11. Shadow Flicker Assessment

Wimmera Plains Energy Facility

Shadow Flicker Assessment

Prepared by:

BayWa r.e. Projects Australia Pty Ltd

July 2020

Revision History

Rev.	Reason for Revision	Date	Prepared	Reviewed	Approved
#1	Planning Permit Application	29/06/20	TB	FC	KJ
#2	Removal of WTGs 45 and 46	21/07/20	TB	FC	KJ

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1 Executive Summary

The Policy and Planning Guidelines - Development of Wind Energy Facilities, DELWP, March 2019 (Victoria Guidelines) specify that "*Shadow flicker results from the position of the sun in relation to the blades of the wind turbine as they rotate.*"

The document also notes that *"Shadow flicker can be modelled in advance and siting and design can mitigate the problem. This is more likely to be an issue for turbines located to the east or west of a dwelling."*

In terms of acceptable threshold it is stipulated that *"Shadow flicker from the wind energy facility must not exceed 30 hours per annum at any pre-existing dwelling, unless an agreement has been entered into with the relevant landowner waiving this requirement"*

An assessment based on worst case conditions of the shadow flicker caused by the 52 wind turbines of the Wimmera Plains Energy Facility has been undertaken following the recommendations and methodology of the National Wind Farm Development Guidelines – Draft, EPHC, July 2010 (National Guidelines). A total of 34 dwellings (receptors) were identified within 3 km of the wind turbines, comprising 12 participant landowners and 22 non-participant landowners. All non-participant landowners are below the 30 hours of shadow flicker per year limit and therefore no additional investigation is deemed necessary. 1 participant landowner will receive greater than 30 hours of shadow flicker per year and this landowner has entered into an agreement waiving the requirement. For this reason, the project is considered to be compliant with the Guidelines and Planning Provisions.

2. Introduction

The present report performs an assessment of the potential shadow flicker as a result of the operation of the Wimmera Plains Energy Facility and has been prepared by BayWa r.e. Projects Australia Pty Ltd in accordance with:

- The Policy and Planning Guidelines - Development of Wind Energy Facilities, DELWP, March 2019 (Victorian Guidelines); and
- The National Wind Farm Development Guidelines – Draft, EPHC, July 2010 (National Guidelines).

According to the Victorian Guidelines:

> *Shadow flicker results from the position of the sun in relation to the blades of the wind turbine as they rotate. This occurs under certain combinations of geographical position and time of day. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the site.*

The Victorian Guidelines also state that:

> *The shadow flicker experienced immediately surrounding the area of a dwelling (garden fenced area) must not exceed 30 hours per year as a result of the operation of the wind energy facility.*

Shadow flicker is defined on the National Guidelines as follows:

