313	2,934	2,937	14	108.0	0.00	80.36	-	-	0.00	0.00	-	0.00
314	3,605	3,607	1	108.0	0.00	82.14	-	-	0.00	0.00	-	0.00
315	3,749	3,751	1	108.0	0.00	82.48	-	-	0.00	0.00	-	0.00
316	3,650	3,652	184	108.0	0.00	82.25	-	-	0.00	0.00	-	0.00
317	3,269	3,272	181	108.0	0.00	81.30	-	-	0.00	0.00	-	0.00
318	2,996	2,998	11	108.0	0.00	80.54	-	-	0.00	0.00	-	0.00
319	4,354	4,356	14	108.0	0.00	83.78	-	-	0.00	0.00	-	0.00
320	4,618	4,620	1	108.0	0.00	84.29	-	-	0.00	0.00	-	0.00
321	4,740	4,742	188	108.0	0.00	84.52	-	-	0.00	0.00	-	0.00
322	5,864	5,865	1	108.0	0.00	86.37	-	-	0.00	0.00	-	0.00
323	6,127	6,128	1	108.0	0.00	86.75	-	-	0.00	0.00	-	0.00
324	5,927	5,929	1	108.0	0.00	86.46	-	-	0.00	0.00	-	0.00
325	7,315	7,316	-	108.0	0.00	88.29	-	-	0.00	0.00	-	0.00
326	6,895	6,897	88	108.0	0.00	87.77	-	-	0.00	0.00	-	0.00
327	6,983	6,984	841	108.0	0.00	87.88	-	-	0.00	0.00	-	0.00
328	7,189	7,190	81	108.0	0.00	88.13	-	-	0.00	0.00	-	0.00
329	8,371	8,372	8	108.0	0.00	89.46	-	-	0.00	0.00	-	0.00
330	8,098	8,099	-	108.0	0.00	89.17	-	-	0.00	0.00	-	0.00
331	7,196	7,197	-	108.0	0.00	88.14	-	-	0.00	0.00	-	0.00
332	7,011	7,012	8	108.0	0.00	87.92	-	-	0.00	0.00	-	0.00
333	6,189	6,190	1	108.0	0.00	86.83	-	-	0.00	0.00	-	0.00
334	6,086	6,087	1	108.0	0.00	86.69	-	-	0.00	0.00	-	0.00
335	5,547	5,548	11	108.0	0.00	85.88	-	-	0.00	0.00	-	0.00
Sum	41.20											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP NSP**

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	11,820	11,821	84	108.0	0.00	92.45	-	-	0.00	0.00	-	0.00
2	12,821	12,822	-	108.0	0.00	93.16	-	-	0.00	0.00	-	0.00
3	8,806	8,807	8	107.0	0.00	89.90	-	-	0.00	0.00	-	0.00
4	9,155	9,155	48	107.0	0.00	90.23	-	-	0.00	0.00	-	0.00
5	9,977	9,977	-	107.0	0.00	90.98	-	-	0.00	0.00	-	0.00
6	13,221	13,222	-8	108.0	0.00	93.43	-	-	0.00	0.00	-	0.00
7	12,094	12,095	-	108.0	0.00	92.65	-	-	0.00	0.00	-	0.00
8	8,236	8,237	48	107.0	0.00	89.32	-	-	0.00	0.00	-	0.00
9	12,198	12,198	-	108.0	0.00	92.73	-	-	0.00	0.00	-	0.00
10	12,354	12,354	1	108.0	0.00	92.84	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

No.	Distance [m]	Sound distance [m]	Wind speed: 8 m/s										
			WTG Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]	
11	13,282	13,283	-08	108.0	0.00	93.47	-	-	0.00	0.00	-	0.00	
12	10,710	10,710	141	107.0	0.00	91.60	-	-	0.00	0.00	-	0.00	
13	9,524	9,525		107.0	0.00	90.58	-	-	0.00	0.00	-	0.00	
14	10,156	10,156	11	107.0	0.00	91.13	-	-	0.00	0.00	-	0.00	
15	12,036	12,037		108.0	0.00	92.61	-	-	0.00	0.00	-	0.00	
16	8,977	8,978		107.0	0.00	90.06	-	-	0.00	0.00	-	0.00	
17	13,516	13,517	-11	108.0	0.00	93.62	-	-	0.00	0.00	-	0.00	
18	10,840	10,840	1	107.0	0.00	91.70	-	-	0.00	0.00	-	0.00	
19	10,504	10,504	1	107.0	0.00	91.43	-	-	0.00	0.00	-	0.00	
20	12,771	12,772	-11	108.0	0.00	93.12	-	-	0.00	0.00	-	0.00	
22	8,851	8,852		107.0	0.00	89.94	-	-	0.00	0.00	-	0.00	
23	7,479	7,481	1	107.0	0.00	88.48	-	-	0.00	0.00	-	0.00	
25	13,877	13,877	-1	108.0	0.00	93.85	-	-	0.00	0.00	-	0.00	
26	13,155	13,155	-	108.0	0.00	93.38	-	-	0.00	0.00	-	0.00	
27	11,430	11,430	14	108.0	0.00	92.16	-	-	0.00	0.00	-	0.00	
28	12,606	12,607	-1	108.0	0.00	93.01	-	-	0.00	0.00	-	0.00	
29	10,840	10,840	1	107.0	0.00	91.70	-	-	0.00	0.00	-	0.00	
30	13,116	13,117	-11	108.0	0.00	93.36	-	-	0.00	0.00	-	0.00	
31	10,167	10,168	1	107.0	0.00	91.14	-	-	0.00	0.00	-	0.00	
32	9,352	9,353		107.0	0.00	90.42	-	-	0.00	0.00	-	0.00	
33	9,438	9,438	8	107.0	0.00	90.50	-	-	0.00	0.00	-	0.00	
201	14,452	14,453	-1	108.0	0.00	94.20	-	-	0.00	0.00	-	0.00	
202	14,751	14,751	-4	108.0	0.00	94.38	-	-	0.00	0.00	-	0.00	
203	14,922	14,923	-4	108.0	0.00	94.48	-	-	0.00	0.00	-	0.00	
204	15,241	15,241	-	108.0	0.00	94.66	-	-	0.00	0.00	-	0.00	
205	15,721	15,722	-4	108.0	0.00	94.93	-	-	0.00	0.00	-	0.00	
206	14,792	14,792	-	108.0	0.00	94.40	-	-	0.00	0.00	-	0.00	
207	15,286	15,287	-	108.0	0.00	94.69	-	-	0.00	0.00	-	0.00	
208	9,054	9,055	4	108.0	0.00	90.14	-	-	0.00	0.00	-	0.00	
209	8,746	8,747	4	108.0	0.00	89.84	-	-	0.00	0.00	-	0.00	
210	8,278	8,279		108.0	0.00	89.36	-	-	0.00	0.00	-	0.00	
211	7,559	7,560	1	108.0	0.00	88.57	-	-	0.00	0.00	-	0.00	
212	7,204	7,205	8	108.0	0.00	88.15	-	-	0.00	0.00	-	0.00	
213	6,791	6,792	8	108.0	0.00	87.64	-	-	0.00	0.00	-	0.00	
214	6,439	6,440		108.0	0.00	87.18	-	-	0.00	0.00	-	0.00	
215	7,516	7,517		108.0	0.00	88.52	-	-	0.00	0.00	-	0.00	
216	6,151	6,152	11	108.0	0.00	86.78	-	-	0.00	0.00	-	0.00	
217	5,463	5,464	11	108.0	0.00	85.75	-	-	0.00	0.00	-	0.00	
218	5,097	5,098	1	108.0	0.00	85.15	-	-	0.00	0.00	-	0.00	
219	4,271	4,272	141	108.0	0.00	83.61	-	-	0.00	0.00	-	0.00	
220	4,087	4,088	14	108.0	0.00	83.23	-	-	0.00	0.00	-	0.00	
221	3,565	3,566	11	108.0	0.00	82.04	-	-	0.00	0.00	-	0.00	
222	1,582	1,584		108.0	0.00	75.00	-	-	0.00	0.00	-	0.00	
223	2,237	2,239	4	108.0	0.00	78.00	-	-	0.00	0.00	-	0.00	
224	2,447	2,449	14	108.0	0.00	78.78	-	-	0.00	0.00	-	0.00	
225	2,699	2,701		108.0	0.00	79.63	-	-	0.00	0.00	-	0.00	
226	2,789	2,791	18	108.0	0.00	79.92	-	-	0.00	0.00	-	0.00	
227	3,630	3,632	111	108.0	0.00	82.20	-	-	0.00	0.00	-	0.00	
228	1,762	1,763		108.0	0.00	75.93	-	-	0.00	0.00	-	0.00	
229	4,226	4,228	144	108.0	0.00	83.52	-	-	0.00	0.00	-	0.00	
230	4,521	4,522	141	108.0	0.00	84.11	-	-	0.00	0.00	-	0.00	
231	5,020	5,021	184	108.0	0.00	85.02	-	-	0.00	0.00	-	0.00	
232	5,529	5,530	11	108.0	0.00	85.86	-	-	0.00	0.00	-	0.00	
233	5,912	5,913	18	108.0	0.00	86.44	-	-	0.00	0.00	-	0.00	
234	6,240	6,241		108.0	0.00	86.91	-	-	0.00	0.00	-	0.00	

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
235	6,659	6,660	□□□□	108.0	0.00	87.47	-	-	0.00	0.00	-	0.00
301	14,428	14,428	-□□1□	108.0	0.00	94.18	-	-	0.00	0.00	-	0.00
302	14,890	14,890	-□□□□	108.0	0.00	94.46	-	-	0.00	0.00	-	0.00
303	15,797	15,797	-□□4□	108.0	0.00	94.97	-	-	0.00	0.00	-	0.00
304	16,380	16,380	-4□□□	108.0	0.00	95.29	-	-	0.00	0.00	-	0.00
305	16,756	16,756	-4□□8	108.0	0.00	95.48	-	-	0.00	0.00	-	0.00
306	16,395	16,395	-4□□□	108.0	0.00	95.29	-	-	0.00	0.00	-	0.00
307	15,738	15,738	-□□4□	108.0	0.00	94.94	-	-	0.00	0.00	-	0.00
308	3,253	3,254	18□□□	108.0	0.00	81.25	-	-	0.00	0.00	-	0.00
309	3,326	3,327	1□□□□	108.0	0.00	81.44	-	-	0.00	0.00	-	0.00
310	3,032	3,033	1□□□□	108.0	0.00	80.64	-	-	0.00	0.00	-	0.00
311	3,337	3,338	1□□□□	108.0	0.00	81.47	-	-	0.00	0.00	-	0.00
312	3,678	3,679	1□□□□	108.0	0.00	82.31	-	-	0.00	0.00	-	0.00
313	4,081	4,083	1□□4□	108.0	0.00	83.22	-	-	0.00	0.00	-	0.00
314	4,603	4,605	1□□□□	108.0	0.00	84.26	-	-	0.00	0.00	-	0.00
315	4,956	4,958	1□□□1	108.0	0.00	84.91	-	-	0.00	0.00	-	0.00
316	4,960	4,962	1□□□□	108.0	0.00	84.91	-	-	0.00	0.00	-	0.00
317	4,595	4,597	1□□□8	108.0	0.00	84.25	-	-	0.00	0.00	-	0.00
318	4,377	4,378	14□□□	108.0	0.00	83.83	-	-	0.00	0.00	-	0.00
319	5,717	5,718	11□1□	108.0	0.00	86.14	-	-	0.00	0.00	-	0.00
320	5,955	5,957	1□□□8	108.0	0.00	86.50	-	-	0.00	0.00	-	0.00
321	6,041	6,042	1□□□□	108.0	0.00	86.62	-	-	0.00	0.00	-	0.00
322	7,182	7,182	8□□□□	108.0	0.00	88.13	-	-	0.00	0.00	-	0.00
323	7,459	7,460	□□4□□	108.0	0.00	88.46	-	-	0.00	0.00	-	0.00
324	7,296	7,297	□□8□□	108.0	0.00	88.26	-	-	0.00	0.00	-	0.00
325	8,658	8,659	□□□8□	108.0	0.00	89.75	-	-	0.00	0.00	-	0.00
326	8,261	8,262	□□□□□	108.0	0.00	89.34	-	-	0.00	0.00	-	0.00
327	8,358	8,359	□□8□□	108.0	0.00	89.44	-	-	0.00	0.00	-	0.00
328	8,575	8,575	□□□□□	108.0	0.00	89.67	-	-	0.00	0.00	-	0.00
329	9,756	9,757	□□□□□	108.0	0.00	90.79	-	-	0.00	0.00	-	0.00
330	9,479	9,480	4□□8□	108.0	0.00	90.54	-	-	0.00	0.00	-	0.00
331	8,572	8,573	□□□□□	108.0	0.00	89.66	-	-	0.00	0.00	-	0.00
332	8,375	8,375	□□8□□	108.0	0.00	89.46	-	-	0.00	0.00	-	0.00
333	7,558	7,559	□□□1□	108.0	0.00	88.57	-	-	0.00	0.00	-	0.00
334	7,466	7,467	□□48□	108.0	0.00	88.46	-	-	0.00	0.00	-	0.00
335	6,929	6,930	8□□□□	108.0	0.00	87.81	-	-	0.00	0.00	-	0.00

