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Glint and Glare Assessment

Muskerry Solar Power Station

21 November 2022

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Glint and Glare Assessment

Muskerry Solar Power Station

AE1185

November 2022

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Abbreviations

BSC	Bendigo Shire Council
CSC	Campaspe Shire Council
FAA	Federal Aviation Administration
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre
kV	kilovolt
LGA	Local Government Area
m	metres
mrad	miliradian
MW	megawatts
OP	observation point
PCU	power conversion unit
PV	photovoltaic
SGHAT	Solar Glare Hazard Analysis Tool
SPS	Solar power station

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1 Introduction

1.1 Overview

This Glint and Glare assessment has been prepared by Accent Environmental Pty Ltd (Accent). The assessment was commissioned by Edify Energy Pty Ltd (Edify) as a part of the Development Application for the construction and operation of the Muskerry Solar Power Station (Muskerry SPS) located in Muskerry, 33 km east of Bendigo in Victoria (Figure 1.1) within both the Greater Bendigo and Campaspe local government areas (LGAs).

This report includes:

- identification of potential receivers of glint and glare from the proposed solar power station
- assessment of the glint and glare hazard using the Solar Glare Hazard Analysis Tool (SGHAT) GlareGauge analysis.

1.2 Glint and glare

Glint and glare from photovoltaic (PV) panels can have potential safety or amenity impacts on surrounding sensitive receivers. Glint is a momentary flash of bright light produced as a direct reflection of the sun in the surface of an object (such as a PV panel). Glare is a continuous source of bright light reflected from a surface (such as a PV panel). Typically, glint is witnessed by moderate or fast-moving receivers while glare is faced by the static or slow-moving receivers. Glint, that occurs for less than one minute, is unlikely to occur from the sun as both the sun and PVs move slowly (Ho 2011). Glint could be encountered by fast moving receptors (road users and aircraft) as they would potentially experience glare from the panels as glint due to their own rapid movement through the path of the glare. As such, modelling impacts from glare also encompasses modelling for glint in the case of Muskerry SPS (and solar farms in general).

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- Project site - north
- Project site - south
- Railway
- Existing transmission lines
- Road
- National Park (NP)
- Nature Conservation Reserve (NCR)
- Lake/reservoir
- Main watercourse
- Watercourse - tributary



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Figure 1. Site location

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Background map: Google Satellite [Feb 2022] - main map and inset map
Additional data: Main map - Vic HY_WATERCOURSE, Vic TR_ROAD, Vic
TR_RAIL, Vic ElectricityTransmissionLines_v2, Vic PARKRES,
Inset map - ABS STE_2021_AUST_GDA2020



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2 Site overview

The proposed Muskerry SPS is located 33 km east of Bendigo in Victoria. The proposed project consists of two sections, informally North Muskerry and South Muskerry, with a combined capacity of up to 250 MW. The proposed Muskerry SPS is located within two planning schemes the Bendigo Shire Council (BSC) and Campaspe Shire Council (CSC) local government areas (LGAs). The two LGAs are located within the Goldfields sub-region of the Victorian Midlands IBRA v.7 Region (IBRA 2020).

The project site is divided into two areas with the northern portion and southern portion having a combined area of 927 ha of rural land. The project footprint occupies 496.21 ha of land within the project site, with the remaining land excluded from development, primarily to minimise environmental impacts. It is anticipated that both portions of the site will be accessed via Toolleen-Angle Road to the north of the northern portion of the development footprint with an access road between the two portions being improved to enable access to the southern portion. This access road is also the planned route for the electrical connection line between the northern and southern portions. The northern portion is traversed by the existing AusNet Bendigo-Fosterville-Shepparton transmission line with an easement running northeast/southwest through the footprint.

The site has favourable topography for visual amenity with undulating land across the site. There are also clusters of vegetation within the site to be retained and trees bordering two of the adjacent public roads, Axedale-Toolleen Road and the Toolleen-Angle Road. The specifics of the project are described in Table 2.1 and a site layout is shown in Figure 2.1.

Table 2.1 Site Details

Component	Description
Planning Scheme(s)	Greater Bendigo and Campaspe Planning Schemes
Solar Project	Muskerry Solar Power Station
Address	Muskerry East School Road, Muskerry, VIC 3557
Applicant	Edify Energy Pty Ltd, ABN 85 606 684 995 Level 1, 34-35 South Steyne, MANLY NSW 2095
Council	Greater Bendigo and Campaspe Planning Schemes
Titles	Volume 10244 Folio 880 Lots 1,2 and 4 TP120975V Volume 04947 Folio 377 (Crown Allotment 5, Section D, Parish of Muskerry) Volume 09070 Folio 485 (being Lot 1 on LP113736) Volume 09070 Folio 486 (being Lot 2 on LP113736) Volume 05794 Folio 602 (being Lots 1 and 2 on TP677364) Crown Allotment 5, Section D, Parish of Muskerry Volume 11659 Folio 176 Crown Allotment 8, Section D, Parish of Muskerry

Component	Description
	<p>Volume 11392 Folio 481 being comprised of Crown Allotments 12C and 12D, Section D, Parish of Muskerry (see TP887296M)</p> <p>Crown Allotments 1, 2, 4 and 5, Section 2, Parish of Weston (see TP887296M)</p> <p>Volume 03326 Folio 130 being Crown Allotment 5A, Section 2, Parish of Weston (see TP867302J)</p> <p>Volume 01966 Folio 061 being Crown Allotment 3, Section 2, Parish of Weston (see TP869754K)</p> <p>Volume 11392 Folio 479 contained in Lot 2 on Plan of Subdivision 704656W</p> <p>Easement: Lot 1 TP892631V Crown Allotment 7B, Section D, Parish of Muskerry</p>
Total indicative area	<p>Site size: approximately 927 ha</p> <p>Development footprint: approximately 496 ha</p>
Land use zoning	Farming Zone (FZ)
Land use	Sheep grazing and small areas cultivated for fodder cropping
Proposed capacity	250MWdc plus 200 MW / 800 MWh Battery Energy Storage System

2.1 Site layout

The solar arrays will be 70 to 90 m long and approximately 7 m apart. The height of the solar panels will vary across the day as they track the path of the sun; however, the maximum height will not exceed 4.2 m. The solar arrays will be positioned in a north-south alignment and will tilt along a single axis in an east to west movement. Each solar photovoltaic (PV) (commonly solar panel) will be fixed to a metal mounting structure, piled or screwed into the ground without the need for any concrete.

An example of solar arrays arranged in blocks is shown in Figure 2.1.

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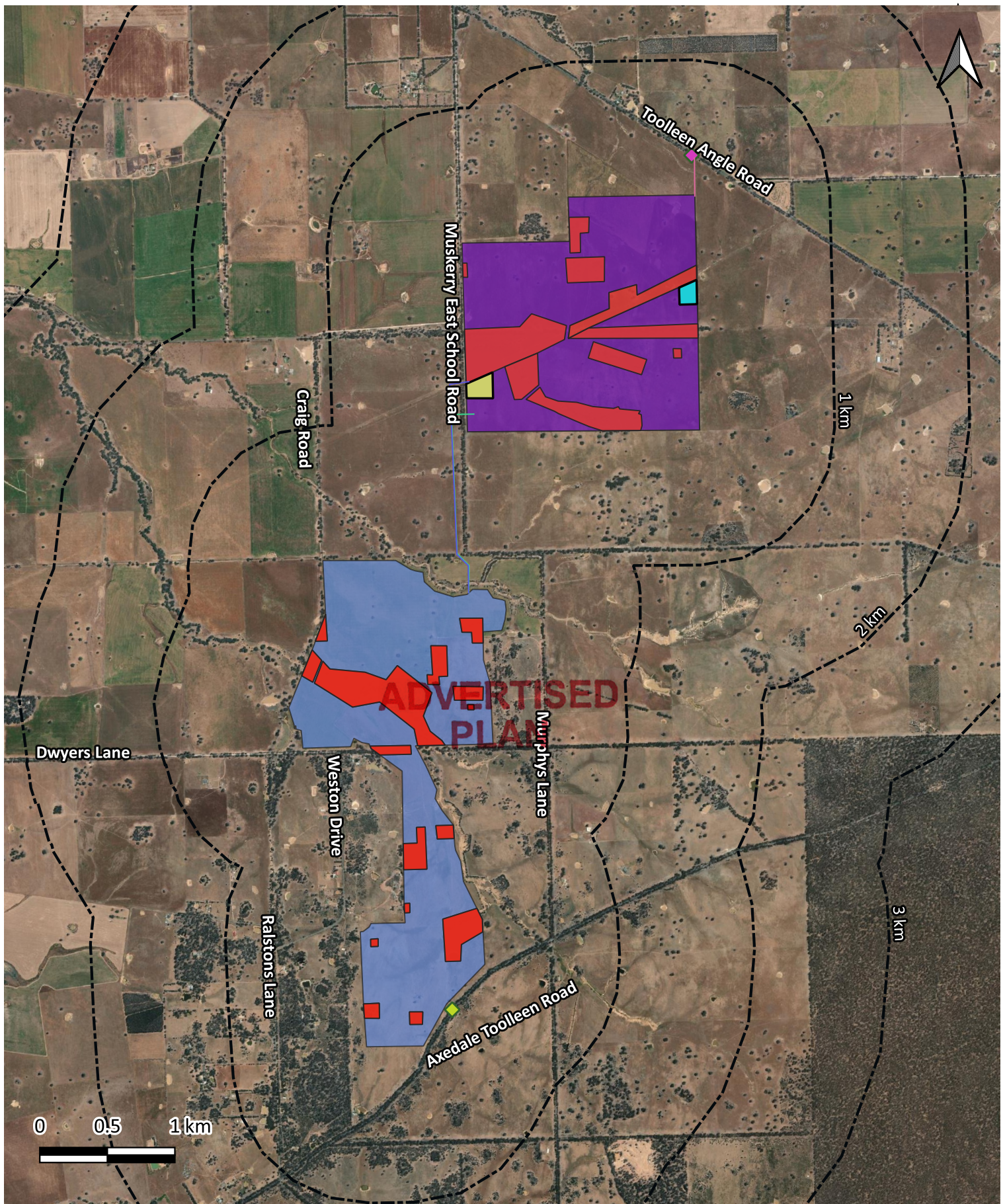
Figure 2.1.1 An example of solar power station array blocks

