Kidman Way Solar Farm

Glint and Glare Assessment

moir
landscape architecture

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Glint and Glare Assessment

Prepared for

NGH Consulting on behalf of Green Gold Energy Pty Ltd

Issue

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Executive Summary

Moir Landscape Architecture (Moir LA) have been engaged by NGH Consulting on behalf of Green Gold Energy Pty Ltd (GGE) (the proponent) to provide a glint and glare assessment for the proposed Kidman Way Solar Farm (the Project). The report will accompany the Environmental Impact Statement (EIS) prepared for the Project.

This Project is located at Kidman Way, Hillston approximately 2.5 kilometers (km) south of Hillston (NSW) in Carrathool Shire Local Government Area (LGA).

The glint and glare assessment has been prepared in accordance with the Department of Planning and Environment (DPE) (now Department of Planning, Housing and Infrastructure (DPHI) Large-Scale Solar Energy Guideline (August 2022) (referred to hereafter as 'the Guideline').

In accordance with the Guideline, the following has been assessed:

- Receptors within 3 km of the proposed solar array with a line of sight of the solar array.
- All roads and rail lines within 1 km of the proposed solar array.
- Aviation receptors within 5 km of the proposed solar array.

Moir LA have undertaken this glint and glare assessment utilising the Solar Glare Hazard Analysis Tool (SGHAT). The SGHAT is used to evaluate glare resulting from solar farms at different receptors, based on proximity, orientation and specifications of the PV modules.

A total of 50 privante receptors with a line of sight to the Project and two (2) public receptors within 3 km of the Project were identified as sensitive Observation Points (OP). Based on the assessment no potential "Yellow" glare were investigated for private and public receptors.

One (1) road and One (1) rail receptors within 1 km of the Project were identified. Based on the assessment, no potential "Yellow" glare were observed for road and rail receptors.

One (1) landing strip was identified within a 5 km radius north west of the Project. As part of the assessment two flight paths were identified for each strip. Based on the assessment no potential "Yellow" glare was identified for either of these flight paths.

It is noted that the assessment is based on a worst-case scenario and does not take into account weather conditions, and intervening elements such as vegetation or built structures.

As a result of the findings, and in accordance with the Guidlines, no mitigation measures are required for the Project.

1.0 Introduction

1.1 The purpose of this report

The Kidman Way Solar Farm (the Project) is a Regionally Significant Development (RSD) located in Carrathrool Shire Council. This report has been prepared in response to the request from Carrathool Shire Council 'to prepare a glint and glare report in accordance with the Solar Glare Hazard Analysis Tool (SGHAT 3.0) in conjunction with a viewshed analysis'. This report refers to the methodology and performance objectives outlined in the Large-Scale Solar Energy Guideline, 2023, to assist in establishing a baseline for assessment and evaluation.

Glint is generally defined as a momentary flash of bright light while glare can be defined as continuous source of excessive brightness proportionates to ambient lighting (FAA, 2021).

While glint and glare impacts can be relatively uncommon, it is important to model and assess these impacts to ensure any potential significant impact is avoided or mitigated appropriately (DEP (now DPHI), 2022). Assessments must to be undertaken to ensure that sensitive visual receptors such as road users, surrounding rail network, nearby buildings, air traffic controllers and pilots are not impacted by the proposed development (ForgeSolar, 2022).

The performance objectives as the Guideline for Residential Receivers, Road and Rail Receivers and Aviation Receivers are outlined in each of the receiver assessments.

1.2 Glint and glare key principles

The key principles for ensuring the Project can be undertaken whilst maintaining an acceptable level of amenity are outlined in the Guideline as follows:

1. **Solar panels should be sited to reduce the likely impacts of glint and glare.**

2. **Solar panels and other infrastructure should be constructed of materials and / or treated to minimise glint and glare.**

3. **If large scale solar energy development is likely to exceed the relevant criteria for glare and standards for glint, mitigation strategies should be adopted.**

1.3 Assessment requirements

Carrathool Shire Council has requested a *"Glint and Glare Assessment Report utilising the Solar Glare Hazard Analysis Tool (SGHAT 3.0) in conjunction with a viewshed analysis".* To assist in establishing a baseline for assessment and evaluation, this report has been prepared in accordance with the Solar Guideline. **Table 1** provides an outline of the stages of the report.

The objective of the assessment as to assess the potential glint and glare resulting from the Project and provide recommendations to reduce potential impacts to ensure there is no significant risk to motorists / pilots and nuisance is minimised at residences.

Report Structure	
Stages in report:	**Summary:**
Section 2.0: Study Methodology	Assessment Methodology Modelling Assumptions Backtracking Operations
Section 3.0: Project Overview	Site context Solar Panel Specifications Array Layout
Section 4.0: Residential Receptors	Assessment of all residential receptors within 3 km of the proposed solar array that have a line of sight.
Section 5.0: Road and Rail Receptors	Assessment of all roads and rail lines within 1 km of the proposed solar array.
Section 6.0: Aviation Receptors	Assessment of all air traffic control towers and take off / landing approaches to any runway or landing strip within 5 km of the proposed solar array.
Section 7.0: Performance Objectives	Summary of assessment results
Section 8.0: Conclusion	Conclusion of report

Table 1 Overview of Report Structure

2.0 Study Method

2.1 Assessment Methodology

Moir LA have undertaken this Glint and Glare Assessment utilising Solar Glare Hazard Analysis Tool (SGHAT 3.0) developed by Sandia National Laboratories. The SGHAT is used to evaluate glare resulting from solar farms at different receptors, based on proximity, orientation and specifications of the PV modules. This tool is recognised by the Australian Government Civil Aviation Safety Authority (CASA).

SGHAT is used to indicate the nature of glare that can be expected at each potential receptor. Glare can be broadly classified into three categories and presented by the following three colours:

- **Green Glare:** Low potential for temporary after-image
- **Yellow Glare:** Potential for temporary after-image
- **Red Glare:** Retinal burn, not expected for PV.

Note: The main focus of this assessment is the yellow glare. Red glare is not expected for PV and green glare is low potential to cause after image and deemed negligible. (Ho, 2011)

The glare analysis tool used to assess the glint and glare hazard was run at a simulation interval of one minute, based on the reflectivity of solar rays off PV modules which typically lasts for at least one minute.

Modelling for the solar farms in the SGHAT tool is based on the following factors:

- Position of the sun over time with respect to the location of the proposed solar farm.
- Assessment is based on a worst-case scenario assuming clear weather all year round, (ie. no consideration of cloud coverage).
- Tracking axis tilt, tracking axis orientation and properties of the PV modules.
- The potential impacts of topography in screening the instances of glare. (does not take into account intervening elements such as vegetation and built structures).

2.2 Modelling Assumptions

The glare and glint impact is calculated utilising the geographic location, elevation, position of the sun and other vector calculations including module orientation, reflective environment and visual factors. Sun position is determined at every one (1) minute interval throughout the year.

Although the SGHAT is an extensive tool to understand the impacts of potential glare, it does not consider weather conditions, separation between PV modules and existing surrounding vegetation (if present) between the Project and a sensitive receiver.

Single axis tracking PV panels with the maximum height of 2.757 m, capable of rotating to a maximum of 60° have been considered to indicate a full rotational range of 120° for this analysis. The trackers are oriented north south with a maximum pitch distance of 6 m. Glare modelling has been conducted to correspond to maximum tracker height to provide a wider range of observed solar glare based on the extremities.

The glint and glare effects of PV panels 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.

Glare modelling has been conducted using the ‘Shade-Slope’ backtracking function within the SGHAT tool. Ground Coverage Ratio (GCR) calculations are used within the SGHAT tool for ‘Shade-Slope’ backtracking analysis. GCR is defined as the ratio of the array length (L) to proposed pitch distance (R) (Doubleday et al. 2016). (Refer to **Image 1**)

$$\text{GCR} = \frac{L}{R}$$

For this assessment GCR is calculated considering L = 2.2778 m and R = 6 m. The resulting GCR = 0.38

Section 3.0 provides an overview of the PV panel parameters used for the assessment.

