Boffa Miskell

Māniatoto Solar Farm

Landscape Effects Assessment
Prepared for Helios Energy Ltd

28 February 2024

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Cover photograph: View towards Naseby Solar Farm Site, © Boffa Miskell, 2023

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1.0 Introduction

Helios Energy Limited (Helios) propose to develop a solar farm and substation at a site of approximately 660 ha near Naseby, in Central Otago. The development will connect to the National Grid and be capable of producing approximately 630 GWh/yr.

The solar farm and substation will be located on land leased by Helios on Ranfurly-Naseby Road between Naseby and Ranfurly (the **Site**).

The proposed solar farm would be built on land leased from two local farming families and connected into the national electricity transmission grid via the Naseby substation on Fennessy Road. The solar farm will generate enough clean electricity to power the equivalent of approximately 70,000 homes annually.

The Site is zoned Rural Resource Area and has an overlay of Other Rural Landscapes (ORL) within the Central Otago District Plan. There are no Outstanding Natural Features or Landscapes (ONFLs) or Significant Amenity Landscapes (SALs) which relate to the Site.

The key features of the project comprise the solar panels, substation and supporting electrical infrastructure/equipment, buildings, lighting, underground cabling, access and internal access tracks, fencing and landscaping.

Agricultural operations in the form of sheep grazing within the property will continue.

1.1 Scope of the report

Boffa Miskell Limited (BML) has been engaged by Helios Energy Ltd to undertake a Landscape Effects Assessment (LEA) for the proposed solar farm on Ranfurly-Naseby Road. The scope of this LEA relates only to proposed infrastructure developments within the Site itself (see **Figure 1** below). It does not include assessment of a proposed underground transmission line from the Site to the existing Naseby Grid Exit Point (substation), as we have been advised by Helios that these works are a permitted activity that would occur within a legal road reserve area.

The following Landscape (and Visual) Effects Assessment:

- Describes the Site and its landscape setting, placing the Site in the wider context of the Maniototo / Māniatoto Plains / Māniatoto Plain[1];
- Describes the nature of the Proposal; and
- Sets out an assessment of the landscape and visual effects of:
    - the temporary construction stages of the proposed solar development through to completion of construction; and
    - 5 years following completion of construction when proposed landscape planting is becoming established.

[1] Although frequently spelt ‘Maniototo’, ‘Māniatoto’ or ‘Maniatoto’ are recognised as the preferred spelling by iwi and Central Otago District Council.

A separate **Graphic Supplement** including visual simulations, has been prepared and is attached. The location and context of the Project Site is shown in **Figure 1** of the Graphic Supplement and reproduced below.

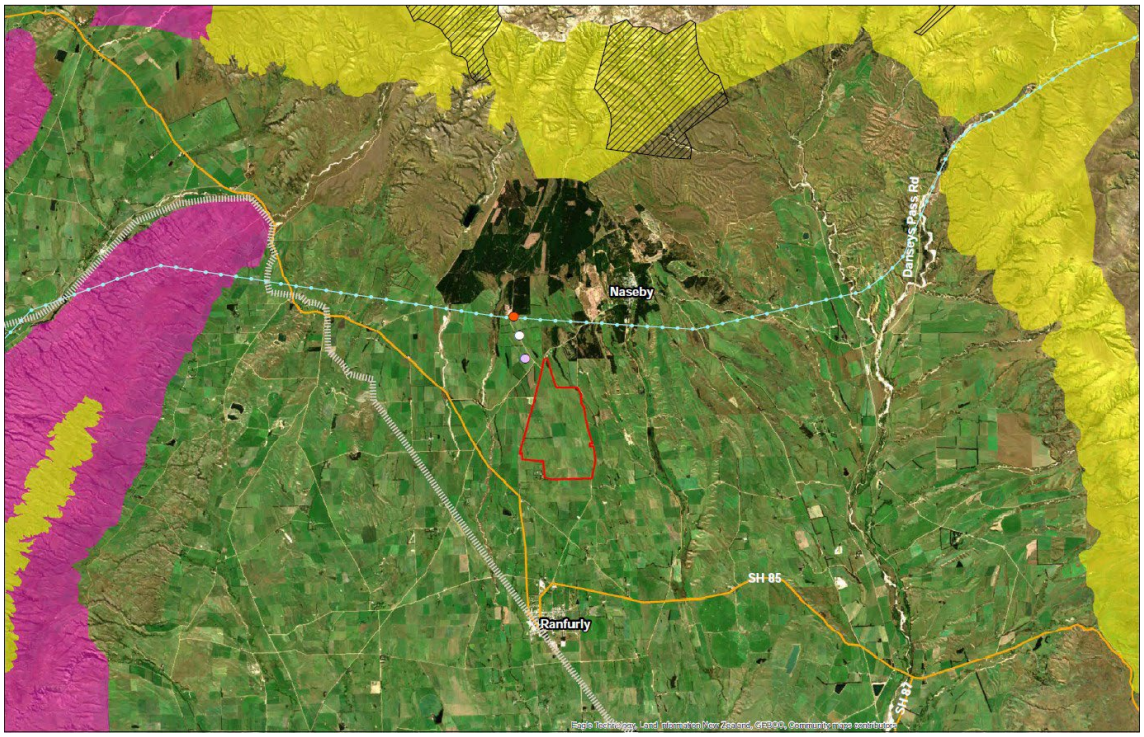


Figure 1: Location and context of proposed Project Site. The nearest Outstanding Natural Landscapes are shown in yellow and Significant Amenity Landscapes in pink. A National Grid transmission line can be seen crossing the landscape to the north of the Site in blue (Source: Boffa Miskell)

1.2 Other Technical Relevant Reports

Boffa Miskell has prepared an Ecological Impact Assessment (EcIA) report to accompany the necessary resource consent applications for the proposed solar farm. The assessment is referenced and discussed throughout this report in the context of the Site description and landscape and natural character assessment.

- *Boffa Miskell Ltd, December 2023: Māniatoto Solar Farm: Ecological Impact Assessment. Prepared by Boffa Miskell for Helios Energy Ltd.*

This report has also drawn information from the 1998 regional landscape study and the 2008 landscape assessment of Central Otago:

- *Boffa Miskell Ltd, 1998: Investigations into Otago's Natural Character, Landscape and Significant Natural Areas. Prepared by Boffa Miskell for Otago Regional Council.*
- *Robson Garland, Ian Brown Consultants and LA4 Landscape Architects, 2008: Central Otago District Rural Review Landscape Assessment Report and Recommendations. Prepared for Central Otago District Council*

This report also relies on and should be read in conjunction with information provided in:

- *ITP Renewables, 2023: Naseby Solar Farm: Glint and Glare Study. Report prepared for Helios Energy.*

This report and the issue of glint and glare are described further below. The full report is attached as **Appendix 3**.

Glint and Glare Study

A Solar Photovoltaic Glint and Glare Study (the Glint and Glare Study) has been undertaken by ITP (September 2023). This report determined the impact of glint and glare from the proposed Solar Farm on the adjacent roads (nine road routes) and nearby houses (16 observation points).The model used for the Glint and Glare Study was constructed taking into account 'existing vegetation within the Site as well as some key external shelterbelts outside the Site'[2], all modelled with an upper edge height of 10 m as a conservative estimate (Figure 7 in the Glint and Glare Study identifies the location of existing vegetation modelled).

Glint is typically defined as a momentary flash of bright light, often caused by a reflection off a moving source. A typical example of glint is a momentary solar reflection from a moving car. Glare is defined as a continuous source of bright light. Glare is generally associated with stationary objects, which, due to the slow relative movement of the sun, reflect sunlight for a longer duration. The difference between glint and glare is duration.

In explaining glare and its potential impacts, the Study states that severity of ocular hazard caused by glint and glare can be divided into three levels:

- **Green glare**, which has low potential to cause temporary afterimage
- **Yellow glare**, which has potential to cause temporary afterimage
- **Red glare**, which can cause retinal burn and is not expected for photovoltaic systems

The Study finds there are two potential levels of glare for this Site – green and yellow.

The limit for glint/glare which creates unreasonable nuisance has been defined in several international guidelines. In Germany the Light-Guideline (Licht-Leitlinie) issued by the Ministry of Environment defines the limits for glare duration at 30 minutes per day and 30 hours per year. In Austria the same values were determined in their national guidelines OVE R11-3. Australian guidance[3] defines glare of high impact as that which is greater than 30 minutes per day and 30 hours per year. Table 1 below, has been adapted from these guidelines with reference to effects of solar glare.

In the United Kingdom, photovoltaic glint and glare guidance[4] states that if visible glint and glare is predicted for a surrounding dwelling for longer than 60 minutes per day, for three or more months of the year, then the impact should be considered significant with respect to residential amenity. **For the purposes of this assessment, limits for glare duration greater than 30 minutes per day and 30 hours per year have been defined as high impact.** This duration of effect has been chosen as it is in line with international best practice for solar glare, but also aligns with the limits defined by international guidelines for addressing the effects of shadow flicker caused by wind turbines. **Table 1** below outlines the level of impact in relation to glare for residential dwellings.

Table 1: Glare Impact in relation to residential dwellings

[2] Glint and Glare Study, section 3.3.2, p14

[3] New South Wales Department of Planning and Environment. Large-Scale Solar Energy Guidelines, August 2022

[4] Pager Power Ltd. Solar Photovoltaic and Building Development Glint and Glare Guidance, Fourth Edition, September 2022.

High glare impact	Moderate glare impact	Low glare impact
> 30 minutes per day > 30 hours per year	< 30 minutes & > 10 minutes per day < 30 hours & > 10 hours per year	< 10 minutes per day < 10 hours per year
Significant amount of glare that should be avoided by solar layout and/or mitigation measures.	Implement mitigation measures to reduce impacts as far as practicable.	No mitigation required.

Solar Glare for road users

A review of international best practice guidance for assessing effects of solar glare from roads finds that reflections which originate in front of the road user require mitigation. Local roads are generally considered to not require mitigation, however as the majority of roads in New Zealand would qualify for what internationally would be considered a 'local road', the assessment has considered all roads.

A road user travelling on surrounding roads where a solar reflection is geometrically possible would experience a solar reflection that is fleeting in nature. The nature of the view is dependent on the speed of the road user travelling past the solar farm at a time when a solar reflection is geometrically possible. Therefore, the location of the solar reflection is more significant than its duration because the road user is moving. Because of this, the length of time a solar reflection is present is not considered when determining its significance. Instead, the location of the solar reflection and road type are considered. Major roads such as State Highways would be considered more sensitive to the effects of glare than local roads where the speed of travel is reduced.

Mitigation is considered necessary for all roads where the road user is aligned directly with the area of glare. For glare which is oblique to the road user's direction of travel, mitigation can also be considered, but is not necessary.

An assessment of glint and glare based on the study findings, in relation to both dwellings and road users is included in the visual effects assessment section (**section 5.3.3**).

1.3 Assessment Approach

This assessment follows the concepts and principles outlined in *Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines*[5]. A full method is outlined in **Appendix 1** of this report. In summary, the effects ratings are based upon a seven-point scale which ranges from very low to very high.

Te Tangi a te Manu recognises the term 'landscape effects' as all-encompassing, and that visual effects and natural character effects are a subset of landscape effects. This assessment discusses landscape, visual and natural character effects separately for clarity, but the overall process is a Landscape Effects Assessment (LEA) in accordance with the Guidelines.