Within each array block is a power conversion unit (PCU) (see Figure 2.1) which contains the central inverters, step-up transformers and switchgear which convert DC electricity collected from the panels into AC electricity for connection and distribution via the 220 kV AusNet Transmission Line. In addition to the solar array infrastructure, Lithium-ion batteries will be installed in a secure, climate-controlled BESS unit with a rating of up to 200 MW/800 MWh.

The expected operational timeframe of the project is 30 years, following which the SPS will be decommissioned. Decommissioning will include the removal of all solar infrastructure to a depth of 1,200 mm and rehabilitation of the land to previous land use.

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- | | |
|---|---|
|  Northern portion of Muskerry SPS |  Easement Option A |
|  Southern portion of Muskerry SPS |  Easement Option B |
|  Restricted Area |  Proposed Site Access |
|  Substation Option a) |  Emergency Site Access - CFA |
|  Substation Option b) |  Main site access |

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Figure 2.2 Site Layout

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SPS: GDA 2020 MGA zone 55
Additional data source: ESRI satellite

2.2 Solar panel details

The solar photovoltaics (solar panels) are designed to track the sun, east-west, along a single axis to maximise energy absorption. The solar panels would remain at a stationary and constant 54-degree angle from sunrise (first light), until approximately 9:00 am when the solar panels will begin to move and follow the path of the sun. Likewise, from approximately 4:30 pm until sunset (last light), the solar panels will remain at a constant -54-degree angle.

Photovoltaic solar panels are specifically designed to maximise the absorption of solar energy for the purpose of converting it to electricity. Tier 1 quality panels, which will be procured by the project, incorporate anti-reflective glass front surfaces to capture and retain as much as possible of the solar spectrum. Typical panels are designed to reflect only about 2% of incoming sunlight and the glass of a solar panel has less reflectivity than window glass (MDER et al 2015). The Tier-1 modules proposed for Muskerry SPS aim to reduce optical losses in order to increase efficiency, and the anti-reflective coating on the cover glass reduces normal incidence reflectance to less than 1% (Sarkin et al 2020). The potential for glare associated with non-concentrating photovoltaic systems which do not involve mirrors or lenses, such as proposed for the Muskerry SPS, is therefore relatively limited.

Additional solar power station infrastructure that may potentially cause glare or reflections depending on the sun's angle, include the following:

- steel array mounting structures – array mounting would be steel or aluminium
- temporary site offices, sheds, containerised inverter stations
- high voltage substation
- BESS modules
- perimeter fencing
- permanent staff amenities.

There are several factors which contribute to the occurrence of reflective visual nuisance, such as the frequency of the reflection, the type of reflection (specular versus diffuse), the reflectivity of the panel's glass, localised environmental impacts and the location of visual receivers (Danks and Good 2016).

The assessment in Section 3, below, considers the following aspects to ascertain the proposal's degree of reflective nuisance:

- surface material of solar panels procured by the project
- the mechanical behaviour (solar tracking method and maximum and resting tilt angles) and orientation of the solar modules
- the existing environment.

Glare-based visual nuisance associated with the proposal will be largely influenced by the design of the solar panels and arrays, the location of the SPS and also the position of the solar panels relative to sensitive visual receivers.

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3 Analysis

3.1 Overview

Accent have undertaken glint and glare modelling using the ForgeSolar GlareGauge tool. The GlareGauge tool which uses the SGHAT was developed by Scandia National Laboratories to evaluate glare resulting from solar farms at specific receiver viewpoints and along receiver routes based on the location, elevation and PV module specifications. The analysis tool simulates the annual sun path based on the project location. The use of the GlareGauge tool is a requirement of the United States Federal Aviation Administration (FAA) to analyse glare hazard near airports. The tool is also recognised by the Australian Government Civil Aviation Safety Authority (CASA). The specific inputs to the GlareGauge analysis are detailed in Section 3.2.

The output of the GlareGauge analysis (detailed in Section 3.4) provides an indication of expected glare hazard which is determined based on the retinal irradiance and subtended glare angle as a result of the Muskerry SPS infrastructure at each potential receptor. The severity of glare is categorised by colour as follows (Ho 2011):

- Green glare: Low potential for temporary after-image
- Yellow glare: Potential for temporary after-image
- Red glare: Retinal burn (not expected for PVs).

3.2 Inputs

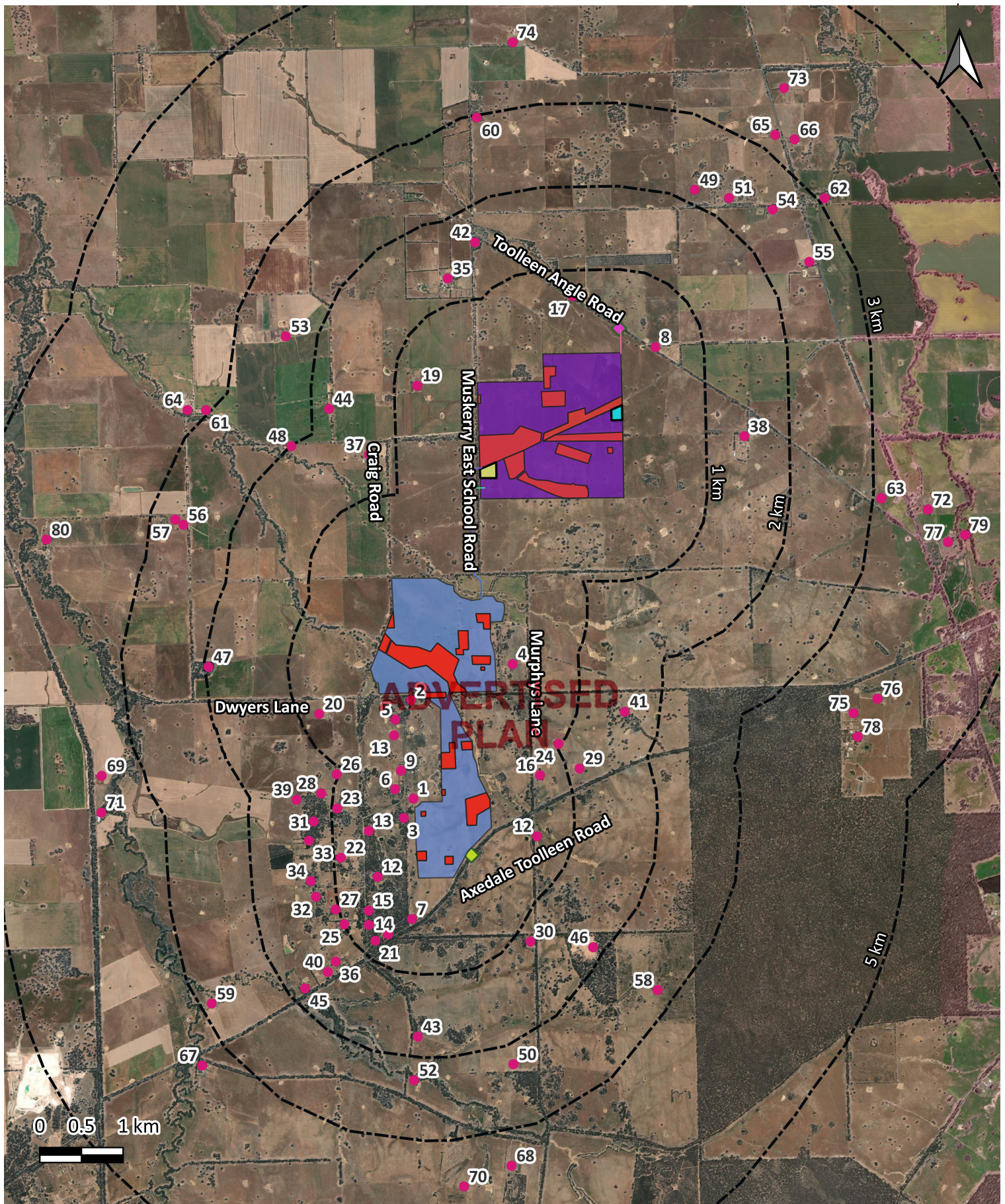
The inputs required for the GlareGauge fall into two groups relating to potential receptors (points, routes and flight paths) and PV parameters. These values are added to GlareGauge via a component template Excel spreadsheet which includes parameters such as PV parameters and elevation and co-ordinates of receptor points and solar arrays, and route and flight path vertices. GlareGauge also has a Google Maps interface whereby solar arrays and receptors can be added manually; however, this interface was used only to verify the uploaded data was correct for this project.

