



EAPC
WIND ENERGY

Summary Report:

Lindahl Wind Farm Sound and Shadow Flicker Analysis Tioga, North Dakota

Submitted To:

Kevin Walter
TradeWind Energy, Inc.
Southlake Tech. Park
16105 W 113th St, Ste 1
Lenea, KS 66219
Tel: (913) 322-7420
E-mail: kwalter@tradewindenergy.com


Submitted By:

Brandon Storm, PhD
Jay Haley, P.E., Partner
EAPC Wind Energy
3100 DeMers Ave.
Grand Forks, ND, 58201
Tel: 701-775-3000
E-mail: wind@eapc.net

July 2,

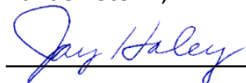
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Author:



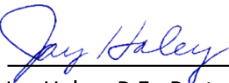
Brandon Storm, PhD

Checked By:



Jay Haley, P.E., Partner

Approved By:



Jay Haley, P.E., Partner

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Report Update

EAPC bears no responsibility to update this report for any changes occurring subsequent to the final issuance of this report.

Revision History

Revision No.	Revision Purpose	Date	Revised By
0	Original	02/17/2015	B. Storm
1	Typos / clarification	02/17/2015	B. Storm
2	Layout	06/16/2015	B. Storm
3	Participation designation	06/23/2015	B. Storm
4	Additional text	06/24/2015	B. Storm
5	Clarification	07/02/2015	B. Storm

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Executive Summary

EAPC was hired by TradeWind Energy, Inc. to provide a shadow flicker and sound analysis on residences within and surrounding the proposed wind farm of 80 wind turbines near Tioga, ND. Coordinates of the proposed turbines were supplied to EAPC via TradeWind (A034 layout). Occupied residence locations were determined in conjunction between TradeWind and EAPC through aerial images and site-visits. A map of the turbine locations and assumed occupied residences are shown in the Appendices.

At the time this report was issued, a specific turbine had not been selected. This report outlines the impacts using a variety of machines that are representative of likely turbine candidates. In particular, likely Vestas and GE turbine machines for the wind regime as dictated by TradeWind were evaluated (Table 1).

The noise produced from potential turbines varies, though a 108.5 dB(A) turbine mounted on a 84 m hub height (HH) (i.e., V117-3.3) produces the loudest sound level at the modeled receptors of the machines evaluated. Any turbine model with sound levels at or below those evaluated would be representative for the results presented. The worst case flicker resulted from the V117-3.3 turbine on a 91.5 m HH. Turbines with lower hub heights or shorter blades would result in a reduction of the size of the shadow flicker footprint. Details for the above stated results are presented in the rest of this report.

In summary, the A034 layout resulted in all occupied resident locations to be under 50 dB(A) within 100 ft of the home under the worst case scenario (no ground attenuation) when modeling a V110-2.0 turbine. Similarly, all of the occupied residences were below 50 dB(A) for the V117-3.3 from sound models that incorporated ground attenuation. All non-participating residences have anticipated sound levels below 43.5 dB(A) assuming worst case scenario. No non-participating residences are anticipated to experience any shadow flicker. All participating locations were below 30 hr/yr of shadow flicker for realistic assumptions and some obstacles when modeling the V110-2.0. Mitigation measures are recommended to reduce shadow flicker at two participating locations if the V117-3.3 turbine is selected for the final turbine to be installed.

Table 1: Specifications of turbines evaluated within this report for the Lindahl wind farm. Turbines listed are to be considered representative and not inclusive of all turbines that could be installed.

Manufacturer	Model	Name plate capacity (kW)	Rotor diameter (m)	Hub height (m)	Sound level (dB(A))
Vestas	V117-3.3	3,300	117	84/91.5	108.5
Vestas	V110-2.0	2,000	110	80	107.5
GE Wind Energy	GE 1.7-100	1,700	100	80	107.0
GE Wind Energy	GE 2.0-116	2,000	116	80	106.5

Shadow Flicker

For preliminary screening purposes, an absolute worst case shadow flicker scenario was analyzed using windPRO for the V117-3.3 on a 91.5 m HH. The worst case scenario assumes that the wind turbines are always operating, perpendicular to the sun, no cloud cover, all shadows within 1.5 km are visible, and that the sensors are 1 m by 1 m “Greenhouses.” Greenhouse sensor mode indicates that a shadow cast from any direction will be accumulated in the results. In reality, individual rooms and

windows would need to be modeled to determine the full impact on a house (i.e., if there are no windows on the side of a house where a shadow is cast, it would not be accumulated).

The worst case scenario resulted in ten locations, all participating in the project, being above 30 hours a year (an arbitrary value). A refined analysis was performed to determine if any turbines should be moved or if other forms of mitigation are warranted. This revised analysis included sunshine probabilities and operational statistics (Appendix A and B), but no obstacle blockage. The refined analysis resulted in five home locations having more than 30 hours a year of shadow flicker anticipated (Table 2).

Table 2: WindPRO estimated shadow flicker hours for realistic scenarios. Only receptors with reported shadow hours listed. All locations are participating residences.

Receptor	V117-3.3*	V117-3.3*	V110-2.0**
	Realistic Shadow No Obstacles (hrs/yr)	Realistic Shadow With Obstacles (hrs/yr)	Realistic Shadow With Obstacles (hrs/yr)
72448-P	29:17	29:17	20:08
73008-P	22:57	22:57	19:22
73047-P	18:03	18:03	15:36
73164-P	44:11	27:48	23:48
73183-P	51:41	51:41 #	27:27
73208-P	3:08	3:08	2:26
73215-P	21:47	21:47	18:09
73352-P	30:50	30:50	23:16
73437-P	22:41	22:41	19:49
73792-P	6:42	6:42	5:53
74133-P	43:53	19:42	18:41
73353-P	33:23	9:23	7:36

* 91.5 m HH ** 80 m HH #value drops to 20:41 hrs/yr when turbines 16 and 25 removed for the V117 option

To determine if those five participating locations were of high concern and if turbines were justified to be moved or excluded from the layout, a detailed shadow flicker analysis taking into consideration local obstacles (i.e., tree breaks) was performed. When taking into consideration local obstacles, and using a conservative estimate of the tree heights, all locations but two participating residences were below the arbitrary value of 30 hours per year (Table 2). Location 73352-P was close to 30 hours, so no further analysis was performed. However, it was determined that if the V117-3.3 turbine is selected for the project, and a site visit reveals the window locations of that residence face proposed turbine locations, a mitigation option would be turbines 16 and 25 not to be included to get realistic shadow flicker hours at 73183-P, a participating residence, to 20:41 hours/year. Turbine curtailment options would also be an option to reduce the shadow flicker at 73183-P. Another practical mitigation option would be to work in close relationship with the participating landowner and establish a vegetative buffer or window dressings that block the potential shadow flicker. Details regarding the refined shadow flicker analysis including obstacles for locations 73164-P, 74133-P, and 73353-P can be found in Appendix C and D.

To determine if turbines should be excluded from the layout for turbines with rotor diameters below 110 m or shorter, a realistic analysis for the V110-2.0 with an 80 m HH was performed. All turbines

with a rotor diameter of 110 m or less resulted in all residences having anticipated realistic shadow flicker hours below 30 hours per year, taking into consideration obstacles (Table 2, Appendix E and F).

Sound

For preliminary screening purposes, a worst case noise scenario was analyzed using windPRO. The worst case scenario assumes that the wind turbines are operating at a wind speed that results in the loudest noise being emitted. According to information supplied by the client, the loudest normal operating noise level emitted from the turbines in consideration was 108.5 dB(A) for the Vestas V117-3.3. The noise emission level of 108.5 dB(A) occurs for hub height wind speeds of 10 m/s for the Vestas V117-3.3 turbine. While it is very likely a hub height of greater than 84 m will be selected for the V117-3.3, the sound analysis of a hub height of 84 m resulted in the highest noise level at the modeled receptors. Therefore, all the results presented from here on are based on the lowest hub height of each turbine being considered, and would only improve with higher hub heights.

The windPRO analysis used the ISO 9613-2 General noise calculation model with no ambient noise considered three different ways; with no ground attenuation, General attenuation (ground factor of 0.7), and Alternative attenuation. Noise levels were modeled 1.5 m above ground level (AGL) at the potential occupied residences and did not incorporate ambient noise. The worst case scenario (no ground attenuation) resulted in two participating locations being above 50 dB(A) within 100 ft of the house (Table 3). The highest non-participating landowner had an anticipated sound level of 43.4 dB(A) for the worst case scenario. Results and maps depicting the worst case noise scenario results are shown in Appendix G and Appendix H. The V117-3.3 with a 91.5 m HH did not result in any significant differences with the location still being above the 50 dB(A) threshold.

For the two locations, 73164-P and 74133-P, exceeding 50 dB(A), three refined analyses were performed. The refined analyses included, the General ground attenuation option (Appendix I and Appendix J) and the Alternative ground attenuation option (Appendix K and Appendix L) windPRO settings, and analyzing the next loudest turbine being considered, V110-2.0 at 107.5 dB(A), with no ground attenuation (Appendix M and Appendix N). The more refined and realistic calculations resulted in all locations with a predicted noise level contributed from the proposed turbines below 50 dB(A) within 100 ft of the sensor locations.

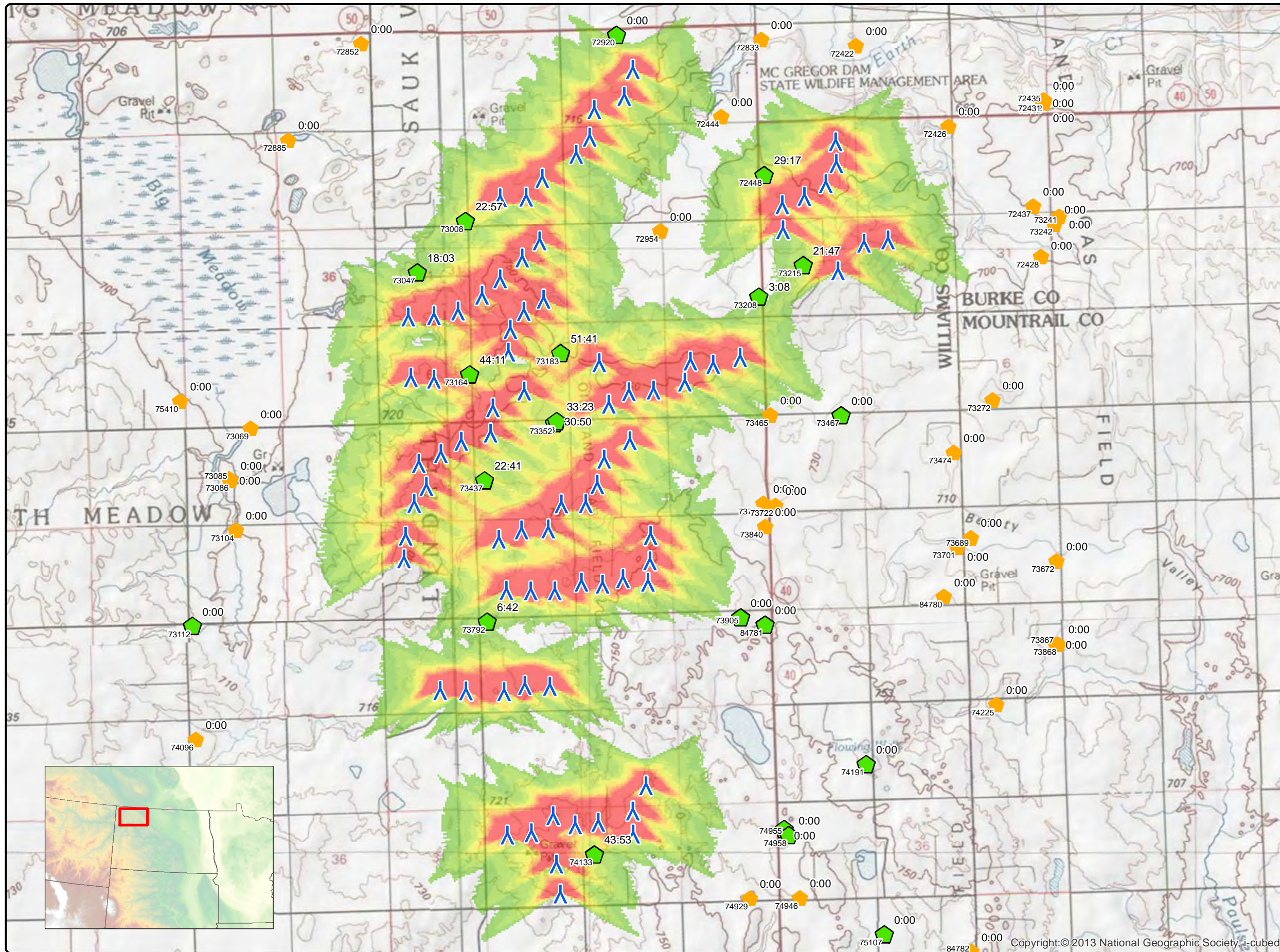
The Alternative ground attenuation option takes into account local terrain (e.g. hills and valleys) as well as a porous surface, while the General ground attenuation option assumes flat terrain or sloping terrain, and a porous surface. The Alternative method does take into account varying terrain.

If all of the turbines locations under consideration have a noise emission level of 108.5 dB(A) or less, no mitigation options are anticipated to be necessary to satisfy North Dakota State regulations regarding acceptable sound levels of 50 dB(A) or below within 100 ft of a noise sensitive point.

Table 3: Noise estimates from windPRO assuming various ground attenuation. Results presented for locations with no ground attenuation results above 35 dB(A). The sound levels are estimated at the center of the house. Distances required to travel from the house to reach 50 dB(A) can be found in the full windPRO reports in the appendices (all are greater than 100 ft for V110-2.0). P indicates location is a participating landowner, NP denotes the location is a non-participating landowner.

Sensor	V117-3.3			
	No Ground Atten. (dB(A))	V117-3.3 General Ground Atten. (dB(A))	V117-3.3 Alternative Ground Atten. (dB(A))	V110 – 2.0 No Ground Atten. (dB(A))
72426-NP	38.2	33.5	34.0	37.2
72444-NP	41.8	37.1	37.8	40.8
72448-P	47.8	43.3	44.8	46.8
72833-NP	38.3	33.7	33.7	37.3
72920-P	45.1	40.6	41.9	44.1
72954-NP	43.1	38.2	39.0	42.1
73008-P	47.2	42.6	43.7	46.2
73047-P	47.4	42.8	44.1	46.4
73069-NP	37.5	33.0	33.1	36.5
73085-NP	36.4	32.1	32.0	35.4
73086-NP	36.5	32.1	32.1	35.5
73104-NP	36.5	32.2	32.1	35.5
73164-P	50.5	46.0	47.5	49.5
73183-P	49.5	44.9	46.2	48.5
73208-P	44.7	40.0	41.0	43.8
73215-P	48.1	43.6	45.2	47.1
73352-P	49.0	44.4	45.5	48.0
73437-P	49.5	44.9	46.1	48.5
73465-NP	43.4	38.7	39.5	42.4
73467-P	39.2	34.6	34.9	38.2
73722-NP	40.2	35.6	35.9	39.2
73729-NP	40.9	36.2	36.6	39.9
73792-P	48.2	43.6	45.0	47.2
73840-NP	40.6	35.9	36.2	39.6
73905-P	40.7	36.1	36.5	39.7
74133-P	50.4	46.0	47.8	49.4
74929-NP	36.5	32.0	32.3	35.5
74955-P	36.2	31.8	31.9	35.2
74958-P	35.9	31.5	31.6	34.9
72422-NP	38.1	33.5	33.9	37.1
73353-P	49.1	44.4	45.5	48.1
84781-P	39.1	34.5	34.7	38.1

Appendix A: Realistic Shadow Flicker Map – V117-3.3 91.5 m HH, without Obstacles




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**Lindahl Wind Farm
V117 Realistic Shadow Flicker
No Obstacles**

Client

TradeWind Energy, Inc.

Project Description

75 Primary WTG locations & 5 Alts (A034) for V117-3.3 on 91.5 m HH. Realistic shadow flicker map and data at receptors (hrs/yr). Assumes statistical reduction due to sunshine probability, turbine orientation and operation probability. Sensors in "greenhouse" mode. No obstacles assumed.

Location: Tioqa, ND




Project #: 20132550

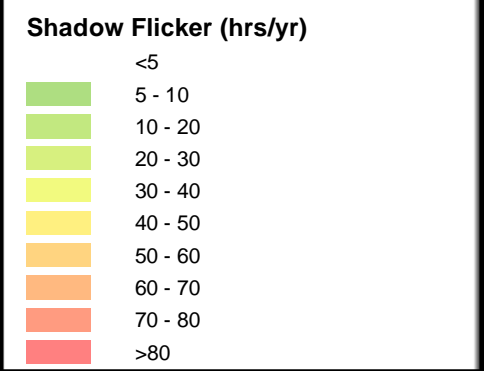
Issue Dates

#	Description	Date
1	Preliminary Draft	2015.06.23


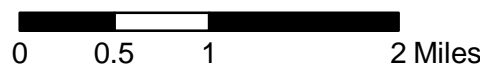
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Legend

-  V117 WTG A034
-  Non-Participating Residences
-  Participating Residence



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Appendix B: windPRO Shadow Flicker Report - V117- 3.3 91.5 m HH, without Obstacles

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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EAPC Wind Energy
 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 3:57 PM/2.9.285

SHADOW - Main Result

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab

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

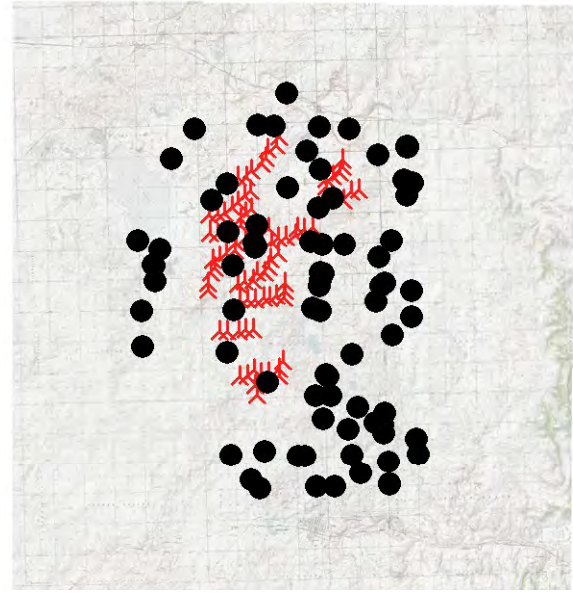
Sunshine probability S (Average daily sunshine hours) [BISMARCK]
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

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

DNV Shadow

Operational time
 N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
 663 334 354 413 612 967 793 577 699 909 1,123 1,198 8,641
 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: 20100616_Lindahl_10ft_HCL.wpo (1)
 Obstacles not used in calculation
 Eye height: 1.5 m
 Grid resolution: 10.0 m



Scale 1:400,000
 New WTG Shadow receptor

WTGs

UTM NAD83 Zone: 13

	East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]
5	646,913	5,375,455	745.7	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
12	648,319	5,377,157	750.7	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
13	648,353	5,377,573	752.5	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
14	648,872	5,377,853	752.9	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
15	648,611	5,378,490	759.0	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
16	648,641	5,378,869	759.0	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
17	648,868	5,379,168	761.9	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
18	649,189	5,379,368	749.8	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
19	648,477	5,379,703	762.0	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
20	648,837	5,380,044	745.1	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
21	648,176	5,379,834	743.7	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
22	649,124	5,380,328	729.3	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
24	651,007	5,377,868	749.0	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
25	650,109	5,378,321	754.1	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
26	651,525	5,378,000	751.5	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
27	651,616	5,378,348	758.6	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
28	651,987	5,378,290	755.5	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
29	652,436	5,378,405	749.8	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
34	654,047	5,379,834	743.7	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
35	654,478	5,380,290	740.5	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
36	654,876	5,380,346	731.4	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
37	649,468	5,369,552	735.9	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
38	649,403	5,370,046	745.2	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
39	648,989	5,370,563	740.7	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
40	649,348	5,370,846	749.8	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
42	650,668	5,370,540	746.8	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
43	650,667	5,370,918	744.1	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
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SHADOW - Main Result

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab

...continued from previous page

UTM NAD83 Zone: 13				WTG type						
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]
45	650,882	5,371,340	743.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
67	649,484	5,375,990	732.9 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
68	649,889	5,375,994	741.6 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
69	650,079	5,376,307	740.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
83	648,826	5,375,558	729.9 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
84	648,982	5,374,557	737.6 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
85	648,580	5,374,558	735.1 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
97	648,537	5,372,891	719.3 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
98	648,903	5,381,054	722.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
99	649,170	5,381,363	721.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
100	649,950	5,382,038	713.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
101	650,030	5,382,496	712.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
102	650,525	5,382,713	713.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
104	650,189	5,376,726	739.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
105	650,267	5,377,632	746.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
114	648,476	5,381,043	724.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
150	650,663	5,383,159	707.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
151	650,947	5,375,049	753.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
152	650,911	5,374,694	758.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
154	650,163	5,374,664	746.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
155	649,378	5,374,555	741.3 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
158	650,614	5,377,029	737.6 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
160	647,380	5,378,047	737.6 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
161	647,780	5,379,172	731.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
166	647,487	5,372,910	715.6 Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
170	647,835	5,377,018	752.9 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
171	647,495	5,376,819	749.1 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
175	653,143	5,380,511	713.2 Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
176	653,130	5,380,927	710.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
177	653,497	5,381,062	704.1 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
178	653,850	5,381,276	700.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
182	647,004	5,378,073	731.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
184	650,599	5,377,842	746.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
185	647,385	5,379,098	722.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
186	646,960	5,379,073	712.5 Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
153b	650,500	5,374,756	749.1 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
156b	649,818	5,374,694	743.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
164b	649,297	5,372,977	725.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
165b	647,909	5,372,903	716.3 Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
172b	647,131	5,376,655	743.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
173b	647,258	5,376,278	743.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
174c	647,056	5,376,002	741.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
179b	654,022	5,381,604	696.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
180b	654,011	5,381,966	694.9 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
181b	648,451	5,375,405	728.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
183b	649,728	5,381,758	721.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
205b	648,594	5,370,523	731.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
206b	650,092	5,370,737	743.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
41b	649,714	5,370,690	746.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
66b	649,269	5,375,574	732.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
6b	646,888	5,375,080	743.7 Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
70b	650,956	5,375,465	751.0 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
96b	648,884	5,372,995	722.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 3:57 PM/2.9.285

SHADOW - Main Result

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab

Shadow receptor-Input

UTM NAD83 Zone: 13

No.	Name	UTM NAD83 Zone: 13			Width	Height	Height a.g.l.	Degrees from south	Slope of window	Direction mode
		East	North	Z						
		[m]	[m]	[m]	[m]	[m]	[°]	[°]		
72422	House	654,346	5,383,551	675.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72426	House	655,873	5,382,222	689.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72428	House	657,399	5,380,070	700.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72431	Field Office	657,434	5,382,649	698.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72432	Field Office	657,452	5,382,650	698.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72433	Field Office	657,452	5,382,638	698.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72434	Field Office	657,431	5,382,638	699.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72435	Field Office	657,425	5,382,612	699.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72436	Field Office	657,443	5,382,612	699.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72437	House	657,270	5,380,900	701.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72444	House	652,124	5,382,382	698.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72448	House	652,833	5,381,417	705.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72833	House	652,780	5,383,651	684.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72843	House	651,086	5,385,430	681.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72852	House	646,183	5,383,581	712.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72885	House	644,980	5,381,994	704.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72910	Garage	649,528	5,383,760	704.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72920	House	650,400	5,383,729	711.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72954	House	651,119	5,380,491	705.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73008	House	647,905	5,380,657	723.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73047	House	647,113	5,379,805	712.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73069	House	644,362	5,377,232	698.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73085	House	644,011	5,376,402	703.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73086	House	644,029	5,376,379	703.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73104	House	644,116	5,375,556	701.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73112	House	643,400	5,373,971	710.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73164	House	647,974	5,378,125	736.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73183	House	649,476	5,378,474	747.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73208	House	652,746	5,379,403	722.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73215	House	653,476	5,379,925	741.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73241	House	657,701	5,380,739	704.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73242	House	657,625	5,380,605	701.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73272	House	656,603	5,377,699	728.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73307	House	652,350	5,377,616	735.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73352	House	649,372	5,377,319	734.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73353	Garage	649,411	5,377,350	734.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73437	House	648,222	5,376,376	731.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73465	House	652,934	5,377,454	728.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73467	House	654,105	5,377,449	726.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73474	House	655,962	5,376,837	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73672	House	657,653	5,375,042	704.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73689	House	656,242	5,375,429	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73701	House	656,021	5,375,274	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73722	House	653,014	5,375,966	734.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73729	House	652,820	5,375,995	733.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73792	House	648,263	5,374,042	728.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73840	House	652,848	5,375,611	736.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73848	Probably Occupied	652,773	5,375,266	744.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73867	House	657,646	5,373,676	710.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73868	House	657,685	5,373,674	711.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73905	House	652,445	5,374,111	759.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74072	Occupiable Structure, per field notes	647,929	5,371,803	716.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74096	House	643,453	5,372,099	716.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74133	House	650,034	5,370,204	742.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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EAPC Wind Energy
 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 3:57 PM/2.9.285

SHADOW - Main Result

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab

...continued from previous page

UTM NAD83 Zone: 13

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from/south	Slope of window	Direction mode
74191	House	654,514	5,371,692	765.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74225	House	656,662	5,372,675	722.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74929	House	652,597	5,369,477	749.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74944	House	652,987	5,368,263	755.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74946	House	653,421	5,369,486	746.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74955	House	653,163	5,370,620	746.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74958	House	653,237	5,370,521	746.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74997	House	656,161	5,367,989	720.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75017	House	655,758	5,368,066	719.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75019	House	656,215	5,367,523	716.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75023	House	657,919	5,367,212	720.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75024	House	657,910	5,367,229	720.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75035	House	658,012	5,366,393	701.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75048	House	656,450	5,365,968	719.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75051	House	656,481	5,364,835	702.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75052	House	656,500	5,364,785	701.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75060	House	654,953	5,365,361	717.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75107	House	654,816	5,368,880	743.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75125	House	654,533	5,366,347	734.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75164	House	653,608	5,364,657	704.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75171	House	652,658	5,364,673	707.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75178	House	652,044	5,366,274	727.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75181	House	651,664	5,366,273	728.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75198	House	649,867	5,366,571	723.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75240	House	648,111	5,366,363	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75250	House	649,156	5,365,047	710.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75262	House	649,634	5,364,566	718.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75410	House	643,198	5,377,684	702.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
77282	Office/Farm	649,350	5,377,570	737.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84780	Occupied structure per Field Notes, not on imagery	655,800	5,374,456	722.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84781	House	652,849	5,373,992	753.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84782	Occupied fifth wheel	656,251	5,368,598	741.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84783	New house per field notes	654,290	5,367,724	742.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
72422	House	0:00	0	0:00	0:00
72426	House	0:00	0	0:00	0:00
72428	House	0:00	0	0:00	0:00
72431	Field Office	0:00	0	0:00	0:00
72432	Field Office	0:00	0	0:00	0:00
72433	Field Office	0:00	0	0:00	0:00
72434	Field Office	0:00	0	0:00	0:00
72435	Field Office	0:00	0	0:00	0:00
72436	Field Office	0:00	0	0:00	0:00
72437	House	0:00	0	0:00	0:00
72444	House	0:00	0	0:00	0:00
72448	House	80:32	207	0:44	29:17

To be continued on next page...

<p>Project: 20132550- Lindahl Wind Farm</p> <p>TradeWind Energy, Inc. Kevin Walter Southlake Technology Park, 16105 W 113th St, Ste 1 Lenexa, KS, 66219</p>	<p>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.</p>	<p>Printed/Page 6/16/2015 11:50 AM / 5</p> <p>Licensed user: EAPC Wind Energy 3100 DeMers Avenue US-GRAND FORKS, ND 58201 +1 701 775 3000 Brandon Storm / bstorm@eapc.net</p> <p>Calculated: 6/15/2015 3:57 PM/2.9.285</p>
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SHADOW - Main Result

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab

...continued from previous page

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
72833	House	0:00	0	0:00	0:00
72843	House	0:00	0	0:00	0:00
72852	House	0:00	0	0:00	0:00
72885	House	0:00	0	0:00	0:00
72910	Garage	7:20	32	0:21	2:30
72920	House	0:00	0	0:00	0:00
72954	House	0:00	0	0:00	0:00
73008	House	57:51	183	0:29	22:57
73047	House	50:40	129	0:32	18:03
73069	House	0:00	0	0:00	0:00
73085	House	0:00	0	0:00	0:00
73086	House	0:00	0	0:00	0:00
73104	House	0:00	0	0:00	0:00
73112	House	0:00	0	0:00	0:00
73164	House	112:26	209	0:59	44:11
73183	House	137:53	274	0:47	51:41
73208	House	7:44	33	0:21	3:08
73215	House	50:39	114	0:46	21:47
73241	House	0:00	0	0:00	0:00
73242	House	0:00	0	0:00	0:00
73272	House	0:00	0	0:00	0:00
73307	House	42:25	105	0:32	21:00
73352	House	75:31	180	0:58	30:50
73353	Garage	84:04	208	0:54	33:23
73437	House	55:33	202	0:36	22:41
73465	House	0:00	0	0:00	0:00
73467	House	0:00	0	0:00	0:00
73474	House	0:00	0	0:00	0:00
73672	House	0:00	0	0:00	0:00
73689	House	0:00	0	0:00	0:00
73701	House	0:00	0	0:00	0:00
73722	House	0:00	0	0:00	0:00
73729	House	0:00	0	0:00	0:00
73792	House	16:11	69	0:24	6:42
73840	House	0:00	0	0:00	0:00
73848	Probably Occupied	0:00	0	0:00	0:00
73867	House	0:00	0	0:00	0:00
73868	House	0:00	0	0:00	0:00
73905	House	0:00	0	0:00	0:00
74072	Occupiable Structure, per field notes	0:00	0	0:00	0:00
74096	House	0:00	0	0:00	0:00
74133	House	115:44	238	0:42	43:53
74191	House	0:00	0	0:00	0:00
74225	House	0:00	0	0:00	0:00
74929	House	0:00	0	0:00	0:00
74944	House	0:00	0	0:00	0:00
74946	House	0:00	0	0:00	0:00
74955	House	0:00	0	0:00	0:00
74958	House	0:00	0	0:00	0:00
74997	House	0:00	0	0:00	0:00
75017	House	0:00	0	0:00	0:00
75019	House	0:00	0	0:00	0:00
75023	House	0:00	0	0:00	0:00
75024	House	0:00	0	0:00	0:00

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.

Kevin Walter

Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

Description:

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EAPC Wind Energy

3100 DeMers Avenue

US-GRAND FORKS, ND 58201

+1 701 775 3000

Brandon Storm / bstorm@eapc.net

Calculated:

6/15/2015 3:57 PM/2.9.285

SHADOW - Main Result**Calculation:** A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab

...continued from previous page

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
75035	House	0:00	0	0:00	0:00
75048	House	0:00	0	0:00	0:00
75051	House	0:00	0	0:00	0:00
75052	House	0:00	0	0:00	0:00
75060	House	0:00	0	0:00	0:00
75107	House	0:00	0	0:00	0:00
75125	House	0:00	0	0:00	0:00
75164	House	0:00	0	0:00	0:00
75171	House	0:00	0	0:00	0:00
75178	House	0:00	0	0:00	0:00
75181	House	0:00	0	0:00	0:00
75198	House	0:00	0	0:00	0:00
75240	House	0:00	0	0:00	0:00
75250	House	0:00	0	0:00	0:00
75262	House	0:00	0	0:00	0:00
75410	House	0:00	0	0:00	0:00
77282	Office/Farm	63:51	167	0:57	24:54
84780	Occupied structure per Field Notes, not on imagery	0:00	0	0:00	0:00
84781	House	0:00	0	0:00	0:00
84782	Occupied fifth wheel	0:00	0	0:00	0:00
84783	New house per field notes	0:00	0	0:00	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
5	Primary	0:00	0:00
12	Primary	21:52	8:04
13	Primary	67:47	24:53
14	Primary	56:26	17:42
15	Primary	47:26	19:55
16	Primary	35:08	17:41
17	Primary	0:00	0:00
18	Primary	0:00	0:00
19	Primary	6:30	2:53
20	Primary	14:36	5:02
21	Primary	10:06	3:46
22	Primary	6:23	2:25
24	Primary	6:15	2:48
25	Primary	28:24	11:51
26	Primary	36:10	18:12
27	Primary	0:00	0:00
28	Primary	0:00	0:00
29	Primary	0:00	0:00
34	Primary	43:22	18:43
35	Primary	12:59	5:21
36	Primary	3:43	1:27
37	Primary	24:31	6:12
38	Primary	28:13	10:42
39	Primary	12:23	5:52
40	Primary	0:00	0:00
42	Primary	47:14	19:52
43	Primary	0:00	0:00
45	Primary	0:00	0:00

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.

Kevin Walter

Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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US-GRAND FORKS, ND 58201

+1 701 775 3000

Brandon Storm / bstorm@eapc.net

Calculated:

6/15/2015 3:57 PM/2.9.285

SHADOW - Main Result**Calculation:** A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
67	Primary	5:27	1:54
68	Primary	0:00	0:00
69	Primary	0:00	0:00
83	Primary	0:00	0:00
84	Primary	3:04	1:12
85	Primary	0:00	0:00
97	Primary	0:00	0:00
98	Primary	13:37	5:40
99	Primary	9:44	4:01
100	Primary	0:00	0:00
101	Primary	0:00	0:00
102	Primary	0:00	0:00
104	Primary	45:37	15:29
105	Primary	43:34	17:42
114	Primary	16:01	6:28
150	Primary	7:20	2:30
151	Primary	0:00	0:00
152	Primary	0:00	0:00
154	Primary	0:00	0:00
155	Primary	13:07	5:29
158	Primary	13:51	5:09
160	Primary	33:35	14:05
161	Primary	34:04	11:22
166	Alternate	0:00	0:00
170	Primary	0:00	0:00
171	Primary	6:44	3:22
175	Alternate	0:00	0:00
176	Primary	31:45	10:16
177	Primary	25:06	8:51
178	Primary	9:30	4:05
182	Primary	10:51	4:34
184	Primary	25:09	9:55
185	Primary	0:00	0:00
186	Alternate	0:00	0:00
153b	Primary	0:00	0:00
156b	Primary	0:00	0:00
164b	Primary	0:00	0:00
165b	Alternate	0:00	0:00
172b	Primary	11:27	5:17
173b	Primary	12:28	5:17
174c	Primary	7:06	2:29
179b	Primary	6:20	2:35
180b	Primary	7:51	3:16
181b	Primary	0:00	0:00
183b	Primary	0:00	0:00
205b	Primary	3:23	1:31
206b	Primary	0:00	0:00
41b	Primary	0:00	0:00
66b	Primary	12:21	4:19
6b	Alternate	0:00	0:00
70b	Primary	0:00	0:00
96b	Primary	0:00	0:00

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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US-GRAND FORKS, ND 58201
+1 701 775 3000
Brandon Storm / bstorm@eapc.net
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6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab Shadow receptor: 72448 - House

Assumptions for shadow calculations

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

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

Operational time

Table with 13 columns (N-NNW) and 2 rows of operational time data.

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

Main shadow calculation table with columns for months (January-June) and rows for each hour of the day (08:45 to 17:48). Includes a summary section at the bottom 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

Matrix defining table layout: 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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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 Brandon Storm / bstorm@eapc.net
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SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 72448 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	July	August	September	October	November	December	
1 05:54	06:26	06:51 (180b) 07:08	07:32 (179b) 07:51	08:13 (178) 07:37	08:06 (177) 08:22	10:13 (176)	
2 05:54	06:27	06:53 (180b) 07:10	07:33 (179b) 07:52	08:15 (178) 07:39	08:06 (177) 08:24	10:12 (176)	
3 05:55	06:28	06:54 (180b) 07:11	07:35 (179b) 07:54	08:16 (178) 07:41	08:07 (177) 08:25	10:11 (176)	
4 05:56	06:30	06:55 (180b) 07:13	07:36 (179b) 07:55	08:18 (178) 07:42	08:07 (177) 08:26	10:12 (176)	
5 05:56	06:31	06:56 (180b) 07:14	07:37 (179b) 07:56	08:19 (178) 07:44	08:09 (177) 08:27	10:11 (176)	
6 05:57	06:32	06:58 (180b) 07:15	07:39 (179b) 07:58	08:21 (178) 07:45	08:11 (177) 08:28	10:11 (176)	
7 05:58	06:34	06:59 (180b) 07:17	07:40 (179b) 07:59	08:22 (178) 07:47	08:13 (177) 08:30	10:11 (176)	
8 05:59	06:35	07:00 (180b) 07:18	07:41 (179b) 08:01	08:26 (178) 07:49	08:14 (177) 08:31	10:11 (176)	
9 06:00	06:36	07:02 (180b) 07:20	07:42 (179b) 08:02	08:27 (178) 07:50	08:15 (177) 08:32	10:11 (176)	
10 06:00	06:38	07:04 (180b) 07:22	07:44 (179b) 08:04	08:28 (178) 07:52	08:16 (177) 08:33	10:11 (176)	
11 06:01	06:39	07:06 (180b) 07:24	07:46 (179b) 08:06	08:29 (178) 07:54	08:17 (177) 08:34	10:11 (176)	
12 06:02	06:40	07:08 (180b) 07:26	07:48 (179b) 08:08	08:30 (178) 07:56	08:18 (177) 08:35	10:11 (176)	
13 06:03	06:42	07:10 (180b) 07:28	07:50 (179b) 08:10	08:31 (178) 07:58	08:19 (177) 08:36	10:11 (176)	
14 06:04	06:43	07:12 (180b) 07:30	07:52 (179b) 08:12	08:32 (178) 07:59	08:20 (177) 08:37	10:12 (176)	
15 06:05	06:45	07:14 (180b) 07:32	07:54 (179b) 08:14	08:33 (178) 08:01	08:21 (177) 08:38	10:13 (176)	
16 06:06	06:46	07:16 (180b) 07:34	07:56 (179b) 08:16	08:34 (178) 08:02	08:22 (177) 08:39	10:13 (176)	
17 06:07	06:47	07:18 (180b) 07:36	07:58 (179b) 08:18	08:35 (178) 08:03	08:23 (177) 08:40	10:14 (176)	
18 06:08	06:49	07:20 (180b) 07:38	08:00 (179b) 08:20	08:36 (178) 08:04	08:24 (177) 08:41	10:14 (176)	
19 06:10	06:50	07:22 (180b) 07:40	08:02 (179b) 08:22	08:37 (178) 08:05	08:25 (177) 08:42	10:15 (176)	
20 06:11	06:52	07:24 (180b) 07:42	08:04 (179b) 08:24	08:38 (178) 08:06	08:26 (177) 08:43	10:15 (176)	
21 06:12	06:53	07:26 (180b) 07:44	08:06 (179b) 08:26	08:39 (178) 08:07	08:27 (177) 08:44	10:16 (176)	
22 06:13	06:54	07:28 (180b) 07:46	08:08 (179b) 08:28	08:40 (178) 08:08	08:28 (177) 08:45	10:16 (176)	
23 06:14	06:56	07:30 (180b) 07:48	08:10 (179b) 08:30	08:41 (178) 08:09	08:29 (177) 08:46	10:17 (176)	
24 06:15	06:57	07:32 (180b) 07:50	08:12 (179b) 08:32	08:42 (178) 08:10	08:30 (177) 08:47	10:17 (176)	
25 06:17	06:59	07:34 (180b) 07:52	08:14 (179b) 08:34	08:43 (178) 08:11	08:31 (177) 08:48	10:18 (176)	
26 06:18	07:00	07:36 (180b) 07:54	08:16 (179b) 08:36	08:44 (178) 08:12	08:32 (177) 08:49	10:18 (176)	
27 06:19	07:01	07:38 (180b) 07:56	08:18 (179b) 08:38	08:45 (178) 08:13	08:33 (177) 08:50	10:19 (176)	
28 06:20	07:03	07:40 (180b) 07:58	08:20 (179b) 08:40	08:46 (178) 08:14	08:34 (177) 08:51	10:19 (176)	
29 06:22	07:04	07:42 (180b) 08:00	08:22 (179b) 08:42	08:47 (178) 08:15	08:35 (177) 08:52	10:20 (176)	
30 06:23	07:06	07:44 (180b) 08:02	08:24 (179b) 08:44	08:48 (178) 08:16	08:36 (177) 08:53	10:20 (176)	
31 06:24	07:07	07:46 (180b) 08:04	08:26 (179b) 08:46	08:49 (178) 08:17	08:37 (177) 08:54	10:21 (176)	
Potential sun hours	486	445	379	336	277	260	1269
Total, worst case	167	165	288	518	448		0.44
Sun reduction	0.75	0.72	0.69	0.52	0.44		0.99
Oper. time red.	0.99	0.99	0.99	0.99	0.99		0.69
Wind dir. red.	0.60	0.62	0.68	0.72	0.71		0.30
Total reduction	0.44	0.45	0.46	0.37	0.31		0.30
Total, real	74	74	133	193	138		386