It is noted that Ngāi Tahu are the iwi who have mana whenua rights over this area. No separate cultural assessment or appraisal has been considered as part of this assessment. It is therefore recognised that this LEA is reflective of the western concept of landscape which does not

[5] *'Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines', Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022.*

incorporate mana whenua cultural aspects. Helios will be engaging with mana whenua to understand any potential impacts on cultural values.

1.4 Assessment Process

The first stage of the assessment process consisted of providing high level landscape advice in relation to this proposal[6] (High-level Landscape and Visual Constraints and Mitigation Memo, April 2023). The primary focus was to provide an overview of key landscape and visual constraints and options for mitigation.

More detailed site investigations were undertaken including creation of a digital model representing the blocks of solar panels combined with existing terrain (at 1m contours) and intervening vegetation represented by point cloud data. The assessment was undertaken, and mitigation recommendations made, using this digital model as a fine-grained analysis tool.

The assessment process is outlined below:

- Familiarisation of the project proposal.
- Desktop review of the existing environment and landscape values.
- Site visits to understand the Site, its context, and nature of existing views, including views from closest neighbours.
- Coordinating the preparation of and utilising a digital model. The model includes the arrays and proposed mitigation planting (bulk, height and location only), added to the existing terrain (within the Site and immediate surrounds including the five nearest dwellings) together with point cloud data representing the intervening vegetation within the site boundary.
- Review of relevant statutory provisions.
- Assessment of landscape and visual effects of the proposed solar farm.
- Recommended mitigation measures to avoid, remedy, and mitigate potential adverse effects including working iteratively with the landscape architect developing the landscape mitigation plan and cross sections, to continually ‘test’ the recommendations.

A graphic supplement accompanies this written assessment. The Graphic Supplement illustrates the Figures, plans and photographs of the Site and includes the Landscape Mitigation Plan, Cross-sections and screen-shots from the 3D model.

A method statement is provided in **Appendix 1** of this report.

Landscape, natural character and visual assessments are closely related and, in part, overlapping. A brief explanation of the assessments made for this proposal is provided below.

[6] High-level Landscape and Visual Constraints and Mitigation Memo, April 2023

1.4.1 Natural Character Assessment

The solar farm is located outside the coastal environment however this assessment considers natural character insofar as this applies to freshwater bodies and their margins, (as defined in RMA Section 6(a)).

Natural character is described in terms of the natural elements, patterns and processes of such areas and how they are perceived and experienced. The level of natural character (naturalness) is determined by the level of human-induced modification, where the highest degree of natural character occurs where there is the least amount of modification.

This assessment describes and assesses the existing level of natural character of the relevant waterbodies within the Site and then assesses the effects of the proposed solar farm on natural character.

1.4.2 Landscape Assessment

The assessment has identified the extent of the relevant landscape and described and analysed its character and values in terms of physical, sensory and associative attributes and how they combine. The condition of the landscape (i.e. the state of an individual area of landscape or landscape feature) is also described.

The assessment has considered the sensitivity of the physical landscape features to the proposed change, together with the magnitude of change.

1.4.3 Visual Assessment

Landscapes are experienced visually and therefore, visual effects are considered to be the consequences of change on landscape values, as experienced in views.[7]

The visual assessment considers where the proposal will be seen from (including the nature of the view), who will see it, and the nature and scale of visual change that would result from the proposal.

For the purpose of this assessment, visual effects are largely assessed based on desktop analysis and the nearest available public viewpoint from which representative views were obtained. However, access to four nearby private properties was obtained and GPS located photographs taken to represent potential views from the vicinity of dwellings.

1.4.4 Site Visit

A visit to the site and its surroundings was undertaken on 5 April 2023 by Yvonne Pfluger and Sue McManaway (Landscape Architects at Boffa Miskell Ltd). The assessors visited the Site and travelled through the wider area to gain an understanding of the landscape context, the character of the landscape and the potential visual catchment and viewing audience. Weather conditions were largely fine with variable cloud cover.

[7] TTTM, pp61-62

A second site visit by Sue McManaway and Corey Murray (Visualisation specialist at Boffa Miskell Ltd) was undertaken specifically to visit the four nearest private residential properties (excluding a Project landowner who is leasing land to Helios) to understand the nature of views and take GPS located photographs. Weather conditions were fine.

A site visit was also undertaken by Cara-Lisa Schloots, an ecologist at Boffa Miskell, on 16 - 18 October 2023 during which she took site context photographs from additional specific viewpoints requested for the purpose of this assessment.

2.0 Proposal Description

The Project comprises the construction, operation and maintenance of an approximately 300MW photovoltaic solar farm on a 660ha site located between the Ranfurly-Naseby Road and Ranfurly Back Road. It will consist of approximately 550,810 solar panels and other associated infrastructure including battery energy storage, substation, and transmission line infrastructure.

The Project will include extensive native and exotic mitigation planting primarily along roadside boundaries, as well as enhancement planting of two large wetland areas on the Site. Existing mature vegetation on the Site (which consists of exotic evergreen shelterbelts) will be retained. and replacement planting will be undertaken where there are gaps or where there are trees that are failing and need to be removed.

The layout of the solar farm is shown in **Figure 2** below.

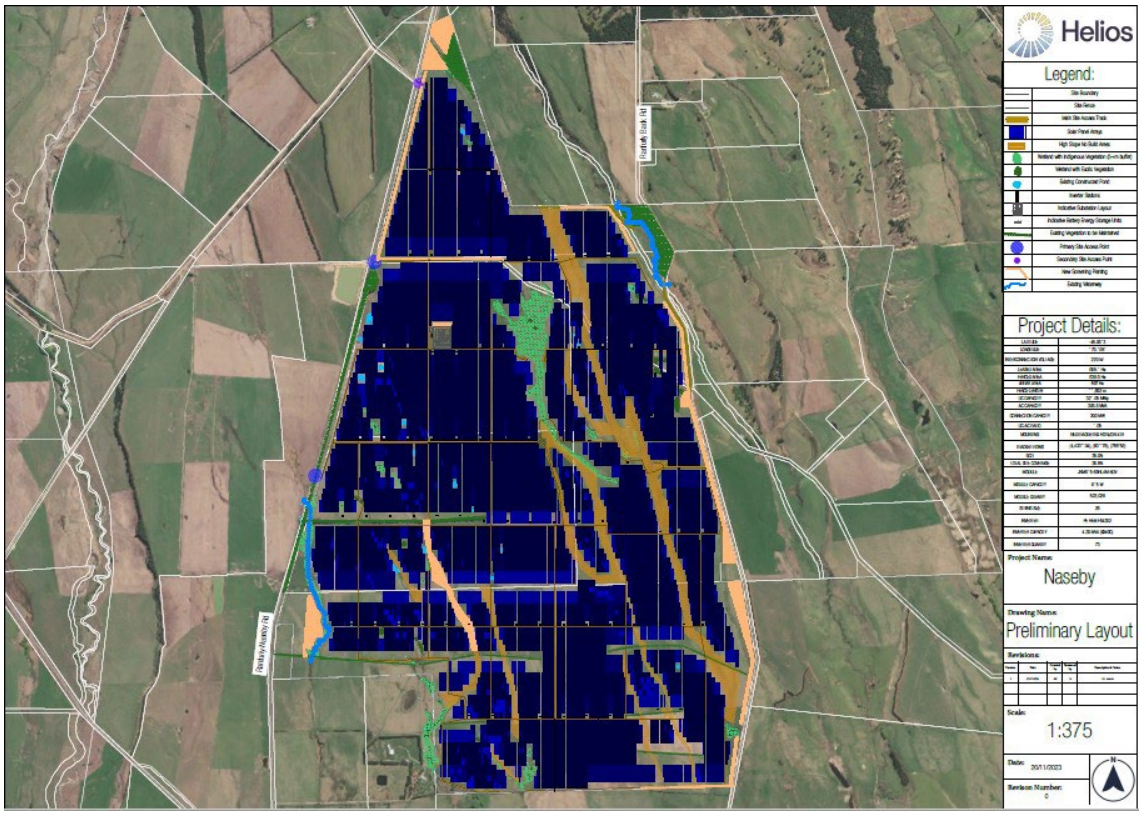


Figure 2: Solar Farm Layout (Source: Helios)

The proposed mitigation planting which is part of the proposal is shown in **Figure 3** below and can be seen in more detail with the legend provided in the Graphic Supplement (**Figure 5A**).

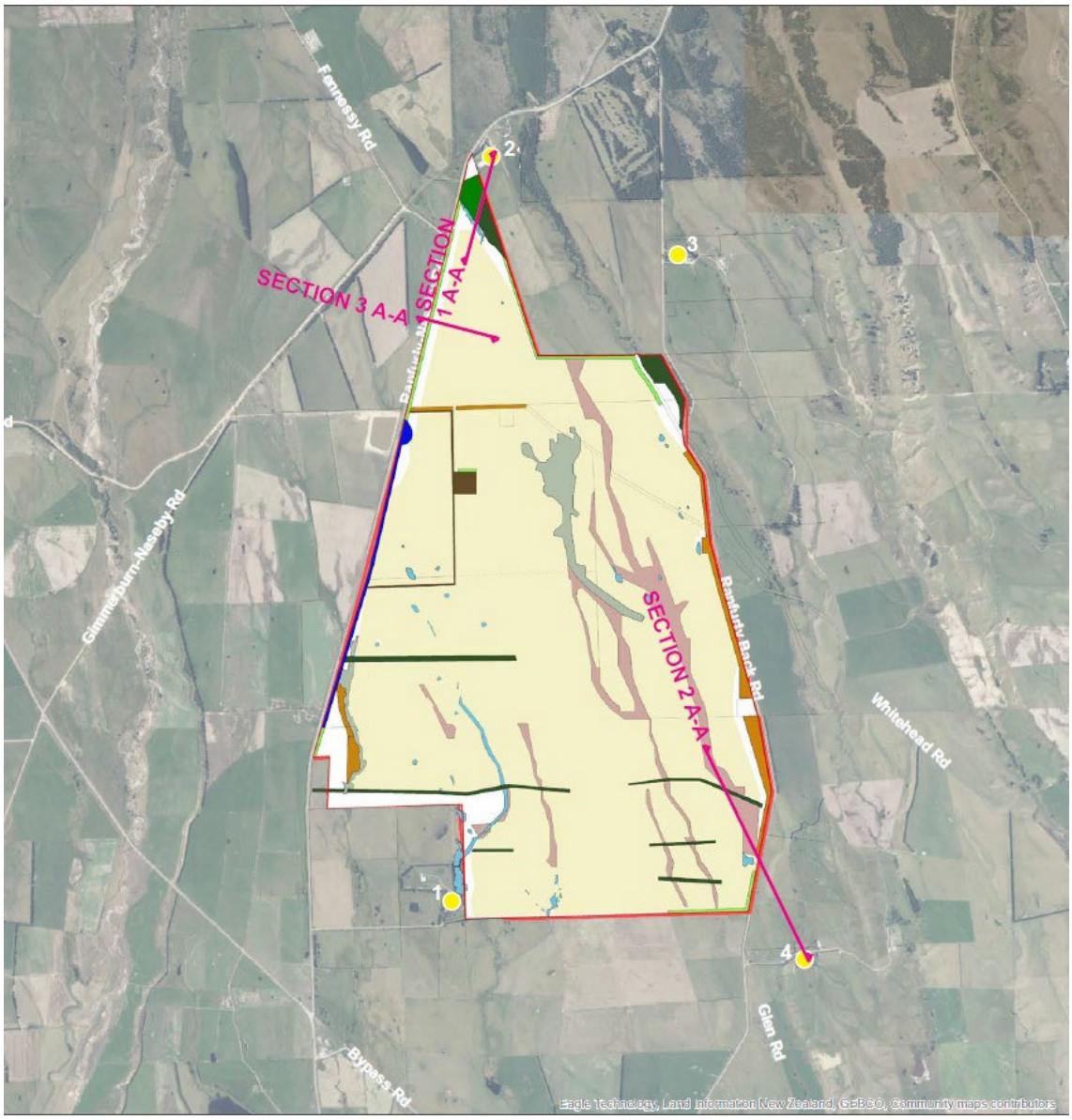


Figure 3: Landscape Mitigation Plan showing general layout, no build areas including setbacks, and planting (Source: Boffa Miskell)

The site will continue to be grazed by sheep (fenced from plantings and wetlands).