3.2.1 Potential receptors

For the Muskerry SPS, Accent has identified the following receptors:

- 80 potential point receptors up to a maximum distance of 4.169 km from the site (referred to within GlareGauge as observation points (OPs)) during the visual impact assessment (Accent 2022) of these receptors (see Figure 3.1)
- 15 route receptors (roads both made and unmade surrounding the development footprint)
- one flight path (this was added as a precaution due to a small flight school at Knowsley Airfield, approximately 5 km south of the development footprint).

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- | | |
|------------------------------------|-------------------------------|
| ● Point receptors (OPs) | — Easement Option A |
| ■ Northern portion of Muskerry SPS | — Easement Option B |
| ■ Southern portion of Muskerry SPS | — Proposed Site Access |
| ■ Restricted Area | ◆ Emergency Site Access - CFA |
| ■ Substation Option a) | ◆ Main site access |
| ■ Substation Option b) | |

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Figure 3.1 Receptors

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For each of the point and route receptors, a viewer height of 1.5 m above ground was assumed to be the typical viewing height whether standing or driving. The route receptors view angle (field of view left and right of centre) was input as 50 degrees. FAA (2010) research suggests that outside of a 50-degree field of view, glare does not impact on the receptor.

A full list of receptors along with co-ordinates and elevations is contained within the GlareGauge Analysis outputs in Appendix A.

3.2.2 Photovoltaic parameters

Table 3.1 details the photovoltaic parameter inputs for the GlareGauge analysis.

Table 3.1 Photovoltaic parameter inputs to GlareGauge analysis for Muskerry SPS

Parameter	Input value	Unit	Comment
General project parameters			
Time zone	+10	UTC	Victoria, Australia time zone
Orientation of array	0	Degrees	Rows aligned north-south direction
Solar panel surface material	Lightly textured glass with anti-reflective coating (ARC)	-	Provided by Edify
Time interval	1	Minutes	Model interval throughout the year
Mounting type	Single axis tracking	-	-
Single axis tracking parameters			
Tilt of tracking axis	0	Degrees	Panels rotate during operation according to single axis tracking operation
Orientation of tracking axis	0	Degrees	Rows aligned north-south
Offset angle of panel	0	Degrees	Angle between tracking axis and panel

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Parameter	Input value	Unit	Comment
Tracking range	±54	Degrees	
Height above ground	2.2	m	Post height from ground measured to the point of tracking rotation

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3.3 Assumptions

Glare hazard definition is limited, as it is not the same for everyone. Glare hazard is dependent on multiple factors including size of glare source, distance from receptor, ocular/eye parameters (pupil diameter, distance from pupil to retina etc.), reflectance parameters (light intensity, angle) (Ho 2011). The following assumptions (which are default GlareGauge input values) have been made during the analysis as outlined in the SGHAT user's manual (Ho and Sims 2013):

- The model assumes flat reflective surfaces and that light reflected by the solar panels is specular (i.e. the angle of incidence = the angle of reflection).
- The average subtended angle of the sun as viewed from earth is ~9.3 mrad or 0.5°.
- The ocular transmission coefficient accounts for radiation that is absorbed in the eye before reaching the retina. A value of 0.5 is typical.
- Diameter of the pupil – the size impacts the amount of light entering the eye and reaching the retina. The typical value is 0.002 m for daylight-adjusted eyes.
- Eye focal length: This value is used to determine the projected image size on the retina for a given subtended angle of the glare source. A typical value of 0.017 m is used.
- ForgeSolar does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, and variable heights of the PV array and support structures, may impact actual glare results. The PV array is simulated as a footprint filled with infinitesimally small panels reflecting sunlight in the trajectory of the tilt and orientation.

Due to the complexity of the shape of the Muskerry SPS site, areas of exclusion have not been removed from the solar array locations. This is due to a maximum allowable number of 40 vertices for each solar array. This is therefore a conservative approach as a greater area of panels has been modelled than will actually be constructed across the site.

3.4 Results

The full results of the GlareGauge analysis are available in Appendix A. Summaries of the results for each receptor are given in Table 3.2. None of the residences (identified as OPs) or roads (identified as routes) are expected to experience glare as a result of the proposed SPS. As outlined in the Muskerry SPS LVIA (Accent 2022), most of these receptors are unlikely to have a direct line of sight to the project due to topography and intermittent vegetation.

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Table 3.2 Glare potential at receptors as determined by GlareGauge analysis for Muskerry SPS

Receptor	Type	Distance from SPS (m)	Green glare (minutes)	Yellow glare (minutes)	Glare potential
OP1	Residential	101	0	0	No glare
OP2	Residential	134	0	0	No glare
OP3	Residential	135	0	0	No glare
OP4	Residential	208	0	0	No glare
OP5	Residential	314	0	0	No glare
OP6	Residential	319	0	0	No glare
OP7	Residential	346	0	0	No glare
OP8	Residential	420	0	0	No glare
OP9	Residential	450	0	0	No glare
OP10	Residential	500	0	0	No glare
OP11	Residential	503	0	0	No glare
OP12	Residential	558	0	0	No glare
OP13	Residential	561	0	0	No glare
OP14	Residential	640	0	0	No glare
OP15	Residential	653	0	0	No glare
OP16	Residential	669	0	0	No glare
OP17	Residential	692	0	0	No glare
OP18	Residential	731	0	0	No glare
OP19	Residential	731	0	0	No glare
OP20	Residential	760	0	0	No glare
OP21	Residential	796	0	0	No glare
OP22	Residential	912	0	0	No glare
OP23	Residential	930	0	0	No glare
OP24	Residential	974	0	0	No glare
OP25	Residential	985	0	0	No glare
OP26	Residential	1014	0	0	No glare
OP27	Residential	1030	0	0	No glare

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Receptor	Type	Distance from SPS (m)	Green glare (minutes)	Yellow glare (minutes)	Glare potential
OP28	Residential	1134	0	0	No glare
OP29	Residential	1139	0	0	No glare
OP30	Residential	1179	0	0	No glare
OP31	Residential	1221	0	0	No glare
OP32	Residential	1243	0	0	No glare
OP33	Residential	1285	0	0	No glare
OP34	Residential	1292	0	0	No glare
OP35	Residential	1298	0	0	No glare
OP36	Residential	1313	0	0	No glare
OP37	Residential	1327	0	0	No glare
OP38	Residential	1414	0	0	No glare
OP39	Residential	1422	0	0	No glare
OP40	Residential	1466	0	0	No glare
OP41	Residential	1559	0	0	No glare
OP42	Residential	1569	0	0	No glare
OP43	Residential	1747	0	0	No glare
OP44	Residential	1789	0	0	No glare
OP45	Residential	1803	0	0	No glare
OP46	Residential	1871	0	0	No glare
OP47	Residential	1947	0	0	No glare
OP48	Residential	1989	0	0	No glare
OP49	Residential	2148	0	0	No glare
OP50	Residential	2234	0	0	No glare
OP51	Residential	2266	0	0	No glare
OP52	Residential	2271	0	0	No glare
OP53	Residential	2366	0	0	No glare
OP54	Residential	2505	0	0	No glare
OP55	Residential	2511	0	0	No glare