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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 US-GRAND FORKS, ND 58201
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SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 73008 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	January	February	March	April	May	June
1 08:45	08:23	08:57 (20)	07:35	07:58 (22)	07:32	06:34
17:07	17:50	25 09:22 (20)	18:34	19 08:17 (22)	20:21	21:05
2 08:45	08:21	08:56 (20)	07:33	07:56 (22)	07:30	06:32
17:08	17:52	25 09:21 (20)	18:35	21 08:17 (22)	20:22	21:06
3 08:45	08:20	08:57 (20)	07:32	07:56 (22)	07:28	06:31
17:09	17:53	24 09:21 (20)	18:37	20 08:16 (22)	20:24	21:08
4 08:45	08:19	08:58 (20)	07:30	07:56 (22)	07:26	06:29
17:10	17:55	22 09:20 (20)	18:39	20 08:16 (22)	20:25	21:09
5 08:44	08:17	08:59 (20)	07:28	07:57 (22)	07:24	06:27
17:11	17:57	21 09:20 (20)	18:40	17 08:14 (22)	20:27	21:11
6 08:44	08:16	09:00 (20)	07:26	07:58 (22)	07:22	06:26
17:13	17:58	19 09:19 (20)	18:42	15 08:13 (22)	20:28	21:12
7 08:44	08:14	09:01 (20)	07:24	08:00 (22)	07:19	06:24
17:14	18:00	17 09:18 (20)	18:43	11 08:11 (22)	20:30	21:13
8 08:44	08:13	09:03 (20)	08:22	07:17	07:17	06:23
17:15	18:00	13 09:16 (20)	18:45	20:31	21:15	21:15
9 08:43	08:11	09:06 (20)	08:20	07:15	06:21	06:21
17:16	18:02	8 09:14 (20)	19:46	20:33	21:16	21:16
10 08:43	08:09	08:17	08:17	07:13	06:20	06:20
17:17	18:03	19:48	20:34	21:18	21:18	21:18
11 08:42	08:08	08:15	08:15	07:11	06:18	06:18
17:19	18:05	19:49	20:36	21:19	21:19	21:19
12 08:42	08:06	08:13	08:13	07:09	06:17	06:17
17:20	18:06	19:51	20:37	21:20	21:20	21:20
13 08:41	08:05	08:11	08:11	07:07	06:15	06:15
17:21	18:08	19:52	20:38	21:22	21:22	21:22
14 08:41	08:03	08:09	08:09	07:05	06:14	06:14
17:23	18:10	19:54	20:40	21:23	21:23	21:23
15 08:40	08:01	08:07	08:07	07:03	06:13	06:13
17:24	18:11	19:55	20:41	21:25	21:25	21:25
16 08:39	07:59	08:05	08:05	07:02	06:11	06:11
17:25	18:13	19:57	20:43	21:26	21:26	21:26
17 08:39	07:58	08:03	08:03	07:00	06:10	06:10
17:27	18:15	19:58	20:44	21:27	21:27	21:27
18 08:38	09:04 (20)	07:56	08:01	06:58	06:09	06:09
17:28	3 09:07 (20)	18:16	20:00	20:46	21:28	21:28
19 08:37	09:03 (20)	07:54	07:59	06:56	06:08	06:08
17:30	8 09:11 (20)	18:18	20:01	20:47	21:30	21:30
20 08:36	09:02 (20)	07:52	07:57	06:54	06:06	06:06
17:31	11 09:13 (20)	18:19	20:03	20:49	21:31	21:31
21 08:35	09:01 (20)	07:51	07:55	06:52	06:05	06:05
17:33	14 09:15 (20)	18:21	20:04	20:50	21:32	21:32
22 08:34	09:00 (20)	07:49	07:53	06:50	06:04	06:04
17:34	16 09:16 (20)	18:23	20:06	20:52	21:34	21:34
23 08:33	08:58 (20)	07:47	07:51	06:48	06:03	06:03
17:36	18 09:16 (20)	18:24	3 08:13 (22)	20:07	20:53	21:35
24 08:32	08:57 (20)	07:45	07:48	06:46	06:02	06:02
17:37	21 09:18 (20)	18:26	7 08:15 (22)	20:09	20:55	21:36
25 08:31	08:56 (20)	07:43	07:46	06:45	06:01	06:01
17:39	23 09:19 (20)	18:27	10 08:16 (22)	20:10	20:56	21:37
26 08:30	08:56 (20)	07:41	07:44	06:43	06:00	06:00
17:41	24 09:20 (20)	18:29	13 08:17 (22)	20:12	20:58	21:38
27 08:29	08:56 (20)	07:39	07:42	06:41	06:41	06:41
17:42	24 09:20 (20)	18:31	15 08:17 (22)	20:13	20:59	21:39
28 08:28	08:55 (20)	07:37	07:40	06:39	06:39	06:39
17:44	25 09:20 (20)	18:32	17 08:17 (22)	20:15	21:00	21:41
29 08:27	08:56 (20)		07:38	06:37	5 07:00 (98)	05:58
17:45	25 09:21 (20)		20:16	21:02	8 07:08 (98)	21:42
30 08:25	08:56 (20)		07:36	06:36	06:59 (98)	05:57
17:47	26 09:22 (20)		20:18	21:03	11 07:10 (98)	21:43
31 08:24	08:56 (20)		07:34	06:34	05:56	06:24 (99)
17:48	25 09:21 (20)		20:19	21:44	17 06:41 (99)	21:59
Potential sun hours	273	284	368	410	472	482
Total, worst case	263	239	123	24	578	757
Sun reduction	0.56	0.50	0.63	0.59	0.67	0.70
Oper. time red.	0.99	0.99	0.99	0.99	0.99	0.99
Wind dir. red.	0.72	0.71	0.70	0.61	0.60	0.58
Total reduction	0.40	0.36	0.44	0.36	0.40	0.40
Total, real	106	86	54	9	233	306

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

Description:

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EAPC Wind Energy
3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
Brandon Storm / bstorm@eapc.net
Calculated:
6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 73008 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	July	August	September	October	November	December
1	05:54 21:58	06:21 (114) 06:46 (114)	06:26 21:32	06:57 (98) 07:21 (98)	07:09 20:38	07:51 19:35
2	05:55 21:58	06:22 (114) 06:47 (114)	06:27 21:31	06:56 (98) 07:22 (98)	07:10 20:36	07:52 19:33
3	05:55 21:58	06:22 (114) 06:46 (114)	06:29 21:29	06:56 (98) 07:22 (98)	07:11 20:34	07:54 19:31
4	05:56 21:58	06:23 (114) 06:46 (114)	06:30 21:28	06:55 (98) 07:21 (98)	07:13 20:32	07:55 19:29
5	05:57 21:57	06:24 (114) 06:46 (114)	06:31 21:26	06:57 (98) 07:22 (98)	07:14 20:30	07:57 19:27
6	05:57 21:57	06:25 (114) 06:46 (114)	06:33 21:25	06:58 (98) 07:22 (98)	07:16 20:27	07:58 19:25
7	05:58 21:56	06:25 (114) 06:44 (99)	06:34 21:23	06:59 (98) 07:21 (98)	07:17 20:25	08:00 19:23
8	05:59 21:56	06:26 (114) 06:45 (99)	06:35 21:22	07:01 (98) 07:22 (98)	07:18 20:23	08:01 19:21
9	06:00 21:55	06:27 (114) 06:46 (99)	06:37 21:20	07:02 (98) 07:21 (98)	07:20 20:21	08:03 19:18
10	06:01 21:55	06:28 (114) 06:47 (99)	06:38 21:19	07:03 (98) 07:20 (98)	07:21 20:19	08:04 19:16
11	06:02 21:54	06:29 (114) 06:48 (99)	06:39 21:17	07:04 (98) 07:19 (98)	07:23 20:17	08:06 19:14
12	06:03 21:54	06:32 (114) 06:49 (99)	06:41 21:15	07:06 (98) 07:19 (98)	07:24 20:15	08:07 19:12
13	06:04 21:53	06:31 (99) 06:48 (99)	06:42 21:13	07:07 (98) 07:17 (98)	07:25 20:13	08:09 19:10
14	06:05 21:52	06:31 (99) 06:49 (99)	06:44 21:12	07:08 (98) 07:15 (98)	07:27 20:11	08:10 19:08
15	06:06 21:51	06:32 (99) 06:49 (99)	06:45 21:10	07:10 (98) 07:14 (98)	07:28 20:09	08:12 19:06
16	06:07 21:51	06:33 (99) 06:50 (99)	06:46 21:08	07:30 20:07	08:13 19:05	14 08:49 (22) 17:14
17	06:08 21:50	06:34 (99) 06:50 (99)	06:48 21:06	07:31 20:04	08:15 19:03	12 08:48 (22) 17:13
18	06:09 21:49	06:35 (99) 06:50 (99)	06:49 21:05	07:32 20:02	08:16 19:01	9 08:47 (22) 17:12
19	06:10 21:48	06:36 (99) 06:50 (99)	06:50 21:03	07:34 20:00	08:18 18:57	6 08:46 (22) 17:10
20	06:11 21:47	06:38 (99) 06:52 (99)	06:52 21:01	07:35 19:58	08:19 18:55	2 08:43 (22) 17:09
21	06:12 21:46	06:39 (99) 06:51 (99)	06:53 20:59	07:37 19:56	08:21 18:53	17:08 17:07
22	06:13 21:45	06:40 (99) 06:51 (99)	06:55 20:57	07:38 19:54	08:22 18:51	16 08:50 (20) 16:59
23	06:15 21:44	06:41 (99) 06:51 (99)	06:56 20:55	07:40 19:52	08:24 18:49	15 08:49 (20) 17:00
24	06:16 21:43	06:42 (99) 07:12 (98)	06:57 20:53	07:41 19:50	08:25 18:48	14 08:47 (20) 17:00
25	06:17 21:41	06:43 (99) 07:14 (98)	06:59 20:51	07:42 19:48	08:27 18:46	13 08:45 (20) 17:01
26	06:18 21:40	06:44 (99) 07:16 (98)	07:00 20:50	07:44 19:45	08:28 18:44	12 08:44 (20) 17:02
27	06:19 21:39	06:46 (99) 07:18 (98)	07:02 20:48	07:45 19:43	08:30 18:42	11 08:49 (20) 17:00
28	06:21 21:38	06:47 (99) 07:19 (98)	07:03 20:46	07:47 19:41	08:31 18:41	10 08:47 (20) 17:00
29	06:22 21:36	06:59 (98) 07:19 (98)	07:04 20:44	07:48 19:39	08:33 18:39	9 08:47 (20) 17:00
30	06:23 21:35	06:58 (98) 07:20 (98)	07:06 20:42	07:49 19:37	08:35 18:37	8 08:47 (20) 17:00
31	06:25 21:34	06:57 (98) 07:20 (98)	07:07 20:40	07:57 19:35	08:36 18:35	7 08:47 (20) 17:00
Potential sun hours	486	445	379	336	277	260
Total, worst case	574	279	195	439		
Sun reduction	0.75	0.72	0.52	0.43		
Oper. time red.	0.99	0.99	0.99	0.99		
Wind dir. red.	0.59	0.61	0.70	0.72		
Total reduction	0.44	0.44	0.37	0.31		
Total, real	253	122	71	138		

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

Description:

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EAPC Wind Energy
3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
Brandon Storm / bstorm@eapc.net
Calculated:
6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 73047 - House**

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
663 334 354 413 612 967 793 577 699 909 1,123 1,198 8,641
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June			
1	08:45	09:22 (161)	08:23	07:35	08:13 (21)	07:32	06:34	05:55	
	17:07	31 09:53 (161)	17:50	18:34	23 08:36 (21)	20:21	21:05	21:45	
2	08:45	09:22 (161)	08:21	07:34	08:14 (21)	07:30	06:32	05:55	
	17:08	31 09:53 (161)	17:52	18:35	21 08:35 (21)	20:22	21:06	21:46	
3	08:45	09:22 (161)	08:20	07:32	08:15 (21)	07:28	06:31	05:54	
	17:09	31 09:53 (161)	17:53	18:37	19 08:34 (21)	20:24	21:08	21:47	
4	08:45	09:23 (161)	08:19	07:30	08:16 (21)	07:26	06:29	05:53	
	17:10	31 09:54 (161)	17:55	18:39	16 08:32 (21)	20:25	21:09	21:48	
5	08:44	09:24 (161)	08:17	07:28	08:17 (21)	07:24	06:27	05:53	
	17:11	31 09:55 (161)	17:57	18:40	13 08:30 (21)	20:27	21:11	21:49	
6	08:44	09:23 (161)	08:16	07:26	08:21 (21)	07:22	06:26	05:52	
	17:13	32 09:55 (161)	17:58	18:42	5 08:26 (21)	20:28	21:12	21:49	
7	08:44	09:24 (161)	08:14	07:24	07:20	06:24	05:52		
	17:14	32 09:56 (161)	18:00	18:43	20:30	21:13	21:50		
8	08:44	09:25 (161)	08:13	08:22	07:18	06:23	05:51		
	17:15	32 09:57 (161)	18:00	18:45	20:31	21:15	21:51		
9	08:43	09:25 (161)	08:11	08:20	07:15	06:21	05:51		
	17:16	31 09:56 (161)	18:02	19:46	20:33	21:16	21:52		
10	08:43	09:26 (161)	08:10	08:18	07:13	06:20	05:51		
	17:17	31 09:57 (161)	18:03	19:48	20:34	21:18	21:53		
11	08:42	09:26 (161)	08:08	08:15	07:11	06:18	05:51		
	17:19	31 09:57 (161)	18:05	19:49	20:36	21:19	21:53		
12	08:42	09:26 (161)	08:06	08:13	07:09	06:17	05:50		
	17:20	31 09:57 (161)	18:07	19:51	20:37	21:20	21:54		
13	08:41	09:27 (161)	08:05	08:11	07:07	06:15	05:50		
	17:21	31 09:58 (161)	18:08	19:52	20:39	21:22	21:55		
14	08:41	09:27 (161)	08:03	08:09	07:06	06:14	05:50		
	17:23	31 09:58 (161)	18:10	19:54	20:40	21:23	21:55		
15	08:40	09:28 (161)	08:01	08:07	07:04	06:13	05:50		
	17:24	30 09:58 (161)	18:11	19:55	20:41	21:25	21:56		
16	08:39	09:28 (161)	08:00	08:05	08:30 (19)	07:02	06:11	05:50	
	17:26	30 09:58 (161)	18:13	19:57	7 08:37 (19)	20:43	21:26	21:56	
17	08:39	09:29 (161)	07:58	08:03	08:27 (19)	07:00	06:10	05:50	
	17:27	29 09:58 (161)	18:15	19:58	13 08:40 (19)	20:44	21:27	21:57	
18	08:38	09:30 (161)	07:56	08:01	08:25 (19)	06:58	06:09	05:50	
	17:28	28 09:58 (161)	18:16	20:00	16 08:41 (19)	20:46	21:28	21:57	
19	08:37	09:31 (161)	07:54	08:21 (21)	07:59	08:24 (19)	06:56	06:08	05:50
	17:30	27 09:58 (161)	18:18	20:01	18 08:42 (19)	20:47	21:30	21:57	
20	08:36	09:32 (161)	07:52	08:18 (21)	07:57	08:23 (19)	06:54	06:07	05:50
	17:31	26 09:58 (161)	18:20	20:03	19 08:42 (19)	20:49	21:31	21:58	
21	08:35	09:33 (161)	07:51	08:16 (21)	07:55	08:23 (19)	06:52	06:05	05:50
	17:33	25 09:58 (161)	18:21	20:04	19 08:42 (19)	20:50	21:32	21:58	
22	08:34	09:34 (161)	07:49	08:15 (21)	07:53	08:21 (19)	06:50	06:04	05:50
	17:34	23 09:57 (161)	18:23	20:06	20 08:41 (19)	20:52	21:34	21:58	
23	08:33	09:34 (161)	07:47	08:15 (21)	07:51	08:21 (19)	06:48	06:03	05:51
	17:36	21 09:55 (161)	18:24	20:07	20 08:41 (19)	20:53	21:35	21:58	
24	08:32	09:36 (161)	07:45	08:14 (21)	07:49	08:22 (19)	06:46	06:02	05:51
	17:37	19 09:55 (161)	18:26	20:09	18 08:40 (19)	20:55	21:36	21:59	
25	08:31	09:38 (161)	07:43	08:14 (21)	07:46	08:22 (19)	06:45	06:01	05:51
	17:39	15 09:53 (161)	18:28	20:10	17 08:39 (19)	20:56	21:37	21:59	
26	08:30	09:41 (161)	07:41	08:13 (21)	07:44	08:23 (19)	06:43	06:00	05:52
	17:41	10 09:51 (161)	18:29	20:12	15 08:38 (19)	20:58	21:38	21:59	
27	08:29	07:39	08:13 (21)	07:42	08:25 (19)	06:41	05:59	05:52	
	17:42	18:31	24 08:37 (21)	20:13	11 08:36 (19)	20:59	21:39	21:59	
28	08:28	07:37	08:13 (21)	07:40	08:28 (19)	06:39	05:58	05:52	
	17:44	18:32	24 08:37 (21)	20:15	4 08:32 (19)	21:01	21:41	21:59	
29	08:27	07:38	07:38	07:38	06:37	05:58	05:53		
	17:45	20:16	21:02	21:42	21:59				
30	08:25	07:36	07:36	07:36	06:36	05:57	05:54		
	17:47	20:18	21:03	21:43	21:59				
31	08:24	07:34	07:34	07:34	05:56				
	17:49	20:19	21:44	21:44					
Potential sun hours	273	284	368	410	472	481			
Total, worst case	720	203	294						
Sun reduction	0.56	0.50	0.63						
Oper. time red.	0.99	0.99	0.99						
Wind dir. red.	0.70	0.71	0.69						
Total reduction	0.39	0.35	0.43						
Total, real	279	72	126						

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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EAPC Wind Energy
 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 73047 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	July	August	September	October	November	December	
1	05:54	06:26	07:09	07:51	07:38	08:23	09:08 (161)
	21:58	21:32	20:38	19:35	17:34	17:00	31 09:39 (161)
2	05:55	06:27	07:10	07:52	07:39	08:24	09:08 (161)
	21:58	21:31	20:36	19:33	17:32	16:59	31 09:39 (161)
3	05:55	06:29	07:12	07:54	07:41	08:25	09:09 (161)
	21:58	21:30	20:34	19:31	17:31	16:59	31 09:40 (161)
4	05:56	06:30	07:13	07:55	07:42	08:26	09:09 (161)
	21:58	21:28	20:32	19:29	17:29	16:58	32 09:41 (161)
5	05:57	06:31	07:14	07:57	07:44	08:28	09:09 (161)
	21:57	21:27	20:30	19:27	17:28	16:58	32 09:41 (161)
6	05:57	06:33	07:16	07:58	07:46	08:29	09:09 (161)
	21:57	21:25	20:28	19:25	17:26	16:58	32 09:41 (161)
7	05:58	06:34	07:17	08:00	07:47	08:30	09:10 (161)
	21:56	21:23	20:25	19:23	17:25	16:58	31 09:41 (161)
8	05:59	06:35	07:19	08:01	08:54 (21)	07:49	08:31 09:11 (161)
	21:56	21:22	20:23	19:21	10 09:04 (21)	17:23	16:57 31 09:42 (161)
9	06:00	06:37	07:20	08:03	08:52 (21)	07:50	08:32 09:11 (161)
	21:55	21:20	20:21	19:19	14 09:06 (21)	17:22	16:57 32 09:43 (161)
10	06:01	06:38	07:21	08:04	08:49 (21)	07:52	08:33 09:12 (161)
	21:55	21:19	20:19	19:16	18 09:07 (21)	17:20	16:57 31 09:43 (161)
11	06:02	06:39	07:23	08:06	08:48 (21)	07:53	08:34 09:12 (161)
	21:54	21:17	20:17	19:14	21 09:09 (21)	17:19	16:57 31 09:43 (161)
12	06:03	06:41	07:24	08:07	08:47 (21)	07:55	08:35 09:13 (161)
	21:54	21:15	20:15	19:12	22 09:09 (21)	17:18	16:57 31 09:44 (161)
13	06:04	06:42	07:26	08:09	08:46 (21)	07:57	08:36 09:14 (161)
	21:53	21:14	20:13	19:10	23 09:09 (21)	17:16	16:57 30 09:44 (161)
14	06:05	06:44	07:27	08:10	08:45 (21)	07:58	08:37 09:13 (161)
	21:52	21:12	20:11	19:09	24 09:09 (21)	17:15	16:57 30 09:43 (161)
15	06:06	06:45	07:28	08:12	08:45 (21)	08:00	08:38 09:14 (161)
	21:51	21:10	20:09	19:07	24 09:09 (21)	17:14	16:57 30 09:44 (161)
16	06:07	06:46	07:30	08:14 (19)	08:13	08:45 (21)	08:01 09:14 (161) 08:38 09:15 (161)
	21:51	21:08	20:07	11 08:25 (19)	19:05	24 09:09 (21)	17:13 10 09:24 (161) 16:57 30 09:45 (161)
17	06:08	06:48	07:31	08:12 (19)	08:15	08:45 (21)	08:03 09:12 (161) 08:39 09:15 (161)
	21:50	21:06	20:05	14 08:26 (19)	19:03	24 09:09 (21)	17:12 15 09:27 (161) 16:58 30 09:45 (161)
18	06:09	06:49	07:33	08:10 (19)	08:16	08:46 (21)	08:04 09:10 (161) 08:40 09:16 (161)
	21:49	21:05	20:02	16 08:26 (19)	19:01	22 09:08 (21)	17:11 19 09:29 (161) 16:58 30 09:46 (161)
19	06:10	06:51	07:34	08:09 (19)	08:18	08:45 (21)	08:06 09:09 (161) 08:40 09:16 (161)
	21:48	21:03	20:00	18 08:27 (19)	18:57	22 09:07 (21)	17:09 21 09:30 (161) 16:58 30 09:46 (161)
20	06:11	06:52	07:35	08:08 (19)	08:19	08:47 (21)	08:07 09:08 (161) 08:41 09:17 (161)
	21:47	21:01	19:58	19 08:27 (19)	18:55	19 09:06 (21)	17:08 23 09:31 (161) 16:59 30 09:47 (161)
21	06:12	06:53	07:37	08:08 (19)	08:21	08:47 (21)	08:09 09:08 (161) 08:42 09:17 (161)
	21:46	20:59	19:56	20 08:28 (19)	18:53	17 09:04 (21)	17:07 25 09:33 (161) 16:59 30 09:47 (161)
22	06:13	06:55	07:38	08:07 (19)	08:22	08:49 (21)	08:10 09:08 (161) 08:42 09:18 (161)
	21:45	20:57	19:54	20 08:27 (19)	18:51	14 09:03 (21)	17:06 26 09:34 (161) 17:00 30 09:48 (161)
23	06:15	06:56	07:40	08:07 (19)	08:24	08:52 (21)	08:12 09:07 (161) 08:43 09:18 (161)
	21:44	20:55	19:52	19 08:26 (19)	18:49	8 09:00 (21)	17:06 27 09:34 (161) 17:00 30 09:48 (161)
24	06:16	06:58	07:41	08:08 (19)	08:25	08:13	09:07 (161) 08:43 09:19 (161)
	21:43	20:53	19:50	17 08:25 (19)	18:48	17:05	29 09:36 (161) 17:01 30 09:49 (161)
25	06:17	06:59	07:42	08:08 (19)	08:27	08:15	09:07 (161) 08:43 09:19 (161)
	21:41	20:52	19:48	16 08:24 (19)	18:46	17:04	29 09:36 (161) 17:01 30 09:49 (161)
26	06:18	07:00	07:44	08:09 (19)	08:28	08:16	09:07 (161) 08:44 09:19 (161)
	21:40	20:50	19:45	14 08:23 (19)	18:44	17:03	30 09:37 (161) 17:02 30 09:49 (161)
27	06:20	07:02	07:45	08:11 (19)	08:30	08:17	09:07 (161) 08:44 09:20 (161)
	21:39	20:48	19:43	9 08:20 (19)	18:42	17:02	30 09:37 (161) 17:03 30 09:50 (161)
28	06:21	07:03	07:47	08:31	08:19	08:19	09:07 (161) 08:44 09:20 (161)
	21:38	20:46	19:41	18:41	17:02	31 09:38 (161)	17:04 30 09:50 (161)
29	06:22	07:05	07:48	08:33	08:20	09:07 (161)	08:45 09:21 (161)
	21:36	20:44	19:39	18:39	17:01	31 09:38 (161)	17:04 30 09:51 (161)
30	06:23	07:06	07:50	08:35	08:21	09:08 (161)	08:45 09:21 (161)
	21:35	20:42	19:37	18:37	17:00	31 09:39 (161)	17:05 31 09:52 (161)
31	06:25	07:07	07:51	08:36	08:23	09:09 (161)	08:45 09:22 (161)
	21:34	20:40	19:35	18:36	17:06	30 09:52 (161)	
Potential sun hours	486	445	379	336	277	260	947
Total, worst case			193	306	377		947
Sun reduction			0.69	0.52	0.43		0.44
Oper. time red.			0.99	0.99	0.99		0.99
Wind dir. red.			0.69	0.71	0.70		0.70
Total reduction			0.47	0.37	0.30		0.31
Total, real			90	112	114		290

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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EAPC Wind Energy
 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 73164 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	January	February	March	April	May	June
1 08:45	10:09 (13) 08:23		07:35	08:03 (14) 07:32	18:55 (160) 06:34	05:55
17:07	37 10:46 (13) 17:50		18:34	28 08:31 (14) 20:21	55 19:50 (182) 21:05	21:45
2 08:45	10:10 (13) 08:21		07:33	08:03 (14) 07:30	18:55 (160) 06:32	05:55
17:08	36 10:46 (13) 17:52		18:35	28 08:31 (14) 20:22	53 19:48 (182) 21:06	21:46
3 08:45	10:11 (13) 08:20		07:31	08:02 (14) 07:28	18:55 (160) 06:31	05:54
17:09	36 10:47 (13) 17:53		18:37	29 08:31 (14) 20:24	51 19:46 (182) 21:08	21:47
4 08:45	10:12 (13) 08:18		07:30	08:02 (14) 07:26	18:56 (160) 06:29	05:53
17:10	35 10:47 (13) 17:55		18:39	29 08:31 (14) 20:25	48 19:44 (182) 21:09	21:48
5 08:44	10:13 (13) 08:17		07:28	08:03 (14) 07:24	18:57 (160) 06:27	05:53
17:11	34 10:47 (13) 17:57		18:40	27 08:30 (14) 20:27	41 19:40 (182) 21:11	21:48
6 08:44	10:13 (13) 08:16		07:26	08:03 (14) 07:22	18:58 (160) 06:26	05:52
17:13	34 10:47 (13) 17:58		18:42	26 08:29 (14) 20:28	31 19:29 (160) 21:12	21:49
7 08:44	10:14 (13) 08:14		07:24	08:04 (14) 07:20	19:00 (160) 06:24	05:52
17:14	33 10:47 (13) 18:00		18:43	24 08:28 (14) 20:30	27 19:27 (160) 21:13	21:50
8 08:44	10:14 (13) 08:13		08:22	09:04 (14) 07:17	19:01 (160) 06:23	05:52
17:15	32 10:46 (13) 18:00		18:45	23 09:27 (14) 20:31	24 19:25 (160) 21:15	21:51
9 08:43	10:16 (13) 08:11		08:19	09:06 (14) 07:15	19:04 (160) 06:21	05:51
17:16	31 10:47 (13) 18:02		19:46	20 09:26 (14) 20:33	18 19:22 (160) 21:16	21:52
10 08:43	10:16 (13) 08:09		08:17	09:06 (14) 07:13	19:08 (160) 06:20	05:51
17:17	30 10:46 (13) 18:03		19:48	16 09:22 (14) 20:34	10 19:18 (160) 21:18	21:52
11 08:42	10:18 (13) 08:08		08:15	09:09 (14) 07:11		06:18
17:19	28 10:46 (13) 18:05		19:49	10 09:19 (14) 20:36		21:19
12 08:42	10:19 (13) 08:06		08:13		07:09	06:17
17:20	26 10:45 (13) 18:07		19:51		20:37	21:20
13 08:41	10:21 (13) 08:05		08:11	19:16 (160) 07:07	06:15	05:50
17:21	24 10:45 (13) 18:08		19:52	9 19:25 (160) 20:38	21:22	21:54
14 08:41	10:22 (13) 08:03		08:09	19:11 (160) 07:05	06:14	05:50
17:23	22 10:44 (13) 18:10		19:54	19 19:30 (160) 20:40	21:23	21:55
15 08:40	10:24 (13) 08:01		08:07	19:08 (160) 07:04	06:13	05:50
17:24	18 10:42 (13) 18:11		19:55	25 19:33 (160) 20:41	21:24	21:56
16 08:39	10:26 (13) 07:59		08:05	19:06 (160) 07:02	06:11	05:50
17:26	14 10:40 (13) 18:13		19:57	28 19:34 (160) 20:43	21:26	21:56
17 08:39	10:30 (13) 07:58		08:03	19:04 (160) 07:00	06:10	05:50
17:27	7 10:37 (13) 18:15		19:58	32 19:36 (160) 20:44	21:27	21:56
18 08:38		07:56	08:01	19:02 (160) 06:58	06:09	05:50
17:28		18:16	20:00	35 19:37 (160) 20:46	21:28	21:57
19 08:37		07:54	07:59	19:01 (160) 06:56	06:08	05:50
17:30		18:18	20:01	38 19:39 (182) 20:47	21:30	21:57
20 08:36		07:52	07:57	19:00 (160) 06:54	06:07	05:50
17:31		18:19	20:03	41 19:41 (182) 20:49	21:31	21:58
21 08:35		07:51	08:15 (14) 07:55	18:58 (160) 06:52	06:05	05:50
17:33		18:21	20:04	43 19:41 (182) 20:50	21:32	21:58
22 08:34		07:49	08:11 (14) 07:53	18:57 (160) 06:50	06:04	05:50
17:34		18:23	13 08:24 (14) 20:06	46 19:43 (182) 20:52	21:33	21:58
23 08:33		07:47	08:09 (14) 07:51	18:56 (160) 06:48	06:03	05:51
17:36		18:24	17 08:26 (14) 20:07	48 19:44 (182) 20:53	21:35	21:58
24 08:32		07:45	08:08 (14) 07:48	18:56 (160) 06:46	06:02	05:51
17:37		18:26	21 08:29 (14) 20:09	50 19:46 (182) 20:55	21:36	21:58
25 08:31		07:43	08:06 (14) 07:46	18:55 (160) 06:45	06:01	05:51
17:39		18:27	24 08:30 (14) 20:10	53 19:48 (182) 20:56	21:37	21:59
26 08:30		07:41	08:05 (14) 07:44	18:55 (160) 06:43	06:00	05:52
17:41		18:29	26 08:31 (14) 20:12	54 19:49 (182) 20:58	21:38	21:59
27 08:29		07:39	08:04 (14) 07:42	18:55 (160) 06:41	05:59	05:52
17:42		18:31	27 08:31 (14) 20:13	56 19:51 (182) 20:59	21:39	21:59
28 08:28		07:37	08:03 (14) 07:40	18:55 (160) 06:39	05:58	05:52
17:44		18:32	28 08:31 (14) 20:15	57 19:52 (182) 21:00	21:40	21:59
29 08:26			07:38	18:54 (160) 06:37	05:58	05:53
17:45			20:16	59 19:53 (182) 21:02	21:42	21:59
30 08:25			07:36	18:55 (160) 06:36	05:57	05:54
17:47			20:18	57 19:52 (182) 21:03	21:43	21:58
31 08:24			07:34	18:55 (160) 06:35	05:56	06:30 (15)
17:49			20:19	56 19:51 (182) 21:04	21:44	29 06:59 (15)
Potential sun hours	273	284	368	410	471	481
Total, worst case	477	162	1066	358	184	1074
Sun reduction	0.56	0.50	0.63	0.59	0.67	0.70
Oper. time red.	0.99	0.99	0.99	0.99	0.99	0.99
Wind dir. red.	0.70	0.70	0.67	0.65	0.59	0.59
Total reduction	0.39	0.35	0.42	0.38	0.39	0.41
Total, real	185	57	443	137	73	441

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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EAPC Wind Energy
 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 73164 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	July	August	September	October	November	December
1	05:54 21:58	06:32 (15) 07:08 (15)	06:26 21:32	07:09 20:38	07:51 19:35	08:23 17:00
2	05:55 21:58	06:33 (15) 07:09 (15)	06:27 21:31	07:10 20:36	19:07 (160) 19:17 (160)	08:50 (14) 08:56 (14)
3	05:55 21:58	06:34 (15) 07:09 (15)	06:29 21:29	07:12 20:34	19:02 (160) 19:20 (160)	08:46 (14) 09:00 (14)
4	05:56 21:58	06:33 (15) 07:08 (15)	06:30 21:28	07:13 20:32	18:59 (160) 19:22 (160)	08:43 (14) 09:02 (14)
5	05:57 21:57	06:34 (15) 07:09 (15)	06:31 21:26	07:14 20:30	18:57 (160) 19:24 (160)	08:42 (14) 09:03 (14)
6	05:58 21:57	06:35 (15) 07:09 (15)	06:33 21:25	07:16 20:27	18:54 (160) 19:25 (160)	08:40 (14) 09:04 (14)
7	05:58 21:56	06:35 (15) 07:08 (15)	06:34 21:23	07:17 20:25	18:52 (160) 19:35 (182)	08:39 (14) 09:05 (14)
8	05:59 21:56	06:35 (15) 07:08 (15)	06:35 21:22	07:19 20:23	18:51 (160) 19:39 (182)	08:38 (14) 09:05 (14)
9	06:00 21:55	06:36 (15) 07:08 (15)	06:37 21:20	07:20 20:21	18:50 (160) 19:40 (182)	08:03 09:06 (14)
10	06:01 21:55	06:37 (15) 07:08 (15)	06:38 21:18	07:21 20:19	18:48 (160) 19:41 (182)	08:04 09:05 (14)
11	06:02 21:54	06:37 (15) 07:08 (15)	06:39 21:17	07:23 20:17	18:47 (160) 19:42 (182)	08:06 09:05 (14)
12	06:03 21:54	06:38 (15) 07:07 (15)	06:41 21:15	07:24 20:15	18:46 (160) 19:43 (182)	08:07 09:05 (14)
13	06:04 21:53	06:39 (15) 07:07 (15)	06:42 21:13	07:25 20:13	18:46 (160) 19:43 (182)	08:08 09:05 (14)
14	06:05 21:52	06:39 (15) 07:06 (15)	06:44 21:12	07:27 20:11	18:45 (160) 19:43 (182)	08:10 09:03 (14)
15	06:06 21:51	06:40 (15) 07:05 (15)	06:45 21:10	07:28 20:09	18:44 (160) 19:42 (182)	08:11 09:03 (14)
16	06:07 21:51	06:41 (15) 07:04 (15)	06:46 21:08	07:30 20:07	18:44 (160) 19:40 (182)	08:13 09:02 (14)
17	06:08 21:50	06:42 (15) 07:03 (15)	06:48 21:06	07:31 20:04	18:43 (160) 19:38 (182)	08:14 09:01 (14)
18	06:09 21:49	06:44 (15) 07:02 (15)	06:49 21:05	07:32 20:02	18:43 (160) 19:35 (182)	08:16 09:00 (14)
19	06:10 21:48	06:46 (15) 07:01 (15)	06:51 21:03	07:34 20:00	18:43 (160) 19:34 (182)	08:18 08:57 (14)
20	06:11 21:47	06:49 (15) 06:59 (15)	06:52 21:01	07:35 19:58	18:43 (160) 19:31 (182)	08:19 08:55 (14)
21	06:12 21:46	06:53 20:59	07:37 19:56	07:37 19:53	18:43 (160) 19:30 (182)	08:21 17:07
22	06:13 21:45	06:55 20:57	07:38 19:54	07:38 19:51	18:43 (160) 19:27 (182)	08:22 17:06
23	06:15 21:44	06:56 20:55	07:40 19:52	07:40 19:49	18:43 (160) 19:25 (182)	08:24 17:06
24	06:16 21:43	06:58 20:53	07:41 19:50	07:41 19:47	18:44 (160) 19:23 (182)	08:25 17:05
25	06:17 21:41	06:59 20:51	07:42 19:48	07:42 19:45	18:45 (160) 19:20 (160)	08:27 17:04
26	06:18 21:40	07:00 20:50	07:44 19:45	07:44 19:42	18:46 (160) 19:19 (160)	08:28 17:03
27	06:20 21:39	07:02 20:48	07:45 19:43	07:45 19:40	18:47 (160) 19:17 (160)	08:30 17:02
28	06:21 21:38	07:03 20:46	07:47 19:41	07:47 19:38	18:48 (160) 19:14 (160)	08:31 17:02
29	06:22 21:36	07:05 20:44	07:48 19:39	07:48 19:36	18:51 (160) 19:12 (160)	08:33 17:01
30	06:23 21:35	07:06 20:42	07:49 19:37	07:49 19:34	18:53 (160) 19:07 (160)	08:35 17:00
31	06:25 21:34	07:07 20:40	07:51 19:35	07:51 19:32	18:55 (160) 19:05 (160)	08:37 17:00
Potential sun hours	486	445	379	336	277	260
Total, worst case	567		1178	429	110	1141
Sun reduction	0.75		0.69	0.52	0.43	0.44
Oper. time red.	0.99		0.99	0.99	0.99	0.99
Wind dir. red.	0.59		0.65	0.70	0.70	0.70
Total reduction	0.44		0.45	0.37	0.30	0.31
Total, real	249		526	157	33	350

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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EAPC Wind Energy
3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
Brandon Storm / bstorm@eapc.net
Calculated: 6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab Shadow receptor: 73183 - House

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
663 334 354 413 612 967 793 577 699 909 1,123 1,198 8,641
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to June) and rows for each day showing sun rise, sun set, and shadow reduction data.