The predicted energy output from the Project is approximately 630 GWh/year, which will be supplied into the National Grid.

2.1 Infrastructure associated with the solar farm

Infrastructure associated with the Project will include the solar arrays, internal accessways, fencing, security cameras, lighting, site office, electrical infrastructure and cabling, a substation, a Battery Energy Storage System (BESS) and a transmission line connecting the substation to

the National Grid via Fennessy Road. A brief outline of the key components is provided below. A more detailed project description is provided in the AEE.

Solar Panels and cabinetry

The solar farm is proposed to comprise tilting bifacial monocrystalline panels (1P Trackers) mounted on a tracking system aligned in north-south rows that will rotate east-west to follow the movement of the sun during the day.

The solar panels (when fully flat and parallel to the ground) and all infrastructure will cover approximately 36.6% of the Site (231 ha in total). The solar panel dimensions will be:

- a maximum height above ground of approximately 2,800 mm (when tilted to the maximum angle);
- a panel width of 2,382 mm;
- a minimum height above ground of approximately 500 mm (when tilted to the maximum angle).

A central axis (post/pole holding the panels above the ground) will be approximately 1.5 m-1.8 m above ground. They will be pole driven into the ground, so no concrete foundations are required.

The panels will be arranged in north-south orientated rows within array blocks of approximately 250 m x 285 m. The rows will be spaced approximately 6 m-8 m apart (pole to pole) which allows at least a 3.6 m horizontal gap between the panels when positioned horizontally. There will be 12 m gaps between array blocks to allow for access tracks.

Figure 4 below provides an indication of the proposed panel design and dimensions.

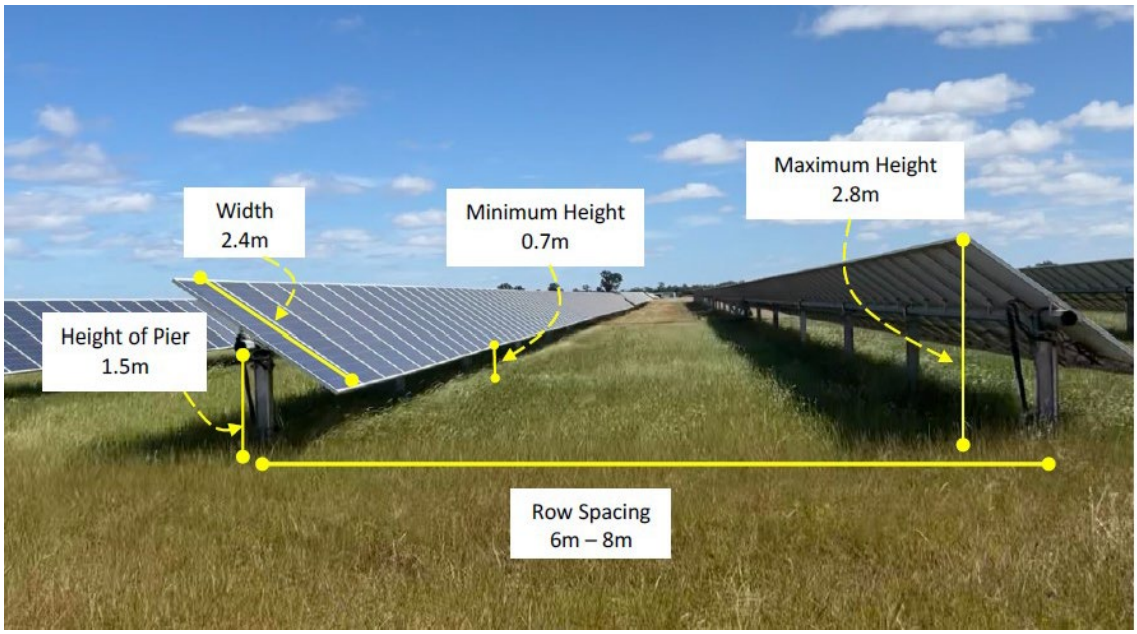


Figure 4: Typical 1P Tracker Arrangement – photograph not to scale (Source: Helios)

On an average day, the following occurs in terms of maximum solar panel height (with approximate timing):

- From sunset to sunrise, the panels are at their lowest, with an approximate 1.6m-1.7 m height.

- From sunrise to approximately 3 hours post sunrise, the panel height slowly increases, peaking at an approximate height of 2.5 m-2.8 m around 8am – 10am (depending on season).
- From 3 hours post sunrise to midday, the panel height decreases to an approximate height of 1.75 m.
- From midday to 2 hours prior to sunset, the panel height increases, peaking at an approximate height of 2.5 m -2.7 m at around 4-6pm (depending on season).
- From approximately 4-6pm to sunset, the panels decrease in height to a 1.6 m-1.7 m height.

Solar angles and irradiances vary during the year, and therefore there are also slight variations to maximum solar panel heights and when they occur during the day because of seasonality. For example, on an average January day, the maximum height of panels occurs around 8am and 6pm. On an average day in July, the maximum height of panels occurs around 10am and 3pm. This relationship between panel height and timing is illustrated in **Figure 5** below.

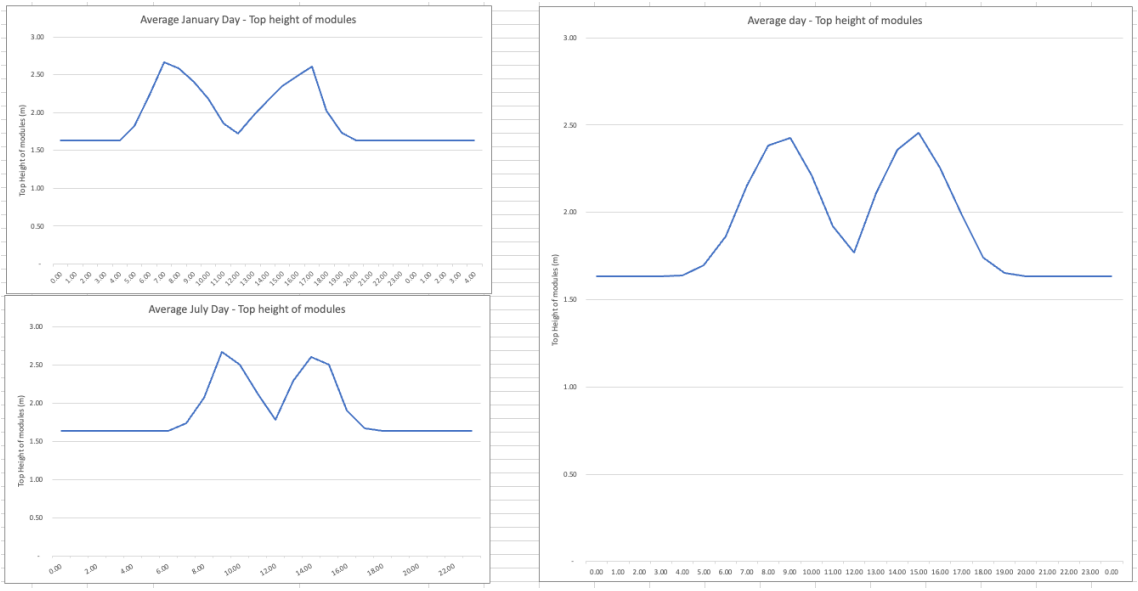


Figure 5: Solar Panel Height and Timing (Source: Helios)

Inverters

Amongst the solar panel arrays will be 74 decentralised inverter structures distributed throughout the farm to be used in the generation of power from the solar arrays. The dimensions of each inverter cabinet will be confirmed through detailed design, but are anticipated to be approximately 2.9 m high, 6.0 m long and 2.5 m wide. These prefabricated structures will sit on piles approximately 600 mm above ground level. The underlying ground will comprise compacted soil and stone.

Underground cabling will be installed across the site (route shown in the drawings in the AEE) to connect the solar panel arrays with the cabinet structures and the substation.

Substation design

A new 33 / 220kV substation will be constructed within the solar farm to connect to the National Grid at the Naseby substation on Fennessy Road. The purpose of the solar farm substation is to

take power from the solar medium voltage power stations via 33 kV cables and transform this to 220kV, suitable for transmission on the National Grid.

While the substation's exact location and layout is subject to future detailed design, it will consist of the following:

- A switchyard with an overall footprint of approximately 100 m x 110 m, approximately 11,100 m² (1.1 ha) in area.
- Up to two 33 kV switchrooms (each approx. 6 m x 20 m); and
- Six lightning masts

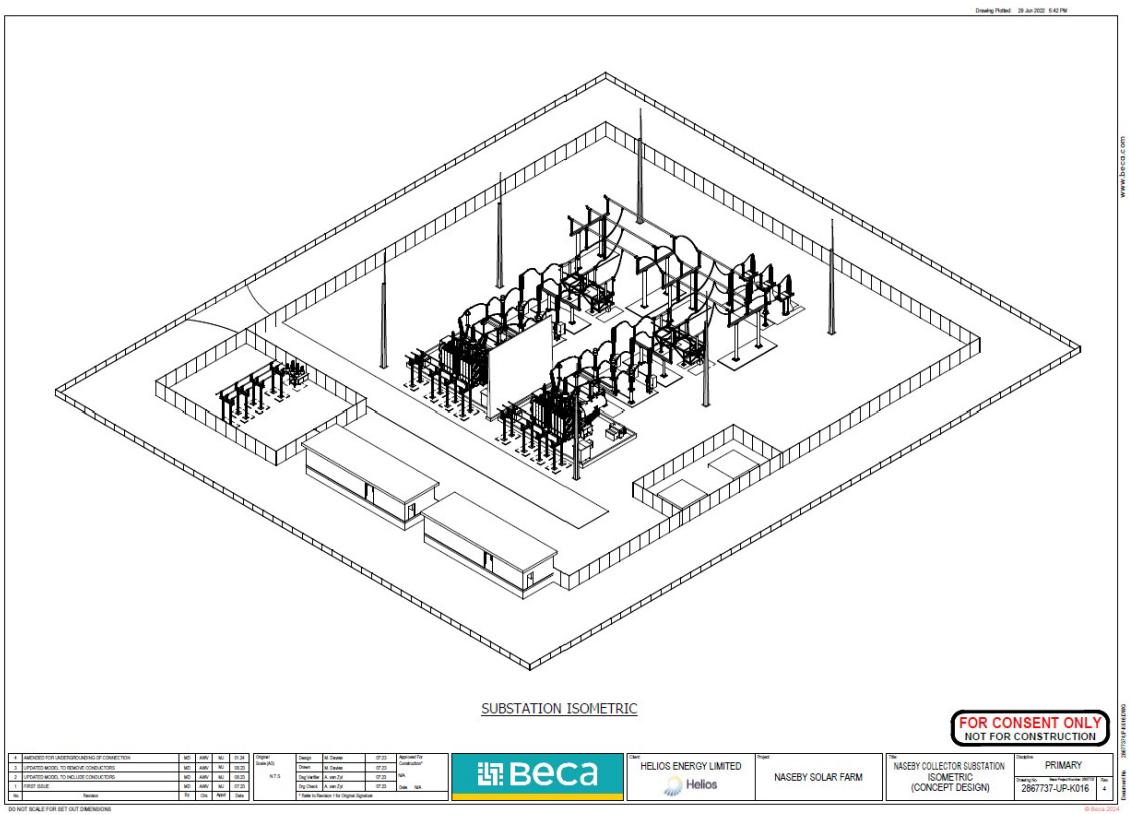


Figure 6: Indicative Substation Design (Source: Helios)

The substation may also house a water storage tank, on-site wastewater treatment, small storage facilities and car parking. There will be additional minor ancillary switchyard equipment that has not been shown. Access will be via internal Site access tracks off Ranfurly-Naseby Road.