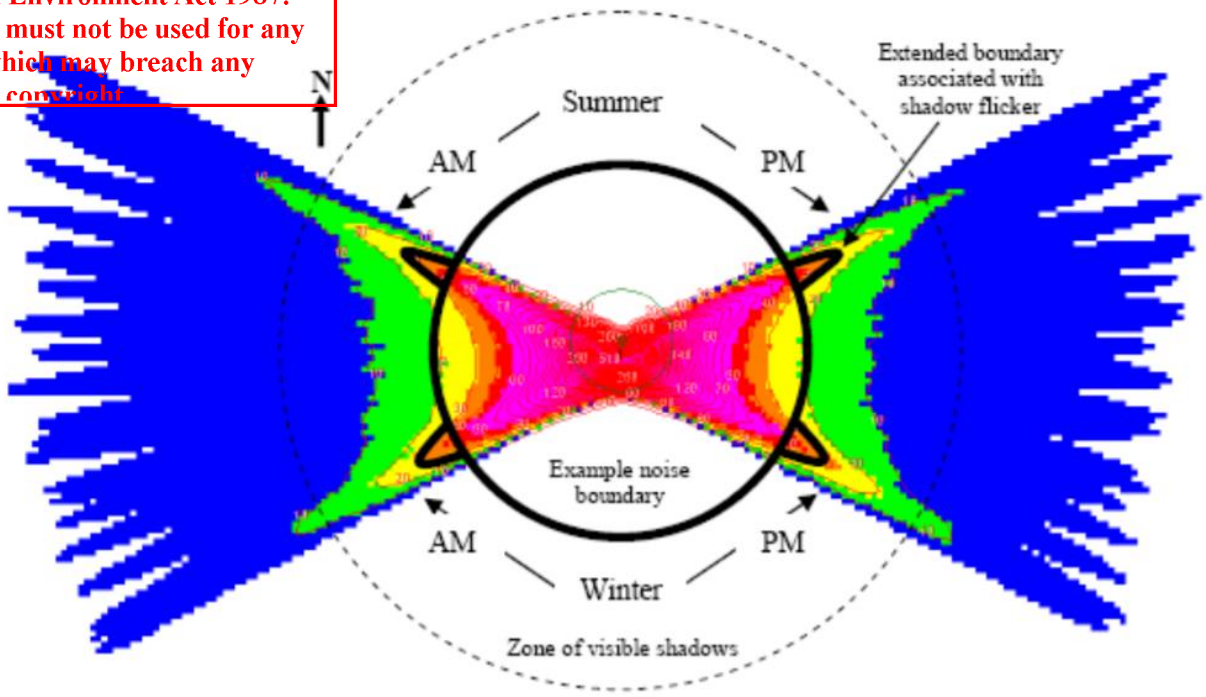
> *Shadow flicker is produced by wind turbine blades blocking the sun for short periods of time (less than 1 second) as the blades rotate, causing a strobing effect. The likelihood of shadow flicker affecting people is dependant on the alignment of the wind turbine and the sun, and their distance from the wind turbine.*

The National Guidelines also explain why shadow flicker is an issue:

> *The main risk associated with shadow flicker is the potential to disturb residents in the immediate vicinity. Investigations undertaken when developing these Guidelines determined that the potential risk for epileptic seizures and distraction of drivers is negligible to people living, visiting or driving near a wind farm.*

Shadow flicker is typically represented by a coloured graph as the one presented on Figure 1 below as an example.

Figure 1.Typical Representation of Shadow Flicker from a Single Turbine



The following features are exhibited on the figure:

- The different colour bands represent different annual exposure to shadow flicker (blue 0-10 hr/yr, green 10-20 hr/yr etc);
- The areas (directions) affected at different times of day and year;
- The zone within which shadows are likely to be visible is shown. Intensity decreases with distance and only shadows occurring within a certain distance of a turbine are likely to be visible

3. The Project

The proposed Wimmera Plains Energy Facility consists of 52 wind turbines located approximately between 12 and 22 km northeast of Horsham.

The selected wind turbine model for this project is the Vestas V162 with a hub height of 166 m agl.

4. Methodology

The assessment has been undertaken as per the methodology recommended on the National Guidelines detailed below:

- Determine the extent of shadows from turbines being a distance of 265 x maximum blade chord (no assessment is required for residences beyond this distance). Section E.7.2 of the National Guidelines provides the basis for this limit.
- Identify all residences within the extent of shadows from proposed turbine positions.

- use modelling software with relevant modelling parameters (further detail in next section) to calculate the theoretical annual shadow flicker duration at each residence, accounting for topography and cumulative effects.
- If necessary, modify turbine layout and repeat calculations, or introduce mitigation measures to achieve compliance with the specified limits in Table 1 below (the limits only apply to non-participating landowners).

Table 1. Recommended Exposure Limits

Assessment Scenario	Acceptable Level (hours/year)
Modelled (through appropriate software based on a worst case scenario)	30
Measured (includes real time meteorological data)	10

The National Guidelines recommend a stepped approach for the Shadow Flicker assessment, starting with a Modelled Assessment followed by a Measured Assessment for receptors where the Modelled Assessment predicted more than 30 h/year of shadow flicker. It is commonly accepted that where a receptor experiences a 'Modelled' level of shadow flicker less than 30 hours per year, no further investigation is required.

