Glint and Glare Assessment

Temora 1C Solar Farm

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ABBREVIATIONS

AC	Alternating current
CASA	Civil Aviation Safety Authority
DC	Direct current
FAA	Federal Aviation Administration (United States)
Ha	Hectare
ITP	ITP Renewables
MW	Megawatt, unit of power (1 million Watts)
MWp	Megawatt-peak, unit of power at standard test conditions used to indicate PV system capacity
NSW	New South Wales
OP	Observation point
PV	Photovoltaic
SGHAT	Solar Glare Hazard Analysis Tool

TABLES

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1 INTRODUCTION

1.1 Overview

ITP Development is proposing to develop a solar farm as described in Table 1. It will be located approximately 3.5 km southeast of the town of Temora, NSW (see Figure 1).

Table 1. Site Information

Parameter	Description
Solar farm name	Temora 1C Solar Farm
Site reference	Temora 1C
Lot/DP(s)	1/1110693
Street address	197 MORONEYS LANE TEMORA NSW 2666
Council	Temora Shire Council
AC capacity	5 MW
DC capacity	6.4 MW
Project area	Approx. 11 ha
Current land use	Alpaca grazing

This report provides a desktop glint and glare assessment to support the Development Application for the project. It provides:

- Identification of potential receptors of glint and glare from the proposed solar farm; and
- Assessment of the glint and glare hazard using the Solar Glare Hazard Analysis Tool (SGHAT) GlareGauge analysis

1.2 Glint and Glare

Glint is defined as a momentary flash of bright light, while glare is a continuous source of excessive brightness relative to ambient lighting (Federal Aviation Administration [FAA], 2018). The GlareGauge analysis used to assess the glint and glare hazard (see Section 3) was run with a simulation interval of one minute, as sunlight reflection from PV modules typically lasts for at least one minute. Glint, which lasts for less than one minute, is unlikely to occur from the sun based on how slowly the sun and modules move, so has not been considered further in this assessment.

Solar photovoltaic (PV) modules are designed to absorb as much light as possible to maximise efficiency (generally around 98% of the light received). To limit reflection, the modules are constructed from dark, light-absorbing material and the glass is treated with an anti-reflective coating. As a result, the glare generated from PV modules is lower than from many other surfaces, including cropping/grassland and concrete (an albedo of 20% is typically assumed for PV modules, compared to 25-30% for grass and up to 25% for concrete; Ramírez & Muňoz, 2012).

However, the glass modules still have the potential to generate glare. This needs to be assessed to ensure that visual receptors—such as road users, nearby buildings, air traffic control towers and aircraft pilots—are not impacted by the development of solar farms.

2 PROJECT DESCRIPTION

ITP Development is proposing to construct a solar farm with a DC capacity of 6.4 MW_p and AC output of 5 MW, on an approximately 11 ha site that is currently used for alpaca grazing.

There are to be approximately 12,100 solar modules installed on around 140 mounting structures running north to south. Each row of solar photovoltaic (PV) modules will rotate to track the sun across the sky from east to west each day. The hub height of each tracker will be around 1.5 m, with the peak of the modules reaching a height of approximately 2.75 m when the array is fully tilted to 60 degrees from horizontal. The general arrangement of the solar farm is shown on drawing TEM1C-G-210, and the array tracker details on drawing TEM1C-E-341.

The solar farm will also comprise two 3 MW inverter stations. These inverters are to be located within the array and are both mounted on a 12.19 m skid. Each of these inverter stations incorporate the high voltage switchgear and transformers. The arrangement of the inverter station skid is shown in drawing TEM1C-E-430.

The mounting system is constructed on piles that are driven into the ground. During construction, there is expected to be 50 personnel on site working from 7am – 4pm, Monday to Friday. The construction is expected to take approximately 3 months. Once operational, the site will be unmanned. Maintenance is expected to be carried out quarterly by a crew of 2to 3 people.

Solar panels and related infrastructure will be decommissioned and removed upon cessation of operations. This is likely to occur within two years of the end of the project. The site will be returned to the pre-development land use.