Sum 33.65

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP□□4 NSP□□4**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	12,697	12,697	-□□□□	108.0	0.00	93.07	-	-	0.00	0.00	-	0.00
2	13,661	13,662	-1□□1□	108.0	0.00	93.71	-	-	0.00	0.00	-	0.00
3	9,670	9,670	□□□□□	107.0	0.00	90.71	-	-	0.00	0.00	-	0.00
4	10,117	10,117	□□1□□	107.0	0.00	91.10	-	-	0.00	0.00	-	0.00
5	10,791	10,791	1□□1□	107.0	0.00	91.66	-	-	0.00	0.00	-	0.00
6	13,983	13,984	-1□□□□	108.0	0.00	93.91	-	-	0.00	0.00	-	0.00
7	12,828	12,828	-□□□□□	108.0	0.00	93.16	-	-	0.00	0.00	-	0.00
8	9,160	9,160	□□4□□	107.0	0.00	90.24	-	-	0.00	0.00	-	0.00
9	13,124	13,124	-□□□1□	108.0	0.00	93.36	-	-	0.00	0.00	-	0.00
10	13,222	13,222	-□□8□□	108.0	0.00	93.43	-	-	0.00	0.00	-	0.00
11	14,226	14,226	-1□□□□	108.0	0.00	94.06	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
12	11,722	11,722	111	107.0	0.00	92.38	-	-	0.00	0.00	-	0.00
13	10,484	10,485	111	107.0	0.00	91.41	-	-	0.00	0.00	-	0.00
14	11,033	11,034	111	107.0	0.00	91.85	-	-	0.00	0.00	-	0.00
15	12,820	12,820	111	108.0	0.00	93.16	-	-	0.00	0.00	-	0.00
16	9,891	9,891	114	107.0	0.00	90.91	-	-	0.00	0.00	-	0.00
17	14,243	14,244	114	108.0	0.00	94.07	-	-	0.00	0.00	-	0.00
18	11,676	11,677	111	107.0	0.00	92.35	-	-	0.00	0.00	-	0.00
19	11,418	11,419	111	107.0	0.00	92.15	-	-	0.00	0.00	-	0.00
20	13,495	13,495	111	108.0	0.00	93.60	-	-	0.00	0.00	-	0.00
22	9,880	9,881	114	107.0	0.00	90.90	-	-	0.00	0.00	-	0.00
23	8,420	8,420	114	107.0	0.00	89.51	-	-	0.00	0.00	-	0.00
25	14,628	14,628	114	108.0	0.00	94.30	-	-	0.00	0.00	-	0.00
26	13,831	13,831	111	108.0	0.00	93.82	-	-	0.00	0.00	-	0.00
27	12,297	12,297	111	108.0	0.00	92.80	-	-	0.00	0.00	-	0.00
28	13,372	13,373	111	108.0	0.00	93.52	-	-	0.00	0.00	-	0.00
29	11,883	11,883	111	107.0	0.00	92.50	-	-	0.00	0.00	-	0.00
30	13,978	13,979	111	108.0	0.00	93.91	-	-	0.00	0.00	-	0.00
31	11,181	11,181	118	107.0	0.00	91.97	-	-	0.00	0.00	-	0.00
32	10,176	10,176	118	107.0	0.00	91.15	-	-	0.00	0.00	-	0.00
33	10,443	10,443	114	107.0	0.00	91.38	-	-	0.00	0.00	-	0.00
201	15,284	15,285	111	108.0	0.00	94.69	-	-	0.00	0.00	-	0.00
202	15,584	15,584	111	108.0	0.00	94.85	-	-	0.00	0.00	-	0.00
203	15,842	15,842	111	108.0	0.00	95.00	-	-	0.00	0.00	-	0.00
204	16,142	16,142	118	108.0	0.00	95.16	-	-	0.00	0.00	-	0.00
205	16,632	16,633	114	108.0	0.00	95.42	-	-	0.00	0.00	-	0.00
206	15,769	15,769	114	108.0	0.00	94.96	-	-	0.00	0.00	-	0.00
207	16,292	16,292	111	108.0	0.00	95.24	-	-	0.00	0.00	-	0.00
208	10,162	10,162	111	108.0	0.00	91.14	-	-	0.00	0.00	-	0.00
209	9,869	9,869	114	108.0	0.00	90.89	-	-	0.00	0.00	-	0.00
210	9,415	9,416	111	108.0	0.00	90.48	-	-	0.00	0.00	-	0.00
211	8,635	8,635	114	108.0	0.00	89.73	-	-	0.00	0.00	-	0.00
212	8,265	8,265	111	108.0	0.00	89.35	-	-	0.00	0.00	-	0.00
213	7,838	7,839	118	108.0	0.00	88.89	-	-	0.00	0.00	-	0.00
214	7,495	7,496	114	108.0	0.00	88.50	-	-	0.00	0.00	-	0.00
215	8,403	8,404	118	108.0	0.00	89.49	-	-	0.00	0.00	-	0.00
216	7,085	7,085	118	108.0	0.00	88.01	-	-	0.00	0.00	-	0.00
217	6,427	6,427	111	108.0	0.00	87.16	-	-	0.00	0.00	-	0.00
218	6,270	6,271	118	108.0	0.00	86.95	-	-	0.00	0.00	-	0.00
219	5,446	5,446	118	108.0	0.00	85.72	-	-	0.00	0.00	-	0.00
220	5,288	5,288	111	108.0	0.00	85.47	-	-	0.00	0.00	-	0.00
221	4,782	4,782	114	108.0	0.00	84.59	-	-	0.00	0.00	-	0.00
222	2,065	2,066	114	108.0	0.00	77.30	-	-	0.00	0.00	-	0.00
223	2,689	2,690	111	108.0	0.00	79.59	-	-	0.00	0.00	-	0.00
224	3,517	3,518	111	108.0	0.00	81.92	-	-	0.00	0.00	-	0.00
225	3,718	3,719	111	108.0	0.00	82.41	-	-	0.00	0.00	-	0.00
226	3,565	3,566	111	108.0	0.00	82.04	-	-	0.00	0.00	-	0.00
227	4,330	4,331	114	108.0	0.00	83.73	-	-	0.00	0.00	-	0.00
228	2,549	2,550	118	108.0	0.00	79.13	-	-	0.00	0.00	-	0.00
229	4,992	4,993	111	108.0	0.00	84.97	-	-	0.00	0.00	-	0.00
230	5,315	5,316	111	108.0	0.00	85.51	-	-	0.00	0.00	-	0.00
231	5,790	5,791	111	108.0	0.00	86.25	-	-	0.00	0.00	-	0.00
232	6,079	6,080	111	108.0	0.00	86.68	-	-	0.00	0.00	-	0.00
233	6,478	6,479	114	108.0	0.00	87.23	-	-	0.00	0.00	-	0.00
234	6,791	6,792	118	108.0	0.00	87.64	-	-	0.00	0.00	-	0.00
235	7,304	7,304	111	108.0	0.00	88.27	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
301	15,538	15,538	-4	108.0	0.00	94.83	-	-	0.00	0.00	-	0.00
302	16,007	16,007	-	108.0	0.00	95.09	-	-	0.00	0.00	-	0.00
303	16,911	16,911	-4.1	108.0	0.00	95.56	-	-	0.00	0.00	-	0.00
304	17,499	17,499	-	108.0	0.00	95.86	-	-	0.00	0.00	-	0.00
305	17,852	17,852	-	108.0	0.00	96.03	-	-	0.00	0.00	-	0.00
306	17,494	17,494	-	108.0	0.00	95.86	-	-	0.00	0.00	-	0.00
307	16,821	16,821	-4.4	108.0	0.00	95.52	-	-	0.00	0.00	-	0.00
308	3,031	3,032	1.4	108.0	0.00	80.63	-	-	0.00	0.00	-	0.00
309	3,294	3,295	18	108.0	0.00	81.36	-	-	0.00	0.00	-	0.00
310	3,270	3,271	18.1	108.0	0.00	81.29	-	-	0.00	0.00	-	0.00
311	3,689	3,690	1	108.0	0.00	82.34	-	-	0.00	0.00	-	0.00
312	4,086	4,087	1.4	108.0	0.00	83.23	-	-	0.00	0.00	-	0.00
313	4,548	4,550	14.11	108.0	0.00	84.16	-	-	0.00	0.00	-	0.00
314	5,223	5,224	1	108.0	0.00	85.36	-	-	0.00	0.00	-	0.00
315	5,341	5,342	1	108.0	0.00	85.55	-	-	0.00	0.00	-	0.00
316	5,166	5,167	1.4	108.0	0.00	85.26	-	-	0.00	0.00	-	0.00
317	4,769	4,771	1	108.0	0.00	84.57	-	-	0.00	0.00	-	0.00
318	4,348	4,349	14.8	108.0	0.00	83.77	-	-	0.00	0.00	-	0.00
319	5,369	5,370	11	108.0	0.00	85.60	-	-	0.00	0.00	-	0.00
320	5,513	5,514	11.1	108.0	0.00	85.83	-	-	0.00	0.00	-	0.00
321	5,507	5,508	11	108.0	0.00	85.82	-	-	0.00	0.00	-	0.00
322	6,661	6,662		108.0	0.00	87.47	-	-	0.00	0.00	-	0.00
323	6,974	6,975	8.4	108.0	0.00	87.87	-	-	0.00	0.00	-	0.00
324	6,940	6,940	8	108.0	0.00	87.83	-	-	0.00	0.00	-	0.00
325	8,187	8,187	1.18	108.0	0.00	89.26	-	-	0.00	0.00	-	0.00
326	7,876	7,877		108.0	0.00	88.93	-	-	0.00	0.00	-	0.00
327	8,026	8,027	1.4	108.0	0.00	89.09	-	-	0.00	0.00	-	0.00
328	8,384	8,384	8.4	108.0	0.00	89.47	-	-	0.00	0.00	-	0.00
329	9,547	9,547		108.0	0.00	90.60	-	-	0.00	0.00	-	0.00
330	9,363	9,364	4	108.0	0.00	90.43	-	-	0.00	0.00	-	0.00
331	8,503	8,504	1.4	108.0	0.00	89.59	-	-	0.00	0.00	-	0.00
332	8,378	8,378	8	108.0	0.00	89.46	-	-	0.00	0.00	-	0.00
333	7,544	7,545		108.0	0.00	88.55	-	-	0.00	0.00	-	0.00
334	7,373	7,374		108.0	0.00	88.35	-	-	0.00	0.00	-	0.00
335	6,829	6,829	8	108.0	0.00	87.69	-	-	0.00	0.00	-	0.00
Sum	31.47											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP NSP**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	7,982	7,984	4	108.0	0.00	89.04	-	-	0.00	0.00	-	0.00
2	7,743	7,744		108.0	0.00	88.78	-	-	0.00	0.00	-	0.00
3	10,442	10,443	1.4	107.0	0.00	91.38	-	-	0.00	0.00	-	0.00
4	9,552	9,553		107.0	0.00	90.60	-	-	0.00	0.00	-	0.00
5	9,888	9,889	1.4	107.0	0.00	90.90	-	-	0.00	0.00	-	0.00
6	8,550	8,551		108.0	0.00	89.64	-	-	0.00	0.00	-	0.00
7	9,399	9,400	4	108.0	0.00	90.46	-	-	0.00	0.00	-	0.00
8	10,592	10,593	1	107.0	0.00	91.50	-	-	0.00	0.00	-	0.00
9	7,187	7,188	8.1	108.0	0.00	88.13	-	-	0.00	0.00	-	0.00
10	7,701	7,703	1.4	108.0	0.00	88.73	-	-	0.00	0.00	-	0.00
11	6,153	6,154	1.14	108.0	0.00	86.78	-	-	0.00	0.00	-	0.00
12	7,820	7,820		107.0	0.00	88.86	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
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Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
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 Calculated:  
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**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
13	9,222	9,223	8	107.0	0.00	90.30	-	-	0.00	0.00	-	0.00
14	9,239	9,240		107.0	0.00	90.31	-	-	0.00	0.00	-	0.00
15	8,862	8,863		108.0	0.00	89.95	-	-	0.00	0.00	-	0.00
16	9,987	9,987		107.0	0.00	90.99	-	-	0.00	0.00	-	0.00
17	8,904	8,905	8	108.0	0.00	89.99	-	-	0.00	0.00	-	0.00
18	9,074	9,075		107.0	0.00	90.16	-	-	0.00	0.00	-	0.00
19	8,667	8,668	4.1	107.0	0.00	89.76	-	-	0.00	0.00	-	0.00
20	9,223	9,224	4.4	108.0	0.00	90.30	-	-	0.00	0.00	-	0.00
22	9,553	9,553		107.0	0.00	90.60	-	-	0.00	0.00	-	0.00
23	11,211	11,212	8	107.0	0.00	91.99	-	-	0.00	0.00	-	0.00
25	8,451	8,452		108.0	0.00	89.54	-	-	0.00	0.00	-	0.00
26	9,686	9,687		108.0	0.00	90.72	-	-	0.00	0.00	-	0.00
27	8,357	8,358	8	108.0	0.00	89.44	-	-	0.00	0.00	-	0.00
28	8,775	8,776	1	108.0	0.00	89.87	-	-	0.00	0.00	-	0.00
29	7,548	7,549		107.0	0.00	88.56	-	-	0.00	0.00	-	0.00
30	7,293	7,294	8.1	108.0	0.00	88.26	-	-	0.00	0.00	-	0.00
31	8,334	8,335	4	107.0	0.00	89.42	-	-	0.00	0.00	-	0.00
32	10,280	10,280	1	107.0	0.00	91.24	-	-	0.00	0.00	-	0.00
33	9,075	9,075		107.0	0.00	90.16	-	-	0.00	0.00	-	0.00
201	7,050	7,051	8.8	108.0	0.00	87.97	-	-	0.00	0.00	-	0.00
202	6,924	6,925	8	108.0	0.00	87.81	-	-	0.00	0.00	-	0.00
203	5,433	5,434	11.8.1	108.0	0.00	85.70	-	-	0.00	0.00	-	0.00
204	5,595	5,596	11.4	108.0	0.00	85.96	-	-	0.00	0.00	-	0.00
205	5,211	5,212	1	108.0	0.00	85.34	-	-	0.00	0.00	-	0.00
206	4,599	4,600	1	108.0	0.00	84.26	-	-	0.00	0.00	-	0.00
207	3,805	3,807	1.4	108.0	0.00	82.61	-	-	0.00	0.00	-	0.00
208	9,232	9,232	4.4	108.0	0.00	90.31	-	-	0.00	0.00	-	0.00
209	9,560	9,560		108.0	0.00	90.61	-	-	0.00	0.00	-	0.00
210	10,059	10,059	1	108.0	0.00	91.05	-	-	0.00	0.00	-	0.00
211	10,736	10,736		108.0	0.00	91.62	-	-	0.00	0.00	-	0.00
212	11,110	11,111	1	108.0	0.00	91.91	-	-	0.00	0.00	-	0.00
213	11,544	11,545	1.1	108.0	0.00	92.25	-	-	0.00	0.00	-	0.00
214	11,880	11,880		108.0	0.00	92.50	-	-	0.00	0.00	-	0.00
215	11,418	11,419	1	108.0	0.00	92.15	-	-	0.00	0.00	-	0.00
216	12,478	12,479	4	108.0	0.00	92.92	-	-	0.00	0.00	-	0.00
217	13,043	13,044	-	108.0	0.00	93.31	-	-	0.00	0.00	-	0.00
218	13,290	13,291	-	108.0	0.00	93.47	-	-	0.00	0.00	-	0.00
219	14,090	14,091	-1.8	108.0	0.00	93.98	-	-	0.00	0.00	-	0.00
220	14,391	14,392	-	108.0	0.00	94.16	-	-	0.00	0.00	-	0.00
221	15,025	15,026	-1.4	108.0	0.00	94.54	-	-	0.00	0.00	-	0.00
222	17,500	17,500	-	108.0	0.00	95.86	-	-	0.00	0.00	-	0.00
223	17,079	17,079	-4	108.0	0.00	95.65	-	-	0.00	0.00	-	0.00
224	15,858	15,858	-	108.0	0.00	95.01	-	-	0.00	0.00	-	0.00
225	15,655	15,655	-	108.0	0.00	94.89	-	-	0.00	0.00	-	0.00
226	15,981	15,981	-	108.0	0.00	95.07	-	-	0.00	0.00	-	0.00
227	15,438	15,439	-1.1	108.0	0.00	94.77	-	-	0.00	0.00	-	0.00
228	16,887	16,887	-4.4	108.0	0.00	95.55	-	-	0.00	0.00	-	0.00
229	14,753	14,753	-4	108.0	0.00	94.38	-	-	0.00	0.00	-	0.00
230	14,412	14,413	-1.1	108.0	0.00	94.18	-	-	0.00	0.00	-	0.00
231	14,064	14,065	-1	108.0	0.00	93.96	-	-	0.00	0.00	-	0.00
232	14,562	14,562	-	108.0	0.00	94.26	-	-	0.00	0.00	-	0.00
233	14,240	14,240	-1	108.0	0.00	94.07	-	-	0.00	0.00	-	0.00
234	14,106	14,107	-1	108.0	0.00	93.99	-	-	0.00	0.00	-	0.00
235	13,356	13,356	-1.8	108.0	0.00	93.51	-	-	0.00	0.00	-	0.00
301	3,901	3,902	1.4	108.0	0.00	82.83	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
302	3,497	3,498	1	108.0	0.00	81.88	-	-	0.00	0.00	-	0.00
303	2,609	2,611		108.0	0.00	79.33	-	-	0.00	0.00	-	0.00
304	2,152	2,154		108.0	0.00	77.67	-	-	0.00	0.00	-	0.00
305	1,541	1,544	8	108.0	0.00	74.77	-	-	0.00	0.00	-	0.00
306	1,912	1,915	4	108.0	0.00	76.65	-	-	0.00	0.00	-	0.00
307	2,552	2,555		108.0	0.00	79.15	-	-	0.00	0.00	-	0.00
308	18,201	18,201		108.0	0.00	96.20	-	-	0.00	0.00	-	0.00
309	17,672	17,673	18	108.0	0.00	95.95	-	-	0.00	0.00	-	0.00
310	17,074	17,075	4	108.0	0.00	95.65	-	-	0.00	0.00	-	0.00
311	16,608	16,609	4	108.0	0.00	95.41	-	-	0.00	0.00	-	0.00
312	16,243	16,244	1	108.0	0.00	95.21	-	-	0.00	0.00	-	0.00
313	15,806	15,807		108.0	0.00	94.98	-	-	0.00	0.00	-	0.00
314	14,927	14,928	4	108.0	0.00	94.48	-	-	0.00	0.00	-	0.00
315	15,596	15,597		108.0	0.00	94.86	-	-	0.00	0.00	-	0.00
316	16,322	16,323	8	108.0	0.00	95.26	-	-	0.00	0.00	-	0.00
317	16,582	16,582	4	108.0	0.00	95.39	-	-	0.00	0.00	-	0.00
318	17,399	17,399	4	108.0	0.00	95.81	-	-	0.00	0.00	-	0.00
319	18,641	18,642	8	108.0	0.00	96.41	-	-	0.00	0.00	-	0.00
320	19,124	19,125		108.0	0.00	96.63	-	-	0.00	0.00	-	0.00
321	19,590	19,590		108.0	0.00	96.84	-	-	0.00	0.00	-	0.00
322	19,856	19,856		108.0	0.00	96.96	-	-	0.00	0.00	-	0.00
323	19,738	19,738	84	108.0	0.00	96.91	-	-	0.00	0.00	-	0.00
324	18,931	18,931	1	108.0	0.00	96.54	-	-	0.00	0.00	-	0.00
325	20,043	20,043		108.0	0.00	97.04	-	-	0.00	0.00	-	0.00
326	19,335	19,336		108.0	0.00	96.73	-	-	0.00	0.00	-	0.00
327	19,014	19,014		108.0	0.00	96.58	-	-	0.00	0.00	-	0.00
328	18,102	18,102	4	108.0	0.00	96.15	-	-	0.00	0.00	-	0.00
329	18,456	18,457	8	108.0	0.00	96.32	-	-	0.00	0.00	-	0.00
330	17,688	17,688	1	108.0	0.00	95.95	-	-	0.00	0.00	-	0.00
331	17,261	17,261	8	108.0	0.00	95.74	-	-	0.00	0.00	-	0.00
332	16,756	16,757	8	108.0	0.00	95.48	-	-	0.00	0.00	-	0.00
333	16,889	16,890	4	108.0	0.00	95.55	-	-	0.00	0.00	-	0.00
334	17,383	17,384	4	108.0	0.00	95.80	-	-	0.00	0.00	-	0.00
335	17,422	17,422	4	108.0	0.00	95.82	-	-	0.00	0.00	-	0.00
Sum	31,92											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP NSP**