It is important to note that the above limits applies to any pre-existing receptor unless an agreement has been entered into with the relevant landowner waiving this requirement.

5. Shadow Flicker Assessment

The present Shadow Flicker Assessment has been carried out using the WindPro modelling software on the basis of the worst case scenario, as discussed above. All relevant parameters, assumptions and inputs adopted in this assessment are discussed below.

5.1. Modelling Parameters and Assumptions

The worst case modelling parameters suggested by the National Guidelines which were used in this assessment are presented below:

Table 2. Shadow Flicker Modelling Parameters

Model Parameter	Setting
Zone of Influence	265 x 4.32 (max blade chord) = 1145 m
Minimum Angle to the Sun	3 deg
Shape of the Sun	Disk
Elevation Resolution	1 m
Receptor Height	1.5 m

The following assumptions have been adopted:

- The rotor plane is always perpendicular to the line from the WTG to the sun;
- The sun is shining all day, from sunrise to sunset; and
- The wind turbine is always operating.

5.2. Modelling Inputs

5.2.1. Wind Turbine Generators

The proposed Wimmera Plains Energy Facility comprises 52 units of the Vestas V162 wind turbine generator. This wind turbine model's specifications relevant for this assessment are presented below. A map showing the turbines' locations can be found further below and GIS coordinates are included in the WindPro report in appendix.

Table 3. Wind Turbine Specifications

Hub Height	166 m
Rotor Diameter	162 m
Top of Rotor (Tip Height)	247 m
Bottom of Rotor	85 m
Maximum Blade Chord	4.32 m

3.2.2. Receptors

A total of 34 dwellings have been identified and mapped within 3km of the Wimmera Plains Energy Facility, being 12 stakeholder properties and 22 non-stakeholder properties.

The figure below shows receptors' and turbines' locations. GIS coordinates are included in the WindPro report in appendix.

