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# Brewster Wind Farm

## Appendix F

*Shadow Flicker Assessment*

December 2021





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 **RE Future**

# Brewster Wind Farm

*Shadow Flicker Report*

November 2021

## Version History

Version	Author	Reviewer	Date	Description
1	SS	PL	08/03/21	First draft
2	SS	PL	25/03/21	Updated draft
3	VM	SS	02/06/21	Updated draft
4	VM	SS	20/11/21	Final

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## 1 Introduction

Under the provisions of the Pyrenees Planning Scheme, proponents of wind farms are required to consider the effect of the proposal on the surrounding area in terms of shadow flicker. Shadow flicker occurs when the movement of wind turbine blades creates a rotating shadow that appears as an intermittent, or flickering, shadow when experienced from a single vantage point in the vicinity of a wind turbine. Shadow flicker does not pose any risk of causing health effects; however, it does have the potential to adversely impact the amenity of nearby dwellings by subjecting residents to sharp contrasts of shade and light in short succession.

## 2 Planning Policy Context

Clause 52.32 of the Pyrenees Planning Scheme sets out the application requirements for planning permit applications for wind energy facilities. Among other matters for consideration, Clause 52.32 stipulates that permit applications must address the potential impact of the wind farm in terms of shadow flicker.

Clause 52.32 does not specifically address the criteria against which wind farm shadow flicker is to be assessed, however it does list the *Policy and Planning Guidelines for the Development of Wind Energy Facilities in Victoria 2019* (Policy and Planning Guidelines) as a document which must be considered by the responsible authority in assessing a wind farm planning permit application. The Policy and Planning Guidelines list a single criterion for the assessment of shadow flicker caused by wind farms, namely:

*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.*

Neither Clause 52.32 nor the Policy and Planning Guidelines address the theory of shadow flicker or its assessment in detail. However, the Draft National Wind Farm Development Guidelines 2010 (National Guidelines) contain an in-depth discussion of shadow flicker theory and address a number of aspects of shadow flicker modelling and assessment. While the National Guidelines are not referenced in either Clause 52.32 or the Policy and Planning Guidelines, they nevertheless describe the phenomenon of shadow flicker and guide best practice modelling and impact assessment.

The National Guidelines distinguish two kinds of receptors of shadow flicker, namely participating landowners and neighbouring landowners. Participating landowners are those landowners who have entered into an agreement with the wind farm to host wind turbines and/or associated infrastructure, and who therefore have an interest in its successful development. Neighbouring landowners are the owners of land in the vicinity of the wind farm which may experience impacts from the wind energy facility.

The National Guidelines also list a number of best practice modelling assumptions which are addressed in the following section.

### 3 Shadow Flicker Modelling

In order to determine the amount of shadow flicker that will be experienced by dwellings surrounding the wind farm, shadow flicker modelling was conducted using industry standard software, namely WindPro. Modelling was conducted on the basis of worst-case assumptions listed in the National Guidelines. These assumptions are listed in the Table 1 below.

*Table 1: Modelling Assumptions*

Modelling Parameter	Description
Zone of influence of shadows	265 x maximum chord length
Receptor height	1.5 m
Minimum angle of the sun	3 degrees
Acceptance criteria	Modelled – maximum of 30 hours per year
Cloud cover correction	Modelled – yes

The resulting shadow flicker map is presented in Figure 1. The levels of shadow flicker predicted at dwellings located within 2 km of a turbine are summarised in Table 2.

*Table 2: Modelled Shadow Flicker Levels at Dwellings Within 2 km (Hours/Year)*

Dwelling Number	Dwelling Type	Modelled Flicker	Cloud Correction Factor	Final Flicker levels
1	Participating	0:00	0.506	0:00
2	Participating	0:00	0.506	0:00
3	Neighbouring	0:00	0.506	0:00
4	Neighbouring	0:00	0.506	0:00
5	Participating	95:18	0.506	48:13
6	Neighbouring	0:00	0.506	0:00
7	Neighbouring	0:00	0.506	0:00
8	Neighbouring	0:00	0.506	0:00
9	Neighbouring	0:00	0.506	0:00
46	Neighbouring	0:00	0.506	0:00
72	Participating	112:07	0.506	56:44

Modelled flicker values represent a worst case scenario in which it is assumed the sun is always shining, there are no intervening obstacles, wind turbines are always facing perpendicular to the line of sight between the point of observation and the turbine, and shadow receptors face all directions. Accordingly, it is important to note that actual shadow flicker will be lower than the levels predicted below.

One simple method for determining a closer estimate of actual shadow flicker is to subtract the proportion of cloudy days from the annual prediction of shadow flicker using weather data from the nearest Bureau of Meteorology weather station. In the case of the present wind farm this weather station is located at Ballarat Aerodrome, approximately 25 km from the wind farm site. According to this data Brewster experiences on average 180.2 cloudy days per year, which equates to a reduction in annual shadow flicker of 49.4%. Cloud cover corrected predictions for shadow flicker are included in the table above.

Shadow flicker modelling was based on the candidate turbine model. In the event that the ultimate choice of turbine differs from the Vestas V162 HH166 all modelling will be redone on the basis of the final model selected and the wind farm will comply with all conditions of development approval.

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Brewster Wind Farm

Predicted Shadow Flicker

Legend

Dwellings



Host - Vacant (uninhabitable)



Host



Shadow Flicker hrs per annum



30 hrs per annum  
Less than 30 hrs per

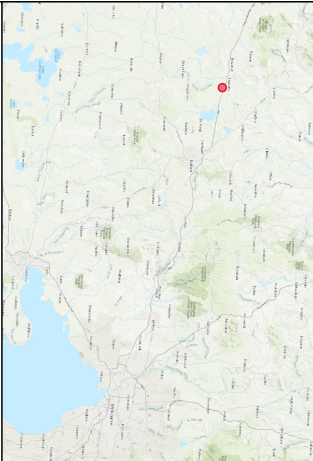
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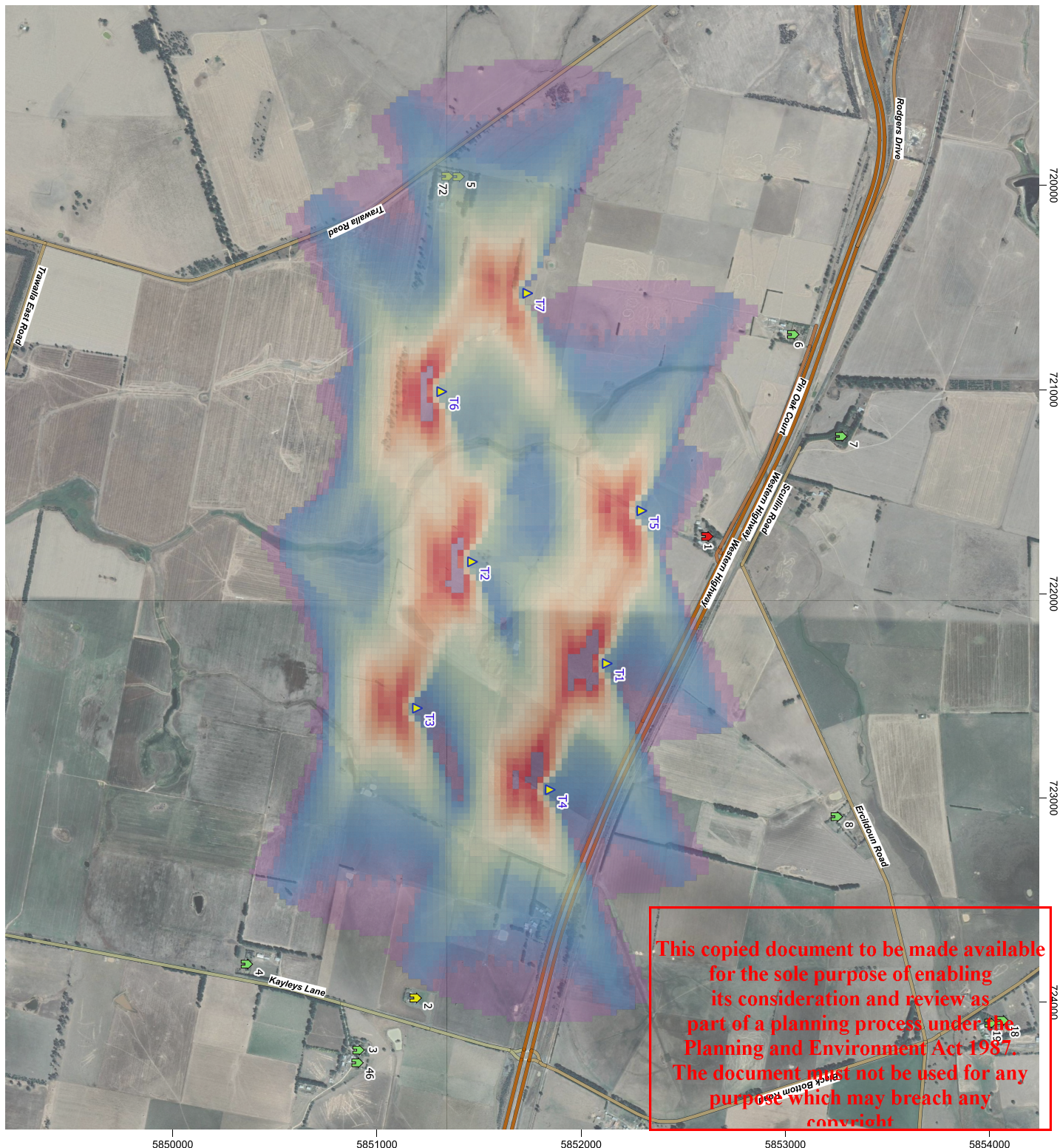
Approved SS Figure No: 1

0 250 500 750 1,000 m



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## 4 Potential Impact on Road Users