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

Matrix 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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 73215 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	January	February	March	April	May	June
1	08:45	08:22	07:35	07:32	08:37 (34)	06:34
	17:07	17:50	18:34	20:20	09:04 (34)	21:05
2	08:44	08:21	07:33	07:29	08:39 (34)	06:32
	17:08	17:51	18:35	20:22	09:01 (34)	21:06
3	08:44	08:20	07:31	07:27	08:43 (34)	06:30
	17:09	17:53	18:37	20:23	08:57 (34)	21:07
4	08:44	08:18	07:29	07:25		06:29
	17:10	17:55	18:38	20:25		21:09
5	08:44	08:17	07:27	07:23		06:27
	17:11	17:56	18:40	20:26		21:10
6	08:44	08:15	07:25	07:52 (34)	07:21	06:26
	17:12	17:58	18:41	08:05 (34)	20:28	21:12
7	08:44	08:14	07:23	07:48 (34)	07:19	06:24
	17:13	18:00	18:43	08:09 (34)	20:29	21:13
8	08:43	08:12	08:21	08:45 (34)	07:17	06:22
	17:15	18:00	18:44	09:11 (34)	20:31	21:15
9	08:43	08:11	08:19	08:43 (34)	07:15	06:21
	17:16	18:01	19:46	09:13 (34)	20:32	21:16
10	08:43	08:09	08:17	08:41 (34)	07:13	06:19
	17:17	18:03	19:48	09:14 (34)	20:34	21:17
11	08:42	08:08	08:15	08:39 (34)	07:11	06:18
	17:18	18:05	19:49	09:16 (34)	20:35	21:19
12	08:42	08:06	08:13	08:38 (34)	07:09	06:17
	17:20	18:06	19:51	09:17 (34)	20:37	21:20
13	08:41	08:04	08:11	08:37 (34)	07:07	06:15
	17:21	18:08	19:52	09:17 (34)	20:38	21:21
14	08:40	08:03	08:09	08:36 (34)	07:05	06:14
	17:22	18:09	19:54	09:18 (34)	20:40	21:23
15	08:40	08:01	08:07	08:35 (34)	07:03	06:12
	17:24	18:11	19:55	09:18 (34)	20:41	21:24
16	08:39	07:59	08:05	08:34 (34)	07:01	06:11
	17:25	18:13	19:57	09:19 (34)	20:43	21:26
17	08:38	07:57	08:03	08:34 (34)	06:59	06:10
	17:27	18:14	19:58	09:19 (34)	20:44	21:27
18	08:38	07:56	08:01	08:32 (34)	06:57	07:19 (36)
	17:28	18:16	20:00	09:18 (34)	20:46	07:20 (36)
19	08:37	07:54	07:59	08:32 (34)	06:55	07:18 (36)
	17:30	18:18	20:01	09:18 (34)	20:47	07:21 (36)
20	08:36	07:52	07:57	08:32 (34)	06:54	07:16 (36)
	17:31	18:19	20:03	09:18 (34)	20:48	07:22 (36)
21	08:35	07:50	07:54	08:31 (34)	06:52	07:14 (36)
	17:33	18:21	20:04	09:17 (34)	20:50	07:22 (36)
22	08:34	07:48	07:52	08:31 (34)	06:50	07:12 (36)
	17:34	18:22	20:06	09:17 (34)	20:51	07:21 (36)
23	08:33	07:47	07:50	08:31 (34)	06:48	07:10 (36)
	17:36	18:24	20:07	09:16 (34)	20:53	07:21 (36)
24	08:32	07:45	07:48	08:32 (34)	06:46	07:09 (35)
	17:37	18:26	20:09	09:16 (34)	20:54	07:21 (36)
25	08:31	07:43	07:46	08:32 (34)	06:44	07:07 (35)
	17:39	18:27	20:10	09:15 (34)	20:56	07:21 (36)
26	08:30	07:41	07:44	08:32 (34)	06:42	07:05 (35)
	17:40	18:29	20:12	09:14 (34)	20:57	07:19 (36)
27	08:29	07:39	07:42	08:33 (34)	06:41	07:03 (35)
	17:42	18:30	20:13	09:13 (34)	20:59	07:18 (36)
28	08:27	07:37	07:40	08:33 (34)	06:39	07:02 (35)
	17:43	18:32	20:15	09:12 (34)	21:00	07:17 (35)
29	08:26		07:38	08:33 (34)	06:37	07:00 (35)
	17:45		20:16	09:09 (34)	21:02	07:17 (35)
30	08:25		07:36	08:34 (34)	06:35	06:58 (35)
	17:47		20:18	09:08 (34)	21:03	07:17 (35)
31	08:24		07:34	08:36 (34)		05:56
	17:48		20:19	09:06 (34)		21:43
Potential sun hours	273	284	368	410	472	481
Total, worst case			997	207		305
Sun reduction			0.63	0.59		0.67
Oper. time red.			0.99	0.99		0.99
Wind dir. red.			0.69	0.64		0.61
Total reduction			0.43	0.37		0.40
Total, real			429	76		123

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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 6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 73215 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	July	August	September	October	November	December		
1	05:54	06:26	07:05 (35)	07:08	07:51	08:16 (34)	07:37	08:22
	21:58	21:32	18 07:23 (35)	20:37	19:35	40 08:56 (34)	17:34	17:00
2	05:54	06:27	07:04 (35)	07:10	07:52	08:18 (34)	07:39	08:24
	21:58	21:31	21 07:25 (35)	20:35	19:33	37 08:55 (34)	17:32	16:59
3	05:55	06:28	07:03 (35)	07:11	07:54	08:18 (34)	07:41	08:25
	21:58	21:29	22 07:25 (35)	20:33	19:31	35 08:53 (34)	17:30	16:59
4	05:56	06:30	07:02 (35)	07:13	07:55	08:20 (34)	07:42	08:26
	21:57	21:28	23 07:25 (35)	20:31	19:28	32 08:52 (34)	17:29	16:58
5	05:56	06:31	07:01 (35)	07:14	07:56	08:21 (34)	07:44	08:27
	21:57	21:26	25 07:26 (35)	20:29	19:26	28 08:49 (34)	17:27	16:58
6	05:57	06:32	07:02 (35)	07:15	07:58	08:23 (34)	07:45	08:28
	21:57	21:25	25 07:27 (35)	20:27	19:24	24 08:47 (34)	17:26	16:57
7	05:58	06:34	07:01 (35)	07:17	07:59	08:25 (34)	07:47	08:30
	21:56	21:23	26 07:27 (35)	20:25	19:22	18 08:43 (34)	17:24	16:57
8	05:59	06:35	07:00 (35)	07:18	08:01	08:31 (34)	07:48	08:31
	21:56	21:21	26 07:26 (35)	20:23	19:20	7 08:38 (34)	17:23	16:57
9	06:00	06:36	07:02 (35)	07:20	08:37 (34)	08:02	07:50	08:32
	21:55	21:20	25 07:27 (35)	20:21	14 08:51 (34)	19:18	17:21	16:57
10	06:00	06:38	07:03 (35)	07:21	08:33 (34)	08:04	07:52	08:33
	21:55	21:18	24 07:27 (35)	20:19	21 08:54 (34)	19:16	17:20	16:57
11	06:01	06:39	07:04 (35)	07:22	08:31 (34)	08:05	07:53	08:34
	21:54	21:17	22 07:26 (35)	20:17	25 08:56 (34)	19:14	17:19	16:57
12	06:02	06:40	07:05 (35)	07:24	08:28 (34)	08:07	07:55	08:35
	21:53	21:15	20 07:25 (35)	20:15	30 08:58 (34)	19:12	17:17	16:57
13	06:03	06:42	07:07 (35)	07:25	08:26 (34)	08:08	07:56	08:36
	21:53	21:13	19 07:26 (35)	20:13	33 08:59 (34)	19:10	17:16	16:57
14	06:04	06:43	07:08 (35)	07:27	08:25 (34)	08:10	07:58	08:36
	21:52	21:11	17 07:25 (35)	20:10	35 09:00 (34)	19:08	17:15	16:57
15	06:05	06:45	07:09 (35)	07:28	08:23 (34)	08:11	07:59	08:37
	21:51	21:10	15 07:24 (36)	20:08	38 09:01 (34)	19:06	17:14	16:57
16	06:06	06:46	07:11 (35)	07:29	08:21 (34)	08:13	08:01	08:38
	21:50	21:08	15 07:26 (36)	20:06	40 09:01 (34)	19:04	17:12	16:57
17	06:07	06:47	07:12 (35)	07:31	08:21 (34)	08:14	08:02	08:39
	21:49	21:06	14 07:26 (36)	20:04	41 09:02 (34)	19:02	17:11	16:57
18	06:09	06:49	07:13 (35)	07:32	08:19 (34)	08:16	08:04	08:39
	21:49	21:04	13 07:26 (36)	20:02	43 09:02 (34)	19:00	17:10	16:58
19	06:10	06:50	07:15 (35)	07:34	08:18 (34)	08:17	08:05	08:40
	21:48	21:02	12 07:27 (36)	20:00	44 09:02 (34)	18:57	17:09	16:58
20	06:11	06:52	07:16 (36)	07:35	08:18 (34)	08:19	08:07	08:41
	21:47	21:01	11 07:27 (36)	19:58	45 09:03 (34)	18:55	17:08	16:58
21	06:12	06:53	07:17 (36)	07:36	08:17 (34)	08:20	08:08	08:41
	21:46	20:59	9 07:26 (36)	19:56	45 09:02 (34)	18:53	17:07	16:59
22	06:13	06:54	07:19 (36)	07:38	08:17 (34)	08:22	08:10	08:42
	21:45	20:57	7 07:26 (36)	19:54	46 09:03 (34)	18:51	17:06	16:59
23	06:14	06:56	07:20 (36)	07:39	08:16 (34)	08:23	08:11	08:42
	21:43	20:55	5 07:25 (36)	19:51	46 09:02 (34)	18:49	17:05	17:00
24	06:15	06:57	07:21 (36)	07:41	08:15 (34)	08:25	08:13	08:43
	21:42	20:53	3 07:24 (36)	19:49	46 09:01 (34)	18:47	17:04	17:00
25	06:17	06:59		07:42	08:16 (34)	08:26	08:14	08:43
	21:41	20:51		19:47	46 09:02 (34)	18:46	17:04	17:01
26	06:18	07:00		07:43	08:15 (34)	08:28	08:16	08:43
	21:40	20:49		19:45	46 09:01 (34)	18:44	17:03	17:02
27	06:19	07:01		07:45	08:16 (34)	08:30	08:17	08:44
	21:39	20:47		19:43	45 09:01 (34)	18:42	17:02	17:02
28	06:20	07:03		07:46	08:15 (34)	08:31	08:18	08:44
	21:37	20:45		19:41	44 08:59 (34)	18:40	17:01	17:03
29	06:22	07:11 (35)		07:48	08:16 (34)	08:33	08:20	08:44
	21:36	7 07:18 (35)		19:39	43 08:59 (34)	18:39	17:01	17:04
30	06:23	07:08 (35)		07:49	08:16 (34)	08:34	08:21	08:44
	21:35	12 07:20 (35)		19:37	41 08:57 (34)	18:37	17:00	17:05
31	06:24	07:06 (35)		07:47	08:15 (34)	08:36	08:36	08:44
	21:33	16 07:22 (35)		20:39	18:35		17:06	17:06
Potential sun hours	486	445	379	336		277	260	
Total, worst case	35	417	857	221				
Sun reduction	0.75	0.72	0.69	0.52				
Oper. time red.	0.99	0.99	0.99	0.99				
Wind dir. red.	0.61	0.61	0.69	0.69				
Total reduction	0.45	0.43	0.47	0.36				
Total, real	16	181	403	79				

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
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 6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor:** 73307 - House

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
 663 334 354 413 612 967 793 577 699 909 1,123 1,198 8,641
 Idle start wind speed: Cut in wind speed from power curve

January	February	March	April	May	June	July	August	September	October	November	December
1 08:44 08:22 07:35 07:32 06:34											
17:07 17:50 18:34 20:21 21:05											
2 08:44 08:21 07:33 07:30 06:32											
17:08 17:52 18:35 20:22 21:06											
3 08:44 08:20 07:31 07:27 06:30											
17:09 17:53 18:37 20:23 21:07											
4 08:44 08:18 07:29 07:25 06:29											
17:10 17:55 18:38 20:25 21:09											
5 08:44 08:17 07:27 07:23 06:27											
17:11 17:56 18:40 20:26 21:10											
6 08:44 08:15 07:25 07:21 06:26											
17:12 17:58 18:41 20:28 21:12											
7 08:44 08:14 07:23 07:19 06:24											
17:14 18:00 18:43 20:29 21:13											
8 08:43 08:12 08:21 07:17 06:23											
17:15 18:00 18:45 20:31 21:15											
9 08:43 08:11 08:19 07:15 06:21											
17:16 18:01 19:46 20:32 21:16											
10 08:43 08:09 08:17 07:13 06:20											
17:17 18:03 19:48 20:34 21:17											
11 08:42 08:08 08:15 07:11 06:18											
17:19 18:05 19:49 20:35 21:19											
12 08:42 08:06 08:13 07:09 06:17											
17:20 18:06 19:51 20:37 21:20											
13 08:41 08:04 08:11 07:07 06:15											
17:21 18:08 19:52 20:38 21:21											
14 08:40 08:03 08:09 07:05 06:14											
17:23 18:10 19:54 20:40 21:23											
15 08:40 08:01 08:07 07:03 06:13											
17:24 18:11 19:55 20:41 21:24											
16 08:39 07:59 08:05 07:01 06:11											
17:25 18:13 19:57 20:43 21:26											
17 08:38 07:57 08:03 06:59 06:10											
17:27 18:14 19:58 20:44 21:27											
18 08:38 07:56 08:01 06:57 06:09											
17:28 18:16 20:00 20:46 21:28											
19 08:37 07:54 07:59 06:56 06:08											
17:30 18:18 20:01 20:47 21:29											
20 08:36 07:52 07:57 06:54 06:06											
17:31 18:19 20:03 20:48 21:31											
21 08:35 07:50 07:55 06:52 06:05											
17:33 18:21 20:04 20:50 21:32											
22 08:34 07:48 07:52 06:50 06:04											
17:34 18:22 20:06 20:51 21:33											
23 08:33 07:47 07:50 06:48 06:03											
17:36 18:24 20:07 20:53 21:34											
24 08:32 07:45 07:48 06:46 06:02											
17:37 18:26 20:09 20:54 21:36											
25 08:31 07:43 07:46 06:44 06:01											
17:39 18:27 20:10 20:56 21:37											
26 08:30 07:41 07:44 06:43 06:00											
17:40 18:29 20:12 20:57 21:38											
27 08:29 07:39 07:42 06:41 05:59											
17:42 18:30 20:13 20:59 21:39											
28 08:27 07:37 07:40 06:39 05:58											
17:44 18:32 20:15 21:00 21:40											
29 08:26 07:36 07:39 06:37 05:57											
17:45 18:35 20:16 21:02 21:41											
30 08:25 07:36 07:39 06:36 05:57											
17:47 18:37 20:18 21:03 21:42											
31 08:24 07:34 07:37 06:35 05:56											
17:48 18:39 20:19 21:04 21:43											
Potential sun hours 273 285 368 410 471 481 486 445 379 336 277 260											
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)	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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

Description:

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3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
Brandon Storm / bstorm@eapc.net
Calculated:
6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 73352 - House**

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
663 334 354 413 612 967 793 577 699 909 1,123 1,198 8,641
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1 08:45		08:23	09:07 (104) 07:35	07:58 (158) 07:32	06:34	06:57 (105) 05:55
17:07		17:50	21 09:28 (104) 18:34	12 08:10 (158) 20:21	21:05	54 20:33 (13) 21:45
2 08:45		08:21	09:08 (104) 07:33	07:56 (158) 07:30	06:32	06:55 (184) 05:55
17:08		17:52	18 09:26 (104) 18:35	14 08:10 (158) 20:22	21:06	56 20:32 (13) 21:46
3 08:45		08:20	09:10 (104) 07:31	07:54 (158) 07:28	06:31	06:54 (184) 05:54
17:09		17:53	15 09:25 (104) 18:37	16 08:10 (158) 20:24	21:08	56 20:32 (13) 21:47
4 08:44		08:18	09:12 (104) 07:29	07:52 (158) 07:26	06:29	06:52 (184) 05:53
17:10		17:55	10 09:22 (104) 18:38	18 08:10 (158) 20:25	21:09	57 20:31 (13) 21:47
5 08:44		08:17	07:27	07:50 (158) 07:24	06:27	06:51 (184) 05:53
17:11		17:57	18:40	20 08:10 (158) 20:27	21:10	58 20:31 (13) 21:48
6 08:44		09:11 (104) 08:15	07:25	07:49 (158) 07:21	06:26	06:49 (184) 05:52
17:13	3	09:14 (104) 17:58	18:42	20 08:09 (158) 20:28	21:12	58 20:30 (13) 21:49
7 08:44		09:11 (104) 08:14	07:23	07:49 (158) 07:19	06:24	06:48 (184) 05:52
17:14	5	09:16 (104) 18:00	18:43	19 08:08 (158) 20:30	21:13	56 20:29 (13) 21:50
8 08:43		09:10 (104) 08:12	08:21	08:50 (158) 07:17	06:23	06:46 (184) 05:51
17:15	7	09:17 (104) 18:00	18:45	17 09:07 (158) 20:31	21:15	55 20:27 (13) 21:51
9 08:43		09:10 (104) 08:11	08:19	08:50 (158) 07:15	06:21	06:45 (184) 05:51
17:16	9	09:19 (104) 18:02	19:46	15 09:05 (158) 20:32	21:16	53 20:26 (13) 21:52
10 08:43		09:09 (104) 08:09	08:17	08:52 (158) 07:13	06:20	06:43 (184) 05:51
17:17	10	09:19 (104) 18:03	19:48	10 09:02 (158) 20:34	21:17	49 20:23 (13) 21:52
11 08:42		09:09 (104) 08:08	08:15	07:11	06:18	06:43 (184) 05:51
17:19	12	09:21 (104) 18:05	19:49	20:35	21:19	40 07:23 (105) 21:53
12 08:42		09:08 (104) 08:06	08:13	19:19 (12) 07:09	06:17	06:43 (184) 05:50
17:20	14	09:22 (104) 18:06	19:51	9 19:28 (12) 20:37	21:20	40 07:23 (105) 21:54
13 08:41		09:07 (104) 08:04	08:11	19:17 (12) 07:07	06:15	06:43 (184) 05:50
17:21	15	09:22 (104) 18:08	19:52	12 19:29 (12) 20:38	21:22	38 07:21 (105) 21:54
14 08:41		09:07 (104) 08:03	08:09	19:15 (12) 07:05	06:14	06:43 (184) 05:50
17:23	17	09:24 (104) 18:10	19:54	16 19:31 (12) 20:40	21:23	38 07:21 (105) 21:55
15 08:40		09:06 (104) 08:01	08:07	19:14 (12) 07:03	06:13	06:44 (184) 05:50
17:24	19	09:25 (104) 18:11	19:55	19 19:33 (12) 20:41	21:24	36 07:20 (105) 21:55
16 08:39		09:05 (104) 07:59	08:05	19:13 (12) 07:02	06:11	06:45 (184) 05:50
17:25	20	09:25 (104) 18:13	19:57	21 19:34 (12) 20:43	21:26	34 07:19 (105) 21:56
17 08:38		09:04 (104) 07:58	08:03	19:12 (12) 07:00	06:10	06:46 (184) 05:50
17:27	22	09:26 (104) 18:15	19:58	24 19:36 (12) 20:44	21:27	31 07:18 (105) 21:56
18 08:38		09:03 (104) 07:56	08:01	19:11 (12) 06:58	06:09	06:47 (184) 05:50
17:28	24	09:27 (104) 18:16	20:00	25 19:36 (12) 20:46	21:28	25 07:16 (105) 21:57
19 08:37		09:02 (104) 07:54	07:59	19:11 (12) 06:56	06:08	06:49 (184) 05:50
17:30	25	09:27 (104) 18:18	20:01	25 19:36 (12) 20:47	21:30	15 07:13 (105) 21:57
20 08:36		09:01 (104) 07:52	07:57	19:11 (12) 06:54	06:07	05:50
17:31	27	09:28 (104) 18:19	20:03	25 19:36 (12) 20:49	5 20:24 (13) 21:31	21:57
21 08:35		09:00 (104) 07:50	07:55	19:10 (12) 06:52	20:15 (13) 06:05	05:50
17:33	28	09:28 (104) 18:21	20:04	24 19:34 (12) 20:50	11 20:26 (13) 21:32	21:58
22 08:34		09:00 (104) 07:49	07:53	19:10 (12) 06:50	20:12 (13) 06:04	05:50
17:34	29	09:29 (104) 18:23	20:06	24 19:34 (12) 20:52	15 20:27 (13) 21:33	21:58
23 08:33		09:01 (104) 07:47	07:51	19:11 (12) 06:48	20:12 (13) 06:03	05:51
17:36	28	09:29 (104) 18:24	20:07	22 19:33 (12) 20:53	17 20:29 (13) 21:35	21:58
24 08:32		09:01 (104) 07:45	07:48	19:12 (12) 06:46	07:09 (105) 06:02	05:51
17:37	28	09:29 (104) 18:26	20:09	20 19:32 (12) 20:54	26 20:30 (13) 21:36	21:58
25 08:31		09:02 (104) 07:43	07:46	19:13 (12) 06:45	07:07 (105) 06:01	05:51
17:39	28	09:30 (104) 18:27	20:10	17 19:30 (12) 20:56	34 20:31 (13) 21:37	21:58
26 08:30		09:02 (104) 07:41	07:44	19:15 (12) 06:43	07:05 (105) 06:00	05:52
17:41	28	09:30 (104) 18:29	2 08:06 (158) 20:12	13 19:28 (12) 20:57	39 20:32 (13) 21:38	21:59
27 08:29		09:02 (104) 07:39	08:02 (158) 07:42	19:18 (12) 06:41	07:04 (105) 05:59	05:52
17:42	27	09:29 (104) 18:31	6 08:08 (158) 20:13	6 19:24 (12) 20:59	44 20:34 (13) 21:39	21:59
28 08:28		09:03 (104) 07:37	08:00 (158) 07:40	08:39	07:02 (105) 05:58	05:52
17:44	26	09:29 (104) 18:32	9 08:09 (158) 20:15	21:00	47 20:33 (13) 21:40	21:59
29 08:26		09:04 (104)	07:38	06:37	07:00 (105) 05:58	05:53
17:45	25	09:29 (104)	20:16	21:02	50 20:33 (13) 21:41	21:58
30 08:25		09:04 (104)	07:36	06:36	06:59 (105) 05:57	05:53
17:47	24	09:28 (104)	20:18	21:03	53 20:34 (13) 21:43	21:58
31 08:24		09:05 (104)	07:34	07:34	05:56	
17:49	23	09:28 (104)	20:19	21:44		
Potential sun hours	273	285	368	410	471	481
Total, worst case	523	81	463	341	849	
Sun reduction	0.56	0.50	0.63	0.59	0.67	
Oper. time red.	0.99	0.99	0.99	0.99	0.99	
Wind dir. red.	0.72	0.71	0.66	0.66	0.63	
Total reduction	0.40	0.36	0.41	0.39	0.42	
Total, real	209	29	191	132	356	

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:

20132550- Lindahl Wind Farm

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Kevin Walter
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SHADOW - Calendar

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Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	July	August	September	October	November	December			
1	05:54	06:26	06:54 (184)	07:09	07:51	18:58 (12) 07:38	08:22	08:51 (104)	
	21:58	21:32	40 07:34 (105)	20:38	19:35	10 19:08 (12) 17:34	17:00	12 09:03 (104)	
2	05:55	06:27	06:53 (184)	07:10	07:52	19:01 (12) 07:39	08:24	08:52 (104)	
	21:58	21:31	46 20:32 (13)	20:36	19:33	5 19:06 (12) 17:32	16:59	10 09:02 (104)	
3	05:55	06:29	06:54 (184)	07:11	07:54	08:33 (158)	07:41	08:25	08:53 (104)
	21:58	21:29	52 20:35 (13)	20:34	19:31	6 08:39 (158) 17:31	16:59	9 09:02 (104)	
4	05:56	06:30	06:55 (184)	07:13	07:55	08:29 (158)	07:42	08:26	08:55 (104)
	21:57	21:28	54 20:36 (13)	20:31	19:29	12 08:41 (158) 17:29	16:58	7 09:02 (104)	
5	05:57	06:31	06:57 (184)	07:14	07:57	08:27 (158)	07:44	08:27	08:56 (104)
	21:57	21:26	56 20:38 (13)	20:29	19:27	15 08:42 (158) 17:28	16:58	5 09:01 (104)	
6	05:57	06:33	06:58 (184)	07:16	07:58	08:26 (158)	07:45	08:29	08:57 (104)
	21:57	21:25	57 20:39 (13)	20:27	19:25	18 08:44 (158) 17:26	16:58	3 09:00 (104)	
7	05:58	06:34	06:59 (184)	07:17	08:00	08:24 (158)	07:47	08:30	08:58 (104)
	21:56	21:23	57 20:40 (13)	20:25	19:22	20 08:44 (158) 17:25	10 08:53 (104)	16:58	1 08:59 (104)
8	05:59	06:35	07:01 (184)	07:18	08:01	08:24 (158)	07:49	08:40	08:31
	21:56	21:22	57 20:41 (13)	20:23	19:20	20 08:44 (158) 17:23	15 08:55 (104)	16:57	
9	06:00	06:37	07:02 (184)	07:20	08:02	08:25 (158)	07:50	08:39	08:32
	21:55	21:20	57 20:41 (13)	20:21	19:18	19 08:44 (158) 17:22	18 08:57 (104)	16:57	
10	06:01	06:38	07:03 (184)	07:21	08:04	08:27 (158)	07:52	08:38	08:33
	21:55	21:18	56 20:41 (13)	20:19	19:16	17 08:44 (158) 17:20	21 08:59 (104)	16:57	
11	06:02	06:39	07:04 (184)	07:23	08:05	08:29 (158)	07:53	08:36	08:34
	21:54	21:17	55 20:41 (13)	20:17	19:14	15 08:44 (158) 17:19	23 08:59 (104)	16:57	
12	06:03	06:41	07:06 (105)	07:24	08:07	08:30 (158)	07:55	08:36	08:35
	21:53	21:15	54 20:42 (13)	20:15	19:12	13 08:43 (158) 17:18	24 09:00 (104)	16:57	
13	06:04	06:42	07:07 (105)	07:25	08:08	08:32 (158)	07:56	08:36	08:36
	21:53	21:13	51 20:41 (13)	20:13	19:10	10 08:42 (158) 17:16	25 09:01 (104)	16:57	
14	06:05	06:44	07:08 (105)	07:27	08:10	08:33 (158)	07:58	08:35	08:37
	21:52	21:12	50 20:41 (13)	20:11	19:08	8 08:41 (158) 17:15	26 09:01 (104)	16:57	
15	06:06	06:45	07:10 (105)	07:28	08:11	08:35 (158)	08:00	08:35	08:37
	21:51	21:10	46 20:41 (13)	20:09	19:06	4 08:39 (158) 17:14	27 09:02 (104)	16:57	
16	06:07	06:46	07:11 (105)	07:30	08:13	08:01	08:35	08:34	08:38
	21:50	21:08	43 20:40 (13)	20:06	19:04	17:13	28 09:03 (104)	16:57	
17	06:08	06:48	07:12 (105)	07:31	19:04 (12)	08:14	08:03	08:35	08:39
	21:50	21:06	39 20:39 (13)	20:04	12 19:16 (12)	19:03	17:12	28 09:03 (104)	16:58
18	06:09	06:49	07:14 (105)	07:32	19:01 (12)	08:16	08:04	08:35	08:40
	21:49	21:04	33 20:38 (13)	20:02	16 19:17 (12)	19:01	17:10	28 09:03 (104)	16:58
19	06:10	06:50	07:17 (105)	07:34	18:59 (12)	08:17	08:06	08:36	08:40
	21:48	21:03	22 20:36 (13)	20:00	20 19:19 (12)	18:57	17:09	28 09:04 (104)	16:58
20	06:11	06:52	20:17 (13)	07:35	18:57 (12)	08:19	08:07	08:35	08:41
	21:47	21:01	16 20:33 (13)	19:58	22 19:19 (12)	18:55	17:08	29 09:04 (104)	16:59
21	06:12	06:53	20:18 (13)	07:37	18:56 (12)	08:20	08:09	08:36	08:41
	21:46	20:59	14 20:32 (13)	19:56	23 19:19 (12)	18:53	17:07	28 09:04 (104)	16:59
22	06:13	06:55	20:20 (13)	07:38	18:56 (12)	08:22	08:10	08:37	08:42
	21:45	20:57	10 20:30 (13)	19:54	24 19:20 (12)	18:51	17:06	27 09:04 (104)	17:00
23	06:15	06:56	20:24 (13)	07:39	18:54 (12)	08:24	08:11	08:39	08:42
	21:44	20:55	3 20:27 (13)	19:52	25 19:19 (12)	18:49	17:06	25 09:04 (104)	17:00
24	06:16	07:00 (184)	06:57	07:41	18:55 (12)	08:25	08:13	08:41	08:43
	21:42	6 07:06 (184)	20:53	19:50	25 19:20 (12)	18:48	17:05	24 09:05 (104)	17:01
25	06:17	06:58 (184)	06:59	07:42	18:54 (12)	08:27	08:14	08:42	08:43
	21:41	20 07:25 (105)	20:51	19:47	25 19:19 (12)	18:46	17:04	22 09:04 (104)	17:01
26	06:18	06:57 (184)	07:00	07:44	18:53 (12)	08:28	08:16	08:44	08:44
	21:40	27 07:27 (105)	20:49	19:45	25 19:18 (12)	18:44	17:03	20 09:04 (104)	17:02
27	06:19	06:56 (184)	07:02	07:45	18:54 (12)	08:30	08:17	08:45	08:44
	21:39	33 07:29 (105)	20:47	19:43	23 19:17 (12)	18:42	17:02	19 09:04 (104)	17:03
28	06:21	06:55 (184)	07:03	07:47	18:54 (12)	08:31	08:18	08:47	08:44
	21:38	35 07:30 (105)	20:46	19:41	20 19:14 (12)	18:41	17:02	17 09:04 (104)	17:04
29	06:22	06:55 (184)	07:04	07:48	18:55 (12)	08:33	08:20	08:48	08:44
	21:36	36 07:31 (105)	20:44	19:39	17 19:12 (12)	18:39	17:01	16 09:04 (104)	17:04
30	06:23	06:54 (184)	07:06	07:49	18:56 (12)	08:34	08:21	08:49	08:44
	21:35	38 07:32 (105)	20:42	19:37	14 19:10 (12)	18:37	17:00	14 09:03 (104)	17:05
31	06:25	06:53 (184)	07:07	07:51	18:57 (12)	08:36	08:24	08:50	08:45
	21:34	39 07:32 (105)	20:40	18:35	18:35	17:06	17:06	17:06	17:06
Potential sun hours	486	445	379	291	336	277	260	47	
Total, worst case	234	968	291	192	542	47			
Sun reduction	0.75	0.72	0.69	0.52	0.43	0.44			
Oper. time red.	0.99	0.99	0.99	0.99	0.99	0.99			
Wind dir. red.	0.61	0.65	0.64	0.69	0.72	0.72			
Total reduction	0.45	0.46	0.44	0.36	0.31	0.31			
Total, real	105	449	128	69	168	15			

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)

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SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab Shadow receptor: 73353 - Garage

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
663 334 354 413 612 967 793 577 699 909 1,123 1,198 8,641
Idle start wind speed: Cut in wind speed from power curve

Table with 6 columns for months (January to June) and 12 rows of daily data. Each row contains sunrise/sunset times, shadow counts, and various reduction factors. Summary statistics at the bottom include potential sun hours, total worst case, and various reduction percentages.

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

Matrix defining fields for table layout: 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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6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab Shadow receptor: 73353 - Garage

Assumptions for shadow calculations

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

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

Operational time

Table with 13 columns (N, NNE, ENE, E, ESE, SSE, S, SSW, WSW, W, WNW, NNW, Sum) and 2 rows of operational time data.

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

Main shadow calculation table with columns for months (July-December) and rows for each hour of the day (05:54 to 21:34). Includes summary rows for potential sun hours and various reduction factors.

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

Matrix defining table layout: 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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

Description:

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US-GRAND FORKS, ND 58201
+1 701 775 3000
Brandon Storm / bstorm@eapc.net
Calculated:
6/15/2015 3:57 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab Shadow receptor: 73437 - House

Assumptions for shadow calculations

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

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

Operational time

Table with 13 columns (N, NNE, ENE, E, ESE, SSE, S, SSW, WSW, W, WNW, NNW, Sum) and 2 rows of operational time values.

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

Main shadow calculation table with columns for months (January to June) and rows for each day of the month, including potential sun hours and various reduction factors.

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

Matrix defining table layout: 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: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 73437 - House**

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
663 334 354 413 612 967 793 577 699 909 1,123 1,198 8,641

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

	July	August	September	October	November	December	
1	05:54 21:12 (171)	06:26 21:25 (171)	07:09 20:38	07:51 19:35	07:38 17:34	08:22 17:00	08:51 (66b) 09:06 (66b)
2	05:55 21:13 (171)	06:27 21:25 (171)	07:10 20:36	07:52 19:33	07:39 17:32	08:24 16:59	08:52 (66b) 09:06 (66b)
3	05:55 21:15 (171)	06:29 21:24 (171)	07:12 20:34	07:54 19:31	07:41 17:31	08:25 16:59	08:53 (66b) 09:06 (66b)
4	05:56 21:16 (171)	06:30 21:22 (171)	07:13 20:30 (172b)	07:55 19:29	07:42 17:29	08:26 16:59	08:55 (66b) 09:07 (66b)
5	05:57 21:17 (171)	06:31 21:26	07:14 20:26 (172b)	07:57 19:27	07:44 18:33 (174c)	08:27 16:58	08:56 (66b) 09:07 (66b)
6	05:58 21:18 (171)	06:33 21:25	07:16 20:24 (172b)	07:58 19:25	07:46 18:30 (174c)	08:29 16:58	08:57 (66b) 09:07 (66b)
7	05:58 21:19 (171)	06:34 21:23	07:17 20:23 (172b)	08:00 19:23	07:47 18:29 (174c)	08:30 16:58	08:58 (66b) 09:07 (66b)
8	05:59 21:20 (171)	06:35 21:22	07:19 20:22 (172b)	08:01 19:21	07:49 18:27 (174c)	08:31 16:57	08:59 (66b) 09:07 (66b)
9	06:00 21:21 (171)	06:37 21:20	07:20 20:21 (172b)	08:03 19:18	07:50 18:27 (174c)	08:32 16:57	09:00 (66b) 09:07 (66b)
10	06:01 21:22 (171)	06:38 21:18	07:21 20:20 (172b)	08:04 19:16 (173b)	07:52 18:48 (174c)	08:33 16:57	09:02 (66b) 09:08 (66b)
11	06:02 21:23 (171)	06:39 21:17	07:23 20:20 (172b)	08:05 19:13 (173b)	07:53 18:39 (67)	08:34 16:57	09:03 (66b) 09:08 (66b)
12	06:03 21:24 (171)	06:41 21:15	07:24 20:19 (172b)	08:07 19:10 (173b)	07:55 18:37 (67)	08:35 16:57	09:03 (66b) 09:07 (66b)
13	06:04 21:25 (171)	06:42 21:13	07:25 20:18 (172b)	08:08 19:09 (173b)	07:56 18:45 (174c)	08:36 16:57	09:04 (66b) 09:07 (66b)
14	06:05 21:26 (171)	06:44 21:12	07:27 20:18 (172b)	08:10 19:07 (173b)	07:58 18:34 (67)	08:37 16:57	09:05 (66b) 09:07 (66b)
15	06:06 21:27 (171)	06:45 21:10	07:28 20:18 (172b)	08:11 19:05 (173b)	08:00 18:35 (67)	08:37 16:57	09:06 (66b) 09:07 (66b)
16	06:07 21:28 (171)	06:46 21:08	07:30 20:18 (172b)	08:13 19:05 (173b)	08:01 18:37 (174c)	08:38 16:58	09:07 (66b) 09:08 (66b)
17	06:08 21:29 (171)	06:48 21:06	07:31 20:17 (172b)	08:14 19:04 (173b)	08:03 18:38 (67)	08:39 16:58	09:08 (66b) 09:09 (66b)
18	06:09 21:30 (171)	06:49 21:05	07:32 20:16 (172b)	08:16 19:03 (173b)	08:04 18:35 (174c)	08:40 16:58	09:08 (66b) 09:09 (66b)
19	06:10 21:31 (171)	06:51 21:03	07:34 20:15 (172b)	08:17 19:02 (173b)	08:06 18:41 (67)	08:41 16:58	09:09 (66b) 09:10 (66b)
20	06:11 21:32 (171)	06:52 21:01	07:35 20:14 (172b)	08:19 19:01 (173b)	08:07 18:43 (67)	08:42 16:58	09:10 (66b) 09:11 (66b)
21	06:12 21:33 (171)	06:53 20:59	07:37 20:13 (172b)	08:21 19:00 (173b)	08:09 18:44 (67)	08:43 16:59	09:11 (66b) 09:12 (66b)
22	06:13 21:34 (171)	06:55 20:57	07:38 20:12 (172b)	08:22 19:00 (173b)	08:10 18:46 (67)	08:44 16:59	09:12 (66b) 09:13 (66b)
23	06:15 21:35 (171)	06:56 20:55	07:40 20:11 (172b)	08:24 19:00 (173b)	08:12 18:49 (67)	08:46 17:00	09:13 (66b) 09:14 (66b)
24	06:16 21:36 (171)	06:58 20:53	07:41 19:59	08:25 19:00 (173b)	08:13 17:06	08:47 17:00	09:14 (66b) 09:15 (66b)
25	06:17 21:37 (171)	06:59 20:51	07:42 19:48	08:27 19:00 (173b)	08:14 17:05	08:48 17:01	09:15 (66b) 09:16 (66b)
26	06:18 21:38 (171)	07:00 20:49	07:44 19:46	08:28 19:00 (173b)	08:16 17:04	08:49 17:01	09:16 (66b) 09:17 (66b)
27	06:20 21:39 (171)	07:02 20:48	07:45 19:43	08:30 19:00 (173b)	08:17 17:03	08:50 17:02	09:17 (66b) 09:18 (66b)
28	06:21 21:40 (171)	07:03 20:46	07:47 19:41	08:31 18:41	08:19 17:02	08:51 17:03	09:18 (66b) 09:19 (66b)
29	06:22 21:41 (171)	07:05 20:44	07:48 19:39	08:33 18:39	08:20 17:01	08:52 17:04	09:19 (66b) 09:20 (66b)
30	06:23 21:42 (171)	07:06 20:42	07:49 19:37	08:35 18:37	08:21 17:00	08:53 17:05	09:20 (66b) 09:21 (66b)
31	06:25 21:43 (171)	07:07 20:40	07:50 19:35	08:36 18:36	08:22 17:00	08:54 17:06	09:21 (66b) 09:22 (66b)
Potential sun hours	486	445	379	336	277	260	
Total, worst case	40	348	377	379	247	138	
Sun reduction	0.75	0.72	0.69	0.52	0.43	0.44	
Oper. time red.	0.99	0.99	0.99	0.99	0.99	0.99	
Wind dir. red.	0.72	0.70	0.66	0.65	0.72	0.72	
Total reduction	0.53	0.50	0.44	0.34	0.31	0.31	
Total, real	21	172	168	127	76	43	

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:

20132550- Lindahl Wind Farm

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 Kevin Walter
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 Lenexa, KS, 66219

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SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 74133 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	January	February	March	April	May	June
1	08:44 17:08	15:49 (37) 16:21 (37)	08:22 17:50	07:35 18:34	07:32 20:21	06:34 21:04
2	08:44 17:09	15:50 (37) 16:21 (37)	08:21 17:52	07:33 18:35	07:30 20:22	06:32 21:06
3	08:44 17:10	15:51 (37) 16:21 (37)	08:20 17:54	07:31 18:37	07:28 20:24	06:31 21:07
4	08:44 17:11	15:52 (37) 16:21 (37)	08:17 17:55	07:27 18:38	07:24 20:25	06:28 21:09
5	08:44 17:12	15:52 (37) 16:21 (37)	08:17 17:57	07:27 18:40	07:24 20:26	06:28 21:10
6	08:44 17:13	15:53 (37) 16:22 (37)	08:15 17:58	07:25 18:42	07:22 20:26	06:26 21:12
7	08:43 17:14	15:53 (37) 16:21 (37)	08:14 18:00	07:23 18:43	07:20 20:29	06:24 21:13
8	08:43 17:15	15:54 (37) 16:22 (37)	08:12 18:00	08:21 18:45	07:17 20:31	06:23 21:14
9	08:43 17:16	15:55 (37) 16:21 (37)	08:11 18:02	08:19 19:22	07:15 20:32	06:21 21:16
10	08:42 17:18	15:56 (37) 16:22 (37)	08:09 18:03	08:17 19:48	07:13 20:34	06:20 21:17
11	08:42 17:19	15:57 (37) 16:21 (37)	08:08 18:05	08:15 19:49	07:11 20:35	06:18 21:19
12	08:41 17:20	15:58 (37) 16:21 (37)	08:06 18:07	08:13 19:51	07:09 20:37	06:17 21:20
13	08:41 17:22	15:59 (37) 16:20 (37)	08:04 18:08	08:11 19:52	07:07 20:38	06:16 21:21
14	08:40 17:23	16:01 (37) 16:20 (37)	08:03 18:10	08:09 19:54	07:05 20:40	06:14 21:23
15	08:40 17:24	16:03 (37) 16:19 (37)	08:01 18:11	08:07 19:55	07:04 20:41	06:13 21:24
16	08:39 17:26	16:05 (37) 16:18 (37)	07:59 18:13	08:05 19:57	07:02 20:43	06:12 21:25
17	08:38 17:27	16:08 (37) 16:16 (37)	07:57 18:15	08:03 19:58	07:00 20:44	06:10 21:27
18	08:37 17:29	07:56 18:16	08:01 20:00	08:01 20:00	07:00 20:46	06:09 21:28
19	08:37 17:30	07:54 18:18	07:59 20:01	08:00 20:01	07:00 20:47	06:09 21:29
20	08:36 17:32	07:52 18:20	07:57 20:03	08:00 20:03	07:00 20:48	06:08 21:31
21	08:35 17:33	07:50 18:21	07:55 20:04	08:00 20:04	07:00 20:50	06:06 21:32
22	08:34 17:35	07:48 18:23	07:53 20:06	08:00 20:06	07:00 20:51	06:04 21:33
23	08:33 17:36	07:47 18:24	07:50 20:07	08:00 20:07	07:00 20:52	06:03 21:34
24	08:32 17:38	07:45 18:26	07:48 20:09	08:00 20:09	07:00 20:54	06:02 21:35
25	08:31 17:39	07:43 18:28	07:46 20:10	08:00 20:10	07:00 20:55	06:01 21:37
26	08:30 17:41	07:41 18:29	07:44 20:12	08:00 20:12	07:00 20:57	06:00 21:38
27	08:29 17:42	07:39 18:31	07:42 20:13	08:00 20:13	07:00 20:59	06:00 21:39
28	08:27 17:44	07:37 18:32	07:40 20:15	08:00 20:15	07:00 21:00	06:00 21:40
29	08:26 17:45	07:38 18:32	07:38 20:16	08:00 20:16	07:00 21:02	06:00 21:41
30	08:25 17:47	07:36 18:32	07:36 20:18	08:00 21:03	07:00 21:03	06:00 21:42
31	08:24 17:49	07:34 18:32	07:34 20:19	08:00 21:03	07:00 21:03	06:00 21:43
Potential sun hours	274	285	368	409	471	481
Total, worst case	413		841	114	935	1216
Sun reduction	0.56		0.63	0.59	0.67	0.70
Oper. time red.	0.99		0.99	0.99	0.99	0.99
Wind dir. red.	0.54		0.62	0.70	0.64	0.60
Total reduction	0.30		0.38	0.40	0.42	0.41
Total, real	123		319	46	392	496

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)