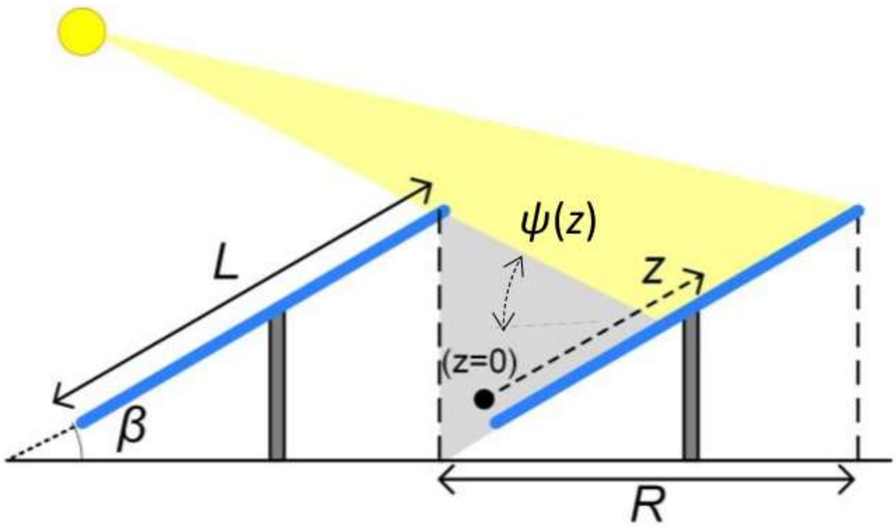


Image 1 Ground Coverage Ratio Calculations (Doubleday et al. 2016)

2.3 Backtracking Operations

A single axis horizontal tracking system can be configured to do a ‘backtracking’ technique, which implies that when the sun is low in the sky in the morning or evening, the tracking system can adjust the panels to maximise solar capture while minimising overshadowing (Refer to **Image 2**).

The SGHAT tool uses a simplified model of backtracking to avoid shading. Single-axis trackers follow the movement of the sun as it moves east to west throughout the day. Yields are maximised, and light reflection is minimised when panels are directly facing the sun. In times when the sun is not in the tracking range, it is assumed that the panels continuously ‘backtrack’ to their resting angle of 0° (horizontal) over the night . Due to this, glare from the backtracking mechanism will be more conservatively simulated and at times of sunset and sunrise, when the sun is at a lower angle relative to the array, glare impacts will be more noticeable.

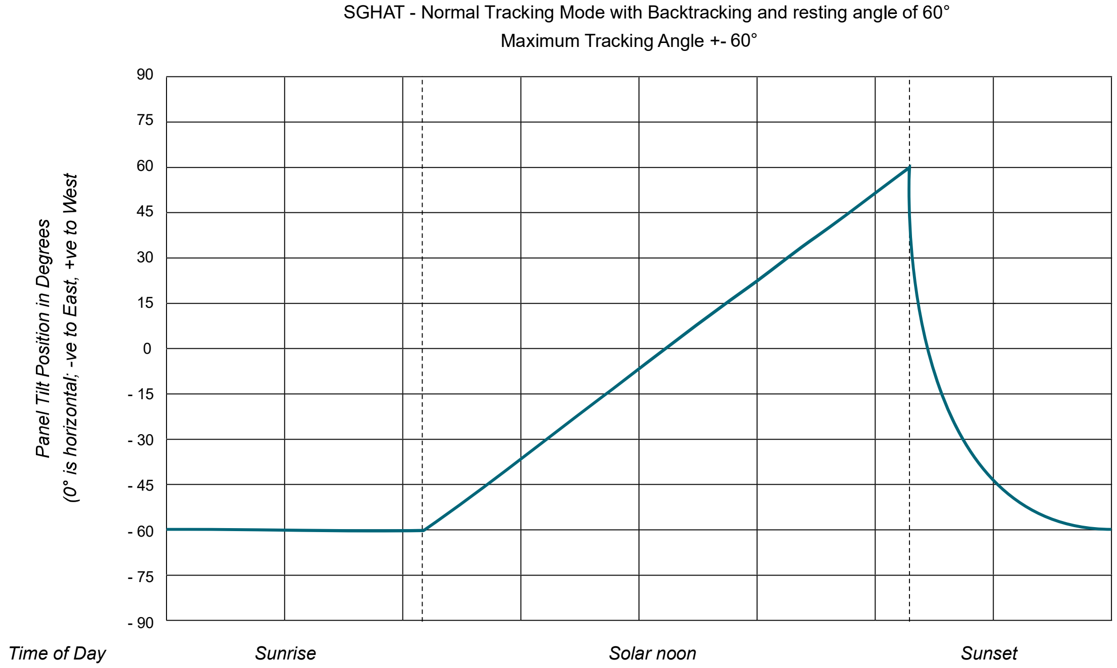
Variable angles of incidence of the sun relative to the panels may occur when the tracking system is performing a backtracking operation, and this variation is somewhat represented by SGHAT software in its update of 2022.

‘Shade-Slope’ backtracking function within the SGHAT tool considers the lowest possible panel rotation angle during backtracking. Therefore, 60° resting angle option is modelled. This function simulates the impression of the panels returning to a predefined angle after the maximum tilt angle has been attained.

It is important to note however, that the backtracking modelling is not a realistic representation of how a backtracking technique would work in actuality but gives an indication of the potential glare of shifting the PV panels away from the sun after the maximum tilt is reached.

For the purposes of the assessment, the assumptions for backtracking in relation to the Project is as follows:

- Normal tracking with backtracking and a night time stowing angle of 60° for the Project. In this case, the panels move between the operational range (maximum tilt).



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60° Resting Angle

Image 2 Normal Tracking with Backtracking and Resting Angle of 60° (2023)

3.0 Project Overview

3.1 Site Context

The Project is located approximately 2.5 km south of Hillston (NSW) in Carrathool Shire LGA at Kidman Way, Hillston as shown in **Figure 1**.

The Project involves the operation of a 4.95 Megawatt (MW) solar farm, two inverter stations, including the inverter and transformer High Voltage (HV) switchboard with the necessary infrastructure to connect it to the existing 33 kV line.

The Project will cover an area of roughly 66.66 hectares (ha) with a proposed development footprint of approximately 12.35 hectares (ha).

The Project is situated approximately 50 m from the northern boundary of the Hillston Solar Farm. The regional context and location of the Project can be found in **Figure 1.**

Figure 1 Project Site Context (Map Source: Google Earth, 2024)

3.2 Solar Panel Specifications

Each module consists of P type Mono-crystalline cell type with a 2.0 mm, anti-reflection coated semi-tempered glass set in an anodised aluminium alloy frame (Suzhou Talesun Solar Technologies Co., Ltd. 2021). (To e confirmed by client)

To attain optimum solar energy collection, the Project modelling has utilised a maximum rotational range of 120°. The panels are fixed on a tubular frame with a single axis tracking procedure. For accuracy, glare analysis has been performed using maximum tracker height not exceeding 1.71 m when facing at the highest angle.

Refer to **Figure 2** for typical panel dimensions utilised for this assessment.