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	8,999	9,000	48	108.0	0.00	90.09	-	-	0.00	0.00	-	0.00
2	9,183	9,184	4	108.0	0.00	90.26	-	-	0.00	0.00	-	0.00
3	10,684	10,685	144	107.0	0.00	91.58	-	-	0.00	0.00	-	0.00
4	9,569	9,570	8	107.0	0.00	90.62	-	-	0.00	0.00	-	0.00
5	10,528	10,529	1	107.0	0.00	91.45	-	-	0.00	0.00	-	0.00
6	10,241	10,242		108.0	0.00	91.21	-	-	0.00	0.00	-	0.00
7	10,781	10,782		108.0	0.00	91.65	-	-	0.00	0.00	-	0.00
8	10,560	10,561	1	107.0	0.00	91.47	-	-	0.00	0.00	-	0.00
9	8,152	8,153	4	108.0	0.00	89.23	-	-	0.00	0.00	-	0.00
10	8,916	8,917	4	108.0	0.00	90.00	-	-	0.00	0.00	-	0.00
11	7,429	7,430		108.0	0.00	88.42	-	-	0.00	0.00	-	0.00
12	7,915	7,916		107.0	0.00	88.97	-	-	0.00	0.00	-	0.00
13	9,320	9,320	4	107.0	0.00	90.39	-	-	0.00	0.00	-	0.00

To be continued on next page...



Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

## DECIBEL - Detailed results

Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s

...continued from previous page

WTG		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
14	9,768	9,769	□□□□	107.0	0.00	90.80	-	-	0.00	0.00	-	0.00
15	10,158	10,159	□□□□	108.0	0.00	91.14	-	-	0.00	0.00	-	0.00
16	10,130	10,131	□14	107.0	0.00	91.11	-	-	0.00	0.00	-	0.00
17	10,713	10,714	□□□□	108.0	0.00	91.60	-	-	0.00	0.00	-	0.00
18	9,902	9,903	□44	107.0	0.00	90.92	-	-	0.00	0.00	-	0.00
19	9,171	9,171	□4□	107.0	0.00	90.25	-	-	0.00	0.00	-	0.00
20	10,815	10,816	□1□	108.0	0.00	91.68	-	-	0.00	0.00	-	0.00
22	9,236	9,237	□□□□	107.0	0.00	90.31	-	-	0.00	0.00	-	0.00
23	11,005	11,006	1□□□	107.0	0.00	91.83	-	-	0.00	0.00	-	0.00
25	10,351	10,352	□□□□	108.0	0.00	91.30	-	-	0.00	0.00	-	0.00
26	11,420	11,421	1□□□	108.0	0.00	92.15	-	-	0.00	0.00	-	0.00
27	9,279	9,280	4□□□	108.0	0.00	90.35	-	-	0.00	0.00	-	0.00
28	10,271	10,272	□□□1	108.0	0.00	91.23	-	-	0.00	0.00	-	0.00
29	7,460	7,461	□14	107.0	0.00	88.46	-	-	0.00	0.00	-	0.00
30	8,784	8,785	□1□	108.0	0.00	89.87	-	-	0.00	0.00	-	0.00
31	8,312	8,312	4□4	107.0	0.00	89.39	-	-	0.00	0.00	-	0.00
32	10,740	10,741	1□□□	107.0	0.00	91.62	-	-	0.00	0.00	-	0.00
33	8,962	8,963	□□□□	107.0	0.00	90.05	-	-	0.00	0.00	-	0.00
201	9,061	9,061	4□□□	108.0	0.00	90.14	-	-	0.00	0.00	-	0.00
202	9,034	9,035	4□□□	108.0	0.00	90.12	-	-	0.00	0.00	-	0.00
203	7,464	7,465	□48	108.0	0.00	88.46	-	-	0.00	0.00	-	0.00
204	7,793	7,794	□88	108.0	0.00	88.83	-	-	0.00	0.00	-	0.00
205	7,578	7,580	□□□□	108.0	0.00	88.59	-	-	0.00	0.00	-	0.00
206	6,355	6,356	□□□□	108.0	0.00	87.06	-	-	0.00	0.00	-	0.00
207	5,638	5,639	11□□□	108.0	0.00	86.02	-	-	0.00	0.00	-	0.00
208	8,480	8,481	□□□8	108.0	0.00	89.57	-	-	0.00	0.00	-	0.00
209	8,692	8,693	□□□□	108.0	0.00	89.78	-	-	0.00	0.00	-	0.00
210	9,088	9,089	4□□□	108.0	0.00	90.17	-	-	0.00	0.00	-	0.00
211	10,078	10,079	□1□	108.0	0.00	91.07	-	-	0.00	0.00	-	0.00
212	10,488	10,488	□□□□	108.0	0.00	91.41	-	-	0.00	0.00	-	0.00
213	10,939	10,940	1□□8	108.0	0.00	91.78	-	-	0.00	0.00	-	0.00
214	11,220	11,220	1□1	108.0	0.00	92.00	-	-	0.00	0.00	-	0.00
215	11,345	11,346	14□	108.0	0.00	92.10	-	-	0.00	0.00	-	0.00
216	12,096	12,097	□□□□	108.0	0.00	92.65	-	-	0.00	0.00	-	0.00
217	12,522	12,522	-□□□□	108.0	0.00	92.95	-	-	0.00	0.00	-	0.00
218	12,192	12,192	□□□8	108.0	0.00	92.72	-	-	0.00	0.00	-	0.00
219	13,017	13,018	-□□□□	108.0	0.00	93.29	-	-	0.00	0.00	-	0.00
220	13,223	13,223	-□8□	108.0	0.00	93.43	-	-	0.00	0.00	-	0.00
221	13,805	13,806	-14□	108.0	0.00	93.80	-	-	0.00	0.00	-	0.00
222	16,781	16,781	-44□	108.0	0.00	95.50	-	-	0.00	0.00	-	0.00
223	16,471	16,471	-41□	108.0	0.00	95.33	-	-	0.00	0.00	-	0.00
224	14,979	14,979	-□□□□	108.0	0.00	94.51	-	-	0.00	0.00	-	0.00
225	14,838	14,839	-□□□□	108.0	0.00	94.43	-	-	0.00	0.00	-	0.00
226	15,346	15,347	-□□□□	108.0	0.00	94.72	-	-	0.00	0.00	-	0.00
227	14,961	14,962	-□□8	108.0	0.00	94.50	-	-	0.00	0.00	-	0.00
228	16,127	16,127	-□8□	108.0	0.00	95.15	-	-	0.00	0.00	-	0.00
229	14,319	14,320	-□□□□	108.0	0.00	94.12	-	-	0.00	0.00	-	0.00
230	13,997	13,997	-1□8	108.0	0.00	93.92	-	-	0.00	0.00	-	0.00
231	13,747	13,748	-141	108.0	0.00	93.76	-	-	0.00	0.00	-	0.00
232	14,509	14,510	-□□□□	108.0	0.00	94.23	-	-	0.00	0.00	-	0.00
233	14,254	14,254	-1□□□	108.0	0.00	94.08	-	-	0.00	0.00	-	0.00
234	14,198	14,199	-18□	108.0	0.00	94.04	-	-	0.00	0.00	-	0.00
235	13,464	13,465	-11□	108.0	0.00	93.58	-	-	0.00	0.00	-	0.00
301	3,691	3,692	1□□1	108.0	0.00	82.35	-	-	0.00	0.00	-	0.00
302	3,213	3,214	18□□	108.0	0.00	81.14	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
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Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
303	2,728	2,730	□□□□	108.0	0.00	79.72	-	-	0.00	0.00	-	0.00
304	2,319	2,321	□□□□	108.0	0.00	78.31	-	-	0.00	0.00	-	0.00
305	2,986	2,988	1□□□1	108.0	0.00	80.51	-	-	0.00	0.00	-	0.00
306	2,951	2,953	1□□□4	108.0	0.00	80.41	-	-	0.00	0.00	-	0.00
307	3,601	3,603	1□□□1	108.0	0.00	82.13	-	-	0.00	0.00	-	0.00
308	17,817	17,817	-□□□□	108.0	0.00	96.02	-	-	0.00	0.00	-	0.00
309	17,311	17,311	-4.8□	108.0	0.00	95.77	-	-	0.00	0.00	-	0.00
310	16,640	16,641	-4□□□	108.0	0.00	95.42	-	-	0.00	0.00	-	0.00
311	16,212	16,213	-□88	108.0	0.00	95.20	-	-	0.00	0.00	-	0.00
312	15,897	15,897	-□□□□	108.0	0.00	95.03	-	-	0.00	0.00	-	0.00
313	15,515	15,516	-□□□□	108.0	0.00	94.82	-	-	0.00	0.00	-	0.00
314	14,659	14,659	-□□□□	108.0	0.00	94.32	-	-	0.00	0.00	-	0.00
315	15,503	15,504	-□□□1	108.0	0.00	94.81	-	-	0.00	0.00	-	0.00
316	16,271	16,272	-□□□□	108.0	0.00	95.23	-	-	0.00	0.00	-	0.00
317	16,461	16,461	-4.11	108.0	0.00	95.33	-	-	0.00	0.00	-	0.00
318	17,244	17,245	-4.81	108.0	0.00	95.73	-	-	0.00	0.00	-	0.00
319	18,702	18,702	-□□□□	108.0	0.00	96.44	-	-	0.00	0.00	-	0.00
320	19,198	19,199	-□4□	108.0	0.00	96.67	-	-	0.00	0.00	-	0.00
321	19,644	19,644	-□□□□	108.0	0.00	96.86	-	-	0.00	0.00	-	0.00
322	20,100	20,100	-□11	108.0	0.00	97.06	-	-	0.00	0.00	-	0.00
323	20,043	20,044	-□□□□	108.0	0.00	97.04	-	-	0.00	0.00	-	0.00
324	19,268	19,268	-□4□	108.0	0.00	96.70	-	-	0.00	0.00	-	0.00
325	20,542	20,543	-□4□	108.0	0.00	97.25	-	-	0.00	0.00	-	0.00
326	19,821	19,821	-□□□□	108.0	0.00	96.94	-	-	0.00	0.00	-	0.00
327	19,541	19,542	-□□□□	108.0	0.00	96.82	-	-	0.00	0.00	-	0.00
328	18,728	18,729	-□□□□	108.0	0.00	96.45	-	-	0.00	0.00	-	0.00
329	19,279	19,280	-□48	108.0	0.00	96.70	-	-	0.00	0.00	-	0.00
330	18,507	18,507	-□8□	108.0	0.00	96.35	-	-	0.00	0.00	-	0.00
331	17,929	17,929	-□□□□	108.0	0.00	96.07	-	-	0.00	0.00	-	0.00
332	17,404	17,405	-4□□□	108.0	0.00	95.81	-	-	0.00	0.00	-	0.00
333	17,372	17,373	-4□□□	108.0	0.00	95.80	-	-	0.00	0.00	-	0.00
334	17,833	17,834	-□□□1	108.0	0.00	96.02	-	-	0.00	0.00	-	0.00
335	17,766	17,767	-□□□□	108.0	0.00	95.99	-	-	0.00	0.00	-	0.00