As the proposed wind farm is located adjacent to the Western Highway it will result in road users experiencing shadow flicker from the wind farm. Neither Clause 52.32 nor the Policy and Planning Guidelines address this matter, and there are no specific guidelines for the assessment of the potential impact of wind farm shadow flicker on road users. However, the National Guidelines includes a discussion of the potential impact of wind farm shadow flicker on road users, which is reproduced verbatim below:

*Distraction of vehicle drivers*

*There is a negligible risk associated with distraction of vehicle drivers who experience shadow flicker, for the following reasons:*

- *Shadow flicker is little different for a vehicle in motion than the effect of shadows from trees on the side of the road or high passing vehicles, neither of which represent a significant risk in terms of road transport.*
- *In spite of extensive searches, no references to motor vehicle accidents caused by this phenomenon have been found.*

*It is noted, however, that until wind farms become widespread in Australia they will represent a novelty that could cause distraction for drivers (regardless of shadow flicker). Consideration should be given to development of viewing areas for wind farms close to high volume roads.*

This assessment is supported by a consideration of how shadow flicker is addressed in broader road safety standards. Shadow flicker is a common feature of the road users experience, especially on rural roads which are bordered by mature vegetation, and in metropolitan areas where roads pass large buildings and overpasses. There are two established road safety standards which address this kind of shadow flicker and which can be used as a guide for the assessment of the potential impact of wind farm shadow flicker on road users. In particular, road related shadow flicker is addressed by Australian Standard AS 1158:5:2007 (Lighting for roads and public spaces – Part 5: Tunnels and underpasses) (Section 3.3.8) and Commission Internationale de L'Eclairage Standard CIE 88:2004 (Guide for Lighting of Roads Tunnels and Underpasses 2nd ed.) (Section 6.14). According to these standards shadow flicker will be noticeable to road users and potentially cause annoyance when it occurs between 2.5 – 15 Hz, and that shadow flicker between 4 – 11 Hz should be avoided for periods of twenty seconds or longer.

The frequency of shadow flicker caused by a wind farm is directly proportional to the rotational velocity of the wind turbine rotor. The maximum rotational velocity of the Vestas V162 is 12.1 RPM, which equates to 36.3 shadow events per minute, or a shadow flicker frequency of 0.605 Hz. Accordingly, the shadow flicker caused by the proposed wind farm will be well below the threshold set by AS 1158:5:2007 and CIE 88:2004 for annoyance, and as such will have no impact on road safety on the Western Highway adjacent to the wind farm site.



While it is possible that the shadow flicker of two or more wind turbines could be superimposed in one location (in the event that the wind turbines formed a line between the sun and the point of observation) and thereby increase the frequency of shadow flicker to 1.21 Hz or even 1.815 Hz, not only would the resulting frequency remain below the annoyance level defined by AS 1158:5:2007 and CIE 88:2004, but a consideration of the zone of influence of shadows for the chosen wind turbine (which is 1139.5 m), together with a consideration of their spacing and geometric layout (as shown in Figure 1), reveals that there is no location along the Western Highway where two or more wind farm shadow flicker events could be superimposed because the respective zones of influence of shadow do not overlap above the Western Highway.

## 5 Conclusion

Shadow flicker modelling has been carried out in accordance with best practice industry guidelines. The resulting levels of shadow flicker levels predicted to occur at non-participating dwellings are all zero, while two of four dwellings belonging to participating landowners are predicted to receive shadow flicker. The owners of these two dwellings have consented to these levels of modelled shadow flicker.

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## Appendix: WindPro Shadow Flicker Report

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## SHADOW - Main Result

### Assumptions for shadow calculations

Maximum distance for influence 1,140 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:

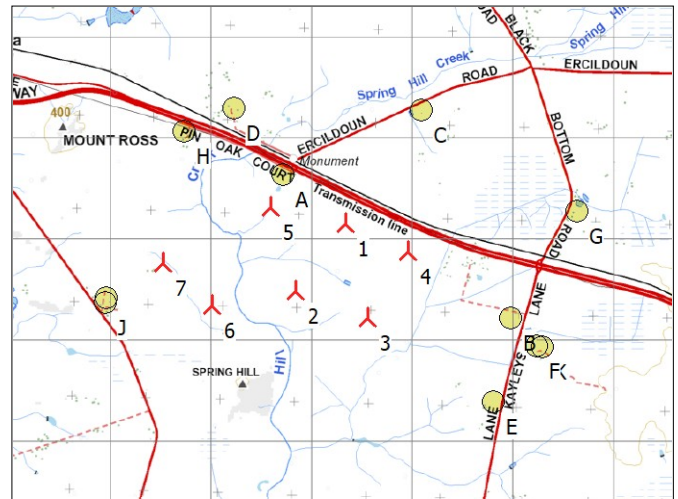
Height contours used: Elevation Contours

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



✂ New WTG

● Shadow receptor

### WTGs

	Easting	Southing	Z [m]	Row data/Description	WTG type		Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]
					Valid	Manufact.				
1	722,341	5,852,128	387.2	WTG 1	Yes	VESTAS	V162-5,600	5,600	162.0	166.0
2	721,843	5,851,468	380.0	WTG 2	Yes	VESTAS	V162-5,600	5,600	162.0	166.0
3	722,560	5,851,199	380.3	WTG 3	Yes	VESTAS	V162-5,600	5,600	162.0	166.0
4	722,959	5,851,849	388.4	WTG 4	Yes	VESTAS	V162-5,600	5,600	162.0	166.0
5	721,593	5,852,298	383.9	WTG 5	Yes	VESTAS	V162-5,600	5,600	162.0	166.0
6	721,010	5,851,318	380.0	WTG 6	Yes	VESTAS	V162-5,600	5,600	162.0	166.0
7	720,528	5,851,739	382.9	WTG 7	Yes	VESTAS	V162-5,600	5,600	162.0	166.0

### Shadow receptor-Input

No.	Name	Easting	Southing	Z	Width	Height	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
				[m]	[m]	[m]				
A	House 1	721,719	5,852,622	381.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B	House 2	723,979	5,851,194	390.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
C	House 8	723,091	5,853,256	390.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
D	House 7	721,229	5,853,278	385.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
E	House 4	723,813	5,850,367	390.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
F	House 3	724,234	5,850,914	391.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
G	House 9	724,642	5,852,253	391.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
H	House 6	720,730	5,853,043	380.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
I	House 5	719,957	5,851,400	386.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
J	House 72	719,955	5,851,350	388.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
K	House 46	724,296	5,850,909	396.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0

### 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]
A	House 1	0:00	0	0:00
B	House 2	0:00	0	0:00
C	House 8	0:00	0	0:00
D	House 7	0:00	0	0:00
E	House 4	0:00	0	0:00
F	House 3	0:00	0	0:00
G	House 9	0:00	0	0:00
H	House 6	0:00	0	0:00
I	House 5	95:18	151	0:56

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## SHADOW - Main Result

...continued from previous page

### Shadow, worst case

No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
	J House 72	112:07	168	0:55
	K House 46	0:00	0	0:00

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

No.	Name	Worst case [h/year]
1	WTG 1	0:00
2	WTG 2	0:00
3	WTG 3	0:00
4	WTG 4	0:00
5	WTG 5	0:00
6	WTG 6	29:22
7	WTG 7	112:30

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.

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## SHADOW - Calendar

Shadow receptor: A - House 1

### Assumptions for shadow calculations

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

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

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		

# ADVERTISED PLAN

## SHADOW - Calendar

Shadow receptor: B - House 2

### Assumptions for shadow calculations

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

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# ADVERTISED PLAN

## SHADOW - Calendar

Shadow receptor: C - House 8

### Assumptions for shadow calculations

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# ADVERTISED PLAN

## SHADOW - Calendar

Shadow receptor: D - House 7

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	20:41		19:23		17:17		17:38	18:04		19:58		20:50
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Total, worst case												

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		

# ADVERTISED PLAN

## SHADOW - Calendar

Shadow receptor: E - House 4

### Assumptions for shadow calculations

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

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	January	February	March	April	May	June	July	August	September	October	November	December
1	06:09	06:41	07:11	07:40	07:07	07:32	07:42	07:26	06:48	06:02	06:20	05:59
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	20:40		19:23		17:17		17:38	18:04		19:58		20:50
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Total, worst case												

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:

Brewster

# ADVERTISED PLAN

Licensed user:

RE Future Pty Ltd

21 Langridge St

AU-NEWTOWN VIC 3220

03 9429 5629

Vaughan Mitchell / v Vaughan.mitchell@refuture.com.au

Calculated:

19/11/2021 5:09 PM/3.4.424

## SHADOW - Calendar

Shadow receptor: F - House 3

### Assumptions for shadow calculations

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

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	January	February	March	April	May	June	July	August	September	October	November	December
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	20:40		19:23		17:17		17:38	18:04		19:58		20:50
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Total, worst case												

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		

# ADVERTISED PLAN

## SHADOW - Calendar

Shadow receptor: G - House 9

### Assumptions for shadow calculations

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

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	January	February	March	April	May	June	July	August	September	October	November	December
1	06:09	06:41	07:11	07:40	07:07	07:32	07:42	07:26	06:48	06:02	06:20	05:59
	20:51	20:40	20:07	19:22	17:41	17:17	17:18	17:39	18:05	18:29	19:59	20:31
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	20:40		19:23		17:17		17:38	18:04		19:58		20:50
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Total, worst case												

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)