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 US-GRAND FORKS, ND 58201
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SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 74133 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	July	August	September	October	November	December		
1	05:54 21:58	06:33 (42) 07:13 (42)	06:26 21:00 (39)	07:09 20:37 (39)	07:51 19:35	18:22 (38) 17:34	07:37 17:00	15:39 (37) 16:03 (37)
2	05:55 21:58	06:33 (42) 07:14 (42)	06:27 21:00 (39)	07:10 20:35 (39)	07:52 19:33	18:22 (38) 17:32	07:39 17:00	15:39 (37) 16:05 (37)
3	05:56 21:57	06:34 (42) 07:14 (42)	06:29 21:00 (39)	07:12 20:33 (39)	07:54 19:31	18:22 (38) 17:31	07:41 16:59	15:39 (37) 16:05 (37)
4	05:56 21:57	06:33 (42) 07:14 (42)	06:30 21:00 (39)	07:13 20:36 (39)	07:55 19:29	18:22 (38) 17:29	07:42 16:59	15:38 (37) 16:06 (37)
5	05:57 21:57	06:34 (42) 07:14 (42)	06:31 21:00 (39)	07:14 20:35 (39)	07:57 19:27	18:22 (38) 17:28	07:44 16:58	15:39 (37) 16:07 (37)
6	05:58 21:56	06:34 (42) 07:15 (42)	06:33 21:00 (39)	07:16 20:35 (39)	07:58 19:25	18:24 (38) 17:26	07:45 16:58	15:39 (37) 16:08 (37)
7	05:59 21:56	06:35 (42) 07:15 (42)	06:34 21:00 (39)	07:17 20:35 (39)	07:59 19:23	18:24 (38) 17:25	07:47 16:58	15:39 (37) 16:08 (37)
8	05:59 21:55	06:34 (42) 07:14 (42)	06:35 21:00 (39)	07:18 20:36 (39)	08:01 19:20	18:26 (38) 17:23	07:48 16:58	15:39 (37) 16:09 (37)
9	06:00 21:55	06:35 (42) 07:15 (42)	06:37 21:00 (39)	07:20 20:32 (39)	08:02 19:18	18:27 (38) 17:22	07:50 16:57	15:39 (37) 16:09 (37)
10	06:01 21:54	06:35 (42) 07:15 (42)	06:38 21:00 (39)	07:21 20:30 (39)	08:04 19:16	18:28 (38) 17:20	07:52 16:57	15:39 (37) 16:10 (37)
11	06:02 21:54	06:35 (42) 07:15 (42)	06:40 21:00 (39)	07:23 20:37 (39)	08:05 19:14	18:32 (38) 17:19	07:53 16:57	15:39 (37) 16:11 (37)
12	06:03 21:53	06:36 (42) 07:15 (42)	06:41 21:00 (39)	07:24 20:37 (39)	08:07 19:12	18:45 (38) 17:18	07:55 16:57	15:40 (37) 16:11 (37)
13	06:04 21:52	06:36 (42) 07:15 (42)	06:42 21:00 (39)	07:25 20:38 (39)	08:08 19:10	17:17	07:56 16:57	15:40 (37) 16:12 (37)
14	06:05 21:52	06:36 (42) 07:15 (42)	06:44 21:00 (39)	07:27 20:39 (39)	08:10 19:08	17:15	07:58 16:57	15:40 (37) 16:13 (37)
15	06:06 21:51	06:37 (42) 07:15 (42)	06:45 21:00 (39)	07:28 20:09	08:11 19:06	17:14	07:59 16:57	15:41 (37) 16:13 (37)
16	06:07 21:50	06:37 (42) 07:15 (42)	06:46 21:00 (39)	07:30 20:06	08:13 19:05	17:13	08:01 16:58	15:41 (37) 16:13 (37)
17	06:08 21:49	06:38 (42) 07:15 (42)	06:48 21:00 (39)	07:31 20:04	08:14 19:03	17:12	08:02 16:58	15:41 (37) 16:14 (37)
18	06:09 21:48	06:38 (42) 07:15 (42)	06:49 21:00 (39)	07:32 20:03	08:16 19:01	17:11	08:04 16:58	15:42 (37) 16:15 (37)
19	06:10 21:47	06:38 (42) 07:15 (42)	06:51 21:00 (39)	07:34 20:00	08:17 19:00	17:10	08:05 16:58	15:43 (37) 16:16 (37)
20	06:11 21:46	06:39 (42) 07:14 (42)	06:52 21:00 (39)	07:35 19:58	08:19 18:55	17:09	08:07 16:59	15:43 (37) 16:15 (37)
21	06:12 21:45	06:39 (42) 07:14 (42)	06:53 21:00 (39)	07:37 19:56	08:20 18:53	17:08	08:08 16:59	15:44 (37) 16:16 (37)
22	06:14 21:44	06:40 (42) 07:13 (42)	06:55 21:00 (39)	07:38 19:54	08:22 18:51	17:08	08:10 16:59	15:44 (37) 16:16 (37)
23	06:15 21:43	06:41 (42) 07:12 (42)	06:56 21:00 (39)	07:39 19:52	08:23 18:49	17:07	08:11 16:59	15:45 (37) 16:17 (37)
24	06:16 21:42	06:42 (42) 07:12 (42)	06:58 21:00 (39)	07:41 19:50	08:25 18:48	17:06	08:13 16:59	15:45 (37) 16:18 (37)
25	06:17 21:41	06:43 (42) 07:11 (42)	06:59 21:00 (39)	07:42 19:47	08:27 18:46	17:05	08:14 16:59	15:45 (37) 16:18 (37)
26	06:18 21:40	06:45 (42) 07:10 (42)	07:00 21:00 (39)	07:44 19:45	08:28 18:44	17:04	08:15 16:59	15:45 (37) 16:18 (37)
27	06:20 21:39	06:46 (42) 07:09 (42)	07:02 21:00 (39)	07:45 19:43	08:30 18:42	17:03	08:17 16:59	15:46 (37) 16:19 (37)
28	06:21 21:37	06:47 (42) 07:08 (42)	07:03 21:00 (39)	07:47 19:41	08:31 18:41	17:03	08:18 16:59	15:47 (37) 16:19 (37)
29	06:22 21:36	06:48 (42) 07:07 (42)	07:05 21:00 (39)	07:48 19:39	08:33 18:39	17:02	08:20 16:59	15:47 (37) 16:19 (37)
30	06:23 21:35	06:50 (42) 07:06 (42)	07:06 21:00 (39)	07:49 19:37	08:34 18:37	17:01	08:21 16:59	15:48 (37) 16:20 (37)
31	06:25 21:33	06:55 (42) 21:00 (39)	07:07 20:39	07:50 19:36	08:36 18:36	17:01	08:22 17:06	15:48 (37) 16:20 (37)
Potential sun hours	486	445	379	337	278	260		
Total, worst case	1171	344	511	341	98	960		
Sun reduction	0.75	0.72	0.69	0.52	0.43	0.44		
Oper. time red.	0.99	0.99	0.99	0.99	0.99	0.99		
Wind dir. red.	0.61	0.70	0.62	0.62	0.54	0.54		
Total reduction	0.44	0.50	0.41	0.32	0.23	0.23		
Total, real	520	171	212	108	23	225		

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab **Shadow receptor: 77282 - Office/Farm**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	January	February	March	April	May	June
1 08:45	09:29 (104) 08:23		07:35	17:39 (12) 07:32	07:53 (105) 06:34	05:55
17:07	18 09:47 (104) 17:50		18:34	20 17:59 (12) 20:21	50 19:57 (13) 21:05	21:45
2 08:45	09:30 (104) 08:21		07:33	17:40 (12) 07:30	07:51 (105) 06:32	05:55
17:08	17 09:47 (104) 17:52		18:35	18 17:58 (12) 20:22	53 19:57 (13) 21:06	21:46
3 08:45	09:31 (104) 08:20		07:31	17:41 (12) 07:28	07:50 (105) 06:31	05:54
17:09	16 09:47 (104) 17:53		18:37	15 17:56 (12) 20:24	55 19:57 (13) 21:08	21:47
4 08:44	09:33 (104) 08:18		07:29	17:43 (12) 07:26	07:49 (105) 06:29	05:53
17:10	14 09:47 (104) 17:55		18:38	11 17:54 (12) 20:25	56 19:57 (13) 21:09	21:47
5 08:44	09:33 (104) 08:17		07:27		07:24	05:53
17:11	13 09:46 (104) 17:57		18:40		07:24	05:53
6 08:44	09:35 (104) 08:15		07:25		07:21	05:52
17:13	11 09:46 (104) 17:58		18:42		07:19	05:52
7 08:44	09:37 (104) 08:14		07:23		07:19	05:52
17:14	8 09:45 (104) 18:00		18:43		07:17	05:51
8 08:43	09:38 (104) 08:12		08:21		07:17	05:51
17:15	5 09:43 (104) 18:00	2 08:36 (158) 18:45	08:21		07:17	05:51
9 08:43		08:11	08:34 (158) 08:19		07:15	05:51
17:16		18:02	5 08:39 (158) 19:46		07:15	05:51
10 08:43		08:09	08:33 (158) 08:17		07:13	05:51
17:17		18:03	7 08:40 (158) 19:48		07:13	05:51
11 08:42		08:08	08:31 (158) 08:15		07:11	05:50
17:19		18:05	10 08:41 (158) 19:49		07:11	05:50
12 08:42		08:06	08:29 (158) 08:13		07:09	05:50
17:20		18:06	12 08:41 (158) 19:51		07:09	05:50
13 08:41		08:04	08:28 (158) 08:11		07:07	05:50
17:21		18:08	14 08:42 (158) 19:52		07:07	05:50
14 08:41		08:03	08:26 (158) 08:09		07:05	05:50
17:23		18:10	16 08:42 (158) 19:54		07:05	05:50
15 08:40		08:01	08:24 (158) 08:07		07:03	05:50
17:24		18:11	17 08:41 (158) 19:55		07:03	05:50
16 08:39		07:59	08:22 (158) 08:05		07:01	05:50
17:25		18:13	18 08:40 (158) 19:57		07:01	05:50
17 08:38		07:58	08:23 (158) 08:03		07:00	05:50
17:27		18:15	23 17:51 (12) 19:58		07:00	05:50
18 08:38		07:56	08:23 (158) 08:01		07:00	05:50
17:28		18:16	25 17:52 (12) 20:00		07:00	05:50
19 08:37		07:54	08:25 (158) 07:59		07:00	05:50
17:30		18:18	26 17:54 (12) 20:01		07:00	05:50
20 08:36		07:52	08:26 (158) 07:57		07:00	05:50
17:31		18:19	24 17:55 (12) 20:03		07:00	05:50
21 08:35		07:50	17:38 (12) 07:55		07:00	05:50
17:33		18:21	19 17:57 (12) 20:04		07:00	05:50
22 08:34		07:49	17:38 (12) 07:53		07:00	05:50
17:34		18:23	20 17:58 (12) 20:06		07:00	05:50
23 08:33		07:47	17:37 (12) 07:51		07:00	05:50
17:36		18:24	23 18:00 (12) 20:07		07:00	05:50
24 08:32		07:45	17:37 (12) 07:48		07:00	05:50
17:37		18:26	24 18:01 (12) 20:09		07:00	05:50
25 08:31		07:43	17:37 (12) 07:46		07:00	05:50
17:39		18:27	25 18:02 (12) 20:10		07:00	05:50
26 08:30		07:41	17:37 (12) 07:44		07:00	05:50
17:41		18:29	25 18:02 (12) 20:12		07:00	05:50
27 08:29		07:39	17:38 (12) 07:42	08:04 (105) 06:41	07:00	05:50
17:42		18:31	23 18:01 (12) 20:13	16 19:51 (13) 20:59	07:00	05:50
28 08:28		07:37	17:38 (12) 07:40	08:02 (105) 06:39	07:00	05:50
17:44		18:32	22 18:00 (12) 20:15	26 19:52 (13) 21:00	07:00	05:50
29 08:26			07:38	08:00 (105) 06:37	07:00	05:50
17:45			20:16	34 19:54 (13) 21:02	07:00	05:50
30 08:25			07:36	07:58 (105) 06:36	07:00	05:50
17:47			20:18	39 19:55 (13) 21:03	07:00	05:50
31 08:24			07:34	07:56 (105) 06:35	07:00	05:50
17:48			20:19	46 19:57 (13) 21:04	07:00	05:50
Potential sun hours	273	285	368	410	471	481
Total, worst case	102	390	225	846		301
Sun reduction	0.56	0.50	0.63	0.59		0.70
Oper. time red.	0.99	0.99	0.99	0.99		0.99
Wind dir. red.	0.70	0.65	0.65	0.66		0.72
Total reduction	0.39	0.32	0.40	0.38		0.50
Total, real	39	123	91	323		150

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:
20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab Shadow receptor: 77282 - Office/Farm

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
663 334 354 413 612 967 793 577 699 909 1,123 1,198 8,641
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (July, August, September, October, November, December) and rows for time slots (1 | 05:54 to 21:34) and summary rows for sun hours and reduction percentages.

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

Matrix layout 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:

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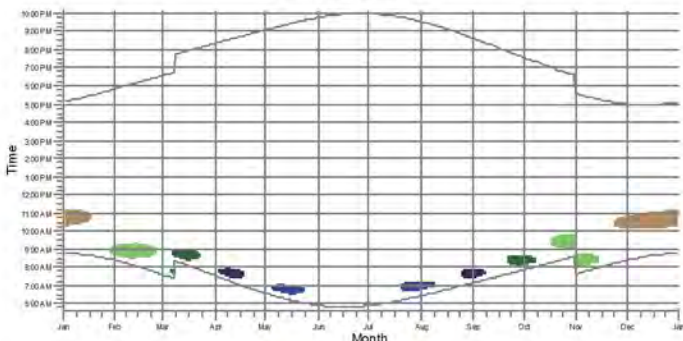
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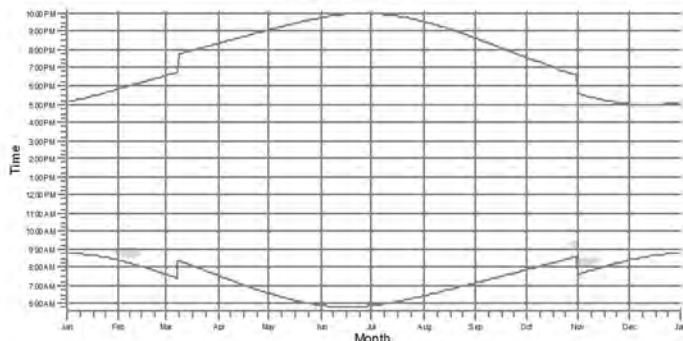
SHADOW - Calendar, graphical

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab

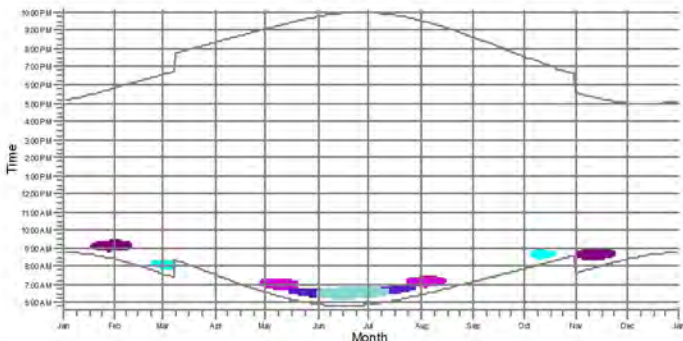
72448: House



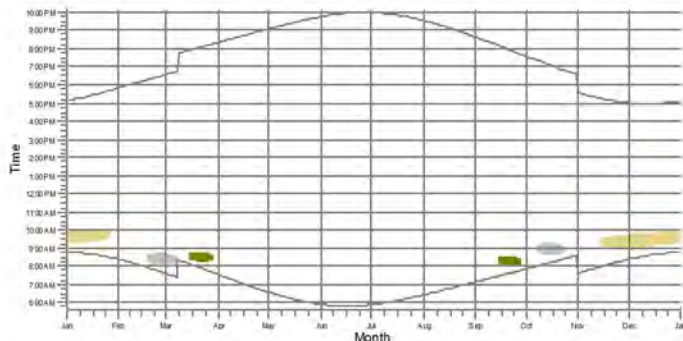
72910: Garage



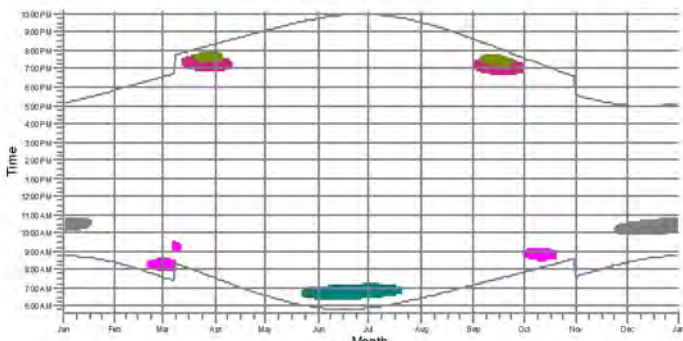
73008: House



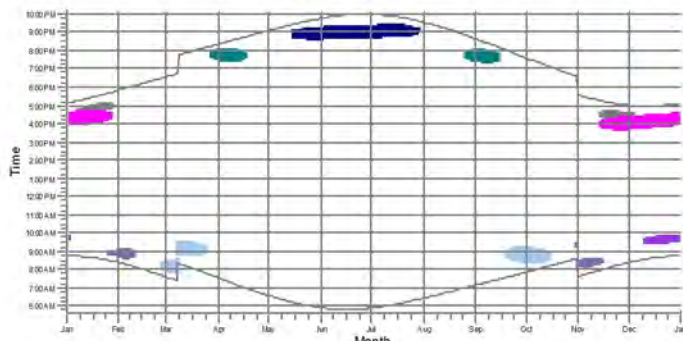
73047: House



73164: House



73183: House



WTGs

- | | | | | | | | |
|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|
| 13: Primary | 16: Primary | 21: Primary | 98: Primary | 114: Primary | 161: Primary | 176: Primary | 179: Primary |
| 14: Primary | 19: Primary | 22: Primary | 99: Primary | 150: Primary | 182: Primary | 177: Primary | 180: Primary |
| 15: Primary | 20: Primary | 25: Primary | 105: Primary | 160: Primary | 184: Primary | 178: Primary | |

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.

Kevin Walter

Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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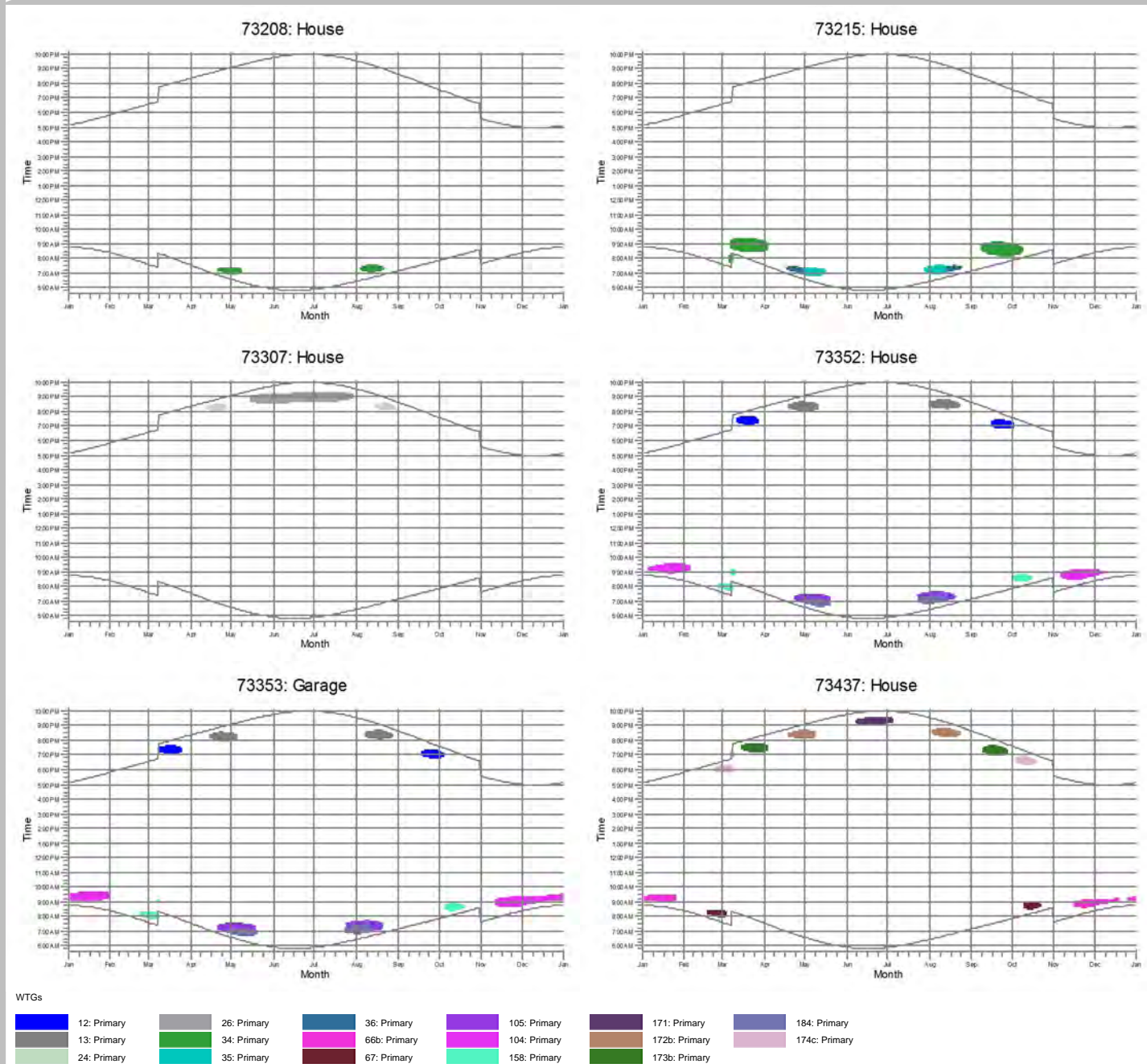
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SHADOW - Calendar, graphical

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab



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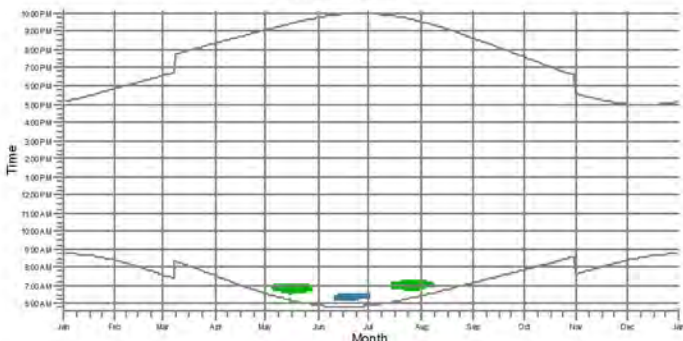
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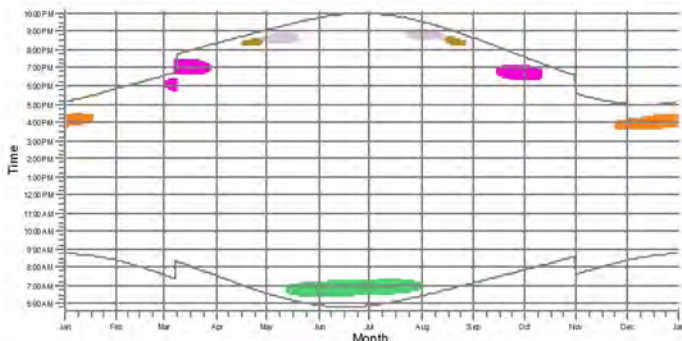
SHADOW - Calendar, graphical

Calculation: A034 V117 91.5m HH Realistic Flicker w/out Obstacles DNV Tab

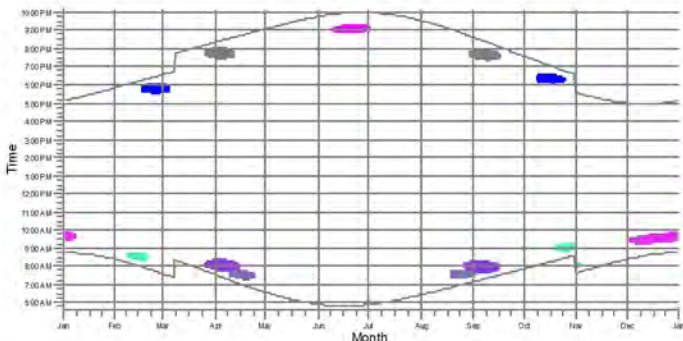
73792: House



74133: House



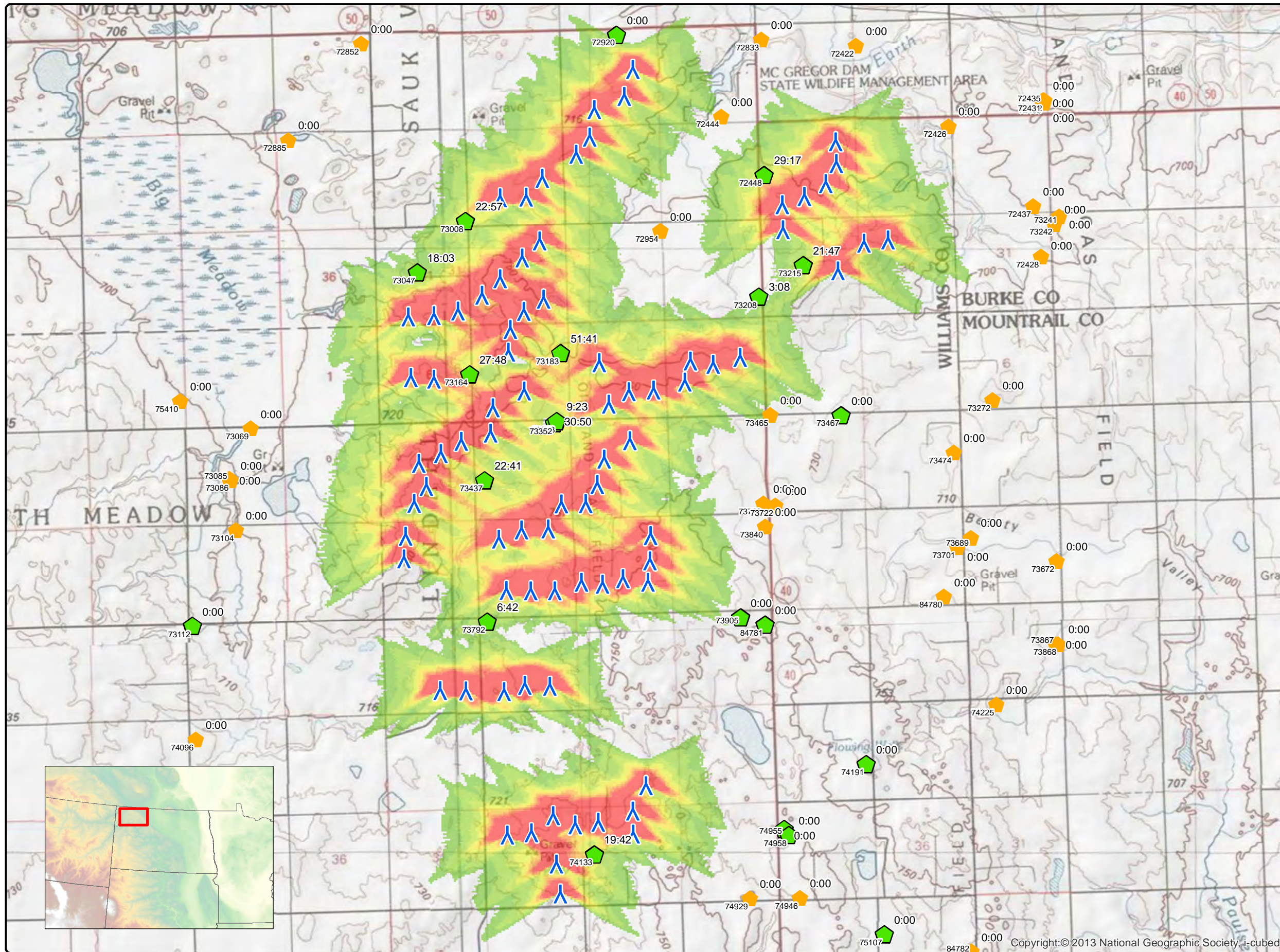
77282: Office/Farm



WTGs

- 12: Primary
- 14: Primary
- 38: Primary
- 42: Primary
- 105: Primary
- 155: Primary
- 184: Primary
- 13: Primary
- 37: Primary
- 39: Primary
- 84: Primary
- 104: Primary
- 158: Primary
- 205b: Primary

Appendix C: Realistic Shadow Flicker Map – V117-3.3 91.5 m HH, with Obstacles




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Lindahl Wind Farm V117 Realistic Shadow Flicker With Obstacles

Client

TradeWind Energy, Inc.

Project Description

75 Primary WTG locations & 5 Alts (A034) for V117-3.3 on 91.5 m HH. Realistic shadow flicker map and data at receptors (hrs/yr). Assumes statistical reduction due to sunshine probability, turbine orientation and operation probability. Sensors in "greenhouse" mode. Obstacles assumed. 73183 reduced to 20:41 hrs/yr with removal of 16 and 25.

Location: Tioqa, ND




Project #: 20132550

Issue Dates











#	Description	Date
1	Preliminary Draft	2015.06.23

Drawn By: BS Checked By: JH

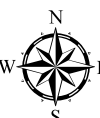
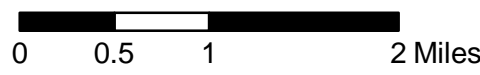
Legend

-  V117 WTG A034
-  Non-Participating Residences
-  Participating Residence

Shadow Flicker (hrs/yr)

-  <5
-  5 - 10
-  10 - 20
-  20 - 30
-  30 - 40
-  40 - 50
-  50 - 60
-  60 - 70
-  70 - 80
-  >80

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Appendix D: windPRO Shadow Flicker Report - V117- 3.3 91.5 m HH, with Obstacles

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SHADOW - Main Result

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab

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

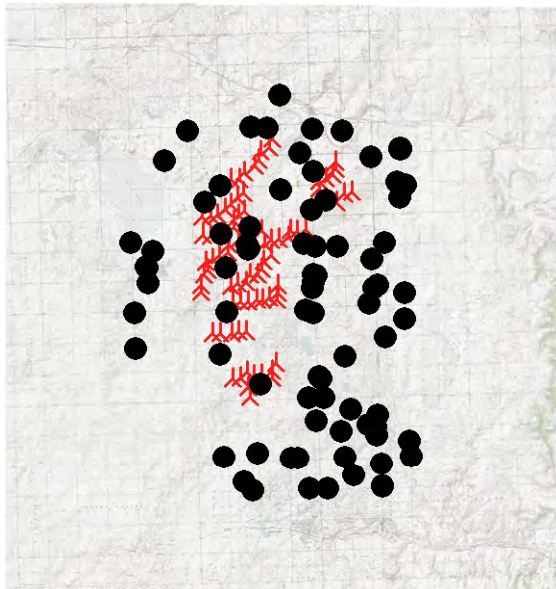
Sunshine probability S (Average daily sunshine hours) [BISMARCK]
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 4.92 5.13 7.45 8.03 10.20 11.21 11.69 10.35 8.68 5.69 4.02 3.69

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

DNV Shadow

Operational time
 N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
 663 334 354 413 612 967 793 577 699 909 1,123 1,198 8,641
 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: 20100616_Lindahl_10ft_HCL.wpo (1)
 Obstacles used in calculation
 Eye height: 1.5 m
 Grid resolution: 10.0 m



Scale 1:400,000
 New WTG Shadow receptor

WTGs

UTM NAD83 Zone: 13			Row data/Description	WTG type								
East	North	Z [m]		Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]		
5	646,913	5,375,455	745.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
12	648,319	5,377,157	750.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
13	648,353	5,377,573	752.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
14	648,872	5,377,853	752.9 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
15	648,611	5,378,490	759.0 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
16	648,641	5,378,869	759.0 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
17	648,868	5,379,168	761.9 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
18	649,189	5,379,368	749.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
19	648,477	5,379,703	762.0 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
20	648,837	5,380,044	745.1 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
21	648,176	5,379,834	743.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
22	649,124	5,380,328	729.3 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
24	651,007	5,377,868	749.0 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
25	650,109	5,378,321	754.1 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
26	651,525	5,378,000	751.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
27	651,616	5,378,348	758.6 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
28	651,987	5,378,290	755.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
29	652,436	5,378,405	749.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
34	654,047	5,379,834	743.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
35	654,478	5,380,290	740.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
36	654,876	5,380,346	731.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
37	649,468	5,369,552	735.9 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
38	649,403	5,370,046	745.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
39	648,989	5,370,563	740.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
40	649,348	5,370,846	749.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
42	650,668	5,370,540	746.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		
43	650,667	5,370,918	744.1 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0		

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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EAPC Wind Energy
 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 4:14 PM/2.9.285

SHADOW - Main Result

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab

...continued from previous page

UTM NAD83 Zone: 13				WTG type						
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]
45	650,882	5,371,340	743.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
67	649,484	5,375,990	732.9 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
68	649,889	5,375,994	741.6 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
69	650,079	5,376,307	740.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
83	648,826	5,375,558	729.9 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
84	648,982	5,374,557	737.6 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
85	648,580	5,374,558	735.1 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
97	648,537	5,372,891	719.3 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
98	648,903	5,381,054	722.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
99	649,170	5,381,363	721.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
100	649,950	5,382,038	713.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
101	650,030	5,382,496	712.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
102	650,525	5,382,713	713.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
104	650,189	5,376,726	739.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
105	650,267	5,377,632	746.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
114	648,476	5,381,043	724.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
150	650,663	5,383,159	707.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
151	650,947	5,375,049	753.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
152	650,911	5,374,694	758.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
154	650,163	5,374,664	746.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
155	649,378	5,374,555	741.3 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
158	650,614	5,377,029	737.6 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
160	647,380	5,378,047	737.6 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
161	647,780	5,379,172	731.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
166	647,487	5,372,910	715.6 Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
170	647,835	5,377,018	752.9 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
171	647,495	5,376,819	749.1 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
175	653,143	5,380,511	713.2 Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
176	653,130	5,380,927	710.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
177	653,497	5,381,062	704.1 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
178	653,850	5,381,276	700.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
182	647,004	5,378,073	731.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
184	650,599	5,377,842	746.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
185	647,385	5,379,098	722.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
186	646,960	5,379,073	712.5 Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
153b	650,500	5,374,756	749.1 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
156b	649,818	5,374,694	743.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
164b	649,297	5,372,977	725.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
165b	647,909	5,372,903	716.3 Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
172b	647,131	5,376,655	743.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
173b	647,258	5,376,278	743.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
174c	647,056	5,376,002	741.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
179b	654,022	5,381,604	696.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
180b	654,011	5,381,966	694.9 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
181b	648,451	5,375,405	728.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
183b	649,728	5,381,758	721.2 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
205b	648,594	5,370,523	731.5 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
206b	650,092	5,370,737	743.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
41b	649,714	5,370,690	746.8 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
66b	649,269	5,375,574	732.7 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
6b	646,888	5,375,080	743.7 Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
70b	650,956	5,375,465	751.0 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0
96b	648,884	5,372,995	722.4 Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	91.5	17.0

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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EAPC Wind Energy
 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 4:14 PM/2.9.285

SHADOW - Main Result

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab

Shadow receptor-Input

UTM NAD83 Zone: 13

No.	Name	UTM NAD83 Zone: 13			Width	Height	Height a.g.l.	Degrees from/south	Slope of window	Direction mode
		East	North	Z						
		[m]	[m]	[m]	[m]	[m]	[°]	[°]		
72422	House	654,346	5,383,551	675.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72426	House	655,873	5,382,222	689.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72428	House	657,399	5,380,070	700.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72431	Field Office	657,434	5,382,649	698.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72432	Field Office	657,452	5,382,650	698.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72433	Field Office	657,452	5,382,638	698.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72434	Field Office	657,431	5,382,638	699.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72435	Field Office	657,425	5,382,612	699.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72436	Field Office	657,443	5,382,612	699.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72437	House	657,270	5,380,900	701.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72444	House	652,124	5,382,382	698.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72448	House	652,833	5,381,417	705.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72833	House	652,780	5,383,651	684.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72843	House	651,086	5,385,430	681.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72852	House	646,183	5,383,581	712.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72885	House	644,980	5,381,994	704.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72910	Garage	649,528	5,383,760	704.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72920	House	650,400	5,383,729	711.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72954	House	651,119	5,380,491	705.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73008	House	647,905	5,380,657	723.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73047	House	647,113	5,379,805	712.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73069	House	644,362	5,377,232	698.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73085	House	644,011	5,376,402	703.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73086	House	644,029	5,376,379	703.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73104	House	644,116	5,375,556	701.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73112	House	643,400	5,373,971	710.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73164	House	647,974	5,378,125	736.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73183	House	649,476	5,378,474	747.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73208	House	652,746	5,379,403	722.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73215	House	653,476	5,379,925	741.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73241	House	657,701	5,380,739	704.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73242	House	657,625	5,380,605	701.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73272	House	656,603	5,377,699	728.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73307	House	652,350	5,377,616	735.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73352	House	649,372	5,377,319	734.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73353	Garage	649,411	5,377,350	734.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73437	House	648,222	5,376,376	731.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73465	House	652,934	5,377,454	728.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73467	House	654,105	5,377,449	726.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73474	House	655,962	5,376,837	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73672	House	657,653	5,375,042	704.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73689	House	656,242	5,375,429	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73701	House	656,021	5,375,274	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73722	House	653,014	5,375,966	734.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73729	House	652,820	5,375,995	733.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73792	House	648,263	5,374,042	728.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73840	House	652,848	5,375,611	736.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73848	Probably Occupied	652,773	5,375,266	744.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73867	House	657,646	5,373,676	710.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73868	House	657,685	5,373,674	711.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73905	House	652,445	5,374,111	759.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74072	Occupiable Structure, per field notes	647,929	5,371,803	716.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74096	House	643,453	5,372,099	716.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74133	House	650,034	5,370,204	742.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

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 Lenexa, KS, 66219

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EAPC Wind Energy
 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 4:14 PM/2.9.285

SHADOW - Main Result

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab

...continued from previous page

UTM NAD83 Zone: 13

No.	Name	East	North	Z	Width	Height	Height	Degrees	Slope of	Direction mode
		[m]	[m]	[m]	[m]	[m]	a.g.l.	from/south	window	
								cw		
								[°]	[°]	
74191	House	654,514	5,371,692	765.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74225	House	656,662	5,372,675	722.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74929	House	652,597	5,369,477	749.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74944	House	652,987	5,368,263	755.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74946	House	653,421	5,369,486	746.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74955	House	653,163	5,370,620	746.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74958	House	653,237	5,370,521	746.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74997	House	656,161	5,367,989	720.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75017	House	655,758	5,368,066	719.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75019	House	656,215	5,367,523	716.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75023	House	657,919	5,367,212	720.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75024	House	657,910	5,367,229	720.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75035	House	658,012	5,366,393	701.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75048	House	656,450	5,365,968	719.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75051	House	656,481	5,364,835	702.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75052	House	656,500	5,364,785	701.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75060	House	654,953	5,365,361	717.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75107	House	654,816	5,368,880	743.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75125	House	654,533	5,366,347	734.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75164	House	653,608	5,364,657	704.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75171	House	652,658	5,364,673	707.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75178	House	652,044	5,366,274	727.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75181	House	651,664	5,366,273	728.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75198	House	649,867	5,366,571	723.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75240	House	648,111	5,366,363	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75250	House	649,156	5,365,047	710.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75262	House	649,634	5,364,566	718.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75410	House	643,198	5,377,684	702.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
77282	Office/Farm	649,350	5,377,570	737.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84780	Occupied structure per Field Notes, not on imagery	655,800	5,374,456	722.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84781	House	652,849	5,373,992	753.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84782	Occupied fifth wheel	656,251	5,368,598	741.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84783	New house per field notes	654,290	5,367,724	742.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
72422	House	0:00	0	0:00	0:00
72426	House	0:00	0	0:00	0:00
72428	House	0:00	0	0:00	0:00
72431	Field Office	0:00	0	0:00	0:00
72432	Field Office	0:00	0	0:00	0:00
72433	Field Office	0:00	0	0:00	0:00
72434	Field Office	0:00	0	0:00	0:00
72435	Field Office	0:00	0	0:00	0:00
72436	Field Office	0:00	0	0:00	0:00
72437	House	0:00	0	0:00	0:00
72444	House	0:00	0	0:00	0:00
72448	House	80:32	207	0:44	29:17

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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EAPC Wind Energy
 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
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SHADOW - Main Result

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab

...continued from previous page

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
72833	House	0:00	0	0:00	0:00
72843	House	0:00	0	0:00	0:00
72852	House	0:00	0	0:00	0:00
72885	House	0:00	0	0:00	0:00
72910	Garage	7:20	32	0:21	2:30
72920	House	0:00	0	0:00	0:00
72954	House	0:00	0	0:00	0:00
73008	House	57:51	183	0:29	22:57
73047	House	50:40	129	0:32	18:03
73069	House	0:00	0	0:00	0:00
73085	House	0:00	0	0:00	0:00
73086	House	0:00	0	0:00	0:00
73104	House	0:00	0	0:00	0:00
73112	House	0:00	0	0:00	0:00
73164	House	73:24	151	0:40	27:48
73183	House	137:53	274	0:47	51:41
73208	House	7:44	33	0:21	3:08
73215	House	50:39	114	0:46	21:47
73241	House	0:00	0	0:00	0:00
73242	House	0:00	0	0:00	0:00
73272	House	0:00	0	0:00	0:00
73307	House	42:25	105	0:32	21:00
73352	House	75:31	180	0:58	30:50
73353	Garage	21:43	71	0:26	9:23
73437	House	55:33	202	0:36	22:41
73465	House	0:00	0	0:00	0:00
73467	House	0:00	0	0:00	0:00
73474	House	0:00	0	0:00	0:00
73672	House	0:00	0	0:00	0:00
73689	House	0:00	0	0:00	0:00
73701	House	0:00	0	0:00	0:00
73722	House	0:00	0	0:00	0:00
73729	House	0:00	0	0:00	0:00
73792	House	16:11	69	0:24	6:42
73840	House	0:00	0	0:00	0:00
73848	Probably Occupied	0:00	0	0:00	0:00
73867	House	0:00	0	0:00	0:00
73868	House	0:00	0	0:00	0:00
73905	House	0:00	0	0:00	0:00
74072	Occupiable Structure, per field notes	0:00	0	0:00	0:00
74096	House	0:00	0	0:00	0:00
74133	House	47:14	80	0:41	19:42
74191	House	0:00	0	0:00	0:00
74225	House	0:00	0	0:00	0:00
74929	House	0:00	0	0:00	0:00
74944	House	0:00	0	0:00	0:00
74946	House	0:00	0	0:00	0:00
74955	House	0:00	0	0:00	0:00
74958	House	0:00	0	0:00	0:00
74997	House	0:00	0	0:00	0:00
75017	House	0:00	0	0:00	0:00
75019	House	0:00	0	0:00	0:00
75023	House	0:00	0	0:00	0:00
75024	House	0:00	0	0:00	0:00

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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EAPC Wind Energy
 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
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SHADOW - Main Result

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab

...continued from previous page

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
75035	House	0:00	0	0:00	0:00
75048	House	0:00	0	0:00	0:00
75051	House	0:00	0	0:00	0:00
75052	House	0:00	0	0:00	0:00
75060	House	0:00	0	0:00	0:00
75107	House	0:00	0	0:00	0:00
75125	House	0:00	0	0:00	0:00
75164	House	0:00	0	0:00	0:00
75171	House	0:00	0	0:00	0:00
75178	House	0:00	0	0:00	0:00
75181	House	0:00	0	0:00	0:00
75198	House	0:00	0	0:00	0:00
75240	House	0:00	0	0:00	0:00
75250	House	0:00	0	0:00	0:00
75262	House	0:00	0	0:00	0:00
75410	House	0:00	0	0:00	0:00
77282	Office/Farm	63:51	167	0:57	24:54
84780	Occupied structure per Field Notes, not on imagery	0:00	0	0:00	0:00
84781	House	0:00	0	0:00	0:00
84782	Occupied fifth wheel	0:00	0	0:00	0:00
84783	New house per field notes	0:00	0	0:00	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
5	Primary	0:00	0:00
12	Primary	21:52	8:04
13	Primary	67:47	25:04
14	Primary	56:26	17:42
15	Primary	47:26	19:55
16	Primary	35:08	17:41
17	Primary	0:00	0:00
18	Primary	0:00	0:00
19	Primary	6:30	2:53
20	Primary	14:36	5:02
21	Primary	10:06	3:46
22	Primary	6:23	2:25
24	Primary	6:15	2:48
25	Primary	28:24	11:51
26	Primary	36:10	18:12
27	Primary	0:00	0:00
28	Primary	0:00	0:00
29	Primary	0:00	0:00
34	Primary	43:22	18:43
35	Primary	12:59	5:21
36	Primary	3:43	1:27
37	Primary	0:00	0:00
38	Primary	0:00	0:00
39	Primary	0:00	0:00
40	Primary	0:00	0:00
42	Primary	47:14	19:42
43	Primary	0:00	0:00
45	Primary	0:00	0:00

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.