Sum 28.80

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP □□□ NSP □□□**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	6,586	6,588	□□□1	108.0	0.00	87.37	-	-	0.00	0.00	-	0.00
2	6,824	6,825	8□□□	108.0	0.00	87.68	-	-	0.00	0.00	-	0.00
3	8,313	8,314	4□□□	107.0	0.00	89.40	-	-	0.00	0.00	-	0.00
4	7,231	7,232	□□□4	107.0	0.00	88.18	-	-	0.00	0.00	-	0.00
5	8,112	8,113	□□□□	107.0	0.00	89.18	-	-	0.00	0.00	-	0.00
6	7,919	7,920	□□□□	108.0	0.00	88.97	-	-	0.00	0.00	-	0.00
7	8,395	8,396	□8□	108.0	0.00	89.48	-	-	0.00	0.00	-	0.00
8	8,243	8,244	4.84	107.0	0.00	89.32	-	-	0.00	0.00	-	0.00
9	5,741	5,742	11□□□	108.0	0.00	86.18	-	-	0.00	0.00	-	0.00
10	6,524	6,525	□□□□	108.0	0.00	87.29	-	-	0.00	0.00	-	0.00
11	5,073	5,074	1□□□1	108.0	0.00	85.11	-	-	0.00	0.00	-	0.00
12	5,541	5,542	□□□4	107.0	0.00	85.87	-	-	0.00	0.00	-	0.00
13	6,962	6,963	□□□□	107.0	0.00	87.86	-	-	0.00	0.00	-	0.00
14	7,357	7,358	□□□□	107.0	0.00	88.33	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:  
**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
Frank Frederickson  
30 West Superior Street  
Duluth, MN 55802-2093

Description:  
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Licensed user:  
**EAPC Wind Energy**  
3100 DeMers Avenue  
US-GRAND FORKS, ND 58201  
+1 701 775 3000  
wind@eapc.net  
Calculated:  
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**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
15	7,764	7,766	□□□□	108.0	0.00	88.80	-	-	0.00	0.00	-	0.00
16	7,772	7,773	□□□1	107.0	0.00	88.81	-	-	0.00	0.00	-	0.00
17	8,415	8,416	□□□□	108.0	0.00	89.50	-	-	0.00	0.00	-	0.00
18	7,480	7,480	□1□□	107.0	0.00	88.48	-	-	0.00	0.00	-	0.00
19	6,758	6,759	□41□	107.0	0.00	87.60	-	-	0.00	0.00	-	0.00
20	8,464	8,465	□□□1	108.0	0.00	89.55	-	-	0.00	0.00	-	0.00
22	6,980	6,981	□□□□	107.0	0.00	87.88	-	-	0.00	0.00	-	0.00
23	8,737	8,738	4□□□	107.0	0.00	89.83	-	-	0.00	0.00	-	0.00
25	8,086	8,087	□□□□	108.0	0.00	89.16	-	-	0.00	0.00	-	0.00
26	9,094	9,094	4□□8	108.0	0.00	90.18	-	-	0.00	0.00	-	0.00
27	6,859	6,860	8□□□	108.0	0.00	87.73	-	-	0.00	0.00	-	0.00
28	7,908	7,909	□□□□	108.0	0.00	88.96	-	-	0.00	0.00	-	0.00
29	5,115	5,116	1□□□□	107.0	0.00	85.18	-	-	0.00	0.00	-	0.00
30	6,442	6,443	□□□□	108.0	0.00	87.18	-	-	0.00	0.00	-	0.00
31	5,966	5,967	□□□□	107.0	0.00	86.51	-	-	0.00	0.00	-	0.00
32	8,340	8,341	4□□□	107.0	0.00	89.42	-	-	0.00	0.00	-	0.00
33	6,646	6,647	□□□□	107.0	0.00	87.45	-	-	0.00	0.00	-	0.00
201	6,865	6,866	8□□□	108.0	0.00	87.73	-	-	0.00	0.00	-	0.00
202	6,879	6,880	8□□□	108.0	0.00	87.75	-	-	0.00	0.00	-	0.00
203	5,345	5,346	1□□□□	108.0	0.00	85.56	-	-	0.00	0.00	-	0.00
204	5,731	5,732	11□1□	108.0	0.00	86.17	-	-	0.00	0.00	-	0.00
205	5,619	5,620	11□□□	108.0	0.00	86.00	-	-	0.00	0.00	-	0.00
206	4,199	4,200	1□□1□	108.0	0.00	83.46	-	-	0.00	0.00	-	0.00
207	3,591	3,593	1□□4□	108.0	0.00	82.11	-	-	0.00	0.00	-	0.00
208	6,373	6,374	□□□□	108.0	0.00	87.09	-	-	0.00	0.00	-	0.00
209	6,641	6,642	□1□□	108.0	0.00	87.45	-	-	0.00	0.00	-	0.00
210	7,094	7,094	8□1□	108.0	0.00	88.02	-	-	0.00	0.00	-	0.00
211	7,956	7,957	□□□□	108.0	0.00	89.01	-	-	0.00	0.00	-	0.00
212	8,356	8,357	□8□□	108.0	0.00	89.44	-	-	0.00	0.00	-	0.00
213	8,806	8,807	□□14□	108.0	0.00	89.90	-	-	0.00	0.00	-	0.00
214	9,111	9,112	4□□□	108.0	0.00	90.19	-	-	0.00	0.00	-	0.00
215	9,045	9,046	4□□□	108.0	0.00	90.13	-	-	0.00	0.00	-	0.00
216	9,893	9,894	□4□□	108.0	0.00	90.91	-	-	0.00	0.00	-	0.00
217	10,372	10,372	□□□□	108.0	0.00	91.32	-	-	0.00	0.00	-	0.00
218	10,298	10,299	□8□□	108.0	0.00	91.26	-	-	0.00	0.00	-	0.00
219	11,117	11,117	1□□□	108.0	0.00	91.92	-	-	0.00	0.00	-	0.00
220	11,375	11,375	141□	108.0	0.00	92.12	-	-	0.00	0.00	-	0.00
221	11,990	11,990	□□□□	108.0	0.00	92.58	-	-	0.00	0.00	-	0.00
222	14,736	14,736	-□4□	108.0	0.00	94.37	-	-	0.00	0.00	-	0.00
223	14,379	14,379	-□□8□	108.0	0.00	94.15	-	-	0.00	0.00	-	0.00
224	12,996	12,996	-□□□□	108.0	0.00	93.28	-	-	0.00	0.00	-	0.00
225	12,826	12,826	-□□□□	108.0	0.00	93.16	-	-	0.00	0.00	-	0.00
226	13,259	13,260	-□8□	108.0	0.00	93.45	-	-	0.00	0.00	-	0.00
227	12,812	12,812	-□□□□	108.0	0.00	93.15	-	-	0.00	0.00	-	0.00
228	14,096	14,097	-1□8□	108.0	0.00	93.98	-	-	0.00	0.00	-	0.00
229	12,150	12,151	□4□□	108.0	0.00	92.69	-	-	0.00	0.00	-	0.00
230	11,820	11,820	□84□	108.0	0.00	92.45	-	-	0.00	0.00	-	0.00
231	11,536	11,536	1□□□	108.0	0.00	92.24	-	-	0.00	0.00	-	0.00
232	12,226	12,226	□□4□	108.0	0.00	92.75	-	-	0.00	0.00	-	0.00
233	11,952	11,953	□□8□	108.0	0.00	92.55	-	-	0.00	0.00	-	0.00
234	11,878	11,879	□□□□	108.0	0.00	92.50	-	-	0.00	0.00	-	0.00
235	11,136	11,137	1□□□	108.0	0.00	91.94	-	-	0.00	0.00	-	0.00
301	1,268	1,271	□□□□	108.0	0.00	73.08	-	-	0.00	0.00	-	0.00
302	803	807	□□□□	108.0	0.00	69.14	-	-	0.00	0.00	-	0.00
303	853	859	□□□1	108.0	0.00	69.68	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
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**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
304	1,160	1,164	□□□□	108.0	0.00	72.32	-	-	0.00	0.00	-	0.00
305	1,910	1,912	4□□8	108.0	0.00	76.63	-	-	0.00	0.00	-	0.00
306	1,586	1,590	□□□□	108.0	0.00	75.03	-	-	0.00	0.00	-	0.00
307	1,695	1,698	□□□□	108.0	0.00	75.60	-	-	0.00	0.00	-	0.00
308	15,649	15,649	-□□□□	108.0	0.00	94.89	-	-	0.00	0.00	-	0.00
309	15,133	15,133	-□8□	108.0	0.00	94.60	-	-	0.00	0.00	-	0.00
310	14,484	14,484	-□1□	108.0	0.00	94.22	-	-	0.00	0.00	-	0.00
311	14,041	14,041	-1□□□	108.0	0.00	93.95	-	-	0.00	0.00	-	0.00
312	13,707	13,708	-1□□□	108.0	0.00	93.74	-	-	0.00	0.00	-	0.00
313	13,306	13,306	-□□□□	108.0	0.00	93.48	-	-	0.00	0.00	-	0.00
314	12,437	12,438	□□8	108.0	0.00	92.90	-	-	0.00	0.00	-	0.00
315	13,235	13,236	-□84	108.0	0.00	93.44	-	-	0.00	0.00	-	0.00
316	13,995	13,996	-1□8	108.0	0.00	93.92	-	-	0.00	0.00	-	0.00
317	14,205	14,206	-1□□□	108.0	0.00	94.05	-	-	0.00	0.00	-	0.00
318	15,001	15,002	-□□1	108.0	0.00	94.52	-	-	0.00	0.00	-	0.00
319	16,407	16,407	-4□□□	108.0	0.00	95.30	-	-	0.00	0.00	-	0.00
320	16,902	16,902	-4□□1	108.0	0.00	95.56	-	-	0.00	0.00	-	0.00
321	17,353	17,354	-4□□□	108.0	0.00	95.79	-	-	0.00	0.00	-	0.00
322	17,768	17,768	-□□□□	108.0	0.00	95.99	-	-	0.00	0.00	-	0.00
323	17,699	17,700	-□□□□	108.0	0.00	95.96	-	-	0.00	0.00	-	0.00
324	16,916	16,917	-4□□□	108.0	0.00	95.57	-	-	0.00	0.00	-	0.00
325	18,167	18,167	-□□□□	108.0	0.00	96.19	-	-	0.00	0.00	-	0.00
326	17,446	17,446	-4□8	108.0	0.00	95.83	-	-	0.00	0.00	-	0.00
327	17,160	17,160	-4□□□	108.0	0.00	95.69	-	-	0.00	0.00	-	0.00
328	16,333	16,333	-□□□□	108.0	0.00	95.26	-	-	0.00	0.00	-	0.00
329	16,867	16,867	-44□	108.0	0.00	95.54	-	-	0.00	0.00	-	0.00
330	16,094	16,094	-□□□□	108.0	0.00	95.13	-	-	0.00	0.00	-	0.00
331	15,528	15,528	-□□□□	108.0	0.00	94.82	-	-	0.00	0.00	-	0.00
332	15,004	15,005	-□□□□	108.0	0.00	94.52	-	-	0.00	0.00	-	0.00
333	14,993	14,993	-□□1	108.0	0.00	94.52	-	-	0.00	0.00	-	0.00
334	15,459	15,460	-□1□	108.0	0.00	94.78	-	-	0.00	0.00	-	0.00
335	15,409	15,410	-□1□	108.0	0.00	94.76	-	-	0.00	0.00	-	0.00

Sum 39.01

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP □8 NSP □8**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	5,602	5,604	114□	108.0	0.00	85.97	-	-	0.00	0.00	-	0.00
2	6,061	6,063	1□□4	108.0	0.00	86.65	-	-	0.00	0.00	-	0.00
3	6,938	6,939	□□□□	107.0	0.00	87.83	-	-	0.00	0.00	-	0.00
4	5,806	5,807	□□□□	107.0	0.00	86.28	-	-	0.00	0.00	-	0.00
5	6,885	6,886	□1□	107.0	0.00	87.76	-	-	0.00	0.00	-	0.00
6	7,230	7,231	□□□□	108.0	0.00	88.18	-	-	0.00	0.00	-	0.00
7	7,504	7,506	□41	108.0	0.00	88.51	-	-	0.00	0.00	-	0.00
8	6,791	6,793	□□□□	107.0	0.00	87.64	-	-	0.00	0.00	-	0.00
9	4,793	4,795	1□44	108.0	0.00	84.62	-	-	0.00	0.00	-	0.00
10	5,653	5,655	11□8	108.0	0.00	86.05	-	-	0.00	0.00	-	0.00
11	4,395	4,397	14□□	108.0	0.00	83.86	-	-	0.00	0.00	-	0.00
12	4,184	4,186	1□4□	107.0	0.00	83.44	-	-	0.00	0.00	-	0.00
13	5,567	5,568	□88	107.0	0.00	85.91	-	-	0.00	0.00	-	0.00
14	6,107	6,108	8□□□	107.0	0.00	86.72	-	-	0.00	0.00	-	0.00
15	6,859	6,861	8□□□	108.0	0.00	87.73	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
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## DECIBEL - Detailed results

Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
16	6,376	6,377	81	107.0	0.00	87.09	-	-	0.00	0.00	-	0.00
17	7,767	7,768		108.0	0.00	88.81	-	-	0.00	0.00	-	0.00
18	6,355	6,356	8	107.0	0.00	87.06	-	-	0.00	0.00	-	0.00
19	5,519	5,520		107.0	0.00	85.84	-	-	0.00	0.00	-	0.00
20	7,686	7,687		108.0	0.00	88.72	-	-	0.00	0.00	-	0.00
22	5,475	5,476	1	107.0	0.00	85.77	-	-	0.00	0.00	-	0.00
23	7,242	7,244		107.0	0.00	88.20	-	-	0.00	0.00	-	0.00
25	7,514	7,515		108.0	0.00	88.52	-	-	0.00	0.00	-	0.00
26	8,366	8,367	8	108.0	0.00	89.45	-	-	0.00	0.00	-	0.00
27	5,809	5,811	1	108.0	0.00	86.28	-	-	0.00	0.00	-	0.00
28	7,106	7,107	81	108.0	0.00	88.03	-	-	0.00	0.00	-	0.00
29	3,706	3,708	14	107.0	0.00	82.38	-	-	0.00	0.00	-	0.00
30	5,743	5,745	11	108.0	0.00	86.19	-	-	0.00	0.00	-	0.00
31	4,555	4,556	14	107.0	0.00	84.17	-	-	0.00	0.00	-	0.00
32	7,038	7,039	8	107.0	0.00	87.95	-	-	0.00	0.00	-	0.00
33	5,194	5,195	1	107.0	0.00	85.31	-	-	0.00	0.00	-	0.00
201	6,463	6,465	4	108.0	0.00	87.21	-	-	0.00	0.00	-	0.00
202	6,545	6,546		108.0	0.00	87.32	-	-	0.00	0.00	-	0.00
203	5,155	5,156	1	108.0	0.00	85.25	-	-	0.00	0.00	-	0.00
204	5,602	5,604	114	108.0	0.00	85.97	-	-	0.00	0.00	-	0.00
205	5,636	5,638	11	108.0	0.00	86.02	-	-	0.00	0.00	-	0.00
206	4,048	4,050	1	108.0	0.00	83.15	-	-	0.00	0.00	-	0.00
207	3,699	3,701	18	108.0	0.00	82.37	-	-	0.00	0.00	-	0.00
208	4,807	4,809	14	108.0	0.00	84.64	-	-	0.00	0.00	-	0.00
209	5,069	5,070	1	108.0	0.00	85.10	-	-	0.00	0.00	-	0.00
210	5,519	5,520	11	108.0	0.00	85.84	-	-	0.00	0.00	-	0.00
211	6,396	6,397		108.0	0.00	87.12	-	-	0.00	0.00	-	0.00
212	6,799	6,801	88	108.0	0.00	87.65	-	-	0.00	0.00	-	0.00
213	7,250	7,251	8	108.0	0.00	88.21	-	-	0.00	0.00	-	0.00
214	7,550	7,551		108.0	0.00	88.56	-	-	0.00	0.00	-	0.00
215	7,576	7,578		108.0	0.00	88.59	-	-	0.00	0.00	-	0.00
216	8,363	8,364	88	108.0	0.00	89.45	-	-	0.00	0.00	-	0.00
217	8,822	8,823	11	108.0	0.00	89.91	-	-	0.00	0.00	-	0.00
218	8,726	8,727		108.0	0.00	89.82	-	-	0.00	0.00	-	0.00
219	9,544	9,544	8	108.0	0.00	90.59	-	-	0.00	0.00	-	0.00
220	9,805	9,806		108.0	0.00	90.83	-	-	0.00	0.00	-	0.00
221	10,423	10,424		108.0	0.00	91.36	-	-	0.00	0.00	-	0.00
222	13,168	13,169	-	108.0	0.00	93.39	-	-	0.00	0.00	-	0.00
223	12,818	12,819	-	108.0	0.00	93.16	-	-	0.00	0.00	-	0.00
224	11,422	11,423	1	108.0	0.00	92.16	-	-	0.00	0.00	-	0.00
225	11,254	11,254	1	108.0	0.00	92.03	-	-	0.00	0.00	-	0.00
226	11,697	11,698	1	108.0	0.00	92.36	-	-	0.00	0.00	-	0.00
227	11,264	11,265	1	108.0	0.00	92.03	-	-	0.00	0.00	-	0.00
228	12,526	12,527	-	108.0	0.00	92.96	-	-	0.00	0.00	-	0.00
229	10,609	10,610	4	108.0	0.00	91.51	-	-	0.00	0.00	-	0.00
230	10,281	10,282	8	108.0	0.00	91.24	-	-	0.00	0.00	-	0.00
231	10,011	10,012	8	108.0	0.00	91.01	-	-	0.00	0.00	-	0.00
232	10,744	10,745		108.0	0.00	91.62	-	-	0.00	0.00	-	0.00
233	10,486	10,487	1	108.0	0.00	91.41	-	-	0.00	0.00	-	0.00
234	10,429	10,430	8	108.0	0.00	91.37	-	-	0.00	0.00	-	0.00
235	9,696	9,697		108.0	0.00	90.73	-	-	0.00	0.00	-	0.00
301	1,010	1,014	1	108.0	0.00	71.12	-	-	0.00	0.00	-	0.00
302	1,244	1,248		108.0	0.00	72.92	-	-	0.00	0.00	-	0.00
303	2,114	2,117	1	108.0	0.00	77.51	-	-	0.00	0.00	-	0.00
304	2,636	2,639	1	108.0	0.00	79.43	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
305	3,205	3,206	18	108.0	0.00	81.12	-	-	0.00	0.00	-	0.00
306	2,834	2,836	18	108.0	0.00	80.06	-	-	0.00	0.00	-	0.00
307	2,485	2,488	1	108.0	0.00	78.92	-	-	0.00	0.00	-	0.00
308	14,109	14,109	-18	108.0	0.00	93.99	-	-	0.00	0.00	-	0.00
309	13,596	13,597	-14	108.0	0.00	93.67	-	-	0.00	0.00	-	0.00
310	12,940	12,940	-	108.0	0.00	93.24	-	-	0.00	0.00	-	0.00
311	12,501	12,502	1	108.0	0.00	92.94	-	-	0.00	0.00	-	0.00
312	12,174	12,175	4	108.0	0.00	92.71	-	-	0.00	0.00	-	0.00
313	11,781	11,782	8	108.0	0.00	92.42	-	-	0.00	0.00	-	0.00
314	10,918	10,919	1	108.0	0.00	91.76	-	-	0.00	0.00	-	0.00
315	11,743	11,744	4	108.0	0.00	92.40	-	-	0.00	0.00	-	0.00
316	12,509	12,510	-	108.0	0.00	92.94	-	-	0.00	0.00	-	0.00
317	12,705	12,706	-	108.0	0.00	93.08	-	-	0.00	0.00	-	0.00
318	13,494	13,495	-11	108.0	0.00	93.60	-	-	0.00	0.00	-	0.00
319	14,935	14,936	-	108.0	0.00	94.48	-	-	0.00	0.00	-	0.00
320	15,432	15,432	-14	108.0	0.00	94.77	-	-	0.00	0.00	-	0.00
321	15,879	15,879	-	108.0	0.00	95.02	-	-	0.00	0.00	-	0.00
322	16,331	16,332	-	108.0	0.00	95.26	-	-	0.00	0.00	-	0.00
323	16,277	16,277	-4	108.0	0.00	95.23	-	-	0.00	0.00	-	0.00
324	15,503	15,504	-1	108.0	0.00	94.81	-	-	0.00	0.00	-	0.00
325	16,790	16,791	-41	108.0	0.00	95.50	-	-	0.00	0.00	-	0.00
326	16,068	16,069	-	108.0	0.00	95.12	-	-	0.00	0.00	-	0.00
327	15,795	15,795	-4	108.0	0.00	94.97	-	-	0.00	0.00	-	0.00
328	15,000	15,000	-1	108.0	0.00	94.52	-	-	0.00	0.00	-	0.00
329	15,591	15,592	-	108.0	0.00	94.86	-	-	0.00	0.00	-	0.00
330	14,822	14,822	-	108.0	0.00	94.42	-	-	0.00	0.00	-	0.00
331	14,212	14,212	-11	108.0	0.00	94.05	-	-	0.00	0.00	-	0.00
332	13,685	13,686	-14	108.0	0.00	93.73	-	-	0.00	0.00	-	0.00
333	13,626	13,627	-18	108.0	0.00	93.69	-	-	0.00	0.00	-	0.00
334	14,081	14,082	-1	108.0	0.00	93.97	-	-	0.00	0.00	-	0.00
335	14,004	14,005	-1	108.0	0.00	93.93	-	-	0.00	0.00	-	0.00