Receptor	Type	Distance from SPS (m)	Green glare (minutes)	Yellow glare (minutes)	Glare potential
OP56	Residential	2579	0	0	No glare
OP57	Residential	2690	0	0	No glare
OP58	Residential	2793	0	0	No glare
OP59	Residential	2836	0	0	No glare
OP60	Residential	2948	0	0	No glare
OP61	Residential	3005	0	0	No glare
OP62	Residential	3071	0	0	No glare
OP63	Residential	3092	0	0	No glare
OP64	Residential	3175	0	0	No glare
OP65	Residential	3204	0	0	No glare
OP66	Residential	3302	0	0	No glare
OP67	Residential	3345	0	0	No glare
OP68	Residential	3395	0	0	No glare
OP69	Residential	3462	0	0	No glare
OP70	Residential	3558	0	0	No glare
OP71	Residential	3628	0	0	No glare
OP72	Residential	3654	0	0	No glare
OP73	Residential	3731	0	0	No glare
OP74	Residential	3761	0	0	No glare
OP75	Residential	3780	0	0	No glare
OP76	Residential	3885	0	0	No glare
OP77	Residential	3929	0	0	No glare
OP78	Residential	4014	0	0	No glare
OP79	Residential	4124	0	0	No glare
OP80	Residential	4170	0	0	No glare
Axedale Crosbie Road	Road Route	1160 (at nearest point)	0	0	No glare

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Receptor	Type	Distance from SPS (m)	Green glare (minutes)	Yellow glare (minutes)	Glare potential
Axedale-Toolleen Road	Road Route	40 (at nearest point)	0	0	No glare
Craig Road	Road Route	30 (at nearest point)	0	0	No glare
Dwyer Lane	Road Route	30 (at nearest point)	0	0	No glare
Harrington Road	Road Route	2110 (at nearest point)	0	0	No glare
Hicksons Road	Road Route	1760 (at nearest point)	0	0	No glare
Joyces Bridge Road	Road Route	60 (at nearest point)	0	0	No glare
Knowsley-Barnadown Road	Road Route	3685 (at nearest point)	0	0	No glare
Murphys Lane	Road Route	375 (at nearest point)	0	0	No glare
Muskerry East School Lane	Road Route	Adjacent to site	0	0	No glare
Northern Highway	Road Route	2670 (at nearest point)	0	0	No glare
Ralstons Road	Road Route	635 (at nearest point)	0	0	No glare
Route 14	Road Route	4000 (at nearest point)	0	0	No glare
Toolleen-Angle Road	Road Route	300 (at nearest point)	0	0	No glare
Weston Drive	Road Route	30 (at nearest point)	0	0	No glare
Knowsley Airpark	Flight path (2 miles)	5100	0	0	No glare

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4 Summary

The results of the GlareGauge analysis indicated the selected receptors (points, routes and flight path) are unlikely to be subjected to glare as a result of the proposed Muskerry SPS. Glint which would potentially be experienced by road users and aircraft is also not expected for the proposed Muskerry SPS.

Existing vegetation along roads and surrounding the proposed site are expected to constitute physical obstructions between the identified receptors (residents at points and road users along routes) further reducing the risk of glare-related visual impact from the project.

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Appendix A: GlareGauge analysis results

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FORGESOLAR GLARE ANALYSIS

Project: **Muskerry SPS**

Proposed 250 MW SPS in Muskerry Victoria

Site configuration: **Muskerry proposed site configuration**

Client: Edify

Site description: 250 MW SPS in northern Victoria

Created 15 Nov, 2022

Updated 16 Nov, 2022

Time-step 1 minute

Timezone offset UTC10

Site ID 79398.14041

Category 100 MW to 1 GW

DNI peaks at 1,000.0 W/m²

Ocular transmission coefficient 0.5

Pupil diameter 0.002 m

Eye focal length 0.017 m

Sun subtended angle 9.3 mrad

Methodology V2

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Summary of Results No glare predicted

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

Total annual 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
Axedale Crosbie Road	0	0.0	0	0.0
Axedale-Toolleen Road	0	0.0	0	0.0
Craig Road	0	0.0	0	0.0
Dwyer LAne	0	0.0	0	0.0
Harrington Road	0	0.0	0	0.0
Hicksons Road	0	0.0	0	0.0
Joyces Bridge Rd	0	0.0	0	0.0
Knowsley-Barnadown Rd	0	0.0	0	0.0
Murphys Lane	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Muskerry East School Road	0	0.0	0	0.0
Northern Highway	0	0.0	0	0.0
Ralstons Road	0	0.0	0	0.0
Route 14	0	0.0	0	0.0
Toolleen Angle Road	0	0.0	0	0.0
Weston Drive	0	0.0	0	0.0
Knowsley Air Park	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 40	0	0.0	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 45	0	0.0	0	0.0
OP 46	0	0.0	0	0.0
OP 47	0	0.0	0	0.0
OP 48	0	0.0	0	0.0
OP 49	0	0.0	0	0.0
OP 50	0	0.0	0	0.0
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0
OP 53	0	0.0	0	0.0
OP 54	0	0.0	0	0.0
OP 55	0	0.0	0	0.0
OP 56	0	0.0	0	0.0
OP 57	0	0.0	0	0.0
OP 58	0	0.0	0	0.0
OP 59	0	0.0	0	0.0
OP 60	0	0.0	0	0.0
OP 61	0	0.0	0	0.0
OP 62	0	0.0	0	0.0
OP 63	0	0.0	0	0.0
OP 64	0	0.0	0	0.0
OP 65	0	0.0	0	0.0
OP 66	0	0.0	0	0.0
OP 67	0	0.0	0	0.0
OP 68	0	0.0	0	0.0
OP 69	0	0.0	0	0.0
OP 70	0	0.0	0	0.0
OP 71	0	0.0	0	0.0
OP 72	0	0.0	0	0.0
OP 73	0	0.0	0	0.0
OP 74	0	0.0	0	0.0
OP 75	0	0.0	0	0.0
OP 76	0	0.0	0	0.0
OP 77	0	0.0	0	0.0
OP 78	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 79	0	0.0	0	0.0
OP 80	0	0.0	0	0.0

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Component Data

PV Arrays

Name: Muskerry North
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 0.0°
Max tracking angle: 54.0°
Resting angle: 30.0°
Ground Coverage Ratio: 0.5
Rated power: -
Panel material: Light textured 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	-36.691716	144.618593	183.58	4.20	187.78
2	-36.691723	144.627512	181.90	4.20	186.10
3	-36.688835	144.627530	182.27	4.20	186.47
4	-36.688854	144.638030	180.24	4.20	184.44
5	-36.693510	144.638029	188.16	4.20	192.36
6	-36.697307	144.627364	184.17	4.20	188.37
7	-36.697566	144.628914	186.38	4.20	190.58
8	-36.694555	144.638021	189.75	4.20	193.95
9	-36.697463	144.638073	197.40	4.20	201.60
10	-36.697585	144.628913	186.38	4.20	190.58
11	-36.698218	144.627289	182.95	4.20	187.15
12	-36.698526	144.637994	201.11	4.20	205.31
13	-36.704512	144.637976	203.06	4.20	207.26
14	-36.704510	144.633114	195.95	4.20	200.15
15	-36.703254	144.633034	194.49	4.20	198.69
16	-36.702132	144.625328	182.22	4.20	186.42
17	-36.701456	144.624806	181.39	4.20	185.59
18	-36.702308	144.623670	182.43	4.20	186.63
19	-36.704519	144.629715	191.34	4.20	195.54
20	-36.704261	144.618701	184.59	4.20	188.79
21	-36.701183	144.618726	180.00	4.20	184.20
22	-36.700029	144.621876	178.34	4.20	182.54
23	-36.702190	144.622541	182.60	4.20	186.80
24	-36.702261	144.623247	182.59	4.20	186.79
25	-36.701225	144.624671	181.25	4.20	185.45
26	-36.699173	144.624687	181.08	4.20	185.28
27	-36.698305	144.626909	182.18	4.20	186.38
28	-36.697397	144.627102	183.67	4.20	187.87
29	-36.696523	144.624250	184.64	4.20	188.84
30	-36.697320	144.623234	181.59	4.20	185.79
31	-36.697438	144.618676	176.85	4.20	181.05