The perimeter of the facility will be enclosed with a lockable security fence and a stock fence. The switchyard surface will generally consist of a 150 mm layer of crushed rock aggregate, with approximately 500 mm of basecourse and sub-base material below this. Switchyard equipment will be mounted on concrete foundations.

Two 33/220 kV 150 MVA transformers will be installed on bunded foundations to contain the possibility of leaked transformer oil. An oil treatment facility will be installed within a separate enclosure on site to treat stormwater before discharging it to the environment. An enclosure may be required over the capacitor banks. The capacitor banks will not contain any oil.

The new 220 kV transmission line cables connecting the onsite substation to the Transpower Naseby substation will terminate at the cable sealing end stand within the switchyard.

Lighting will be provided in accordance with Transpower's Switchyard and Grounds Lighting Approved Standard (TP.DS 40.03) and will only be used where emergency work/inspections are required. The Site will not otherwise be lit at night, unless there are urgent fault repairs that must be carried out at night.

Battery Energy Storage System

A Battery Energy Storage System (BESS) will be situated within a fenced off area within the substation and will be an area of 2000 m^2 (0.2 ha) for BESS packs that are each 3 m high.

Runoff from the substation platform area will enter a stormwater drain, to discharge to land. There is an unlikely need for any pre-treatment of the stormwater as a comprehensive oil tank system and bunding for oil in transformers means there is distinct containment which would be emptied via a sucker truck from that containment system on an as required basis.

Transmission infrastructure

The solar farm will be connected to the Naseby substation via underground cabling in the road reserve outside the Site, traversing along Fennessy Road.

2.2 Other Works

Earthworks

Earthworks will be required for the installation of cables (AC and DC Cables), internal access roads, establishing a flat surface for the substation and inverter foundations, BESS. No cut and fill will be undertaken to make areas easier to install panels.

Earthworks will be completed in stages and progressively rehabilitated to minimise the amount of soil exposed at any one time.

A total of approximately 48,230m^3 of earthworks will be undertaken. This will be a mix of cut and fill works and all material is to be reused on-site. Approximately 9,274 m^3 of thermal sand will be imported to the Site for trenching purposes, as well as approximately 25,044 m^3 of gap 20 gravel to create flat and stable areas for the inverters, substation, BESS and roading.

DC trenches will have a width of 0.6 m and depth of 0.8m. AC trenches will have a width of 0.8 m and depth of 1.2 m. Trenches will be remediated in exotic grass. Directional boring / Horizontal Directional Drilling (**HDD**) will enable cabling beneath the central wetland without requiring surface disturbance or works within the wetland.

The estimated total area and volume of earthworks per project component is broken down as follows:

Table 2. Estimated Earthworks Quantities

Component	Area of Earthworks	Volume of Earthworks
DC Cable trenching	21,000	12,600
AC Cable Trenching	10,743	8,595
HV Cable Trench	1,660	1,992
Inverters	1,270	381
Roading	109,116	21,823
Substation	6,300	2,520
BESS Area	1,600	320
Total:	151,689	48,230.34

All site works will be undertaken in accordance with the Construction Methodology as outlined in the AEE, including appropriate sediment and erosion control measures.

Site access

The Site will be fenced and gated for security/insurance purposes. A 2 m high deer-fence type perimeter fence is proposed to be constructed using wooden posts and wire mesh and will be located on the inward side of the proposed mitigation planting.

A total of four site accesses are proposed. Three will be from Ranfurly-Naseby Road and the fourth will be from Ranfurly Back Road as shown in **Figure 7**.

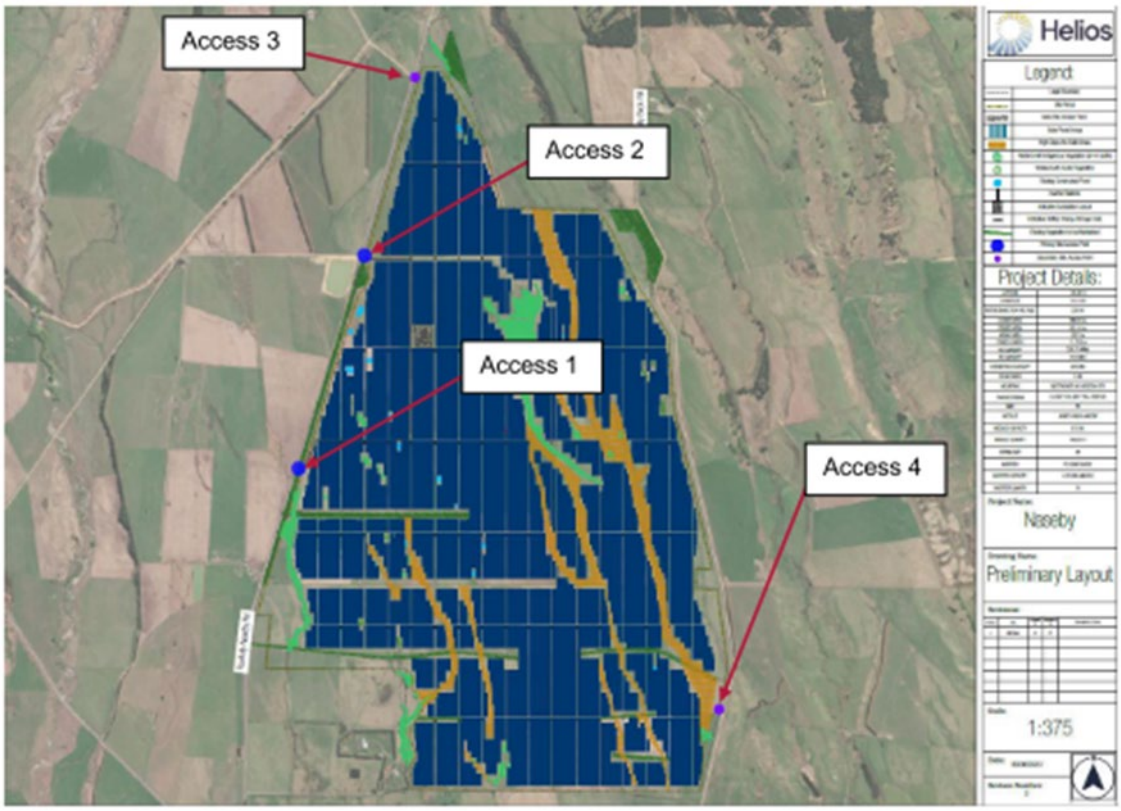


Figure 7: Proposed Access Locations (Source: Helios)

Accesses 1 and 2 will be the primary access points to be used by heavy vehicles during construction. It is proposed to establish an entry and exit access configuration so that construction vehicles enter the site via Access 1, unload materials onsite, and subsequently exit the site via Access 2.

Accesses 3 and 4 are to be secondary access points which will primarily be used to gain more direct access to other parts of the site to reduce the amount of travel through the site. Accesses 3 and 4 will not be used by heavy vehicles.

All accesses will be retained once construction is completed to allow for easier access to all parts of the site when required (although Accesses 1 and 2 will remain the primary accesses and Accesses 3 and 4 will receive minimal use).

New sections of access track will be required which will be formed by the placement of subbase aggregate, approximately 4 m wide. Together with upgrades to existing access tracks, the total length of internal access tracks (new and existing) will be approximately 27 km.

Existing waterway crossings central within the Site will be utilised for construction and operational vehicle access (predominantly construction). At time of detailed design, these will be further inspected to confirm whether any upgrade or new waterway crossings will be required, and additional resource consents sought if required. Therefore, for the purpose of this assessment, and at time of consent lodgement, we have assumed[8] that there will be no works undertaken within or near waterways, including in relation to existing vehicle crossings.

2.3 Mitigation and Restoration Strategy

The Project has been designed in a manner so as to minimise its impact on the landscape and natural character values of the site as far as practicable through the retention of all mature trees/vegetation and the avoidance of wetland areas and waterways.

To assist with screening views of the solar panels and integrating the proposed development with the surrounding landscape, a combination of setbacks, screen planting and wetland restoration are proposed.

Setbacks

Setbacks are proposed from the Site boundaries, wetlands and waterways as part of the Project. The boundary setbacks vary around the Site in response to different character and sensitivities and can be seen in **Figure 5A** of the Graphic Supplement.

Large setbacks from the boundary to the panel arrays are provided from the boundaries with road interfaces, typically of 20 m-50 m, and 350 m to the substation. At the southwestern corner, a greater boundary setback is proposed of approximately 200 m (300 m to the road), to accommodate the existing waterway in the foreground and reduce visibility. Along the quieter, unsealed road on the eastern boundary (Ranfurly Back Road), where there are fewer shelterbelts, the minimum setback is less, varying from 20 m-30 m up to approximately 130 m. The nearest panels from the northern Site boundary will be approximately 300 m to allow for visual mitigation planting and a setback from the waterway at the foot of the slope. Further large setbacks of up to approximately 150 m are proposed along sections of the Ranfurly Back Road interface to reduce visibility and retain legibility of shallow gully landforms in this area.

[8] Based on information provided to Boffa Miskell by Helios on 1 November 2023.

Setbacks from wetlands and waterways and mitigation planting are discussed further in the sections below and in the Mitigation Analysis provided in the Graphic Supplement (**Figures 7-7D**).

Boundary treatment and screening planting

New strategic blocks of planting, together with boundary setbacks are proposed as part of the Project (refer to the Graphic Supplement, **Figure 5A: Landscape Mitigation Plan, Figure 5B: Proposed Planting Palette, Figure 5C-5D: Indicative Sections and Figure 5E-5F: Section Elevations**).

The proposed planting strategy varies in species and coverage in response to varying landscape characteristics such as existing vegetation, landform and landscape features as well as the nature and extent of mitigation required.

A mix of dryland native species is proposed in some locations, predominantly along Ranfurly Back Road where there are existing indigenous shrubs present. At Risk-Declining species identified at the Site (matagouri, desert broom and scrub pohuehue) are proposed to form part of the native palette as recommended by the Project Ecologists[9] to remediate any loss as a result of the development and provide a positive impact in the long term (>20 years).