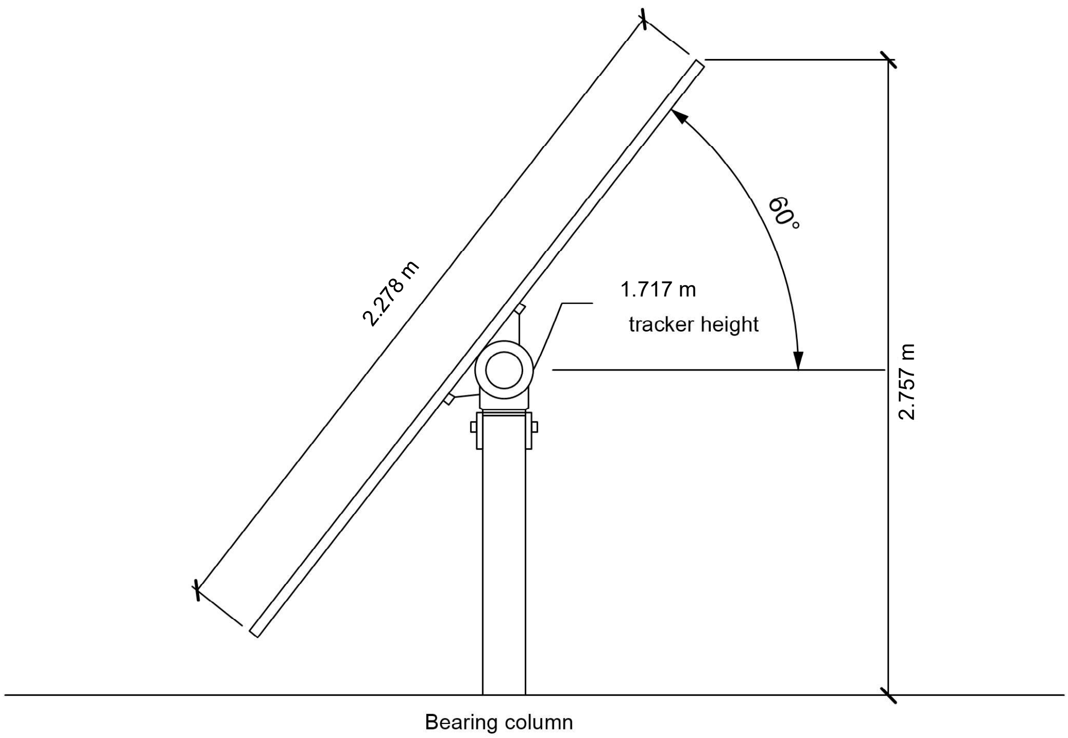


Figure 2 PV Parameters utilised for assessment (provided by Green Gold Energy Pty Ltd (GGE))

General Solar PV system inputs:			
Input Data	**Units**	**Value**	**Comments**
Time Zone	UTC	+10	NSW time Zone
Orientation of Array	Degrees	0	Rows aligned in north-south directions
PV Surface materials	-	Smooth Glass with Anti-Reflective Coating	Provided by the Green Gold Energy Pty Ltd (GGE).
Mounting Type	-	Single Axis Tracking	As per tracker data sheet
Single Axis Tracking Parameters			
Axis Orientation	Degrees	0	Panels orientated north south
Module Offset angle	Degrees	0	Facing upwards Panels rotate during operation
Max tracking angle	Degrees	±60° (Range of 120°)	Panels following the Sun
Resting angle	Degrees	60°	Panels following the Sun, to represent backtracking and after dark stowing angles
Maximum Tracker Height	Metres	1.717 m	Provided by the Green Gold Energy Pty Ltd (GGE).
Backtracking	-	Shade-Slope	Provided by the Green Gold Energy Pty Ltd (GGE).
Ground Coverage Ration	-	0.38	Ratio of the Array length to the pitch distance as provided by the Green Gold Energy Pty Ltd (GGE).

Table 2. Summary of modelling parameters

3.3 Array layout

A single axis tracking system follows the sun's trajectory and rotates the panels across east to west. The rows of modules will be spaced approximately 6 m apart to ensure no shading occurs and allows for ease of access for maintenance purposes (refer to **Table 2**).

Figure 3 PV Array Areas (Map Source: Google Earth, 2024)

4.0 Private Receptors

4.1 Overview of methodology

Table 3 provides an overview of the scope, methodology and performance objectives for assessment of glint and glare on residential receptors.

Glint and Glare Requirements - Private Receptors		
Scope	**Methodology**	**Performance Objective**
All residential receptors within 3 km of the proposed solar array that have a line of sight. Representative viewpoints may be used for residential receptors that are clustered together.	**Analysis of the daily and yearly glare impacts in minutes.** **All residential receptors must be assessed at a height of 1.5 m above ground level.**	**Refer to Table 4.**
Note: Modelling for residential receptors is calculated on a receptor height of 1.5 m AGL.		

Table 3. Residential Receptors Assessment Requirements (Source: DPE (now DPHI), 2022)

Impact rating and performance objectives for glare impacts to residential		
High Glare Impact	**Moderate Glare Impact**	**Low Glare Impact**
> 30 minutes per day **> 30 hours per year**	**< 30 minutes per day** **< 30 hours per year**	**< 10 minutes per day** **< 10 hours per year**
Significant amount of glare that should be avoided	*Implement mitigation measures to reduce impacts as far as practicable*	*No mitigation required*

Table 4. Residential Receptor Impact Rating and Performance Objectives (Source: DPE (now DPHI), 2022)

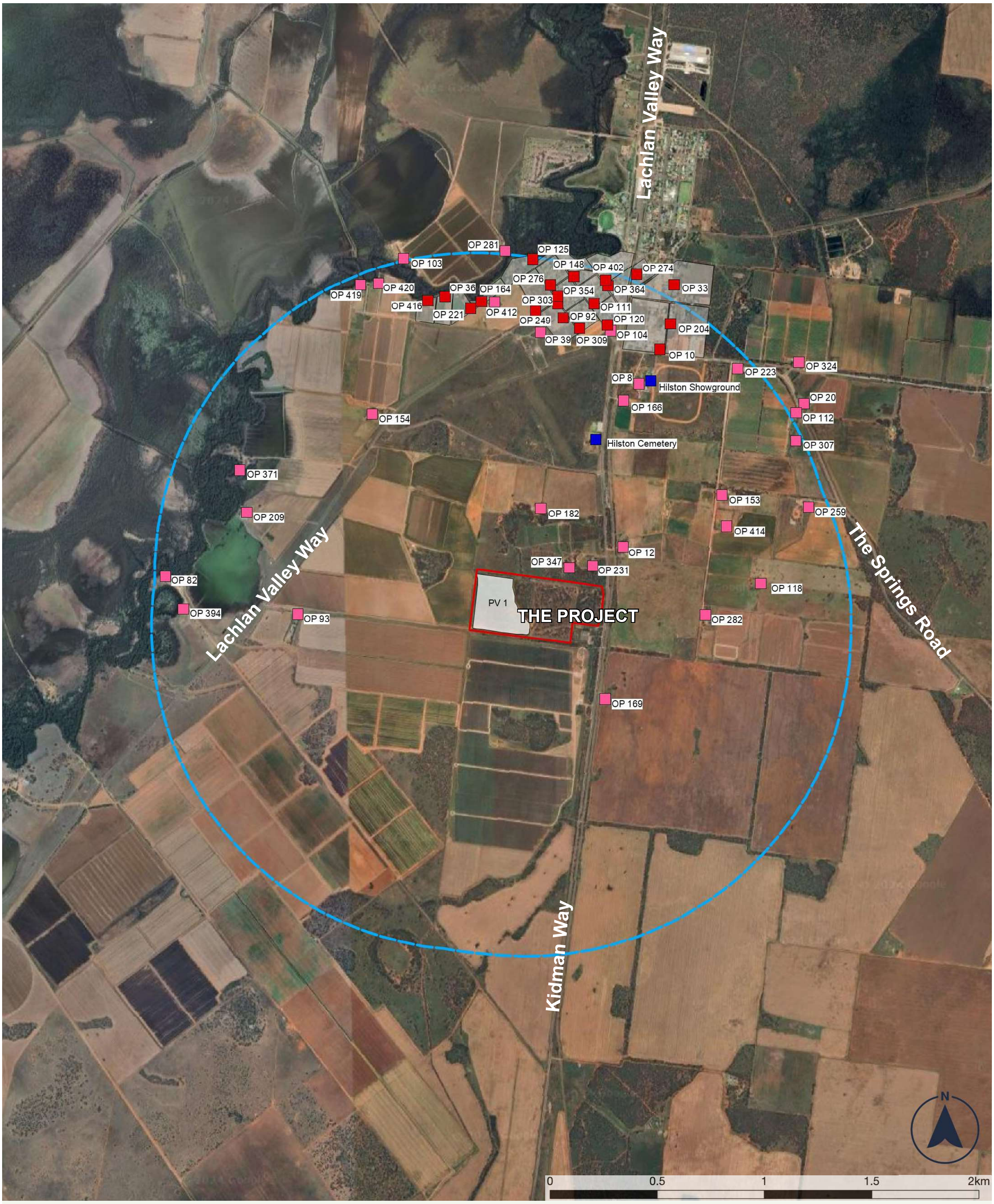
4.2 Private and Public Receptors

During the desktop assessment, a viewshed analysis was conducted to identify any Private or Public Receptors within 3 km of the Project.