Figure 2. Receptors' and Turbines' Locations

Wimmera Plains Energy Facility

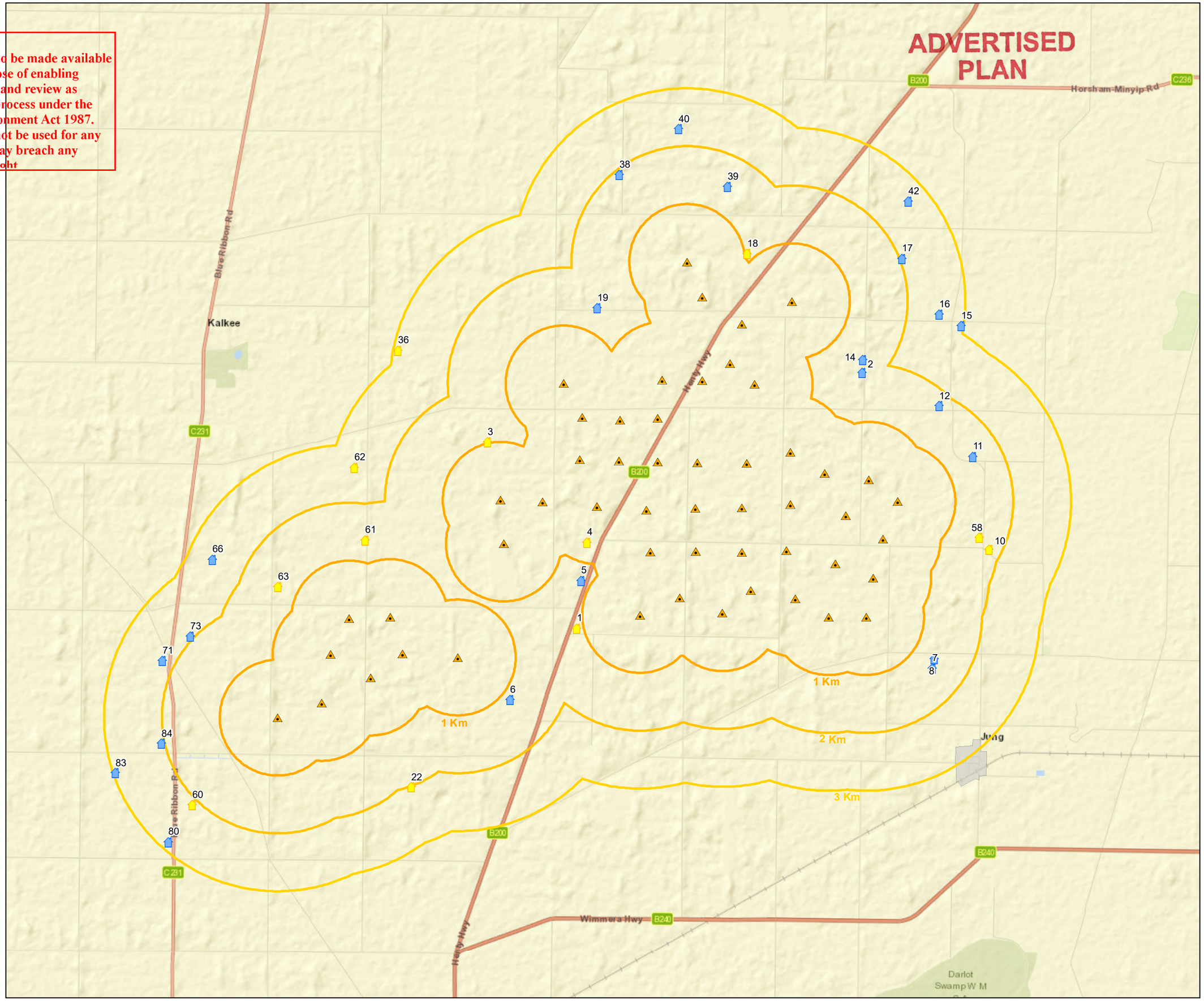
Nearby Dwellings

Legend

- Turbine Location

Dwelling

- Non-stakeholder
- Stakeholder



N
W E
S

Scale at A3:
1:60,000

0 1.5 3 Km

BayWa r.e.

Date: 07/15/2020

5.3. Results

A summary of the results of the worst case scenario Shadow Flicker Assessment for the Wimmera Plains Energy Facility is presented in the table below. Full results can be found on the WindPro report included as an appendix to the present report.

Table 4. Shadow Flicker Assessment Results

Modelled Shadow Flicker (hours/year)	Participant Receptor	Non-Participant Receptor	Total
<30	11	22	**33**
≥30	1	0	**1**
Total	**12**	**22**	**34**

The table above shows that only one receptor is above the limit of 30 hours of shadow flicker per year. As it can be seen on the full WindPro report in appendix, this receptor (ID 4) is a participant landowner in the project and a host for wind turbines and other infrastructure. This owner has entered into an agreement waiving the requirement, in accordance with the shadow flicker guidelines. All non-participant landowners are expected to receive 0 hours of shadow flicker per year.

As discussed in previous sections and in accordance with the Guidelines, further investigation is deemed to be undertaken only where a non-participant receptor is predicted to have more than 30 hours of shadow flicker per year.

The figure below shows the graphic representation of the modelled shadow flicker.

Figure 3. Modelled Shadow Flicker

Wimmera Plains Energy Facility

Predicted Shadow Flicker

Legend

- Turbine Location

Dwelling

- Non-stakeholder
- Stakeholder

Hours per year, worst case

- 0.1 - 30.0
- 30.1 - 650.0

N W E S

Scale at A3: 1:40,000

0 1 2 Km

BayWa r.e.

