ADVERTISED PLAN

NHILL RENEWABLE ENERGY FACILITY

GLINT AND GLARE IMPACT ASSESSMENT REPORT

UPDATED ISSUE

Prepared For

Vibe Energy Pty Ltd

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ENVIRONMENTAL
ETHOS

Prepared By Environmental Ethos
for Vibe Energy Pty Ltd

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Cover Image: ToGa Wanderings

CONTENTS

EXECUTIVE SUMMARY

The Solar Energy Facilities Design and Development Guidelines, 2019, triggers the assessment of glint and glare resulting from solar farms including potential impacts to dwellings and roads within 1 km of a proposed facility, aviation infrastructure including any air traffic control tower or runway approach path close to a proposed facility, and any other receptor to which a responsible authority considers solar reflection may be a hazard.

This glint and glare impact assessment utilised the Solar Glare Hazard Analysis Tool (SGHAT 3.0) in conjunction with a viewshed analysis, to prepare the glint and glare modelling which is the basis for the impact assessment methodology. The assessment considered dwellings and roads within 2km of the Project.

In summary, based on the assumptions and parameters of this desktop assessment, the following results were identified:

- No glare potential was identified affecting rural and residential dwellings within the viewshed.
- No glare potential was identified affecting the Western Highway and surrounding local roads within the viewshed.
- The SGHAT modelling found no glare hazard potential affecting Nhill Airport runways.
- No glare potential was identified for dwellings, commercial and recreational properties, the highway, roads, and airport when the tracking system resting angle was set at 45 degrees – simulating a backtracking operation.
- No glare potential was identified when the PV modules resting angle was set at 5 degree simulating a backtracking operation advancing to its stowing angle (normally completed after dark).

1. INTRODUCTION

This report has been prepared by Environmental Ethos on behalf of Vibe Energy Pty Ltd to assess the potential solar glint and glare impacts of the proposed Nhill Renewable Energy Facility (the Project). The Project comprises of the installation and operation of a solar farm up to 5MW AC, which will utilise photovoltaic (PV) modules to generate electricity. The Project will supplying clean energy to power the equivalent of 1,500 average Victorian homes per year, offsetting approximately 11,000tonnes of CO2 annually, making a significant contribution to the Hindmarsh Council area overall emissions profile.

The Project site is located on Lot 1 on Plan of Subdivision 630537Q on Ervins Road, Nhill, on a 27 acre subdivision of 239 Nhill-Harrow Road, Nhill ("the Project site"). The PV arrays will run north/south (Azimuth 7.9 degrees) and will be mounted on a single axis horizontal tracking system. The solar panels, including the mounting structures, will be approximately 2.1 metres high when flat, rotating to approximately 3.1 metres maximum height.

1.1. Location

The Project site is located approximately 2.5 kilometres south-west of Nhill town centre, *refer Figure 1.* The Project site adjoins Ervins Road on the western boundary, which is a gravel access road. The Western Highway is located between 220 to 500 metres to the west of the Project site. To the north of the site is the Nhill Trailer Exchange, and to the north east is the GWM Water Treatment Plant. To the south and east of the site is open rural land used for cropping. The site is zoned FZ Farming Zone and is currently used for cropping. Farming is the predominant land use within the area.

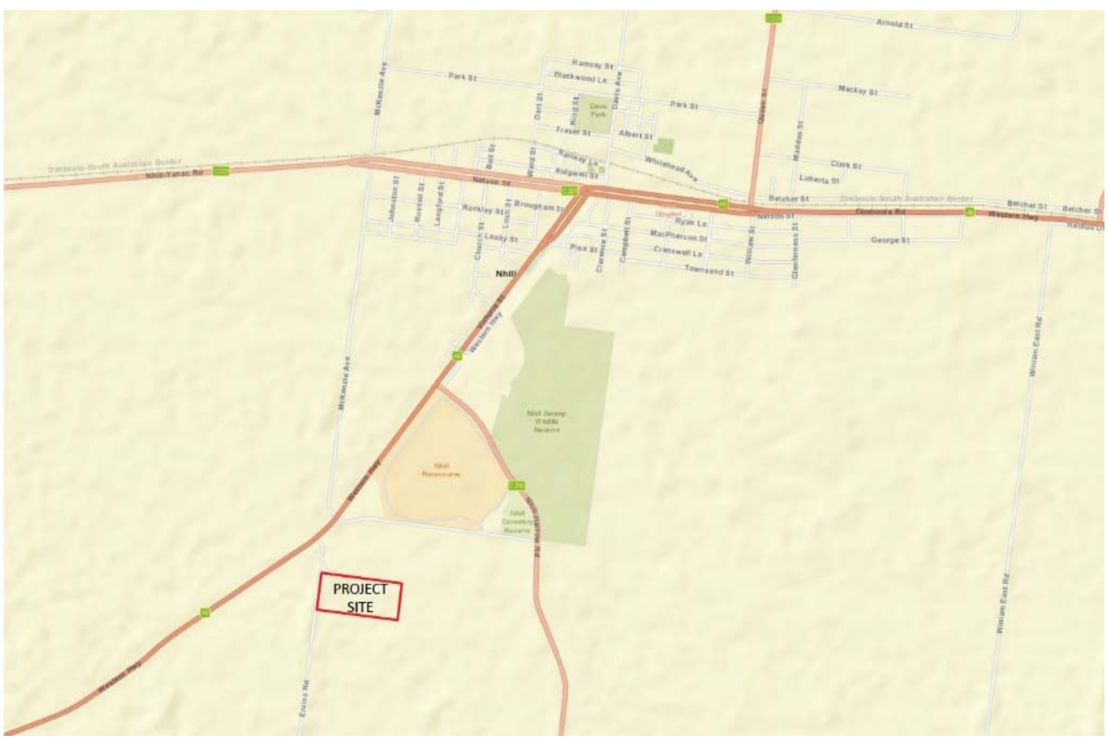


Figure 1. Location Plan

2. SCOPE OF THE ASSESSMENT

The scope of this glint and glare impact assessment includes the following:

- Description of the methodology used to undertake the study;
- Assessment of the baseline conditions;
- Description of the elements of the Project with the potential to influence glint and glare including size, height, and angle of PV modules, the type of framing system, as well as operational considerations for the tracking system;
- Identification of the viewshed and potential visibility of the Project;
- Desktop mapping of potential glint and glare at the location of sensitive receptors within the viewshed, based on Solar Glare Hazard Analysis and viewshed analysis;
- Assessment of the likely hazard of glint and glare on sensitive receptors during operation of the Project;
- Assessment of potential mitigations measures to avoid, mitigate, or manage potential impacts; and
- Consideration of impacts, before and after mitigation measures are established, on surrounding sensitive receptors including:
    - Dwellings and roads within 1km of the proposed facility, taking into consideration their height within the landscape,
    - Aviation infrastructure including any air traffic control tower or runway approach path close to the proposed facility,
    - Any other receptor to which a responsible authority considers solar reflection may be a hazard.

3. METHODOLOGY

3.1. Glint and Glare Definitions

Glint and glare refers to the human experience of reflected light.

This study utilises Solar Glare Hazard Analysis software developed in the USA to address policy adherence required for the 2013 U.S. Federal Aviation Administration (FAA) Interim Policy 78 FR 63276. The FAA definitions of glint and glare are as follows:

"Reflectivity refers to light that is reflected off surfaces. The potential effects of reflectivity are glint (a momentary flash of bright light) and glare (a continuous source of bright light). These two effects are referred to hereinafter as "glare," which can cause a brief loss of vision, also known as flash blindness."[1]

[1] Federal Aviation Administration, Version 1.1 April 2018, Technical Guidance for Evaluating Selected Solar Technologies on Airports

The FAA Technical Guidelines distinguishes between glint and glare according to time duration, without correlation to light intensity.

The Solar Energy Facilities Design and Development Guidelines, 2019[2] (Development Guidelines), identifies the difference between glint and glare as intensity:

"Glint can be caused by direct reflection of the sun from the surface of an object, whereas glare is a continuous source of brightness. Glare is much less intense than glint."(p23)

This differentiation is consistent with the descriptions of glint and glare as:

- Glint being specular reflection, a momentary flash of light produced as a direct reflection of the sun in the surface of an object (such as a PV panel); and
- Glare being a continuous source of brightness relative to the ambient lighting, glare is not a direct reflection of the sun, but rather a reflection of the bright sky around the sun.

Solar Glare Hazard Analysis software evaluates the potential impact of light produced as a direct reflection of the sun from PV modules, this is consistent with the Development Guidelines reference to 'glint', as the more intense type of solar reflectivity. However, the FAA Guidelines refers to direct solar reflection from stationary objects such as fixed frame solar systems, or relatively slow moving objects such as solar tracking systems, as 'glare' since the source of the solar reflectance occurs over a long (not momentary) duration.

For the purpose of this study the term 'glare' is used in reference to the more intense light impact of direct solar reflectivity from PV modules over potentially long duration (consistent with terminology used by Solar Glare Hazard Analysis software based on FAA Guidelines). The assessment of direct solar reflectivity from PV modules addresses the Development Guidelines requirements to consider the impacts of glint (defined as the more intense solar reflectivity), and also glare as a reflection of light surrounding the sun.

3.2. Glare Assessment Parameters

Glare assessment modelling for solar farms is based on the following factors:

- the tilt, orientation, and optical properties of the PV modules in the solar array;
- sun position over time, taking into account geographic location;
- the location of sensitive receptors (viewers); and
- Screening potential of surrounding topography and vegetation.

3.3. Glare Intensity Categories

The potential hazard from solar glare is a function of retinal irradiance (power of electromagnetic radiation per unit area produced by the sun) and the subtended angle (size and distance) of the glare source.[3]

[2] The State of Victoria Department of Environment, Land, Water and Planning 2019, Solar Energy Facilities Design and Development Guidelines

[3] HO, C.K., C.M. Ghanbari, and R.B. Diver, 2011, Methodology to Assess Potential Glint and Glare hazards from Concentrated Solar Power Plants

Glare can be broadly classified into three categories: low potential for after-image, potential for after-image, and potential for permanent eye damage, *Figure 2* illustrates the glare intensity categories used in this study.