In accordance with the Guidelines, representative viewpoints have been used for residential receivers that are clustered together. Representative receptors were selected to provide a conservative assessment of the residential cluster where possible.

A total of 50 non-associated Private Receptors were found with a direct a line of sight to the Project. Out of these 50, 30 were free-standing rural Private Receptors while 20 were representative receptors from Hillston town, refer **Figure 4**).

In addition to the Private Receptors, two (2) Public Receptor locations were identified within 3 km of the Project. These locations include Hillston Cemetery and Hillston Showground, refer **Figure 4**).



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	PV Array Area		Representative Private Receptors
	Project Area		Free Standing Private Receptors
	3 km from nearest panel		Public Receptors

Figure 4 Private and Public Receptors (Map Source: Google Earth, 2024)

Private Receptor	Address	Coordinates	Eleva-tion	Distance to the nearest solar panel	Yellow Glare (Hours Per Year):	Potential Glint and Glare Rat-ing	Recommended Mitigation Measures
OP 8	Showground, 9109 The Springs Road, Hillston, NSW, 2675	145° 32' 07.95"E 33° 29' 41.55"S	120 m	2.16 km	0	NIL	Not Required.
OP 10	175 Cowper St, Hillston, NSW, 2675	145° 32' 15.58"E 33° 29' 31.18"S	120 m	2.54 km	0	NIL	Not Required.
OP 12	10872 Kidman Way, Hillston, NSW, 2675	145° 32' 01.32"E 33° 30' 30.94"S	121 m	1.06 km	0	NIL	Not Required.
OP 20	8946 The Springs Road, Hillston, NSW, 2675	145° 33' 07.49"E 33° 29' 48.19"S	121 m	3.17 km	0	NIL	Not Required.
OP 33	92 Cowper St, Hillston, NSW, 2675	145° 32' 21.14"E 33° 29' 11.67"S	120 m	3.12 km	0	NIL	Not Required.
OP 36	14 Boundary Road, Hillston, NSW, 2675	145° 30' 58.27"E 33° 29' 14.25"S	119 m	2.60 km	0	NIL	Not Required.
OP 39	110 Molesworth St, Hillston, NSW, 2675	145° 31' 32.57"E 33° 29' 25.52"S	121 m	2.31 km	0	NIL	Not Required.
OP 82	Woodlands, 9590 Lachlan Valley Way, Hillston, NSW, 2675	145° 29' 15.69"E 33° 30' 37.78"S	119 m	2.90 km	0	NIL	Not Required.
OP 92	86-90 Molesworth Street, Hillston, NSW, 2675	145° 31' 40.87"E 33° 29' 21.24"S	120 m	2.48 km	0	NIL	Not Required.
OP 93	9529 Lachlan Vale Way, Hillston, NSW, 2675	145° 30' 03.44"E 33° 30' 49.87"S	122 m	1.63 km	0	NIL	Not Required.
OP 103	157 Mossgiel Road, Hillston, NSW, 2675	145° 30' 43.47"E 33° 29' 02.56"S	121 m	3.02 km	0	NIL	Not Required.
OP 104	12 O'Donnell St, Hillston, NSW, 2675	145° 31' 57.93"E 33° 29' 25.36"S	120 m	2.48 km	0	NIL	Not Required.
OP 111	33 Grattan St, Hillston, NSW, 2675	145° 31' 52.03"E 33° 29' 17.02"S	121 m	2.67 km	0	NIL	Not Required.
OP 112	Norwood Farm, 8939 The Springs Road, Hillston, NSW, 2675	145° 33' 04.59"E 33° 29' 50.88"S	120 m	3.06 km	0	NIL	Not Required.
OP 118	181 Norwood Lane, Hillston, NSW, 2675	145° 32' 50.95"E 33° 30' 42.55"S	120 m	2.19 km	0	NIL	Not Required.
OP 120	11 O'Donnell St, Hillston, NSW, 2675	145° 31' 56.79"E 33° 29' 23.56"S	121 m	2.52 km	0	NIL	Not Required.
OP 125	25 Lachlan St, Hillston, NSW, 2675	145° 31' 30.16"E 33° 29' 03.30"S	121 m	2.98 km	0	NIL	Not Required.
OP 148	8 Aidan St, Hillston, NSW, 2675	145° 31' 44.95"E 33° 29' 08.77"S	121 m	2.87 km	0	NIL	Not Required.
OP 153	129 Norwood Lane, Hillston, NSW, 2675	145° 32' 37.33"E 33° 30' 15.56"S	120 m	2.10 km	0	NIL	Not Required.
OP 154	Drovers Run, 9310 Lachlan Valley Way, Hillston, NSW, 2675	145° 30' 31.34"E 33° 29' 49.55"S	121 m	1.77 km	0	NIL	Not Required.
OP 164	59 Lachlan St, Hillston, NSW, 2675	145° 31' 11.35"E 33° 29' 15.95"S	120 m	2.54 km	0	NIL	Not Required.

Private Receptor	Address	Coordinates	Elevation	Distance to the nearest solar panel	Yellow Glare (Hours Per Year):	Potential Glint and Glare Rating	Recommended Mitigation Measures
OP 166	11014 Kidman Way, Hillston, NSW, 2675	145° 32' 02.30"E 33° 29' 46.53"S	121 m	1.95 km	0	NIL	Not Required.
OP 169	10738 Kidman Way, Hillston, NSW, 2675	145° 31' 54.07"E 33° 31' 16.85"S	120 m	0.93 km	0	NIL	Not Required.
OP 182	10903 Kidman Way, Hillston, NSW, 2675	145° 31' 31.76"E 33° 30' 18.79"S	119 m	0.70 km	0	NIL	Not Required.
OP 204	126 Cowper St, Hillston, NSW, 2675	145° 32' 19.61"E 33° 29' 23.47"S	120 m	2.79 km	0	NIL	Not Required.
OP 209	Fina-Lea, 9440 Lachlan Valley Way, Hillston, NSW, 2675	145° 29' 45.48"E 33° 30' 18.79"S	120 m	2.21 km	0	NIL	Not Required.
OP 221	67 Lachlan St, Hillston, NSW, 2675	145° 31' 07.44"E 33° 29' 17.89"S	120 m	2.48 km	0	NIL	Not Required.
OP 223	9019 The Springs Road, Hillston, NSW, 2675	145° 32' 43.66"E 33° 29' 37.31"S	120 m	2.87 km	0	NIL	Not Required.
OP 231	10865 Kidman Way, Hillston, NSW, 2675	145° 31' 50.28"E 33° 30' 36.47"S	118 m	0.75 km	0	NIL	Not Required.
OP 249	237 High St, Hillston, NSW, 2675	145° 31' 30.90"E 33° 29' 18.99"S	120 m	2.50 km	0	NIL	Not Required.
OP 259	Greentrees, 8847 The Springs Road, Hillston, NSW, 2675	145° 33' 08.66"E 33° 30' 19.53"S	121 m	2.82 km	0	NIL	Not Required.
OP 274	23 Rose St, Hillston, NSW, 2675	145° 32' 07.64"E 33° 29' 08.36"S	120 m	3.06 km	0	NIL	Not Required.
OP 276	19 Henry St, Hillston, NSW, 2675	145° 31' 36.42"E 33° 29' 11.19"S	120 m	2.76 km	0	NIL	Not Required.
OP 281	Tarcoola, 127 Mossgiel Rd, Hillston, NSW, 2675	145° 31' 20.25"E 33° 29' 00.62"S	121 m	3.02 km	0	NIL	Not Required.
OP 282	The Oasis, 237 Norwood Lane, Hillston, NSW, 2675	145° 32' 30.73"E 33° 30' 51.77"S	121 m	1.64 km	0	NIL	Not Required.
OP 303	240 High St, Hillston, NSW, 2675	145° 31' 39.01"E 33° 29' 16.90"S	119 m	2.60 km	0	NIL	Not Required.
OP 307	8933 The Springs Road, Hillston, NSW, 2675	145° 33' 04.34"E 33° 29' 59.43"S	120 m	2.93 km	0	NIL	Not Required.
OP 309	37 Mcgregor St, Hillston, NSW, 2675	145° 31' 46.76"E 33° 29' 24.48"S	119 m	2.41 km	0	NIL	Not Required.
OP 324	Westbank Farm, 19 Jardines Rd, Hillston, NSW, 2675	145° 33' 05.82"E 33° 29' 35.73"S	121 m	3.34 km	0	NIL	Not Required.
OP 347	10867 Kidman Way, Hillston, NSW, 2675	145° 31' 41.77"E 33° 30' 36.95"S	118 m	0.53 km	0	NIL	Not Required.
OP 354	215 High St, Hillston, NSW, 2675	145° 31' 39.05"E 33° 29' 14.59"S	120 m	2.67 km	0	NIL	Not Required.
OP 364	42 Molesworth St, Hillston, NSW, 2675	145° 31' 57.15"E 33° 29' 11.62"S	121 m	2.87 km	0	NIL	Not Required.