Kevin Walter

Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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SHADOW - Main Result**Calculation:** A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
67	Primary	5:27	1:54
68	Primary	0:00	0:00
69	Primary	0:00	0:00
83	Primary	0:00	0:00
84	Primary	3:04	1:12
85	Primary	0:00	0:00
97	Primary	0:00	0:00
98	Primary	13:37	5:40
99	Primary	9:44	4:01
100	Primary	0:00	0:00
101	Primary	0:00	0:00
102	Primary	0:00	0:00
104	Primary	29:32	10:01
105	Primary	39:00	15:49
114	Primary	16:01	6:28
150	Primary	7:20	2:30
151	Primary	0:00	0:00
152	Primary	0:00	0:00
154	Primary	0:00	0:00
155	Primary	13:07	5:29
158	Primary	11:08	4:09
160	Primary	0:00	0:00
161	Primary	34:04	11:22
166	Alternate	0:00	0:00
170	Primary	0:00	0:00
171	Primary	6:44	3:22
175	Alternate	0:00	0:00
176	Primary	31:45	10:16
177	Primary	25:06	8:51
178	Primary	9:30	4:05
182	Primary	0:00	0:00
184	Primary	23:30	9:14
185	Primary	0:00	0:00
186	Alternate	0:00	0:00
153b	Primary	0:00	0:00
156b	Primary	0:00	0:00
164b	Primary	0:00	0:00
165b	Alternate	0:00	0:00
172b	Primary	11:27	5:17
173b	Primary	12:28	5:17
174c	Primary	7:06	2:29
179b	Primary	6:20	2:35
180b	Primary	7:51	3:16
181b	Primary	0:00	0:00
183b	Primary	0:00	0:00
205b	Primary	0:00	0:00
206b	Primary	0:00	0:00
41b	Primary	0:00	0:00
66b	Primary	12:21	4:19
6b	Alternate	0:00	0:00
70b	Primary	0:00	0:00
96b	Primary	0:00	0:00

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
Brandon Storm / bstorm@eapc.net
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SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab **Shadow receptor: 73164 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	January	February	March	April	May	June	
1	08:45 17:07	10:09 (13) 08:23 10:46 (13) 17:50	07:35 18:34	08:03 (14) 07:32 08:31 (14) 20:21	06:34 21:05	05:55 21:45	06:29 (15) 06:59 (15)
2	08:45 17:08	10:10 (13) 08:21 10:46 (13) 17:52	07:33 18:35	08:03 (14) 07:30 08:31 (14) 20:22	06:32 21:06	05:55 21:46	06:30 (15) 07:00 (15)
3	08:45 17:09	10:11 (13) 08:20 10:47 (13) 17:53	07:31 18:37	08:02 (14) 07:28 08:31 (14) 20:24	06:31 21:08	05:54 21:47	06:29 (15) 07:01 (15)
4	08:45 17:10	10:12 (13) 08:18 10:47 (13) 17:55	07:30 18:39	08:02 (14) 07:26 08:31 (14) 20:25	06:29 21:09	05:53 21:48	06:29 (15) 07:02 (15)
5	08:44 17:11	10:13 (13) 08:17 10:47 (13) 17:57	07:28 18:40	08:03 (14) 07:24 08:30 (14) 20:27	06:27 21:11	05:53 21:48	06:28 (15) 07:02 (15)
6	08:44 17:13	10:13 (13) 08:16 10:47 (13) 17:58	07:26 18:42	08:03 (14) 07:22 08:29 (14) 20:28	06:26 21:12	05:52 21:49	06:29 (15) 07:02 (15)
7	08:44 17:14	10:14 (13) 08:14 10:47 (13) 18:00	07:24 18:43	08:04 (14) 07:20 08:28 (14) 20:30	06:24 21:13	05:52 21:50	06:28 (15) 07:02 (15)
8	08:44 17:15	10:14 (13) 08:13 10:46 (13) 18:00	08:22 18:45	09:04 (14) 07:17 09:27 (14) 20:31	06:23 21:15	05:52 21:51	06:28 (15) 07:03 (15)
9	08:43 17:16	10:16 (13) 08:11 10:47 (13) 18:02	08:19 19:46	09:06 (14) 07:15 09:26 (14) 20:33	06:21 21:16	05:51 21:52	06:29 (15) 07:04 (15)
10	08:43 17:17	10:16 (13) 08:09 10:46 (13) 18:03	08:17 19:48	09:06 (14) 07:13 09:22 (14) 20:34	06:20 21:18	05:51 21:52	06:28 (15) 07:03 (15)
11	08:42 17:19	10:18 (13) 08:08 10:46 (13) 18:05	08:15 19:49	09:09 (14) 07:11 09:19 (14) 20:36	06:18 21:19	05:51 21:53	06:28 (15) 07:04 (15)
12	08:42 17:20	10:19 (13) 08:06 10:45 (13) 18:07	08:13 19:51	07:09 20:37	06:17 21:20	05:50 21:54	06:28 (15) 07:05 (15)
13	08:41 17:21	10:21 (13) 08:05 10:45 (13) 18:08	08:11 19:52	07:07 20:38	06:15 21:22	05:50 21:54	06:28 (15) 07:05 (15)
14	08:41 17:23	10:22 (13) 08:03 10:44 (13) 18:10	08:09 19:54	07:05 20:40	06:14 21:23	05:50 21:55	06:29 (15) 07:05 (15)
15	08:40 17:24	10:24 (13) 08:01 10:42 (13) 18:11	08:07 19:55	07:04 20:41	06:13 21:24	05:50 21:56	06:29 (15) 07:06 (15)
16	08:39 17:26	10:26 (13) 07:59 10:40 (13) 18:13	08:05 19:57	07:02 20:43	06:11 21:26	05:50 21:56	06:29 (15) 07:06 (15)
17	08:39 17:27	10:30 (13) 07:58 10:37 (13) 18:15	08:03 19:58	07:00 20:44	06:10 21:27	05:50 21:56	06:29 (15) 07:06 (15)
18	08:38 17:28	07:56 18:16	08:01 20:00	06:58 20:46	06:09 21:28	05:50 21:57	06:29 (15) 07:06 (15)
19	08:37 17:30	07:54 18:18	07:59 20:01	06:56 20:47	06:08 21:30	05:50 21:57	06:29 (15) 07:07 (15)
20	08:36 17:31	07:52 18:19	07:57 20:03	06:54 20:49	06:07 21:31	05:50 21:58	06:29 (15) 07:07 (15)
21	08:35 17:33	07:51 18:21	07:55 20:04	06:52 20:50	06:05 21:32	05:50 21:58	06:29 (15) 07:07 (15)
22	08:34 17:34	07:49 18:23	07:53 20:06	06:50 20:52	06:04 21:33	05:50 21:58	06:30 (15) 07:08 (15)
23	08:33 17:36	07:47 18:24	07:51 20:07	06:48 20:53	06:03 21:35	05:51 21:58	06:30 (15) 07:08 (15)
24	08:32 17:37	07:45 18:26	07:48 20:09	06:46 20:55	06:02 21:36	05:51 21:58	06:30 (15) 07:08 (15)
25	08:31 17:39	07:43 18:27	07:46 20:10	06:45 20:56	06:01 21:37	05:51 21:59	06:30 (15) 07:07 (15)
26	08:30 17:41	07:41 18:29	07:44 20:12	06:43 20:58	06:00 21:38	05:52 21:59	06:31 (15) 07:08 (15)
27	08:29 17:42	07:39 18:31	07:42 20:13	06:41 20:59	05:59 21:39	05:52 21:59	06:31 (15) 07:08 (15)
28	08:28 17:44	07:37 18:32	07:40 20:15	06:39 21:00	05:58 21:40	05:52 21:59	06:32 (15) 07:09 (15)
29	08:26 17:45	07:35 18:34	07:38 20:16	06:37 21:02	05:58 21:42	05:53 21:59	06:32 (15) 07:08 (15)
30	08:25 17:47	07:33 18:35	07:36 20:18	06:36 21:03	05:57 21:43	05:54 21:58	06:32 (15) 07:09 (15)
31	08:24 17:49	07:31 18:36	07:34 20:19	06:34 21:04	05:56 21:44	05:55 21:59	06:30 (15) 07:09 (15)
Potential sun hours	273	284	368	410	471	481	1074
Total, worst case	477	162	260	184	184	1074	
Sun reduction	0.56	0.50	0.63	0.67	0.67	0.70	
Oper. time red.	0.99	0.99	0.99	0.99	0.99	0.99	
Wind dir. red.	0.70	0.70	0.70	0.59	0.59	0.59	
Total reduction	0.39	0.35	0.44	0.40	0.40	0.41	
Total, real	186	57	115	73	73	444	

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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EAPC Wind Energy
 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 4:14 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab **Shadow receptor: 73164 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	July	August	September	October	November	December
1	05:54	06:32 (15)	06:26	07:09	07:51	08:23
	21:58	36 07:08 (15)	21:32	20:38	19:35	17:34
2	05:55	06:33 (15)	06:27	07:10	07:52	08:24
	21:58	36 07:09 (15)	21:31	20:36	19:33	16:59
3	05:55	06:34 (15)	06:29	07:12	07:54	08:25
	21:58	35 07:09 (15)	21:29	20:34	19:31	16:59
4	05:56	06:33 (15)	06:30	07:13	07:55	08:26
	21:58	35 07:08 (15)	21:28	20:32	19:29	16:59
5	05:57	06:34 (15)	06:31	07:14	07:57	08:27
	21:57	35 07:09 (15)	21:26	20:30	19:27	16:58
6	05:58	06:35 (15)	06:33	07:16	07:58	08:29
	21:57	34 07:09 (15)	21:25	20:27	19:25	16:58
7	05:58	06:35 (15)	06:34	07:17	08:00	08:30
	21:56	33 07:08 (15)	21:23	20:25	19:23	16:58
8	05:59	06:35 (15)	06:35	07:19	08:01	08:31
	21:56	33 07:08 (15)	21:22	20:23	19:21	16:57
9	06:00	06:36 (15)	06:37	07:20	08:03	08:32
	21:55	32 07:08 (15)	21:20	20:21	19:18	16:57
10	06:01	06:37 (15)	06:38	07:21	08:04	08:33
	21:55	31 07:08 (15)	21:18	20:19	19:16	16:57
11	06:02	06:37 (15)	06:39	07:23	08:06	08:34
	21:54	31 07:08 (15)	21:17	20:17	19:14	16:57
12	06:03	06:38 (15)	06:41	07:24	08:07	08:35
	21:54	29 07:07 (15)	21:15	20:15	19:12	16:57
13	06:04	06:39 (15)	06:42	07:25	08:08	08:36
	21:53	28 07:07 (15)	21:13	20:13	19:10	16:57
14	06:05	06:39 (15)	06:44	07:27	08:10	08:37
	21:52	27 07:06 (15)	21:12	20:11	19:08	16:57
15	06:06	06:40 (15)	06:45	07:28	08:11	08:37
	21:51	25 07:05 (15)	21:10	20:09	19:07	16:57
16	06:07	06:41 (15)	06:46	07:30	08:13	08:38
	21:51	23 07:04 (15)	21:08	20:07	19:05	16:57
17	06:08	06:42 (15)	06:48	07:31	08:14	08:39
	21:50	21 07:03 (15)	21:06	20:04	19:03	16:58
18	06:09	06:44 (15)	06:49	07:32	08:16	08:40
	21:49	18 07:02 (15)	21:05	20:02	19:01	16:58
19	06:10	06:46 (15)	06:51	07:34	08:18	08:41
	21:48	15 07:01 (15)	21:03	20:00	18:57	16:58
20	06:11	06:49 (15)	06:52	07:35	08:19	08:43
	21:47	10 06:59 (15)	21:01	19:58	18:55	16:59
21	06:12	06:53	07:37	08:21	08:09	08:42
	21:46	06:55	19:56	18:53	17:07	16:59
22	06:13	06:55	07:38	08:22	08:10	08:42
	21:45	06:57	19:54	18:51	17:06	16:59
23	06:15	06:56	07:40	08:24	08:12	08:43
	21:44	06:58	19:52	18:49	17:06	16:59
24	06:16	06:58	07:41	08:25	08:13	08:43
	21:43	06:59	19:50	18:48	17:05	16:59
25	06:17	06:59	07:42	08:27	08:14	10:08 (13)
	21:41	07:00	19:48	18:46	17:04	7 10:15 (13)
26	06:18	07:00	07:44	08:28	08:16	10:05 (13)
	21:40	07:01	19:45	18:44	17:03	14 10:19 (13)
27	06:20	07:02	07:45	08:30	08:17	10:03 (13)
	21:39	07:03	19:43	18:42	17:02	18 10:21 (13)
28	06:21	07:03	07:47	08:31	08:19	10:03 (13)
	21:38	07:04	19:41	18:41	17:02	21 10:24 (13)
29	06:22	07:05	07:48	08:33	08:20	10:01 (13)
	21:36	07:06	19:39	18:39	17:01	24 10:25 (13)
30	06:23	07:06	07:49	08:35	08:21	10:00 (13)
	21:35	07:07	19:37	18:37	17:00	26 10:26 (13)
31	06:25	07:07	07:50	08:36	08:23	08:45
	21:34	07:08	19:36	18:36	17:00	38 10:27 (13)
Potential sun hours	486	445	379	336	277	260
Total, worst case	567			429	110	1141
Sun reduction	0.75			0.52	0.43	0.44
Oper. time red.	0.99			0.99	0.99	0.99
Wind dir. red.	0.59			0.70	0.70	0.70
Total reduction	0.44			0.37	0.30	0.31
Total, real	250			158	33	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	(WTG causing flicker first time)
	Sun set (hh:mm)		Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
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 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 4:14 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab **Shadow receptor: 73353 - Garage**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
663	334	354	413	612	967	793	577	699	909	1,123	1,198	8,641

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

	January	February	March	April	May	June
1	08:45	08:23	07:35	07:32	06:34	20:04 (13) 05:55
	17:07	17:50	18:34	20:21	21:05	20:24 (13) 21:45
2	08:45	08:21	07:33	07:30	06:32	20:05 (13) 05:55
	17:08	17:52	18:35	20:22	21:06	17 20:22 (13) 21:46
3	08:45	08:20	07:31	07:28	06:31	20:06 (13) 05:54
	17:09	17:53	18:37	20:24	21:08	15 20:21 (13) 21:47
4	08:44	08:18	07:29	07:26	06:29	20:08 (13) 05:53
	17:10	17:55	18:38	20:25	21:09	11 20:19 (13) 21:47
5	08:44	08:17	07:27	07:24	06:27	05:53
	17:11	17:57	18:40	20:27	21:10	21:48
6	08:44	08:15	07:25	07:21	06:26	05:52
	17:13	17:58	18:42	20:28	21:12	21:49
7	08:44	08:14	07:23	07:19	06:24	05:52
	17:14	18:00	18:43	20:30	21:13	21:50
8	08:43	08:12	08:21	07:17	06:23	05:51
	17:15	18:00	18:45	20:31	21:15	21:51
9	08:43	08:11	08:19	19:20 (12) 07:15	06:21	05:51
	17:16	18:02	19:46	3 19:23 (12) 20:32	21:16	21:52
10	08:43	08:09	08:17	19:16 (12) 07:13	06:20	05:51
	17:17	18:03	19:48	9 19:25 (12) 20:34	21:17	21:52
11	08:42	08:08	08:15	19:14 (12) 07:11	06:18	05:51
	17:19	18:05	19:49	12 19:26 (12) 20:35	21:19	21:53
12	08:42	08:06	08:13	19:12 (12) 07:09	06:17	05:50
	17:20	18:06	19:51	16 19:28 (12) 20:37	21:20	21:54
13	08:41	08:04	08:11	19:11 (12) 07:07	06:15	05:50
	17:21	18:08	19:52	18 19:29 (12) 20:38	21:22	21:54
14	08:41	08:03	08:09	19:10 (12) 07:05	06:14	05:50
	17:23	18:10	19:54	21 19:31 (12) 20:40	21:23	21:55
15	08:40	08:01	08:07	19:09 (12) 07:03	06:13	05:50
	17:24	18:11	19:55	24 19:33 (12) 20:41	21:24	21:55
16	08:39	07:59	08:05	19:09 (12) 07:01	20:13 (13) 06:11	05:50
	17:25	18:13	19:57	24 19:33 (12) 20:43	5 20:18 (13) 21:26	21:56
17	08:38	07:58	08:03	19:09 (12) 07:00	20:10 (13) 06:10	05:50
	17:27	18:15	19:58	24 19:33 (12) 20:44	11 20:21 (13) 21:27	21:56
18	08:38	07:56	08:01	19:09 (12) 06:58	20:08 (13) 06:09	05:50
	17:28	18:16	20:00	24 19:33 (12) 20:46	14 20:22 (13) 21:28	21:57
19	08:37	07:54	07:59	19:09 (12) 06:56	20:06 (13) 06:08	05:50
	17:30	18:18	20:01	23 19:32 (12) 20:47	17 20:23 (13) 21:30	21:57
20	08:36	07:52	07:57	19:09 (12) 06:54	20:05 (13) 06:07	05:50
	17:31	18:19	20:03	22 19:31 (12) 20:49	19 20:24 (13) 21:31	21:57
21	08:35	07:50	07:55	19:09 (12) 06:52	20:04 (13) 06:05	05:50
	17:33	18:21	20:04	20 19:29 (12) 20:50	22 20:26 (13) 21:32	21:58
22	08:34	07:49	07:53	19:10 (12) 06:50	20:03 (13) 06:04	05:50
	17:34	18:23	20:06	17 19:27 (12) 20:52	24 20:27 (13) 21:33	21:58
23	08:33	07:47	07:50	19:12 (12) 06:48	20:03 (13) 06:03	05:51
	17:36	18:24	20:07	13 19:25 (12) 20:53	25 20:28 (13) 21:35	21:58
24	08:32	07:45	07:48	19:15 (12) 06:46	20:02 (13) 06:02	05:51
	17:37	18:26	20:09	7 19:22 (12) 20:54	26 20:28 (13) 21:36	21:58
25	08:31	07:43	07:46	06:45	20:02 (13) 06:01	05:51
	17:39	18:27	20:10	25 20:27 (13) 21:37	21:58	
26	08:30	07:41	07:44	06:43	20:02 (13) 06:00	05:52
	17:41	18:29	20:12	25 20:27 (13) 21:38	21:59	
27	08:29	07:39	07:42	06:41	20:02 (13) 05:59	05:52
	17:42	18:31	20:13	25 20:27 (13) 21:39	21:59	
28	08:28	07:37	07:40	06:39	20:02 (13) 05:58	05:52
	17:44	18:32	20:15	24 20:26 (13) 21:40	21:59	
29	08:26		07:38	06:37	20:02 (13) 05:58	05:53
	17:45		20:16	23 20:25 (13) 21:41	21:58	
30	08:25		07:36	06:36	20:03 (13) 05:57	05:53
	17:47		20:18	22 20:25 (13) 21:43	21:58	
31	08:24		07:34	21:03	05:56	
	17:49		20:19		21:44	
Potential sun hours	273	285	368	410	471	481
Total, worst case			277	307	63	
Sun reduction			0.63	0.59	0.67	
Oper. time red.			0.99	0.99	0.99	
Wind dir. red.			0.64	0.70	0.70	
Total reduction			0.39	0.40	0.46	
Total, real			109	124	29	

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
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Calculated:
6/15/2015 4:14 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab **Shadow receptor:** 73353 - Garage

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
663 334 354 413 612 967 793 577 699 909 1,123 1,198 8,641
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:54 21:58	06:26 21:32	07:09 20:38	07:51 19:35	18:51 (12)	07:38 17:00
2	05:55 21:58	06:27 21:31	07:10 20:36	07:52 19:33	18:52 (12)	07:39 16:59
3	05:55 21:58	06:29 21:29	07:11 20:33	07:54 19:31	18:54 (12)	07:41 16:59
4	05:56 21:57	06:30 21:28	07:13 20:31	07:55 19:29	18:56 (12)	07:42 16:58
5	05:57 21:57	06:31 21:26	07:14 20:29	07:57 19:27	19:02 (12)	07:44 16:58
6	05:57 21:57	06:33 21:25	07:16 20:27	07:58 19:25	08:00	07:45 16:58
7	05:58 21:56	06:34 21:23	07:17 20:25	08:00 19:22	08:01	07:47 16:58
8	05:59 21:56	06:35 21:22	20:20 (13) 20:23	07:18 19:20	08:02	07:49 16:57
9	06:00 21:55	06:37 21:20	20:12 (13) 20:21	07:20 19:18	08:02	07:50 16:57
10	06:01 21:55	06:38 21:18	20:15 (13) 20:19	07:21 19:16	08:04	07:52 16:57
11	06:02 21:54	06:39 21:17	20:13 (13) 20:17	07:23 19:14	08:05	07:53 16:57
12	06:03 21:53	06:41 21:15	20:12 (13) 20:15	07:24 19:12	08:07	07:55 16:57
13	06:04 21:53	06:42 21:13	20:11 (13) 20:13	07:25 19:10	08:08	07:56 16:57
14	06:05 21:52	06:44 21:12	20:10 (13) 20:11	07:27 19:08	08:10	07:58 16:57
15	06:06 21:51	06:45 21:10	20:10 (13) 20:09	07:28 19:06	08:11	08:00 16:57
16	06:07 21:50	06:46 21:08	20:34 (13) 20:06	07:30 19:04	08:13	08:01 16:57
17	06:08 21:50	06:48 21:06	20:09 (13) 20:04	07:31 19:03	08:14	08:03 16:58
18	06:09 21:49	06:49 21:04	20:34 (13) 20:02	07:32 19:01	08:16	08:04 16:58
19	06:10 21:48	06:50 21:03	20:08 (13) 20:00	19:04 (12) 18:57	08:17	08:06 16:58
20	06:11 21:47	06:52 21:01	20:34 (13) 19:58	3 19:07 (12) 18:59	18:59 (12) 18:55	08:19 17:08
21	06:12 21:46	06:53 20:59	20:09 (13) 19:56	12 19:11 (12) 18:56	18:56 (12) 18:53	08:20 17:07
22	06:13 21:45	06:55 20:57	20:32 (13) 19:54	16 19:12 (12) 18:55	18:55 (12) 18:51	08:22 17:06
23	06:15 21:44	06:56 20:55	20:09 (13) 19:52	19 18:53 (12) 18:49	18:53 (12) 18:45	08:24 17:06
24	06:16 21:42	06:57 20:53	20:28 (13) 19:50	21 19:14 (12) 18:48	18:53 (12) 18:44	08:25 17:06
25	06:17 21:41	06:59 20:51	20:10 (13) 19:47	22 18:51 (12) 18:46	18:51 (12) 18:42	08:13 17:05
26	06:18 21:40	07:00 20:49	20:27 (13) 19:45	24 18:50 (12) 18:44	18:50 (12) 18:40	08:14 17:04
27	06:19 21:39	07:02 20:47	20:16 (13) 19:43	25 18:50 (12) 18:42	18:50 (12) 18:38	08:17 17:03
28	06:21 21:38	07:03 20:46	20:21 (13) 19:41	25 18:47 18:40	18:50 (12) 18:36	17:02 17:04
29	06:22 21:36	07:04 20:44	19:41 19:39	24 18:50 (12) 18:38	18:50 (12) 18:34	17:02 17:04
30	06:23 21:35	07:06 20:42	19:39 19:37	22 18:50 (12) 18:37	18:50 (12) 18:33	17:01 17:05
31	06:25 21:34	07:07 20:40	19:37 19:35	20 19:10 (12) 18:35	18:50 (12) 18:31	17:00 17:06
Potential sun hours	486	445	379	336	277	260
Total, worst case		377	232	47		
Sun reduction		0.72	0.69	0.52		
Oper. time red.		0.99	0.99	0.99		
Wind dir. red.		0.70	0.64	0.64		
Total reduction		0.49	0.43	0.33		
Total, real		186	100	15		

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.

Kevin Walter

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Lenexa, KS, 66219

Description:

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Brandon Storm / bstorm@eapc.net
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6/15/2015 4:14 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 74133 - House

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

Assumptions for shadow calculations

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
663 334 354 413 612 967 793 577 699 909 1,123 1,198 8,641

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

Table with columns for months (January to December) and rows for specific times of day (e.g., 08:44, 17:08). 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) 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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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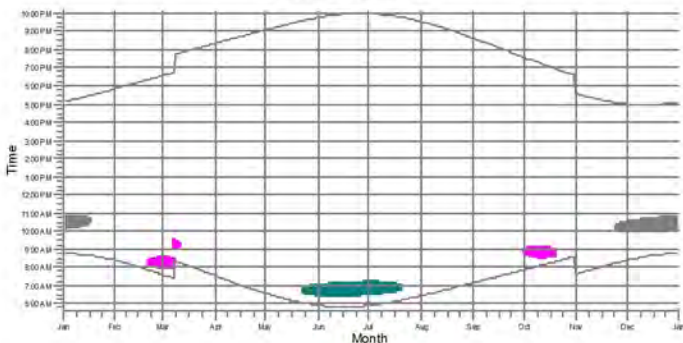
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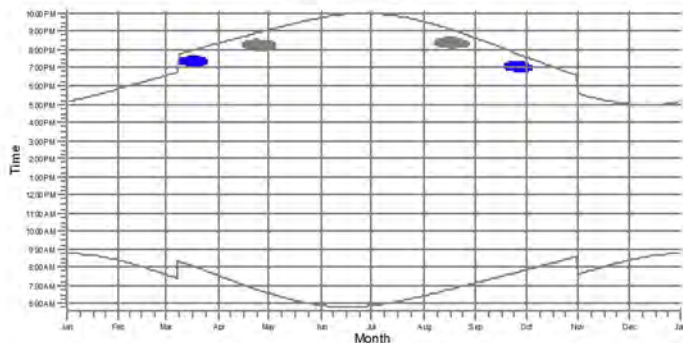
SHADOW - Calendar, graphical

Calculation: A034 V117 91.5m HH Realistic Flicker w/ Obstacles DNV Tab

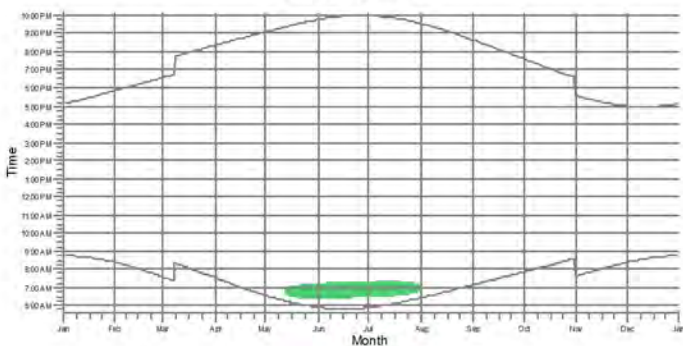
73164: House



73353: Garage



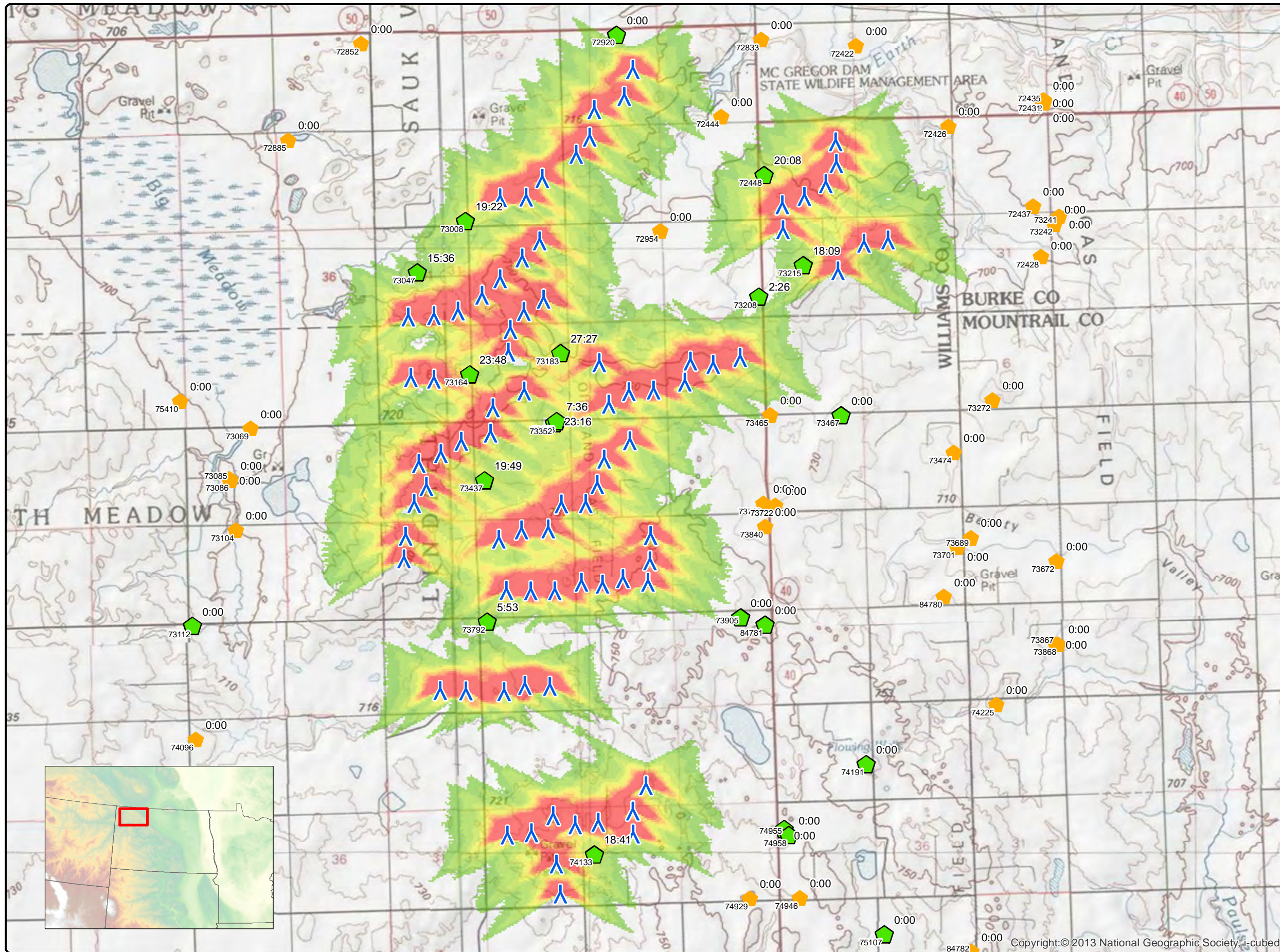
74133: House



WTGs

- 12: Primary
- 13: Primary
- 14: Primary
- 15: Primary
- 42: Primary

Appendix E: Realistic Shadow Flicker Map – V110-2.0 80 m HH, with Obstacles




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Lindahl Wind Farm V110 Realistic Shadow Flicker With Obstacles

Client

TradeWind Energy, Inc.

Project Description

75 Primary WTG locations & 5 Alts (A034) for V110-2.0 on 80 m HH. Realistic shadow flicker map and data at receptors (hrs/yr). Assumes statistical reduction due to sunshine probability, turbine orientation and operation probability. Sensors in "greenhouse" mode. Obstacles assumed.

Location: Tioqa, ND




Project #: 20132550

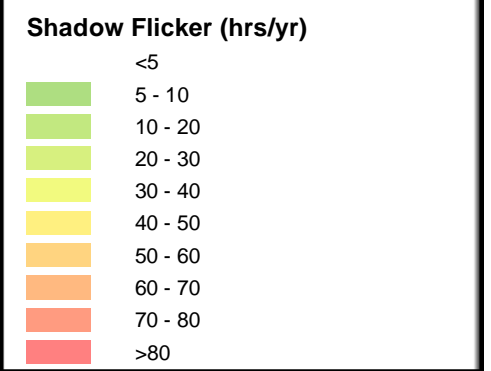
Issue Dates

#	Description	Date
1	Preliminary Draft	2015.06.23


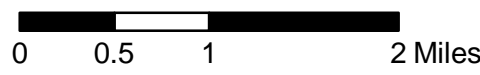
Drawn By: BS Checked By: JH

Legend

-  V110 WTG A034
-  Non-Participating Residences
-  Participating Residence



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Appendix F: windPRO Shadow Flicker Report - V110- 2.0 80 m HH, with Obstacles

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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SHADOW - Main Result

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab

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:

DNV Shadow

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
 660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594

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

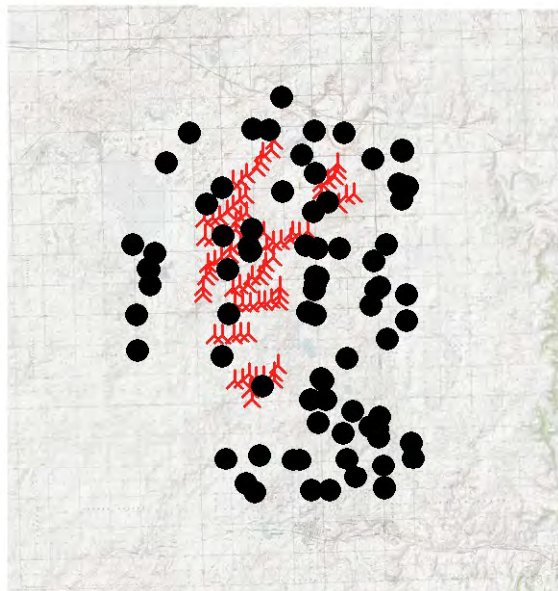
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: 20100616_Lindahl_10ft_HCL.wpo (1)

Obstacles used in calculation

Eye height: 1.5 m

Grid resolution: 10.0 m



⤴ New WTG

Scale 1:400,000
 🗺 Shadow receptor

WTGs

UTM NAD83 Zone: 13

	East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]
5	646,913	5,375,455	745.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
12	648,319	5,377,157	750.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
13	648,353	5,377,573	752.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
14	648,872	5,377,853	752.9	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
15	648,611	5,378,490	759.0	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
16	648,641	5,378,869	759.0	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
17	648,868	5,379,168	761.9	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
18	649,189	5,379,368	749.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
19	648,477	5,379,703	762.0	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
20	648,837	5,380,044	745.1	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
21	648,176	5,379,834	743.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
22	649,124	5,380,328	729.3	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
24	651,007	5,377,868	749.0	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
25	650,109	5,378,321	754.1	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
26	651,525	5,378,000	751.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
27	651,616	5,378,348	758.6	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
28	651,987	5,378,290	755.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
29	652,436	5,378,405	749.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
34	654,047	5,379,834	743.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
35	654,478	5,380,290	740.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
36	654,876	5,380,346	731.4	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
37	649,468	5,369,552	735.9	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
38	649,403	5,370,046	745.2	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
39	648,989	5,370,563	740.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
40	649,348	5,370,846	749.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
42	650,668	5,370,540	746.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9
43	650,667	5,370,918	744.1	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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SHADOW - Main Result

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab

...continued from previous page

UTM NAD83 Zone: 13				WTG type							
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]	
45	650,882	5,371,340	743.7 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
67	649,484	5,375,990	732.9 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
68	649,889	5,375,994	741.6 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
69	650,079	5,376,307	740.7 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
83	648,826	5,375,558	729.9 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
84	648,982	5,374,557	737.6 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
85	648,580	5,374,558	735.1 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
97	648,537	5,372,891	719.3 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
98	648,903	5,381,054	722.4 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
99	649,170	5,381,363	721.7 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
100	649,950	5,382,038	713.8 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
101	650,030	5,382,496	712.8 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
102	650,525	5,382,713	713.2 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
104	650,189	5,376,726	739.2 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
105	650,267	5,377,632	746.8 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
114	648,476	5,381,043	724.2 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
150	650,663	5,383,159	707.7 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
151	650,947	5,375,049	753.4 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
152	650,911	5,374,694	758.8 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
154	650,163	5,374,664	746.8 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
155	649,378	5,374,555	741.3 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
158	650,614	5,377,029	737.6 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
160	647,380	5,378,047	737.6 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
161	647,780	5,379,172	731.5 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
166	647,487	5,372,910	715.6 Alternate	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
170	647,835	5,377,018	752.9 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
171	647,495	5,376,819	749.1 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
175	653,143	5,380,511	713.2 Alternate	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
176	653,130	5,380,927	710.2 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
177	653,497	5,381,062	704.1 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
178	653,850	5,381,276	700.7 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
182	647,004	5,378,073	731.5 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
184	650,599	5,377,842	746.4 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
185	647,385	5,379,098	722.4 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
186	646,960	5,379,073	712.5 Alternate	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
153b	650,500	5,374,756	749.1 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
156b	649,818	5,374,694	743.7 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
164b	649,297	5,372,977	725.4 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
165b	647,909	5,372,903	716.3 Alternate	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
172b	647,131	5,376,655	743.7 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
173b	647,258	5,376,278	743.2 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
174c	647,056	5,376,002	741.8 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
179b	654,022	5,381,604	696.2 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
180b	654,011	5,381,966	694.9 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
181b	648,451	5,375,405	728.5 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
183b	649,728	5,381,758	721.2 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
205b	648,594	5,370,523	731.5 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
206b	650,092	5,370,737	743.7 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
41b	649,714	5,370,690	746.8 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
66b	649,269	5,375,574	732.7 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
6b	646,888	5,375,080	731.7 Alternate	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
70b	650,956	5,375,465	751.0 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	
96b	648,884	5,372,995	722.4 Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	14.9	

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SHADOW - Main Result

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab

Shadow receptor-Input

No.	Name	UTM NAD83 Zone: 13			Width	Height	Height a.g.l.	Degrees from/south	Slope of window	Direction mode
		East	North	Z						
		[m]	[m]	[m]	[m]	[m]	[°]	[°]		
72422	House	654,346	5,383,551	675.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72426	House	655,873	5,382,222	689.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72428	House	657,399	5,380,070	700.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72431	Field Office	657,434	5,382,649	698.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72432	Field Office	657,452	5,382,650	698.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72433	Field Office	657,452	5,382,638	698.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72434	Field Office	657,431	5,382,638	699.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72435	Field Office	657,425	5,382,612	699.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72436	Field Office	657,443	5,382,612	699.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72437	House	657,270	5,380,900	701.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72444	House	652,124	5,382,382	698.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72448	House	652,833	5,381,417	705.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72833	House	652,780	5,383,651	684.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72843	House	651,086	5,385,430	681.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72852	House	646,183	5,383,581	712.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72885	House	644,980	5,381,994	704.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72910	Garage	649,528	5,383,760	704.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72920	House	650,400	5,383,729	711.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
72954	House	651,119	5,380,491	705.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73008	House	647,905	5,380,657	723.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73047	House	647,113	5,379,805	712.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73069	House	644,362	5,377,232	698.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73085	House	644,011	5,376,402	703.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73086	House	644,029	5,376,379	703.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73104	House	644,116	5,375,556	701.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73112	House	643,400	5,373,971	710.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73164	House	647,974	5,378,125	736.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73183	House	649,476	5,378,474	747.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73208	House	652,746	5,379,403	722.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73215	House	653,476	5,379,925	741.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73241	House	657,701	5,380,739	704.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73242	House	657,625	5,380,605	701.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73272	House	656,603	5,377,699	728.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73307	House	652,350	5,377,616	735.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73352	House	649,372	5,377,319	734.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73353	Garage	649,411	5,377,350	734.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73437	House	648,222	5,376,376	731.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73465	House	652,934	5,377,454	728.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73467	House	654,105	5,377,449	726.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73474	House	655,962	5,376,837	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73672	House	657,653	5,375,042	704.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73689	House	656,242	5,375,429	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73701	House	656,021	5,375,274	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73722	House	653,014	5,375,966	734.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73729	House	652,820	5,375,995	733.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73792	House	648,263	5,374,042	728.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73840	House	652,848	5,375,611	736.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73848	Probably Occupied	652,773	5,375,266	744.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73867	House	657,646	5,373,676	710.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73868	House	657,685	5,373,674	711.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
73905	House	652,445	5,374,111	759.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74072	Occupiable Structure, per field notes	647,929	5,371,803	716.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74096	House	643,453	5,372,099	716.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74133	House	650,034	5,370,204	742.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab

...continued from previous page

UTM NAD83 Zone: 13

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from/south	Slope of window	Direction mode
74191	House	654,514	5,371,692	765.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74225	House	656,662	5,372,675	722.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74929	House	652,597	5,369,477	749.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74944	House	652,987	5,368,263	755.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74946	House	653,421	5,369,486	746.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74955	House	653,163	5,370,620	746.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74958	House	653,237	5,370,521	746.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
74997	House	656,161	5,367,989	720.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75017	House	655,758	5,368,066	719.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75019	House	656,215	5,367,523	716.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75023	House	657,919	5,367,212	720.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75024	House	657,910	5,367,229	720.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75035	House	658,012	5,366,393	701.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75048	House	656,450	5,365,968	719.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75051	House	656,481	5,364,835	702.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75052	House	656,500	5,364,785	701.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75060	House	654,953	5,365,361	717.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75107	House	654,816	5,368,880	743.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75125	House	654,533	5,366,347	734.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75164	House	653,608	5,364,657	704.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75171	House	652,658	5,364,673	707.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75178	House	652,044	5,366,274	727.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75181	House	651,664	5,366,273	728.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75198	House	649,867	5,366,571	723.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75240	House	648,111	5,366,363	710.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75250	House	649,156	5,365,047	710.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75262	House	649,634	5,364,566	718.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
75410	House	643,198	5,377,684	702.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
77282	Office/Farm	649,350	5,377,570	737.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84780	Occupied structure per Field Notes, not on imagery	655,800	5,374,456	722.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84781	House	652,849	5,373,992	753.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84782	Occupied fifth wheel	656,251	5,368,598	741.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
84783	New house per field notes	654,290	5,367,724	742.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
72422	House	0:00	0	0:00	0:00
72426	House	0:00	0	0:00	0:00
72428	House	0:00	0	0:00	0:00
72431	Field Office	0:00	0	0:00	0:00
72432	Field Office	0:00	0	0:00	0:00
72433	Field Office	0:00	0	0:00	0:00
72434	Field Office	0:00	0	0:00	0:00
72435	Field Office	0:00	0	0:00	0:00
72436	Field Office	0:00	0	0:00	0:00
72437	House	0:00	0	0:00	0:00
72444	House	0:00	0	0:00	0:00
72448	House	55:27	177	0:35	20:08

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
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SHADOW - Main Result

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab

...continued from previous page

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
72833	House	0:00	0	0:00	0:00
72843	House	0:00	0	0:00	0:00
72852	House	0:00	0	0:00	0:00
72885	House	0:00	0	0:00	0:00
72910	Garage	5:45	30	0:18	1:56
72920	House	0:00	0	0:00	0:00
72954	House	0:00	0	0:00	0:00
73008	House	49:08	180	0:27	19:22
73047	House	44:12	120	0:30	15:36
73069	House	0:00	0	0:00	0:00
73085	House	0:00	0	0:00	0:00
73086	House	0:00	0	0:00	0:00
73104	House	0:00	0	0:00	0:00
73112	House	0:00	0	0:00	0:00
73164	House	61:54	139	0:37	23:48
73183	House	82:38	189	0:39	27:27
73208	House	6:05	29	0:19	2:26
73215	House	42:36	103	0:44	18:09
73241	House	0:00	0	0:00	0:00
73242	House	0:00	0	0:00	0:00
73272	House	0:00	0	0:00	0:00
73307	House	38:39	105	0:30	19:05
73352	House	57:19	147	0:51	23:16
73353	Garage	17:47	64	0:24	7:36
73437	House	48:01	193	0:30	19:49
73465	House	0:00	0	0:00	0:00
73467	House	0:00	0	0:00	0:00
73474	House	0:00	0	0:00	0:00
73672	House	0:00	0	0:00	0:00
73689	House	0:00	0	0:00	0:00
73701	House	0:00	0	0:00	0:00
73722	House	0:00	0	0:00	0:00
73729	House	0:00	0	0:00	0:00
73792	House	14:22	70	0:21	5:53
73840	House	0:00	0	0:00	0:00
73848	Probably Occupied	0:00	0	0:00	0:00
73867	House	0:00	0	0:00	0:00
73868	House	0:00	0	0:00	0:00
73905	House	0:00	0	0:00	0:00
74072	Occupiable Structure, per field notes	0:00	0	0:00	0:00
74096	House	0:00	0	0:00	0:00
74133	House	45:02	83	0:39	18:41
74191	House	0:00	0	0:00	0:00
74225	House	0:00	0	0:00	0:00
74929	House	0:00	0	0:00	0:00
74944	House	0:00	0	0:00	0:00
74946	House	0:00	0	0:00	0:00
74955	House	0:00	0	0:00	0:00
74958	House	0:00	0	0:00	0:00
74997	House	0:00	0	0:00	0:00
75017	House	0:00	0	0:00	0:00
75019	House	0:00	0	0:00	0:00
75023	House	0:00	0	0:00	0:00
75024	House	0:00	0	0:00	0:00

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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 US-GRAND FORKS, ND 58201
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 Brandon Storm / bstorm@eapc.net
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SHADOW - Main Result

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab

...continued from previous page

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
75035	House	0:00	0	0:00	0:00
75048	House	0:00	0	0:00	0:00
75051	House	0:00	0	0:00	0:00
75052	House	0:00	0	0:00	0:00
75060	House	0:00	0	0:00	0:00
75107	House	0:00	0	0:00	0:00
75125	House	0:00	0	0:00	0:00
75164	House	0:00	0	0:00	0:00
75171	House	0:00	0	0:00	0:00
75178	House	0:00	0	0:00	0:00
75181	House	0:00	0	0:00	0:00
75198	House	0:00	0	0:00	0:00
75240	House	0:00	0	0:00	0:00
75250	House	0:00	0	0:00	0:00
75262	House	0:00	0	0:00	0:00
75410	House	0:00	0	0:00	0:00
77282	Office/Farm	56:29	163	0:53	22:55
84780	Occupied structure per Field Notes, not on imagery	0:00	0	0:00	0:00
84781	House	0:00	0	0:00	0:00
84782	Occupied fifth wheel	0:00	0	0:00	0:00
84783	New house per field notes	0:00	0	0:00	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
5	Primary	0:00	0:00
12	Primary	18:05	6:36
13	Primary	48:55	18:13
14	Primary	55:58	18:37
15	Primary	46:42	19:27
16	Primary	0:00	0:00
17	Primary	0:00	0:00
18	Primary	0:00	0:00
19	Primary	5:47	2:33
20	Primary	12:34	4:20
21	Primary	9:07	3:20
22	Primary	4:59	1:52
24	Primary	4:50	2:09
25	Primary	25:00	10:12
26	Primary	33:49	16:55
27	Primary	0:00	0:00
28	Primary	0:00	0:00
29	Primary	0:00	0:00
34	Primary	37:13	15:54
35	Primary	9:57	4:04
36	Primary	2:33	0:59
37	Primary	0:00	0:00
38	Primary	0:00	0:00
39	Primary	0:00	0:00
40	Primary	0:00	0:00
42	Primary	45:02	18:41
43	Primary	0:00	0:00
45	Primary	0:00	0:00

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

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Kevin Walter

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SHADOW - Main Result**Calculation:** A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
67	Primary	4:08	1:25
68	Primary	0:00	0:00
69	Primary	0:00	0:00
83	Primary	0:00	0:00
84	Primary	4:10	1:38
85	Primary	0:00	0:00
97	Primary	0:00	0:00
98	Primary	10:22	4:17
99	Primary	6:27	2:38
100	Primary	0:00	0:00
101	Primary	0:00	0:00
102	Primary	0:00	0:00
104	Primary	21:27	7:17
105	Primary	27:52	11:49
114	Primary	16:20	6:34
150	Primary	5:45	1:56
151	Primary	0:00	0:00
152	Primary	0:00	0:00
154	Primary	0:00	0:00
155	Primary	10:12	4:14
158	Primary	3:55	1:22
160	Primary	0:00	0:00
161	Primary	29:18	9:41
166	Alternate	0:00	0:00
170	Primary	0:00	0:00
171	Primary	9:02	4:31
175	Alternate	0:00	0:00
176	Primary	16:29	5:11
177	Primary	21:23	7:28
178	Primary	7:29	3:11
182	Primary	0:00	0:00
184	Primary	18:07	7:04
185	Primary	0:00	0:00
186	Alternate	0:00	0:00
153b	Primary	0:00	0:00
156b	Primary	0:00	0:00
164b	Primary	0:00	0:00
165b	Alternate	0:00	0:00
172b	Primary	9:08	4:10
173b	Primary	10:20	4:22
174c	Primary	5:39	1:56
179b	Primary	4:38	1:52
180b	Primary	5:28	2:16
181b	Primary	0:00	0:00
183b	Primary	0:00	0:00
205b	Primary	0:00	0:00
206b	Primary	0:00	0:00
41b	Primary	0:00	0:00
66b	Primary	9:44	3:23
6b	Alternate	0:00	0:00
70b	Primary	0:00	0:00
96b	Primary	0:00	0:00

Project: 20132550- Lindahl Wind Farm

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Kevin Walter
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3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
Brandon Storm / bstorm@eapc.net
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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 72448 - House

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to June) and rows for each day of the month, showing start and end times of shadow events. Includes a summary table at the bottom 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

Matrix 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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab **Shadow receptor: 72448 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
660	333	352	411	608	961	789	574	695	904	1,117	1,191	8,594

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

	July	August	September	October	November	December
1 05:54	06:26	06:51 (180b)	07:08	07:32 (179b)	07:51	08:13 (178)
2 05:54	06:27	06:53 (180b)	07:10	07:33 (179b)	07:52	08:15 (178)
3 05:55	06:28	06:54 (180b)	07:11	07:35 (179b)	07:54	08:16 (178)
4 05:56	06:30	06:55 (180b)	07:13	07:36 (179b)	07:55	08:18 (178)
5 05:56	06:31	06:56 (180b)	07:14	07:37 (179b)	07:56	08:19 (178)
6 05:57	06:32	06:58 (180b)	07:15	07:39 (179b)	07:58	08:21 (178)
7 05:58	06:34	06:59 (180b)	07:17	07:40 (179b)	07:59	08:22 (178)
8 05:59	06:35	07:00 (180b)	07:18	07:41 (179b)	08:01	07:49
9 06:00	06:36	07:01 (180b)	07:20	07:42 (179b)	08:02	07:50
10 06:00	06:38	07:02	07:21	07:43 (179b)	08:04	07:52
11 06:01	06:39	07:03	07:22	07:44 (179b)	08:05	07:53
12 06:02	06:40	07:04	07:24	07:45 (179b)	08:07	07:55
13 06:03	06:42	07:05	07:25	07:46 (179b)	08:08	07:56
14 06:04	06:43	07:06	07:27	07:47 (179b)	08:10	07:58
15 06:05	06:45	07:07	07:28	07:48 (179b)	08:11	07:59
16 06:06	06:46	07:08	07:29	07:49 (179b)	08:13	08:01
17 06:07	06:47	07:09	07:31	07:50 (179b)	08:14	08:02
18 06:08	06:49	07:10	07:32	07:51 (179b)	08:16	08:04
19 06:10	06:50	07:11	07:34	07:52 (179b)	08:17	08:06
20 06:11	06:52	07:12	07:35	07:53 (179b)	08:19	08:07
21 06:12	06:53	07:13	07:36	07:54 (179b)	08:20	08:08
22 06:13	06:54	07:14	07:38	07:55 (179b)	08:22	08:10
23 06:14	06:56	07:15	07:39	07:56 (179b)	08:23	08:11
24 06:15	06:57	07:16	07:41	07:57 (179b)	08:25	08:13
25 06:17	06:59	07:17	07:42	07:58 (179b)	08:27	08:14
26 06:18	06:47 (180b)	07:00	07:43	07:59 (179b)	08:28	08:16
27 06:19	06:46 (180b)	07:01	07:45	08:00 (179b)	08:30	08:17
28 06:20	06:46 (180b)	07:03	07:46	08:01 (179b)	08:31	08:18
29 06:22	06:48 (180b)	07:04	07:48	08:02 (179b)	08:33	08:20
30 06:23	06:49 (180b)	07:06	07:49	08:03 (179b)	08:34	08:21
31 06:24	06:50 (180b)	07:07	07:51	08:04 (179b)	08:36	08:23
Potential sun hours	486	445	379	336	277	260
Total, worst case	105	116	223	405	327	807
Sun reduction	0.75	0.72	0.69	0.52	0.44	0.44
Oper. time red.	0.98	0.98	0.98	0.98	0.98	0.98
Wind dir. red.	0.60	0.62	0.67	0.72	0.72	0.69
Total reduction	0.44	0.44	0.46	0.37	0.31	0.30
Total, real	46	51	102	150	101	244

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73008 - House

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to June) and rows for each hour of the day, showing sun rise and set times with various reduction factors.

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

Matrix 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:

20132550- Lindahl Wind Farm

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 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab **Shadow receptor: 73008 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
660	333	352	411	608	961	789	574	695	904	1,117	1,191	8,594

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

	July	August	September	October	November	December
1	05:54 21:58	06:21 (114) 06:45 (114)	06:26 21:32	06:57 (98) 07:18 (98)	07:09 20:38	07:51 19:35
2	05:55 21:58	06:22 (114) 06:46 (114)	06:27 21:31	06:56 (98) 07:18 (98)	07:10 20:36	07:52 19:33
3	05:55 21:58	06:22 (114) 06:45 (114)	06:29 21:29	06:56 (98) 07:18 (98)	07:11 20:34	07:54 19:31
4	05:56 21:58	06:23 (114) 06:45 (114)	06:30 21:28	06:55 (98) 07:18 (98)	07:13 20:32	07:55 19:29
5	05:57 21:57	06:24 (114) 06:45 (114)	06:31 21:26	06:57 (98) 07:19 (98)	07:14 20:30	07:57 19:27
6	05:57 21:57	06:25 (114) 06:45 (114)	06:33 21:25	06:58 (98) 07:19 (98)	07:16 20:27	07:58 19:25
7	05:58 21:56	06:25 (114) 06:44 (114)	06:34 21:23	06:59 (98) 07:19 (98)	07:17 20:25	08:00 19:23
8	05:59 21:56	06:26 (114) 06:44 (114)	06:35 21:22	07:01 (98) 07:20 (98)	07:18 20:23	08:01 19:21
9	06:00 21:55	06:27 (114) 06:43 (114)	06:37 21:20	07:02 (98) 07:19 (98)	07:20 20:21	08:03 19:18
10	06:01 21:55	06:28 (114) 06:43 (99)	06:38 21:19	07:03 (98) 07:18 (98)	07:21 20:19	08:04 19:16
11	06:02 21:54	06:29 (114) 06:44 (99)	06:39 21:17	07:04 (98) 07:17 (98)	07:23 20:17	08:06 19:14
12	06:03 21:54	06:30 (114) 06:45 (99)	06:41 21:15	07:06 (98) 07:17 (98)	07:24 20:15	08:07 19:12
13	06:04 21:53	06:30 (114) 06:45 (99)	06:42 21:13	07:07 (98) 07:16 (98)	07:25 20:13	08:09 19:10
14	06:05 21:52	06:31 (114) 06:46 (99)	06:44 21:12	07:08 (98) 07:15 (98)	07:27 20:11	08:10 19:08
15	06:06 21:51	06:32 (99) 06:47 (99)	06:45 21:10	07:10 (98) 07:14 (98)	07:28 20:09	08:12 19:06
16	06:07 21:51	06:33 (99) 06:47 (99)	06:46 21:08	07:30 20:07	08:13 19:05	08:13 19:05
17	06:08 21:50	06:34 (99) 06:48 (99)	06:48 21:06	07:31 20:04	08:15 19:03	08:15 19:03
18	06:09 21:49	06:35 (99) 06:48 (99)	06:49 21:05	07:32 20:02	08:16 19:01	08:16 19:01
19	06:10 21:48	06:36 (99) 06:48 (99)	06:50 21:03	07:34 20:00	08:18 18:57	08:18 18:57
20	06:11 21:47	06:38 (99) 06:50 (99)	06:52 21:01	07:35 19:58	08:19 18:55	08:19 18:55
21	06:12 21:46	06:39 (99) 06:50 (99)	06:53 20:59	07:37 19:56	08:21 18:53	08:21 18:53
22	06:13 21:45	06:40 (99) 06:50 (99)	06:55 20:57	07:38 19:54	08:22 18:51	08:22 18:51
23	06:15 21:44	06:41 (99) 06:50 (99)	06:56 20:55	07:40 19:52	08:24 18:49	08:24 18:49
24	06:16 21:43	06:42 (99) 06:49 (99)	06:57 20:53	07:41 19:50	08:25 18:48	08:25 18:48
25	06:17 21:41	06:43 (99) 06:49 (99)	06:59 20:51	07:42 19:48	08:27 18:46	08:27 18:46
26	06:18 21:40	06:44 (99) 06:48 (99)	07:00 20:50	07:44 19:45	08:28 18:44	08:28 18:44
27	06:19 21:39	06:46 (99) 07:11 (98)	07:02 20:48	07:45 19:43	08:30 18:42	08:30 18:42
28	06:21 21:38	06:47 (99) 07:13 (98)	07:03 20:46	07:47 19:41	08:31 18:41	08:31 18:41
29	06:22 21:36	07:00 (98) 07:15 (98)	07:04 20:44	07:48 19:39	08:33 18:39	08:33 18:39
30	06:23 21:35	06:59 (98) 07:16 (98)	07:06 20:42	07:49 19:37	08:35 18:37	08:35 18:37
31	06:25 21:34	06:58 (98) 07:16 (98)	07:07 20:40	07:50 19:35	08:36 18:35	08:36 18:35
Potential sun hours	486	445	379	336	277	260
Total, worst case	460	246	152	378		
Sun reduction	0.75	0.72	0.52	0.43		
Oper. time red.	0.98	0.98	0.98	0.98		
Wind dir. red.	0.59	0.61	0.70	0.72		
Total reduction	0.44	0.44	0.36	0.31		
Total, real	200	107	55	118		

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73047 - House

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to June) and rows for each day of the month, showing sunrise and sunset times (hh:mm) and minutes with flicker. Includes a summary table at the bottom for potential sun hours and various reductions.

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

Matrix defining 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, and WTG causing flicker first/last time.

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73164 - House

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (July, August, September, October, November, December) and rows for each day of the year (1-31). Columns contain sun rise and set times, and a final column contains potential sun hours.

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

Matrix defining variables for the table layout: 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:

20132550- Lindahl Wind Farm

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Kevin Walter
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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73183 - House

Assumptions for shadow calculations

Table with 12 columns (Jan-Dec) and 2 rows of data showing Sunshine probability S (Average daily sunshine hours) [BISMARCK] and numerical values for each month.

Operational time table with columns for N, NNE, ENE, E, ESE, SSE, S, SSW, WSW, W, WNW, NNW, Sum and values for each direction.

Main shadow calculation table with columns for months (July-December) and rows for hourly times, potential sun hours, sun reduction, and total reduction.

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

Matrix layout table with columns for Day in month, Sun rise, Sun set, Minutes with flicker, First time with flicker, Last time with flicker, and (WTG causing flicker first/last time).

Project:

20132550- Lindahl Wind Farm

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73208 - House

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594
Idle start wind speed: Cut in wind speed from power curve

Table with 12 columns for months (January to December) and rows for each day of the month, showing sun rise/set times, shadow reduction percentages, and operational hours.

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:

20132550- Lindahl Wind Farm

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Lenexa, KS, 66219

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73215 - House

Assumptions for shadow calculations

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

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

Operational time

Table with 12 columns (N-NNW) and 2 rows of operational time values, including idle start wind speed.

Main shadow calculation table with columns for months (January-June) and rows for various time slots (e.g., 1 | 08:45, 2 | 17:07, etc.).

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

Summary matrix with columns: Day in month, Sun rise, Sun set, Minutes with flicker, First time, Last time, and WTG causing flicker.

Project:

20132550- Lindahl Wind Farm

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Lenexa, KS, 66219

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73215 - House

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (July, August, September, October, November, December) and rows for time intervals (e.g., 05:54, 06:26, etc.) showing shadow calculation data.

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

Matrix 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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

Description:

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Brandon Storm / bstorm@eapc.net
6/15/2015 4:36 PM/2.9.285

SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73307 - House

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for specific dates (1-31) showing shadow calculations and summary statistics at the bottom.

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73352 - House

Assumptions for shadow calculations

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 13 columns (N, NNE, ENE, E, ESE, SSE, S, SSW, WSW, W, WNW, NNW, Sum) and 1 row of values: 660, 333, 352, 411, 608, 961, 789, 574, 695, 904, 1,117, 1,191, 8,594

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

Main shadow calculation table with columns for months (January-June) and rows for each day (1-31) showing sun rise/set times, shadow reduction, and total real sun hours.

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

Matrix defining table layout: 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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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73352 - House

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (July to December) and rows for time slots (1:05:54 to 21:34) and summary rows (Potential sun hours, Total, worst case, etc.)

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

Matrix 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: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73353 - Garage

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to June) and rows for each day (1-31) showing sunrise and sunset 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

Matrix 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: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab **Shadow receptor: 73353 - Garage**

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December	
1	05:54 21:58	06:26 21:32	07:09 20:38	07:51 19:35	18:53 (12) 19:08 (12)	07:38 17:34	08:22 17:00
2	05:55 21:58	06:27 21:31	07:10 20:36	07:52 19:33	18:53 (12) 19:06 (12)	07:39 17:32	08:24 16:59
3	05:55 21:58	06:29 21:29	07:11 20:33	07:54 19:31	18:54 (12) 19:04 (12)	07:41 17:31	08:25 16:59
4	05:56 21:57	06:30 21:28	07:13 20:31	07:55 19:29	18:55 (12) 19:02 (12)	07:42 17:29	08:26 16:58
5	05:57 21:57	06:31 21:26	07:14 20:29	07:57 19:27	18:58 (12) 18:59 (12)	07:44 17:28	08:27 16:58
6	05:57 21:57	06:33 21:25	07:16 20:27	07:58 19:25		07:45 17:26	08:29 16:58
7	05:58 21:56	06:34 21:23	07:17 20:25	08:00 19:22		07:47 17:25	08:30 16:58
8	05:59 21:56	06:35 21:22	07:18 20:23	08:01 19:20		07:49 17:23	08:31 16:57
9	06:00 21:55	06:37 21:20	07:20 20:21	08:02 19:18		07:50 17:22	08:32 16:57
10	06:01 21:55	06:38 21:18	20:22 (13) 20:26 (13)	07:21 20:19	08:04 19:16	07:52 17:20	08:33 16:57
11	06:02 21:54	06:39 21:17	20:18 (13) 20:29 (13)	07:23 20:17	08:05 19:14	07:53 17:19	08:34 16:57
12	06:03 21:53	06:41 21:15	20:17 (13) 20:32 (13)	07:24 20:15	08:07 19:12	07:55 17:18	08:35 16:57
13	06:04 21:53	06:42 21:13	20:15 (13) 20:32 (13)	07:25 20:13	08:08 19:10	07:56 17:16	08:36 16:57
14	06:05 21:52	06:44 21:12	20:13 (13) 20:33 (13)	07:27 20:11	08:10 19:08	07:58 17:15	08:37 16:57
15	06:06 21:51	06:45 21:10	20:13 (13) 20:34 (13)	07:28 20:09	08:11 19:06	08:00 17:14	08:37 16:57
16	06:07 21:50	06:46 21:08	20:12 (13) 20:34 (13)	07:30 20:06	08:13 19:04	08:01 17:13	08:38 16:57
17	06:08 21:50	06:48 21:06	20:11 (13) 20:34 (13)	07:31 20:04	08:14 19:03	08:03 17:12	08:39 16:58
18	06:09 21:49	06:49 21:04	20:11 (13) 20:35 (13)	07:32 20:02	08:16 19:01	08:04 17:10	08:40 16:58
19	06:10 21:48	06:50 21:03	20:10 (13) 20:34 (13)	07:34 20:00	08:17 18:57	08:06 17:09	08:40 16:58
20	06:11 21:47	06:52 21:01	20:10 (13) 20:33 (13)	07:35 19:58	08:19 18:55	08:07 17:08	08:41 16:59
21	06:12 21:46	06:53 20:59	20:10 (13) 20:32 (13)	07:37 19:56	19:02 (12) 19:10 (12)	08:20 18:53	08:41 17:07
22	06:13 21:45	06:55 20:57	20:10 (13) 20:30 (13)	07:38 19:54	18:59 (12) 19:13 (12)	08:22 18:51	08:42 17:06
23	06:15 21:44	06:56 20:55	20:10 (13) 20:28 (13)	07:39 19:52	18:57 (12) 19:14 (12)	08:24 18:49	08:42 17:06
24	06:16 21:42	06:57 20:53	20:11 (13) 20:27 (13)	07:41 19:50	18:56 (12) 19:15 (12)	08:25 18:48	08:43 17:05
25	06:17 21:41	06:59 20:51	20:12 (13) 20:25 (13)	07:42 19:47	18:54 (12) 19:15 (12)	08:27 18:46	08:43 17:04
26	06:18 21:40	07:00 20:49	20:13 (13) 20:22 (13)	07:44 19:45	18:53 (12) 19:15 (12)	08:28 18:44	08:44 17:03
27	06:19 21:39	07:02 20:47	20:15 (13) 20:21 (13)	07:45 19:43	18:53 (12) 19:15 (12)	08:30 18:42	08:44 17:02
28	06:21 21:38	07:03 20:46		07:47 19:41	18:52 (12) 19:14 (12)	08:31 18:41	08:44 17:02
29	06:22 21:36	07:04 20:44		07:48 19:39	18:52 (12) 19:12 (12)	08:33 18:39	08:44 17:01
30	06:23 21:35	07:06 20:42		07:49 19:37	18:52 (12) 19:10 (12)	08:34 18:37	08:44 17:00
31	06:25 21:34	07:07 20:40				08:36 18:35	08:45 17:06
Potential sun hours	486	445	379	336		277	260
Total, worst case		308	183	46			
Sun reduction		0.72	0.69	0.52			
Oper. time red.		0.98	0.98	0.98			
Wind dir. red.		0.70	0.64	0.64			
Total reduction		0.49	0.43	0.33			
Total, real		151	78	15			

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab Shadow receptor: 73437 - House

Assumptions for shadow calculations

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 ENE E ESE SSE S SSW WSW W WNW NNW Sum
660 333 352 411 608 961 789 574 695 904 1,117 1,191 8,594
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (July, August, September, October, November, December) and rows for specific times of day (05:54 to 21:34). 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

Matrix 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:

20132550- Lindahl Wind Farm

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab **Shadow receptor: 73792 - House**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
660	333	352	411	608	961	789	574	695	904	1,117	1,191	8,594

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

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:45	08:23	07:35	07:32	06:34	05:55	05:54	06:21 (84)	06:26	06:52 (155)	07:09	07:51	07:38	08:22
2	08:45	08:21	07:33	07:30	06:32	05:55	05:55	06:22 (84)	06:27	06:53 (155)	07:10	07:52	07:39	08:24
3	08:44	08:20	07:31	07:28	06:31	05:54	05:56	06:23 (84)	06:29	06:54 (155)	07:12	07:54	07:41	08:25
4	08:44	08:18	07:29	07:26	06:29	05:54	05:56	06:23 (84)	06:30	06:56 (155)	07:13	07:55	07:42	08:29
5	08:44	08:17	07:27	07:24	06:28	05:53	05:57	06:24 (84)	06:31	06:57 (155)	07:14	07:57	07:44	08:27
6	08:44	08:15	07:25	07:22	06:26	05:53	05:58	06:25 (84)	06:32	06:58 (155)	07:16	07:58	07:45	08:28
7	08:44	08:14	07:23	07:20	06:24	05:52	05:58	06:26 (84)	06:33	06:59 (155)	07:17	08:00	07:47	08:30
8	08:43	08:12	07:21	07:18	06:23	05:52	06:18 (84)	06:34	06:34	07:01 (155)	07:19	08:01	07:49	08:31
9	08:43	08:11	07:19	07:16	06:21	05:51	06:21 (84)	06:35	06:35	07:03 (155)	07:20	08:03	07:50	08:32
10	08:43	08:09	07:17	07:13	06:20	05:51	06:22 (84)	06:36	06:36	07:04 (155)	07:21	08:04	07:52	08:33
11	08:42	08:08	07:15	07:11	06:18	05:51	06:23 (84)	06:37	06:37	07:05 (155)	07:22	08:05	07:53	08:34
12	08:42	08:06	07:13	07:09	06:17	05:50	06:24 (84)	06:38	06:38	07:06 (155)	07:23	08:06	07:55	08:35
13	08:41	08:04	07:11	07:08	06:16	05:50	06:25 (84)	06:39	06:39	07:07 (155)	07:24	08:07	07:56	08:36
14	08:40	08:03	07:09	07:06	06:14	05:50	06:26 (84)	06:40	06:40	07:08 (155)	07:25	08:08	07:57	08:37
15	08:40	08:01	07:07	07:04	06:13	05:50	06:27 (84)	06:41	06:41	07:09 (155)	07:26	08:09	07:58	08:38
16	08:39	07:59	07:05	07:02	06:12	05:50	06:28 (84)	06:42	06:42	07:10 (155)	07:27	08:10	07:59	08:39
17	08:38	07:58	07:03	07:00	06:10	05:50	06:29 (84)	06:43	06:43	07:11 (155)	07:28	08:11	07:59	08:40
18	08:38	07:56	07:01	06:58	06:09	05:50	06:30 (84)	06:44	06:44	07:12 (155)	07:29	08:12	07:59	08:41
19	08:37	07:54	07:00	06:56	06:08	05:50	06:31 (84)	06:45	06:45	07:13 (155)	07:30	08:13	07:59	08:42
20	08:36	07:52	06:58	06:54	06:07	05:50	06:32 (84)	06:46	06:46	07:14 (155)	07:31	08:14	07:59	08:43
21	08:35	07:50	06:56	06:52	06:06	05:50	06:33 (84)	06:47	06:47	07:15 (155)	07:32	08:15	07:59	08:44
22	08:34	07:49	06:54	06:50	06:04	05:51	06:34 (84)	06:48	06:48	07:16 (155)	07:33	08:16	07:59	08:45
23	08:33	07:47	06:52	06:48	06:03	05:51	06:35 (84)	06:49	06:49	07:17 (155)	07:34	08:17	07:59	08:46
24	08:32	07:45	06:50	06:46	06:02	05:51	06:36 (84)	06:50	06:50	07:18 (155)	07:35	08:18	07:59	08:47
25	08:31	07:43	06:48	06:44	06:01	05:51	06:37 (84)	06:51	06:51	07:19 (155)	07:36	08:19	07:59	08:48
26	08:30	07:41	06:46	06:42	06:00	05:51	06:38 (84)	06:52	06:52	07:20 (155)	07:37	08:20	07:59	08:49
27	08:29	07:39	06:44	06:40	05:59	05:52	06:39 (84)	06:53	06:53	07:21 (155)	07:38	08:21	07:59	08:50
28	08:28	07:37	06:42	06:38	05:59	05:53	06:40 (84)	06:54	06:54	07:22 (155)	07:39	08:22	07:59	08:51
29	08:26	07:38	06:40	06:36	05:58	05:53	06:41 (84)	06:55	06:55	07:23 (155)	07:40	08:23	07:59	08:52
30	08:25	07:36	06:38	06:34	05:57	05:54	06:42 (84)	06:56	06:56	07:24 (155)	07:41	08:24	07:59	08:53
31	08:24	07:34	06:36	06:32	05:56	05:54	06:43 (84)	06:57	06:57	07:25 (155)	07:42	08:25	07:59	08:54
Potential sun hours	273	285	368	409	471	481	486	445	379	336	277	260		
Total, worst case					306	225	247	84						
Sun reduction					0.67	0.70	0.75	0.72						
Oper. time red.					0.98	0.98	0.98	0.98						
Wind dir. red.					0.60	0.57	0.60	0.60						
Total reduction					0.40	0.39	0.44	0.43						
Total, real					121	88	108	36						

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:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab **Shadow receptor: 77282 - Office/Farm**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
660	333	352	411	608	961	789	574	695	904	1,117	1,191	8,594

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

	January	February	March	April	May	June
1 08:45	09:32 (104)	08:23	07:35	17:43 (12)	07:32	07:53 (105)
17:07	9 09:41 (104)	17:50	18:34	15 17:58 (12)	20:21	46 19:57 (13)
2 08:45	09:34 (104)	08:21	07:33	17:44 (12)	07:30	07:51 (105)
17:08	6 09:40 (104)	17:52	18:35	12 17:56 (12)	20:22	51 19:59 (13)
3 08:45		08:20	07:31	17:48 (12)	07:28	07:49 (105)
17:09		17:53	18:37	4 17:52 (12)	20:24	52 19:58 (13)
4 08:44		08:18	07:29		07:26	07:48 (105)
17:10		17:55	18:38		20:25	53 19:58 (13)
5 08:44		08:17	07:27		07:24	07:48 (105)
17:11		17:57	18:40		20:27	51 19:57 (13)
6 08:44		08:15	07:25		07:21	07:48 (105)
17:13		17:58	18:42		20:28	51 19:57 (13)
7 08:44		08:14	07:23		07:19	07:48 (105)
17:14		18:00	18:43		20:30	47 19:55 (13)
8 08:43		08:12	08:21		07:17	07:48 (105)
17:15		18:00	1 08:37 (158)	18:45	20:31	44 19:54 (13)
9 08:43		08:11	08:19		07:15	07:49 (105)
17:16		18:02	4 08:38 (158)	19:46	20:32	39 19:52 (13)
10 08:43		08:09	08:17		07:13	07:35 (184)
17:17		18:03	6 08:39 (158)	19:48	20:34	33 19:50 (13)
11 08:42		08:08	08:15		07:11	07:33 (184)
17:19		18:05	8 08:39 (158)	19:49	20:35	23 08:09 (105)
12 08:42		08:06	08:13		07:09	07:31 (184)
17:20		18:06	10 08:39 (158)	19:51	20:37	21 08:06 (105)
13 08:41		08:04	08:11		07:07	07:29 (184)
17:21		18:08	12 08:40 (158)	19:52	20:38	14 08:01 (105)
14 08:41		08:03	08:09		07:05	07:27 (184)
17:23		18:10	14 08:40 (158)	19:54	20:40	12 07:39 (184)
15 08:40		08:01	08:07		07:03	07:25 (184)
17:24		18:11	15 08:39 (158)	19:55	20:41	14 07:39 (184)
16 08:39		07:59	08:05		07:01	07:23 (184)
17:25		18:13	17 17:48 (12)	19:57	20:43	16 07:39 (184)
17 08:38		07:58	08:03		07:00	07:22 (184)
17:27		18:15	21 17:51 (12)	19:58	20:44	17 07:39 (184)
18 08:38		07:56	08:01		06:58	07:20 (184)
17:28		18:16	20 17:52 (12)	20:00	20:46	19 07:39 (184)
19 08:37		07:54	07:59		06:56	07:20 (184)
17:30		18:18	18 17:54 (12)	20:01	20:47	18 07:38 (184)
20 08:36		07:52	07:57		06:54	07:20 (184)
17:31		18:19	14 17:55 (12)	20:03	20:49	17 07:37 (184)
21 08:35		07:50	07:55		06:52	07:21 (184)
17:33		18:21	17 17:57 (12)	20:04	20:50	14 07:35 (184)
22 08:34		07:49	07:53		06:50	07:22 (184)
17:34		18:23	19 17:58 (12)	20:06	20:52	11 07:33 (184)
23 08:33		07:47	07:51		06:48	07:27 (184)
17:36		18:24	21 18:00 (12)	20:07	20:53	2 07:29 (184)
24 08:32		07:45	07:48		06:46	06:02
17:37		18:26	23 18:02 (12)	20:09	20:54	21:36
25 08:31		07:43	07:46		06:45	06:01
17:39		18:27	23 18:03 (12)	20:10	20:56	21:37
26 08:30		07:41	07:44		06:43	06:00
17:41		18:29	22 18:02 (12)	20:12	5 19:44 (13)	06:43
27 08:29		07:39	07:42		06:41	06:00
17:42		18:31	20 18:01 (12)	20:13	17 19:51 (13)	20:59
28 08:28		07:37	07:40		06:39	06:00
17:44		18:32	19 18:00 (12)	20:15	25 19:52 (13)	21:00
29 08:26					07:38	08:00 (105)
17:45					32 19:54 (13)	21:02
30 08:25					07:36	07:58 (105)
17:47					37 19:55 (13)	21:03
31 08:24					07:34	07:56 (105)
17:48					43 19:57 (13)	21:04
Potential sun hours	273	285	368	410	471	481
Total, worst case	15	324	190	665	607	607
Sun reduction	0.56	0.50	0.63	0.59	0.70	0.70
Oper. time red.	0.98	0.98	0.98	0.98	0.98	0.98
Wind dir. red.	0.70	0.65	0.66	0.66	0.72	0.72
Total reduction	0.38	0.32	0.41	0.38	0.49	0.49
Total, real	6	103	77	252	300	300

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:

20132550- Lindahl Wind Farm

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 Kevin Walter
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 Lenexa, KS, 66219

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SHADOW - Calendar

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab **Shadow receptor: 77282 - Office/Farm**

Assumptions for shadow calculations

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	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
660	333	352	411	608	961	789	574	695	904	1,117	1,191	8,594

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

	July	August	September	October	November	December
1	05:54 21:58	20:58 (14) 21:21 (14)	06:26 21:32	07:09 20:38	07:32 (184) 08:08 (105)	07:51 19:35
2	05:55 21:58	20:59 (14) 21:21 (14)	06:27 21:31	07:10 20:36	07:34 (184) 19:49 (13)	07:52 19:33
3	05:55 21:58	21:01 (14) 21:20 (14)	06:29 21:29	07:11 20:34	07:47 (105) 19:50 (13)	07:54 19:31
4	05:56 21:57	21:01 (14) 21:19 (14)	06:30 21:28	07:13 20:31	07:46 (105) 19:51 (13)	07:55 19:29
5	05:57 21:57	21:03 (14) 21:18 (14)	06:31 21:26	07:14 20:29	07:45 (105) 19:52 (13)	07:57 19:27
6	05:57 21:57	21:05 (14) 21:17 (14)	06:33 21:25	07:16 20:27	07:44 (105) 19:53 (13)	07:58 19:25
7	05:58 21:56	21:06 (14) 21:15 (14)	06:34 21:23	07:17 20:25	07:43 (105) 19:52 (13)	08:00 19:22
8	05:59 21:56	06:35 21:22	06:35 21:22	07:18 20:23	07:43 (105) 19:53 (13)	08:01 19:20
9	06:00 21:55	06:37 21:20	06:37 21:20	07:20 20:21	07:43 (105) 19:53 (13)	08:02 19:18
10	06:01 21:55	06:38 21:18	06:38 21:18	07:21 20:19	07:44 (105) 19:52 (13)	08:04 19:16
11	06:02 21:54	06:39 21:17	06:39 21:17	07:23 20:17	07:46 (105) 19:51 (13)	08:05 19:14
12	06:03 21:53	06:41 21:15	06:41 21:15	07:24 20:15	07:47 (105) 19:48 (13)	08:07 19:12
13	06:04 21:53	06:42 21:13	06:42 21:13	07:25 20:13	07:48 (105) 19:46 (13)	08:08 19:10
14	06:05 21:52	06:44 21:12	06:44 21:12	07:27 20:11	07:50 (105) 19:44 (13)	08:10 19:08
15	06:06 21:51	06:45 21:10	06:45 21:10	07:28 20:09	07:51 (105) 19:42 (13)	08:11 19:06
16	06:07 21:50	06:46 21:08	06:46 21:08	07:30 20:06	07:53 (105) 19:40 (13)	08:13 19:04
17	06:08 21:50	06:48 21:06	06:48 21:06	07:31 20:04	07:54 (105) 19:38 (13)	08:14 19:03
18	06:09 21:49	06:49 21:05	06:49 21:05	07:32 20:02	07:55 (105) 19:37 (13)	08:15 19:02
19	06:10 21:48	06:50 21:03	06:50 21:03	07:34 20:00	07:56 (105) 19:36 (13)	08:16 19:01
20	06:11 21:47	06:52 21:01	06:52 21:01	07:35 19:58	07:57 (105) 19:35 (13)	08:17 18:59
21	06:12 21:46	06:53 20:59	06:53 20:59	07:37 19:56	07:58 (105) 19:34 (13)	08:19 18:57
22	06:13 21:45	06:55 20:57	06:55 20:57	07:38 19:54	07:59 (105) 19:33 (13)	08:20 18:56
23	06:15 21:44	06:56 20:55	06:56 20:55	07:39 19:52	08:00 (105) 19:32 (13)	08:22 18:54
24	06:16 21:42	06:57 20:53	06:57 20:53	07:41 19:50	08:01 (105) 19:31 (13)	08:23 18:53
25	06:17 21:41	06:59 20:51	06:59 20:51	07:42 19:47	08:02 (105) 19:30 (13)	08:24 18:52
26	06:18 21:40	07:00 20:49	07:00 20:49	07:44 19:45	08:03 (105) 19:29 (13)	08:25 18:51
27	06:19 21:39	07:02 20:47	07:02 20:47	07:45 19:43	08:04 (105) 19:28 (13)	08:26 18:50
28	06:21 21:38	07:03 20:46	07:03 20:46	07:47 19:41	08:05 (105) 19:27 (13)	08:27 18:49
29	06:22 21:36	07:04 20:44	07:04 20:44	07:48 19:39	08:06 (105) 19:26 (13)	08:28 18:48
30	06:23 21:35	07:06 20:42	07:06 20:42	07:49 19:37	08:07 (105) 19:25 (13)	08:29 18:47
31	06:25 21:34	07:07 20:40	07:07 20:40	07:31 (184) 08:06 (105)	08:08 (105) 19:24 (13)	08:30 18:46
Potential sun hours	486	445	379	336	277	260
Total, worst case	118	178	659	348	10	275
Sun reduction	0.75	0.72	0.69	0.52	0.43	0.44
Oper. time red.	0.98	0.98	0.98	0.98	0.98	0.98
Wind dir. red.	0.72	0.63	0.67	0.64	0.72	0.70
Total reduction	0.53	0.44	0.45	0.33	0.30	0.30
Total, real	62	79	296	114	3	83