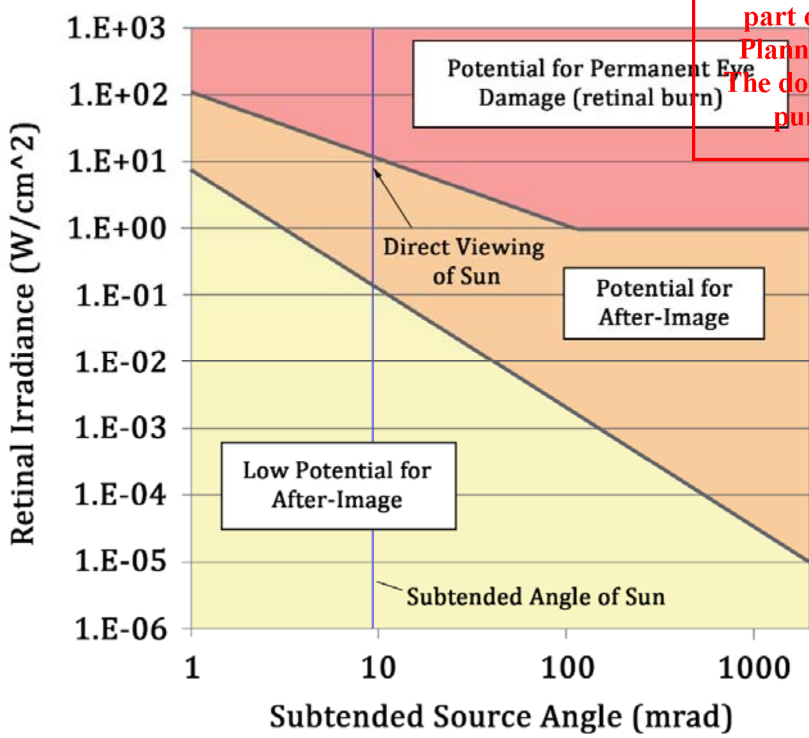


Figure 2. Ocular impacts and Hazard Ranges[4]

The amount of light reflected from a PV module depends on the amount of sunlight hitting the surface, as well as the surface reflectivity. The amount of sunlight interacting with the PV module will vary based on geographic location, time of year, cloud cover, and PV module orientation. 1000W/m^2 is generally used in most counties as an estimate of the solar energy interacting with a PV module when no other information is available. This study modelled scenarios using 2000 W/m^2 in order to cover potentially higher solar energy levels in Australia as compared to other parts of the world. Flash blindness for a period of 4-12 seconds (i.e. time to recovery of vision) occurs when 7-11 W/m^2 (or 650-1,100 lumens/m^2) reaches the eye[5].

3.4. Reflection and Angle of Incidence

PV modules are designed to maximise the absorption of solar energy and therefore minimise the extent of solar energy reflected. PV modules have low levels of reflectivity between 0.03 and 0.20 depending on the specific materials, anti-reflective coatings, and angle of incidence.[6]

[4] Source: Solar Glare Hazard Analysis Tool (SGHAT) Presentation (2013) https://share.sandia.gov/phlux/static/references/glint-glare/SGHAT_Ho.pdf
[5] Sandia National Laboratory, SGHAT Technical Manual
[6] *Ho, C. 2013 Relieving a Glare Problem*

The higher reflectivity values of 0.20, that is 20% of incident light being reflected, can occur when the angle of incidence is greater than 50º. *Figure 3 and 4* show the relationship between increased angles of incidence and increased levels of reflected light. Where the angle of incidence remains below 50° the amount of reflected light remains below 10%. The angle of incidence is particularly relevant to specular reflection (light reflection from a smooth surface). Diffuse reflection (light reflection from a rough surface) may also occur in PV modules, however this is typically a result of dust or similar materials building up on the PV module surface, which would potentially reduce the reflection.

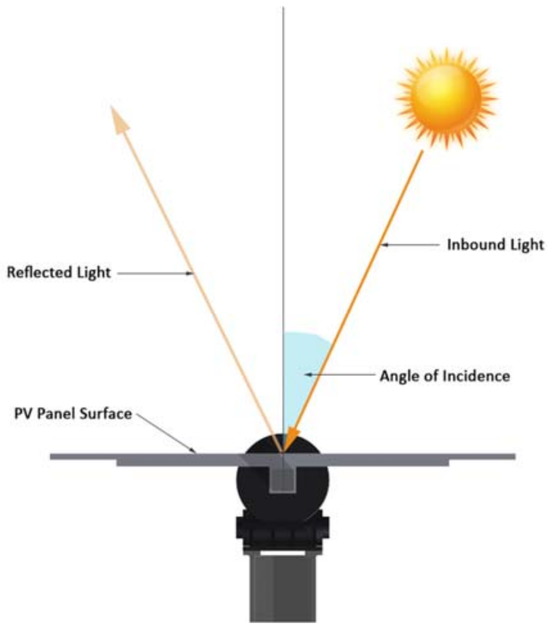


Figure 3. Angle of Incidence Relative to PV Panel Surface

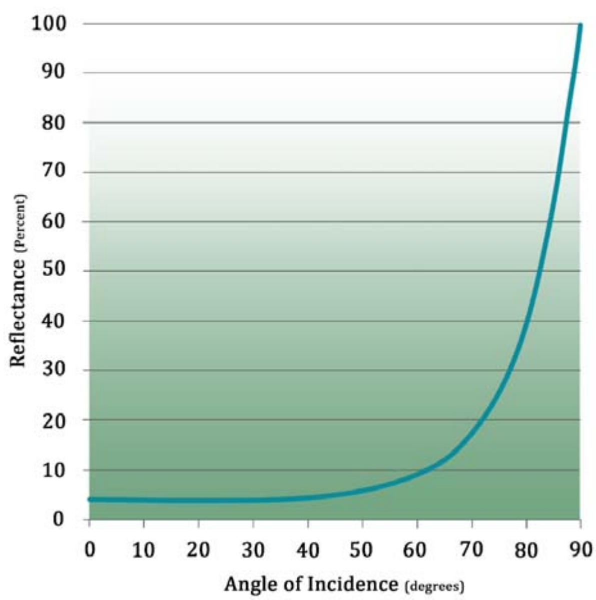


Figure 4. Angles of Incidence and Increased Levels of Reflected Light (Glass (n-1.5))

The sun changes its east-west orientation throughout the day, and the sun's north-south position in the sky changes throughout the year. The sun reaches its highest position at noon on the Summer Solstice (21 December in the Southern Hemisphere) and its lowest position at sunrise and sunset on the Winter Solstice (21 June in the Southern Hemisphere).

In a fixed PV solar array, the angle of incidence varies as the sun moves across the sky, that is the angle of incidence are at their lowest around noon where the sun is directly overhead, and increase in the early mornings and late evenings as the incidence angles increase. If the PV array is mounted on a tracking system, this variation is reduced because the panel is rotated to remain perpendicular to the sun. Therefore a PV modular array using a tracking system has less potential to cause glare whilst it tracks the sun. *Figure 5* illustrates a PV module mounted horizontal single axis tracking system following the east to west path of the sun.

A single axis tracking system has a fixed maximum angle of rotation, once the tracking mechanism reaches this maximum angle, the PV modules position relative to the sun becomes fixed and therefore the angle of incidence increases and the potential for glare increases. Some tracking systems utilise 'backtracking' to avoid PV modules over-shadowing each other. During the backtracking procedure (early morning and late afternoon) the tracking system begins to rotate away from the sun to reduce shadow casting to adjoining PV panels. During the backtracking phase, higher angles of incidence will occur in comparison to the tracking phase, and this may increase the potential for glare.

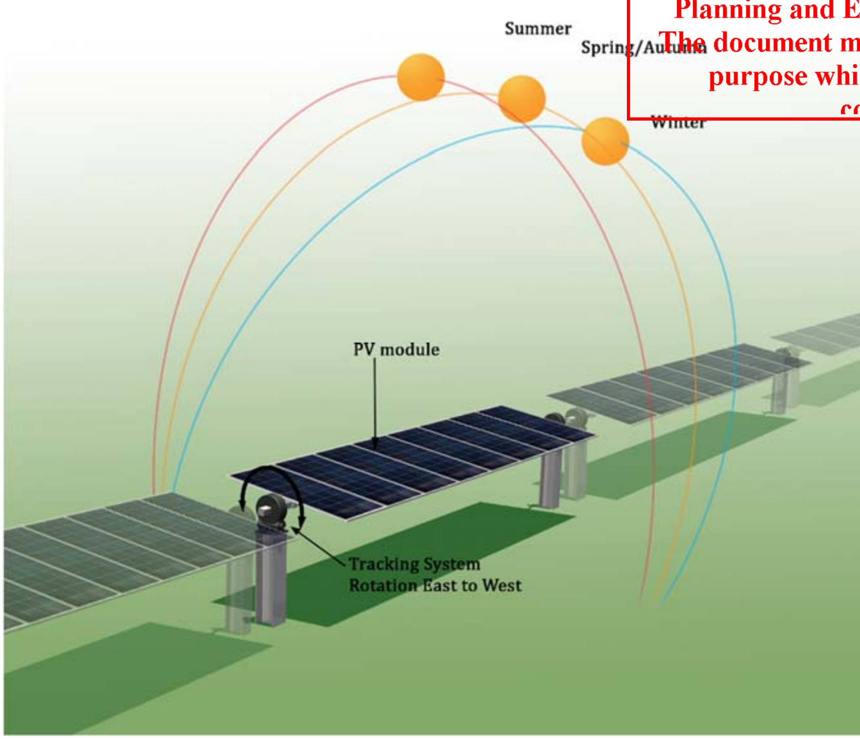


Figure 5. Diagrammatic illustration of sun position relative to PV module mounted on a horizontal single axis tracking system.

3.5. Viewshed Analysis

A desktop viewshed analysis was undertaken using ArcGIS 3D modelling. The extent of visibility of the proposed solar farm was assessed relative to the location of sensitive receptors (dwellings, roads, etc.) The desktop viewshed analysis is based on topography only and does not take into consideration vegetation. A site assessment of visibility was undertaken as part of the Planning Report for the Project and this information, together with aerial imagery, has been utilised as the basis for assessing the screening effect of existing vegetation in conjunction with the desktop viewshed analysis and glare modelling.

3.6. Solar Glare Hazard Analysis

This assessment has utilised the Solar Glare Hazard Analysis Tool (SGHAT 3.0) co-developed by Sandi National Laboratory[7] and ForgeSolar (Sim Industries) (referred to as GlareGauge) to assess potential glare utilising latitude and longitudinal coordinates, elevation, sun position, and vector calculations. The PV module orientation, reflectance environment and ocular factors are also considered by the software. If potential glare is identified by the model, the tool calculates the retinal irradiance and subtended angle (size/distance) of the glare source to predict potential ocular hazards according to the glare intensity categories (refer *Section 3.3*).

The sun position algorithm used by SGHAT calculates the sun position in two forms: first as a unit vector extending from the Cartesian origin toward the sun, and second as azimuthal and altitudinal angles. The algorithm enables determination of the sun position at one (1) minute intervals throughout the year.