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Name: Muskerry South

Axis tracking: Single-axis rotation

Backtracking: Shade-slope

Tracking axis orientation: 0.0°

Max tracking angle: 54.0°

Resting angle: 30.0°

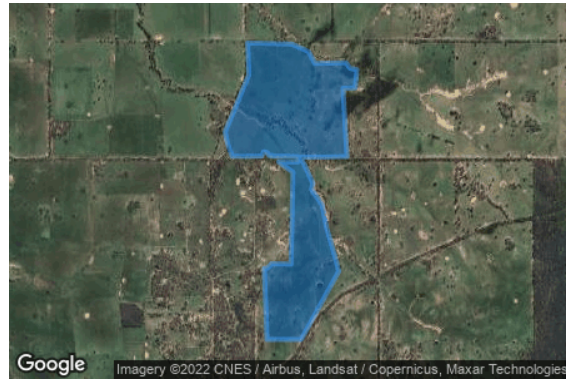
Ground Coverage Ratio: 0.5

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	-36.724691	144.609151	183.28	4.20	187.48
2	-36.724601	144.608642	182.82	4.20	187.02
3	-36.725090	144.608344	184.53	4.20	188.73
4	-36.725104	144.604330	184.62	4.20	188.82
5	-36.723761	144.603711	180.49	4.20	184.69
6	-36.722424	144.603351	180.11	4.20	184.31
7	-36.716180	144.606608	179.12	4.20	183.32
8	-36.712661	144.606457	178.11	4.20	182.31
9	-36.712783	144.612520	175.89	4.20	180.09
10	-36.713608	144.614807	177.47	4.20	181.67
11	-36.714918	144.615687	177.84	4.20	182.04
12	-36.714814	144.619963	178.74	4.20	182.94
13	-36.715432	144.620487	178.76	4.20	182.96
14	-36.715604	144.621473	178.00	4.20	182.20
15	-36.717575	144.621223	185.83	4.20	190.03
16	-36.717637	144.619545	187.39	4.20	191.59
17	-36.725135	144.620093	189.40	4.20	193.60
18	-36.725217	144.613764	184.06	4.20	188.26
19	-36.728082	144.615422	182.71	4.20	186.91
20	-36.728724	144.615213	181.00	4.20	185.20
21	-36.730464	144.616694	182.32	4.20	186.52
22	-36.732908	144.617279	183.47	4.20	187.67
23	-36.736143	144.618454	186.88	4.20	191.08
24	-36.737712	144.618972	193.41	4.20	197.61
25	-36.745210	144.613806	207.55	4.20	211.75
26	-36.745210	144.609106	205.28	4.20	209.48
27	-36.737431	144.608734	204.59	4.20	208.79
28	-36.737400	144.609089	204.25	4.20	208.45
29	-36.737142	144.609499	203.39	4.20	207.59
30	-36.736899	144.609695	202.84	4.20	207.04
31	-36.736934	144.612409	199.64	4.20	203.84
32	-36.726849	144.612680	181.01	4.20	185.21
33	-36.725707	144.610709	186.08	4.20	190.28
34	-36.725723	144.613400	183.86	4.20	188.06
35	-36.725133	144.613371	183.18	4.20	187.38
36	-36.725083	144.609902	183.79	4.20	187.99
37	-36.724996	144.609824	183.55	4.20	187.75
38	-36.725048	144.609681	184.05	4.20	188.25
39	-36.724999	144.609373	184.31	4.20	188.51

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Route Receptors

Name: Axedale Crosbie Road

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.774119	144.624990	199.28	1.50	200.78
2	-36.772331	144.615462	191.65	1.50	193.15
3	-36.768619	144.606536	193.41	1.50	194.91
4	-36.766212	144.598211	187.49	1.50	188.99
5	-36.766006	144.586194	186.41	1.50	187.91
6	-36.763806	144.577954	183.08	1.50	184.58

Name: Axedale-Toolleen Road

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.728474	144.658007	216.36	1.50	217.86
2	-36.731535	144.648459	228.26	1.50	229.76
3	-36.732532	144.640626	211.06	1.50	212.56
4	-36.736591	144.628996	204.13	1.50	205.63
5	-36.740425	144.619405	203.55	1.50	205.05
6	-36.742661	144.616422	203.51	1.50	205.01
7	-36.745274	144.614148	209.11	1.50	210.61
8	-36.746925	144.613225	208.23	1.50	209.73
9	-36.749693	144.609792	201.71	1.50	203.21
10	-36.752478	144.603784	197.32	1.50	199.02
11	-36.753905	144.601638	194.49	1.50	195.99
12	-36.761366	144.585223	182.75	1.50	184.25
13	-36.768380	144.565568	187.17	1.50	188.67

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



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.697654	144.606147	174.83	1.50	176.33
2	-36.712518	144.606318	177.70	1.50	179.20
3	-36.712449	144.579368	176.94	1.50	178.44

Name: Dwyer LAne
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.725514	144.609112	185.83	1.50	187.33
2	-36.725445	144.607138	186.77	1.50	188.27
3	-36.725393	144.575767	173.79	1.50	175.29
4	-36.725238	144.574673	173.01	1.50	174.51
5	-36.724980	144.573278	173.57	1.50	175.07
6	-36.723811	144.570124	174.24	1.50	175.74
7	-36.725238	144.567399	169.53	1.50	171.03
8	-36.725359	144.566862	168.80	1.50	170.30

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



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.725410	144.579185	179.61	1.50	181.11
2	-36.694378	144.579185	165.09	1.50	166.59

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



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.697326	144.598955	172.00	1.50	173.50
2	-36.683217	144.598955	182.81	1.50	184.31
3	-36.681634	144.596380	178.86	1.50	180.36
4	-36.655266	144.596638	158.20	1.50	159.70

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Name: Joyces Bridge Rd
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.696789	144.617409	181.47	1.50	182.97
2	-36.697409	144.607281	174.66	1.50	176.16
3	-36.697615	144.604448	174.43	1.50	175.93
4	-36.697753	144.588999	167.98	1.50	169.48
5	-36.695964	144.585823	165.56	1.50	167.06
6	-36.694656	144.583677	165.13	1.50	166.63
7	-36.693968	144.580501	164.32	1.50	165.82
8	-36.694587	144.578785	165.08	1.50	166.58
9	-36.693348	144.575781	163.84	1.50	165.34
10	-36.689976	144.572090	160.05	1.50	161.55
11	-36.683231	144.565824	161.17	1.50	162.67
12	-36.683024	144.560503	163.29	1.50	164.79

Name: Knowsley-Barnadown Rd
Path type: Two-way
Observer view angle: 50.0°

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Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.779955	144.565451	193.70	1.50	195.20
2	-36.730443	144.565108	174.60	1.50	176.10
3	-36.697692	144.549830	167.90	1.50	169.40
4	-36.683101	144.550002	161.80	1.50	163.30

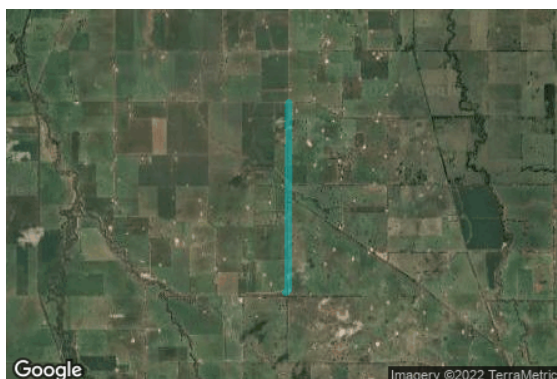
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Name: Murphys Lane
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.721899	144.624474	196.05	1.50	197.55
2	-36.769526	144.624689	202.01	1.50	203.51
3	-36.772552	144.625762	199.54	1.50	201.04
4	-36.774030	144.625204	199.21	1.50	200.71

Name: Muskerry East School Road
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.696885	144.617666	182.42	1.50	183.92
2	-36.696472	144.618353	185.05	1.50	186.55
3	-36.655307	144.618524	171.99	1.50	173.49

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Name: Northern Highway
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.777932	144.700822	214.51	1.50	216.01
2	-36.765144	144.692411	205.39	1.50	206.89
3	-36.762806	144.691553	205.69	1.50	207.19
4	-36.761087	144.691810	205.94	1.50	207.44
5	-36.754623	144.692840	208.29	1.50	209.79
6	-36.752285	144.692583	205.48	1.50	206.98
7	-36.730550	144.684772	196.03	1.50	197.53
8	-36.724703	144.684686	197.37	1.50	198.87
9	-36.720438	144.682626	191.70	1.50	193.20
10	-36.687958	144.667434	177.20	1.50	178.70
11	-36.643758	144.653015	175.75	1.50	177.25

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

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Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.736238	144.595834	196.08	1.50	197.58
2	-36.737064	144.601585	194.22	1.50	195.72
3	-36.737339	144.601670	194.63	1.50	196.13
4	-36.739385	144.601778	201.41	1.50	202.91
5	-36.750131	144.601628	196.23	1.50	197.73
6	-36.753897	144.601628	194.41	1.50	195.91

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Name: Route 14
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.728414	144.657855	216.64	1.50	218.14
2	-36.720090	144.683861	196.22	1.50	197.72

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



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.676206	144.618396	172.03	1.50	173.53
2	-36.678491	144.624061	171.92	1.50	173.42
3	-36.695423	144.654789	189.54	1.50	191.04
4	-36.710046	144.677748	187.71	1.50	189.21

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Name: Weston Drive
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-36.725502	144.607454	186.82	1.50	188.32
2	-36.735976	144.607497	202.23	1.50	203.73
3	-36.736595	144.607282	203.36	1.50	204.86
4	-36.737007	144.606724	203.92	1.50	205.42
5	-36.738624	144.601574	198.13	1.50	199.63