Figure 1. Proposed 48.56 ha solar farm site and surrounding farm area (note the project will comprise 11 ha within this area)

3 ANALYSIS

3.1 Overview

In a fixed-tilt PV array, the angle of incidence at which direct sunlight hits the PV modules varies as the sun moves across the sky. It will be smallest around noon when the sun is overhead and largest in the early morning and late afternoon when the sun is near the horizon. If the PV array is mounted on a single-axis tracking system as proposed in this project, the variation in the angle of incidence will be much smaller since the modules rotate to follow the sun. The main variation will be seasonal, i.e. because the sun is higher in the sky during summer and lower during winter. A PV array that is mounted on a tracking system therefore has less potential to cause glare.

The SGHAT was developed by Sandia National Laboratories to evaluate glare resulting from solar farms at different viewpoints, based on the location, orientation and specifications of the PV modules. This tool is required by the United States FAA for glare hazard analysis near airports and is also recognised by the Australian Government Civil Aviation Safety Authority (CASA).

The GlareGauge analysis uses SGHAT to provide an indication of the type of glare that can be expected at each potential receptor. Glare is indicated by three colours according to severity:

- Green glare: Low potential for temporary after-image;
- Yellow glare: Potential for temporary after-image; and
- Red glare: Retinal burn, not expected for PV.

The parameters used in the SGHAT model for the project are detailed in Table 2. GlareGauge default settings were adopted for the analysis time interval, direct normal irradiance, observer eye characteristics and slope error. The heights of the observation points were assumed to be 1.5m for a road user (i.e. sitting in a car) and 1.65m for a person (i.e. standing).

Table 2. SGHAT specification inputs

Parameters	Input
Time zone	UTC+10:00
Module tracking	Single axis
Module surface material	Smooth glass with ARC (anti-reflective coating)
Tracking axis tilt	0°
Tracking axis orientation	0°
Module offset angle (angle between module and tracking axis)	0°
Maximum tracking angle	60°
Resting angle	30°
Height of modules above ground	1.78m (height from the ground to the PV panel centroid)

3.2 Potential Receptors

For this project, visual receptors within 2 km of the site were considered including residences and road users. There is no formal guidance on the maximum distance at which glint and glare should be assessed; however, the significance of a reflection decreases with distance. This is due to the proportion of the observer's field of vision taken up by the reflective area decreasing as distance increases. In addition, as the separation distance increases, terrain and shielding by vegetation and other structures are more likely to obstruct the view of the reflective area. A 2-km radius from the site was considered appropriate based on it being highly unlikely for glint and glare impacts at distances greater than this. This is a conservative distance based on existing studies and assessment experience.

As shown in Figure 2, 3 commercial and 18 residential observation points were identified as potential visual receptors of the site. The potential for glare was also assessed along 11 different road routes.

While there was a greater number of residential/commercial properties considered, some were discounted based on large stands of trees and other structures acting as visual barriers.

The Temora Airport is located approximately 6 km north-west of the site so was not considered a potential visual receptor.