The SGHAT is a high level tool and does not take into consideration the following factors:

- Backtracking or the effect of shading in relation to the PV array tracking system;
- Gaps between PV modules;
- Atmospheric conditions; and
- Vegetation between the solar panels and the viewer (sensitive receptor).

SGHAT has been used extensively in the United States to assess the potential impact of solar arrays located in close proximity to airports.

Resting Angles

A single axis horizontal tracking system can be programed to operate a 'backtracking' procedure (*refer section 3.4*). There are several backtracking algorithms developed for this purpose, with each system optimised dependent on the distance between panels, the width of each panel, the incidence angle of the sun, and the field slope angle.

SGHAT software does not currently model backtracking, however it does include a 'resting angle' feature which models the effect of the panels reverting (resting) to a specified angle once the maximum tilt angle is reached. Modelling resting angles is not a true representation of how a backtracking procedure would operate under normal circumstances. However, the 'resting angle' feature does provide some indication of the potential glare implications of moving the PV panels away from the sun once the maximum tilt is reached.

[7] https://share.sandia.gov/phlux/static/references/glint-glare/SGHAT_Technical_Reference-v5.pdf

Route Parameters

The assessment of potential glare impacts to route receptors, people travelling along roads and rail, includes the parameters of direction of travel (single or both directions) and field-of-view (FOV). FOV defines the left and right field-of-view of observers traveling along a route. A view angle of 90° means the observer has a field-of-view of 90° to their left and right, i.e. a total FOV of 180°, refer *Figure 6.*

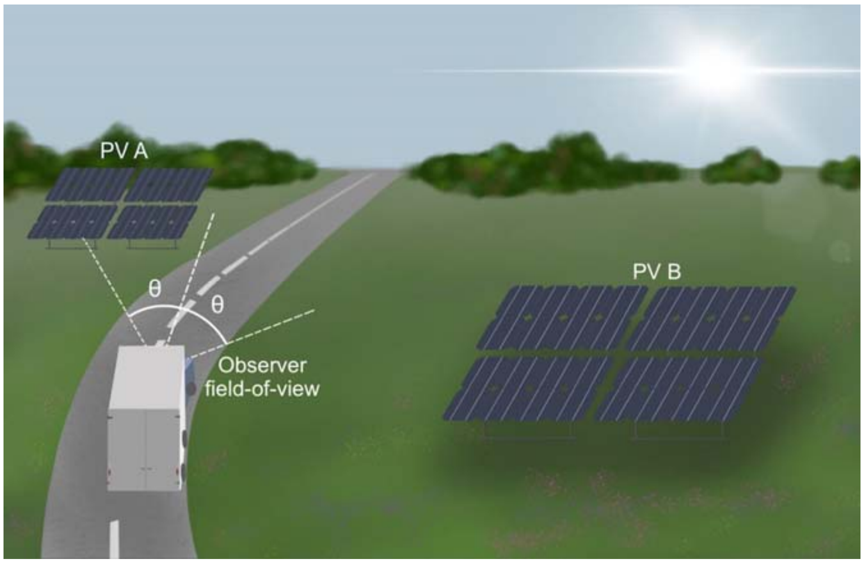


Figure 6. Diagrammatic illustration of Observer Field of View relative to PV array (source: ForgeSolar).

FAA research has identified 'impairment ratings' based on simulations of glare at various angles and duration, and the effect on a pilot's ability to fly a plane[8]. The research identified impairment was highest when the glare source was within a FOV of 25° or less. The impact of glare fell below 'slight impairment' rating when the glare source was at an angle of 50° from the direction of travel. When the glare source was located at an angle of 90° the impairment rating reduced further. In relation to piloting a plane, the report noted there was no significant difference in impairment when the source of glare angle was increased from 50° to 90°. In conclusion the research noted 'these results taken together suggest that any sources of glare at an airport may be potentially mitigated if the angle of the glare is greater than 25° from the direction that the pilot is looking in'.

SGHAT default parameters is FOV 50°, this assessment increased the FOV to 90°, representing a conservative assessment of potential hazard to drivers using roads and rail network within the vicinity of the solar farm.

3.7. Hazard Assessment

Once the potential for solar glare has been identified through the viewshed analysis and SGHAT, which is based on topography only, an assessment of the likelihood of glare hazard occurring is undertaken taking into consideration existing mitigating factors such as existing vegetation, buildings, and minor topographic variations outside the parameters of the modelling. Embedded mitigation measures, such as proposed vegetation screens to be undertaken as part of the Project, are also considered to identify residual glare potential. An assessment is then undertaken to identify

[8] https://www.faa.gov/data_research/research/med_humanfacs/oamtechreports/2010s/media/201512.pdf

the potential significance of the glare hazard based on the magnitude (amount and intensity) of the glare hazard generated, duration and frequency, distance from the Project, and the sensitivity of the receptors (viewers). Additional mitigation measures, beyond those previously considered as part of the Project, are recommended to avoid, reduce or manage the identified risks.

3.8. Limitations to the assessment

This desktop assessment is based on a geometric analysis of potential glare using SGHAT software modelling. The parameters of the modelling are based on the default values within the software. Where these values have been altered (generally increased), this has been noted in the assessment.

The assessment considers potential impacts of solar glare under normal operational procedures, potential impacts during construction and non-operational events have not been assessed.

Field tests has not been undertaken as part of the assessment, therefore the modelling is reliant on the algorithms contained in the software.

SGHAT software is used under license to Sims Industries d/b/a ForgeSolar, refer to assumptions and limitations listed in the data output (Appendices) and for further information refer to www.forgesolar.com/help/.

Environmental Ethos does not verify the accuracy of the SGHAT software modelling. Responsibility and accountability for the accuracy of the SGHAT software (GlareGauge) resides with Sims Industries d/b/a ForgeSolar.

4. EXISTING CONDITIONS

The baseline is a statement of the characteristics which currently exist in the Project area. The baseline glare condition assessment takes into consideration the following:

- Characteristics of the environment that may affect the potential for glare;
- Land use and human modifications to the landscape such as roads, buildings and existing infrastructure which may influence glare and sensitivity to glare.

4.1. Baseline Conditions

The baseline conditions within the vicinity of the Project site are characteristic of the area, being generally flat rural land. The Project adjoins infrastructure and utility land uses to the north which are compatible with the Project's utility purpose, that is, to generate renewable energy. The majority of remnant vegetation in the area has been cleared as a result of past agricultural practices, some areas of native vegetation remain along roads and within protected wetland areas.

Existing dwellings in the area include scattered rural properties, and the southern residential areas of Nhill. Commercial and industrial properties are also located on the outskirts of Nhill. The Nhill race course is located to the north together with the Nhill cemetery.

Nhill Airport and Aviation Heritage Centre are located 4.7km north of the Project site.

Existing features in the landscape with the potential to contribute to glare include the water bodies associated with the GWM Water Treatment Plant. However, these are generally screened from surround areas by earth bunding.

4.2. Atmospheric Conditions

Atmospheric conditions such as cloud cover, dust and haze will impact light reflection, however these factors have not been accounted for in this glare assessment. The Bureau of Meteorology statistics for Horsham Polkemmet Road 58 km from the Project site (the closest BOM records for cloud cover statistics) recorded 141 cloudy days per year (mean number over the period 1957 to 2008)[9]. Cloudy days predominately occur during the winter months, May to September. Since atmospheric conditions have not been factored into this assessment modelling, statistically the glare potential represents a conservative assessment.

5. PROJECT DESCRIPTION

The general layout of the solar farm is as shown in *Figure 7.* The main elements of the Solar Farm with the potential to influence glare are the tilt, orientation, and optical properties of the PV modules in the solar array, and the rotational capabilities of the system. Whilst specific products are yet to be determined for the Project, the general technical properties of the main elements influencing glare are described below.

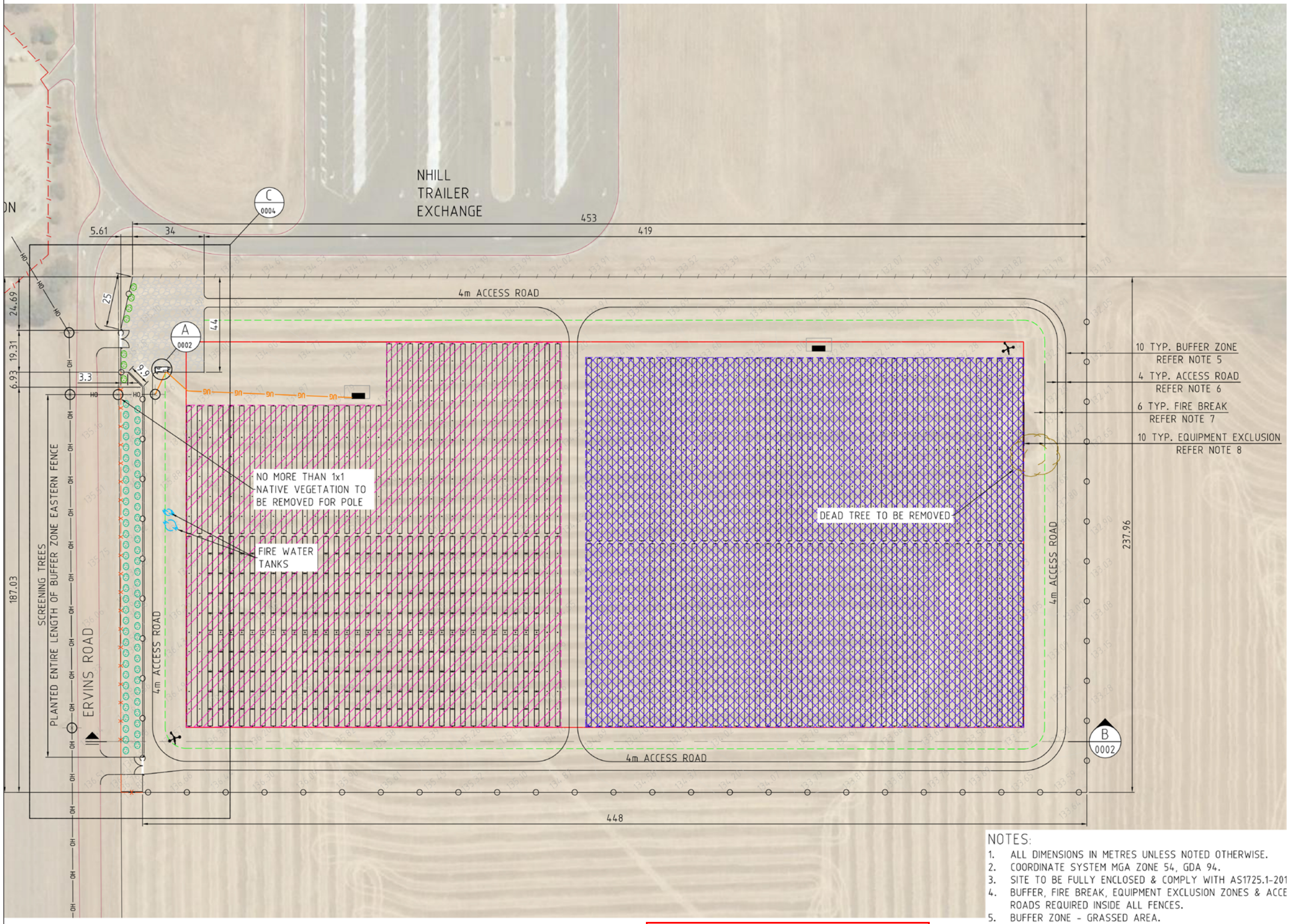
5.1. PV modules

Each PV panel typically comprises of 72 polycrystalline silicon solar cells overlayed by a 3.2 to 4.0 mm tempered glass front and held in an anodised aluminium alloy frame. Half cut cell technology is also available which consists of 144 monocrystalline cells connected in series to reduce ribbon resistant. Dual-glass and frameless PV systems area also available. The approximate dimensions for a typical solar panel is 2 metres x 1 metre. The proposed solar array arrangement for this Project is 2 solar panels in portrait, resulting in an array width of approximately 4.0 metres wide.