Sum 35.44

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP NSP**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	12,276	12,276	8	108.0	0.00	92.78	-	-	0.00	0.00	-	0.00
2	12,502	12,502	1	108.0	0.00	92.94	-	-	0.00	0.00	-	0.00
3	10,529	10,529	1	107.0	0.00	91.45	-	-	0.00	0.00	-	0.00
4	11,725	11,725	-	107.0	0.00	92.38	-	-	0.00	0.00	-	0.00
5	10,568	10,568	18	107.0	0.00	91.48	-	-	0.00	0.00	-	0.00
6	11,885	11,885	-	108.0	0.00	92.50	-	-	0.00	0.00	-	0.00
7	10,871	10,871	8	108.0	0.00	91.73	-	-	0.00	0.00	-	0.00
8	10,883	10,884	11	107.0	0.00	91.74	-	-	0.00	0.00	-	0.00
9	13,107	13,107	-	108.0	0.00	93.35	-	-	0.00	0.00	-	0.00
10	12,521	12,521	-1	108.0	0.00	92.95	-	-	0.00	0.00	-	0.00
11	14,076	14,076	-1	108.0	0.00	93.97	-	-	0.00	0.00	-	0.00
12	13,231	13,231	-14	107.0	0.00	93.43	-	-	0.00	0.00	-	0.00
13	11,900	11,900	1	107.0	0.00	92.51	-	-	0.00	0.00	-	0.00
14	11,326	11,327	-	107.0	0.00	92.08	-	-	0.00	0.00	-	0.00
15	11,368	11,369	14	108.0	0.00	92.11	-	-	0.00	0.00	-	0.00
16	11,114	11,114	-	107.0	0.00	91.92	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
17	11,699	11,699	□□□□	108.0	0.00	92.36	-	-	0.00	0.00	-	0.00
18	11,251	11,251	□□□□	107.0	0.00	92.02	-	-	0.00	0.00	-	0.00
19	11,924	11,924	-□□□□	107.0	0.00	92.53	-	-	0.00	0.00	-	0.00
20	11,178	11,179	1□□□	108.0	0.00	91.97	-	-	0.00	0.00	-	0.00
22	12,339	12,339	-□48	107.0	0.00	92.83	-	-	0.00	0.00	-	0.00
23	10,737	10,738	1□□□	107.0	0.00	91.62	-	-	0.00	0.00	-	0.00
25	12,208	12,208	□□□□	108.0	0.00	92.73	-	-	0.00	0.00	-	0.00
26	10,920	10,920	□□1	108.0	0.00	91.76	-	-	0.00	0.00	-	0.00
27	11,932	11,932	□□□□	108.0	0.00	92.53	-	-	0.00	0.00	-	0.00
28	11,530	11,531	1□1	108.0	0.00	92.24	-	-	0.00	0.00	-	0.00
29	13,733	13,733	-1□□□	107.0	0.00	93.76	-	-	0.00	0.00	-	0.00
30	12,955	12,955	-□□□□	108.0	0.00	93.25	-	-	0.00	0.00	-	0.00
31	12,908	12,908	-1□8	107.0	0.00	93.22	-	-	0.00	0.00	-	0.00
32	10,373	10,373	18□	107.0	0.00	91.32	-	-	0.00	0.00	-	0.00
33	12,376	12,376	-□□□□	107.0	0.00	92.85	-	-	0.00	0.00	-	0.00
201	13,538	13,538	-118	108.0	0.00	93.63	-	-	0.00	0.00	-	0.00
202	13,765	13,765	-14□	108.0	0.00	93.78	-	-	0.00	0.00	-	0.00
203	14,965	14,966	-□□8	108.0	0.00	94.50	-	-	0.00	0.00	-	0.00
204	14,967	14,968	-□□8	108.0	0.00	94.50	-	-	0.00	0.00	-	0.00
205	15,470	15,470	-□18	108.0	0.00	94.79	-	-	0.00	0.00	-	0.00
206	15,632	15,633	-□□□□	108.0	0.00	94.88	-	-	0.00	0.00	-	0.00
207	16,418	16,418	-4□□□	108.0	0.00	95.31	-	-	0.00	0.00	-	0.00
208	13,507	13,508	-114	108.0	0.00	93.61	-	-	0.00	0.00	-	0.00
209	13,544	13,544	-11□	108.0	0.00	93.64	-	-	0.00	0.00	-	0.00
210	13,480	13,480	-111	108.0	0.00	93.59	-	-	0.00	0.00	-	0.00
211	12,218	12,219	□□□□	108.0	0.00	92.74	-	-	0.00	0.00	-	0.00
212	11,869	11,869	□□8	108.0	0.00	92.49	-	-	0.00	0.00	-	0.00
213	11,528	11,529	1□1	108.0	0.00	92.24	-	-	0.00	0.00	-	0.00
214	11,473	11,474	1□8	108.0	0.00	92.19	-	-	0.00	0.00	-	0.00
215	10,260	10,260	□□□□	108.0	0.00	91.22	-	-	0.00	0.00	-	0.00
216	10,248	10,249	□□4	108.0	0.00	91.21	-	-	0.00	0.00	-	0.00
217	10,318	10,318	□84	108.0	0.00	91.27	-	-	0.00	0.00	-	0.00
218	12,259	12,260	□□□□	108.0	0.00	92.77	-	-	0.00	0.00	-	0.00
219	11,878	11,878	□□□□	108.0	0.00	92.49	-	-	0.00	0.00	-	0.00
220	12,188	12,188	□□□□	108.0	0.00	92.72	-	-	0.00	0.00	-	0.00
221	12,263	12,264	□□□□	108.0	0.00	92.77	-	-	0.00	0.00	-	0.00
222	9,419	9,419	41□	108.0	0.00	90.48	-	-	0.00	0.00	-	0.00
223	8,938	8,939	4□□	108.0	0.00	90.03	-	-	0.00	0.00	-	0.00
224	10,523	10,523	□□□□	108.0	0.00	91.44	-	-	0.00	0.00	-	0.00
225	10,292	10,292	□88	108.0	0.00	91.25	-	-	0.00	0.00	-	0.00
226	9,364	9,364	4□□	108.0	0.00	90.43	-	-	0.00	0.00	-	0.00
227	8,878	8,879	□□□□	108.0	0.00	89.97	-	-	0.00	0.00	-	0.00
228	9,728	9,728	□□□□	108.0	0.00	90.76	-	-	0.00	0.00	-	0.00
229	9,032	9,032	4□8	108.0	0.00	90.12	-	-	0.00	0.00	-	0.00
230	9,146	9,146	4□□□	108.0	0.00	90.22	-	-	0.00	0.00	-	0.00
231	8,991	8,991	484	108.0	0.00	90.08	-	-	0.00	0.00	-	0.00
232	7,747	7,748	□□□□	108.0	0.00	88.78	-	-	0.00	0.00	-	0.00
233	7,764	7,765	□□□□	108.0	0.00	88.80	-	-	0.00	0.00	-	0.00
234	7,631	7,632	□1□	108.0	0.00	88.65	-	-	0.00	0.00	-	0.00
235	8,195	8,195	□1□	108.0	0.00	89.27	-	-	0.00	0.00	-	0.00
301	17,417	17,417	-4□□□	108.0	0.00	95.82	-	-	0.00	0.00	-	0.00
302	17,912	17,912	-□□8	108.0	0.00	96.06	-	-	0.00	0.00	-	0.00
303	18,598	18,598	-□□4	108.0	0.00	96.39	-	-	0.00	0.00	-	0.00
304	19,182	19,182	-□41	108.0	0.00	96.66	-	-	0.00	0.00	-	0.00
305	19,063	19,063	-□□1	108.0	0.00	96.60	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
306	18,818	18,818	-1	108.0	0.00	96.49	-	-	0.00	0.00	-	0.00
307	18,002	18,002	-4	108.0	0.00	96.11	-	-	0.00	0.00	-	0.00
308	7,568	7,568		108.0	0.00	88.58	-	-	0.00	0.00	-	0.00
309	7,561	7,562		108.0	0.00	88.57	-	-	0.00	0.00	-	0.00
310	8,083	8,083		108.0	0.00	89.15	-	-	0.00	0.00	-	0.00
311	8,050	8,050	4	108.0	0.00	89.12	-	-	0.00	0.00	-	0.00
312	7,965	7,965		108.0	0.00	89.02	-	-	0.00	0.00	-	0.00
313	7,919	7,920		108.0	0.00	88.97	-	-	0.00	0.00	-	0.00
314	8,297	8,297		108.0	0.00	89.38	-	-	0.00	0.00	-	0.00
315	7,222	7,222	4	108.0	0.00	88.17	-	-	0.00	0.00	-	0.00
316	6,632	6,633	1	108.0	0.00	87.43	-	-	0.00	0.00	-	0.00
317	6,803	6,804	8	108.0	0.00	87.66	-	-	0.00	0.00	-	0.00
318	6,610	6,610	1	108.0	0.00	87.40	-	-	0.00	0.00	-	0.00
319	5,105	5,106	1	108.0	0.00	85.16	-	-	0.00	0.00	-	0.00
320	4,918	4,919	11	108.0	0.00	84.84	-	-	0.00	0.00	-	0.00
321	4,966	4,966	1	108.0	0.00	84.92	-	-	0.00	0.00	-	0.00
322	3,842	3,843	1	108.0	0.00	82.69	-	-	0.00	0.00	-	0.00
323	3,495	3,496	1	108.0	0.00	81.87	-	-	0.00	0.00	-	0.00
324	3,525	3,526	1	108.0	0.00	81.95	-	-	0.00	0.00	-	0.00
325	2,310	2,311	1	108.0	0.00	78.28	-	-	0.00	0.00	-	0.00
326	2,563	2,564		108.0	0.00	79.18	-	-	0.00	0.00	-	0.00
327	2,482	2,483	1	108.0	0.00	78.90	-	-	0.00	0.00	-	0.00
328	2,674	2,675	4	108.0	0.00	79.55	-	-	0.00	0.00	-	0.00
329	1,822	1,824	4	108.0	0.00	76.22	-	-	0.00	0.00	-	0.00
330	2,590	2,591	81	108.0	0.00	79.27	-	-	0.00	0.00	-	0.00
331	3,292	3,293	188	108.0	0.00	81.35	-	-	0.00	0.00	-	0.00
332	3,809	3,810	1	108.0	0.00	82.62	-	-	0.00	0.00	-	0.00
333	4,161	4,162	1	108.0	0.00	83.39	-	-	0.00	0.00	-	0.00
334	3,891	3,892	1	108.0	0.00	82.80	-	-	0.00	0.00	-	0.00
335	4,289	4,289	148	108.0	0.00	83.65	-	-	0.00	0.00	-	0.00
Sum	31.90											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP NSP**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	11,299	11,299	11	108.0	0.00	92.06	-	-	0.00	0.00	-	0.00
2	11,492	11,492	1	108.0	0.00	92.21	-	-	0.00	0.00	-	0.00
3	9,669	9,670		107.0	0.00	90.71	-	-	0.00	0.00	-	0.00
4	10,875	10,875	11	107.0	0.00	91.73	-	-	0.00	0.00	-	0.00
5	9,638	9,639	8	107.0	0.00	90.68	-	-	0.00	0.00	-	0.00
6	10,851	10,852	1	108.0	0.00	91.71	-	-	0.00	0.00	-	0.00
7	9,853	9,854		108.0	0.00	90.87	-	-	0.00	0.00	-	0.00
8	10,071	10,071		107.0	0.00	91.06	-	-	0.00	0.00	-	0.00
9	12,135	12,135	4	108.0	0.00	92.68	-	-	0.00	0.00	-	0.00
10	11,528	11,528	11	108.0	0.00	92.24	-	-	0.00	0.00	-	0.00
11	13,086	13,086		108.0	0.00	93.34	-	-	0.00	0.00	-	0.00
12	12,336	12,336	48	107.0	0.00	92.82	-	-	0.00	0.00	-	0.00
13	11,032	11,032	11	107.0	0.00	91.85	-	-	0.00	0.00	-	0.00
14	10,406	10,406	1	107.0	0.00	91.35	-	-	0.00	0.00	-	0.00
15	10,362	10,362	8	108.0	0.00	91.31	-	-	0.00	0.00	-	0.00
16	10,258	10,258	18	107.0	0.00	91.22	-	-	0.00	0.00	-	0.00
17	10,657	10,657		108.0	0.00	91.55	-	-	0.00	0.00	-	0.00

To be continued on next page...



Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
18	10,293	10,293	1	107.0	0.00	91.25	-	-	0.00	0.00	-	0.00
19	11,000	11,000	1	107.0	0.00	91.83	-	-	0.00	0.00	-	0.00
20	10,146	10,146		108.0	0.00	91.13	-	-	0.00	0.00	-	0.00
22	11,527	11,528	4	107.0	0.00	92.23	-	-	0.00	0.00	-	0.00
23	9,976	9,977		107.0	0.00	90.98	-	-	0.00	0.00	-	0.00
25	11,165	11,165	1	108.0	0.00	91.96	-	-	0.00	0.00	-	0.00
26	9,875	9,875	4	108.0	0.00	90.89	-	-	0.00	0.00	-	0.00
27	10,963	10,963	1	108.0	0.00	91.80	-	-	0.00	0.00	-	0.00
28	10,508	10,508		108.0	0.00	91.43	-	-	0.00	0.00	-	0.00
29	12,848	12,848	-1	107.0	0.00	93.18	-	-	0.00	0.00	-	0.00
30	11,945	11,945		108.0	0.00	92.54	-	-	0.00	0.00	-	0.00
31	12,033	12,033	-4	107.0	0.00	92.61	-	-	0.00	0.00	-	0.00
32	9,475	9,475		107.0	0.00	90.53	-	-	0.00	0.00	-	0.00
33	11,527	11,528	4	107.0	0.00	92.23	-	-	0.00	0.00	-	0.00
201	12,501	12,501	1	108.0	0.00	92.94	-	-	0.00	0.00	-	0.00
202	12,726	12,726	-	108.0	0.00	93.09	-	-	0.00	0.00	-	0.00
203	13,943	13,943	-1	108.0	0.00	93.89	-	-	0.00	0.00	-	0.00
204	13,937	13,937	-1	108.0	0.00	93.88	-	-	0.00	0.00	-	0.00
205	14,436	14,437	-4	108.0	0.00	94.19	-	-	0.00	0.00	-	0.00
206	14,628	14,628	-4	108.0	0.00	94.30	-	-	0.00	0.00	-	0.00
207	15,417	15,417	-1	108.0	0.00	94.76	-	-	0.00	0.00	-	0.00
208	12,724	12,724	-	108.0	0.00	93.09	-	-	0.00	0.00	-	0.00
209	12,784	12,784	-	108.0	0.00	93.13	-	-	0.00	0.00	-	0.00
210	12,750	12,750	-8	108.0	0.00	93.11	-	-	0.00	0.00	-	0.00
211	11,494	11,494	1	108.0	0.00	92.21	-	-	0.00	0.00	-	0.00
212	11,159	11,160	1	108.0	0.00	91.95	-	-	0.00	0.00	-	0.00
213	10,840	10,841	1	108.0	0.00	91.70	-	-	0.00	0.00	-	0.00
214	10,812	10,812	1	108.0	0.00	91.68	-	-	0.00	0.00	-	0.00
215	9,486	9,486	4	108.0	0.00	90.54	-	-	0.00	0.00	-	0.00
216	9,585	9,585		108.0	0.00	90.63	-	-	0.00	0.00	-	0.00
217	9,714	9,714		108.0	0.00	90.75	-	-	0.00	0.00	-	0.00
218	11,734	11,735		108.0	0.00	92.39	-	-	0.00	0.00	-	0.00
219	11,411	11,412	1	108.0	0.00	92.15	-	-	0.00	0.00	-	0.00
220	11,750	11,750		108.0	0.00	92.40	-	-	0.00	0.00	-	0.00
221	11,878	11,878		108.0	0.00	92.49	-	-	0.00	0.00	-	0.00
222	9,264	9,264	4.41	108.0	0.00	90.34	-	-	0.00	0.00	-	0.00
223	8,734	8,734		108.0	0.00	89.82	-	-	0.00	0.00	-	0.00
224	10,201	10,201	1	108.0	0.00	91.17	-	-	0.00	0.00	-	0.00
225	9,947	9,947	8	108.0	0.00	90.95	-	-	0.00	0.00	-	0.00
226	9,039	9,039	4	108.0	0.00	90.12	-	-	0.00	0.00	-	0.00
227	8,478	8,478	8	108.0	0.00	89.57	-	-	0.00	0.00	-	0.00
228	9,506	9,506	4	108.0	0.00	90.56	-	-	0.00	0.00	-	0.00
229	8,556	8,556		108.0	0.00	89.65	-	-	0.00	0.00	-	0.00
230	8,635	8,636	4	108.0	0.00	89.73	-	-	0.00	0.00	-	0.00
231	8,432	8,432		108.0	0.00	89.52	-	-	0.00	0.00	-	0.00
232	7,169	7,169	8	108.0	0.00	88.11	-	-	0.00	0.00	-	0.00
233	7,139	7,140	8.1	108.0	0.00	88.07	-	-	0.00	0.00	-	0.00
234	6,972	6,972	8.4	108.0	0.00	87.87	-	-	0.00	0.00	-	0.00
235	7,480	7,480	4	108.0	0.00	88.48	-	-	0.00	0.00	-	0.00
301	16,481	16,481	-4.1	108.0	0.00	95.34	-	-	0.00	0.00	-	0.00
302	16,973	16,973	-4	108.0	0.00	95.60	-	-	0.00	0.00	-	0.00
303	17,643	17,643	-1	108.0	0.00	95.93	-	-	0.00	0.00	-	0.00
304	18,222	18,222	-4	108.0	0.00	96.21	-	-	0.00	0.00	-	0.00
305	18,084	18,084	-	108.0	0.00	96.15	-	-	0.00	0.00	-	0.00
306	17,846	17,846	-	108.0	0.00	96.03	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
307	17,030	17,030	-4	108.0	0.00	95.62	-	-	0.00	0.00	-	0.00
308	7,501	7,501	4	108.0	0.00	88.50	-	-	0.00	0.00	-	0.00
309	7,420	7,421		108.0	0.00	88.41	-	-	0.00	0.00	-	0.00
310	7,868	7,868	4	108.0	0.00	88.92	-	-	0.00	0.00	-	0.00
311	7,773	7,773		108.0	0.00	88.81	-	-	0.00	0.00	-	0.00
312	7,636	7,636	1	108.0	0.00	88.66	-	-	0.00	0.00	-	0.00
313	7,529	7,529		108.0	0.00	88.54	-	-	0.00	0.00	-	0.00
314	7,807	7,807	8	108.0	0.00	88.85	-	-	0.00	0.00	-	0.00
315	6,761	6,762	8 8	108.0	0.00	87.60	-	-	0.00	0.00	-	0.00
316	6,251	6,251		108.0	0.00	86.92	-	-	0.00	0.00	-	0.00
317	6,475	6,476	4	108.0	0.00	87.23	-	-	0.00	0.00	-	0.00
318	6,408	6,408		108.0	0.00	87.13	-	-	0.00	0.00	-	0.00
319	5,095	5,095	1	108.0	0.00	85.14	-	-	0.00	0.00	-	0.00
320	5,008	5,008	1 88	108.0	0.00	84.99	-	-	0.00	0.00	-	0.00
321	5,152	5,152	1 1	108.0	0.00	85.24	-	-	0.00	0.00	-	0.00
322	4,117	4,118	1	108.0	0.00	83.29	-	-	0.00	0.00	-	0.00
323	3,749	3,750	1	108.0	0.00	82.48	-	-	0.00	0.00	-	0.00
324	3,543	3,543	1 1	108.0	0.00	81.99	-	-	0.00	0.00	-	0.00
325	2,715	2,716		108.0	0.00	79.68	-	-	0.00	0.00	-	0.00
326	2,683	2,685	4	108.0	0.00	79.58	-	-	0.00	0.00	-	0.00
327	2,456	2,458	1 8	108.0	0.00	78.81	-	-	0.00	0.00	-	0.00
328	2,219	2,221		108.0	0.00	77.93	-	-	0.00	0.00	-	0.00
329	1,087	1,090	4	108.0	0.00	71.75	-	-	0.00	0.00	-	0.00
330	1,754	1,756	8	108.0	0.00	75.89	-	-	0.00	0.00	-	0.00
331	2,610	2,612		108.0	0.00	79.34	-	-	0.00	0.00	-	0.00
332	3,087	3,088	18 8	108.0	0.00	80.79	-	-	0.00	0.00	-	0.00
333	3,603	3,604	1	108.0	0.00	82.13	-	-	0.00	0.00	-	0.00
334	3,446	3,447	1 4	108.0	0.00	81.75	-	-	0.00	0.00	-	0.00
335	3,924	3,925	1	108.0	0.00	82.88	-	-	0.00	0.00	-	0.00
Sum	34.47											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP 1 NSP 1**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	13,990	13,991	-1	108.0	0.00	93.92	-	-	0.00	0.00	-	0.00
2	14,611	14,611		108.0	0.00	94.29	-	-	0.00	0.00	-	0.00
3	11,349	11,349	4	107.0	0.00	92.10	-	-	0.00	0.00	-	0.00
4	12,325	12,325	-4	107.0	0.00	92.82	-	-	0.00	0.00	-	0.00
5	11,975	11,975	8	107.0	0.00	92.57	-	-	0.00	0.00	-	0.00
6	14,408	14,408	-11	108.0	0.00	94.17	-	-	0.00	0.00	-	0.00
7	13,223	13,223	-8	108.0	0.00	93.43	-	-	0.00	0.00	-	0.00
8	11,296	11,297		107.0	0.00	92.06	-	-	0.00	0.00	-	0.00
9	14,695	14,695	-41	108.0	0.00	94.34	-	-	0.00	0.00	-	0.00
10	14,401	14,401	-1	108.0	0.00	94.17	-	-	0.00	0.00	-	0.00
11	15,810	15,811		108.0	0.00	94.98	-	-	0.00	0.00	-	0.00
12	14,055	14,055		107.0	0.00	93.96	-	-	0.00	0.00	-	0.00
13	12,623	12,624		107.0	0.00	93.02	-	-	0.00	0.00	-	0.00
14	12,564	12,564		107.0	0.00	92.98	-	-	0.00	0.00	-	0.00
15	13,515	13,515	-11	108.0	0.00	93.62	-	-	0.00	0.00	-	0.00
16	11,830	11,831	8	107.0	0.00	92.46	-	-	0.00	0.00	-	0.00
17	14,427	14,427	-1	108.0	0.00	94.18	-	-	0.00	0.00	-	0.00
18	12,855	12,855	-1	107.0	0.00	93.18	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
19	13,124	13,124	-1.1	107.0	0.00	93.36	-	-	0.00	0.00	-	0.00
20	13,744	13,745	-1.4	108.0	0.00	93.76	-	-	0.00	0.00	-	0.00
22	12,573	12,573	-	107.0	0.00	92.99	-	-	0.00	0.00	-	0.00
23	10,805	10,805	1.0	107.0	0.00	91.67	-	-	0.00	0.00	-	0.00
25	14,917	14,917	-	108.0	0.00	94.47	-	-	0.00	0.00	-	0.00
26	13,759	13,760	-1.4	108.0	0.00	93.77	-	-	0.00	0.00	-	0.00
27	13,582	13,583	-1.0	108.0	0.00	93.66	-	-	0.00	0.00	-	0.00
28	13,892	13,892	-1.0	108.0	0.00	93.86	-	-	0.00	0.00	-	0.00
29	14,430	14,430	-	107.0	0.00	94.19	-	-	0.00	0.00	-	0.00
30	15,035	15,035	-	108.0	0.00	94.54	-	-	0.00	0.00	-	0.00
31	13,587	13,587	-1.0	107.0	0.00	93.66	-	-	0.00	0.00	-	0.00
32	11,525	11,525	0.4	107.0	0.00	92.23	-	-	0.00	0.00	-	0.00
33	12,888	12,888	-1.0	107.0	0.00	93.20	-	-	0.00	0.00	-	0.00
201	16,018	16,018	-	108.0	0.00	95.09	-	-	0.00	0.00	-	0.00
202	16,295	16,296	-	108.0	0.00	95.24	-	-	0.00	0.00	-	0.00
203	17,117	17,117	-4.0	108.0	0.00	95.67	-	-	0.00	0.00	-	0.00
204	17,263	17,264	-4.8	108.0	0.00	95.74	-	-	0.00	0.00	-	0.00
205	17,789	17,790	-	108.0	0.00	96.00	-	-	0.00	0.00	-	0.00
206	17,465	17,465	-	108.0	0.00	95.84	-	-	0.00	0.00	-	0.00
207	18,167	18,167	-	108.0	0.00	96.19	-	-	0.00	0.00	-	0.00
208	13,413	13,413	-1.4	108.0	0.00	93.55	-	-	0.00	0.00	-	0.00
209	13,283	13,283	-0.8	108.0	0.00	93.47	-	-	0.00	0.00	-	0.00
210	13,010	13,010	-0.8	108.0	0.00	93.29	-	-	0.00	0.00	-	0.00
211	11,848	11,848	0.81	108.0	0.00	92.47	-	-	0.00	0.00	-	0.00
212	11,437	11,438	1.0	108.0	0.00	92.17	-	-	0.00	0.00	-	0.00
213	10,999	10,999	1.0	108.0	0.00	91.83	-	-	0.00	0.00	-	0.00
214	10,782	10,782	-	108.0	0.00	91.65	-	-	0.00	0.00	-	0.00
215	10,487	10,488	-	108.0	0.00	91.41	-	-	0.00	0.00	-	0.00
216	9,755	9,755	-	108.0	0.00	90.78	-	-	0.00	0.00	-	0.00
217	9,441	9,442	4.14	108.0	0.00	90.50	-	-	0.00	0.00	-	0.00
218	10,637	10,637	0.4	108.0	0.00	91.54	-	-	0.00	0.00	-	0.00
219	9,967	9,968	-	108.0	0.00	90.97	-	-	0.00	0.00	-	0.00
220	10,082	10,083	0.18	108.0	0.00	91.07	-	-	0.00	0.00	-	0.00
221	9,867	9,867	0.4	108.0	0.00	90.88	-	-	0.00	0.00	-	0.00
222	6,276	6,277	0.88	108.0	0.00	86.95	-	-	0.00	0.00	-	0.00
223	6,149	6,149	1.11	108.0	0.00	86.78	-	-	0.00	0.00	-	0.00
224	8,032	8,033	0.4	108.0	0.00	89.10	-	-	0.00	0.00	-	0.00
225	7,959	7,960	0.8	108.0	0.00	89.02	-	-	0.00	0.00	-	0.00
226	7,106	7,106	8.1	108.0	0.00	88.03	-	-	0.00	0.00	-	0.00
227	7,135	7,136	8.11	108.0	0.00	88.07	-	-	0.00	0.00	-	0.00
228	6,860	6,861	8.0	108.0	0.00	87.73	-	-	0.00	0.00	-	0.00
229	7,668	7,668	0.11	108.0	0.00	88.69	-	-	0.00	0.00	-	0.00
230	7,952	7,952	-	108.0	0.00	89.01	-	-	0.00	0.00	-	0.00
231	8,114	8,114	0.1	108.0	0.00	89.18	-	-	0.00	0.00	-	0.00
232	7,306	7,307	0.8	108.0	0.00	88.27	-	-	0.00	0.00	-	0.00
233	7,587	7,588	-	108.0	0.00	88.60	-	-	0.00	0.00	-	0.00
234	7,691	7,691	-	108.0	0.00	88.72	-	-	0.00	0.00	-	0.00
235	8,441	8,442	0.4	108.0	0.00	89.53	-	-	0.00	0.00	-	0.00
301	18,354	18,354	-0.4	108.0	0.00	96.27	-	-	0.00	0.00	-	0.00
302	18,861	18,861	-0.1	108.0	0.00	96.51	-	-	0.00	0.00	-	0.00
303	19,688	19,688	-0.8	108.0	0.00	96.88	-	-	0.00	0.00	-	0.00
304	20,299	20,300	-	108.0	0.00	97.15	-	-	0.00	0.00	-	0.00
305	20,408	20,408	-0.4	108.0	0.00	97.20	-	-	0.00	0.00	-	0.00
306	20,097	20,097	-0.11	108.0	0.00	97.06	-	-	0.00	0.00	-	0.00
307	19,315	19,315	-0.1	108.0	0.00	96.72	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
308	4,465	4,466	14	108.0	0.00	84.00	-	-	0.00	0.00	-	0.00
309	4,841	4,841	1	108.0	0.00	84.70	-	-	0.00	0.00	-	0.00
310	5,576	5,576	11.4	108.0	0.00	85.93	-	-	0.00	0.00	-	0.00
311	5,878	5,879	1	108.0	0.00	86.39	-	-	0.00	0.00	-	0.00
312	6,092	6,092	1.8	108.0	0.00	86.70	-	-	0.00	0.00	-	0.00
313	6,388	6,389		108.0	0.00	87.11	-	-	0.00	0.00	-	0.00
314	7,198	7,199		108.0	0.00	88.15	-	-	0.00	0.00	-	0.00
315	6,305	6,306	.81	108.0	0.00	86.99	-	-	0.00	0.00	-	0.00
316	5,538	5,539	11	108.0	0.00	85.87	-	-	0.00	0.00	-	0.00
317	5,356	5,357	1	108.0	0.00	85.58	-	-	0.00	0.00	-	0.00
318	4,602	4,603	1	108.0	0.00	84.26	-	-	0.00	0.00	-	0.00
319	3,146	3,147	18.1	108.0	0.00	80.96	-	-	0.00	0.00	-	0.00
320	2,664	2,666	.4	108.0	0.00	79.52	-	-	0.00	0.00	-	0.00
321	2,197	2,199	.1	108.0	0.00	77.84	-	-	0.00	0.00	-	0.00
322	2,273	2,275		108.0	0.00	78.14	-	-	0.00	0.00	-	0.00
323	2,576	2,578	.8	108.0	0.00	79.22	-	-	0.00	0.00	-	0.00
324	3,295	3,296	18	108.0	0.00	81.36	-	-	0.00	0.00	-	0.00
325	3,303	3,304	18.4	108.0	0.00	81.38	-	-	0.00	0.00	-	0.00
326	3,578	3,580	1.8	108.0	0.00	82.08	-	-	0.00	0.00	-	0.00
327	3,947	3,948	1.8	108.0	0.00	82.93	-	-	0.00	0.00	-	0.00
328	4,909	4,910	1.1	108.0	0.00	84.82	-	-	0.00	0.00	-	0.00
329	5,605	5,606	11	108.0	0.00	85.97	-	-	0.00	0.00	-	0.00
330	5,949	5,950	1	108.0	0.00	86.49	-	-	0.00	0.00	-	0.00
331	5,615	5,616	11	108.0	0.00	85.99	-	-	0.00	0.00	-	0.00
332	5,912	5,913	1.8	108.0	0.00	86.44	-	-	0.00	0.00	-	0.00
333	5,361	5,362	11.8	108.0	0.00	85.59	-	-	0.00	0.00	-	0.00
334	4,868	4,868	1.4	108.0	0.00	84.75	-	-	0.00	0.00	-	0.00
335	4,606	4,606	1	108.0	0.00	84.27	-	-	0.00	0.00	-	0.00
Sum	31.18											

- Data undefined due to calculation with octave data

**Noise sensitive area: NSP NSP**

**WTG** **Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	12,479	12,480	.4	108.0	0.00	92.92	-	-	0.00	0.00	-	0.00
2	13,108	13,109	-	108.0	0.00	93.35	-	-	0.00	0.00	-	0.00
3	9,840	9,840		107.0	0.00	90.86	-	-	0.00	0.00	-	0.00
4	10,826	10,826	1	107.0	0.00	91.69	-	-	0.00	0.00	-	0.00
5	10,462	10,462	1	107.0	0.00	91.39	-	-	0.00	0.00	-	0.00
6	12,926	12,926	.4	108.0	0.00	93.23	-	-	0.00	0.00	-	0.00
7	11,736	11,737		108.0	0.00	92.39	-	-	0.00	0.00	-	0.00
8	9,801	9,802	.8	107.0	0.00	90.83	-	-	0.00	0.00	-	0.00
9	13,182	13,182	- .8	108.0	0.00	93.40	-	-	0.00	0.00	-	0.00
10	12,892	12,892	- .4	108.0	0.00	93.21	-	-	0.00	0.00	-	0.00
11	14,298	14,298	-	108.0	0.00	94.11	-	-	0.00	0.00	-	0.00
12	12,553	12,553	- .1	107.0	0.00	92.98	-	-	0.00	0.00	-	0.00
13	11,121	11,121	.1	107.0	0.00	91.92	-	-	0.00	0.00	-	0.00
14	11,051	11,051		107.0	0.00	91.87	-	-	0.00	0.00	-	0.00
15	12,017	12,018		108.0	0.00	92.60	-	-	0.00	0.00	-	0.00
16	10,326	10,326	1.8	107.0	0.00	91.28	-	-	0.00	0.00	-	0.00
17	12,959	12,959	-	108.0	0.00	93.25	-	-	0.00	0.00	-	0.00
18	11,343	11,343	.4	107.0	0.00	92.09	-	-	0.00	0.00	-	0.00
19	11,612	11,612		107.0	0.00	92.30	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