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:

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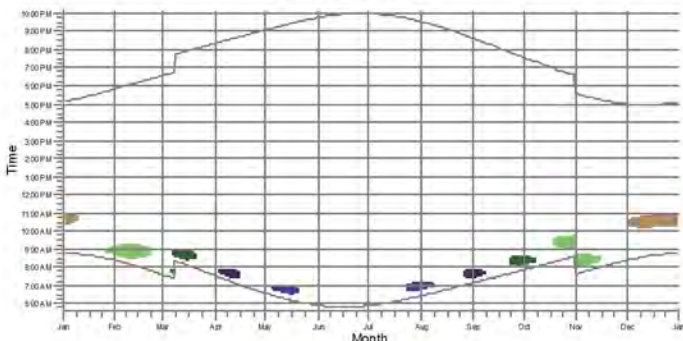
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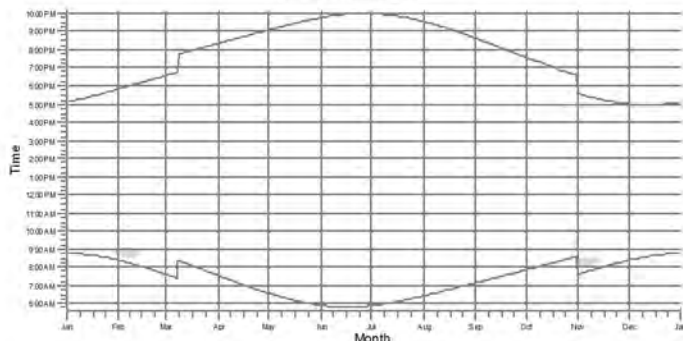
SHADOW - Calendar, graphical

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab

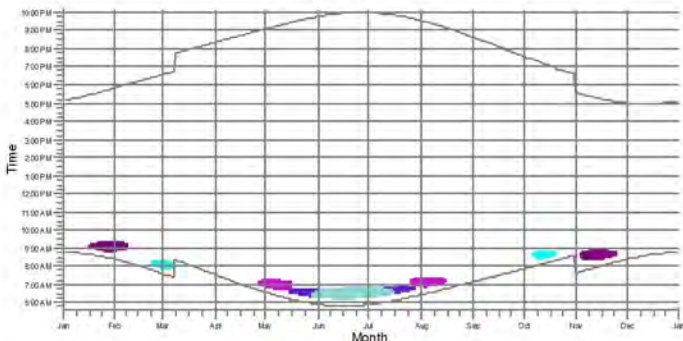
72448: House



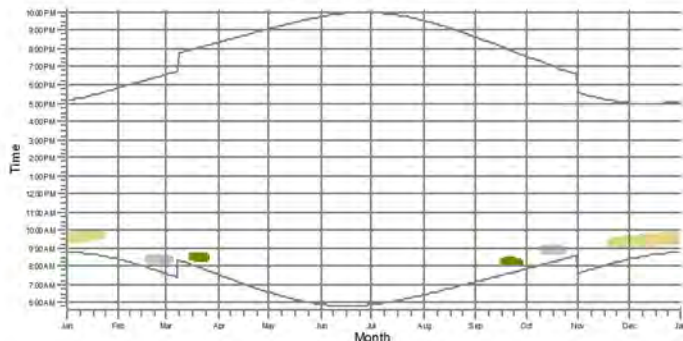
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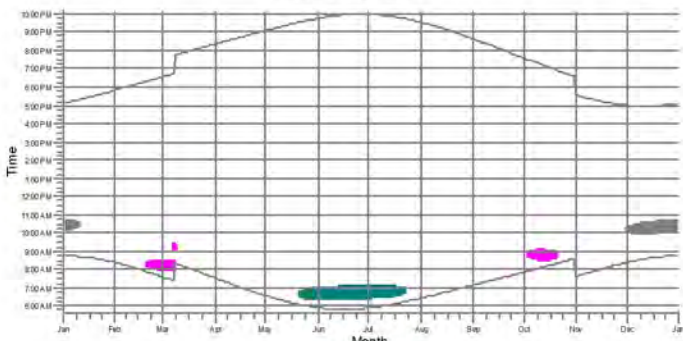
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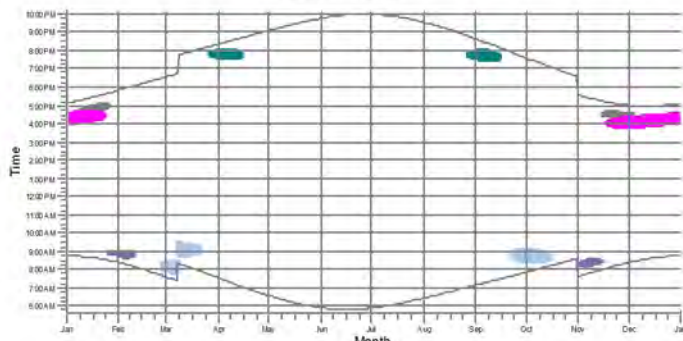
73047: House



73164: House



73183: House



WTGs

- | | | | | | | |
|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| 13: Primary | 19: Primary | 22: Primary | 99: Primary | 161: Primary | 177: Primary | 180: Primary |
| 14: Primary | 20: Primary | 25: Primary | 114: Primary | 184: Primary | 178: Primary | |
| 15: Primary | 21: Primary | 98: Primary | 150: Primary | 176: Primary | 179: Primary | |

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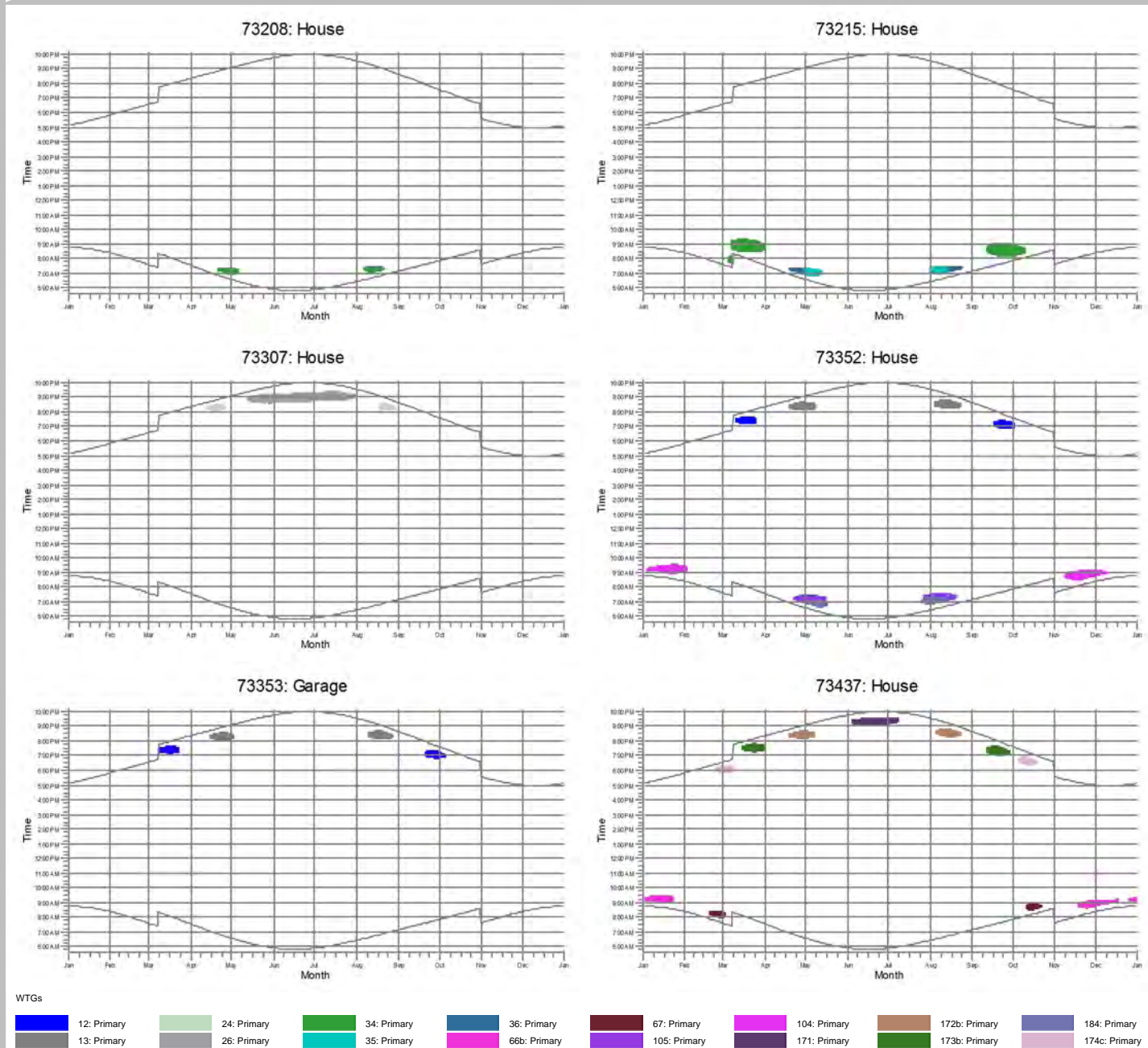
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SHADOW - Calendar, graphical

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab



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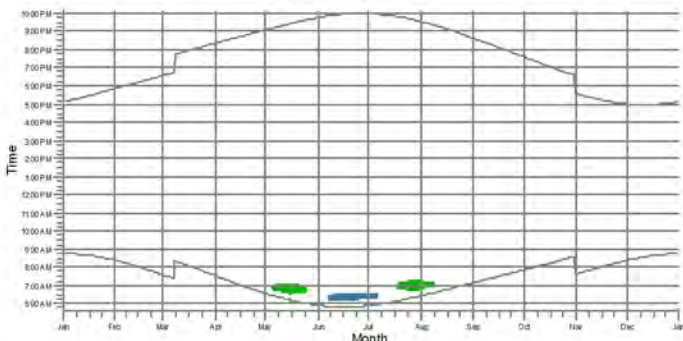
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 +1 701 775 3000
 Brandon Storm / bstorm@eapc.net
 Calculated:
 6/15/2015 4:36 PM/2.9.285

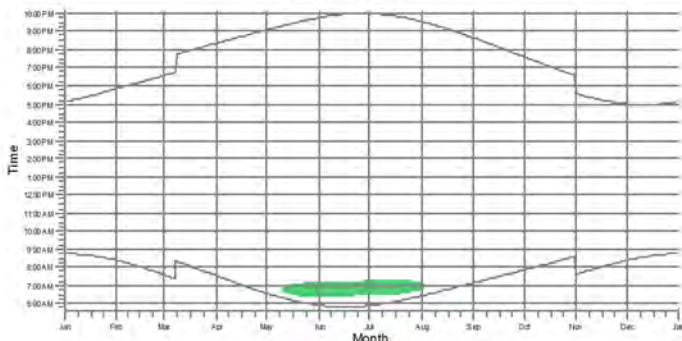
SHADOW - Calendar, graphical

Calculation: A034 V110-2.0 80m HH Realistic Flicker w/ Obstacles DNV Tab

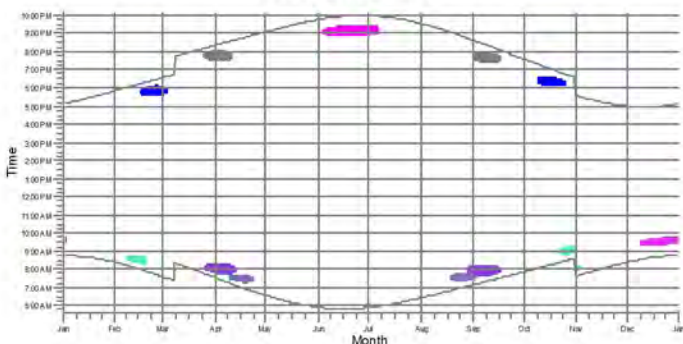
73792: House



74133: House



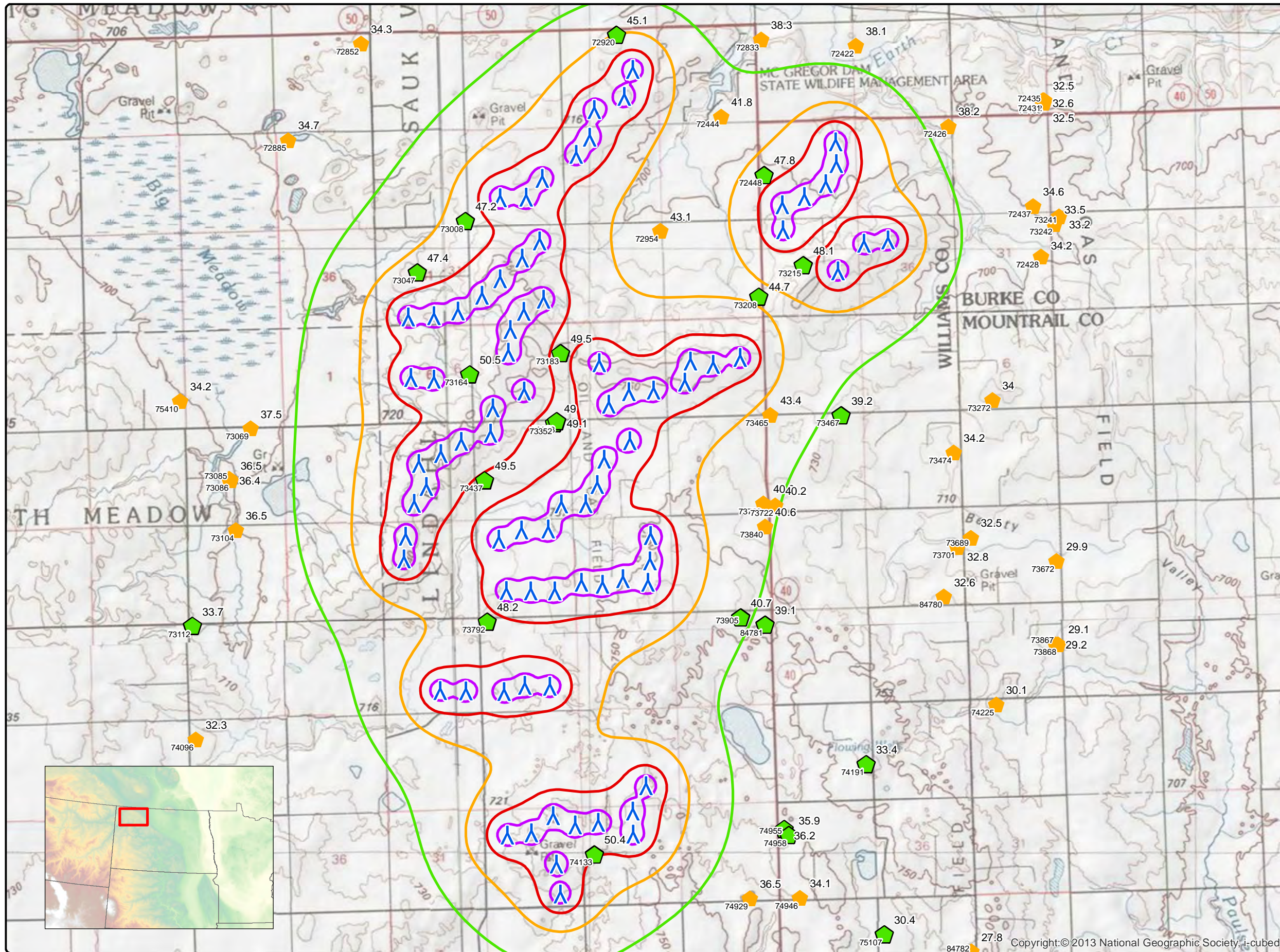
77282: Office/Farm



WTGs

- 12: Primary
- 14: Primary
- 84: Primary
- 104: Primary
- 158: Primary
- 13: Primary
- 42: Primary
- 105: Primary
- 155: Primary
- 184: Primary

Appendix G: No Ground Attenuation Sound Map – V117-3.3 84 m HH



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Lindahl Wind Farm V117 Worst Case Sound

Client

TradeWind Energy, Inc.

Project Description

75 Primary WTG locations & 5 Alts (A034) for V117-3.3 on 84 m HH. Worst case noise map and data at receptors (dB(A)). Assumes WTGs at rated noise of 108.5 dB(A) for new WTGs ISO-9613-2 General model. No ground attenuation. No ambient noise.

Location: Tioga, ND

Project #: 20132550

Issue Dates

#	Description	Date
1	Preliminary Draft	2015.06.23

Drawn By: BS Checked By: JH

Legend

- V117 WTG A034
- Non-Participating Residences
- Participating Residence

- Sound Level (dB(A))**
- 40
 - 45
 - 50
 - 55

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0 0.5 1 2 Miles

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Appendix H: windPRO Sound Analysis with No Ground Attenuation – V117-3.3 84 m HH

Project:

20132550- Lindahl Wind Farm

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 Lenexa, KS, 66219

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DECIBEL - Main Result

Calculation: A034 V117-3.3 84 m HH No Grnd Atten. Generic Octave

...continued from previous page

Noise sensitive area

No.	Name	UTM NAD83 Zone: 13			Emission height [m]	Demands Noise [dB(A)]	Sound Level From WTGs [dB(A)]	Distance to noise demand [m]	Demands fulfilled ? Noise
		East	North	Z					
72910	Garage	649,528	5,383,760	704.7	1.5	50.0	41.5	932	Yes
72920	House	650,400	5,383,729	711.5	1.5	50.0	45.1	304	Yes
72954	House	651,119	5,380,491	705.0	1.5	50.0	43.1	1,461	Yes
73008	House	647,905	5,380,657	723.4	1.5	50.0	47.2	305	Yes
73047	House	647,113	5,379,805	712.6	1.5	50.0	47.4	267	Yes
73069	House	644,362	5,377,232	698.7	1.5	50.0	37.5	2,396	Yes
73085	House	644,011	5,376,402	703.5	1.5	50.0	36.4	2,618	Yes
73086	House	644,029	5,376,379	703.9	1.5	50.0	36.5	2,597	Yes
73104	House	644,116	5,375,556	701.0	1.5	50.0	36.5	2,385	Yes
73112	House	643,400	5,373,971	710.6	1.5	50.0	33.7	3,300	Yes
73164	House	647,974	5,378,125	736.6	1.5	50.0	50.5	-1,044	No
73183	House	649,476	5,378,474	747.0	1.5	50.0	49.5	177	Yes
73208	House	652,746	5,379,403	722.4	1.5	50.0	44.7	699	Yes
73215	House	653,476	5,379,925	741.5	1.5	50.0	48.1	218	Yes
73241	House	657,701	5,380,739	704.1	1.5	50.0	33.2	2,528	Yes
73242	House	657,625	5,380,605	701.2	1.5	50.0	33.5	2,438	Yes
73272	House	656,603	5,377,699	728.9	1.5	50.0	34.0	2,822	Yes
73307	House	652,350	5,377,616	735.4	1.5	50.0	46.9	304	Yes
73352	House	649,372	5,377,319	734.6	1.5	50.0	49.0	252	Yes
73353	Garage	649,411	5,377,350	734.6	1.5	50.0	49.1	260	Yes
73437	House	648,222	5,376,376	731.5	1.5	50.0	49.5	116	Yes
73465	House	652,934	5,377,454	728.5	1.5	50.0	43.4	713	Yes
73467	House	654,105	5,377,449	726.3	1.5	50.0	39.2	1,586	Yes
73474	House	655,962	5,376,837	710.2	1.5	50.0	34.2	3,226	Yes
73672	House	657,653	5,375,042	704.1	1.5	50.0	29.9	5,642	Yes
73689	House	656,242	5,375,429	710.2	1.5	50.0	32.5	4,491	Yes
73701	House	656,021	5,375,274	710.2	1.5	50.0	32.8	4,417	Yes
73722	House	653,014	5,375,966	734.6	1.5	50.0	40.2	1,718	Yes
73729	House	652,820	5,375,995	733.4	1.5	50.0	40.9	1,541	Yes
73792	House	648,263	5,374,042	728.5	1.5	50.0	48.2	194	Yes
73840	House	652,848	5,375,611	736.1	1.5	50.0	40.6	1,483	Yes
73848	Probably Occupied	652,773	5,375,266	744.9	1.5	50.0	40.6	1,375	Yes
73867	House	657,646	5,373,676	710.9	1.5	50.0	29.2	6,368	Yes
73868	House	657,685	5,373,674	711.1	1.5	50.0	29.1	6,407	Yes
73905	House	652,445	5,374,111	759.0	1.5	50.0	40.7	1,227	Yes
74072	Occupiable Structure, per field notes	647,929	5,371,803	716.8	1.5	50.0	44.4	702	Yes
74096	House	643,453	5,372,099	716.3	1.5	50.0	32.3	3,788	Yes
74133	House	650,034	5,370,204	742.6	1.5	50.0	50.4	-47	No
74191	House	654,514	5,371,692	765.0	1.5	50.0	33.4	3,310	Yes
74225	House	656,662	5,372,675	722.4	1.5	50.0	30.1	5,597	Yes
74929	House	652,597	5,369,477	749.8	1.5	50.0	36.5	1,837	Yes
74944	House	652,987	5,368,263	755.9	1.5	50.0	33.1	2,892	Yes
74946	House	653,421	5,369,486	746.6	1.5	50.0	34.1	2,575	Yes
74955	House	653,163	5,370,620	746.2	1.5	50.0	36.2	2,032	Yes
74958	House	653,237	5,370,521	746.8	1.5	50.0	35.9	2,131	Yes
74997	House	656,161	5,367,989	720.8	1.5	50.0	27.4	5,688	Yes
75017	House	655,758	5,368,066	719.3	1.5	50.0	28.0	5,292	Yes
75019	House	656,215	5,367,523	716.3	1.5	50.0	26.9	5,948	Yes
75023	House	657,919	5,367,212	720.4	1.5	50.0	24.7	7,609	Yes
75024	House	657,910	5,367,229	720.5	1.5	50.0	24.7	7,594	Yes
75035	House	658,012	5,366,393	701.6	1.5	50.0	23.9	8,069	Yes
75048	House	656,450	5,365,968	719.4	1.5	50.0	25.1	7,011	Yes
75051	House	656,481	5,364,835	702.0	1.5	50.0	23.9	7,787	Yes
75052	House	656,500	5,364,785	701.1	1.5	50.0	23.9	7,835	Yes

To be continued on next page...

Project: 20132550- Lindahl Wind Farm

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DECIBEL - Main Result

Calculation: A034 V117-3.3 84 m HH No Grnd Atten. Generic Octave

...continued from previous page

Table with columns labeled WTG (37-100) and rows of numerical data representing decibel levels for various wind turbine configurations.

To be continued on next page...

Project:
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WTG

Table with 18 columns (NSA 102 to 181b) containing numerical values for wind speed or decibel measurements.

WTG

Table with 13 columns (NSA 182 to 174c) containing numerical values for wind speed or decibel measurements.

To be continued on next page...

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DECIBEL - Main Result

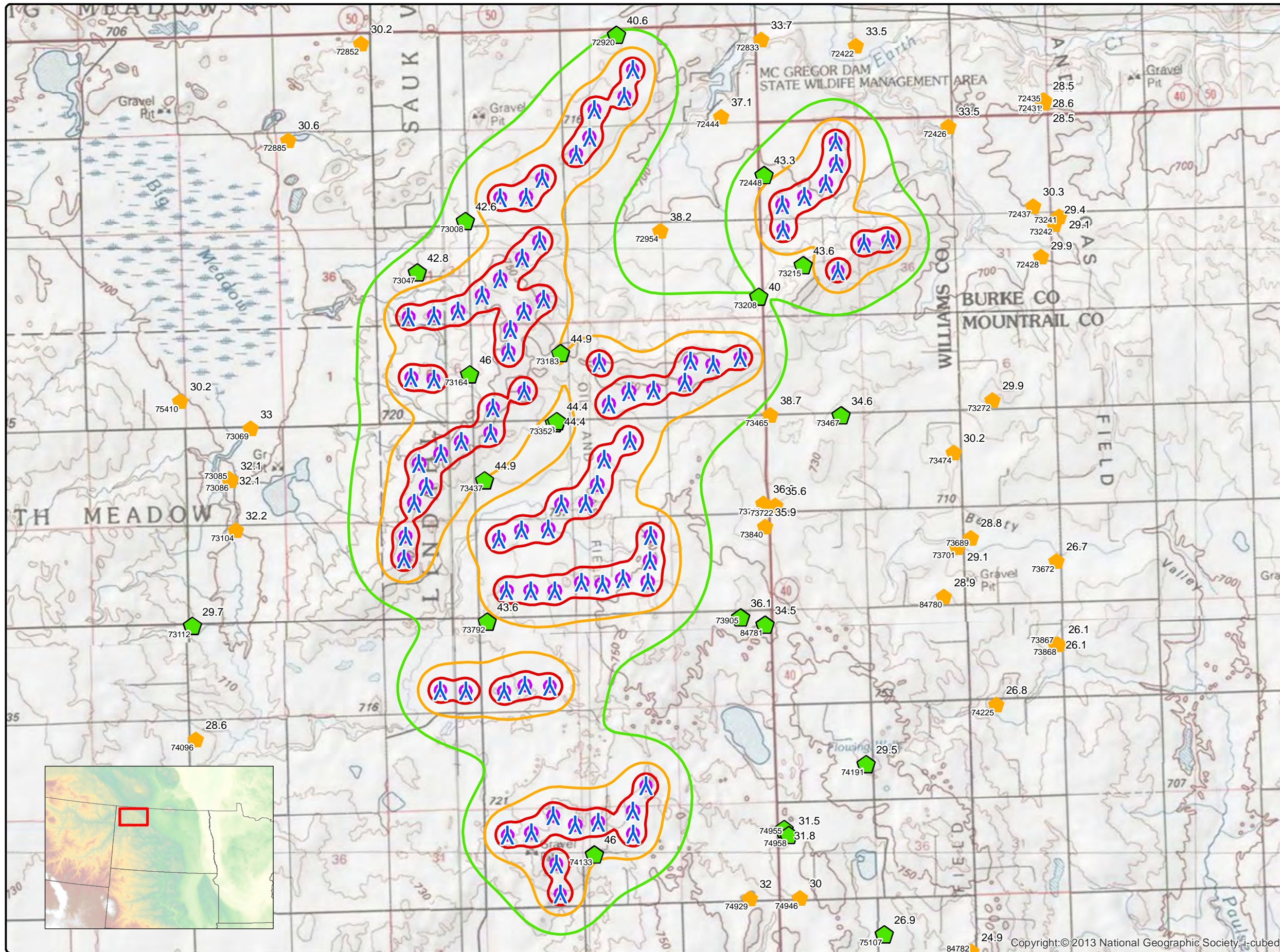
Calculation: A034 V117-3.3 84 m HH No Grnd Atten. Generic Octave

...continued from previous page

WTG

NSA	182	183b	184	175	176	177	178	179b	180b	185	186	205b	206b	174c
77282	2399	4205	1278	4800	5056	5422	5830	6173	6407	2489	2823	7088	6873	2779
84780	9511	9497	6206	6612	7000	6996	7093	7366	7720	9611	9973	8210	6813	8880
84781	7129	8370	4459	6526	6941	7100	7353	7702	8058	7479	7778	5490	4266	6132
84782	13240	14688	10835	12312	12718	12765	12904	13196	13555	13743	14002	7895	6520	11806
84783	12657	14757	10771	12839	13254	13362	13560	13883	14245	13306	13511	6347	5167	10994

Appendix I: General Ground Attenuation Sound Map – V117-3.3 84 m HH



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Lindahl Wind Farm V117 Realistic Case Sound 1

Client

TradeWind Energy, Inc.

Project Description

75 Primary WTG locations & 5 Alts (A034) for V117-3.3 on 84 m HH. Worst case noise map and data at receptors (dB(A)). Assumes WTGs at rated noise of 108.5 dB(A) for new WTGs ISO-9613-2 General model. General ground attenuation. No ambient noise.

Location: Tiooga, ND

Project #: 20132550

Issue Dates

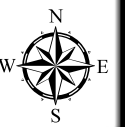
#	Description	Date
1	Preliminary Draft	2015.06.23

Drawn By: BS Checked By: JH

Legend

- V117 WTG A034
 - Non-Participating Residences
 - Participating Residence
- Sound Level (dB(A))**
- 40
 - 45
 - 50
 - 55

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0 0.5 1 2 Miles

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Appendix J: windPRO Sound Analysis with General Ground Attenuation – V117-3.3 84 m HH

Project:

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DECIBEL - Main Result

Calculation: A034 V117-3.3 84 m HH General Grnd Atten. Generic Octave

Noise calculation model:

ISO 9613-2 General

Wind speed:

95% rated power

Ground attenuation:

General, Ground factor: 0.7

Meteorological coefficient, C0:

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 no value in NSA object:

1.5 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)



New WTG

Noise sensitive area

WTGs

Table with columns: UTM NAD83 Zone: 13 (East, North, Z), Row data/Description, WTG type (Valid, Manufact., Type-generator, Power, Rotor diameter, Hub height), Noise data (Creator, Name), Wind speed, Status, Lwa,ref, Pure tones.

To be continued on next page...

Project:

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DECIBEL - Main Result

Calculation: A034 V117-3.3 84 m HH General Grnd Atten. Generic Octave

...continued from previous page

Noise sensitive area

No.	Name	UTM NAD83 Zone: 13			Emission height	Demands Noise	Sound Level From WTGs	Distance to noise demand	Demands fulfilled ? Noise
		East	North	Z					
72910	Garage	649,528	5,383,760	704.7	1.5	50.0	36.8	1,087	Yes
72920	House	650,400	5,383,729	711.5	1.5	50.0	40.6	437	Yes
72954	House	651,119	5,380,491	705.0	1.5	50.0	38.2	1,667	Yes
73008	House	647,905	5,380,657	723.4	1.5	50.0	42.6	488	Yes
73047	House	647,113	5,379,805	712.6	1.5	50.0	42.8	523	Yes
73069	House	644,362	5,377,232	698.7	1.5	50.0	33.0	2,573	Yes
73085	House	644,011	5,376,402	703.5	1.5	50.0	32.1	2,841	Yes
73086	House	644,029	5,376,379	703.9	1.5	50.0	32.1	2,817	Yes
73104	House	644,116	5,375,556	701.0	1.5	50.0	32.2	2,584	Yes
73112	House	643,400	5,373,971	710.6	1.5	50.0	29.7	3,459	Yes
73164	House	647,974	5,378,125	736.6	1.5	50.0	46.0	387	Yes
73183	House	649,476	5,378,474	747.0	1.5	50.0	44.9	449	Yes
73208	House	652,746	5,379,403	722.4	1.5	50.0	40.0	854	Yes
73215	House	653,476	5,379,925	741.5	1.5	50.0	43.6	384	Yes
73241	House	657,701	5,380,739	704.1	1.5	50.0	29.1	2,661	Yes
73242	House	657,625	5,380,605	701.2	1.5	50.0	29.4	2,569	Yes
73272	House	656,603	5,377,699	728.9	1.5	50.0	29.9	2,968	Yes
73307	House	652,350	5,377,616	735.4	1.5	50.0	42.4	540	Yes
73352	House	649,372	5,377,319	734.6	1.5	50.0	44.4	523	Yes
73353	Garage	649,411	5,377,350	734.6	1.5	50.0	44.4	530	Yes
73437	House	648,222	5,376,376	731.5	1.5	50.0	44.9	506	Yes
73465	House	652,934	5,377,454	728.5	1.5	50.0	38.7	877	Yes
73467	House	654,105	5,377,449	726.3	1.5	50.0	34.6	1,730	Yes
73474	House	655,962	5,376,837	710.2	1.5	50.0	30.2	3,368	Yes
73672	House	657,653	5,375,042	704.1	1.5	50.0	26.7	5,791	Yes
73689	House	656,242	5,375,429	710.2	1.5	50.0	28.8	4,639	Yes
73701	House	656,021	5,375,274	710.2	1.5	50.0	29.1	4,568	Yes
73722	House	653,014	5,375,966	734.6	1.5	50.0	35.6	1,907	Yes
73729	House	652,820	5,375,995	733.4	1.5	50.0	36.2	1,728	Yes
73792	House	648,263	5,374,042	728.5	1.5	50.0	43.6	400	Yes
73840	House	652,848	5,375,611	736.1	1.5	50.0	35.9	1,684	Yes
73848	Probably Occupied	652,773	5,375,266	744.9	1.5	50.0	36.0	1,603	Yes
73867	House	657,646	5,373,676	710.9	1.5	50.0	26.1	6,584	Yes
73868	House	657,685	5,373,674	711.1	1.5	50.0	26.1	6,622	Yes
73905	House	652,445	5,374,111	759.0	1.5	50.0	36.1	1,419	Yes
74072	Occupiable Structure, per field notes	647,929	5,371,803	716.8	1.5	50.0	39.7	890	Yes
74096	House	643,453	5,372,099	716.3	1.5	50.0	28.6	3,924	Yes
74133	House	650,034	5,370,204	742.6	1.5	50.0	46.0	292	Yes
74191	House	654,514	5,371,692	765.0	1.5	50.0	29.5	3,456	Yes
74225	House	656,662	5,372,675	722.4	1.5	50.0	26.8	5,742	Yes
74929	House	652,597	5,369,477	749.8	1.5	50.0	32.0	1,998	Yes
74944	House	652,987	5,368,263	755.9	1.5	50.0	29.0	3,048	Yes
74946	House	653,421	5,369,486	746.6	1.5	50.0	30.0	2,742	Yes
74955	House	653,163	5,370,620	746.2	1.5	50.0	31.8	2,196	Yes
74958	House	653,237	5,370,521	746.8	1.5	50.0	31.5	2,296	Yes
74997	House	656,161	5,367,989	720.8	1.5	50.0	24.5	5,852	Yes
75017	House	655,758	5,368,066	719.3	1.5	50.0	25.0	5,454	Yes
75019	House	656,215	5,367,523	716.3	1.5	50.0	24.1	6,110	Yes
75023	House	657,919	5,367,212	720.4	1.5	50.0	22.4	7,773	Yes
75024	House	657,910	5,367,229	720.5	1.5	50.0	22.5	7,758	Yes
75035	House	658,012	5,366,393	701.6	1.5	50.0	21.9	8,229	Yes
75048	House	656,450	5,365,968	719.4	1.5	50.0	22.7	7,170	Yes
75051	House	656,481	5,364,835	702.0	1.5	50.0	21.8	7,943	Yes
75052	House	656,500	5,364,785	701.1	1.5	50.0	21.7	7,991	Yes

To be continued on next page...

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DECIBEL - Main Result

Calculation: A034 V117-3.3 84 m HH General Grnd Atten. Generic Octave

...continued from previous page

Table with 23 columns (NSA to 36) and 23 rows (WTG 73465 to 72833). It contains numerical data representing decibel levels for various wind turbine models and tower heights.

To be continued on next page...

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DECIBEL - Main Result

Calculation: A034 V117-3.3 84 m HH General Grnd Atten. Generic Octave

...continued from previous page

Table with two sections, each starting with 'WTG'. The first section has 10 columns (NSA to 101) and 21 rows of data. The second section also has 10 columns (NSA to 181b) and 48 rows of data. Each row contains numerical values representing decibel measurements.

To be continued on next page...

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DECIBEL - Main Result

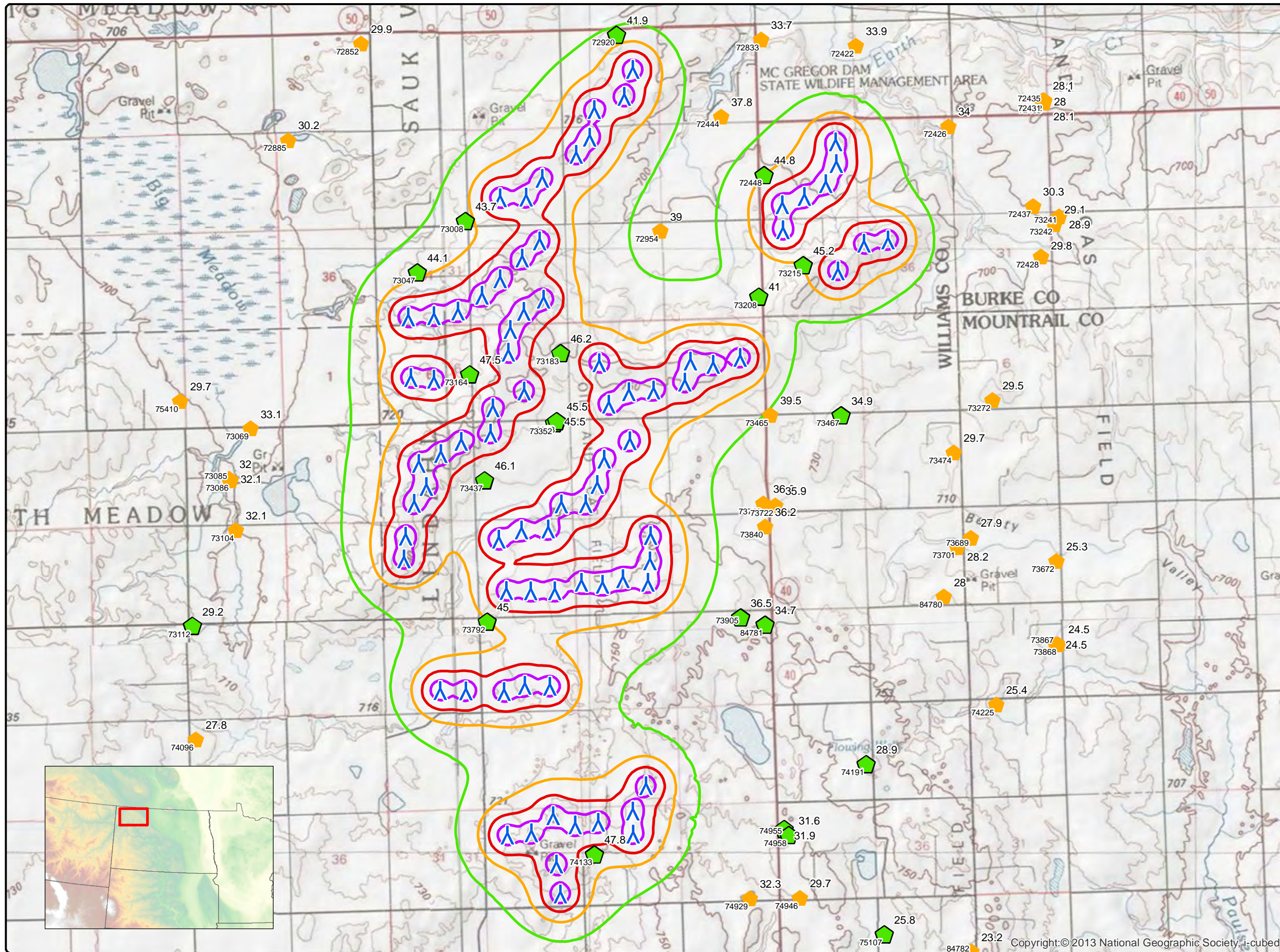
Calculation: A034 V117-3.3 84 m HH General Grnd Atten. Generic Octave

...continued from previous page

WTG

NSA	182	183b	184	175	176	177	178	179b	180b	185	186	205b	206b	174c
77282	2399	4205	1278	4800	5056	5422	5830	6173	6407	2489	2823	7088	6873	2779
84780	9511	9497	6206	6612	7000	6996	7093	7366	7720	9611	9973	8210	6813	8880
84781	7129	8370	4459	6526	6941	7100	7353	7702	8058	7479	7778	5490	4266	6132
84782	13240	14688	10835	12312	12718	12765	12904	13196	13555	13743	14002	7895	6520	11806
84783	12657	14757	10771	12839	13254	13362	13560	13883	14245	13306	13511	6347	5167	10994

Appendix K: Alternative Ground Attenuation Sound Map – V117-3.3 84 m HH



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Lindahl Wind Farm V117 Realistic Case Sound 2

Client

TradeWind Energy, Inc.

Project Description

75 Primary WTG locations & 5 Alts (A034) for V117-3.3 on 84 m HH. Worst case noise map and data at receptors (dB(A)). Assumes WTGs at rated noise of 108.5 dB(A) for new WTGs ISO-9613-2 General model. Alternative ground attenuation. No ambient noise.