Date: 07/21/2020

6. Conclusion

An assessment based on worst case conditions of the shadow flicker caused by the 52 wind turbines of the Wimmera Plains Energy Facility has been undertaken following the recommendations of the Guidelines. A total of 34 dwellings (receptors) were identified within 3 km of the wind turbines, comprising 12 participant landowners and 22 non-participant landowners. All non-participant landowners are below the 30 hours of shadow flicker per year limit and therefore no additional investigation is deemed necessary. 1 participant landowner will receive greater than 30 hours of shadow flicker per year and this landowner has entered into an agreement waiving the requirement. For this reason, the project is deemed to be compliant with the Guidelines and Planning Provisions.

Appendix - Detailed WindPro Report

Project:
WIM

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Calculated:
21/07/2020 10:53 AM/3.3.294

SHADOW - Main Result

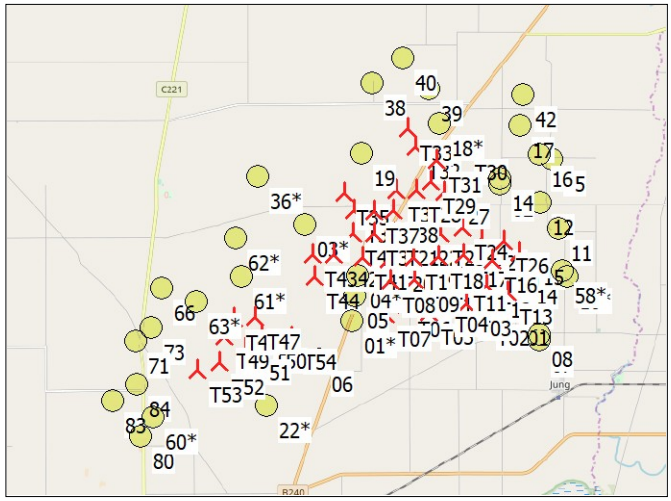
Assumptions for shadow calculations

Maximum distance for influence	1,145	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

The calculated times are "worst case" given by the following assumptions:
- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

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: Elevation Grid Data Object: WIM_EMDGrid_0.wpg (7)
Obstacles used in calculation
Eye height for map: 1.5 m
Grid resolution: 1.0 m

All coordinates are in
UTM (south)-WGS84 Zone: 54



Scale 1:250,000

New WTG Shadow receptor

WTGs

	Easting	Southing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
T01	619,688	5,950,302	137.9	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T02	619,038	5,950,302	136.9	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T03	618,466	5,950,616	139.0	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T04	617,696	5,950,763	139.1	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T05	617,200	5,950,371	140.7	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T06	616,469	5,950,635	144.0	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T07	615,777	5,950,339	143.1	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T08	615,957	5,951,427	142.1	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T09	616,748	5,951,442	141.0	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T10	617,536	5,951,419	139.6	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T11	618,309	5,951,457	138.1	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T12	619,157	5,951,224	137.3	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T13	619,810	5,950,981	138.4	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T14	619,974	5,951,652	137.7	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T15	620,230	5,952,297	136.9	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T16	619,337	5,952,057	137.7	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T17	618,376	5,952,252	137.4	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T18	617,543	5,952,192	140.0	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T19	616,733	5,952,185	141.1	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T20	615,893	5,952,147	141.7	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T21	616,080	5,952,987	140.7	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T22	616,771	5,952,972	140.5	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T23	617,626	5,952,957	139.5	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T24	618,379	5,953,147	137.0	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T25	618,970	5,952,782	136.1	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T26	619,730	5,952,674	135.9	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T27	617,761	5,954,323	138.1	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T28	616,853	5,954,390	139.4	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T29	617,333	5,954,683	138.7	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T30	618,404	5,955,757	136.3	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T31	617,538	5,955,364	138.0	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T32	616,852	5,955,834	141.3	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T33	616,593	5,956,437	139.4	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T34	616,159	5,954,401	139.4	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T35	614,455	5,954,338	138.6	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T36	614,782	5,953,760	140.1	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T37	615,434	5,953,704	139.7	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T38	616,088	5,953,738	141.0	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T39	615,412	5,953,002	139.5	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T40	614,737	5,953,017	140.6	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0

To be continued on next page...