Private Receptor	Address	Coordinates	Elevation	Distance to the nearest solar panel	Yellow Glare (Hours Per Year):	Potential Glint and Glare Rating	Recommended Mitigation Measures
OP 371	The Rye, 9374 Lachlan Valley Way, Hillston, NSW, 2675	145° 29' 43.19"E 33° 30' 05.93"S	120 m	2.40 km	0	NIL	Not Required.
OP 394	9592 Lachlan Vale Way, Hillston, NSW, 2675	145° 29' 21.99"E 33° 30' 47.76"S	118 m	2.70 km	0	NIL	Not Required.
OP 402	47 Molesworth St, Hillston, NSW, 2675	145° 31' 56.38"E 33° 29' 09.97"S	121 m	2.91 km	0	NIL	Not Required.
OP 412	62-70 Lachlan St, Hillston, NSW, 2675	145° 31' 16.17"E 33° 29' 16.11"S	120 m	2.54 km	0	NIL	Not Required.
OP 414	Green Trees, 157 Norwood Lane, Hillston, NSW, 2675	145° 32' 38.87"E 33° 30' 25.06"S	119 m	2.05 km	0	NIL	Not Required.
OP 416	6 Boundary Road, Hillston, NSW, 2675	145° 30' 51.99"E 33° 29' 15.41"S	121 m	2.59 km	0	NIL	Not Required.
OP 419	2 Boundary Rd, Hillston, NSW, 2675	145° 30' 27.71"E 33° 29' 10.29"S	119 m	2.90 km	0	NIL	Not Required.
OP 420	Lot 21 Lachlan Vale Way, Hillston, NSW, 2675	145° 30' 34.29"E 33° 29' 10.00"S	119 m	2.86 km	0	NIL	Not Required.
OP 422	Hillston Showground 9109 The Spring Road, Hillston, NSW, 2675	145° 32' 12.22"E 33° 29' 40.65"S	120 m	2.25 km	0	NIL	Not Required.
OP 423	Hillston Cemetery 7301 Kidman Way, Hillston, NSW, 2675	145° 31' 51.99"E 33° 29' 58.19"S	120 m	1.51 km	0	NIL	Not Required.

Table 5. Private and Public Receptors assessment results

The results indicate that, there is no potential “Yellow” glare for Private and Public Receptors.

In accordance with the Guidelines, there is no requirement for mitigation measures for Private and Public Receptors of the Project. Detailed information for each Private Receptor is provided in **Appendix A**.

5.0 Road and Rail Receptors

5.1 Overview of Methodology

Table 6 provides an overview of the scope, methodology and performance objectives for assessment of glint and glare on road and railway line receptors.

Glint and Glare Requirements - Road & Rail		
Scope	**Methodology**	**Performance Objective**
All roads and rail lines within 1 km of the proposed solar array.	**Solar glare analysis to identify whether glint and glare are geometrically possible within the forward looking eye-line of motorists and rail operators.**	**If glare is geometrically possible then measures should be taken to eliminate the occurrence of glare. Alternatively, the applicant must demonstrate that glare would not significantly impede the safe operation of vehicles or the interpretation of signals and signage.**
Note: Modelling for Road Receptors is calculated on a maximum height of 2.4 m AGL - representative of the eye level for truck drivers (Source: Austroads Ltd. 2021). **Modelling for rail lines is based a representative eye height of 3 m AGL to represent the eye level of train drivers** (Source: Transport Asset Standards Authority 2020).		

Table 6. Road and Rail Receptor Assessment Requirements (Source: DPE(now DPHI), 2022)

5.2 Road and Rail Receptors

The desktop assessment has identified that Temora Roto Railway as a Rail Receptor located within a 1 km radius of the Project.

Additionally, one (1) Road Receptor - Kidman Way - was identified within 1 km radius of the Project.

Figure 5 provides a visual representation of the Road and Rail Receptors that have been identified within proximity of the Project.

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	PV Array Area		Extent of Road Receptor identified within 1 km of Project
	Project Area		Extent of Rail Receptor identified within 1 km of Project
	1 km from nearest solar array area		

Figure 5 Rail and Road Receptors (Map Source: Google Earth, 2024)

5.3 Results of Glint and Glare Assessment - Road and Rail

One (1) road receptor (Kidman Way) and one (1) rail receptor were identified as part of the assessment.

Table 7 provides an overview of the potential annual 'yellow' glare experienced along the Road and Rail Receptors.

Road / Rail Receptor:	Approximate Distance to the Project:	Elevation:	Yellow Glare (Hours Per Year):	Mitigation Recommendations:
Kidman Way	0.68 km	118-120 m	0	Not Required.
Temora Roto Railway	0.72 km	118-120 m	0	Not Required.

Table 7. Road & Rail receptor assessment results

The results indicate that, there is no potential "Yellow" glare observed by Road and Rail Receptors.

In accordance with the Guidelines, there is no requirement for mitigation measures for Road and Rail Receptor within 1 km of the solar array area. Detailed information for each receptor are provided in **Appendix A**.

6.0 Aviation Receptors

6.1 Overview of Methodology

Table 8 provides an overview of the scope, methodology and performance objectives for assessment of glint and glare on aviation receptors.

Glint and Glare Requirements - Aviation Receptors		
Scope	**Methodology**	**Performance Objective**
All air traffic control towers and take off / landing approaches to any runway or landing strip within 5km of the proposed solar array.	**Solar glare analysis that is worst case in all scenarios accounting for all aircraft using the airport (e.g. gliders, helicopters etc).**	**Any glint and glare should be avoided unless the aerodrome operator agrees that the impact would not be material (e.g. occurs at times when there are no flights or would not pose a safety risk to airport operations).**

Note: Modelling for Flight Path receptors is calculated on a threshold crossing height of 50 ft (15 m) in 2 mile (3.21 km) point ground elevation and the ±50 degree azimuthal and 30 degree vertical viewing angle representative of the pilot field view from cockpit. (Source: Rogers, 2015)

Table 8. Aviation Receptor Assessment Requirements (Source: DPE (now DPHI), 2022)

6.2 Aviation Receptors

The desktop assessment has identified the presence of one (1) landing strip, Hillston Aerodrome, located within a 5 km radius to the north west of the development footprint. For each landing strip, two (2) flight paths have been identified, each with a threshold distance of 2 miles (equivalent to 3.21 km), refer **Figure 6**.