# ADVERTISED PLAN

## SHADOW - Calendar

Shadow receptor: H - House 6

### Assumptions for shadow calculations

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

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	January	February	March	April	May	June	July	August	September	October	November	December
1	06:09	06:41	07:11	07:40	07:07	07:32	07:42	07:26	06:48	06:03	06:21	05:59
	20:51	20:40	20:08	19:22	17:41	17:17	17:19	17:39	18:05	18:30	19:59	20:31
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	20:43	20:09	19:28	17:45	17:19	17:17	17:36	18:01	18:27	19:55	20:28	20:50
29	06:38		07:37	07:05	07:30	07:42	07:29	06:52	06:06	06:24	06:00	06:07
	20:42		19:26	17:44	17:18	17:18	17:37	18:02	18:28	19:56	20:29	20:50
30	06:39		07:38	07:06	07:30	07:42	07:28	06:51	06:04	06:23	06:00	06:07
	20:41		19:25	17:42	17:18	17:18	17:38	18:03	18:29	19:57	20:30	20:50
31	06:40		07:39		07:31		07:27	06:50		06:22		06:08
	20:41		19:23		17:17		17:38	18:04		19:58		20:50
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Total, worst case												

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		



# ADVERTISED PLAN

## SHADOW - Calendar

Shadow receptor: I - House 5

### Assumptions for shadow calculations

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

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	January	February	March	April	May	June	
1	06:09 20:51	06:41 20:40	07:11 20:08	07:41 (6) 19:22	07:07 17:41	08:00 (7) 17:17	08:21 (7) 17:17
2	06:10 20:51	06:42 20:39	07:12 20:06	07:40 (6) 19:20	07:08 17:40	08:00 (7) 17:17	08:22 (7) 17:17
3	06:11 20:51	06:43 20:38	07:13 20:05	07:40 (6) 19:19	07:09 17:39	08:00 (7) 17:16	08:26 (7) 17:16
4	06:12 20:51	06:44 20:37	07:14 20:03	07:41 (6) 19:17	07:09 17:38	08:00 (7) 17:16	08:32 (7) 17:16
5	06:13 20:51	06:45 20:36	07:15 20:02	07:41 (6) 18:16	07:10 17:37	08:00 (7) 17:16	07:34 17:16
6	06:13 20:51	06:47 20:35	07:16 20:01	07:41 (6) 18:14	07:11 17:36	08:00 (7) 17:16	07:35 17:16
7	06:14 20:51	06:48 20:34	07:17 19:59	07:42 (6) 18:13	07:12 17:35	08:00 (7) 17:15	07:35 17:15
8	06:15 20:51	06:49 20:33	07:18 19:58	07:43 (6) 18:12	07:13 17:34	08:00 (7) 17:15	07:36 17:15
9	06:16 20:51	06:50 20:32	07:19 19:56	07:44 (6) 18:10	07:14 17:33	08:00 (7) 17:15	07:37 17:15
10	06:17 20:51	06:51 20:31	07:20 19:55	07:45 (6) 18:09	07:15 17:32	08:01 (7) 17:15	07:37 17:15
11	06:18 20:51	06:52 20:30	07:21 19:53	07:46 (6) 18:07	07:16 17:31	08:00 (7) 17:15	07:38 17:15
12	06:19 20:51	06:53 20:29	07:22 19:52	07:51 (6) 18:06	07:16 17:30	08:01 (7) 17:15	07:38 17:15
13	06:20 20:50	06:54 20:28	07:23 19:50	06:51 18:04	08:24 (7) 17:29	08:01 (7) 17:15	07:39 17:15
14	06:21 20:50	06:55 20:27	07:24 19:49	06:52 18:03	08:37 (7) 17:28	08:53 (7) 17:15	07:40 17:15
15	06:22 20:50	06:57 20:26	07:25 19:47	06:53 18:02	08:17 (7) 17:27	08:02 (7) 17:15	07:39 17:15
16	06:23 20:49	06:58 20:24	07:26 19:46	06:53 18:00	08:44 (7) 17:27	08:52 (7) 17:15	07:40 17:15
17	06:24 20:49	06:59 20:23	07:27 19:44	06:54 17:59	08:12 (7) 17:26	08:04 (7) 17:15	07:40 17:15
18	06:25 20:49	07:00 20:22	07:54 (6) 19:43	06:55 17:58	08:10 (7) 17:25	08:05 (7) 17:15	07:40 17:15
19	06:26 20:48	07:01 20:21	08:05 (6) 19:41	06:56 17:56	08:48 (7) 17:24	08:51 (7) 17:15	07:41 17:15
20	06:28 20:48	07:02 20:20	08:08 (6) 19:40	06:57 17:55	08:08 (7) 17:24	08:06 (7) 17:15	07:41 17:15
21	06:29 20:47	07:03 20:18	07:47 (6) 19:38	06:58 17:54	08:51 (7) 17:23	08:49 (7) 17:15	07:41 17:15
22	06:30 20:47	07:04 20:17	08:12 (6) 19:37	06:59 17:52	08:07 (7) 17:22	08:05 (7) 17:16	07:41 17:16
23	06:31 20:46	07:05 20:16	07:45 (6) 19:35	07:00 17:51	08:52 (7) 17:22	08:07 (7) 17:16	07:41 17:16
24	06:32 20:46	07:06 20:14	07:44 (6) 19:34	07:01 17:50	08:04 (7) 17:21	08:09 (7) 17:16	07:42 17:16
25	06:33 20:45	07:07 20:13	08:14 (6) 19:32	07:02 17:48	08:53 (7) 17:20	08:10 (7) 17:16	07:42 17:16
26	06:34 20:44	07:08 20:12	07:42 (6) 19:31	07:02 17:47	08:55 (7) 17:20	08:45 (7) 17:17	07:42 17:17
27	06:35 20:44	07:09 20:10	07:41 (6) 19:29	07:03 17:46	08:02 (7) 17:19	08:13 (7) 17:17	07:42 17:17
28	06:36 20:43	07:10 20:09	08:16 (6) 19:28	07:04 17:45	08:56 (7) 17:19	08:44 (7) 17:17	07:42 17:17
29	06:38 20:42		07:37 19:26	07:05 17:44	08:00 (7) 17:18	08:16 (7) 17:18	07:42 17:18
30	06:39 20:41		07:38 19:25	07:06 17:42	08:00 (7) 17:18	08:17 (7) 17:18	07:42 17:18
31	06:40 20:41		07:39 19:23		08:55 (7) 17:17	08:40 (7) 17:18	
Potential sun hours	447	378	382	334	314	289	36
Total, worst case		299	341	769	1400		

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)

# ADVERTISED PLAN

## SHADOW - Calendar

Shadow receptor: I - House 5

### Assumptions for shadow calculations

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

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July		August		September		October		November		December	
1	07:42		07:26		08:11 (7)	06:48	06:03		06:33 (6)	06:21	05:59
	17:19		17:39	53	09:04 (7)	18:05	18:30	5	06:38 (6)	19:59	20:31
2	07:42		07:25		08:10 (7)	06:47	06:01		06:27 (6)	06:19	05:59
	17:19		17:40	54	09:04 (7)	18:06	18:31	16	06:43 (6)	20:00	20:32
3	07:42		07:24		08:10 (7)	06:45	06:00		06:25 (6)	06:18	05:59
	17:19		17:41	54	09:04 (7)	18:06	18:31	20	06:45 (6)	20:02	20:33
4	07:42		07:23		08:10 (7)	06:44	06:58		06:22 (6)	06:17	05:59
	17:20		17:42	55	09:05 (7)	18:07	19:32	24	06:46 (6)	20:03	20:34
5	07:41		07:22		08:09 (7)	06:42	06:57		07:21 (6)	06:16	05:59
	17:20		17:42	56	09:05 (7)	18:08	19:33	27	07:48 (6)	20:04	20:35
6	07:41		07:21		08:09 (7)	06:41	06:55		07:19 (6)	06:15	05:59
	17:21		17:43	56	09:05 (7)	18:09	19:34	29	07:48 (6)	20:05	20:36
7	07:41		07:20		08:09 (7)	06:39	06:54		07:18 (6)	06:14	05:59
	17:21		17:44	56	09:05 (7)	18:10	19:35	31	07:49 (6)	20:06	20:37
8	07:41		07:19		08:09 (7)	06:38	06:52		07:17 (6)	06:13	05:59
	17:22		17:45	56	09:05 (7)	18:10	19:36	32	07:49 (6)	20:07	20:38
9	07:41		07:18		08:09 (7)	06:36	06:51		07:16 (6)	06:12	05:59
	17:23		17:46	56	09:05 (7)	18:11	19:37	34	07:50 (6)	20:08	20:38
10	07:40		07:17		08:09 (7)	06:35	06:49		07:15 (6)	06:12	05:59
	17:23	10	08:41 (7)	07:17	09:05 (7)	18:12	19:38	34	07:49 (6)	20:09	20:39
11	07:40		07:16		08:09 (7)	06:33	06:48		07:15 (6)	06:11	05:59
	17:24	15	08:44 (7)	07:17	09:05 (7)	18:13	19:39	35	07:50 (6)	20:10	20:40
12	07:39		07:15		08:08 (7)	06:32	06:46		07:14 (6)	06:10	05:59
	17:24	19	08:46 (7)	07:18	09:04 (7)	18:14	19:40	35	07:49 (6)	20:11	20:41
13	07:39		07:14		08:08 (7)	06:30	06:45		07:14 (6)	06:09	05:59
	17:25	22	08:48 (7)	07:19	09:04 (7)	18:15	19:41	35	07:49 (6)	20:12	20:42
14	07:39		07:12		08:08 (7)	06:29	06:44		07:14 (6)	06:08	06:00
	17:26	25	08:49 (7)	07:20	09:03 (7)	18:15	19:41	35	07:49 (6)	20:13	20:42
15	07:38		07:11		08:09 (7)	06:27	06:42		07:14 (6)	06:07	06:00
	17:26	28	08:51 (7)	07:21	09:03 (7)	18:16	19:42	34	07:48 (6)	20:14	20:43
16	07:38		07:10		08:08 (7)	06:26	06:41		07:14 (6)	06:07	06:00
	17:27	30	08:52 (7)	07:22	09:02 (7)	18:17	19:43	34	07:48 (6)	20:15	20:44
17	07:37		07:09		08:09 (7)	06:24	06:39		07:15 (6)	06:06	06:00
	17:28	31	08:53 (7)	07:23	09:01 (7)	18:18	19:44	32	07:47 (6)	20:17	20:44
18	07:37		07:07		08:09 (7)	06:23	06:38		07:15 (6)	06:05	06:01
	17:28	34	08:54 (7)	07:24	09:01 (7)	18:19	19:45	31	07:46 (6)	20:18	20:45
19	07:36		07:06		08:10 (7)	06:21	06:37		07:16 (6)	06:05	06:01
	17:29	36	08:56 (7)	07:25	09:00 (7)	18:20	19:46	29	07:45 (6)	20:19	20:46
20	07:35		07:05		08:10 (7)	06:20	06:35		07:17 (6)	06:04	06:02
	17:30	37	08:56 (7)	07:26	08:58 (7)	18:20	19:47	27	07:44 (6)	20:20	20:46
21	07:35		07:03		08:10 (7)	06:18	06:34		07:18 (6)	06:03	06:02
	17:31	39	08:57 (7)	07:27	08:58 (7)	18:21	19:48	23	07:41 (6)	20:21	20:47
22	07:34		07:02		08:10 (7)	06:16	06:33		07:20 (6)	06:03	06:02
	17:31	42	08:59 (7)	07:28	08:56 (7)	18:22	19:49	20	07:40 (6)	20:22	20:47
23	07:34		07:01		08:12 (7)	06:15	06:31		07:22 (6)	06:02	06:03
	17:32	43	08:59 (7)	07:29	08:55 (7)	18:23	19:50	16	07:38 (6)	20:23	20:48
24	07:33		06:59		08:13 (7)	06:13	06:30		07:26 (6)	06:02	06:04
	17:33	45	09:00 (7)	07:30	08:54 (7)	18:24	19:51	8	07:34 (6)	20:24	20:48
25	07:32		06:58		08:13 (7)	06:12	06:29			06:01	06:04
	17:34	45	09:01 (7)	07:31	08:51 (7)	18:25	19:52			20:25	20:49
26	07:31		06:57		08:15 (7)	06:10	06:28			06:01	06:05
	17:34	47	09:02 (7)	07:32	08:50 (7)	18:25	19:53			20:26	20:49
27	07:31		06:55		08:16 (7)	06:09	06:26			06:01	06:05
	17:35	48	09:02 (7)	07:33	08:47 (7)	18:26	19:54			20:27	20:49
28	07:30		06:54		08:18 (7)	06:07	06:25			06:00	06:06
	17:36	49	09:02 (7)	07:34	08:45 (7)	18:27	19:55			20:28	20:50
29	07:29		06:53		08:21 (7)	06:06	06:24			06:00	06:07
	17:37	50	09:03 (7)	07:35	08:42 (7)	18:28	19:56			20:29	20:50
30	07:28		06:51		08:24 (7)	06:04	06:23			06:00	06:07
	17:38	51	09:03 (7)	07:36	08:37 (7)	18:29	19:57			20:30	20:50
31	07:27		06:50				06:22				06:08
	17:38	53	09:04 (7)	07:37			19:58				20:51
Potential sun hours	305		332		355		404		423		455
Total, worst case	799		1428				646				