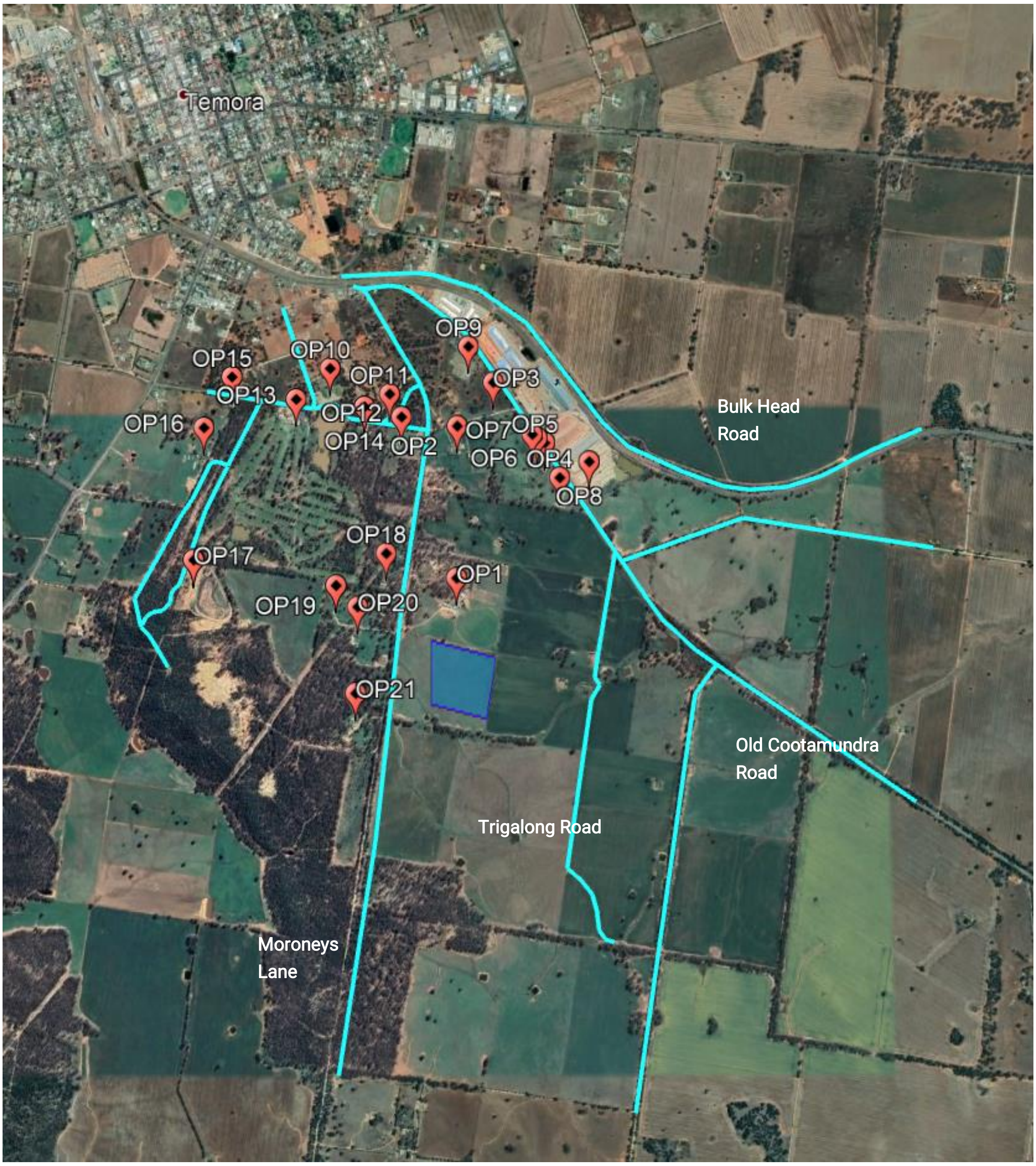

Figure 2. Map showing potential visual receptors within 2km of the site

3.3 Assumptions

The visual impact of solar farm development depends on the scale and type of infrastructure, the prominence and topography of the site relative to the surrounding environment, and any proposed screening measures to reduce visibility of the site. Some potential viewpoints were discounted because of significant existing features (such as trees or buildings), however, minor screening—such as roadside vegetation—was not assessed in detail. The GlareGauge analysis results are therefore considered conservative as the model assumes there is no screening. It is noted that the site is almost entirely cleared with only a few trees within the property.

Atmospheric conditions such as cloud cover, will also influence light reflection and the resulting impact on visual receptors. The same is true of varying tilt angles of the modules. Varying atmospheric conditions have not been accounted for in the GlareGauge analysis, nor have the complexities of backtracking (due to the software's limitations). The GlareGauge analysis assumes clear sky conditions, with a peak direct normal irradiance (DNI) of 1,000 W/m2 which varies throughout the day.

3.4 Results

The results of the GlareGauge analysis (attached in Appendix A) at each of the observation points are summarised in Table 3. None of the residences, commercial properties or road users are expected to experience any glare from the solar farm. Many residences will also not have direct view of the solar farm due to visual obstructions from trees and other structures. The distances in the table below are provided as indication of the location of the receptor relative to the solar array, but are not direct inputs to the GlareGauge analysis, which utilises the PV array centroid for its calculations.