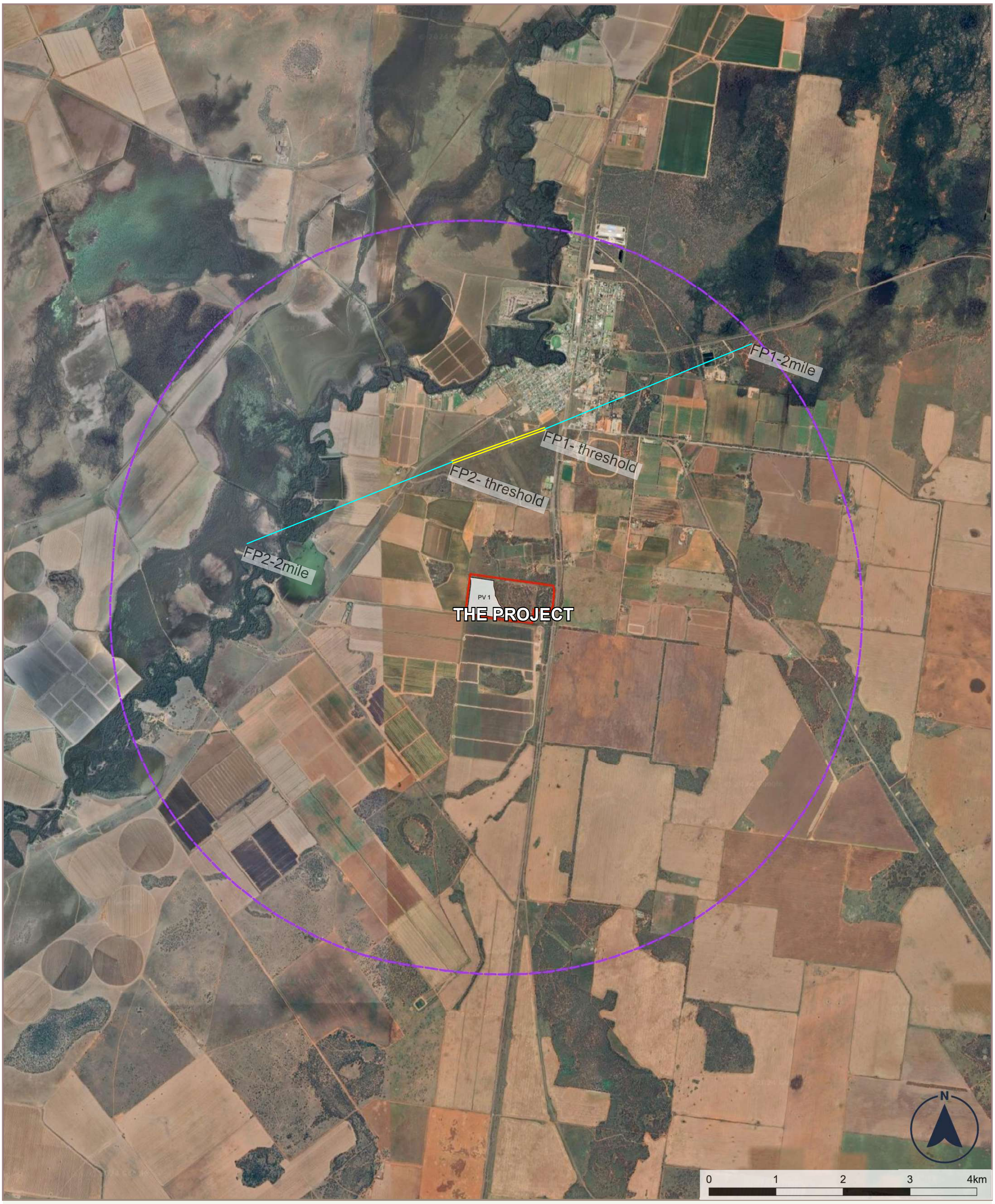
6.3 Results of Glint and Glare Assessment - Aviation Receptors

Based on the desktop assessment, two (2) Flight Point thresholds (a threshold of 2 miles representing the flight paths from the identified landing strips) are situated within 5 km of the proposed solar array, refer **Figure 6**. The assessment indicated that no potential for 'yellow' glare was identified for the two (2) Flight Paths. As a result, and in accordance with the Guideline, no mitigation measures are required.

Detailed glare impact outputs for each receptor is provided in **Appendix A**.

Aviation Receptor:	Approximate Distance to the Project:	Ground Elevation:	Yellow Glare (Hours Per Year):	Mitigation Recommendations:
FP01	2.87 km	117 m	0	Not Required.
FP02	3.00 km	119 m	0	Not Required.

Table 9. Aviation receptor assessment results



LEGEND

PV Array Area

Aviation Receptor

Project Area

2 mile Flight Path threshold

5 km from nearest panel

Figure 6 Aviation Receptors (Map Source: Google Earth, 2024)

7.0 Performance Objectives

7.1 Summary of assessment results

7.1.1 Private and Public Receptors

Table 3 provides a comprehensive overview of the scope, methodology, and performance objectives related to the assessment of glint and glare on Private and Public Receptors. The assessment conducted is summarised as follows:

A total of 50 Private and two (2) Public Receptors have been assessed. No receptors have been identified to have the potential for experiencing 'Yellow' glare.
Consequently, no mitigation measures are required in accordance with the Guideline.

7.1.2 Road and Rail Receptors

Table 6 provides a comprehensive overview of the scope, methodology, and performance objectives concerning the assessment of glint and glare on Road Receptors. The assessment conducted is summarised below:

One (1) Road Receptor and One (1) Rail Receptor have been assessed. No receptors have been identified to have the potential for experiencing 'Yellow' glare.
Consequently, no mitigation measures are required in accordance with the Guideline.

7.1.3 Aviation Receptors

Table 9 provides a comprehensive overview of the scope, methodology, and performance objectives concerning the assessment of glint and glare on Aviation Receptors. The assessment conducted is summarised below:

One (1) Aviation Receptor including two (2) Flight Paths have been assessed. No Flight Paths have been identified to have the potential for experiencing 'Yellow' glare.
Consequently, no mitigation measures are required in accordance with the Guideline.

As a result of the findings, no further mitigation measures are required for private and public receptors, road and rail receptors and aviation receptors in accordance with the Guidlines.

8.0 Conclusion

The purpose of this report is to identify potential glint and glare impacts on the surrounding area, including Private and Public Receptors (within 3 km of the Project), Road and Rail Receptors (within 1 km of the Project) and Aviation Receptors (within 5 km of the Project).

Based on the assumptions and aforementioned parameters for the potential worst-case operating scenario for the Project (refer Section 2.3), the findings of the assessment were:

A total of 50 private and two (2) Public Receptors, One (1) Road Receptor and One (1) Rail Receptor and One (1) Aviation Receptor including two (2) Flight Paths were identified and assessed.

The results indicated that there are no receptors identified to have a potential for experiencing ‘Yellow’ glare.

In line with the Guidelines, no further mitigation measures is required.

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FORGESOLAR GLARE ANALYSIS

Project: **2416 Kidman Way Solar Farm**
Site configuration: **2416_KidmanWaySolarFarm_60d_20240403**

Created 20 Mar, 2024
Updated 03 Apr, 2024
Time-step 1 minute
Timezone offset UTC10
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 5 MW to 10 MW
Site ID 114901.19776

Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
PV analysis methodology V2

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV1	SA tracking	SA tracking	0	0.0	0	0.0	-

Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Kidman Way	0	0.0	0	0.0
Temora Roto Rail Way	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
FP 2	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 82	0	0.0	0	0.0
OP 92	0	0.0	0	0.0
OP 93	0	0.0	0	0.0
OP 103	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 104	0	0.0	0	0.0
OP 111	0	0.0	0	0.0
OP 112	0	0.0	0	0.0
OP 118	0	0.0	0	0.0
OP 120	0	0.0	0	0.0
OP 125	0	0.0	0	0.0
OP 148	0	0.0	0	0.0
OP 153	0	0.0	0	0.0
OP 154	0	0.0	0	0.0
OP 164	0	0.0	0	0.0
OP 166	0	0.0	0	0.0
OP 169	0	0.0	0	0.0
OP 182	0	0.0	0	0.0
OP 204	0	0.0	0	0.0
OP 209	0	0.0	0	0.0
OP 221	0	0.0	0	0.0
OP 223	0	0.0	0	0.0
OP 231	0	0.0	0	0.0
OP 249	0	0.0	0	0.0
OP 259	0	0.0	0	0.0
OP 274	0	0.0	0	0.0
OP 276	0	0.0	0	0.0
OP 281	0	0.0	0	0.0
OP 282	0	0.0	0	0.0
OP 303	0	0.0	0	0.0
OP 307	0	0.0	0	0.0
OP 309	0	0.0	0	0.0
OP 324	0	0.0	0	0.0
OP 347	0	0.0	0	0.0
OP 354	0	0.0	0	0.0
OP 364	0	0.0	0	0.0
OP 371	0	0.0	0	0.0
OP 394	0	0.0	0	0.0
OP 402	0	0.0	0	0.0
OP 412	0	0.0	0	0.0
OP 414	0	0.0	0	0.0
OP 416	0	0.0	0	0.0
OP 419	0	0.0	0	0.0
OP 420	0	0.0	0	0.0
OP 421	0	0.0	0	0.0
OP 422	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV1
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Ground Coverage Ratio: 0.38
Rated power: -
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	-33.511054	145.519067	117.01	1.72	118.72
2	-33.510672	145.518917	117.00	1.72	118.72
3	-33.511132	145.522613	117.74	1.72	119.46
4	-33.511848	145.522570	118.31	1.72	120.03
5	-33.512599	145.522755	119.93	1.72	121.65
6	-33.512848	145.522772	120.37	1.72	122.09
7	-33.512848	145.522772	120.37	1.72	122.09
8	-33.513061	145.522766	120.71	1.72	122.43
9	-33.513351	145.522935	119.99	1.72	121.71
10	-33.513717	145.523129	118.70	1.72	120.41
11	-33.514025	145.523306	118.35	1.72	120.07
12	-33.514339	145.523529	118.21	1.72	119.93
13	-33.514486	145.523697	118.75	1.72	120.47
14	-33.514559	145.523866	119.55	1.72	121.26
15	-33.514716	145.524024	120.39	1.72	122.11
16	-33.514831	145.524163	121.22	1.72	122.94
17	-33.514963	145.524212	121.67	1.72	123.38
18	-33.515088	145.524212	121.86	1.72	123.57
19	-33.515254	145.524212	121.73	1.72	123.44
20	-33.515430	145.524193	121.11	1.72	122.83
21	-33.515555	145.524173	120.67	1.72	122.38
22	-33.515731	145.524134	120.07	1.72	121.78
23	-33.515816	145.524035	119.56	1.72	121.28
24	-33.515825	145.523886	119.09	1.72	120.80
25	-33.515842	145.523866	119.01	1.72	120.73
26	-33.515811	145.523478	117.93	1.72	119.65
27	-33.515780	145.522889	117.07	1.72	118.79
28	-33.515697	145.522249	117.00	1.72	118.72
29	-33.515606	145.521419	116.58	1.72	118.29
30	-33.515437	145.520300	117.04	1.72	118.76
31	-33.515330	145.519410	117.00	1.72	118.72
32	-33.515272	145.518820	116.87	1.72	118.59
33	-33.515255	145.518580	116.86	1.72	118.58
34	-33.515209	145.518507	116.94	1.72	118.65
35	-33.514635	145.518587	117.00	1.72	118.72
36	-33.511552	145.519056	118.10	1.72	119.82

Route Receptors

Name: Kidman Way
Path type: Two-way
Observer view angle: 50.0°

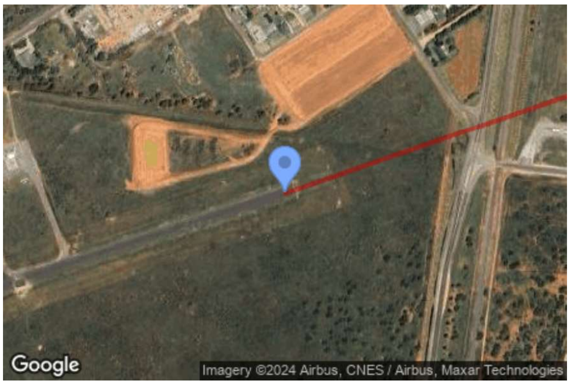
Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.506097	145.531979	120.04	2.40	122.44
2	-33.506553	145.531989	120.32	2.40	122.72
3	-33.506902	145.531998	120.34	2.40	122.74
4	-33.507331	145.531998	119.55	2.40	121.95
5	-33.507832	145.532008	119.00	2.40	121.40
6	-33.508825	145.532040	118.39	2.40	120.79
7	-33.509532	145.532073	117.68	2.40	120.08
8	-33.510283	145.532094	117.06	2.40	119.46
9	-33.511267	145.532137	117.32	2.40	119.72
10	-33.512466	145.532201	118.95	2.40	121.35
11	-33.513969	145.531998	119.92	2.40	122.32
12	-33.515776	145.531665	117.46	2.40	119.86
13	-33.517216	145.531407	118.01	2.40	120.41
14	-33.518862	145.531150	118.90	2.40	121.30
15	-33.520221	145.530957	118.00	2.40	120.40
16	-33.521116	145.530785	118.28	2.40	120.68
17	-33.522332	145.530571	118.75	2.40	121.15
18	-33.523298	145.530420	119.78	2.40	122.18

Name: Temora Roto Rail Way
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.505894	145.532764	119.54	3.00	122.54
2	-33.506782	145.532812	119.97	3.00	122.97
3	-33.507862	145.532869	118.78	3.00	121.78
4	-33.508654	145.532906	117.66	3.00	120.66
5	-33.509474	145.532968	117.00	3.00	120.00
6	-33.510335	145.532938	117.68	3.00	120.68
7	-33.510788	145.532871	117.60	3.00	120.60
8	-33.511678	145.532747	118.35	3.00	121.35
9	-33.512537	145.532586	118.63	3.00	121.63
10	-33.513646	145.532409	118.86	3.00	121.86
11	-33.514230	145.532289	119.88	3.00	122.88
12	-33.515010	145.532144	119.69	3.00	122.69
13	-33.515829	145.532039	117.47	3.00	120.47
14	-33.516866	145.531852	118.40	3.00	121.40
15	-33.517967	145.531664	118.16	3.00	121.16
16	-33.519241	145.531449	118.46	3.00	121.46
17	-33.520440	145.531288	117.70	3.00	120.70
18	-33.521531	145.531084	118.00	3.00	121.00
19	-33.522506	145.530924	118.24	3.00	121.24
20	-33.523588	145.530720	118.65	3.00	121.65

Flight Path Receptors

Name: FP 1
Description:
Threshold height: 15 m
Direction: 250.9°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-33.492417	145.530120	116.78	15.24	132.02
Two-mile	-33.482966	145.562923	122.11	178.59	300.70

Name: FP 2
Description:
Threshold height: 15 m
Direction: 70.0°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-33.496032	145.517138	118.14	15.24	133.38
Two-mile	-33.505916	145.484518	118.09	183.97	302.06