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)

# ADVERTISED PLAN

## SHADOW - Calendar

Shadow receptor: J - House 72

### Assumptions for shadow calculations

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

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	January	February	March	April	May	June
1	06:09 20:51	06:41 20:40	07:11 20:08	07:49 (6) 19:22	07:07 17:41	08:12 (7) 17:17
2	06:10 20:51	06:42 20:39	07:12 20:06	07:48 (6) 19:20	07:08 17:40	08:12 (7) 17:17
3	06:11 20:51	06:43 20:38	07:13 20:05	07:48 (6) 19:19	07:09 17:39	08:11 (7) 17:16
4	06:12 20:51	06:44 20:37	07:14 20:03	07:47 (6) 19:17	07:09 17:38	08:10 (7) 17:16
5	06:13 20:51	06:45 20:36	07:15 20:02	07:46 (6) 18:16	07:10 17:37	08:10 (7) 17:16
6	06:13 20:51	06:47 20:35	07:16 20:01	07:46 (6) 18:14	07:11 17:36	08:09 (7) 17:16
7	06:14 20:51	06:48 20:34	07:17 19:59	07:46 (6) 18:13	07:12 17:35	08:09 (7) 17:15
8	06:15 20:51	06:49 20:33	07:18 19:58	07:46 (6) 18:12	07:13 17:34	08:09 (7) 17:15
9	06:16 20:51	06:50 20:32	07:19 19:56	07:46 (6) 18:10	07:14 17:33	08:09 (7) 17:15
10	06:17 20:51	06:51 20:31	07:20 19:55	07:46 (6) 18:09	07:15 17:32	08:09 (7) 17:15
11	06:18 20:51	06:52 20:30	07:21 19:53	07:46 (6) 18:07	07:16 17:31	08:08 (7) 17:15
12	06:19 20:51	06:53 20:29	07:22 19:52	07:47 (6) 18:06	07:16 17:30	08:07 (7) 17:15
13	06:20 20:50	06:54 20:28	07:23 19:50	07:47 (6) 18:04	07:17 17:29	08:08 (7) 17:15
14	06:21 20:50	06:55 20:27	07:24 19:49	07:48 (6) 18:03	07:18 17:28	08:08 (7) 17:15
15	06:22 20:50	06:57 20:26	07:25 19:47	07:49 (6) 18:02	07:19 17:27	08:08 (7) 17:15
16	06:23 20:49	06:58 20:24	07:26 19:46	07:51 (6) 18:00	07:20 17:27	08:08 (7) 17:15
17	06:24 20:49	06:59 20:23	07:27 19:44	07:53 (6) 17:59	07:21 17:26	08:08 (7) 17:15
18	06:25 20:49	07:00 20:22	07:27 19:43	07:58 (6) 17:58	07:21 17:25	08:09 (7) 17:15
19	06:26 20:48	07:01 20:21	07:28 19:41	06:56 17:56	07:22 17:24	08:09 (7) 17:15
20	06:28 20:48	07:02 20:20	07:29 19:40	06:57 17:55	07:23 17:24	08:08 (7) 17:15
21	06:29 20:47	07:03 20:18	07:30 19:38	06:58 17:54	07:24 17:23	08:09 (7) 17:15
22	06:30 20:47	07:04 20:17	07:31 19:37	06:59 17:52	07:25 17:22	08:09 (7) 17:16
23	06:31 20:46	07:05 20:16	07:32 19:35	07:00 17:51	07:25 17:22	08:10 (7) 17:16
24	06:32 20:46	07:06 20:14	07:33 19:34	07:01 17:50	07:26 17:21	08:10 (7) 17:16
25	06:33 20:45	07:07 20:13	07:34 19:32	07:01 17:48	07:27 17:20	08:10 (7) 17:16
26	06:34 20:44	07:08 20:12	07:35 19:31	07:02 17:47	07:28 17:20	08:11 (7) 17:17
27	06:35 20:44	07:09 20:10	07:36 19:29	07:03 17:46	07:28 17:19	08:11 (7) 17:17
28	06:36 20:43	07:10 20:09	07:37 19:28	07:04 17:45	07:29 17:19	08:12 (7) 17:17
29	06:38 20:42		07:37 19:26	07:05 17:44	07:30 17:18	08:13 (7) 17:18
30	06:39 20:41		07:38 19:25	07:06 17:42	07:30 17:18	08:12 (7) 17:18
31	06:40 20:41		07:39 19:23		07:31 17:17	08:13 (7) 17:18
Potential sun hours	447	378	382	334	314	289
Total, worst case		100	525	293	1608	1161

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)