5.2. Horizontal single axis tracking system

A horizontal single axis tracking system rotates the PV panels across an east to west arc, following the sun's trajectory across the sky. The purpose of the tracking system is to optimize solar energy collection by holding the PV module perpendicular to the sun. The tracking system is capable of a maximum rotation range of 90° (+/- 45°) or 120° (+/- 60°) depending on the system used. The Project modelling utilised a rotation range of 120° (+/- 60°), refer *Figure 8.*

[9] http://www.bom.gov.au/climate/averages/tables/cw_079023.shtml



LEGEND

- FENCE - EXISTING FARM
- FENCE - EXISTING 2.1m HIGH CHAIN MESH SECURITY
- FENCE - PROPOSED 2.4m HIGH CHAIN MESH SECURIT
- PROPOSED SCREENING TREES
- EXISTING TREE - DEAD
- OVERHEAD LINE
- POWER POLE
- UNDERGROUND CABLE
- FIRE BREAK (REFER NOTE 7)
- 30m EQUIPMENT EXCLUSION ZONE
- SOLAR PANELS NEXTRACKER 25 MODULES PER STRING
- SOLAR PANELS NEXTRACKER 36 MODULES PER STRING
- HARDSTAND AREA
- ES006 ENVIRONMENTALLY SIGNIFICANT AREA
- WEATHER STATION

NOTES:

1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATE SYSTEM MGA ZONE 54, GDA 94.
3. SITE TO BE FULLY ENCLOSED & COMPLY WITH AS1725.1-201
4. BUFFER, FIRE BREAK, EQUIPMENT EXCLUSION ZONES & ACCE ROADS REQUIRED INSIDE ALL FENCES.
5. BUFFER ZONE - GRASSED AREA.
6. ACCESS ROAD TO BE OF COMPACTED RUBBLE AT GROUND L
7. FIRE BREAK - WEED FREE.
8. EQUIPMENT EXCLUSION ZONE IN AN ADDITIONAL 10m CLEAR/ FROM FIRE BREAK.
9. NO PROVISION HAS BEEN MADE ON THIS DRAWING FOR PLATFORMS, RAMPS, STAIRS, RAINHOODS, FIRE, CABLE ENT INTERNAL / EXTERNAL LIGHTING.
10. SWITCHROOM ELECTRICAL INSTALLATION TO COMPLY WITH AS/NZS3000 & AS/NZS2067.
11. PERIMETER SECURITY FENCE TO COMPLY WITH WIMMERA CM REQUIREMENTS (CONDITION 29).

SOURCE: RJE GLOBAL
LAYOUT PLAN 3718-321-0004
REV. E 06/07/2021

PROJECT NO. 20002
CREATED BY: SC
DATE: 17 08 2021 VERSION: A

NHILL SOLAR FARM

GLINT AND GLARE IMPACT ASSESSMENT

PROJECT LAYOUT PLAN

FIGURE 7.0

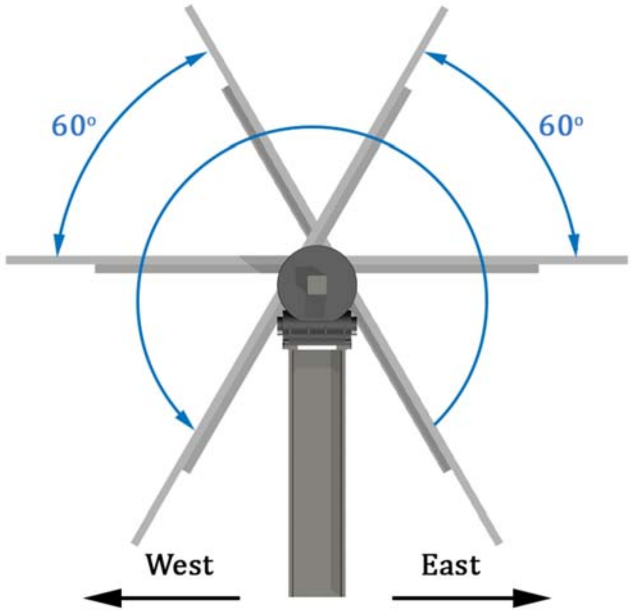


Figure 8. Illustration of PV Module Rotation Angles

The zenith tilt angle of the panels was assumed to be set at zero, that is, the panels are not tilted on a north – south alignment but remain horizontal along the plane of the tracker. This enables the height of the panel to remain consistent relative to each other and avoids potential over shadowing.

The maximum height of the PV modules above natural ground was assumed to be approximately 3.1 metres (2.1 metres when the panels are held at 0 degrees (flat) and 3.1 metres at maximum tilt). A height of 2.1 metres at the centroid was used in the modelling. The glare assessment modelling uses an analytical approach to simulate light reflection from a planar PV footprint relative to the location of sensitive receptors.

The configuration of the tracking system rows vary slightly dependent on the type of system used, generally rows are approximately 5-7 metres apart. *Figure 9* and *Plate 1* show a typical layout for a horizontal single axis tracking system.

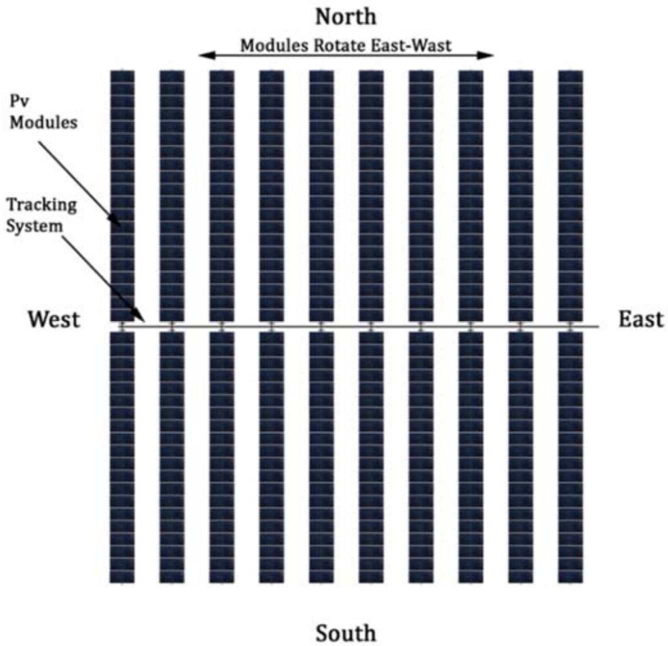


Figure 9. Illustration of PV Module Row Alignment

Plate 1. Example of a typical frameless solar array mounted on a single axis tracking system[10]

5.3. Solar Inverters, Control Room, and Fencing

The proposed solar farm will also include solar inverters, a control/switch building, and perimeter fencing. These elements are not considered likely to influence glare as they generally comprise of non-reflective surfaces typically found in the built environment.

5.4. Landscape Screening

A landscape screen comprising of native Eucalyptus species is proposed along the western boundary of the Project site. This vegetation, once established, will assist in mitigating potential visual and

[10] Source: http://solarbuildermag.com/featured/frameless-modules-mount/

glare impacts to travellers on Ervins Road and the Western Highway, and properties to the west of the Site.

6. DESKTOP GLARE ASSESSMENT

The aim of the desktop glare assessment is to identify if any sensitive receptors have the potential to be impacted by glare. The software modelling systems used in the desktop assessment include viewshed modelling to identify the location of sensitive receptors with line of sight to the Project, and the SGHAT to identify the potential and ocular significance of glare.

6.1. Viewshed Analysis

The results of the viewshed analysis (based on topography) are shown in *Figure 10.*

The Digital Elevation Model (DEM) for the viewshed modelling was set as 'Finest' (> 10 m). Contour information for the site (DELWP dataset) was assessed and shows the Project site is located within a flat landscape with minor topographic variation.