Table 3. Glare potential at observation points

	Type of Observation Point	Location relative to solar farm	Green glare (minutes)	Yellow glare (minutes)	Glare potential
OP1	Residential	0.39 km north	0	0	No glare
OP2	Residential	1.2 km north	0	0	No glare
OP3	Residential	1.5 km north	0	0	No glare
OP4	Commercial	1.1 km north-east	0	0	No glare
OP5	Residential	1.2 km north-east	0	0	No glare
OP6	Residential	1.2 km north-east	0	0	No glare
OP7	Residential	1.2 km north-east	0	0	No glare
OP8	Commercial	1.2 km north-east	0	0	No glare
OP9	Infrastructure	1.6 km north	0	0	No glare

OP10	Residential	1.7 km north-west	0	0	No glare
OP11	Residential	1.5 km north	0	0	No glare
OP12	Residential	1.3 km north	0	0	No glare
OP13	Commercial	1.7 km north-west	0	0	No glare
OP14	Residential	1.4 km north-west	0	0	No glare
OP15	Residential	1.9 km north-west	0	0	No glare
OP16	Residential	1.8 km north-west	0	0	No glare
OP17	Residential	1.5 km west	0	0	No glare
OP18	Residential	0.7 km west	0	0	No glare
OP19	Residential	0.8 km west	0	0	No glare
OP20	Residential	0.6 km west	0	0	No glare
OP21	Residential	0.6 km south-west	0	0	No glare
Bulk Head Road	Road Route	North-east	0	0	No glare
Golf Club Road	Road Route	North-west	0	0	No glare
Miners Street	Road Route	North	0	0	No glare
Moroneys Lane	Road Route	North-west	0	0	No glare
Old Cootamundra Road	Road Route	North-east	0	0	No glare
Reynolds Lane	Road Route	North-east	0	0	No glare
Rifle Range Road	Road Route	West	0	0	No glare
Trigalong Road	Road Route	South-east	0	0	No glare

Unnamed Road	Road Route	East	0	0	No glare
Websters Lane	Road Route	North	0	0	No glare
Woodlands Road	Road Route	West	0	0	No glare

4 SUMMARY

The results of the GlareGauge analysis indicated that the selected observation points are unlikely to receive glare due to the proposed solar farm.

Existing roadside vegetation and structures are expected to provide a physical obstruction between the solar farm and road users on the major roads at risk of glare (Moroneys Lane, Trigalong Road and Old Cootamundra Road), further minimising the visual impact of the project. Road users approaching the solar farm along the other roads surrounding the site are also not expected to experience any glare.

5 REFERENCES

Federal Aviation Administration (FAA) (2018). Solar Guide: Technical Guidance for Evaluating Selected Solar Technologies on Airports. Retrieved from the FAA website: https://www.faa.gov/airports/environmental/

Ramírez, A. Z., & Muňoz, C. B (2012). Albedo effect and energy efficiency of cities. Sustainable Development – Energy, Engineering and Technologies – Manufacturing and Environment. Retrieved from https://www.intechopen.com/books/sustainable-development-energy-engineering-and-technologies-manufacturing-and-environment/albedo-effect-and-energy-efficiency-of-cities

APPENDIX A. FORGESOLAR GLARE ANALYSIS

FORGESOLAR GLARE ANALYSIS

Project: **TEM1C**
Site configuration: **TEM1C - OPs Updated**
Analysis conducted by ITP Engineering (engineering@itpau.com.au) at 00:07 on 02 Mar, 2021.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 50337.7842

PV Array(s)

Name: PV array TEM1C - KMZ
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 30.0°
Rated power: 6400.0 kW
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.474010	147.548960	317.08	1.78	318.86
2	-34.474808	147.552750	308.72	1.78	310.50
3	-34.477720	147.552209	310.13	1.78	311.91
4	-34.477030	147.548960	312.72	1.78	314.50