# ADVERTISED PLAN

## SHADOW - Calendar

Shadow receptor: J - House 72

### Assumptions for shadow calculations

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

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July		August		September		October		November		December	
1	07:42	08:24 (7)	07:26	08:18 (7)	06:48	06:03	06:26 (6)	06:21	05:59		
	17:19	09:02 (7)	17:39	09:13 (7)	18:05	18:30	06:57 (6)	19:59	20:31		
2	07:42	08:24 (7)	07:25	08:18 (7)	06:47	06:01	06:25 (6)	06:19	05:59		
	17:19	09:03 (7)	17:40	09:12 (7)	18:06	18:31	06:57 (6)	20:00	20:32		
3	07:42	08:24 (7)	07:24	08:18 (7)	06:45	06:00	06:24 (6)	06:18	05:59		
	17:19	09:04 (7)	17:41	09:12 (7)	18:06	18:31	06:58 (6)	20:02	20:33		
4	07:42	08:24 (7)	07:23	08:18 (7)	06:44	06:58	06:23 (6)	06:17	05:59		
	17:20	09:04 (7)	17:42	09:12 (7)	18:07	19:32	06:57 (6)	20:03	20:34		
5	07:41	08:23 (7)	07:22	08:18 (7)	06:42	06:57	07:23 (6)	06:16	05:59		
	17:20	09:04 (7)	17:42	09:11 (7)	18:08	19:33	07:58 (6)	20:04	20:35		
6	07:41	08:23 (7)	07:21	08:19 (7)	06:41	06:55	07:22 (6)	06:15	05:59		
	17:21	09:05 (7)	17:43	09:11 (7)	18:09	19:34	07:57 (6)	20:05	20:36		
7	07:41	08:23 (7)	07:20	08:19 (7)	06:39	06:54	07:22 (6)	06:14	05:59		
	17:21	09:06 (7)	17:44	09:11 (7)	18:10	19:35	07:57 (6)	20:06	20:37		
8	07:41	08:23 (7)	07:19	08:19 (7)	06:38	06:52	07:22 (6)	06:13	05:59		
	17:22	09:06 (7)	17:45	09:10 (7)	18:10	19:36	07:56 (6)	20:07	20:38		
9	07:41	08:22 (7)	07:18	08:20 (7)	06:36	06:51	07:22 (6)	06:12	05:59		
	17:23	09:06 (7)	17:46	09:10 (7)	18:11	19:37	07:56 (6)	20:08	20:38		
10	07:40	08:22 (7)	07:17	08:20 (7)	06:35	06:49	07:22 (6)	06:12	05:59		
	17:23	09:07 (7)	17:47	09:09 (7)	18:12	19:38	07:55 (6)	20:09	20:39		
11	07:40	08:22 (7)	07:16	08:21 (7)	06:33	06:48	07:22 (6)	06:11	05:59		
	17:24	09:08 (7)	17:47	09:08 (7)	18:13	19:39	07:54 (6)	20:10	20:40		
12	07:39	08:21 (7)	07:15	08:21 (7)	06:32	06:46	07:22 (6)	06:10	05:59		
	17:24	09:08 (7)	17:48	09:06 (7)	18:14	19:40	07:53 (6)	20:11	20:41		
13	07:39	08:21 (7)	07:14	08:22 (7)	06:30	06:45	07:23 (6)	06:09	05:59		
	17:25	09:09 (7)	17:49	09:05 (7)	18:15	19:41	07:52 (6)	20:12	20:42		
14	07:39	08:21 (7)	07:12	08:23 (7)	06:29	06:44	07:25 (6)	06:08	05:59		
	17:26	09:09 (7)	17:50	09:04 (7)	18:15	19:41	07:51 (6)	20:13	20:42		
15	07:38	08:21 (7)	07:11	08:24 (7)	06:27	06:42	07:25 (6)	06:07	06:00		
	17:26	09:10 (7)	17:51	09:03 (7)	18:16	19:42	07:49 (6)	20:14	20:43		
16	07:38	08:20 (7)	07:10	08:24 (7)	06:26	06:41	07:27 (6)	06:07	06:00		
	17:27	09:10 (7)	17:51	09:01 (7)	18:17	19:43	07:47 (6)	20:15	20:44		
17	07:37	08:20 (7)	07:09	08:26 (7)	06:24	06:39	07:30 (6)	06:06	06:00		
	17:28	09:11 (7)	17:52	09:00 (7)	18:18	19:44	07:44 (6)	20:17	20:44		
18	07:37	08:20 (7)	07:07	08:27 (7)	06:23	06:38	07:34 (6)	06:05	06:01		
	17:28	09:11 (7)	17:53	08:58 (7)	18:19	19:45	07:39 (6)	20:18	20:45		
19	07:36	08:20 (7)	07:06	08:29 (7)	06:21	06:37		06:05	06:01		
	17:29	09:12 (7)	17:54	08:56 (7)	18:20	19:46		20:19	20:46		
20	07:35	08:19 (7)	07:05	08:31 (7)	06:20	06:35		06:04	06:02		
	17:30	09:12 (7)	17:55	08:52 (7)	18:20	19:47		20:20	20:46		
21	07:35	08:19 (7)	07:03	08:35 (7)	06:18	06:34		06:03	06:02		
	17:31	09:12 (7)	17:56	08:48 (7)	18:21	19:48		20:21	20:47		
22	07:34	08:19 (7)	07:02		06:16	06:33		06:03	06:02		
	17:31	09:13 (7)	17:56		18:22	19:49		20:22	20:47		
23	07:34	08:19 (7)	07:01		06:15	06:31		06:02	06:03		
	17:32	09:13 (7)	17:57		18:23	19:50		20:23	20:48		
24	07:33	08:19 (7)	06:59		06:13	06:30		06:02	06:04		
	17:33	09:13 (7)	17:58		18:24	19:51		20:24	20:48		
25	07:32	08:19 (7)	06:58		06:12	06:29		06:01	06:04		
	17:34	09:14 (7)	17:59		18:25	19:52		20:25	20:49		
26	07:31	08:19 (7)	06:57		06:10	06:28		06:01	06:05		
	17:34	09:13 (7)	18:00		18:25	19:53		20:26	20:49		
27	07:31	08:19 (7)	06:55		06:09	06:33 (6)		06:01	06:05		
	17:35	09:13 (7)	18:01		18:26	20	06:53 (6)	19:54	20:49		
28	07:30	08:18 (7)	06:54		06:07	06:31 (6)		06:00	06:06		
	17:36	09:13 (7)	18:01		18:27	23	06:54 (6)	19:55	20:50		
29	07:29	08:18 (7)	06:53		06:06	06:29 (6)		06:00	06:07		
	17:37	09:13 (7)	18:02		18:28	27	06:56 (6)	19:56	20:50		
30	07:28	08:18 (7)	06:51		06:04	06:27 (6)		06:00	06:07		
	17:38	09:13 (7)	18:03		18:29	29	06:56 (6)	19:57	20:50		
31	07:27	08:18 (7)	06:50					20:30	06:08		
	17:38	09:13 (7)	18:04						20:51		
Potential sun hours	305			355		404		423	455		
Total, worst case	1508		902	112		518					

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)

# ADVERTISED PLAN

## SHADOW - Calendar

Shadow receptor: K - House 46

### Assumptions for shadow calculations

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

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	January	February	March	April	May	June	July	August	September	October	November	December
1	06:09	06:41	07:11	07:40	07:07	07:32	07:42	07:26	06:48	06:02	06:20	05:59
	20:51	20:40	20:07	19:22	17:41	17:17	17:18	17:39	18:05	18:30	19:59	20:31
2	06:10	06:42	07:12	07:41	07:07	07:32	07:42	07:25	06:47	06:01	06:19	05:59
	20:51	20:39	20:06	19:20	17:40	17:16	17:19	17:40	18:05	18:30	20:00	20:32
3	06:11	06:43	07:13	07:42	07:08	07:33	07:42	07:24	06:45	05:59	06:18	05:59
	20:51	20:38	20:05	19:19	17:39	17:16	17:19	17:41	18:06	18:31	20:01	20:33
4	06:11	06:44	07:14	07:43	07:09	07:34	07:41	07:23	06:44	06:58	06:17	05:59
	20:51	20:37	20:03	19:17	17:38	17:16	17:20	17:41	18:07	19:32	20:02	20:34
5	06:12	06:45	07:15	06:44	07:10	07:34	07:41	07:22	06:42	06:56	06:16	05:59
	20:51	20:36	20:02	18:16	17:37	17:16	17:20	17:42	18:08	19:33	20:03	20:35
6	06:13	06:46	07:16	06:44	07:11	07:35	07:41	07:21	06:41	06:55	06:15	05:59
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	20:51	20:34	19:59	18:13	17:35	17:15	17:21	17:44	18:09	19:35	20:06	20:36
8	06:15	06:49	07:18	06:46	07:13	07:36	07:41	07:19	06:38	06:52	06:13	05:59
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	20:51	20:30	19:53	18:07	17:31	17:15	17:24	17:47	18:13	19:38	20:10	20:40
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24	06:32	07:06	07:33	07:00	07:26	07:41	07:33	06:59	06:13	06:30	06:02	06:03
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25	06:33	07:07	07:34	07:01	07:27	07:42	07:32	06:58	06:12	06:29	06:01	06:04
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	20:41		19:25	17:42	17:18	17:18	17:37	18:03	18:29	19:57	20:30	20:50
31	06:40		07:39		07:31		07:27	06:49		06:21		06:08
	20:40		19:23		17:17		17:38	18:04		19:58		20:50
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Total, worst case												