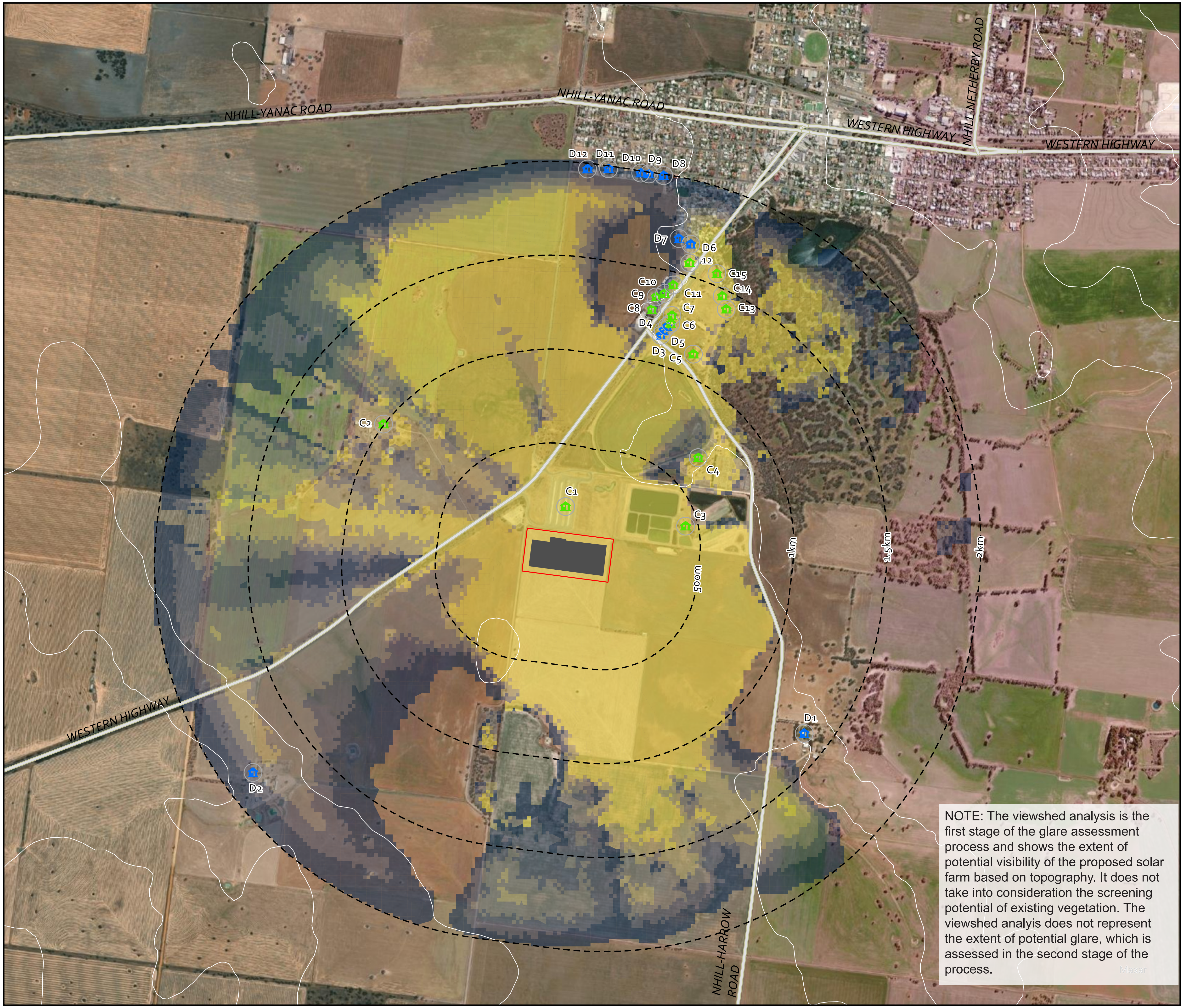
Solar Farms are characterised by their low horizontal profile. The major elements of a solar farm are the PV models, these are generally 2 to 4 metres above ground level. In this study a maximum height of 3.1 metres above ground level was used in the modelling. At distances greater than 1 km a 3 metre high horizontal object in the landscape becomes visually insignificant (perceived as a narrow line in the distance) when viewed across a flat plain. At distances greater than 2 km the Project will be barely visible, therefore the viewshed analysis focussed on potential visibility of the Project within 2km of the site.

The viewshed analysis in this study has utilised the visibility assessment undertaken in the *Planning Report,* [11] and desktop assessment of aerial imagery, to confirm screening provided by minor topographic variations (outside the parameters of the modelling), and the screening potential of existing vegetation.

The results of the viewshed analysis are summarised below:

- The desktop assessment identified the Project is generally visibility within 1km of the site, with visibility decreasing with distance as minor variations in the flat landscape interrupt line of sight.
- The Project is not considered likely to be visible from (2) two farming properties to the south.
- The Project has the potential to be visible from properties to the north, including commercial and residential properties. However, residential areas of Nhill are not considered likely to have views of the Project due to distance (greater than 2km).
- 27 observation points were assessed within the viewshed including 12 dwellings and 15 commercial properties, as follows:
  - One (1) commercial property within 500 metres of the Project site (C1) at the office of the Nhill Trailer Exchange.

[11] Vibe Energy, February 2019, Nhill Renewable Energy Facility – Planning Report



NOTE: The viewshed analysis is the first stage of the glare assessment process and shows the extent of potential visibility of the proposed solar farm based on topography. It does not take into consideration the screening potential of existing vegetation. The viewshed analysis does not represent the extent of potential glare, which is assessed in the second stage of the glare assessment process.

ENVIRONMENTAL ETHOS

N

DATUM GDA 1994,
PROJECTION MGA ZONE 56

0 0.25 0.5 1 Kilometers

SCALE 1:24,000 @ A3

LEGEND

SITE BOUNDARY

PV MODULE AREA

DISTANCE FROM SOLAR FARM

COMMERCIAL/PUBLIC PROPERTIES

DWELLINGS

EXTENT OF VISIBILITY*

Less visible

More visible

*(Analysis based on Digital Terrain Model)

PROJECT No. 2002
CREATED BY: SC
DATE: 17 08 2021
VERSION: A

NHILL SOLAR FARM

GLINT AND GLARE ASSESSMENT

VIEWSHED ANALYSIS

FIGURE 10.0

  - Two (2) commercial and recreational properties within 1km of the Project site (C3 & C4) including GWM Water Treatment Plant (buildings) and Nhill Racecourse.
  - Four (4) residential and commercial properties within 1.5km of the Project site (C2, C5, D3, D4).
  - 12 rural, residential and commercial properties within 2km of the Project site (D1, D5, D6 to C15).
  - An additional 8 rural and residential properties were assessed in the modelling, although these were located outside the 2km viewshed. The majority of these dwellings are located to the north of the site, on the southern outskirts of Nhill.
- The Western Highway and Nhill-Harrow Road pass through the viewshed and these were assessed together with minor roads including McKenzie Avenue and Ervins Road, and circulation roads within the Nhill Trailer Exchange.
- Nhill Airport is outside the 2km viewshed of the Project, however the runway flight paths were included in the glare model.

The potential glare hazard impact for identified properties, surrounding roads and highway, and aviation infrastructure, with potential views to the site has been assessed in *Section 6.2.*

6.2. Solar Glare Hazard Analysis

The parameters used in the SGHAT model are detailed in *Tables 1.*

Table 1. Input data for SGHAT Analysis – Horizontal Single Axis Tracking System

SGHAT Model Parameters	Values
Time Zone	UTC +10
Axis Tracking	Horizontal Single Axis
Tilt of tracking axis	0
Orientation of tracking axis	7.9
Offset angle of module	0
Module Surface material	Smooth glass without anti-reflective coating (ARC)
Maximum tracking angle	60
Resting angles	60 – 45 – 5
Reflectivity	Vary with sun
Correlate slope error with surface type?	Yes
Slope error	6.55mrad
Height of panels above ground	2.1m to centroid

The proposed operational procedures of the Project tracking system were modelled based on the PV panels rotating to a maximum tilt of 60 degrees and held at 60 degrees. In addition, various 'typical' resting and stowing angles were tested in the model to assess the potential implications of changing these variables, and also identifying (in a preliminary manner) limitations should a backtracking procedure be considered in the future. As noted previously, modelling resting angles is not a true representation of a backtracking procedure since it assumes the PV models will revert immediately to the resting angle whereas in in reality this process would track gradually, therefore the model represents a worst case scenario.

6.3. Solar Glare Hazard Analysis Tool (SGHAT) Results

The assessment results for the SGHAT modelling are detailed in *Appendix A* and outlined in *Table 2*.

Table 2. SGHAT Assessment Results – Horizontal Single Axis Tracking System (Resting angle 60 degrees)

Sensitive Receptor	Glare Potential
Observation Points Rural and Residential Dwellings D1 to D12	No Glare
Observation Points Commercial and recreational properties – C1 to C15	No Glare
Western Highway	No Glare
Nhill-Harrow Road	No Glare
McKenzie Avenue	No Glare
Nhill Trailer Exchange	No Glare
Ervins Road	No Glare
Flight Path 1 – Nhill Airport Asphalt Runway (east)	No Glare
Flight Path 2 – Nhill Airport Asphalt Runway (west)	No Glare
Flight Path 3 – Nhill Airport Grass Runway (south)	No Glare
Flight Path 4 – Nhill Airport Grass Runway (north)	No Glare

The SGHAT modelling identified no glare hazard potential is likely to affect rural and residential dwellings, commercial and recreational properties, and travellers along the western highway and surrounding local roads within the Project viewshed, *refer Appendix A.*

In addition, SGHAT modelling identified no glare hazard potential is likely to affect Nhill Airport under normal operation of the tracking system, *refer Appendix A*.

Various resting angles were tested in the model to provide some assessment of potential glare hazard should a backtracking operation be considered, the results of this assessment are presented in *Table 3.*

Table 3. SGHAT Assessment Results – Resting Angle Analysis of 45 and 5 degrees

Sensitive Receptor	Resting Angle 45 degrees *- Glare Potential	Stowing Angle 5 degrees **- Glare Potential
Observation Points Rural and Residential Dwellings D1 to D12	No Glare	No Glare
Observation Points Commercial and recreational properties – C1 to C15	No Glare	No Glare
Western Highway	No Glare	No Glare
Nhill-Harrow Road	No Glare	No Glare
McKenzie Avenue	No Glare	No Glare
Nhill Trailer Exchange	No Glare	No Glare

Ervins Road	No Glare	No Glare
Flight Path 1 – Nhill Airport Asphalt Runway (east)	No Glare	No Glare
Flight Path 2 – Nhill Airport Asphalt Runway (west)	No Glare	No Glare
Flight Path 3 – Nhill Airport Grass Runway (south)	No Glare	No Glare
Flight Path 4 – Nhill Airport Grass Runway (north)	No Glare	No Glare

*Modelling is based on the PV panels moving directly to 45 degrees once maximum tilt of 60 degrees is reached, in reality this process would track gradually, therefore this represents a worst case scenario.

**Modelling is based on the PV panels moving directly to 5 degrees once maximum tracking of 60 degrees is reached, in reality this process would track gradually, therefore this represents a worst case scenario.

The SGHAT modelling found no potential glare hazard is likely when the panels rotate from a maximum tilt angle of 60 degrees, to 45 degrees and 5 degrees. This procedure would normally occur gradually, with the panels reaching their stowing angle of 5 degrees after dark. Whist the limitations of modelling resting angles distorts the results, presenting a worst case than is considered likely, the model indicates a normal backtracking procedure does not increase the likelihood of glare hazard affecting sensitive receptors.

7. MANAGEMENT AND MITIGATION MEASURES

Under normal operation of the solar farm no glare potential was identified, therefore no mitigation measures are considered necessary.

Where the backtracking procedure was simulated in the model using a resting angle of 45 degrees and 5 degrees, no glare potential was identified.