While the proposed width of boundary planting varies, an indicative cross section is provided (**Figure 5C**) to demonstrate 'drifts' of tree and shrub planting intertwined with a mix of species and plant sizes. It is proposed that new plantings be implemented at spaces that allow for established plant sizes while achieving this varied, natural outcome. The aim is to avoid an 'avenue' effect and to ensure the planting looks as natural as possible.

Detailed planting plans will be developed later as part of a Landscape Management Plan which is described further in **section 6: Recommendations**.

Faster growing exotic evergreen shelterbelt species are proposed in other locations where there are existing shelterbelts such as along Ranfurly-Naseby Road and where additional height is needed. A stand of exotic trees is proposed on the slopes at the northern tip of the Site due to the extra height needed for visual mitigation from elevated locations and is consistent with an existing neighbouring stand of pine trees.

It is also proposed to fill gaps in existing shelterbelts.

This boundary planting will provide screening for year-round visual mitigation and enhance biodiversity on the Site.

It is important that the species selected can grow well in relatively harsh conditions as well as providing a level of visual screening required to reduce visual effects. The use of indigenous species is also considered an opportunity to enhance natural character. Therefore, the species selection process has been carefully considered, and recommends a mix of evergreen species endemic to this ecological district, tolerant of the environment (based on ecologist recommendations), that will retain a degree of tolerance to fire.

Regular watering/irrigation over the first 5 years following planting will be essential for plant growth in this environment. Protective wind shelters are also recommended.

The existing shelterbelts on Site will be retained and regular monitoring and maintenance will be required for their long-term health and survival, which is coupled with their effectiveness to act as a screen. This may require occasional pruning and 'spot' planting to 'fill in any gaps' that may be evident at ground level in between the trunks of the individual trees. Replacement planting

[9] EcIA, section 8.12. (p60) and Table 15, section 8.2 (p63)

with evergreen species will be undertaken where there are gaps or where there are trees that are failing and need to be removed.

As noted above, while the Landscape Mitigation Plan provides the high level plan, a Landscape Management Plan is also recommended to set out and schedule all these details and is described further in **section 6: Recommendations**.

The planting will be located just inside the property boundary with a security fence on the inward side of the planting.

Wetland management and restoration

A number of project shaping recommendations were provided from the Project's Ecologists (in relation to ecological effects) and Landscape Architects. Ecology recommendations are outlined in a separate Ecological Impact Assessment also attached to the AEE.

To summarise the process, ecological surveys were carried out early in the development of the Project. Following completion of the surveys, the field data was analysed, and the boundaries of wetlands and waterways were mapped. As a result of the ecological values identified, a number of 'no-build' areas were recommended and adopted as part of the Project Design. Other recommendations included methods for cable laying and options for construction setbacks.

Setback distances from all wetlands were also adopted to ensure they will be fully avoided by construction works[10]. The two natural inland wetlands (the central wetland and the wetland/waterway in the southwest of the Site) and the waterway in the northeast of the Site will have a minimum 10m setback from solar farm development. All other wetlands will have a minimum of a 5m setback.

As part of the project shaping process, it was also proposed that the two large wetlands (the central and southwest wetlands) be fenced off from grazing stock and planted with appropriate native wetland species. Recommended wetland species identified in the planting palette (**Figure 5B** of the Graphic Supplement) include At Risk-Declining species identified at the Site (Sedge and Spaniard (Carex kaloides and Aciphylla subflabellata)) by the Project Ecologists.

Proposed Mitigation Planting Summary

Proposed planting species are detailed in **Figure 5B** in the Graphic Supplement. The total areas of planting proposed are set out in Table 3 below:

Table 3: Areas of proposed planting

Location / type of planting	**Area of planting proposed (ha)**
All proposed terrestrial native mitigation planting	11.4 ha
All proposed wetland enhancement planting	14.0 ha
Total area of native planting proposed	**25.4 ha**
All proposed exotic shelterbelt planting	7.0 ha
Total area of planting proposed	**32.4 ha**

[10] Refer to Table 1 in the EclA

2.4 Construction

A draft construction methodology for the project is provided in the AEE. The total construction period is anticipated to take approximately 24 months, which includes enabling works, site preparation and construction.

2.5 Operation

Once the solar farm is operational, activity will be very limited. No on-site staff will be required as the componentry is operated/monitored remotely. However, should componentry need to be replaced, it will need to be accessed. This is likely to be infrequent. Vehicle movement within the Site will typically be by quad bike or small, farm utility vehicle.

Typical day-to-day operation of the substation will also largely occur remotely. Infrequent visits by maintenance / inspection teams will be undertaken. There may be 5-6 staff visiting the site office once per week.

Agricultural activity will continue on the Site, utilising remaining existing infrastructure. The panels will be raised off the ground sufficiently to enable sheep grazing.

The grazing of sheep not only continues productive use of the rural site but also removes the need for grass mowing and weed management.

2.6 Decommissioning

At the end of the intended 35-year operational lifespan of the solar panels, the solar farm, including the substation building and all ancillary equipment, will be dismantled and removed from the site. As no concrete foundations are required, the panels can be completely removed quite easily.

Materials will be reused or taken to an appropriate location for recycling or disposal. The site will be reinstated to its original pre-construction condition.

3.0 Existing Environment

This section provides a description of the Site followed by an analysis of the landscape and natural character attributes of the existing context at both a broad and local scale, as well as potential viewing audiences, providing the baseline for the assessment of landscape effects.

Photographs **(Site Appraisal Photographs A - D)** were taken from within the Site to illustrate the current landscape character of the site. **Site Context Photographs (1 – 18)** were taken from outside the Site to represent the character of the local and wider landscape, and visibility of the Site from the surrounding landscape. The locations of these photographs are shown in **Figure 4** of the Graphic Supplement.

3.1 Broader Landscape Context

The Site is located in the Maniototo / Māniatoto Plains, Central Otago, approximately 3.3 km southwest of Naseby and some 4.3 km north of Ranfurly.

The Maniototo Plains are identified as part of Character Area 16 in the 1998 landscape study for the Otago Regional Council (BML)[11] and described as an elevated inland alluvial basin with areas of glacial terracing and meandering rivers, characterised by extensive farming, roads, pasture, shelterbelts and small towns.

In the more recent 2008 landscape assessment of Central Otago (LA4 et al), the Maniototo is identified as part of landscape unit 23 and the broader Sub Category C, 'Valleys and Open Plains'.[12] These landscapes are described as having a rural nature, an open, expansive quality and an almost complete lack of screening which 'means that they are highly sensitive to any change because changes would be visible for miles across the flat plains'. However, the report does note that some additional development could be accommodated on the outskirts of existing towns such as Naseby. It also describes the landscape character of the Maniototo as highly modified and the accompanying maps identify the area as having 'limited landscape sensitivity'.

The Site is not considered to be adjacent to or form part of any significant or outstanding natural feature or landscape. It lies within an overlay of Other Rural Landscapes (ORL) in the Central Otago District Plan. ORLs are all those landscapes in the Rural Resource Area that are not otherwise identified as Outstanding Natural Landscape (ONL), Outstanding Natural Features (ONF), or Significant Amenity Landscapes (SAL), or in the Upper Manorburn / Lake Onslow Landscape Management Area.

The landscape is described below in terms of each of the three landscape dimensions – physical, associative and perceptual, however it is not intended that they be considered separately. The landscape as a whole is greater than the sum of its parts.[13]

3.1.1 Physical

Landform

The Maniototo / Māniatoto is a large inland basin consisting of broad flat plains, low undulating ridges and steep river terraces. The basin is located to the west of the Taieri Plain and to the east of the Manuherikia and Ida Valleys and is defined by five surrounding mountain ranges: the Hawkdun and Ida Ranges to the north, the Kakanui Mountains to the northeast, Rough Ridge to the northwest, and the Rock and Pillar Range to the south. These block-faulted schist mountains provide a legible, scenic backdrop to the Maniototo / Māniatoto Basin, characteristic of the range-and-basin landscape of Central Otago. Numerous small rivers and tributaries drain these mountains southwards into the Taieri River.

Between Ranfurly and Naseby the elevation of the plains gradually rises from approximately 430masl to 600masl, steepening up along terraced landforms in the vicinity of the north end of the Site as the basin transitions to the foothills of the surrounding ranges.

[11] BML (1998) Investigations into Otago's Natural Character, Landscape and Significant Natural Areas, p45

[12] LA4 et al (2008) Central Otago District Rural Review Landscape Assessment Report and Recommendations pp11, 12, 21-23

[13] TTATM, p34

***Figure 8**: Photo from SH85 looking northeast towards the Site in the mid-ground with Naseby Forest and the Ida Ranges beyond.*

At typical elevations of 1500-1600masl, the mountains influence the sub-continental climate of the Maniototo / Māniatoto Plains which has very cold winters, hot summers and low precipitation.

Ecological context

The solar farm Site is within the Maniototo Ecological District (ED) in the Central Otago Ecological Region.

Vegetation at the time of European settlement would have comprised dense shrublands and tussock grassland with extensive areas of wetland likely along the Taieri River. Land cover surrounding the Site today primarily consists of exotic pasture species, exotic shelterbelts and forest dominated by *Pinus species,* and few areas of remaining indigenous vegetation.[14]

The Site falls within an area identified as the 'Central Otago Drylands/Manuherikia Place' in the Otago Conservation Management Strategy (CMS)[15]. This area is described as being characterised by semi-natural and agricultural landscapes and wide open spaces set amongst rolling hills and the backdrop of the Central Otago uplands. Here, the indigenous dryland ecosystems and landscapes have been*:*

'…modified extensively due to human settlement, gold mining, pastoral farming, and more recently new activities such as cropping, viticulture, horticulture, dairying and lifestyle blocks.'[16]

Land use

Land use in this plains landscape, and specifically the land to the east, west and south of the Site is characterised by its agricultural use. Other land uses include forestry, tourism, recreation, conservation, as well as residential. There are also existing energy-related land uses nearby.

North of the Site, at the foot of the ranges is the Naseby Golf Club, township of Naseby, and the surrounding Naseby Forest. Naseby is the closest settlement to the Site and lies predominantly in a hollow, largely surrounded by the exotic conifer forest. The 2,500 hectare Naseby Forest is both a working exotic forestry plantation and recreation area with walking and biking tracks. The

[14] EclA, p22

[15] Conservation Management Strategy Otago 2016 (Incorporating the July 2022 partial review) Volume 1, published March 2023, NZ Department of Conservation

[16] Ibid, p89

trees and forestry operations are a distinctive large, industrial-scale rural activity associated with Naseby and characteristic of this northern edge of the Maniototo / Māniatoto Plains landscape.

The permanent population of Naseby is relatively small (120 in the 2018 census), however conversation with the land-owner during the site visit suggests the town may be growing. It is also a recognised holiday destination. Nearby Ranfurly is the main service town in the Maniototo / Māniatoto Plains and there are many other small settlements scattered across the basin.

However overall, dwellings are sparsely located and at some distance to the Site with five residential buildings (including one of the Project landowners) within approximately 1km of the Site boundary.

State Highway 85 is the main route traversing the area to the south of the Site. The Roxburgh to Livingstone 220 kV transmission line, part of the National Grid, crosses to the north of the Site with the Naseby Transpower Substation located nearby on Fennessy Road. LeoLabs Kiwi Space Radar, an international facility for tracking space debris, is also on Fennessy Road.