Minnesota Power - BISON Wind Energy Center

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

		Wind speed: 8 m/s										
No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
20	12,269	12,269	□□□	108.0	0.00	92.78	-	-	0.00	0.00	-	0.00
22	11,095	11,095	□□4	107.0	0.00	91.90	-	-	0.00	0.00	-	0.00
23	9,325	9,326	□□□	107.0	0.00	90.39	-	-	0.00	0.00	-	0.00
25	13,445	13,445	-1□□8	108.0	0.00	93.57	-	-	0.00	0.00	-	0.00
26	12,305	12,305	□□4	108.0	0.00	92.80	-	-	0.00	0.00	-	0.00
27	12,071	12,071	□□□	108.0	0.00	92.63	-	-	0.00	0.00	-	0.00
28	12,403	12,403	□1□	108.0	0.00	92.87	-	-	0.00	0.00	-	0.00
29	12,935	12,935	-1□11	107.0	0.00	93.24	-	-	0.00	0.00	-	0.00
30	13,530	13,530	-1□1□	108.0	0.00	93.63	-	-	0.00	0.00	-	0.00
31	12,089	12,090	-□□1	107.0	0.00	92.65	-	-	0.00	0.00	-	0.00
32	10,012	10,012	□□□	107.0	0.00	91.01	-	-	0.00	0.00	-	0.00
33	11,395	11,396	□□8	107.0	0.00	92.13	-	-	0.00	0.00	-	0.00
201	14,528	14,528	-□□□	108.0	0.00	94.24	-	-	0.00	0.00	-	0.00
202	14,807	14,808	-□□□	108.0	0.00	94.41	-	-	0.00	0.00	-	0.00
203	15,611	15,611	-□□1	108.0	0.00	94.87	-	-	0.00	0.00	-	0.00
204	15,762	15,762	-□4□	108.0	0.00	94.95	-	-	0.00	0.00	-	0.00
205	16,288	16,288	-□□□	108.0	0.00	95.24	-	-	0.00	0.00	-	0.00
206	15,952	15,952	-□□4	108.0	0.00	95.06	-	-	0.00	0.00	-	0.00
207	16,654	16,654	-4□8	108.0	0.00	95.43	-	-	0.00	0.00	-	0.00
208	11,965	11,965	□□□	108.0	0.00	92.56	-	-	0.00	0.00	-	0.00
209	11,850	11,850	□8□	108.0	0.00	92.47	-	-	0.00	0.00	-	0.00
210	11,596	11,597	1□1□	108.0	0.00	92.29	-	-	0.00	0.00	-	0.00
211	10,413	10,414	□□1	108.0	0.00	91.35	-	-	0.00	0.00	-	0.00
212	10,005	10,006	□□□	108.0	0.00	91.01	-	-	0.00	0.00	-	0.00
213	9,572	9,573	□□4	108.0	0.00	90.62	-	-	0.00	0.00	-	0.00
214	9,371	9,371	4□4	108.0	0.00	90.44	-	-	0.00	0.00	-	0.00
215	8,997	8,997	48□	108.0	0.00	90.08	-	-	0.00	0.00	-	0.00
216	8,310	8,311	□□□	108.0	0.00	89.39	-	-	0.00	0.00	-	0.00
217	8,034	8,034	□4□	108.0	0.00	89.10	-	-	0.00	0.00	-	0.00
218	9,363	9,363	4□□	108.0	0.00	90.43	-	-	0.00	0.00	-	0.00
219	8,738	8,739	□□□	108.0	0.00	89.83	-	-	0.00	0.00	-	0.00
220	8,898	8,898	4□□	108.0	0.00	89.99	-	-	0.00	0.00	-	0.00
221	8,748	8,748	□□□	108.0	0.00	89.84	-	-	0.00	0.00	-	0.00
222	5,281	5,281	1□18	108.0	0.00	85.46	-	-	0.00	0.00	-	0.00
223	5,031	5,032	1□8□	108.0	0.00	85.03	-	-	0.00	0.00	-	0.00
224	6,896	6,896	8□□	108.0	0.00	87.77	-	-	0.00	0.00	-	0.00
225	6,780	6,781	88□	108.0	0.00	87.63	-	-	0.00	0.00	-	0.00
226	5,882	5,883	1□□□	108.0	0.00	86.39	-	-	0.00	0.00	-	0.00
227	5,805	5,805	1□□□	108.0	0.00	86.28	-	-	0.00	0.00	-	0.00
228	5,795	5,796	1□□□	108.0	0.00	86.26	-	-	0.00	0.00	-	0.00
229	6,290	6,291	□84	108.0	0.00	86.97	-	-	0.00	0.00	-	0.00
230	6,556	6,557	□□8	108.0	0.00	87.33	-	-	0.00	0.00	-	0.00
231	6,682	6,683	□□□	108.0	0.00	87.50	-	-	0.00	0.00	-	0.00
232	5,821	5,822	1□8□	108.0	0.00	86.30	-	-	0.00	0.00	-	0.00
233	6,090	6,091	1□□8	108.0	0.00	86.69	-	-	0.00	0.00	-	0.00
234	6,185	6,186	1□□□	108.0	0.00	86.83	-	-	0.00	0.00	-	0.00
235	6,935	6,936	8□1	108.0	0.00	87.82	-	-	0.00	0.00	-	0.00
301	16,858	16,858	-44□	108.0	0.00	95.54	-	-	0.00	0.00	-	0.00
302	17,365	17,365	-4□1	108.0	0.00	95.79	-	-	0.00	0.00	-	0.00
303	18,187	18,187	-□□1	108.0	0.00	96.20	-	-	0.00	0.00	-	0.00
304	18,799	18,799	-□1□	108.0	0.00	96.48	-	-	0.00	0.00	-	0.00
305	18,900	18,900	-□18	108.0	0.00	96.53	-	-	0.00	0.00	-	0.00
306	18,591	18,591	-□□4	108.0	0.00	96.39	-	-	0.00	0.00	-	0.00
307	17,807	17,807	-□□□	108.0	0.00	96.01	-	-	0.00	0.00	-	0.00
308	3,357	3,358	1□8□	108.0	0.00	81.52	-	-	0.00	0.00	-	0.00

To be continued on next page...

Project:

**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

Description:

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
 6/23/2011 1:33 PM/2.7.486

**DECIBEL - Detailed results**

**Calculation: BISON 3 Noise (with existing BISON 1, 2) Noise calculation model: ISO 9613-2 General 8.0 m/s**

...continued from previous page

**WTG**

**Wind speed: 8 m/s**

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
309	3,631	3,632	100.1	108.0	0.00	82.20	-	-	0.00	0.00	-	0.00
310	4,350	4,350	140.8	108.0	0.00	83.77	-	-	0.00	0.00	-	0.00
311	4,585	4,586	140.1	108.0	0.00	84.23	-	-	0.00	0.00	-	0.00
312	4,747	4,748	100.0	108.0	0.00	84.53	-	-	0.00	0.00	-	0.00
313	4,997	4,998	100.0	108.0	0.00	84.98	-	-	0.00	0.00	-	0.00
314	5,772	5,773	110.0	108.0	0.00	86.23	-	-	0.00	0.00	-	0.00
315	4,836	4,837	100.0	108.0	0.00	84.69	-	-	0.00	0.00	-	0.00
316	4,063	4,064	100.0	108.0	0.00	83.18	-	-	0.00	0.00	-	0.00
317	3,912	3,914	100.0	108.0	0.00	82.85	-	-	0.00	0.00	-	0.00
318	3,203	3,205	184.0	108.0	0.00	81.12	-	-	0.00	0.00	-	0.00
319	1,638	1,641	100.1	108.0	0.00	75.30	-	-	0.00	0.00	-	0.00
320	1,151	1,157	100.0	108.0	0.00	72.27	-	-	0.00	0.00	-	0.00
321	688	696	100.0	108.0	0.00	67.85	-	-	0.00	0.00	-	0.00
322	1,159	1,164	100.0	108.0	0.00	72.32	-	-	0.00	0.00	-	0.00
323	1,529	1,532	100.0	108.0	0.00	74.70	-	-	0.00	0.00	-	0.00
324	2,022	2,025	100.0	108.0	0.00	77.13	-	-	0.00	0.00	-	0.00
325	2,640	2,642	100.0	108.0	0.00	79.44	-	-	0.00	0.00	-	0.00
326	2,615	2,617	100.0	108.0	0.00	79.36	-	-	0.00	0.00	-	0.00
327	2,923	2,924	104.0	108.0	0.00	80.32	-	-	0.00	0.00	-	0.00
328	3,751	3,752	100.1	108.0	0.00	82.49	-	-	0.00	0.00	-	0.00
329	4,647	4,648	108.4	108.0	0.00	84.35	-	-	0.00	0.00	-	0.00
330	4,839	4,840	100.0	108.0	0.00	84.70	-	-	0.00	0.00	-	0.00
331	4,350	4,352	140.8	108.0	0.00	83.77	-	-	0.00	0.00	-	0.00
332	4,577	4,578	140.0	108.0	0.00	84.21	-	-	0.00	0.00	-	0.00
333	3,950	3,951	108.8	108.0	0.00	82.94	-	-	0.00	0.00	-	0.00
334	3,477	3,479	104.0	108.0	0.00	81.83	-	-	0.00	0.00	-	0.00
335	3,155	3,157	180.0	108.0	0.00	80.99	-	-	0.00	0.00	-	0.00

Sum 39.03

- Data undefined due to calculation with octave data

Project:

**Minnesota Power - BISON Wind Energy Center**

Minnesota Power  
 Frank Frederickson  
 30 West Superior Street  
 Duluth, MN 55802-2093

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Licensed user:

**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000

wind@eapc.net

Calculated:

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## DECIBEL - Assumptions for noise calculation

**Calculation:** BISON 3 Noise (with existing BISON 1, 2) **Noise calculation model:** ISO 9613-2 General 8.0 m/s

### Noise calculation model:

ISO 9613-2 General

### Wind speed:

8.0 m/s

### Ground attenuation:

General, Ground factor: 0.5

### Meteorological coefficient $C_m$ :

0.0 dB

### Type of demand in calculation:

1: WTG noise is compared to demand (DK, DE, SE, NL etc.)

### Noise values in calculation:

All noise values are mean values (Lwa) (Normal)

### Pure tones:

Pure and Impulse tone penalty are added to WTG source noise

### Height above the ground level when no value in NSA object:

0.0 m Don't allow override of model height with height from NSA object

### Deviation from official noise demands Negative is more restrictive positive is less restrictive

0.0 dB(A)

### Octave data required

Air absorption

	63	125	250	500	1,000	2,000	4,000	8,000
[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]
	0.1	0.4	1.0	1.9	3.7	9.7	32.8	117.0

**WTG:** Siemens SWT-2.3-101 60Hz 2300 101.0

**Noise:** SWT-2.3-101 Standard

Source	Source/Date	Creator	Edited
Siemens via MN Power	3/31/2009	USER	4/4/2011 3:12 PM

### Octave data

Status	Hub height	Wind speed	LwA,ref	Pure tones	63	125	250	500	1000	2000	4000	8000
	[m]	[m/s]	[dB(A)]		[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
From Windcat	80.0	8.0	107.0	No	83.5	94.4	98.1	102.1	102.1	98.4	91.2	87.2

**WTG:** Siemens SWT-3.0-101 60Hz 3000 101.0

**Noise:** SWT-3.0-101 Standard

Source	Source/Date	Creator	Edited
Siemens via MN Power	5/17/2010	USER	4/4/2011 3:17 PM

### Octave data

Status	Hub height	Wind speed	LwA,ref	Pure tones	63	125	250	500	1000	2000	4000	8000
	[m]	[m/s]	[dB(A)]		[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
From Windcat	80.0	8.0	108.0	No	82.8	94.7	101.4	104.7	101.4	93.5	82.6	79.3

**NSA:** NSP001-NSP001

### Predefined calculation standard:

**Imission height a g I:** Use standard value from calculation model

**Noise demand:** 45.0 dB(A)

**Distance demand:** 427.0 m

**NSA:** NSP002-NSP002

### Predefined calculation standard:

**Imission height a g I:** Use standard value from calculation model

**Noise demand:** 45.0 dB(A)

**Distance demand:** 427.0 m

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 Duluth, MN 55802-2093

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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
 Calculated:  
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**DECIBEL - Assumptions for noise calculation****Calculation:** BISON 3 Noise (with existing BISON 1, 2) **Noise calculation model:** ISO 9613-2 General 8.0 m/s**NSA:** NSP003-NSP003**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP004-NSP004**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP005-NSP005**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP006-NSP006**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP007-NSP007**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP008-NSP008**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP009-NSP009**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP010-NSP010**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m



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**EAPC Wind Energy**  
 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000

wind@eapc.net

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**DECIBEL - Assumptions for noise calculation****Calculation:** BISON 3 Noise (with existing BISON 1, 2) **Noise calculation model:** ISO 9613-2 General 8.0 m/s**NSA:** NSP011-NSP011**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP012-NSP012**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP013-NSP013**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP014-NSP014**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP015-NSP015**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP016-NSP016**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP017-NSP017**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP018-NSP018**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m

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 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
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**DECIBEL - Assumptions for noise calculation****Calculation:** BISON 3 Noise (with existing BISON 1, 2) **Noise calculation model:** ISO 9613-2 General 8.0 m/s**NSA:** NSP019-NSP019**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP020-NSP020**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP021-NSP021**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP022-NSP022**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP023-NSP023**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP024-NSP024**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP025-NSP025**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP026-NSP026**Predefined calculation standard:****Imission height a g I:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m

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 3100 DeMers Avenue  
 US-GRAND FORKS, ND 58201  
 +1 701 775 3000  
 wind@eapc.net  
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**DECIBEL - Assumptions for noise calculation****Calculation:** BISON 3 Noise (with existing BISON 1, 2) **Noise calculation model:** ISO 9613-2 General 8.0 m/s**NSA:** NSP027-NSP027**Predefined calculation standard:****Immission height a<sub>g</sub>:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP028-NSP028**Predefined calculation standard:****Immission height a<sub>g</sub>:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP029-NSP029**Predefined calculation standard:****Immission height a<sub>g</sub>:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP030-NSP030**Predefined calculation standard:****Immission height a<sub>g</sub>:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP031-NSP031**Predefined calculation standard:****Immission height a<sub>g</sub>:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m**NSA:** NSP032-NSP032**Predefined calculation standard:****Immission height a<sub>g</sub>:** Use standard value from calculation model**Noise demand:** 45.0 dB(A)**Distance demand:** 427.0 m