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-34.472307	147.550427	318.74	1.65
OP 2	2	-34.464923	147.550439	319.36	1.65
OP 3	3	-34.462780	147.552567	326.06	1.65
OP 4	4	-34.467440	147.556506	320.41	1.65
OP 5	5	-34.465738	147.555622	321.57	1.65
OP 6	6	-34.465508	147.555182	323.61	1.65
OP 7	7	-34.465331	147.554885	324.28	1.65
OP 8	8	-34.466659	147.558253	312.02	1.65
OP 9	9	-34.460999	147.551083	316.02	1.65
OP 10	10	-34.462079	147.542858	306.98	1.65
OP 11	11	-34.463344	147.546421	313.94	1.65
OP 12	12	-34.464476	147.547133	318.11	1.65
OP 13	13	-34.463601	147.540859	311.46	1.65
OP 14	14	-34.463972	147.544930	312.98	1.65
OP 15	15	-34.462502	147.537030	311.74	1.65
OP 16	16	-34.464998	147.535417	311.65	1.65
OP 17	17	-34.471420	147.535021	332.75	1.65
OP 18	18	-34.471113	147.546288	323.05	1.65
OP 19	19	-34.472656	147.543359	321.36	1.65
OP 20	20	-34.473683	147.544638	320.00	1.65
OP 21	21	-34.477805	147.544564	326.31	1.65

Route Receptor(s)

Name: Bulk Head Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.456107	147.543583	299.32	1.50	300.82
2	-34.455939	147.547757	303.20	1.50	304.70
3	-34.456089	147.549001	302.21	1.50	303.71
4	-34.456771	147.551619	304.16	1.50	305.66
5	-34.458549	147.554559	307.99	1.50	309.49
6	-34.464102	147.559850	315.22	1.50	316.72
7	-34.465110	147.561502	314.53	1.50	316.03
8	-34.466296	147.565429	311.43	1.50	312.93
9	-34.466720	147.567403	309.28	1.50	310.78
10	-34.466703	147.569120	305.89	1.50	307.39
11	-34.466366	147.571051	303.82	1.50	305.32
12	-34.465482	147.573454	301.60	1.50	303.10
13	-34.463748	147.578175	298.24	1.50	299.74

Name: Golf Club Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.461926	147.536027	308.08	1.50	309.58
2	-34.462652	147.541579	310.87	1.50	312.37
3	-34.462528	147.541853	309.67	1.50	311.17
4	-34.462311	147.541928	308.72	1.50	310.22
5	-34.459892	147.540914	304.77	1.50	306.27

Name: Miners Street
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.462740	147.553992	319.79	1.50	321.29
2	-34.463412	147.550752	320.38	1.50	321.88
3	-34.463412	147.550366	320.02	1.50	321.52
4	-34.463819	147.548821	316.74	1.50	318.24
5	-34.463235	147.544565	312.97	1.50	314.47
6	-34.463474	147.544236	312.18	1.50	313.68
7	-34.462833	147.543206	311.29	1.50	312.79
8	-34.462720	147.542627	309.45	1.50	310.95
9	-34.462767	147.542284	309.11	1.50	310.61
10	-34.462754	147.541576	311.02	1.50	312.52

Name: Moroneys Lane
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.493721	147.543175	344.16	1.50	345.66
2	-34.463404	147.548779	317.07	1.50	318.57
3	-34.462024	147.548543	316.26	1.50	317.76
4	-34.456911	147.544895	301.24	1.50	302.74

Name: Old Cootamundra Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.456738	147.544762	300.80	1.50	302.30
2	-34.456703	147.547186	306.41	1.50	307.91
3	-34.458950	147.550941	310.70	1.50	312.20
4	-34.472483	147.562078	301.38	1.50	302.88
5	-34.475278	147.565640	301.88	1.50	303.38
6	-34.481469	147.576841	296.38	1.50	297.88

Name: Reynolds Lane
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.470068	147.560176	304.70	1.50	306.20
2	-34.467945	147.567429	309.35	1.50	310.85
3	-34.469644	147.579360	291.06	1.50	292.56