Flight Path Receptors

Name: Knowsley Air Park
Description:
Threshold height: 15 m
Direction: 176.6°
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	-36.792367	144.607512	213.51	15.24	228.75
Two-mile	-36.763506	144.605343	180.95	216.49	397.43

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Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-36.736562	144.608605	199.28	1.50
OP 2	2	-36.725900	144.608635	180.69	1.50
OP 3	3	-36.738617	144.607261	201.95	1.50
OP 4	4	-36.722271	144.622382	191.50	1.50
OP 5	5	-36.727954	144.606457	182.54	1.50
OP 6	6	-36.735477	144.606180	197.46	1.50
OP 7	7	-36.749572	144.608022	193.04	1.50
OP 8	8	-36.688362	144.642631	182.89	1.50
OP 9	9	-36.733483	144.607016	191.00	1.50
OP 10	10	-36.740967	144.625097	196.98	1.50
OP 11	11	-36.744923	144.603532	199.84	1.50
OP 12	12	-36.739933	144.602513	184.46	1.50
OP 13	13	-36.729658	144.606209	191.82	1.50
OP 14	14	-36.751182	144.604776	194.90	1.50
OP 15	15	-36.748554	144.602216	191.16	1.50
OP 16	16	-36.734363	144.625716	193.17	1.50
OP 17	17	-36.682620	144.631688	199.15	1.50
OP 18	18	-36.750093	144.602183	173.71	1.50
OP 19	19	-36.691889	144.610504	192.33	1.50
OP 20	20	-36.727137	144.596226	183.01	1.50
OP 21	21	-36.751819	144.603010	180.81	1.50
OP 22	22	-36.742754	144.598662	188.38	1.50
OP 23	23	-36.737410	144.598329	190.81	1.50
OP 24	24	-36.731015	144.628271	190.19	1.50
OP 25	25	-36.749960	144.598903	191.51	1.50
OP 26	26	-36.733722	144.598388	190.02	1.50
OP 27	27	-36.748331	144.597769	188.92	1.50
OP 28	28	-36.735743	144.596228	197.26	1.50
OP 29	29	-36.733748	144.631047	191.07	1.50
OP 30	30	-36.752325	144.623851	196.51	1.50
OP 31	31	-36.738747	144.595097	206.89	1.50
OP 32	32	-36.746905	144.595188	187.79	1.50
OP 33	33	-36.740813	144.594429	192.26	1.50
OP 34	34	-36.745188	144.594535	184.75	1.50
OP 35	35	-36.680380	144.614948	191.09	1.50
OP 36	36	-36.753965	144.597619	175.64	1.50
OP 37	37	-36.699212	144.603783	182.73	1.50
OP 38	38	-36.698236	144.654282	172.21	1.50
OP 39	39	-36.736359	144.592886	189.68	1.50
OP 40	40	-36.755070	144.596525	181.99	1.50
OP 41	41	-36.727727	144.637290	180.80	1.50
OP 42	42	-36.676552	144.618738	203.49	1.50
OP 43	43	-36.762311	144.608388	167.81	1.50
OP 44	44	-36.694163	144.598579	184.13	1.50
OP 45	45	-36.756783	144.593385	168.38	1.50
OP 46	46	-36.753113	144.632261	176.56	1.50
OP 47	47	-36.721745	144.581505	218.63	1.50
OP 48	48	-36.698103	144.593396	182.34	1.50
OP 49	49	-36.671439	144.648418	161.85	1.50
OP 50	50	-36.765543	144.621165	179.75	1.50
OP 51	51	-36.672423	144.652997	200.89	1.50

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 52	52	-36.767018	144.607738	179.11	1.50
OP 53	53	-36.686204	144.593012	181.63	1.50
OP 54	54	-36.673798	144.658842	171.72	1.50
OP 55	55	-36.679552	144.663570	172.86	1.50
OP 56	56	-36.706312	144.578634	170.77	1.50
OP 57	57	-36.705728	144.577548	170.77	1.50
OP 58	58	-36.757906	144.640789	168.35	1.50
OP 59	59	-36.758170	144.580796	219.64	1.50
OP 60	60	-36.663061	144.619389	173.39	1.50
OP 61	61	-36.693969	144.582054	173.60	1.50
OP 62	62	-36.672693	144.665850	160.05	1.50
OP 63	63	-36.705318	144.672484	167.96	1.50
OP 64	64	-36.693899	144.579571	184.76	1.50
OP 65	65	-36.665723	144.659404	159.74	1.50
OP 66	66	-36.666260	144.661989	172.72	1.50
OP 67	67	-36.764850	144.579311	167.90	1.50
OP 68	68	-36.776528	144.620554	174.02	1.50
OP 69	69	-36.733239	144.566777	196.14	1.50
OP 70	70	-36.778631	144.614106	166.26	1.50
OP 71	71	-36.737213	144.566618	197.36	1.50
OP 72	72	-36.706639	144.678704	167.56	1.50
OP 73	73	-36.660687	144.660739	181.99	1.50
OP 74	74	-36.655010	144.624473	173.07	1.50
OP 75	75	-36.728481	144.668026	167.04	1.50
OP 76	76	-36.726975	144.671302	192.37	1.50
OP 77	77	-36.710224	144.681300	187.56	1.50
OP 78	78	-36.731035	144.668515	179.12	1.50
OP 79	79	-36.709503	144.683639	194.07	1.50
OP 80	80	-36.707530	144.560173	179.23	1.50

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Glare Analysis Results

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Summary of Results No glare predicted

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

Total annual 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
Axedale Crosbie Road	0	0.0	0	0.0
Axedale-Toolleen Road	0	0.0	0	0.0
Craig Road	0	0.0	0	0.0
Dwyer LAne	0	0.0	0	0.0
Harrington Road	0	0.0	0	0.0
Hicksons Road	0	0.0	0	0.0
Joyces Bridge Rd	0	0.0	0	0.0
Knowsley-Barnadown Rd	0	0.0	0	0.0
Murphys Lane	0	0.0	0	0.0
Muskerry East School Road	0	0.0	0	0.0
Northern Highway	0	0.0	0	0.0
Ralstons Road	0	0.0	0	0.0
Route 14	0	0.0	0	0.0
Toolleen Angle Road	0	0.0	0	0.0
Weston Drive	0	0.0	0	0.0
Knowsley Air Park	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0

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Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 40	0	0.0	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 45	0	0.0	0	0.0
OP 46	0	0.0	0	0.0
OP 47	0	0.0	0	0.0
OP 48	0	0.0	0	0.0
OP 49	0	0.0	0	0.0
OP 50	0	0.0	0	0.0
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0
OP 53	0	0.0	0	0.0

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Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 54	0	0.0	0	0.0
OP 55	0	0.0	0	0.0
OP 56	0	0.0	0	0.0
OP 57	0	0.0	0	0.0
OP 58	0	0.0	0	0.0
OP 59	0	0.0	0	0.0
OP 60	0	0.0	0	0.0
OP 61	0	0.0	0	0.0
OP 62	0	0.0	0	0.0
OP 63	0	0.0	0	0.0
OP 64	0	0.0	0	0.0
OP 65	0	0.0	0	0.0
OP 66	0	0.0	0	0.0
OP 67	0	0.0	0	0.0
OP 68	0	0.0	0	0.0
OP 69	0	0.0	0	0.0
OP 70	0	0.0	0	0.0
OP 71	0	0.0	0	0.0
OP 72	0	0.0	0	0.0
OP 73	0	0.0	0	0.0
OP 74	0	0.0	0	0.0
OP 75	0	0.0	0	0.0
OP 76	0	0.0	0	0.0
OP 77	0	0.0	0	0.0
OP 78	0	0.0	0	0.0
OP 79	0	0.0	0	0.0
OP 80	0	0.0	0	0.0

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PV: Muskerry North no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Axedale Crosbie Road	0	0.0	0	0.0
Axedale-Toolleen Road	0	0.0	0	0.0
Craig Road	0	0.0	0	0.0
Dwyer Lane	0	0.0	0	0.0
Harrington Road	0	0.0	0	0.0
Hicksons Road	0	0.0	0	0.0
Joyces Bridge Rd	0	0.0	0	0.0
Knowsley-Barnadown Rd	0	0.0	0	0.0
Murphys Lane	0	0.0	0	0.0
Muskerry East School Road	0	0.0	0	0.0
Northern Highway	0	0.0	0	0.0
Ralstons Road	0	0.0	0	0.0
Route 14	0	0.0	0	0.0
Toolleen Angle Road	0	0.0	0	0.0
Weston Drive	0	0.0	0	0.0
Knowsley Air Park	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0