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		

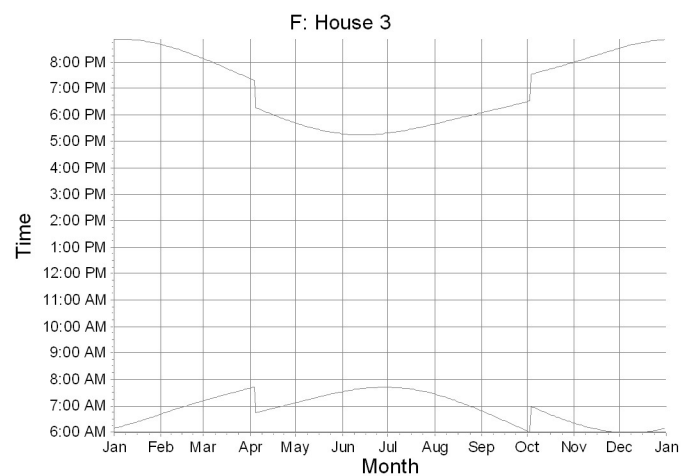
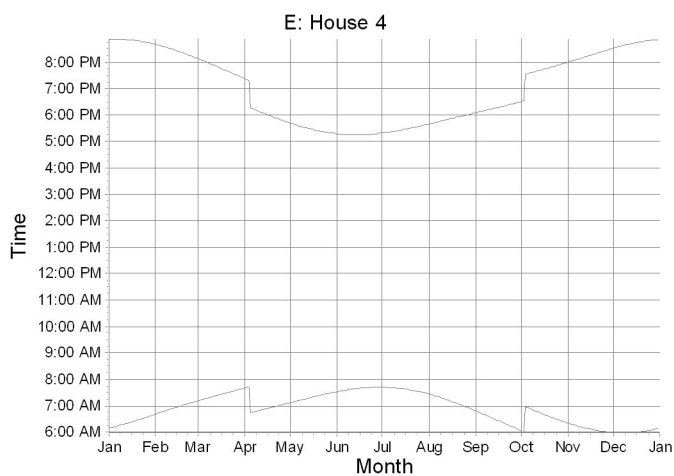
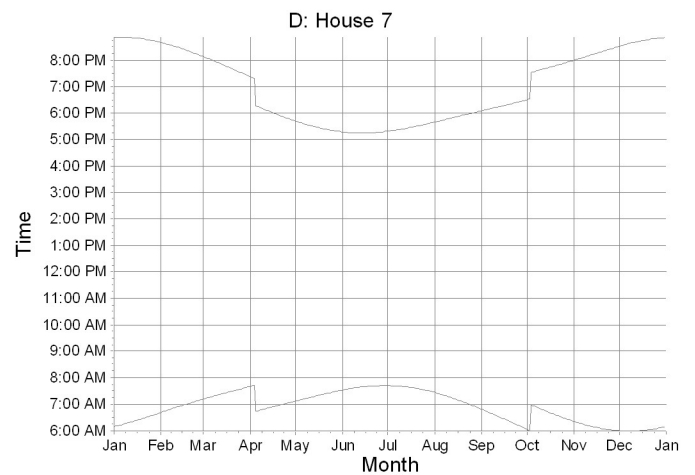
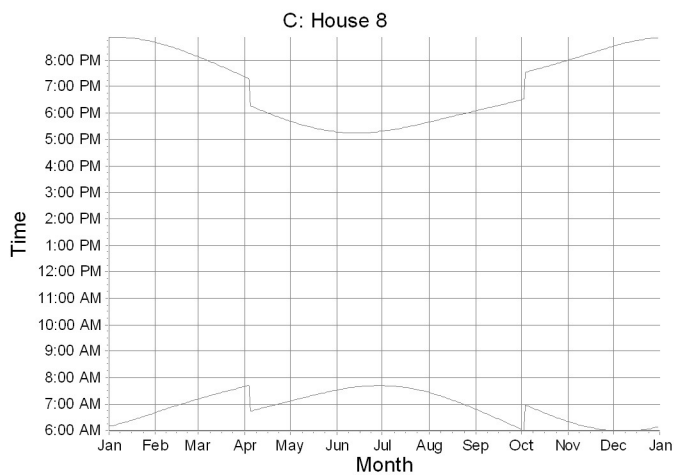
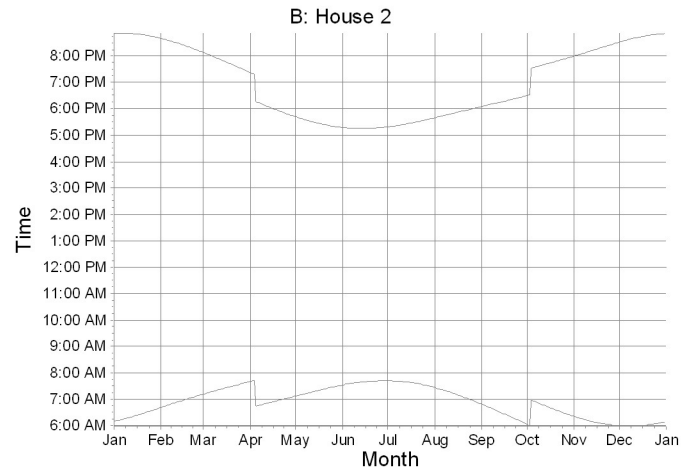
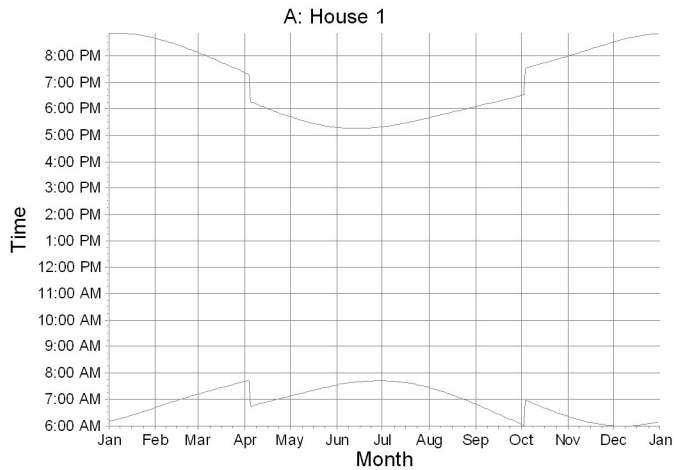


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19/11/2021 5:09 PM/3.4.424

## SHADOW - Calendar, graphical



WTGs

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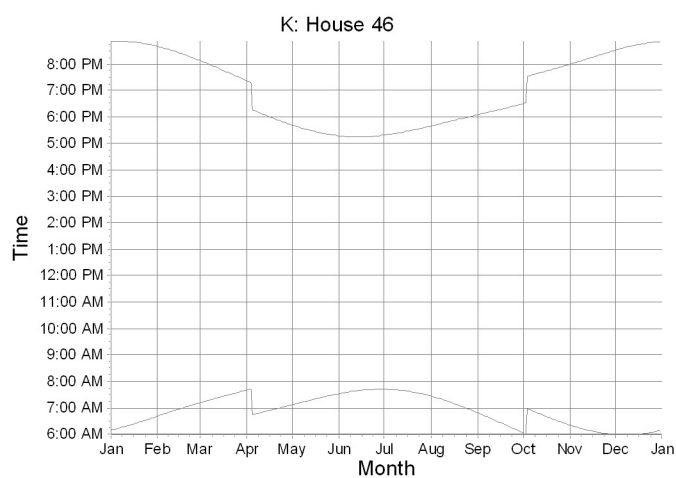
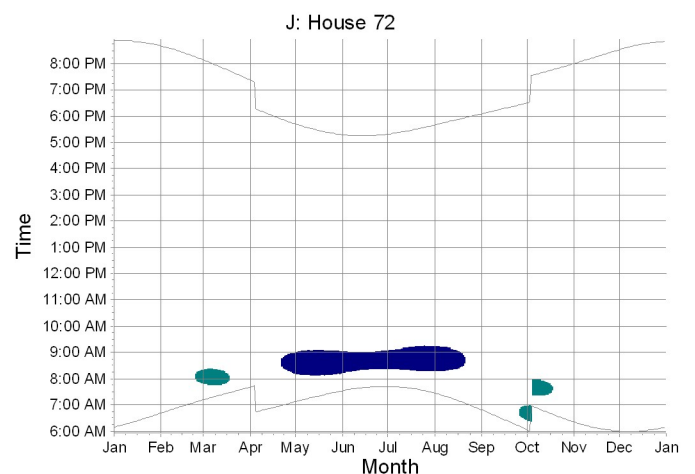
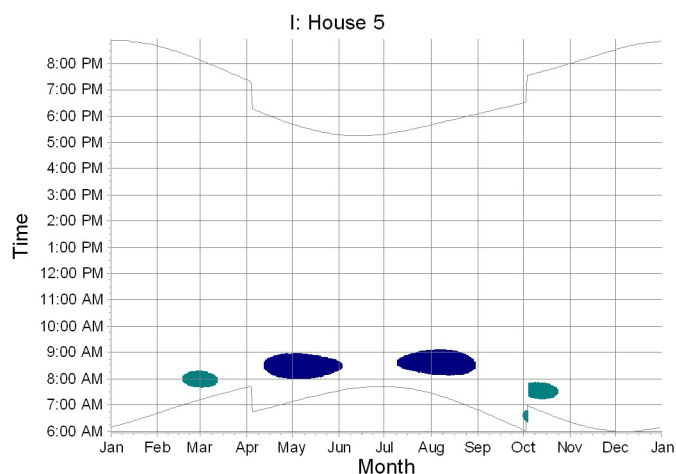
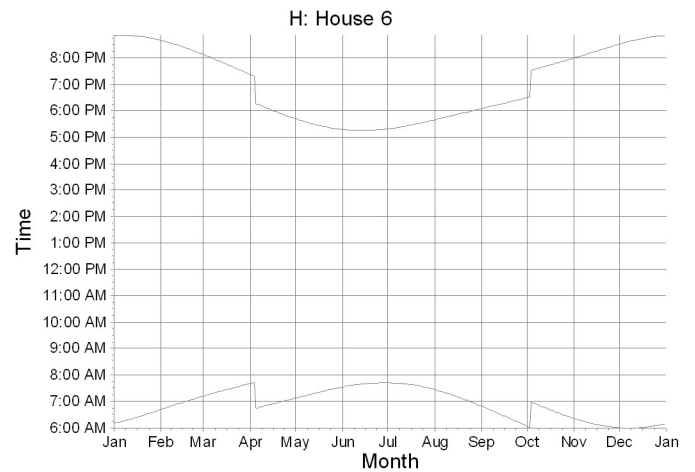
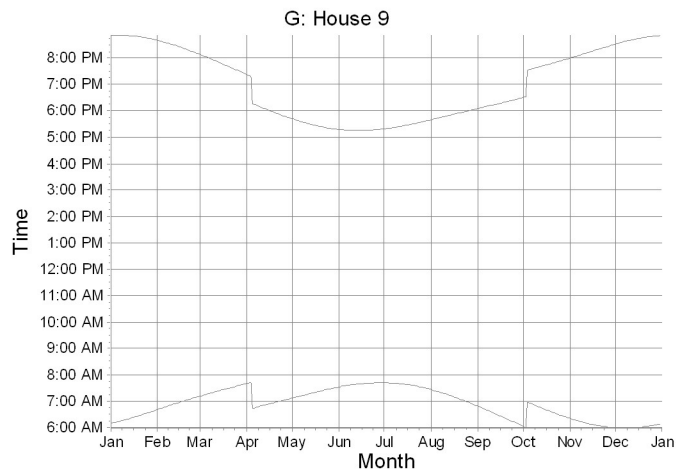
03 9429 5629

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## SHADOW - Calendar, graphical