Solar Bay Energy has been granted consent for a 50MW solar farm on a 54.5 ha site located off Fennessy Road (see **Figure 6** in the Graphic Supplement), which once developed, will introduce another type of agro-industrial character to this rural landscape.

3.1.2 Associative

Associative means the intangible things that influence how places are perceived, such as shared and recognised values of a community, history, identity, creation stories, and activities specifically associated with a landscape.

Tāngata whenua have a holistic relationship with whenua that integrates physical, associative, and perceptual dimensions. As set out in landscape guidance, Te Tangi a Te Manu, while described under the heading of 'Associative', it is intended that consideration of tāngata whenua landscape attributes will overlap with the physical and perceptual.[17] Helios will be engaging with mana whenua to understand any potential impacts on cultural values.

The wider area has significant cultural and historic values with many notable heritage buildings and sites. There is a widespread network of Māori cultural and archaeological sites throughout the Maniototo / Māniatoto Plains. Early Māori used the Taieri River and major valley systems and passes such as the route over Danseys Pass to access the area, establishing semi-permanent seasonal campsites (kaika nohoaka) while collecting food (mahika kai).

The Ngai Tahu Atlas also notes that Māniatoto is the correct spelling for Maniototo:

One possible explanation of the name Māniatoto is that Mānia means "plain" and Buchanans Sedge (Carex buchananii) – the reddish brown native sedge that is widespread throughout Te Waipounamu. In certain light the Buchanans Sedge on the plain resembles a huge red blanket, or a sea of red blood (toto).[18]

The first European settlers in the Maniototo / Māniatoto Plains were pastoral farmers and goldminers. Naseby was established following the discovery of gold nearby in 1863 and as a result contains a unique collection of 19th Century heritage buildings and trees. Heritage New Zealand has registered the town centre as a Historic Area, recognising these heritage values.

[17] TTATM, p33

[18] https://kahurumanu.co.nz/atlas

While the plains and area in the vicinity of the Site is not considered wild or notably remote, the surrounding mountain ranges comprise large areas of public conservation land with these attributes. Visitors enjoy a wide range of experiences in these parks (Oteake Conservation Park is centred on the ranges to the north and Kakanui Conservation Area to the east) including recreational hunting and four wheel driving. However, in winter many roads are closed to vehicles and it is a time when the park is described as a peaceful Backcountry destination where natural quiet and a sense of isolation are high[19]. Away from four wheel drive routes and during winter it is a place of solitude and challenge for recreationalists and people have few encounters with others.

Other attractions include the extensive network of mountain bike trails throughout the forestry area nearby and within the wider locality such as the popular Central Otago Rail Trail, which passes through Ranfurly and for which Naseby and the wider Central Otago area is known. The Rail Trail passes some 3km southwest of the Site at the nearest point.

The conservation areas also coincide with areas of Significant Natural Value and a large area identified as Outstanding Natural Landscape in the CODP. Refer to **Figure 1** (Landscape Context) in the Graphic Supplement which identifies the location of Outstanding Natural Landscapes, Significant Amenity Landscapes and areas of Significant Natural Value in the wider landscape.

While they are very distant from the Site (approximately 6 km between the nearest boundaries) there is a strong visual relationship between the plains and these distinctive ranges as noted in the 1998 landscape study:

> *'…the broad flat landscape of the Maniototo Plains sets a dramatic stage for the surrounding steep and rugged mountainous backdrops.'*

Paintings of the Maniototo / Māniatoto Plains by well-known artist Graham Sydney have made these hills, open plains and big skies more widely renowned and recognisable.

3.1.3 Perceptual

As touched on in the section above, openness, big skies and long views to the backdrop of ranges are key characteristics and values of the Maniototo / Māniatoto Plains landscape. The simplicity and scale of these landscapes in terms of their landform and landcover means they have a high degree of visual coherence and legibility. Mt Kyeburn is a particularly noticeable feature in views from the vicinity of the Site due to its conical shape and appearing to stand alone.

There are also transient but pronounced seasonal changes and a quality of light that are distinctive attributes associated with the Maniototo / Māniatoto Plains basin landscape. While shelterbelts within the Site are almost entirely evergreen, there are deciduous species present in the surrounding area that noticeably lose their leaves through Winter.

At the finer scale, there are noticeable features and variations in topography such as the Eweburn river terrace scarps, and shelterbelts and other large stands of trees that form part of local views. These features add an impression of linearity to the landscape.

[19] CMS, p51

3.2 Site Description

Roughly triangular in shape, the Site is bounded by Ranfurly-Naseby Road to the west, the more undulating, unsealed Ranfurly Back Road to the east, and is set back approximately 1km from Bypass Road, the nearest road to the south.

The Ranfurly-Naseby Road provides the main, sealed connection between State Highway 85 (Ranfurly-Wedderburn Road) to the south and Naseby to the north. The other main road in and out of Naseby is Danseys Pass Road which provides a connection north to the Waitaki Valley.

Ranfurly-Naseby Road and Ranfurly Back Road provide the access points to the Site.

An application for a 54.5 ha solar farm (Solar Bay Naseby) has been approved (February 2023) nearby at 216 Fennessy Road. Fennessy Road is a low volume, unsealed, no exit road that intersects with Ranfurly-Naseby Road opposite the north end of the Site.

The Site itself has been modified through agricultural use, cultivation, and the prevalence of exotic vegetation and is presently used for sheep and beef grazing on intensively improved exotic pastures and short rotation cropland. The Site is characterised by flat to undulating paddocks partially divided by evergreen shelterbelts (refer to **Site Appraisal Photographs A-B**). These include a roadside shelterbelt screening views along part of Ranfurly-Naseby Road.

The solar farm Site is located at approximately 500 m-560 m elevation; the topography broadly comprises a gentle fall from north to south over approximately 4.5 km and a series of long folds, the ridges and gullies orientated northwest to southeast (refer to **Site Appraisal Photograph C-D**). Some of these slopes and crests are moderately steep and elevated and are a feature of the Site.

Figure 9*: View east from near the centre of the Site showing undulating ridges and wet area with Juncus spp. in foreground.*

The Site contains numerous small depressions (dozens) that in currently available imagery contain ponded water; all of these locations were visited as part of the Boffa Miskell Ecological Impact Assessment to determine their wetland status. There are two large natural inland wetlands at the centre ('Central Wetland', refer to **Site Appraisal Photograph C**) and southwest of the Site ('Southwest Wetland').

The small wetlands/depressions, the Southwest Wetland and the large Central Wetland area are dominated by exotic species but also contain indigenous wetland species which contribute

to natural character. Species identified as part of the ecology investigations include occasional indigenous wīwī (*Juncus edgariae)*, sedge / *Carex* spp and waoriki (*Ranunculus glabrifolius*).[20]

Elsewhere, vegetation predominantly consists of improved pasture and short rotation cropland that is regularly mechanically cultivated and grazed by sheep and beef cattle. All indigenous vegetation has been removed from the paddocks. Remaining indigenous dryland plants persist as sparse isolated shrubs only along fencelines and include tūmatakuru / matagouri, mākaka / desert broom, and pōhuehue and porcupine shrub.[21]

A well-established shelterbelt (predominantly *Pinus species*) with occasional gaps and deciduous species, lines approximately half the length of the perimeter of the Site along the Ranfurly-Naseby Road. There is also a stand of exotic evergreens on the slopes at the northeast tip of the Site. Several internal east-west orientated shelterbelts partially divide the southern end of the Site.

Figure 10*: Group of trees at northeast tip of the Site.*

There are no buildings or other large structures on the Site and a small number of residential dwellings and farm buildings are in the immediate surrounding landscape.

3.3 Summary

While the Site is not located in an ONL, SAL or SNL, there are many important physical, associative and perceptual values in the wider landscape. These include cultural landscape values, the historic heritage and recreation values at Naseby, and the shared and recognised qualities of light, vast skies, scenic mountain backdrops and extreme seasonal changes characteristic of the wider range-and-basin landscape of Central Otago.

The character of the Maniototo / Māniatoto Plains is also recognised as highly modified. The Otago CMS describes this area as part of a chain of dryland ecosystems that contain some of the most threatened and least protected indigenous ecosystems and species.[22] This is an open,

[20] Ibid, pp26-27

[21] Boffa Miskell EclA, p23

[22] CMS, p88

modified rural landscape characterised by its agricultural use; a landscape where natural systems continue to operate but in which rural activities prevail.

The Site is also in proximity to features that are not associated with traditional farming land use with a more industrial scale or appearance such as the LeoLabs Kiwi Space Radar, Naseby Transpower Substation, the consented Solar Bay solar farm and the Earnslaw One Naseby forestry operations nearby.

Key rural landscape and amenity values that relate to the Site and immediate surrounds include:

- Expansive areas of pasture which creates a sense of openness with vast skies and opportunities for long views to the wider plains and mountain backdrops.
- The exotic forestry which is characteristic of this northern edge of the Maniototo / Māniatoto Plains landscape.
- Legibility of landform such as the undulating folded landscape within the Site as well as the contrast between the plains and surrounding ranges.
- Two large natural inland wetlands.
- A low density of structures and buildings that are predominantly used for rural activities.

3.4 Visual Catchment

In addition to the Site visit, to determine the visual catchment and viewing audience of the proposal, a study of aerial photography was undertaken and the use of a 3D digital terrain model.

Private properties likely to be affected have been visually surveyed from nearby publicly accessible locations where possible and analysed using the terrain model. The four closest dwellings (with the exception of Dwelling 1, a Project landowner residence) have also been visited (15 November 2023) to assist with understanding the nature of these potential private views.

The nearest areas of concentrated settlement are located at Naseby, approximately 3.3 km north of the Site and Ranfurly, 4.3 km south of the Site. There are no views of the Site from these residential areas.

The visual catchment is relatively contained to the immediate context of the Site. While the total size of the proposed Site is 660 ha, it is broken up into smaller areas by topography and vegetation; the folded landform and existing shelterbelts restrict views to the whole development.

Most available views to the Site are from local roads including Ranfurly-Naseby Road, Ranfurly Back Road, and Bypass Road. There is also potential for visibility of parts of the Site from a short section of State Highway 85 (Ranfurly-Wedderburn Road). The viewing audience will typically be transitory and travelling at speed.

The northern portion of the Site is without existing screening along the road boundary and therefore open to potential views from Ranfurly-Naseby Road while also enabling views across the Site to the mountain ranges beyond. By comparison, the lower, southern portion of the Site is partially broken up by shelterbelt plantings and set well back from the closest road to the south. Open views across the Site are also possible from along much of the Ranfurly Back Road between the gully at the north end and the shelterbelts at the southern end.

There are a small number of residential dwellings where views into the Site can be obtained. Of the closest properties (excluding the Project landowner), Dwelling 2 on Ranfurly-Naseby Road and Dwelling 4 on Ranfurly Back Road will be the most visually affected, due primarily to their elevated location and the lack of screening at the north end of Ranfurly-Naseby Road and along Ranfurly Back Road.

Other more distant dwelling locations include those on Bypass Road, Ranfurly-Wedderburn Road, Gimmerburn-Naseby Road, and Brinsdon Road.

The visual catchment for public and private viewing audiences is outlined below.