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 8	8	-33.494875	145.535540	120.75	1.50
OP 10	10	-33.491995	145.537661	120.51	1.50
OP 12	12	-33.508595	145.533700	121.56	1.50
OP 20	20	-33.496720	145.552082	121.23	1.50
OP 33	33	-33.486574	145.539205	120.42	1.50
OP 36	36	-33.487291	145.516185	119.96	1.50
OP 39	39	-33.490423	145.525715	121.53	1.50
OP 82	82	-33.510494	145.487692	119.11	1.50
OP 92	92	-33.489233	145.528018	120.23	1.50
OP 93	93	-33.513852	145.500957	122.40	1.50
OP 103	103	-33.484045	145.512074	121.31	1.50
OP 104	104	-33.490377	145.532759	120.15	1.50
OP 111	111	-33.488061	145.531120	121.42	1.50
OP 112	112	-33.497467	145.551274	120.63	1.50
OP 118	118	-33.511820	145.547485	120.40	1.50
OP 120	120	-33.489877	145.532441	121.15	1.50
OP 125	125	-33.484250	145.525045	121.06	1.50
OP 148	148	-33.485770	145.529154	121.09	1.50
OP 153	153	-33.504323	145.543703	120.26	1.50
OP 154	154	-33.497099	145.508706	121.20	1.50
OP 164	164	-33.487763	145.519820	120.58	1.50
OP 166	166	-33.496259	145.533972	121.60	1.50
OP 169	169	-33.521347	145.531686	120.10	1.50
OP 182	182	-33.505220	145.525488	119.87	1.50
OP 204	204	-33.489854	145.538780	120.56	1.50
OP 209	209	-33.505218	145.495967	120.19	1.50
OP 221	221	-33.488303	145.518734	120.28	1.50
OP 223	223	-33.493696	145.545462	120.78	1.50
OP 231	231	-33.510130	145.530634	118.41	1.50
OP 249	249	-33.488607	145.525252	120.03	1.50
OP 259	259	-33.505425	145.552406	121.55	1.50
OP 274	274	-33.485657	145.535454	120.11	1.50
OP 276	276	-33.486443	145.526784	120.40	1.50
OP 281	281	-33.483505	145.522291	121.47	1.50
OP 282	282	-33.514380	145.541870	121.21	1.50
OP 303	303	-33.488029	145.527504	119.80	1.50
OP 307	307	-33.499841	145.551205	120.69	1.50
OP 309	309	-33.490132	145.529654	119.54	1.50
OP 324	324	-33.493254	145.551615	121.75	1.50
OP 347	347	-33.510263	145.528269	118.75	1.50
OP 354	354	-33.487385	145.527514	120.20	1.50
OP 364	364	-33.486562	145.532543	121.86	1.50
OP 371	371	-33.501646	145.495331	120.23	1.50
OP 394	394	-33.513268	145.489444	118.28	1.50
OP 402	402	-33.486104	145.532328	121.86	1.50
OP 412	412	-33.487808	145.521159	120.14	1.50
OP 414	414	-33.506961	145.544130	119.75	1.50
OP 416	416	-33.487615	145.514441	121.50	1.50
OP 419	419	-33.486193	145.507698	119.63	1.50
OP 420	420	-33.486112	145.509526	119.55	1.50
OP 421	421	-33.494624	145.536728	120.40	1.50

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 422	422	-33.499498	145.531108	120.38	1.50

Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV1	SA tracking	SA tracking	0	0.0	0	0.0	-

Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Kidman Way	0	0.0	0	0.0
Temora Roto Rail Way	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
FP 2	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 82	0	0.0	0	0.0
OP 92	0	0.0	0	0.0
OP 93	0	0.0	0	0.0
OP 103	0	0.0	0	0.0
OP 104	0	0.0	0	0.0
OP 111	0	0.0	0	0.0
OP 112	0	0.0	0	0.0
OP 118	0	0.0	0	0.0
OP 120	0	0.0	0	0.0
OP 125	0	0.0	0	0.0
OP 148	0	0.0	0	0.0
OP 153	0	0.0	0	0.0
OP 154	0	0.0	0	0.0
OP 164	0	0.0	0	0.0
OP 166	0	0.0	0	0.0
OP 169	0	0.0	0	0.0
OP 182	0	0.0	0	0.0
OP 204	0	0.0	0	0.0
OP 209	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 221	0	0.0	0	0.0
OP 223	0	0.0	0	0.0
OP 231	0	0.0	0	0.0
OP 249	0	0.0	0	0.0
OP 259	0	0.0	0	0.0
OP 274	0	0.0	0	0.0
OP 276	0	0.0	0	0.0
OP 281	0	0.0	0	0.0
OP 282	0	0.0	0	0.0
OP 303	0	0.0	0	0.0
OP 307	0	0.0	0	0.0
OP 309	0	0.0	0	0.0
OP 324	0	0.0	0	0.0
OP 347	0	0.0	0	0.0
OP 354	0	0.0	0	0.0
OP 364	0	0.0	0	0.0
OP 371	0	0.0	0	0.0
OP 394	0	0.0	0	0.0
OP 402	0	0.0	0	0.0
OP 412	0	0.0	0	0.0
OP 414	0	0.0	0	0.0
OP 416	0	0.0	0	0.0
OP 419	0	0.0	0	0.0
OP 420	0	0.0	0	0.0
OP 421	0	0.0	0	0.0
OP 422	0	0.0	0	0.0

PV: PV1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Kidman Way	0	0.0	0	0.0
Temora Roto Rail Way	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
FP 2	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 82	0	0.0	0	0.0
OP 92	0	0.0	0	0.0
OP 93	0	0.0	0	0.0
OP 103	0	0.0	0	0.0
OP 104	0	0.0	0	0.0
OP 111	0	0.0	0	0.0
OP 112	0	0.0	0	0.0
OP 118	0	0.0	0	0.0
OP 120	0	0.0	0	0.0
OP 125	0	0.0	0	0.0
OP 148	0	0.0	0	0.0
OP 153	0	0.0	0	0.0
OP 154	0	0.0	0	0.0
OP 164	0	0.0	0	0.0
OP 166	0	0.0	0	0.0
OP 169	0	0.0	0	0.0
OP 182	0	0.0	0	0.0
OP 204	0	0.0	0	0.0
OP 209	0	0.0	0	0.0
OP 221	0	0.0	0	0.0
OP 223	0	0.0	0	0.0
OP 231	0	0.0	0	0.0
OP 249	0	0.0	0	0.0
OP 259	0	0.0	0	0.0
OP 274	0	0.0	0	0.0
OP 276	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 281	0	0.0	0	0.0
OP 282	0	0.0	0	0.0
OP 303	0	0.0	0	0.0
OP 307	0	0.0	0	0.0
OP 309	0	0.0	0	0.0
OP 324	0	0.0	0	0.0
OP 347	0	0.0	0	0.0
OP 354	0	0.0	0	0.0
OP 364	0	0.0	0	0.0
OP 371	0	0.0	0	0.0
OP 394	0	0.0	0	0.0
OP 402	0	0.0	0	0.0
OP 412	0	0.0	0	0.0
OP 414	0	0.0	0	0.0
OP 416	0	0.0	0	0.0
OP 419	0	0.0	0	0.0
OP 420	0	0.0	0	0.0
OP 421	0	0.0	0	0.0
OP 422	0	0.0	0	0.0

PV1 and Route: Kidman Way

No glare found

PV1 and Route: Temora Roto Rail Way

No glare found

PV1 and FP: FP 1

No glare found

PV1 and FP: FP 2

No glare found

PV1 and OP 8

No glare found

PV1 and OP 10

No glare found

PV1 and OP 12

No glare found

PV1 and OP 20

No glare found

PV1 and OP 33

No glare found

PV1 and OP 36

No glare found

PV1 and OP 39

No glare found

PV1 and OP 82

No glare found

PV1 and OP 92

No glare found

PV1 and OP 93

No glare found

PV1 and OP 103

No glare found

PV1 and OP 104

No glare found

PV1 and OP 111

No glare found

PV1 and OP 112

No glare found

PV1 and OP 118

No glare found

PV1 and OP 120

No glare found

PV1 and OP 125

No glare found

PV1 and OP 148

No glare found

PV1 and OP 153

No glare found

PV1 and OP 154

No glare found

PV1 and OP 164

No glare found

PV1 and OP 166

No glare found

PV1 and OP 169

No glare found

PV1 and OP 182

No glare found

PV1 and OP 204

No glare found

PV1 and OP 209

No glare found

PV1 and OP 221

No glare found

PV1 and OP 223

No glare found

PV1 and OP 231

No glare found

PV1 and OP 249

No glare found

PV1 and OP 259

No glare found

PV1 and OP 274

No glare found

PV1 and OP 276

No glare found

PV1 and OP 281

No glare found

PV1 and OP 282

No glare found

PV1 and OP 303

No glare found

PV1 and OP 307

No glare found

PV1 and OP 309

No glare found

PV1 and OP 324

No glare found

PV1 and OP 347

No glare found

PV1 and OP 354

No glare found

PV1 and OP 364

No glare found

PV1 and OP 371

No glare found

PV1 and OP 394

No glare found

PV1 and OP 402

No glare found

PV1 and OP 412

No glare found

PV1 and OP 414

No glare found

PV1 and OP 416

No glare found

PV1 and OP 419

No glare found

PV1 and OP 420

No glare found

PV1 and OP 421

No glare found

PV1 and OP 422

No glare found

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.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 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. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
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.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
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.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

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

Appendix A