WTGs

6: WTG 6 7: WTG 7

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# ADVERTISED PLAN

## SHADOW - Calendar per WTG

### WTG: 1 - WTG 1

#### Assumptions for shadow calculations

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

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	January	February	March	April	May	June	July	August	September	October	November	December
1	06:09	06:41	07:11	07:40	07:07	07:32	07:42	07:26	06:48	06:03	06:20	05:59
	20:51	20:40	20:08	19:22	17:41	17:17	17:18	17:39	18:05	18:30	19:59	20:31
2	06:10	06:42	07:12	07:41	07:08	07:32	07:42	07:25	06:47	06:01	06:19	05:59
	20:51	20:39	20:06	19:20	17:40	17:17	17:19	17:40	18:05	18:30	20:00	20:32
3	06:11	06:43	07:13	07:42	07:08	07:33	07:42	07:24	06:45	06:00	06:18	05:59
	20:51	20:38	20:05	19:19	17:39	17:16	17:19	17:41	18:06	18:31	20:01	20:33
4	06:12	06:44	07:14	07:43	07:09	07:34	07:41	07:23	06:44	06:58	06:17	05:59
	20:51	20:37	20:03	19:17	17:38	17:16	17:20	17:41	18:07	19:32	20:02	20:34
5	06:12	06:45	07:15	06:44	07:10	07:34	07:41	07:22	06:42	06:57	06:16	05:59
	20:51	20:36	20:02	18:16	17:37	17:16	17:20	17:42	18:08	19:33	20:04	20:35
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7	06:14	06:48	07:17	06:45	07:12	07:35	07:41	07:20	06:39	06:54	06:14	05:59
	20:51	20:34	19:59	18:13	17:35	17:15	17:21	17:44	18:10	19:35	20:06	20:37
8	06:15	06:49	07:18	06:46	07:13	07:36	07:41	07:19	06:38	06:52	06:13	05:59
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	20:41		19:23		17:17		17:38	18:04		19:58		20:50
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

# ADVERTISED PLAN

## SHADOW - Calendar per WTG

### WTG: 2 - WTG 2

#### Assumptions for shadow calculations

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

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	January	February	March	April	May	June	July	August	September	October	November	December
1	06:09	06:41	07:11	07:40	07:07	07:32	07:42	07:26	06:48	06:03	06:20	05:59
	20:51	20:40	20:08	19:22	17:41	17:17	17:18	17:39	18:05	18:30	19:59	20:31
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	20:41		19:23		17:17		17:38	18:04		19:58		20:50
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

# ADVERTISED PLAN

## SHADOW - Calendar per WTG

### WTG: 3 - WTG 3

#### Assumptions for shadow calculations

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

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	January	February	March	April	May	June	July	August	September	October	November	December
1	06:09	06:41	07:11	07:40	07:07	07:32	07:42	07:26	06:48	06:03	06:20	05:59
	20:51	20:40	20:07	19:22	17:41	17:17	17:18	17:39	18:05	18:30	19:59	20:31
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	20:41		19:23		17:17		17:38	18:04		19:58		20:50
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker



# ADVERTISED PLAN

## SHADOW - Calendar per WTG

WTG: 4 - WTG 4

### Assumptions for shadow calculations

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

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	January	February	March	April	May	June	July	August	September	October	November	December
1	06:09	06:41	07:11	07:40	07:07	07:32	07:42	07:26	06:48	06:03	06:20	05:59
	20:51	20:40	20:07	19:22	17:41	17:17	17:18	17:39	18:05	18:30	19:59	20:31
2	06:10	06:42	07:12	07:41	07:08	07:32	07:42	07:25	06:47	06:01	06:19	05:59
	20:51	20:39	20:06	19:20	17:40	17:17	17:19	17:40	18:05	18:30	20:00	20:32
3	06:11	06:43	07:13	07:42	07:08	07:33	07:42	07:24	06:45	05:59	06:18	05:59
	20:51	20:38	20:05	19:19	17:39	17:16	17:19	17:41	18:06	18:31	20:01	20:33
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	20:40		19:23		17:17		17:38	18:04		19:58		20:50
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

# ADVERTISED PLAN

## SHADOW - Calendar per WTG

WTG: 5 - WTG 5

### Assumptions for shadow calculations

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

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	January	February	March	April	May	June	July	August	September	October	November	December
1	06:09	06:41	07:11	07:40	07:07	07:32	07:42	07:26	06:48	06:03	06:20	05:59
	20:51	20:40	20:08	19:22	17:41	17:17	17:18	17:39	18:05	18:30	19:59	20:31
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Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

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	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Brewster

Licensed user:

RE Future Pty Ltd

21 Langridge St

AU-NEWTOWN VIC 3220

03 9429 5629

Vaughan Mitchell / v Vaughan.mitchell@refuture.com.au

Calculated:

19/11/2021 5:09 PM/3.4.424

## SHADOW - Calendar per WTG

WTG: 6 - WTG 6

### Assumptions for shadow calculations

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	06:09	06:41	07:11 07:41-08:19/38	07:40	07:07	07:32	07:42	07:26	06:48	06:03 06:26-06:57/31	06:20	05:59
2	20:51	20:40	20:08	19:22	17:41	17:17	17:18	17:39	18:05	18:30	19:59	20:31
3	06:11	06:43	07:12 07:40-08:20/40	07:41	07:08	07:32	07:42	07:25	06:47	06:01 06:25-06:57/32	06:19	05:59
4	20:51	20:39	20:06	19:20	17:40	17:17	17:19	17:40	18:05	18:31	20:00	20:32
5	06:12	06:44	07:13 07:40-08:20/40	07:42	07:09	07:33	07:42	07:24	06:45	06:00 06:24-06:58/34	06:18	05:59
6	20:51	20:38	20:05	19:19	17:39	17:16	17:19	17:41	18:06	18:31	20:01	20:33
7	06:12	06:44	07:14 07:41-08:21/40	07:43	07:09	07:34	07:42	07:23	06:44	06:58 06:22-06:57/35	06:17	05:59
8	20:51	20:37	20:03	19:17	17:38	17:16	17:20	17:42	18:07	19:32	20:03	20:34
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10	20:51	20:36	20:02	18:16	17:37	17:16	17:20	17:42	18:08	19:33	20:04	20:35
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13	06:14	06:48	07:17 07:42-08:21/39	06:45	07:12	07:35	07:41	07:20	06:39	06:54 07:18-07:57/39	06:14	05:59
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15	06:15	06:49	07:18 07:43-08:20/37	06:46	07:13	07:36	07:41	07:19	06:38	06:52 07:17-07:56/39	06:13	05:59
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60	20:41		19:25	17:42	17:18	17:18	17:37	18:03	18:29	19:57	20:30	20:50
61	06:40		07:39		07:31		07:27	06:50		06:22		06:08
62	20:41		19:23		17:17		17:38	18:04		19:58		20:50
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Sum of minutes with flicker	0	302	575	0	0	0	0	0	112	773	0	0

ADVERTISED  
PLAN

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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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Brewster

Licensed user:

RE Future Pty Ltd

21 Langridge St

AU-NEWTOWN VIC 3220

03 9429 5629

Vaughan Mitchell / v Vaughan.mitchell@refuture.com.au

Calculated:

19/11/2021 5:09 PM/3.4.424

## SHADOW - Calendar per WTG

WTG: 7 - WTG 7

### Assumptions for shadow calculations

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	06:09 20:51	06:41 20:40	07:11 20:08	07:40 19:22	07:07 17:41 08:00-08:58/58	07:32 17:17 08:14-09:00/46	07:42 17:18 08:24-09:02/38	07:26 17:39 08:11-09:13/62	06:48 18:05 08:10-09:12/62	06:03 18:30 08:10-09:12/62	06:21 19:59 08:10-09:12/62	05:59 20:31 08:10-09:12/62
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23	06:31 20:46	07:05 20:16	07:32 19:35	07:00 17:51	07:25 17:22 08:09-09:02/53	07:41 17:15 08:24-09:00/36	07:33 17:33 08:16-09:13/57	07:01 18:23 08:12-08:55/43	06:15 18:23 08:12-08:55/43	06:31 19:50 08:12-08:55/43	06:02 20:23 08:12-08:55/43	06:03 20:48 08:12-08:55/43
24	06:32 20:46	07:06 20:14	07:33 19:34	07:01 17:50	07:26 17:21 08:10-09:02/52	07:42 17:16 08:24-09:00/36	07:33 17:33 08:15-09:13/58	06:59 17:58 08:13-08:54/41	06:13 18:24 08:13-08:54/41	06:30 19:51 08:13-08:54/41	06:02 20:24 08:13-08:54/41	06:04 20:48 08:13-08:54/41
25	06:33 20:45	07:07 20:13	07:34 19:32	07:01 17:48	07:27 17:20 08:10-09:01/51	07:42 17:16 08:24-09:00/36	07:32 17:34 08:16-09:14/58	06:58 17:59 08:13-08:51/38	06:12 18:25 08:13-08:51/38	06:29 19:52 08:13-08:51/38	06:04 20:25 08:13-08:51/38	06:04 20:49 08:13-08:51/38
26	06:34 20:44	07:08 20:12	07:35 19:31	07:02 17:47	07:28 17:20 08:11-09:01/50	07:42 17:17 08:24-09:00/36	07:31 17:34 08:15-09:13/58	06:57 18:00 08:15-08:50/35	06:10 18:25 08:15-08:50/35	06:28 19:53 08:15-08:50/35	06:05 20:26 08:15-08:50/35	06:05 20:49 08:15-08:50/35
27	06:35 20:44	07:09 20:10	07:36 19:29	07:03 17:46	07:28 17:19 08:11-09:01/50	07:42 17:17 08:24-09:01/37	07:30 17:35 08:14-09:13/59	06:55 18:01 08:16-08:47/31	06:09 18:26 08:16-08:47/31	06:26 19:54 08:16-08:47/31	06:05 20:27 08:16-08:47/31	06:05 20:49 08:16-08:47/31
28	06:36 20:43	07:10 20:09	07:37 19:28	07:04 17:45	07:29 17:19 08:12-09:01/49	07:42 17:17 08:24-09:01/37	07:30 17:36 08:13-09:13/60	06:54 18:01 08:18-08:45/27	06:07 18:27 08:18-08:45/27	06:25 19:55 08:18-08:45/27	06:00 20:28 08:18-08:45/27	06:06 20:50 08:18-08:45/27
29	06:38 20:42	07:12 20:06	07:39 19:26	07:05 17:44	07:30 17:18 08:13-09:01/48	07:42 17:18 08:24-09:01/37	07:29 17:37 08:13-09:13/60	06:53 18:02 08:21-08:42/21	06:06 18:28 08:21-08:42/21	06:24 19:56 08:21-08:42/21	06:00 20:29 08:21-08:42/21	06:07 20:50 08:21-08:42/21
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31	06:40 20:41	07:14 20:03	07:39 19:23	07:07 17:42	07:31 17:17 08:13-09:00/47	07:42 17:38 08:24-09:02/38	07:27 17:38 08:11-09:13/62	06:50 18:04 08:11-09:13/62	06:03 18:04 08:11-09:13/62	06:22 19:58 08:11-09:13/62	06:08 20:30 08:11-09:13/62	06:09 20:50 08:11-09:13/62
Potential sun hours	447	378	382	334	314	289	305	332	355	404	423	455
Sum of minutes with flicker	0	0	0	772	1765	1161	1553	1499	0	0	0	0