Location: Tiooga, ND

Project #: 20132550

Issue Dates

#	Description	Date
1	Preliminary Draft	2015.06.23

Drawn By: BS Checked By: JH

Legend

- V117 WTG A034
- Non-Participating Residences
- Participating Residence

- Sound Level (dB(A))**
- 40
 - 45
 - 50
 - 55

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0 0.5 1 2 Miles

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Appendix L: windPRO Sound Analysis with Alternative Ground Attenuation – V117-3.3 84 m HH

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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DECIBEL - Main Result

Calculation: A034 V117-3.3 84 m HH Alternative Grnd Atten. Generic Octave

Noise calculation model:

ISO 9613-2 General

Wind speed:

95% rated power

Ground attenuation:

Alternative

Meteorological coefficient, C0:

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:

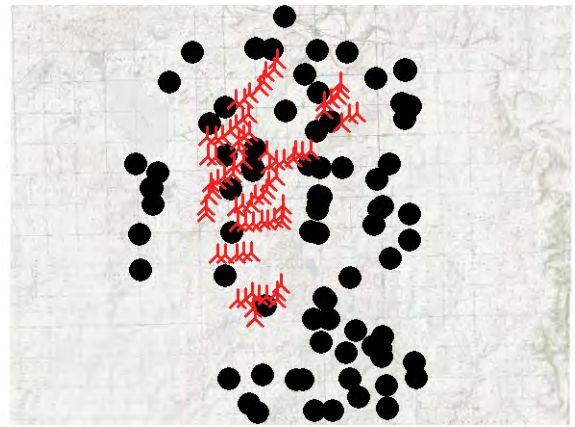
Pure and Impulse tone penalty are added to WTG source noise

Height above ground level, when no value in NSA object:

1.5 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)



New WTG

Noise sensitive area

WTGs

Table with columns: UTM NAD83 Zone: 13 (East, North, Z), Row data/Description, WTG type (Valid, Manufact., Type-generator, Power, Rotor diameter, Hub height), Noise data (Creator, Name), Wind speed, Status, Lwa,ref, Pure tones. Rows 1-114.

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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DECIBEL - Main Result

Calculation: A034 V117-3.3 84 m HH Alternative Grnd Atten. Generic Octave

...continued from previous page

	UTM NAD83 Zone: 13			Row data/Description	WG Type	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data		Wind speed [m/s]	Status	LwA.ref [dB(A)]	Pure tones
	East	North	Z									Creator	Name				
150	650,663	5,383,159	707.7	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
151	650,947	5,375,049	753.4	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
152	650,911	5,374,694	758.8	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
154	650,163	5,374,664	746.8	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
155	649,378	5,374,555	741.3	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
158	650,614	5,377,029	737.6	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
160	647,380	5,378,047	737.6	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
161	647,780	5,379,172	731.5	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
166	647,487	5,372,910	715.6	Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
170	647,835	5,377,018	752.9	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
171	647,495	5,376,819	749.1	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
175	653,143	5,380,511	713.2	Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
176	653,130	5,380,927	710.2	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
177	653,497	5,381,062	704.1	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
178	653,850	5,381,276	700.7	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
182	647,004	5,378,073	731.5	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
184	650,599	5,377,842	746.4	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
185	647,385	5,379,098	722.4	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
186	646,960	5,379,073	712.5	Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
153b	650,500	5,374,756	749.1	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
156b	649,818	5,374,694	743.7	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
164b	649,297	5,372,977	725.4	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
165b	647,909	5,372,903	716.3	Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
172b	647,131	5,376,655	743.7	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
173b	647,258	5,376,278	743.2	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
174c	647,056	5,376,002	741.8	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
179b	654,022	5,381,604	696.2	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
180b	654,011	5,381,966	694.9	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
181b	648,451	5,375,405	728.5	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
183b	649,728	5,381,758	721.2	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
205b	648,594	5,370,523	731.5	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
206b	650,092	5,370,737	743.7	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
41b	649,714	5,370,690	746.8	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
66b	649,269	5,375,574	732.7	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
6b	646,888	5,375,080	743.7	Alternate	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
70b	650,956	5,375,465	751.0	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	
96b	648,884	5,372,995	722.4	Primary	No	VESTAS	V117-3.3-3,300	3,300	117.0	84.0	USER	Noise Mode 0 - No Trailing Edge	(95%)	User value	108.5	0 dB h	

h) Generic octave distribution used

Calculation Results

Sound Level

Noise sensitive area	UTM NAD83 Zone: 13			Demand	Sound Level	Demands fulfilled ?		
	No.	Name	East				North	Z
72422	House	654,346	5,383,551	675.6	1.5	50.0 33.9	1,319	Yes
72426	House	655,873	5,382,222	689.2	1.5	50.0 34.0	1,554	Yes
72428	House	657,399	5,380,070	700.2	1.5	50.0 29.8	2,244	Yes
72431	Field Office	657,434	5,382,649	698.9	1.5	50.0 28.1	3,140	Yes
72432	Field Office	657,452	5,382,650	698.4	1.5	50.0 28.0	3,154	Yes
72433	Field Office	657,452	5,382,638	698.7	1.5	50.0 28.0	3,146	Yes
72434	Field Office	657,431	5,382,638	699.3	1.5	50.0 28.1	3,130	Yes
72435	Field Office	657,425	5,382,612	699.7	1.5	50.0 28.2	3,109	Yes
72436	Field Office	657,443	5,382,612	699.6	1.5	50.0 28.1	3,122	Yes
72437	House	657,270	5,380,900	701.0	1.5	50.0 30.3	2,160	Yes
72444	House	652,124	5,382,382	698.0	1.5	50.0 37.8	1,312	Yes
72448	House	652,833	5,381,417	705.0	1.5	50.0 44.8	246	Yes
72833	House	652,780	5,383,651	684.1	1.5	50.0 33.7	1,779	Yes
72843	House	651,086	5,385,430	681.0	1.5	50.0 30.4	2,013	Yes
72852	House	646,183	5,383,581	712.5	1.5	50.0 29.9	3,108	Yes
72885	House	644,980	5,381,994	704.1	1.5	50.0 30.2	3,218	Yes

To be continued on next page...

Project:
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 US-GRAND FORKS, ND 58201
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DECIBEL - Main Result

Calculation: A034 V117-3.3 84 m HH Alternative Grnd Atten. Generic Octave

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Noise sensitive area

No.	Name	UTM NAD83 Zone: 13			Emission height	Demands Noise	Sound Level From WTGs	Distance to noise demand	Demands fulfilled ? Noise
		East	North	Z					
					[m]	[dB(A)]	[dB(A)]	[m]	
72910	Garage	649,528	5,383,760	704.7	1.5	50.0	37.6	974	Yes
72920	House	650,400	5,383,729	711.5	1.5	50.0	41.9	328	Yes
72954	House	651,119	5,380,491	705.0	1.5	50.0	39.0	1,547	Yes
73008	House	647,905	5,380,657	723.4	1.5	50.0	43.7	374	Yes
73047	House	647,113	5,379,805	712.6	1.5	50.0	44.1	390	Yes
73069	House	644,362	5,377,232	698.7	1.5	50.0	33.1	2,461	Yes
73085	House	644,011	5,376,402	703.5	1.5	50.0	32.0	2,728	Yes
73086	House	644,029	5,376,379	703.9	1.5	50.0	32.1	2,704	Yes
73104	House	644,116	5,375,556	701.0	1.5	50.0	32.1	2,466	Yes
73112	House	643,400	5,373,971	710.6	1.5	50.0	29.2	3,349	Yes
73164	House	647,974	5,378,125	736.6	1.5	50.0	47.5	257	Yes
73183	House	649,476	5,378,474	747.0	1.5	50.0	46.2	327	Yes
73208	House	652,746	5,379,403	722.4	1.5	50.0	41.0	742	Yes
73215	House	653,476	5,379,925	741.5	1.5	50.0	45.2	268	Yes
73241	House	657,701	5,380,739	704.1	1.5	50.0	28.9	2,555	Yes
73242	House	657,625	5,380,605	701.2	1.5	50.0	29.1	2,465	Yes
73272	House	656,603	5,377,699	728.9	1.5	50.0	29.5	2,862	Yes
73307	House	652,350	5,377,616	735.4	1.5	50.0	43.6	417	Yes
73352	House	649,372	5,377,319	734.6	1.5	50.0	45.5	404	Yes
73353	Garage	649,411	5,377,350	734.6	1.5	50.0	45.5	410	Yes
73437	House	648,222	5,376,376	731.5	1.5	50.0	46.1	380	Yes
73465	House	652,934	5,377,454	728.5	1.5	50.0	39.5	766	Yes
73467	House	654,105	5,377,449	726.3	1.5	50.0	34.9	1,622	Yes
73474	House	655,962	5,376,837	710.2	1.5	50.0	29.7	3,261	Yes
73672	House	657,653	5,375,042	704.1	1.5	50.0	25.3	5,685	Yes
73689	House	656,242	5,375,429	710.2	1.5	50.0	27.9	4,529	Yes
73701	House	656,021	5,375,274	710.2	1.5	50.0	28.2	4,456	Yes
73722	House	653,014	5,375,966	734.6	1.5	50.0	35.9	1,794	Yes
73729	House	652,820	5,375,995	733.4	1.5	50.0	36.6	1,614	Yes
73792	House	648,263	5,374,042	728.5	1.5	50.0	45.0	280	Yes
73840	House	652,848	5,375,611	736.1	1.5	50.0	36.2	1,568	Yes
73848	Probably Occupied	652,773	5,375,266	744.9	1.5	50.0	36.3	1,477	Yes
73867	House	657,646	5,373,676	710.9	1.5	50.0	24.5	6,468	Yes
73868	House	657,685	5,373,674	711.1	1.5	50.0	24.5	6,506	Yes
73905	House	652,445	5,374,111	759.0	1.5	50.0	36.5	1,306	Yes
74072	Occupiable Structure, per field notes	647,929	5,371,803	716.8	1.5	50.0	40.6	771	Yes
74096	House	643,453	5,372,099	716.3	1.5	50.0	27.8	3,815	Yes
74133	House	650,034	5,370,204	742.6	1.5	50.0	47.8	151	Yes
74191	House	654,514	5,371,692	765.0	1.5	50.0	28.9	3,343	Yes
74225	House	656,662	5,372,675	722.4	1.5	50.0	25.4	5,630	Yes
74929	House	652,597	5,369,477	749.8	1.5	50.0	32.3	1,888	Yes
74944	House	652,987	5,368,263	755.9	1.5	50.0	28.6	2,938	Yes
74946	House	653,421	5,369,486	746.6	1.5	50.0	29.7	2,631	Yes
74955	House	653,163	5,370,620	746.2	1.5	50.0	31.9	2,080	Yes
74958	House	653,237	5,370,521	746.8	1.5	50.0	31.6	2,180	Yes
74997	House	656,161	5,367,989	720.8	1.5	50.0	22.7	5,742	Yes
75017	House	655,758	5,368,066	719.3	1.5	50.0	23.3	5,345	Yes
75019	House	656,215	5,367,523	716.3	1.5	50.0	22.2	6,000	Yes
75023	House	657,919	5,367,212	720.4	1.5	50.0	19.9	7,664	Yes
75024	House	657,910	5,367,229	720.5	1.5	50.0	19.9	7,648	Yes
75035	House	658,012	5,366,393	701.6	1.5	50.0	19.1	8,120	Yes
75048	House	656,450	5,365,968	719.4	1.5	50.0	20.3	7,059	Yes
75051	House	656,481	5,364,835	702.0	1.5	50.0	19.1	7,833	Yes
75052	House	656,500	5,364,785	701.1	1.5	50.0	19.1	7,881	Yes

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
Kevin Walter
Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

Description:

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DECIBEL - Main Result

Calculation: A034 V117-3.3 84 m HH Alternative Grnd Atten. Generic Octave

...continued from previous page

Table with columns for WTG and various frequency bands (NSA, 182, 183b, 184, 175, 176, 177, 178, 179b, 180b, 185, 186, 205b, 206b, 174c) containing numerical data points.

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

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 Kevin Walter
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 Lenexa, KS, 66219

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DECIBEL - Main Result

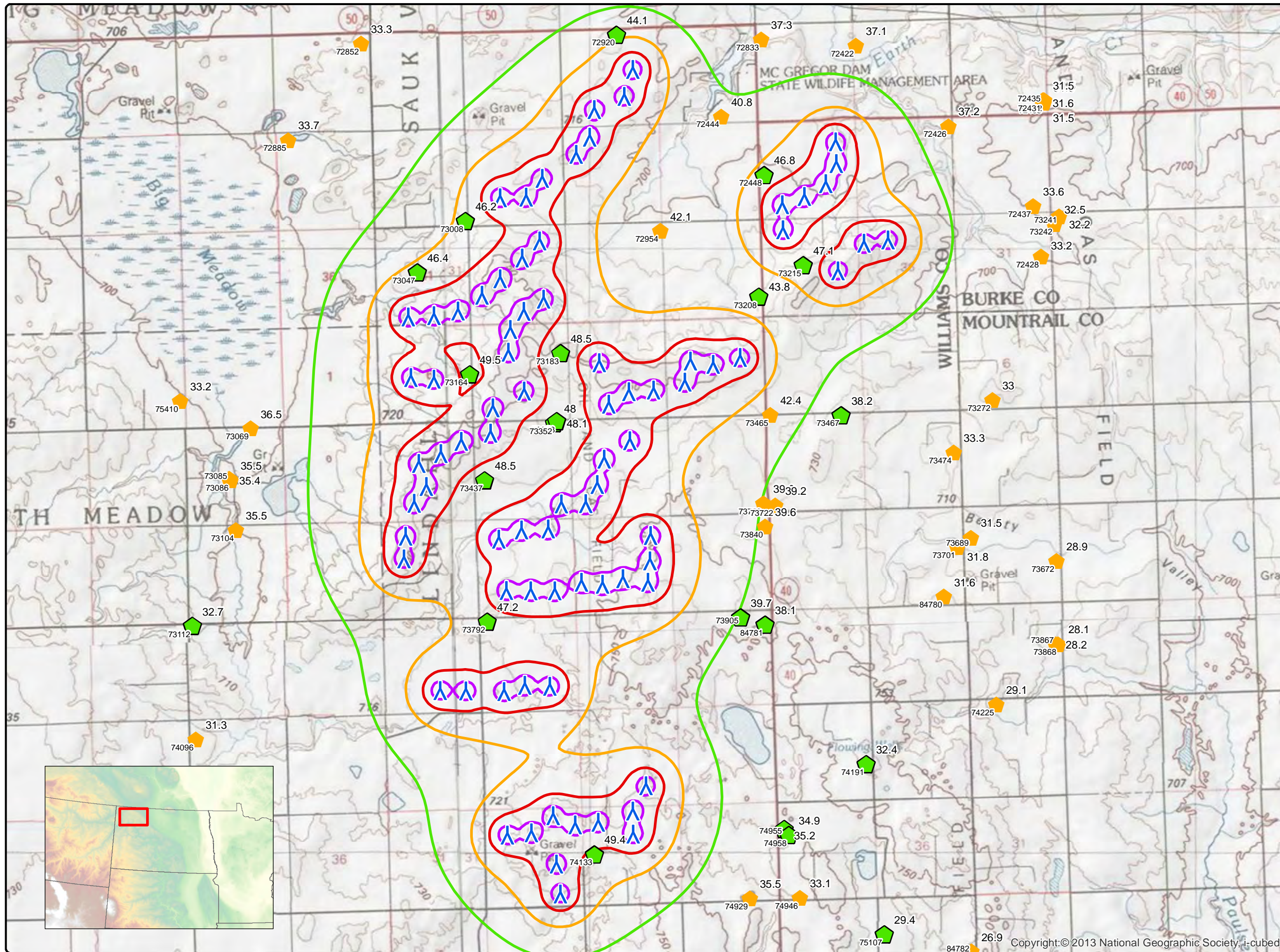
Calculation: A034 V117-3.3 84 m HH Alternative Grnd Atten. Generic Octave

...continued from previous page

WTG

NSA	182	183b	184	175	176	177	178	179b	180b	185	186	205b	206b	174c
77282	2399	4205	1278	4800	5056	5422	5830	6173	6407	2489	2823	7088	6873	2779
84780	9511	9497	6206	6612	7000	6996	7093	7366	7720	9611	9973	8210	6813	8880
84781	7129	8370	4459	6526	6941	7100	7353	7702	8058	7479	7778	5490	4266	6132
84782	13240	14688	10835	12312	12718	12765	12904	13196	13555	13743	14002	7895	6520	11806
84783	12657	14757	10771	12839	13254	13362	13560	13883	14245	13306	13511	6347	5167	10994

Appendix M: No Ground Attenuation Sound Map – V110-2.0 80 m HH



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Lindahl Wind Farm V110 Worst Case Sound

Client
TradeWind Energy, Inc.

Project Description
75 Primary WTG locations & 5 Alts (A034) for V110-2.0 on 80 m HH. Worst case noise map and data at receptors (dB(A)). Assumes WTGs at rated noise of 107.4 dB(A) for new WTGs ISO-9613-2 General model. No ground attenuation. No ambient noise.

Location: Tioga, ND
Project #: 20132550

Issue Dates

#	Description	Date
1	Preliminary Draft	2015.06.23

Drawn By: BS Checked By: JH

- Legend**
- V110 WTG A034
 - Non-Participating Residences
 - Participating Residence

- Sound Level (dB(A))**
- 40
 - 45
 - 50
 - 55

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Appendix N: windPRO Sound Analysis with No Ground Attenuation – V110-2.0 80 m HH

Project:
20132550- Lindahl Wind Farm
 TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

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DECIBEL - Main Result

Calculation: A034 V110-2.0 80 m HH No Grnd Atten. Generic Octave

Noise calculation model:

ISO 9613-2 General

Wind speed:

95% rated power

Ground attenuation:

None

Meteorological coefficient, C0:

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:

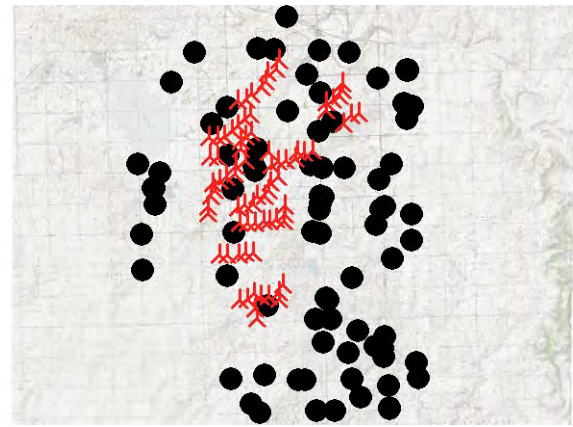
Pure and Impulse tone penalty are added to WTG source noise

Height above ground level, when no value in NSA object:

1.5 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

UTM NAD83 Zone: 13				Row data/Description	WTG type			Noise data								
East	North	Z	Valid		Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Creator	Name	Wind speed [m/s]	Status	Lwa,ref [dB(A)]	Pure tones	
5	646,913	5,375,455	745.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
12	648,319	5,377,157	750.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
13	648,353	5,377,573	752.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
14	648,872	5,377,853	752.9	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
15	648,611	5,378,490	759.0	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
16	648,641	5,378,869	759.0	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
17	648,868	5,379,168	761.9	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
18	649,189	5,379,368	749.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
19	648,477	5,379,703	762.0	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
20	648,837	5,380,044	745.1	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
21	648,176	5,379,433	749.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
22	649,124	5,380,328	729.3	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
24	651,007	5,377,868	749.0	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
25	650,109	5,378,321	754.1	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
26	651,525	5,378,000	751.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
27	651,616	5,378,348	758.6	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
28	651,987	5,378,290	755.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
29	652,436	5,378,405	749.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
34	654,047	5,379,834	743.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
35	654,478	5,380,290	740.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
36	654,876	5,380,346	731.4	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
37	649,468	5,369,552	735.9	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
38	649,403	5,370,046	745.2	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
39	648,989	5,370,563	740.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
40	649,348	5,370,846	749.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
42	650,668	5,370,540	746.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
43	650,667	5,370,918	744.1	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
45	650,882	5,371,340	743.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
67	649,484	5,375,990	732.9	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
68	649,889	5,375,994	741.6	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
69	650,079	5,376,307	740.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
83	648,826	5,375,558	729.9	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
84	648,982	5,374,557	737.6	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
85	648,580	5,374,558	735.1	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
97	648,537	5,372,891	719.3	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
98	648,903	5,381,054	722.4	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
99	649,170	5,381,363	721.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
100	649,950	5,382,038	713.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
101	650,030	5,382,496	712.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

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 Southlake Technology Park, 16105 W 113th St, Ste 1
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 US-GRAND FORKS, ND 58201
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DECIBEL - Main Result

Calculation: A034 V110-2.0 80 m HH No Grnd Atten. Generic Octave

...continued from previous page

Row	UTM NAD83 Zone: 13			Row data/Description	WTG type		Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data					Pure tones	
	East	North	Z		Valid	Manufact.				Type-generator	Creator	Name	Wind speed [m/s]	Status		LwA,ref [dB(A)]
102	650,525	5,382,713	713.2	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
104	650,189	5,376,726	739.2	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
105	650,267	5,377,632	746.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
114	648,476	5,381,043	724.2	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
150	650,663	5,383,159	707.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
151	650,947	5,375,049	753.4	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
152	650,911	5,374,694	758.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
154	650,163	5,374,664	746.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
155	649,378	5,374,555	741.3	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
158	650,614	5,377,029	737.6	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
160	647,380	5,378,047	737.6	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
161	647,780	5,379,172	731.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
166	647,487	5,372,910	715.6	Alternate	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
170	647,835	5,377,018	752.9	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
171	647,495	5,376,819	749.1	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
175	653,143	5,380,511	713.2	Alternate	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
176	653,130	5,380,927	710.2	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
177	653,497	5,381,062	704.1	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
178	653,850	5,381,276	700.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
182	647,004	5,378,073	731.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
184	650,599	5,377,842	746.4	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
185	647,385	5,379,098	722.4	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
186	646,960	5,379,073	712.5	Alternate	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
153b	650,500	5,374,756	749.1	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
156b	649,818	5,374,694	743.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
164b	649,297	5,372,977	725.4	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
165b	647,909	5,372,903	716.3	Alternate	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
172b	647,131	5,376,655	743.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
173b	647,258	5,376,278	743.2	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
174c	647,056	5,376,002	741.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
179b	654,022	5,381,604	696.2	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
180b	654,011	5,381,966	694.9	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
181b	648,451	5,375,405	728.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
183b	649,728	5,381,758	721.2	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
205b	648,594	5,370,523	731.5	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
206b	650,092	5,370,737	743.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
41b	649,714	5,370,690	746.8	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
66b	649,269	5,375,574	732.7	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
6b	646,888	5,375,080	743.7	Alternate	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
70b	650,956	5,375,465	751.0	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h
96b	648,884	5,372,995	722.4	Primary	Yes	VESTAS	V110-2,000	2,000	110.0	80.0	USER	95% Rated	(95%)	User value	107.5	0 dB h

h) Generic octave distribution used

Calculation Results

Sound Level

Noise sensitive area

No.	Name	UTM NAD83 Zone: 13			Demands			Sound Level	Distance to noise demand [m]	Demands fulfilled ?
		East	North	Z	Imission height	Noise [dB(A)]	From WTGs [dB(A)]	Noise		
72422	House	654,346	5,383,551	675.6	1.5	50.0	37.1	1,330	Yes	
72426	House	655,873	5,382,222	689.2	1.5	50.0	37.2	1,552	Yes	
72428	House	657,399	5,380,070	700.2	1.5	50.0	33.2	2,254	Yes	
72431	Field Office	657,434	5,382,649	698.9	1.5	50.0	31.5	3,153	Yes	
72432	Field Office	657,452	5,382,650	698.4	1.5	50.0	31.5	3,167	Yes	
72433	Field Office	657,452	5,382,638	698.7	1.5	50.0	31.5	3,159	Yes	
72434	Field Office	657,431	5,382,638	699.3	1.5	50.0	31.5	3,144	Yes	
72435	Field Office	657,425	5,382,612	699.7	1.5	50.0	31.6	3,122	Yes	
72436	Field Office	657,443	5,382,612	699.6	1.5	50.0	31.5	3,136	Yes	

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.
 Kevin Walter
 Southlake Technology Park, 16105 W 113th St, Ste 1
 Lenexa, KS, 66219

Description:

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DECIBEL - Main Result

Calculation: A034 V110-2.0 80 m HH No Grnd Atten. Generic Octave

...continued from previous page

Noise sensitive area

No.	Name	UTM NAD83 Zone: 13			Emission height	Demands Noise	Sound Level From WTGs	Distance to noise demand	Demands fulfilled ? Noise
		East	North	Z					
		[m]			[m]	[dB(A)]	[dB(A)]	[m]	
72437	House	657,270	5,380,900	701.0	1.5	50.0	33.6	2,172	Yes
72444	House	652,124	5,382,382	698.0	1.5	50.0	40.8	1,311	Yes
72448	House	652,833	5,381,417	705.0	1.5	50.0	46.8	230	Yes
72833	House	652,780	5,383,651	684.1	1.5	50.0	37.3	1,787	Yes
72843	House	651,086	5,385,430	681.0	1.5	50.0	33.8	2,030	Yes
72852	House	646,183	5,383,581	712.5	1.5	50.0	33.3	3,108	Yes
72885	House	644,980	5,381,994	704.1	1.5	50.0	33.7	3,215	Yes
72910	Garage	649,528	5,383,760	704.7	1.5	50.0	40.5	981	Yes
72920	House	650,400	5,383,729	711.5	1.5	50.0	44.1	343	Yes
72954	House	651,119	5,380,491	705.0	1.5	50.0	42.1	1,525	Yes
73008	House	647,905	5,380,657	723.4	1.5	50.0	46.2	365	Yes
73047	House	647,113	5,379,805	712.6	1.5	50.0	46.4	344	Yes
73069	House	644,362	5,377,232	698.7	1.5	50.0	36.5	2,458	Yes
73085	House	644,011	5,376,402	703.5	1.5	50.0	35.4	2,690	Yes
73086	House	644,029	5,376,379	703.9	1.5	50.0	35.5	2,669	Yes
73104	House	644,116	5,375,556	701.0	1.5	50.0	35.5	2,445	Yes
73112	House	643,400	5,373,971	710.6	1.5	50.0	32.7	3,349	Yes
73164	House	647,974	5,378,125	736.6	1.5	50.0	49.5	174	Yes
73183	House	649,476	5,378,474	747.0	1.5	50.0	48.5	298	Yes
73208	House	652,746	5,379,403	722.4	1.5	50.0	43.8	747	Yes
73215	House	653,476	5,379,925	741.5	1.5	50.0	47.1	274	Yes
73241	House	657,701	5,380,739	704.1	1.5	50.0	32.2	2,567	Yes
73242	House	657,625	5,380,605	701.2	1.5	50.0	32.5	2,477	Yes
73272	House	656,603	5,377,699	728.9	1.5	50.0	33.0	2,865	Yes
73307	House	652,350	5,377,616	735.4	1.5	50.0	45.9	377	Yes
73352	House	649,372	5,377,319	734.6	1.5	50.0	48.0	358	Yes
73353	Garage	649,411	5,377,350	734.6	1.5	50.0	48.1	365	Yes
73437	House	648,222	5,376,376	731.5	1.5	50.0	48.5	263	Yes
73465	House	652,934	5,377,454	728.5	1.5	50.0	42.4	763	Yes
73467	House	654,105	5,377,449	726.3	1.5	50.0	38.2	1,629	Yes
73474	House	655,962	5,376,837	710.2	1.5	50.0	33.3	3,269	Yes
73672	House	657,653	5,375,042	704.1	1.5	50.0	28.9	5,688	Yes
73689	House	656,242	5,375,429	710.2	1.5	50.0	31.5	4,535	Yes
73701	House	656,021	5,375,274	710.2	1.5	50.0	31.8	4,462	Yes
73722	House	653,014	5,375,966	734.6	1.5	50.0	39.2	1,778	Yes
73729	House	652,820	5,375,995	733.4	1.5	50.0	39.9	1,600	Yes
73792	House	648,263	5,374,042	728.5	1.5	50.0	47.2	262	Yes
73840	House	652,848	5,375,611	736.1	1.5	50.0	39.6	1,546	Yes
73848	Probably Occupied	652,773	5,375,266	744.9	1.5	50.0	39.6	1,442	Yes
73867	House	657,646	5,373,676	710.9	1.5	50.0	28.2	6,433	Yes
73868	House	657,685	5,373,674	711.1	1.5	50.0	28.1	6,472	Yes
73905	House	652,445	5,374,111	759.0	1.5	50.0	39.7	1,285	Yes
74072	Occupiable Structure, per field notes	647,929	5,371,803	716.8	1.5	50.0	43.4	760	Yes
74096	House	643,453	5,372,099	716.3	1.5	50.0	31.3	3,828	Yes
74133	House	650,034	5,370,204	742.6	1.5	50.0	49.4	66	Yes
74191	House	654,514	5,371,692	765.0	1.5	50.0	32.4	3,354	Yes
74225	House	656,662	5,372,675	722.4	1.5	50.0	29.1	5,640	Yes
74929	House	652,597	5,369,477	749.8	1.5	50.0	35.5	1,886	Yes
74944	House	652,987	5,368,263	755.9	1.5	50.0	32.1	2,938	Yes
74946	House	653,421	5,369,486	746.6	1.5	50.0	33.1	2,626	Yes
74955	House	653,163	5,370,620	746.2	1.5	50.0	35.2	2,082	Yes
74958	House	653,237	5,370,521	746.8	1.5	50.0	34.9	2,182	Yes
74997	House	656,161	5,367,989	720.8	1.5	50.0	26.4	5,737	Yes
75017	House	655,758	5,368,066	719.3	1.5	50.0	27.0	5,341	Yes

To be continued on next page...

Project:

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DECIBEL - Main Result

Calculation: A034 V110-2.0 80 m HH No Grnd Atten. Generic Octave

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Noise sensitive area

Table with columns: No., Name, UTM NAD83 Zone: 13 (East, North, Z), Demands (Noise), Sound Level (From, Distance to demand), Demands fulfilled? (Noise). Rows list various house and office locations with their coordinates and noise metrics.

Distances (m)

Distance matrix table showing distances between various noise sensitive areas (NSA) and wind turbine groups (WTG) 5 through 36. Columns include NSA ID and WTG IDs.

To be continued on next page...

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Table with columns for WTG (5-36) and rows for NSA (72422-84783). Contains numerical data for wind speed and decibel levels.

Table with columns for WTG (37-101) and rows for NSA (72422-72432). Contains numerical data for wind speed and decibel levels.

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Table with columns: WTG (37-100), NSA (72433-75060), and numerical values representing wind speed data for various wind turbine types.

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WTG																						
NSA	37	38	39	40	41b	42	43	45	66b	67	68	69	70b	83	84	85	96b	97	98	99	100	101
75107	5390	5537	6065	5811	5414	4468	4623	4640	8694	8887	8654	8809	7633	8971	8140	8434	7220	7451	13534	13701	14029	14433
75125	5994	6325	6965	6865	6487	5703	5987	6186	10623	10885	10707	10911	9795	10836	9911	10142	8724	8876	15748	15945	16347	16766
75164	6411	6836	7498	7514	7181	6577	6918	7218	11748	12060	11932	12173	11129	11904	10928	11105	9584	9671	17059	17286	17762	18195
75171	5829	6282	6939	7005	6699	6195	6555	6900	11416	11754	11655	11917	10926	11540	10546	10693	9138	9194	16806	17051	17575	18016
75178	4169	4605	5266	5308	4993	4483	4844	5198	9705	10048	9956	10224	9255	9826	8831	8979	7427	7489	15110	15361	15903	16347
75181	3947	4399	5056	5126	4828	4382	4751	5127	9605	9959	9882	10159	9219	9709	8708	8841	7274	7320	15037	15295	15858	16306
75198	3008	3506	4088	4306	4122	4049	4420	4876	9023	9427	9423	9739	8961	9047	8035	8090	6499	6459	14515	14809	15468	15926
75240	3466	3903	4291	4651	4615	4898	5223	5697	9284	9725	9794	10137	9537	9223	8240	8209	6677	6542	14713	15038	15783	16247
75250	4516	5005	5519	5802	5671	5697	6062	6526	10528	10948	10972	11298	10573	10516	9512	9529	7953	7869	16009	16316	17010	17471
75262	4989	5485	6032	6287	6125	6063	6436	6888	11014	11425	11431	11750	10979	11022	10013	10048	8463	8397	16505	16804	17475	17935
75410	10269	9841	9179	9197	9559	10337	10078	9965	6427	6510	6901	7018	8069	6016	6575	6224	7370	7175	6626	7014	8034	8357
77282	8019	7524	7017	6724	6890	7153	6781	6416	1998	1586	1666	1458	2648	2079	3035	3109	4599	4749	3513	3797	4508	4973
84780	8009	7770	7845	7393	7157	6456	6234	5822	6626	6500	6108	6013	4948	7061	6819	7221	7069	7430	9545	9574	9577	9896
84781	5581	5239	5163	4707	4553	4083	3770	3302	3914	3914	3574	3610	2399	4317	3908	4306	4089	4450	8090	8238	8553	8959
84782	6850	7000	7523	7260	6864	5911	6047	6029	9870	10022	9756	9876	8672	10177	9400	9714	8580	8828	14462	14598	14844	15227
84783	5157	5411	6014	5846	5453	4588	4830	4969	9319	9562	9368	9561	8429	9552	8653	8906	7551	7733	14378	14569	14958	15374

WTG																						
NSA	102	105	104	114	150	151	152	153b	154	155	156b	158	160	161	164b	165b	166	170	171	172b	173b	181b
72422	3912	7189	7992	6384	3704	9157	9500	9599	9823	10277	9948	7515	8878	7893	11718	12443	12660	9224	9605	9981	10156	10056
72426	5371	7246	7907	7491	5294	8702	9017	9199	9473	10049	9661	7391	9464	8649	11346	12259	12532	9576	9969	10364	10467	10078
72428	7365	7537	7948	8976	7411	8176	8426	8709	9033	9734	9294	7436	10222	9661	10768	11893	12228	10039	10424	10821	10827	10091
72431	6909	8749	9358	9101	6790	9992	10288	10507	10800	11420	11013	8838	11058	10261	12640	13628	13921	11129	11523	11920	12006	11540
72432	6927	8764	9373	9119	6808	10005	10300	10519	10813	11434	11026	8852	11074	10279	12652	13641	13935	11445	11539	11936	12022	11555
72433	6928	8757	9365	9117	6809	9996	10291	10510	10804	11425	11018	8844	11069	10275	12643	13633	13926	11139	11533	11930	12016	11547
72434	6907	8740	9349	9096	6788	9982	10277	10496	10790	11410	11003	8828	11050	10255	12630	13618	13911	11121	11515	11912	11998	11531
72435	6901	8720	9328	9086	6784	9958	10253	10473	10766	11388	10980	8807	11034	10240	12606	13595	13889	11103	11497	11894	11979	11510
72436	6919	8735	9342	9104	6802	9970	10265	10485	10779	11400	10993	8821	11050	10257	12617	13608	13902	11118	11512	11909	11994	11524
72437	6985	7728	8220	8795	6983	8615	8886	9143	9455	10127	9698	7700	10294	9646	11241	12312	12632	10203	10593	10992	11028	10391
72444	1633	5100	5978	3886	1655	7427	7783	7797	7963	8295	8027	5562	6427	5402	9821	10374	10546	6868	7237	7598	7806	7885
72448	2647	4573	5385	4773	2783	6642	6993	7058	7262	7683	7368	4917	6411	5529	9151	9836	10488	6658	7045	7429	7582	7440
72833	2442	6523	7394	5033	2173	8795	9150	9183	9361	9712	9434	6967	7783	6713	11228	11801	11975	8274	8638	8992	9212	9314
72843	2774	7841	8750	5105	2310	10382	10738	10690	10806	11009	10811	8415	8261	7078	12581	12924	13027	9019	9330	9625	9921	10366
72852	4428	7216	7940	3421	4500	9772	10067	9825	9765	9575	9602	7910	5662	4689	11052	10817	10751	6768	6888	6991	7382	8485
72885	5592	6854	7409	3623	5801	9157	9406	9103	8978	8642	8758	7510	4620	3976	9997	9551	9424	5737	5754	5756	6153	7448
72910	1446	6173	7065	2914	1284	8826	9171	9057	9118	9207	9071	6818	6104	4910	10786	10977	11041	6952	7233	7499	7819	8424
72920	1024	6099	7006	3304	628	8697	9050	8974	9068	9231	9054	6704	6435	5257	10809	11109	11205	7185	7496	7993	8087	8549
72954	2300	2983	3878	2700	2707	5445	5801	5768	5905	6186	5941	3499	4467	3590	7732	8239	8406	4780	5159	5534	5715	5743
73008	3330	3838	4547	689	3724	6380	6678	6447	6404	6277	6263	4528	2662	1490	7805	7754	7759	3640	3860	4076	4427	5280
73047	4483	3830	4352	1841	4884	6109	6368	6080	5978	5718	5783	4468	1778	920	7169	6948	6905	2879	3010	3150	3530	4599
73069	8248	5919	5849	5608	8651	6938	7024	6619	6344	5686	6018	6255	3126	3930	6516	5597	5334	3480	3160	2829	3049	4479
73085	9070	6376	6187	6440	9482	7067	7108	6695	6393	5676	6053	6633	3749	4678	6299	5238	4927	3873	3509	3130	3249	4551
73086	9073	6363	6170	6444	9486	7045	7085	6672	6369	5652	6029	6617	3743	4677	6271	5209	4898	3859	3494	3114	3231	4528
73104	9607	6492	6185	7009	10034	6850	6850	6434	6113	5357	5767	6663	4106	5148	5788	4629	4286	3996	3607	3209	3224	4338
73112	11278	7782	7327	8705	11712	7624	7546	7143	6799	6007	6459	7836	5697	6800	5980	4634	4223	5381	4988	4596	4495	5251
73164	5250	2345	2620	2961	5707	4278	4517	4211	4095	3836	3895	2859	599	1065	5315	5223	5238	1116	1391	1695	1981	2762
73183	4367	1155	1888	2757	4833	3728	4043	3857	3872	3920	3796	1839	2139	1834	5500	5787	5909	2194	2581	2968	3121	3236
73208	3986	3047	3702	4574	4295	4711	5054	5161	5397	5903	5545	3191	5535	4972	7293	8103	8356	5460	5853	6252	6316	5868
73215	4060	3944	4587	5124	4286	5493	5826	5965	6217	6755	6383	4072	6379	5746	8108	8961	9224	6346	6740	7138	7209	6759
73241	7443	8057	8517	9230	7443	8832	9091	9362	9682	10369	9934	8000	10667	10044	11440	12542	12870	10545	10933	11332	11356	10678
73242	7407	7936	8387	9160	7416	8687	8946	9219	9538	10228	9793	7871	10560	9949	11294	12399	12728	10427	10815	11213	11234	10546
73272	7879	6337	6488	8788	8068	6246	6437	6776	7120	7880	7421	6027	9230	8945	8699	9929	10298	8795	9151	9530	9453	8469
73307	5414	2083	2337	5172	5794	2925	3257	3406	3674	4267	3867	1833	4989	4828	5554	6476	6767	4555	4920	5307	5265	4482
73352	5516	948	1010	3830	5981	2763	3043	2800	2770	2764	2663	1275	2121	2443	4343	4652						

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Lenexa, KS, 66219

Description:

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+1 701 775 3000
Brandon Storm / bstorm@eapc.net
Calculated:
6/16/2015 1:10 PM/2.9.285

DECIBEL - Main Result

Calculation: A034 V110-2.0 80 m HH No Grnd Atten. Generic Octave

...continued from previous page

WTG

Table with 20 columns (NSA 102 to 181b) and 50 rows of numerical data representing wind speed measurements for various wind turbines.

WTG

Table with 13 columns (NSA 182 to 174c) and 20 rows of numerical data representing wind speed measurements for various wind turbines.

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.

Kevin Walter

Southlake Technology Park, 16105 W 113th St, Ste 1

Lenexa, KS, 66219

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DECIBEL - Main Result

Calculation: A034 V110-2.0 80 m HH No Grnd Atten. Generic Octave

...continued from previous page

Table with columns for wind speed (NSA, 182, 183b, 184, 175, 176, 177, 178, 179b, 180b, 185, 186, 205b, 206b, 174c) and corresponding decibel values for each combination.

To be continued on next page...

Project:

20132550- Lindahl Wind Farm

TradeWind Energy, Inc.

Kevin Walter

Southlake Technology Park, 16105 W 113th St, Ste 1
Lenexa, KS, 66219

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DECIBEL - Main Result**Calculation:** A034 V110-2.0 80 m HH No Grnd Atten. Generic Octave

...continued from previous page

WTG

NSA	182	183b	184	175	176	177	178	179b	180b	185	186	205b	206b	174c
75178	12831	15657	11658	14280	14694	14860	15111	15458	15815	13644	13772	5473	4871	10933
75181	12687	15606	11618	14315	14728	14903	15162	15512	15868	13520	13637	5243	4733	10765
75198	11853	15188	11295	14320	14723	14939	15235	15597	15943	12771	12836	4152	4172	9841
75240	11763	15480	11746	15017	15405	15655	15980	16348	16682	12756	12762	4188	4802	9697
75250	13203	16721	12876	15970	16370	16593	16895	17258	17602	14163	14197	5505	5767	11155
75262	13761	17193	13311	16327	16731	16943	17234	17594	17943	14705	14752	6047	6188	11723
75410	3826	7697	7403	10339	10448	10839	11242	11512	11630	4419	4010	8967	9787	4209
77282	2399	4205	1278	4800	5056	5422	5830	6173	6407	2489	2823	7088	6873	2779
84780	9511	9497	6206	6612	7000	6996	7093	7366	7720	9611	9973	8210	6813	8880
84781	7129	8370	4459	6526	6941	7100	7353	7702	8058	7479	7778	5490	4266	6132
84782	13240	14688	10835	12312	12718	12765	12904	13196	13555	13743	14002	7895	6520	11806
84783	12657	14757	10771	12839	13254	13362	13560	13883	14245	13306	13511	6347	5167	10994