8. SUMMARY

In summary, based on the assumptions and parameters of this desktop assessment, the following results were identified:

- No glare potential was identified affecting rural and residential dwellings within the viewshed.
- No glare potential was identified affecting the Western Highway and surrounding local roads within the viewshed.
- The SGHAT modelling found no glare hazard potential affecting Nhill Airport runways.
- No glare potential was identified for dwellings, commercial and recreational properties, the highway, roads, and airport when the tracking system resting angle was set at 45 degrees – simulating a backtracking operation;
- No glare potential was identified when the PV modules resting angle was set at 5 degree simulating a backtracking operation advancing to its stowing angle (normally completed after dark).

APPENDIX A:

SOLAR GLARE HAZARD ANALYSIS

ForgeSolar

Nhill Solar Farm Update

Nhill Solar Farm Update _ OPs and Roads

Created Aug. 14, 2021
Updated Aug. 14, 2021
Time-step 1 minute
Timezone offset UTC10
Site ID 57409.10256

Project type Advanced
Project status: active
Category 1 MW to 5 MW

Misc. Analysis Settings

DNI: **varies (2,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:
- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

Summary of Results No glare predicted!

PV Name	Tilt deg	Orientation deg	"Green" Glare min	"Yellow" Glare min	Energy Produced kWh
PV array 1	SA tracking	SA tracking	0	0	-

ADVERTISED PLAN

Component Data

PV Array(s)

Total PV footprint area: 63,545 m^2

Name: PV array 1
Axis tracking: Single-axis rotation
Tracking axis orientation: 7.9 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 60.0 deg
Footprint area: 63,545 m^2
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 6.55 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.352956	141.638363	132.03	2.10	134.13
2	-36.352714	141.635995	133.34	2.10	135.44
3	-36.352649	141.635997	133.38	2.10	135.48
4	-36.352572	141.635161	133.96	2.10	136.06
5	-36.352794	141.635139	133.93	2.10	136.03
6	-36.352669	141.633940	135.56	2.10	137.66
7	-36.353967	141.633761	135.08	2.10	137.18
8	-36.354425	141.638143	132.98	2.10	135.08

2-Mile Flight Path Receptor(s)

Name: Grass runway - north
Description:
Threshold height : 15 m
Direction: 187.7 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-36.306999	141.643820	133.22	15.24	148.46
2-mile point	-36.278349	141.648657	136.79	180.36	317.15

Name: Grass runway south
Description:
Threshold height : 15 m
Direction: 8.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-36.317390	141.642146	129.30	15.24	144.54
2-mile point	-36.346023	141.637159	133.61	179.62	313.22

Name: Runway 09
Description:
Threshold height : 15 m
Direction: 102.4 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-36.309806	141.641545	128.47	15.24	143.71
2-mile point	-36.303602	141.606460	131.66	180.74	312.40

Name: Runway 27
Description:
Threshold height : 15 m
Direction: 280.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude deg	Longitude deg	Ground elevation m	Height above ground m	Total elevation m
Threshold	-36.311729	141.652381	138.03	15.24	153.27
2-mile point	-36.316725	141.687763	158.96	162.99	321.95

Route Receptor(s)

Name: Ervins Road
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude deg	Longitude deg	Ground elevation m	Height above ground m	Total elevation m
1	-36.351911	141.633707	135.28	2.00	137.28
2	-36.352101	141.633525	135.58	2.00	137.58
3	-36.354287	141.633203	135.54	2.00	137.54
4	-36.357346	141.632742	138.52	2.00	140.52
5	-36.358451	141.632570	138.49	2.00	140.49
6	-36.360076	141.632302	136.00	2.00	138.00
7	-36.360542	141.632205	136.13	2.00	138.13
8	-36.360681	141.631948	136.56	2.00	138.56
9	-36.360655	141.631090	137.03	2.00	139.03
10	-36.360681	141.630768	137.06	2.00	139.06
11	-36.361346	141.630607	137.58	2.00	139.58
12	-36.364370	141.630103	137.33	2.00	139.33

Name: McKenzie Avenue
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude deg	Longitude deg	Ground elevation m	Height above ground m	Total elevation m
1	-36.349228	141.634526	133.46	2.00	135.46
2	-36.348779	141.634118	134.57	2.00	136.57
3	-36.348157	141.634118	135.98	2.00	137.98
4	-36.343611	141.634890	131.24	2.00	133.24
5	-36.339221	141.635577	135.59	2.00	137.59
6	-36.334961	141.636226	133.44	2.00	135.44
7	-36.331884	141.636719	134.21	2.00	136.21

Name: Nhill-Harrow Road
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.342644	141.640840	130.08	2.00	132.08
2	-36.343154	141.641602	129.16	2.00	131.16
3	-36.343569	141.642321	129.23	2.00	131.23
4	-36.343975	141.642857	129.73	2.00	131.73
5	-36.344450	141.643415	128.64	2.00	130.64
6	-36.344969	141.643844	129.82	2.00	131.82
7	-36.345764	141.644381	127.92	2.00	129.92
8	-36.346593	141.644842	127.14	2.00	129.14
9	-36.347181	141.645271	128.71	2.00	130.71
10	-36.348019	141.646140	128.86	2.00	130.86
11	-36.348356	141.646441	128.48	2.00	130.48
12	-36.348909	141.646913	128.30	2.00	130.30
13	-36.349480	141.647127	129.67	2.00	131.67
14	-36.350136	141.647127	130.30	2.00	132.30
15	-36.352132	141.647031	131.29	2.00	133.29
16	-36.353022	141.646977	130.68	2.00	132.68
17	-36.353567	141.647041	130.94	2.00	132.94
18	-36.354146	141.647256	130.58	2.00	132.58
19	-36.356513	141.648436	133.51	2.00	135.51
20	-36.357248	141.648779	133.02	2.00	135.02
21	-36.357801	141.648919	132.81	2.00	134.81
22	-36.358302	141.648897	132.94	2.00	134.94
23	-36.359339	141.648726	134.84	2.00	136.84
24	-36.360686	141.648490	134.63	2.00	136.63
25	-36.363952	141.648039	140.74	2.00	142.74
26	-36.368358	141.647310	140.69	2.00	142.69
27	-36.372695	141.646601	138.94	2.00	140.94

Name: Nhill Trailer Exchange
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.350407	141.633375	132.72	2.00	134.72
2	-36.350718	141.633654	133.55	2.00	135.55
3	-36.351090	141.633707	134.11	2.00	136.11
4	-36.351375	141.633643	134.52	2.00	136.52
5	-36.351764	141.633729	135.08	2.00	137.08
6	-36.352014	141.634094	134.92	2.00	136.92
7	-36.352092	141.634630	134.43	2.00	136.43
8	-36.352170	141.635349	134.04	2.00	136.04
9	-36.352239	141.636100	133.04	2.00	135.04
10	-36.351893	141.636368	131.04	2.00	133.04
11	-36.350770	141.636486	132.06	2.00	134.06
12	-36.349906	141.636626	132.00	2.00	134.00
13	-36.349863	141.636851	132.00	2.00	134.00
14	-36.349871	141.637323	131.80	2.00	133.80
15	-36.349724	141.637516	131.48	2.00	133.48
16	-36.349457	141.637355	131.64	2.00	133.64
17	-36.349353	141.636583	131.67	2.00	133.67
18	-36.349413	141.635918	131.67	2.00	133.67
19	-36.349578	141.635242	132.71	2.00	134.71
20	-36.349517	141.634898	133.04	2.00	135.04
21	-36.349353	141.634684	133.23	2.00	135.23

Name: Western Highway
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.359569	141.616073	136.27	2.00	138.27
2	-36.358921	141.618165	136.29	2.00	138.29
3	-36.358152	141.619667	133.93	2.00	135.93
4	-36.356649	141.622338	134.00	2.00	136.00
5	-36.356009	141.623229	134.32	2.00	136.32
6	-36.355422	141.624119	134.76	2.00	136.76
7	-36.354126	141.626458	135.54	2.00	137.54
8	-36.352415	141.629612	135.03	2.00	137.03
9	-36.351153	141.631930	132.74	2.00	134.74
10	-36.350427	141.633260	132.63	2.00	134.63
11	-36.349995	141.633882	133.15	2.00	135.15
12	-36.349459	141.634462	133.23	2.00	135.23
13	-36.348734	141.635191	133.46	2.00	135.46
14	-36.345415	141.638185	135.30	2.00	137.30
15	-36.341794	141.641586	131.52	2.00	133.52
16	-36.339232	141.643994	127.17	2.00	129.17
17	-36.337970	141.645175	128.00	2.00	130.00
18	-36.336963	141.646108	129.49	2.00	131.49

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-36.362022	141.650135	140.06	1.50	141.56
OP 2	-36.363866	141.617285	145.86	1.50	147.36
OP 3	-36.342947	141.641642	129.59	1.50	131.09
OP 4	-36.342675	141.641755	130.26	1.50	131.76
OP 5	-36.342463	141.641969	130.92	1.50	132.42
OP 6	-36.338453	141.643396	128.30	1.50	129.80
OP 7	-36.338194	141.642677	128.70	1.50	130.20
OP 8	-36.335204	141.641766	133.97	1.50	135.47
OP 9	-36.335160	141.640929	133.10	1.50	134.60
OP 10	-36.335109	141.640231	132.16	1.50	133.66
OP 11	-36.334892	141.638525	134.36	1.50	135.86
OP 12	-36.334841	141.637238	133.55	1.50	135.05
OP 13	-36.351105	141.635875	132.05	1.50	133.55
OP 14	-36.347473	141.624929	135.96	1.50	137.46
OP 15	-36.352039	141.643075	134.15	1.50	135.65
OP 16	-36.348719	141.643772	129.88	1.50	131.38
OP 17	-36.344076	141.643952	130.73	1.50	132.23
OP 18	-36.341933	141.642288	131.46	1.50	132.96
OP 19	-36.341527	141.642631	130.97	1.50	132.47
OP 20	-36.341656	141.641097	130.80	1.50	132.30
OP 21	-36.341046	141.641467	130.48	1.50	131.98
OP 22	-36.340890	141.641854	129.82	1.50	131.32
OP 23	-36.340553	141.642390	129.32	1.50	130.82
OP 24	-36.339542	141.643366	128.38	1.50	129.88
OP 25	-36.341655	141.645630	128.75	1.50	130.25
OP 26	-36.340989	141.645265	128.95	1.50	130.45
OP 27	-36.339909	141.644815	128.41	1.50	129.91

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	SA tracking	SA tracking	0	0	-	

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array 1 no glare found

Component	Green glare (min)	Yellow glare (min)
FP: Grass runway - north	0	0
FP: Grass runway south	0	0
FP: Runway 09	0	0
FP: Runway 27	0	0
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
OP: OP 23	0	0
OP: OP 24	0	0
OP: OP 25	0	0
OP: OP 26	0	0
OP: OP 27	0	0
Route: Ervins Road	0	0
Route: McKenzie Avenue	0	0
Route: Nhill-Harrow Road	0	0
Route: Nhill Trailer Exchange	0	0
Route: Western Highway	0	0

No glare found

Assumptions

- 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.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actu values and results may vary.
- 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.