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	Easting	Southing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
T41	615,031	5,952,219	143.0	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T42	614,090	5,952,296	140.6	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T43	613,368	5,952,328	139.6	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T44	613,423	5,951,573	139.6	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T47	611,458	5,950,302	136.4	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T48	610,749	5,950,278	133.8	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T49	610,429	5,949,663	133.9	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T50	611,671	5,949,664	137.3	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T51	611,125	5,949,257	135.1	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T52	610,273	5,948,818	134.3	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T53	609,512	5,948,566	133.9	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0
T54	612,628	5,949,604	141.6	VESTAS V162 5.6MW HH:166m tip:247m	Yes	VESTAS	V162-5,600	5,600	162.0	166.0	0.0

Shadow receptor-Input

No.	Name	Easting	Southing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
01*	ID 01*	614,683	5,950,101	145.3	1.0	1.5	0.0	90.0	"Green house mode"	1.5
02	ID 02	619,626	5,954,517	136.3	1.0	1.5	0.0	90.0	"Green house mode"	1.5
03*	ID 03*	613,143	5,953,314	144.4	1.0	1.5	0.0	90.0	"Green house mode"	1.5
04*	ID 04*	614,867	5,951,583	143.2	1.0	1.5	0.0	90.0	"Green house mode"	1.5
05	ID 05	614,762	5,950,924	142.5	1.0	1.5	0.0	90.0	"Green house mode"	1.5
06	ID 06	613,536	5,948,867	143.4	1.0	1.5	0.0	90.0	"Green house mode"	1.5
07	ID 07	620,832	5,949,409	141.7	1.0	1.5	0.0	90.0	"Green house mode"	1.5
08	ID 08	620,871	5,949,576	142.1	1.0	1.5	0.0	90.0	"Green house mode"	1.5
10*	ID 10*	621,813	5,951,460	143.6	1.0	1.5	0.0	90.0	"Green house mode"	1.5
11	ID 11	621,535	5,953,066	139.6	1.0	1.5	0.0	90.0	"Green house mode"	1.5
12	ID 12	620,948	5,953,943	135.8	1.0	1.5	0.0	90.0	"Green house mode"	1.5
14	ID 14	619,632	5,954,743	135.6	1.0	1.5	0.0	90.0	"Green house mode"	1.5
15	ID 15	621,335	5,955,324	136.9	1.0	1.5	0.0	90.0	"Green house mode"	1.5
16	ID 16	620,955	5,955,524	136.0	1.0	1.5	0.0	90.0	"Green house mode"	1.5
17	ID 17	620,310	5,956,485	135.2	1.0	1.5	0.0	90.0	"Green house mode"	1.5
18*	ID 18*	617,633	5,956,569	141.3	1.0	1.5	0.0	90.0	"Green house mode"	1.5
19	ID 19	615,046	5,955,633	139.7	1.0	1.5	0.0	90.0	"Green house mode"	1.5
22*	ID 22*	611,823	5,947,355	140.3	1.0	1.5	0.0	90.0	"Green house mode"	1.5
36*	ID 36*	611,600	5,954,903	137.7	1.0	1.5	0.0	90.0	"Green house mode"	1.5
38	ID 38	615,424	5,957,939	140.2	1.0	1.5	0.0	90.0	"Green house mode"	1.5
39	ID 39	617,297	5,957,730	138.2	1.0	1.5	0.0	90.0	"Green house mode"	1.5
40	ID 40	616,448	5,958,725	139.5	1.0	1.5	0.0	90.0	"Green house mode"	1.5
42	ID 42	620,421	5,957,478	134.8	1.0	1.5	0.0	90.0	"Green house mode"	1.5
58*	ID 58*	621,646	5,951,665	140.9	1.0	1.5	0.0	90.0	"Green house mode"	1.5
60*	ID 60*	608,041	5,947,051	135.2	1.0	1.5	0.0	90.0	"Green house mode"	1.5
61*	ID 61*	611,026	5,951,627	133.7	1.0	1.5	0.0	90.0	"Green house mode"	1.5
62*	ID 62*	610,840	5,952,878	134.0	1.0	1.5	0.0	90.0	"Green house mode"	1.5
63*	ID 63*	609,525	5,950,816	132.7	1.0	1.5	0.0	90.0	"Green house mode"	1.5
66	ID 66	608,385	5,951,289	133.9	1.0	1.5	0.0	90.0	"Green house mode"	1.5
71	ID 71	607,522	5,949,538	131.8	1.0	1.5	0.0	90.0	"Green house mode"	1.5
73	ID 73	608,005	5,949,963	132.6	1.0	1.5	0.0	90.0	"Green house mode"	1.5
80	ID 80	607,624	5,946,412	134.5	1.0	1.5	0.0	90.0	"Green house mode"	1.5
83	ID 83	606,712	5,947,601	137.0	1.0	1.5	0.0	90.0	"Green house mode"	1.5
84	ID 84	607,509	5,948,109	132.9	1.0	1.5	0.0	90.0	"Green house mode"	1.5