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Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 40	0	0.0	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 45	0	0.0	0	0.0
OP 46	0	0.0	0	0.0
OP 47	0	0.0	0	0.0
OP 48	0	0.0	0	0.0
OP 49	0	0.0	0	0.0
OP 50	0	0.0	0	0.0
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0
OP 53	0	0.0	0	0.0
OP 54	0	0.0	0	0.0
OP 55	0	0.0	0	0.0
OP 56	0	0.0	0	0.0
OP 57	0	0.0	0	0.0
OP 58	0	0.0	0	0.0

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Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 59	0	0.0	0	0.0
OP 60	0	0.0	0	0.0
OP 61	0	0.0	0	0.0
OP 62	0	0.0	0	0.0
OP 63	0	0.0	0	0.0
OP 64	0	0.0	0	0.0
OP 65	0	0.0	0	0.0
OP 66	0	0.0	0	0.0
OP 67	0	0.0	0	0.0
OP 68	0	0.0	0	0.0
OP 69	0	0.0	0	0.0
OP 70	0	0.0	0	0.0
OP 71	0	0.0	0	0.0
OP 72	0	0.0	0	0.0
OP 73	0	0.0	0	0.0
OP 74	0	0.0	0	0.0
OP 75	0	0.0	0	0.0
OP 76	0	0.0	0	0.0
OP 77	0	0.0	0	0.0
OP 78	0	0.0	0	0.0
OP 79	0	0.0	0	0.0
OP 80	0	0.0	0	0.0

Muskerry North and Axedale Crosbie Road

Receptor type: Route
No glare found

Muskerry North and Axedale- Toolleen Road

Receptor type: Route
No glare found

Muskerry North and Craig Road

Receptor type: Route
No glare found

Muskerry North and Dwyer Lane

Receptor type: Route
No glare found

Muskerry North and Harrington Road

Receptor type: Route
No glare found

Muskerry North and Hicksons Road

Receptor type: Route
No glare found

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**Muskerry North and Joyces
Bridge Rd**

Receptor type: Route
No glare found

**Muskerry North and Knowsley-
Barnadown Rd**

Receptor type: Route
No glare found

**Muskerry North and Murphys
Lane**

Receptor type: Route
No glare found

**Muskerry North and Muskerry
East School Road**

Receptor type: Route
No glare found

**Muskerry North and Northern
Highway**

Receptor type: Route
No glare found

**Muskerry North and Ralstons
Road**

Receptor type: Route
No glare found

Muskerry North and Route 14

Receptor type: Route
No glare found

**Muskerry North and Toolleen
Angle Road**

Receptor type: Route
No glare found

**Muskerry North and Weston
Drive**

Receptor type: Route
No glare found

**Muskerry North and Knowsley
Air Park**

Receptor type: 2-mile Flight Path
No glare found

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Muskerry North and OP 1

Receptor type: Observation Point
No glare found

Muskerry North and OP 2

Receptor type: Observation Point
No glare found

Muskerry North and OP 3

Receptor type: Observation Point
No glare found

Muskerry North and OP 4

Receptor type: Observation Point
No glare found

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Muskerry North and OP 5

Receptor type: Observation Point
No glare found

Muskerry North and OP 6

Receptor type: Observation Point
No glare found

Muskerry North and OP 7

Receptor type: Observation Point
No glare found

Muskerry North and OP 8

Receptor type: Observation Point
No glare found

Muskerry North and OP 9

Receptor type: Observation Point
No glare found

Muskerry North and OP 10

Receptor type: Observation Point
No glare found

Muskerry North and OP 11

Receptor type: Observation Point
No glare found

Muskerry North and OP 12

Receptor type: Observation Point
No glare found

Muskerry North and OP 13

Receptor type: Observation Point
No glare found

Muskerry North and OP 14

Receptor type: Observation Point
No glare found

Muskerry North and OP 15

Receptor type: Observation Point
No glare found

Muskerry North and OP 16

Receptor type: Observation Point
No glare found

Muskerry North and OP 17

Receptor type: Observation Point
No glare found

Muskerry North and OP 18

Receptor type: Observation Point
No glare found

Muskerry North and OP 19

Receptor type: Observation Point
No glare found

Muskerry North and OP 20

Receptor type: Observation Point
No glare found

Muskerry North and OP 21

Receptor type: Observation Point
No glare found

Muskerry North and OP 22

Receptor type: Observation Point
No glare found

Muskerry North and OP 23

Receptor type: Observation Point
No glare found

Muskerry North and OP 24

Receptor type: Observation Point
No glare found

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Muskerry North and OP 25

Receptor type: Observation Point
No glare found

Muskerry North and OP 26

Receptor type: Observation Point
No glare found

Muskerry North and OP 27

Receptor type: Observation Point
No glare found

Muskerry North and OP 28

Receptor type: Observation Point
No glare found

Muskerry North and OP 29

Receptor type: Observation Point
No glare found

Muskerry North and OP 30

Receptor type: Observation Point
No glare found

Muskerry North and OP 31

Receptor type: Observation Point
No glare found

Muskerry North and OP 32

Receptor type: Observation Point
No glare found

Muskerry North and OP 33

Receptor type: Observation Point
No glare found

Muskerry North and OP 34

Receptor type: Observation Point
No glare found

Muskerry North and OP 35

Receptor type: Observation Point
No glare found

Muskerry North and OP 36

Receptor type: Observation Point
No glare found

Muskerry North and OP 37

Receptor type: Observation Point
No glare found

Muskerry North and OP 38

Receptor type: Observation Point
No glare found

Muskerry North and OP 39

Receptor type: Observation Point
No glare found

Muskerry North and OP 40

Receptor type: Observation Point
No glare found

Muskerry North and OP 41

Receptor type: Observation Point
No glare found

Muskerry North and OP 42

Receptor type: Observation Point
No glare found

Muskerry North and OP 43

Receptor type: Observation Point
No glare found

Muskerry North and OP 44

Receptor type: Observation Point
No glare found

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Muskerry North and OP 45

Receptor type: Observation Point
No glare found

Muskerry North and OP 46

Receptor type: Observation Point
No glare found

Muskerry North and OP 47

Receptor type: Observation Point
No glare found

Muskerry North and OP 48

Receptor type: Observation Point
No glare found

Muskerry North and OP 49

Receptor type: Observation Point
No glare found

Muskerry North and OP 50

Receptor type: Observation Point
No glare found

Muskerry North and OP 51

Receptor type: Observation Point
No glare found

Muskerry North and OP 52

Receptor type: Observation Point
No glare found

Muskerry North and OP 53

Receptor type: Observation Point
No glare found

Muskerry North and OP 54

Receptor type: Observation Point
No glare found

Muskerry North and OP 55

Receptor type: Observation Point
No glare found

Muskerry North and OP 56

Receptor type: Observation Point
No glare found

Muskerry North and OP 57

Receptor type: Observation Point
No glare found

Muskerry North and OP 58

Receptor type: Observation Point
No glare found

Muskerry North and OP 59

Receptor type: Observation Point
No glare found

Muskerry North and OP 60

Receptor type: Observation Point
No glare found

Muskerry North and OP 61

Receptor type: Observation Point
No glare found

Muskerry North and OP 62

Receptor type: Observation Point
No glare found

Muskerry North and OP 63

Receptor type: Observation Point
No glare found

Muskerry North and OP 64

Receptor type: Observation Point
No glare found

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Muskerry North and OP 65

Receptor type: Observation Point
No glare found

Muskerry North and OP 66

Receptor type: Observation Point
No glare found

Muskerry North and OP 67

Receptor type: Observation Point
No glare found

Muskerry North and OP 68

Receptor type: Observation Point
No glare found

Muskerry North and OP 69

Receptor type: Observation Point
No glare found

Muskerry North and OP 70

Receptor type: Observation Point
No glare found

Muskerry North and OP 71

Receptor type: Observation Point
No glare found

Muskerry North and OP 72

Receptor type: Observation Point
No glare found

Muskerry North and OP 73

Receptor type: Observation Point
No glare found

Muskerry North and OP 74

Receptor type: Observation Point
No glare found

Muskerry North and OP 75

Receptor type: Observation Point
No glare found

Muskerry North and OP 76

Receptor type: Observation Point
No glare found

Muskerry North and OP 77

Receptor type: Observation Point
No glare found

Muskerry North and OP 78

Receptor type: Observation Point
No glare found

Muskerry North and OP 79

Receptor type: Observation Point
No glare found

Muskerry North and OP 80

Receptor type: Observation Point
No glare found

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PV: Muskerry South no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Axedale Crosbie Road	0	0.0	0	0.0
Axedale-Toolleen Road	0	0.0	0	0.0
Craig Road	0	0.0	0	0.0
Dwyer LAne	0	0.0	0	0.0
Harrington Road	0	0.0	0	0.0
Hicksons Road	0	0.0	0	0.0
Joyces Bridge Rd	0	0.0	0	0.0
Knowsley-Barnadown Rd	0	0.0	0	0.0
Murphys Lane	0	0.0	0	0.0
Muskerry East School Road	0	0.0	0	0.0
Northern Highway	0	0.0	0	0.0
Ralstons Road	0	0.0	0	0.0
Route 14	0	0.0	0	0.0
Toolleen Angle Road	0	0.0	0	0.0
Weston Drive	0	0.0	0	0.0
Knowsley Air Park	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0