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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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker



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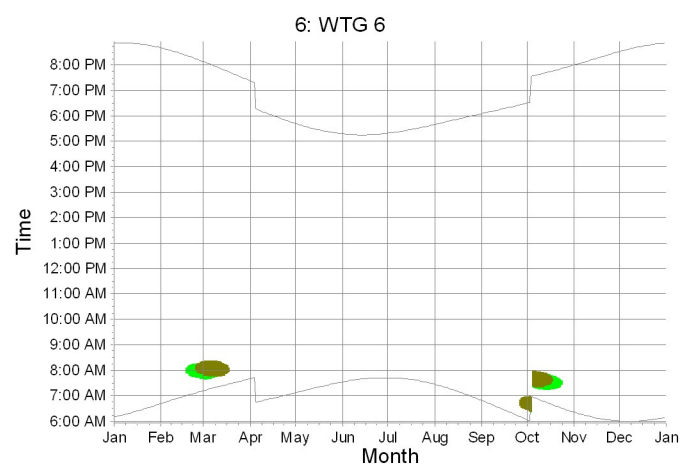
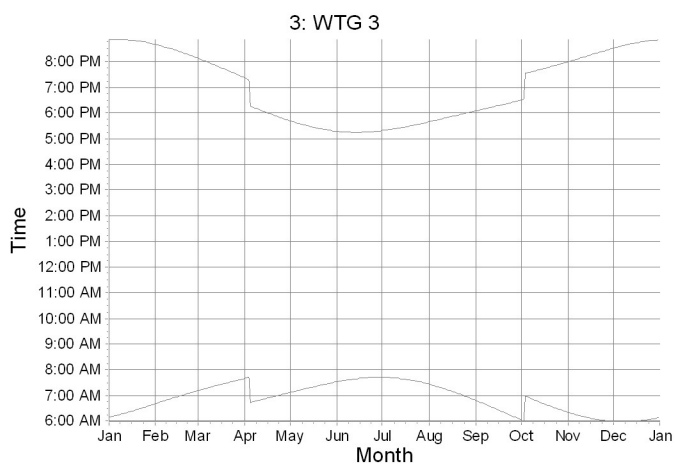
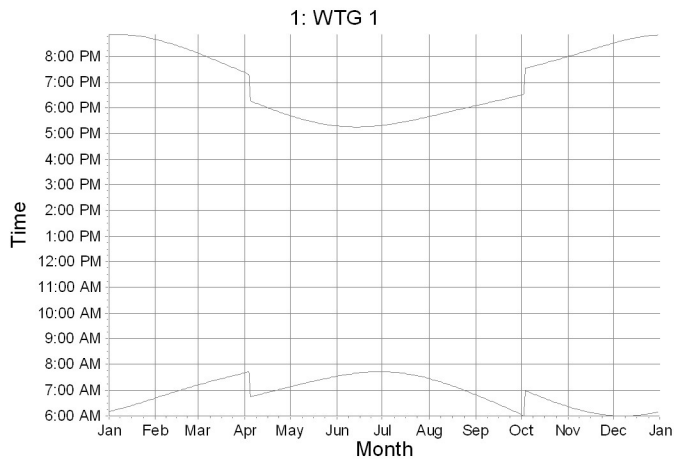
03 9429 5629

Vaughan Mitchell / [vaughan.mitchell@refuture.com.au](mailto:vaughan.mitchell@refuture.com.au)

Calculated:

19/11/2021 5:09 PM/3.4.424

## SHADOW - Calendar per WTG, graphical



Shadow receptors



I: House 5



J: House 72

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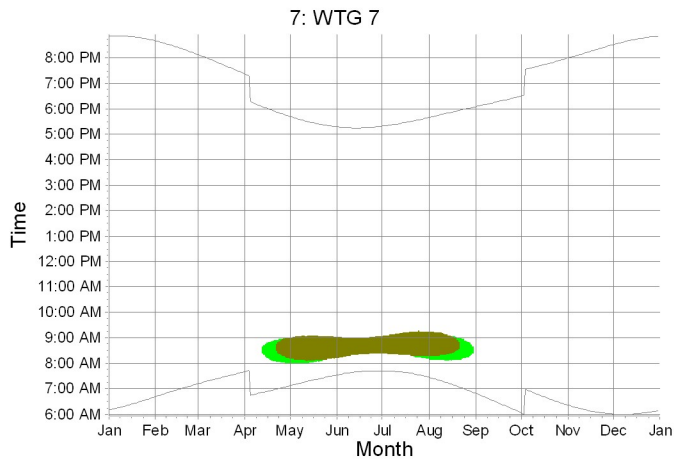
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Shadow receptors



I: House 5



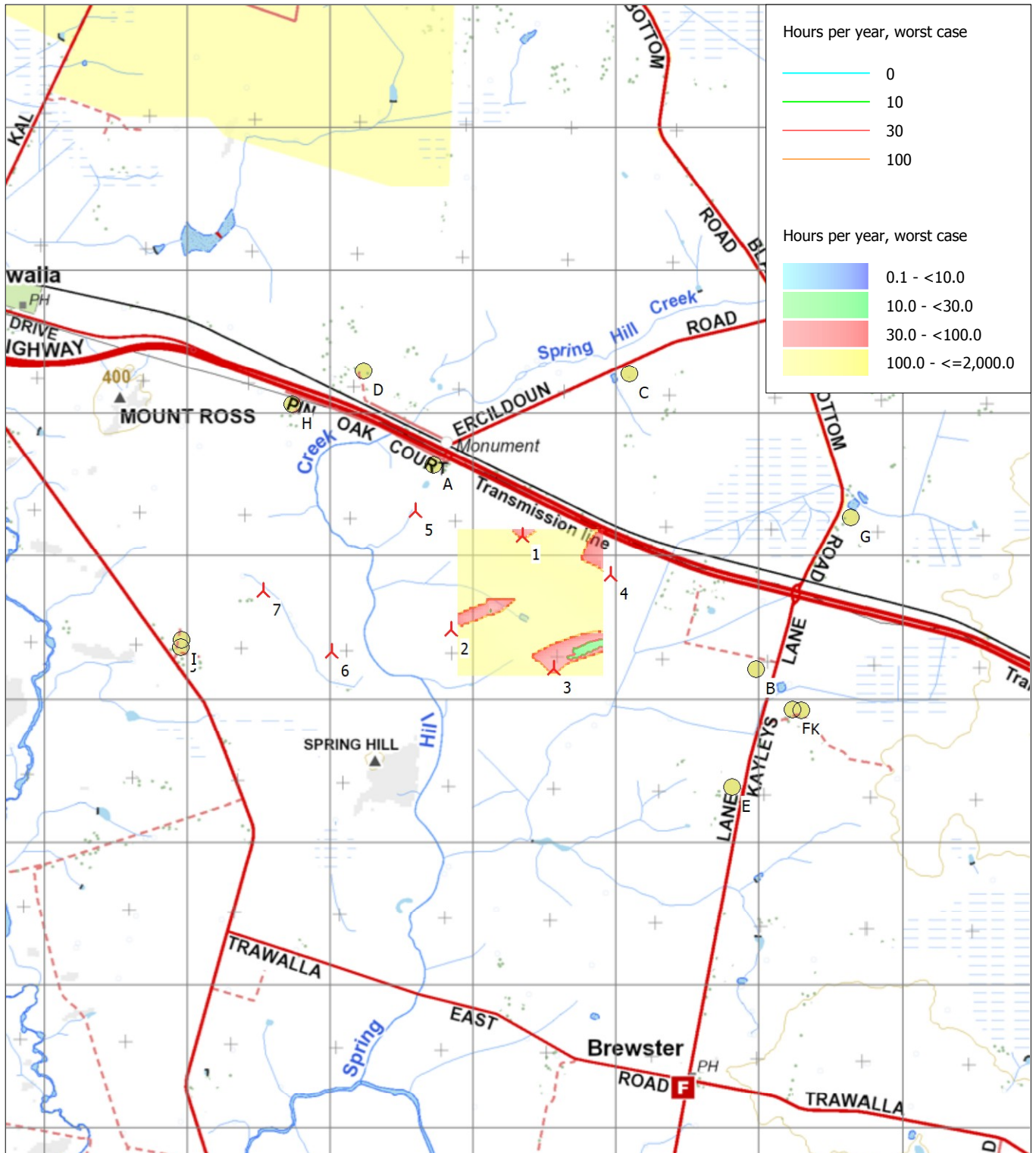
J: House 72

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## SHADOW - Map



0 500 1000 1500 2000 m

Map: BRE\_Custom\_210321 , Print scale 1:40,000, Map center UTM (south)-WGS84 Zone: 54 East: 722,299 North: 5,851,822

New WTG Shadow receptor

Flicker map level: Elevation Contours