Long-distance views (over 1 km from nearest Site boundary):

- Elevated publicly accessible views such as from Ridge Road (approximately 4.5 km away) and further away in the surrounding foothills and ranges.
- Views from State Highway 85, travelling east or west at distances of approximately 1 km away at the closest viewpoint.
- Views from Bypass Road, travelling southeast or northwest at distances of approximately 1 km at the closest viewpoint.

Views from recreational areas:

- Central Otago Rail Trail (3 km)
- Naseby Forest Trails (2 km)
- Naseby Golf Course (700 m)

Views from the west: *(panels typically set back some 20 m-50 m from boundary; substation set back approximately 350 m)*

- Naseby Link Road and Gimmerburn Naseby Road (unsealed, 300 m-1500 m away)
- Fennessy Road (intersects with Ranfurly-Naseby Road which borders the Site)
- Ranfurly-Naseby Road (borders Site)
    - Approach from south
    - Central section
    - Northern section, travelling north
    - Northern section, travelling south

Views from the east: *(panels typically set back some 20 m-30 m but up to 130 m from boundary, substation set back approximately 1250 m)*

- Ranfurly Back Road (unsealed, borders site)

Views from private dwellings:

There are a small number of dwellings in the local area surrounding the Site up to a distance of approximately 3 km from the nearest Site boundary (refer to the **Figure 7 below** and **Figure 4** in the Graphic Supplement).

- Views from Dwellings 5 - 17 (1 km-3 km)

- Views from Dwelling 1 (45 m). The residents are one of the two Project landowners leasing land to Helios for this development so this dwelling has been excluded from the visual assessment.
- Views from Dwelling 2 (130 m)
- Views from Dwelling 3 (580 m)
- Views from Dwelling 4 (400 m).

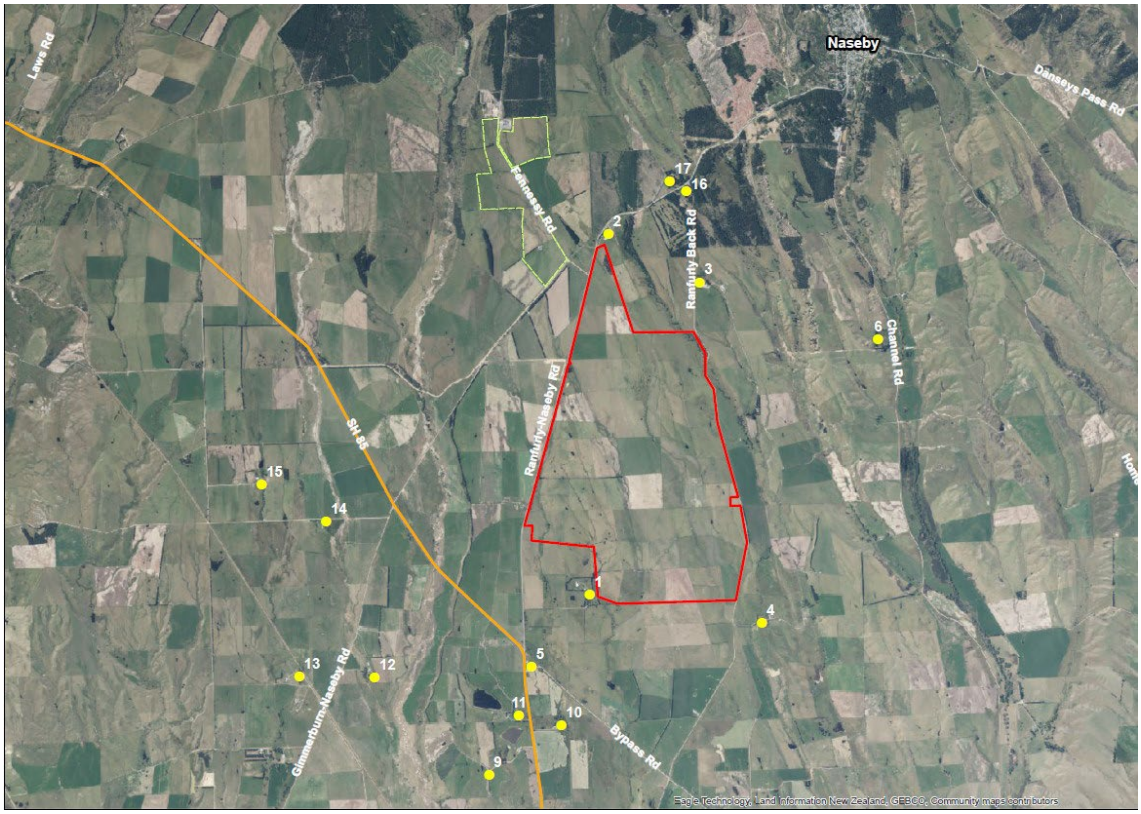


***Figure 11**: Dwelling locations (source: Boffa Miskell)*

3.4.1 Site Appraisal and Site Context Photographs

To assist the assessment of available views and understand the landscape of the Site and immediately surrounding context, panoramic photographs were taken on Site (**Site Appraisal Photographs A-D,** refer **Figure 4** in **Graphic Supplement** for photograph locations). These are described in Table 4 below:

Table 4: Description of Site Appraisal Photographs

Photo Ref#	Location	Description
SA Photo A	Ridge, southwest corner	View looking southeast showing the undulating landform and layers of vegetation to the south including linear shelterbelts within the Site.

SA Photo B	Ridge, southwest corner	View looking west showing one of the tall east-west pine shelterbelts that break up the Site
SA Photo C	Central	View looking northeast showing the identified wetland area located between low ridges near the centre of the Site.
SA Photo D	Centre-east	View looking south showing undulating landform and linear shelterbelts. Dwelling 4 can be seen in the distance in a gap between trees.

Site Context Photographs were also taken from publicly available vantage points surrounding the Site. Available views occur at a range of distances and directions looking towards the Site (**Site Context Photographs 1-18**, refer **Figure 4** in Graphic Supplement for photograph locations). The Site Context Photographs are described in Table 5 below:

Table 5: Description of Site Context Photographs

Photo Ref#	Catchment	Approx. Distance to Site boundary	Description
SC Photo 1	Long-distance views (**Ridge Road**)	4560 m	From **Ridge Road** looking southwest, showing expansive view over Maniototo / Māniatoto Plains with Ranges in the background. Naseby dwellings amongst trees to the right of the photograph and transmission line in the midground. The Site is in the distance, largely screened by intervening vegetation
SC Photo 2	Long-distance views (Ranfurly-Wedderburn Road/**SH85**)	1055 m	From Ranfurly-Wedderburn Road (**SH85**) looking northeast. Ranfurly-Naseby Road is in the midground with the Site beyond, backdropped by the Hawkdun Ranges, Mt Kyeburn and the Kakanui Mountains to the right of the photograph.
SC Photo 3	Long distance views Ranfurly-Wedderburn Road (**SH85**)	1105 m	From Ranfurly-Wedderburn Road (**SH85**) looking northeast showing the layers of intervening vegetation. Broadly representative of views from Dwelling 5.
SC Photo 4	Long distance views Ranfurly-Wedderburn Road (**SH85**)	1625 m	From Ranfurly-Wedderburn Road (**SH85**) looking northeast showing the layers of intervening vegetation.

SC Photo 5	Views from the west (**Ranfurly-Naseby Road** Southern)	100 m	From **Ranfurly-Naseby Road** looking northeast towards the highly visible slopes of the undulating landform. One of the two large wetlands identified at the Site is in the foreground.
SC Photo 6	Views from the west (**Ranfurly-Naseby Road** Central)	Borders Site	From Ranfurly-Naseby Road showing the existing shelterbelt that screens the Site for part of this western road boundary and the prominent slopes of the undulating landform in this part of the Site.
SC Photo 7	Views from the west (**Ranfurly-Naseby Road** Northern)	Borders Site	From Ranfurly-Naseby Road looking east showing the open views available across the north end of Site to the mountain ranges beyond.
SC Photo 8	Views from the west (**Ranfurly-Naseby Road** Elevated northern)	135 m	From Ranfurly-Naseby Road looking south, showing a high level of visibility to the north end of Site due to this elevated viewpoint and the lack of vegetation within the northern end of the Site. The central shelterbelt breaks up views to the south end of the Site.
SC Photo 9	Views from the west (**Ranfurly-Naseby Road** Elevated northern – potential cumulative)	Borders Site	From Ranfurly-Naseby Road – looking southwest towards **Fennessy Road** and the location of the approved Solar Bay solar farm. LeoLabs Kiwi Space Radar is also visible to the right of the photograph.
SC Photo 10	Views to approved solar farm from Ranfurly-Naseby Road	Borders Site	From Ranfurly-Naseby Road – looking west down Fennessy Road towards the location of the approved Solar Bay solar farm.
SC Photo 11	Views to existing substation from Fennessy Road	1845m	From Fennessy Road to the existing substation illustrating the characteristics of the infrastructure.
SC Photo 12	Views from the east (**Ranfurly Back Road)**	20m	From **Ranfurly Back Road** looking southwest across the gully to the nearest Site boundary, broadly representative of the angle (but not distance) of view from Dwelling 3.

SC Photo 13	Views from the east (**Ranfurly Back Road)**	Borders Site	From Ranfurly Back Road looking north towards Naseby Forest and Hawkdun Range with Site in the foreground to the left of the road. Hedging around Dwelling 3 visible to right of photograph.
SC Photo 14	Views from the east (**Ranfurly Back Road)**	Borders Site	From Ranfurly Back Road looking northeast across the Site with Hawkdun Range and Rough Ridge in the distance.
SC Photo 15	Views from the east (**Ranfurly Back Road)**	Borders Site	From Ranfurly Back Road looking south. Dwelling 4 is partially visible to left of photograph.
SC Photo 16	Views from the east (**Ranfurly Back Road)**	Borders Site	From Ranfurly Back Road looking northwest in one of the folds between ridges showing the legibility of the landform and the linear shelterbelts that visually break up the Site.
SC Photo 17	Views from the east (**Ranfurly Back Road)**	670 m	From Ranfurly Back Road looking north towards Site with the elevated location of Dwelling 4 to the right of the photograph.
SC Photo 18	Long distance views (**Bypass Road**)	1070 m	From Bypass Road looking north, showing layers of intervening vegetation. There is a partial shelterbelt along the southern boundary of the Site towards the southwest corner, however much of the boundary is not currently planted.

Private Viewpoint Photographs (**Viewpoint Photographs 19-23,** refer **Figure 4** in **Graphic Supplement** for photograph locations) were taken from Dwellings 2-5 as set out in Table 6 below:

Table 6: Description of Private Viewpoint Photographs

Photo Ref#	**Location**	**Approx. Distance to Site boundary**	**Description**

VP Photo 19	Dwelling 2 (outside dwelling)	130 m to nearest Site boundary 360 m to nearest panel arrays 1200 m-1400 m to nearest visible part of Site	View from immediately outside dwelling, looking south. Site is in mid-ground, partially screened by vegetation within the Site as well as shelterbelts/hedging within the Dwelling 2 property and backdropped by ranges.
VP Photo 20	Dwelling 2 (driveway)	50 m to nearest Site boundary	View from driveway (approximately 130 m from dwelling), looking south. The Site boundary is in the foreground with the nearest panel arrays set back approximately 280 m beyond. The approved Solar Bay solar farm site is approximately 450 m to the southwest.
VP Photo 21	Dwelling 3 (outside dwelling)	580 m to nearest Site boundary	View adjacent to dwelling, looking southwest. Glimpse of Site possible between trees however largely screened by shelterbelts/hedging within Dwelling 3 property.
VP Photo 22	Dwelling 4 (outside bedroom window)	400 m to nearest Site boundary 900 m to nearest visible part of Site	View outside dwelling (bedroom window) looking north. Northeast of Site is in mid-ground, backdropped by Ida and Hawkdun Ranges. The south end of the Site is screened by shelterbelts/hedging within the Dwelling 4 property. The north end of Site is partially visible, broken up by an existing shelterbelt within the Site.
VP Photo 23	Dwelling 4 (garden/ carpark)	370 m to nearest Site boundary 800 m to nearest visible part of Site	View from edge of garden entrance/carpark area, looking northwest. North end of Site is in mid-ground, backdropped by ranges. The south end of the Site is screened by shelterbelts/hedging within the Dwelling 4 property. Visibility of the northeast corner is broken up by an existing shelterbelt and undulating landform partially screens the western and eastern-most edges. There are open views to the balance of the north end of the Site. The LeoLabs Kiwi Space Radar is visible beyond the Site.