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Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 40	0	0.0	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 45	0	0.0	0	0.0
OP 46	0	0.0	0	0.0
OP 47	0	0.0	0	0.0
OP 48	0	0.0	0	0.0
OP 49	0	0.0	0	0.0
OP 50	0	0.0	0	0.0
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0
OP 53	0	0.0	0	0.0
OP 54	0	0.0	0	0.0
OP 55	0	0.0	0	0.0
OP 56	0	0.0	0	0.0
OP 57	0	0.0	0	0.0
OP 58	0	0.0	0	0.0
OP 59	0	0.0	0	0.0
OP 60	0	0.0	0	0.0

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Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 61	0	0.0	0	0.0
OP 62	0	0.0	0	0.0
OP 63	0	0.0	0	0.0
OP 64	0	0.0	0	0.0
OP 65	0	0.0	0	0.0
OP 66	0	0.0	0	0.0
OP 67	0	0.0	0	0.0
OP 68	0	0.0	0	0.0
OP 69	0	0.0	0	0.0
OP 70	0	0.0	0	0.0
OP 71	0	0.0	0	0.0
OP 72	0	0.0	0	0.0
OP 73	0	0.0	0	0.0
OP 74	0	0.0	0	0.0
OP 75	0	0.0	0	0.0
OP 76	0	0.0	0	0.0
OP 77	0	0.0	0	0.0
OP 78	0	0.0	0	0.0
OP 79	0	0.0	0	0.0
OP 80	0	0.0	0	0.0

Muskerry South and Axedale Crosbie Road

Receptor type: Route
No glare found

Muskerry South and Craig Road

Receptor type: Route
No glare found

Muskerry South and Harrington Road

Receptor type: Route
No glare found

Muskerry South and Joyces Bridge Rd

Receptor type: Route
No glare found

Muskerry South and Axedale- Toolleen Road

Receptor type: Route
No glare found

Muskerry South and Dwyer LAne

Receptor type: Route
No glare found

Muskerry South and Hicksons Road

Receptor type: Route
No glare found

Muskerry South and Knowsley-Barnadown Rd

Receptor type: Route
No glare found

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Muskerry South and Murphys Lane

Receptor type: Route
No glare found

Muskerry South and Muskerry East School Road

Receptor type: Route
No glare found

Muskerry South and Northern Highway

Receptor type: Route
No glare found

Muskerry South and Ralstons Road

Receptor type: Route
No glare found

Muskerry South and Route 14

Receptor type: Route
No glare found

Muskerry South and Toolleen Angle Road

Receptor type: Route
No glare found

Muskerry South and Weston Drive

Receptor type: Route
No glare found

Muskerry South and Knowsley Air Park

Receptor type: 2-mile Flight Path
No glare found

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Muskerry South and OP 1

Receptor type: Observation Point
No glare found

Muskerry South and OP 2

Receptor type: Observation Point
No glare found

Muskerry South and OP 3

Receptor type: Observation Point
No glare found

Muskerry South and OP 4

Receptor type: Observation Point
No glare found

Muskerry South and OP 5

Receptor type: Observation Point
No glare found

Muskerry South and OP 6

Receptor type: Observation Point
No glare found

Muskerry South and OP 7

Receptor type: Observation Point
No glare found

Muskerry South and OP 8

Receptor type: Observation Point
No glare found

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Muskerry South and OP 9

Receptor type: Observation Point
No glare found

Muskerry South and OP 10

Receptor type: Observation Point
No glare found

Muskerry South and OP 11

Receptor type: Observation Point
No glare found

Muskerry South and OP 12

Receptor type: Observation Point
No glare found

Muskerry South and OP 13

Receptor type: Observation Point
No glare found

Muskerry South and OP 14

Receptor type: Observation Point
No glare found

Muskerry South and OP 15

Receptor type: Observation Point
No glare found

Muskerry South and OP 16

Receptor type: Observation Point
No glare found

Muskerry South and OP 17

Receptor type: Observation Point
No glare found

Muskerry South and OP 18

Receptor type: Observation Point
No glare found

Muskerry South and OP 19

Receptor type: Observation Point
No glare found

Muskerry South and OP 20

Receptor type: Observation Point
No glare found

Muskerry South and OP 21

Receptor type: Observation Point
No glare found

Muskerry South and OP 22

Receptor type: Observation Point
No glare found

Muskerry South and OP 23

Receptor type: Observation Point
No glare found

Muskerry South and OP 24

Receptor type: Observation Point
No glare found

Muskerry South and OP 25

Receptor type: Observation Point
No glare found

Muskerry South and OP 26

Receptor type: Observation Point
No glare found

Muskerry South and OP 27

Receptor type: Observation Point
No glare found

Muskerry South and OP 28

Receptor type: Observation Point
No glare found

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Muskerry South and OP 29

Receptor type: Observation Point
No glare found

Muskerry South and OP 30

Receptor type: Observation Point
No glare found

Muskerry South and OP 31

Receptor type: Observation Point
No glare found

Muskerry South and OP 32

Receptor type: Observation Point
No glare found

Muskerry South and OP 33

Receptor type: Observation Point
No glare found

Muskerry South and OP 34

Receptor type: Observation Point
No glare found

Muskerry South and OP 35

Receptor type: Observation Point
No glare found

Muskerry South and OP 36

Receptor type: Observation Point
No glare found

Muskerry South and OP 37

Receptor type: Observation Point
No glare found

Muskerry South and OP 38

Receptor type: Observation Point
No glare found

Muskerry South and OP 39

Receptor type: Observation Point
No glare found

Muskerry South and OP 40

Receptor type: Observation Point
No glare found

Muskerry South and OP 41

Receptor type: Observation Point
No glare found

Muskerry South and OP 42

Receptor type: Observation Point
No glare found

Muskerry South and OP 43

Receptor type: Observation Point
No glare found

Muskerry South and OP 44

Receptor type: Observation Point
No glare found

Muskerry South and OP 45

Receptor type: Observation Point
No glare found

Muskerry South and OP 46

Receptor type: Observation Point
No glare found

Muskerry South and OP 47

Receptor type: Observation Point
No glare found

Muskerry South and OP 48

Receptor type: Observation Point
No glare found

Muskerry South and OP 49

Receptor type: Observation Point
No glare found

Muskerry South and OP 50

Receptor type: Observation Point
No glare found

Muskerry South and OP 51

Receptor type: Observation Point
No glare found

Muskerry South and OP 52

Receptor type: Observation Point
No glare found

Muskerry South and OP 53

Receptor type: Observation Point
No glare found

Muskerry South and OP 54

Receptor type: Observation Point
No glare found

Muskerry South and OP 55

Receptor type: Observation Point
No glare found

Muskerry South and OP 56

Receptor type: Observation Point
No glare found

Muskerry South and OP 57

Receptor type: Observation Point
No glare found

Muskerry South and OP 58

Receptor type: Observation Point
No glare found

Muskerry South and OP 59

Receptor type: Observation Point
No glare found

Muskerry South and OP 60

Receptor type: Observation Point
No glare found

Muskerry South and OP 61

Receptor type: Observation Point
No glare found

Muskerry South and OP 62

Receptor type: Observation Point
No glare found

Muskerry South and OP 63

Receptor type: Observation Point
No glare found

Muskerry South and OP 64

Receptor type: Observation Point
No glare found

Muskerry South and OP 65

Receptor type: Observation Point
No glare found

Muskerry South and OP 66

Receptor type: Observation Point
No glare found

Muskerry South and OP 67

Receptor type: Observation Point
No glare found

Muskerry South and OP 68

Receptor type: Observation Point
No glare found

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Muskerry South and OP 69

Receptor type: Observation Point
No glare found

Muskerry South and OP 70

Receptor type: Observation Point
No glare found

Muskerry South and OP 71

Receptor type: Observation Point
No glare found

Muskerry South and OP 72

Receptor type: Observation Point
No glare found

Muskerry South and OP 73

Receptor type: Observation Point
No glare found

Muskerry South and OP 74

Receptor type: Observation Point
No glare found

Muskerry South and OP 75

Receptor type: Observation Point
No glare found

Muskerry South and OP 76

Receptor type: Observation Point
No glare found

Muskerry South and OP 77

Receptor type: Observation Point
No glare found

Muskerry South and OP 78

Receptor type: Observation Point
No glare found

Muskerry South and OP 79

Receptor type: Observation Point
No glare found

Muskerry South and OP 80

Receptor type: Observation Point
No glare found

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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

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