Name: Rifle Range Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.462304	147.538772	314.51	1.50	316.01
2	-34.465497	147.536862	315.75	1.50	317.25
3	-34.465311	147.536111	314.79	1.50	316.29
4	-34.465488	147.535800	314.18	1.50	315.68
5	-34.471901	147.531680	344.61	1.50	346.11
6	-34.473077	147.531476	355.10	1.50	356.60
7	-34.473245	147.532045	357.90	1.50	359.40
8	-34.474422	147.533139	360.57	1.50	362.07
9	-34.475191	147.533750	366.46	1.50	367.96

Name: Trigalong Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.475257	147.565597	302.06	1.50	303.56
2	-34.476424	147.564481	302.50	1.50	304.00
3	-34.495986	147.560747	313.49	1.50	314.99

Name: Unnamed Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.469882	147.559632	305.62	1.50	307.12
2	-34.474544	147.558795	301.66	1.50	303.16
3	-34.475825	147.558540	302.98	1.50	304.48
4	-34.476187	147.558835	302.98	1.50	304.48
5	-34.476885	147.558337	302.17	1.50	303.67
6	-34.484859	147.556882	305.15	1.50	306.65
7	-34.485519	147.557855	304.97	1.50	306.47
8	-34.486067	147.558327	305.18	1.50	306.68
9	-34.486775	147.558606	305.20	1.50	306.70
10	-34.487694	147.558649	306.08	1.50	307.58
11	-34.488101	147.559056	309.65	1.50	311.15
12	-34.488260	147.560108	308.36	1.50	309.86

Name: Websters Lane
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.463307	147.545176	313.53	1.50	315.03
2	-34.463028	147.545315	313.70	1.50	315.20
3	-34.462382	147.546726	314.00	1.50	315.50
4	-34.461431	147.547155	313.20	1.50	314.70
5	-34.461073	147.547847	312.57	1.50	314.07

Name: Woodlands Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-34.465513	147.536846	315.78	1.50	317.28
2	-34.467335	147.535751	318.38	1.50	319.88
3	-34.471253	147.534196	337.02	1.50	338.52
4	-34.471616	147.533745	342.80	1.50	344.30
5	-34.472155	147.533692	347.06	1.50	348.56
6	-34.472500	147.533273	352.77	1.50	354.27
7	-34.472607	147.532629	358.02	1.50	359.52
8	-34.473173	147.532029	357.99	1.50	359.49

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array TEM1C - KMZ	SA tracking	SA tracking	0	0	18,480,000.0

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
Bulk Head Road	0	0
Golf Club Road	0	0
Miners Street	0	0
Moroneys Lane	0	0
Old Cootamundra Road	0	0
Reynolds Lane	0	0
Rifle Range Road	0	0
Trigalong Road	0	0
Unnamed Road	0	0
Websters Lane	0	0
Woodlands Road	0	0

Results for: PV array TEM1C - KMZ

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Receptor	Green Glare (min)	Yellow Glare (min)
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
Bulk Head Road	0	0
Golf Club Road	0	0
Miners Street	0	0
Moroneys Lane	0	0
Old Cootamundra Road	0	0
Reynolds Lane	0	0
Rifle Range Road	0	0
Trigalong Road	0	0
Unnamed Road	0	0
Websters Lane	0	0
Woodlands Road	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare
0 minutes of green glare

Route: Bulk Head Road

0 minutes of yellow glare
0 minutes of green glare

Route: Golf Club Road

0 minutes of yellow glare
0 minutes of green glare

Route: Miners Street

0 minutes of yellow glare

0 minutes of green glare

Route: Moroneys Lane

0 minutes of yellow glare
0 minutes of green glare

Route: Old Cootamundra Road

0 minutes of yellow glare
0 minutes of green glare

Route: Reynolds Lane

0 minutes of yellow glare
0 minutes of green glare

Route: Rifle Range Road

0 minutes of yellow glare
0 minutes of green glare

Route: Trigalong Road

0 minutes of yellow glare
0 minutes of green glare

Route: Unnamed Road

0 minutes of yellow glare
0 minutes of green glare

Route: Websters Lane

0 minutes of yellow glare
0 minutes of green glare

Route: Woodlands Road

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size.
Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

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