- 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.
- 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 combine area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
- 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.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

ForgeSolar

Nhill Solar Farm Update

Nhill Solar Farm Update _ OPs and Roads

Created Aug. 14, 2021
Updated Aug. 15, 2021
Time-step 1 minute
Timezone offset UTC10
Site ID 57409.10256

Project type Advanced
Project status: active
Category 1 MW to 5 MW

Misc. Analysis Settings

DNI: **varies (2,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:
- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

Summary of Results No glare predicted!

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
PV array 1	SA tracking	SA tracking	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 63,545 m^2

Name: PV array 1
Axis tracking: Single-axis rotation
Tracking axis orientation: 7.9 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 45.0 deg
Footprint area: 63,545 m^2
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 6.55 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.352956	141.638363	132.03	2.10	134.13
2	-36.352714	141.635995	133.34	2.10	135.44
3	-36.352649	141.635997	133.38	2.10	135.48
4	-36.352572	141.635161	133.96	2.10	136.06
5	-36.352794	141.635139	133.93	2.10	136.03
6	-36.352669	141.633940	135.56	2.10	137.66
7	-36.353967	141.633761	135.08	2.10	137.18
8	-36.354425	141.638143	132.98	2.10	135.08

2-Mile Flight Path Receptor(s)

Name: Grass runway - north
Description:
Threshold height : 15 m
Direction: 187.7 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude deg	Longitude deg	Ground elevation m	Height above ground m	Total elevation m
Threshold	-36.306999	141.643820	133.22	15.24	148.46
2-mile point	-36.278349	141.648657	136.79	180.36	317.15

Name: Grass runway south
Description:
Threshold height : 15 m
Direction: 8.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude deg	Longitude deg	Ground elevation m	Height above ground m	Total elevation m
Threshold	-36.317390	141.642146	129.30	15.24	144.54
2-mile point	-36.346023	141.637159	133.61	179.62	313.22

Name: Runway 09
Description:
Threshold height : 15 m
Direction: 102.4 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude deg	Longitude deg	Ground elevation m	Height above ground m	Total elevation m
Threshold	-36.309806	141.641545	128.47	15.24	143.71
2-mile point	-36.303602	141.606460	131.66	180.74	312.40

Name: Runway 27
Description:
Threshold height : 15 m
Direction: 280.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-36.311729	141.652381	138.03	15.24	153.27
2-mile point	-36.316725	141.687763	158.96	162.99	321.95

Route Receptor(s)

Name: Ervins Road
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.351911	141.633707	135.28	2.00	137.28
2	-36.352101	141.633525	135.58	2.00	137.58
3	-36.354287	141.633203	135.54	2.00	137.54
4	-36.357346	141.632742	138.52	2.00	140.52
5	-36.358451	141.632570	138.49	2.00	140.49
6	-36.360076	141.632302	136.00	2.00	138.00
7	-36.360542	141.632205	136.13	2.00	138.13
8	-36.360681	141.631948	136.56	2.00	138.56
9	-36.360655	141.631090	137.03	2.00	139.03
10	-36.360681	141.630768	137.06	2.00	139.06
11	-36.361346	141.630607	137.58	2.00	139.58
12	-36.364370	141.630103	137.33	2.00	139.33

Name: McKenzie Avenue
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.349228	141.634526	133.46	2.00	135.46
2	-36.348779	141.634118	134.57	2.00	136.57
3	-36.348157	141.634118	135.98	2.00	137.98
4	-36.343611	141.634890	131.24	2.00	133.24
5	-36.339221	141.635577	135.59	2.00	137.59
6	-36.334961	141.636226	133.44	2.00	135.44
7	-36.331884	141.636719	134.21	2.00	136.21

Name: Nhill-Harrow Road
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.342644	141.640840	130.08	2.00	132.08
2	-36.343154	141.641602	129.16	2.00	131.16
3	-36.343569	141.642321	129.23	2.00	131.23
4	-36.343975	141.642857	129.73	2.00	131.73
5	-36.344450	141.643415	128.64	2.00	130.64
6	-36.344969	141.643844	129.82	2.00	131.82
7	-36.345764	141.644381	127.92	2.00	129.92
8	-36.346593	141.644842	127.14	2.00	129.14
9	-36.347181	141.645271	128.71	2.00	130.71
10	-36.348019	141.646140	128.86	2.00	130.86
11	-36.348356	141.646441	128.48	2.00	130.48
12	-36.348909	141.646913	128.30	2.00	130.30
13	-36.349480	141.647127	129.67	2.00	131.67
14	-36.350136	141.647127	130.30	2.00	132.30
15	-36.352132	141.647031	131.29	2.00	133.29
16	-36.353022	141.646977	130.68	2.00	132.68
17	-36.353567	141.647041	130.94	2.00	132.94
18	-36.354146	141.647256	130.58	2.00	132.58
19	-36.356513	141.648436	133.51	2.00	135.51
20	-36.357248	141.648779	133.02	2.00	135.02
21	-36.357801	141.648919	132.81	2.00	134.81
22	-36.358302	141.648897	132.94	2.00	134.94
23	-36.359339	141.648726	134.84	2.00	136.84
24	-36.360686	141.648490	134.63	2.00	136.63
25	-36.363952	141.648039	140.74	2.00	142.74
26	-36.368358	141.647310	140.69	2.00	142.69
27	-36.372695	141.646601	138.94	2.00	140.94

Name: Nhill Trailer Exchange
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.350407	141.633375	132.72	2.00	134.72
2	-36.350718	141.633654	133.55	2.00	135.55
3	-36.351090	141.633707	134.11	2.00	136.11
4	-36.351375	141.633643	134.52	2.00	136.52
5	-36.351764	141.633729	135.08	2.00	137.08
6	-36.352014	141.634094	134.92	2.00	136.92
7	-36.352092	141.634630	134.43	2.00	136.43
8	-36.352170	141.635349	134.04	2.00	136.04
9	-36.352239	141.636100	133.04	2.00	135.04
10	-36.351893	141.636368	131.04	2.00	133.04
11	-36.350770	141.636486	132.06	2.00	134.06
12	-36.349906	141.636626	132.00	2.00	134.00
13	-36.349863	141.636851	132.00	2.00	134.00
14	-36.349871	141.637323	131.80	2.00	133.80
15	-36.349724	141.637516	131.48	2.00	133.48
16	-36.349457	141.637355	131.64	2.00	133.64
17	-36.349353	141.636583	131.67	2.00	133.67
18	-36.349413	141.635918	131.67	2.00	133.67
19	-36.349578	141.635242	132.71	2.00	134.71
20	-36.349517	141.634898	133.04	2.00	135.04
21	-36.349353	141.634684	133.23	2.00	135.23

Name: Western Highway
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.359569	141.616073	136.27	2.00	138.27
2	-36.358921	141.618165	136.29	2.00	138.29
3	-36.358152	141.619667	133.93	2.00	135.93
4	-36.356649	141.622338	134.00	2.00	136.00
5	-36.356009	141.623229	134.32	2.00	136.32
6	-36.355422	141.624119	134.76	2.00	136.76
7	-36.354126	141.626458	135.54	2.00	137.54
8	-36.352415	141.629612	135.03	2.00	137.03
9	-36.351153	141.631930	132.74	2.00	134.74
10	-36.350427	141.633260	132.63	2.00	134.63
11	-36.349995	141.633882	133.15	2.00	135.15
12	-36.349459	141.634462	133.23	2.00	135.23
13	-36.348734	141.635191	133.46	2.00	135.46
14	-36.345415	141.638185	135.30	2.00	137.30
15	-36.341794	141.641586	131.52	2.00	133.52
16	-36.339232	141.643994	127.17	2.00	129.17
17	-36.337970	141.645175	128.00	2.00	130.00
18	-36.336963	141.646108	129.49	2.00	131.49

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-36.362022	141.650135	140.06	1.50	141.56
OP 2	-36.363866	141.617285	145.86	1.50	147.36
OP 3	-36.342947	141.641642	129.59	1.50	131.09
OP 4	-36.342675	141.641755	130.26	1.50	131.76
OP 5	-36.342463	141.641969	130.92	1.50	132.42
OP 6	-36.338453	141.643396	128.30	1.50	129.80
OP 7	-36.338194	141.642677	128.70	1.50	130.20
OP 8	-36.335204	141.641766	133.97	1.50	135.47
OP 9	-36.335160	141.640929	133.10	1.50	134.60
OP 10	-36.335109	141.640231	132.16	1.50	133.66
OP 11	-36.334892	141.638525	134.36	1.50	135.86
OP 12	-36.334841	141.637238	133.55	1.50	135.05
OP 13	-36.351105	141.635875	132.05	1.50	133.55
OP 14	-36.347473	141.624929	135.96	1.50	137.46
OP 15	-36.352039	141.643075	134.15	1.50	135.65
OP 16	-36.348719	141.643772	129.88	1.50	131.38
OP 17	-36.344076	141.643952	130.73	1.50	132.23
OP 18	-36.341933	141.642288	131.46	1.50	132.96
OP 19	-36.341527	141.642631	130.97	1.50	132.47
OP 20	-36.341656	141.641097	130.80	1.50	132.30
OP 21	-36.341046	141.641467	130.48	1.50	131.98
OP 22	-36.340890	141.641854	129.82	1.50	131.32
OP 23	-36.340553	141.642390	129.32	1.50	130.82
OP 24	-36.339542	141.643366	128.38	1.50	129.88
OP 25	-36.341655	141.645630	128.75	1.50	130.25
OP 26	-36.340989	141.645265	128.95	1.50	130.45
OP 27	-36.339909	141.644815	128.41	1.50	129.91

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	SA tracking	SA tracking	0	0	-	

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array 1 no glare found

Component	Green glare (min)	Yellow glare (min)
FP: Grass runway - north	0	0
FP: Grass runway south	0	0
FP: Runway 09	0	0
FP: Runway 27	0	0
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
OP: OP 23	0	0
OP: OP 24	0	0
OP: OP 25	0	0
OP: OP 26	0	0
OP: OP 27	0	0
Route: Ervins Road	0	0
Route: McKenzie Avenue	0	0
Route: Nhill-Harrow Road	0	0
Route: Nhill Trailer Exchange	0	0
Route: Western Highway	0	0

No glare found

Assumptions

- 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.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actu values and results may vary.
- 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.