Calculation Results

Shadow receptor

		Shadow, worst case		
No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
01*	ID 01*	18:56	44	0:33
02	ID 02	0:00	0	0:00
03*	ID 03*	0:00	0	0:00

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Shadow, worst case

No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
04*	ID 04*	40:44	94	0:35
05	ID 05	0:00	0	0:00
06	ID 06	0:00	0	0:00
07	ID 07	0:00	0	0:00
08	ID 08	0:00	0	0:00
10*	ID 10*	0:00	0	0:00
11	ID 11	0:00	0	0:00
12	ID 12	0:00	0	0:00
14	ID 14	0:00	0	0:00
15	ID 15	0:00	0	0:00
16	ID 16	0:00	0	0:00
17	ID 17	0:00	0	0:00
18*	ID 18*	23:53	51	0:36
19	ID 19	0:00	0	0:00
22*	ID 22*	0:00	0	0:00
36*	ID 36*	0:00	0	0:00
38	ID 38	0:00	0	0:00
39	ID 39	0:00	0	0:00
40	ID 40	0:00	0	0:00
42	ID 42	0:00	0	0:00
58*	ID 58*	0:00	0	0:00
60*	ID 60*	0:00	0	0:00
61*	ID 61*	0:00	0	0:00
62*	ID 62*	0:00	0	0:00
63*	ID 63*	0:00	0	0:00
66	ID 66	0:00	0	0:00
71	ID 71	0:00	0	0:00
73	ID 73	0:00	0	0:00
80	ID 80	0:00	0	0:00
83	ID 83	0:00	0	0:00
84	ID 84	0:00	0	0:00

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

No.	Name	Worst case [h/year]
T01	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T02	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T03	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T04	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T05	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T06	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T07	VESTAS V162 5.6MW HH:166m tip:247m	18:56
T08	VESTAS V162 5.6MW HH:166m tip:247m	21:17
T09	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T10	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T11	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T12	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T13	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T14	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T15	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T16	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T17	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T18	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T19	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T20	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T21	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T22	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T23	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T24	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T25	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T26	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T27	VESTAS V162 5.6MW HH:166m tip:247m	0:00

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No.	Name	Worst case [h/year]
T28	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T29	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T30	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T31	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T32	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T33	VESTAS V162 5.6MW HH:166m tip:247m	23:53
T34	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T35	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T36	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T37	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T38	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T39	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T40	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T41	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T42	VESTAS V162 5.6MW HH:166m tip:247m	19:27
T43	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T44	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T47	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T48	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T49	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T50	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T51	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T52	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T53	VESTAS V162 5.6MW HH:166m tip:247m	0:00
T54	VESTAS V162 5.6MW HH:166m tip:247m	0:00

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.