- 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.
- 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 combine area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
- 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.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

ForgeSolar

Nhill Solar Farm Update

Nhill Solar Farm Update _ OPs and Roads

Created Aug. 14, 2021
Updated Aug. 15, 2021
Time-step 1 minute
Timezone offset UTC10
Site ID 57409.10256

Project type Advanced
Project status: active
Category 1 MW to 5 MW

Misc. Analysis Settings

DNI: **varies (2,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:

- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

Summary of Results No glare predicted!

PV Name	Tilt deg	Orientation deg	"Green" Glare min	"Yellow" Glare min	Energy Produced kWh
PV array 1	SA tracking	SA tracking	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 63,545 m^2

Name: PV array 1
Axis tracking: Single-axis rotation
Tracking axis orientation: 7.9 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 5.0 deg
Footprint area: 63,545 m^2
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 6.55 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.352956	141.638363	132.03	2.10	134.13
2	-36.352714	141.635995	133.34	2.10	135.44
3	-36.352649	141.635997	133.38	2.10	135.48
4	-36.352572	141.635161	133.96	2.10	136.06
5	-36.352794	141.635139	133.93	2.10	136.03
6	-36.352669	141.633940	135.56	2.10	137.66
7	-36.353967	141.633761	135.08	2.10	137.18
8	-36.354425	141.638143	132.98	2.10	135.08

2-Mile Flight Path Receptor(s)

Name: Grass runway - north
Description:
Threshold height : 15 m
Direction: 187.7 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-36.306999	141.643820	133.22	15.24	148.46
2-mile point	-36.278349	141.648657	136.79	180.36	317.15

Name: Grass runway south
Description:
Threshold height : 15 m
Direction: 8.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-36.317390	141.642146	129.30	15.24	144.54
2-mile point	-36.346023	141.637159	133.61	179.62	313.22

Name: Runway 09
Description:
Threshold height : 15 m
Direction: 102.4 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-36.309806	141.641545	128.47	15.24	143.71
2-mile point	-36.303602	141.606460	131.66	180.74	312.40

Name: Runway 27
Description:
Threshold height : 15 m
Direction: 280.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude deg	Longitude deg	Ground elevation m	Height above ground m	Total elevation m
Threshold	-36.311729	141.652381	138.03	15.24	153.27
2-mile point	-36.316725	141.687763	158.96	162.99	321.95

Route Receptor(s)

Name: Ervins Road
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude deg	Longitude deg	Ground elevation m	Height above ground m	Total elevation m
1	-36.351911	141.633707	135.28	2.00	137.28
2	-36.352101	141.633525	135.58	2.00	137.58
3	-36.354287	141.633203	135.54	2.00	137.54
4	-36.357346	141.632742	138.52	2.00	140.52
5	-36.358451	141.632570	138.49	2.00	140.49
6	-36.360076	141.632302	136.00	2.00	138.00
7	-36.360542	141.632205	136.13	2.00	138.13
8	-36.360681	141.631948	136.56	2.00	138.56
9	-36.360655	141.631090	137.03	2.00	139.03
10	-36.360681	141.630768	137.06	2.00	139.06
11	-36.361346	141.630607	137.58	2.00	139.58
12	-36.364370	141.630103	137.33	2.00	139.33

Name: McKenzie Avenue
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude deg	Longitude deg	Ground elevation m	Height above ground m	Total elevation m
1	-36.349228	141.634526	133.46	2.00	135.46
2	-36.348779	141.634118	134.57	2.00	136.57
3	-36.348157	141.634118	135.98	2.00	137.98
4	-36.343611	141.634890	131.24	2.00	133.24
5	-36.339221	141.635577	135.59	2.00	137.59
6	-36.334961	141.636226	133.44	2.00	135.44
7	-36.331884	141.636719	134.21	2.00	136.21

Name: Nhill-Harrow Road
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.342644	141.640840	130.08	2.00	132.08
2	-36.343154	141.641602	129.16	2.00	131.16
3	-36.343569	141.642321	129.23	2.00	131.23
4	-36.343975	141.642857	129.73	2.00	131.73
5	-36.344450	141.643415	128.64	2.00	130.64
6	-36.344969	141.643844	129.82	2.00	131.82
7	-36.345764	141.644381	127.92	2.00	129.92
8	-36.346593	141.644842	127.14	2.00	129.14
9	-36.347181	141.645271	128.71	2.00	130.71
10	-36.348019	141.646140	128.86	2.00	130.86
11	-36.348356	141.646441	128.48	2.00	130.48
12	-36.348909	141.646913	128.30	2.00	130.30
13	-36.349480	141.647127	129.67	2.00	131.67
14	-36.350136	141.647127	130.30	2.00	132.30
15	-36.352132	141.647031	131.29	2.00	133.29
16	-36.353022	141.646977	130.68	2.00	132.68
17	-36.353567	141.647041	130.94	2.00	132.94
18	-36.354146	141.647256	130.58	2.00	132.58
19	-36.356513	141.648436	133.51	2.00	135.51
20	-36.357248	141.648779	133.02	2.00	135.02
21	-36.357801	141.648919	132.81	2.00	134.81
22	-36.358302	141.648897	132.94	2.00	134.94
23	-36.359339	141.648726	134.84	2.00	136.84
24	-36.360686	141.648490	134.63	2.00	136.63
25	-36.363952	141.648039	140.74	2.00	142.74
26	-36.368358	141.647310	140.69	2.00	142.69
27	-36.372695	141.646601	138.94	2.00	140.94

Name: Nhill Trailer Exchange
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.350407	141.633375	132.72	2.00	134.72
2	-36.350718	141.633654	133.55	2.00	135.55
3	-36.351090	141.633707	134.11	2.00	136.11
4	-36.351375	141.633643	134.52	2.00	136.52
5	-36.351764	141.633729	135.08	2.00	137.08
6	-36.352014	141.634094	134.92	2.00	136.92
7	-36.352092	141.634630	134.43	2.00	136.43
8	-36.352170	141.635349	134.04	2.00	136.04
9	-36.352239	141.636100	133.04	2.00	135.04
10	-36.351893	141.636368	131.04	2.00	133.04
11	-36.350770	141.636486	132.06	2.00	134.06
12	-36.349906	141.636626	132.00	2.00	134.00
13	-36.349863	141.636851	132.00	2.00	134.00
14	-36.349871	141.637323	131.80	2.00	133.80
15	-36.349724	141.637516	131.48	2.00	133.48
16	-36.349457	141.637355	131.64	2.00	133.64
17	-36.349353	141.636583	131.67	2.00	133.67
18	-36.349413	141.635918	131.67	2.00	133.67
19	-36.349578	141.635242	132.71	2.00	134.71
20	-36.349517	141.634898	133.04	2.00	135.04
21	-36.349353	141.634684	133.23	2.00	135.23

Name: Western Highway
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.359569	141.616073	136.27	2.00	138.27
2	-36.358921	141.618165	136.29	2.00	138.29
3	-36.358152	141.619667	133.93	2.00	135.93
4	-36.356649	141.622338	134.00	2.00	136.00
5	-36.356009	141.623229	134.32	2.00	136.32
6	-36.355422	141.624119	134.76	2.00	136.76
7	-36.354126	141.626458	135.54	2.00	137.54
8	-36.352415	141.629612	135.03	2.00	137.03
9	-36.351153	141.631930	132.74	2.00	134.74
10	-36.350427	141.633260	132.63	2.00	134.63
11	-36.349995	141.633882	133.15	2.00	135.15
12	-36.349459	141.634462	133.23	2.00	135.23
13	-36.348734	141.635191	133.46	2.00	135.46
14	-36.345415	141.638185	135.30	2.00	137.30
15	-36.341794	141.641586	131.52	2.00	133.52
16	-36.339232	141.643994	127.17	2.00	129.17
17	-36.337970	141.645175	128.00	2.00	130.00
18	-36.336963	141.646108	129.49	2.00	131.49

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-36.362022	141.650135	140.06	1.50	141.56
OP 2	-36.363866	141.617285	145.86	1.50	147.36
OP 3	-36.342947	141.641642	129.59	1.50	131.09
OP 4	-36.342675	141.641755	130.26	1.50	131.76
OP 5	-36.342463	141.641969	130.92	1.50	132.42
OP 6	-36.338453	141.643396	128.30	1.50	129.80
OP 7	-36.338194	141.642677	128.70	1.50	130.20
OP 8	-36.335204	141.641766	133.97	1.50	135.47
OP 9	-36.335160	141.640929	133.10	1.50	134.60
OP 10	-36.335109	141.640231	132.16	1.50	133.66
OP 11	-36.334892	141.638525	134.36	1.50	135.86
OP 12	-36.334841	141.637238	133.55	1.50	135.05
OP 13	-36.351105	141.635875	132.05	1.50	133.55
OP 14	-36.347473	141.624929	135.96	1.50	137.46
OP 15	-36.352039	141.643075	134.15	1.50	135.65
OP 16	-36.348719	141.643772	129.88	1.50	131.38
OP 17	-36.344076	141.643952	130.73	1.50	132.23
OP 18	-36.341933	141.642288	131.46	1.50	132.96
OP 19	-36.341527	141.642631	130.97	1.50	132.47
OP 20	-36.341656	141.641097	130.80	1.50	132.30
OP 21	-36.341046	141.641467	130.48	1.50	131.98
OP 22	-36.340890	141.641854	129.82	1.50	131.32
OP 23	-36.340553	141.642390	129.32	1.50	130.82
OP 24	-36.339542	141.643366	128.38	1.50	129.88
OP 25	-36.341655	141.645630	128.75	1.50	130.25
OP 26	-36.340989	141.645265	128.95	1.50	130.45
OP 27	-36.339909	141.644815	128.41	1.50	129.91

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	SA tracking	SA tracking	0	0	-	

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array 1 no glare found

Component	Green glare (min)	Yellow glare (min)
FP: Grass runway - north	0	0
FP: Grass runway south	0	0
FP: Runway 09	0	0
FP: Runway 27	0	0
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
OP: OP 23	0	0
OP: OP 24	0	0
OP: OP 25	0	0
OP: OP 26	0	0
OP: OP 27	0	0
Route: Ervins Road	0	0
Route: McKenzie Avenue	0	0
Route: Nhill-Harrow Road	0	0
Route: Nhill Trailer Exchange	0	0
Route: Western Highway	0	0

No glare found

Assumptions

- 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.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actu values and results may vary.
- 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.

- 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.
- 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 combine area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
- 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.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.