VP Photo 24	Dwelling 5	1080 m	View from immediately outside dwelling, looking northeast. Occasional glimpses of Site are possible between layers of intervening vegetation. Visibility is difficult to discern in the photograph with vegetation in leaf but will be greater in Winter when deciduous trees such as the willows and poplars will be bare.

4.0 Relevant Statutory Provisions

As part of this assessment, there are a number of planning provisions that are relevant to this project. Specifically, they include:

- The Resource Management Act (RMA)
- Partially Operative Otago Regional Policy Statement (Otago RPS)
- Proposed Regional Policy Statement (PRPS)
- Operative Central Otago District Plan (CODP)

Resource Management Act

The assessment of landscape, natural character and visual effects primarily addresses the following relevant RMA matters:

- Section 6(a): Preserving the natural character of wetlands, streams, rivers and their margins.
- Section 6 (b) – the protection of outstanding natural features and landscapes from inappropriate subdivision, use and development.
- Section 7(c): Maintain and enhance amenity values.
- Section 7(f): Maintain and enhance the quality of the environment.

The Site is not within the coastal environment nor part of any outstanding natural feature or landscape or significant amenity landscape. However, due to the potential (albeit limited) for elevated views from surrounding ranges that are identified as outstanding, the protection of these under s6(b) from inappropriate use and development is also considered.

A number of wetlands have been identified within the Site and therefore an assessment of natural character under s6(a) will be undertaken.

Proposed RPS

The RPS provides the current framework for the sustainable management of the Region's natural and physical resources.

Central Otago District Plan

The site is located within the Rural Resource Area (RRA) in the CODP and within an overlay of Other Rural Landscapes (ORL).

The ORL is described as being *'those landscapes in the Rural Resource Area not identified as Outstanding Natural Landscape (ONL), Outstanding Natural Features (ONF), or Significant Amenity Landscapes (SAL), or in the Upper Manorburn / Lake Onslow Landscape Management Area.'*[23]

The site does not lie adjacent to or within a Significant Amenity Landscape (SAL), Outstanding Natural Landscape (ONL), or Outstanding Natural Feature (ONF). Refer to **Figure 1** of the Graphic Supplement.

Nevertheless, the unique landscape of the Central Otago District has been identified as an important resource of the District that is renowned internationally. Ensuring adverse effects on its values are avoided, remedied or mitigated is identified a significant resource management issue.

The sections most relevant to the landscape and visual effects assessment of the proposed development are Section 4 – Rural Resource Area and Section 13 – Infrastructure, Energy and Utilities. The proposed solar farm development is being considered as a Discretionary Activity.

The landscape issues most relevant to this Proposal are:

- The landscape and amenity values associated with the open character of rural land, which is a key element that can be vulnerable to degradation from subdivision, development, and non-farming activities. In particular:
    - The prevalence of large farms and landholdings.
    - The predominance of open space over housing and related domestic elements.
- Amenity values of neighbouring properties.
- Areas of fill and excavations.
- Removal of vegetation.
- The natural character of water bodies, including wetlands, and their margins.
- Promoting and encouraging the co-siting of utilities and the location of utilities in "corridors" where this is possible.

4.1 Non- statutory Documents

The Kāi Tahu ki Otago Natural Resources Management Plan 2005 (NRMP) policies express the cultural importance of water to Kāi Tahu and the importance of protecting and restoring the mauri of all water. The policies cover the protection and enhancement of existing wetlands as well as the reinstatement of wetlands that have been neglected.

[23] Central Otago District Plan (July 2013), Rural Resource Area, Page 4:36

5.0 Assessment of Effects

Landscape and visual impacts result from natural or induced change in the components, character or quality of the landscape. Usually these are the result of landform or vegetation modification or the introduction of new structures, facilities or activities. All these impacts are assessed to determine their effects on character and quality, amenity as well as on public and private views.

In this study, the assessment of potential effects is based on a combination of the landscape's sensitivity and visibility together with the nature and scale of the development proposal.

In this study, the assessment of potential effects is based on a combination of the landscape's sensitivity and visibility together with the nature and scale of the development proposal.

Particular effects considered relate to the following:

- Natural Character effects.
- Landscape character effects.
- Visual effects from public and private locations.
- Potential cumulative effects.
- Effects in relation to statutory provisions.

The principal elements of the Project that have potential to give rise to landscape and visual effects are:

- Earthworks and movement of vehicles and machinery during the construction process.
- New access tracks.
- The overall scale of built form.
- The linear patterning of the panel array rows.
- Visibility of the tall elements of the substation.
- Glint and glare.

5.1 Natural Character Effects

Within the RMA, sustainable management of natural and physical resources requires the preservation of natural character of wetlands, rivers and their margins.

In terms of natural character, the highest degree of naturalness occurs where there is the least amount of human induced modification. Structures, such as solar panels can adversely change and alter the natural character of an area. The significance of this effect is determined by the size and location of the proposal and sensitivity of the receiving environment.

The waterways and wetland areas within the Site have been modified through its current agricultural land use for pastoral grazing and are not highly visible or publicly accessible so that experiential aspects of natural character are low. However, the Ecological Impact Assessment finds that all wetlands at the Site are considered ecologically significant.

In regard to wildlife, the Site is largely dominated by exotic bird species, but does provide foraging, roosting and / or nesting habitat for indigenous bird species. The Site does not provide suitable habitat for indigenous lizards or assemblages of indigenous terrestrial invertebrates.[24]

Therefore, overall it is considered that there are low levels of natural character values present at the Site, albeit highly modified.

As part of the proposal, setback distances from all wetlands have been adopted to ensure they will be fully avoided by construction works. The two natural inland wetlands (the central wetland and the wetland/waterway in the southwest of the Site) and the waterway in the northeast of the Site will have a minimum 10m setback from solar farm development. All other wetlands will have a minimum of a 5m setback.

It is also proposed that the two large wetlands (the Central and Southwest Wetlands) be fenced off from grazing stock and planted with an appropriate mix of native wetland species, including At Risk-Declining species of sedge and spaniard identified at the Site (refer to **Figure 5B: Proposed Planting Palette** of the Graphic Supplement). Together these two wetland areas account for approximately 14 ha of wetland enhancement.

In addition, approximately 11.4 ha of mixed dryland native planting is proposed, primarily for visual mitigation purposes however the use of indigenous species will enhance biodiversity on the Site, contributing to natural character.

The Ecological Impact Assessment considers that there would be no net loss of significant shrub values following proposed mitigation planting and in the long-term, the greater numbers of shrubs would provide a positive impact. All wetlands at the Site would be fully avoided by Site works, with setbacks applied; and existing rainfall runoff patterns and other hydrological inputs to wetlands would be unaffected by the proposal. Fencing and enhancement of the Central and Southwest Wetlands 'represents a net gain in terms of significant wetland values at the Site'[25]. However the Assessment notes that construction works may temporarily disturb and displace indigenous birds on Site to a very low to low and temporary level.

Overall, the Ecological Impact Assessment concludes that the potential adverse ecological effects of the solar farm have been avoided, or else would be remedied where possible, with no residual adverse effects identified as being greater than low-level.

While the size and scale of the proposed development is large, the design incorporates setbacks so that the wetlands are avoided and when considering the Site's existing modified level of natural character, the biotic and abiotic attributes (particularly of existing wetland areas) will undergo improvement through fencing out stock and undertaking planting.

Experiential attributes associated with the natural character of the Site and area will reduce due to the presence of built form over the landscape. While visibility is limited, where visible, wetland margins will be surrounded with panel structures rather than open space. However, there may also be a perception of healthier, restored wetland habitat and indigenous shrublands due to the extensive native planting and regeneration proposed.

5.1.1 Summary of Natural Character Effects

A number of wetlands have been identified within the Site. They contribute natural character values to the Site at different levels; many are constructed ponds, and all are modified through agricultural land use. Nevertheless, all wetlands at the Site are considered ecologically

[24] EcIA, p65

[25] EclA, Executive Summary

significant as wetlands have been reduced to less than 20% of their original cover regionally and nationally and some support At Risk species.

During construction, effects on natural character are assessed as **very low** to **low** due to potential for temporary, localised levels of activity in the vicinity of these wetlands. However, no identified wetland will be built on and due to the proposed setback buffers and fencing, any disturbance will be minimised.

While there will be some reduction in experiential aspects of natural character, it is considered that natural character values will improve overall on completion of the Project due particularly to the scale of fencing off and enhancement planting proposed in the central and southwest wetlands comprising a total area of some 14 ha. The estimated 11.4 ha of additional native planting proposed elsewhere as part of the landscape and visual mitigation will also contribute positively to natural character.

Overall, following completion, the adverse effects on natural character values will be **very low**. While new built modification will be apparent, modified rural activities already prevail at the Site. The proposed removal of stock and scale of indigenous dryland and wetland planting, will result in **positive** effects on the natural systems, characteristics and qualities of the Site that will become increasingly beneficial over time.

5.2 Landscape Effects

5.2.1 Landscape Character Effects

Landscape character is derived from the distinct and recognisable pattern of elements that occur consistently in a particular landscape. It reflects particular combinations of geology, landform, soils, vegetation, land use and features of human settlement. It creates the unique sense of place defining different areas of the landscape.

The existing character of the Site is comprised of expansive, open pastoral farmland with an underlying folded landform, the ridges and gullies following a northwest/southeast orientation. The existing shelterbelts create linear patterns similar to others in the surrounding landscape. The wider setting is part of an elevated inland alluvial basin with areas of glacial terracing and meandering rivers and the distinctive ranges and skyline that backdrop the Site; it is also characterised by extensive farming, roads, pasture, shelterbelts and small towns and includes the productive character of the Naseby Forest.

During Construction

Impacts on landscape character during construction have the potential to occur as a result of disturbance to the ground and exposure of bare earth, the movement of construction vehicles to and from the Site and people working on the Site, and the erection of solar panels and ancillary equipment, including construction of the substation.

The construction of the substation is likely to involve the largest-scale machinery. However the location is well set back and partially screened or backdropped by vegetation from most public and private viewpoints.

During the construction period there will be earthworks associated with the construction of the solar panels, access tracks, substation and battery storage areas including cabling (trenching) and the fencing around the Site.

Construction of the substation and BESS area will also involve groundworks to create a level platform for the construction of foundations and building platforms. The substation site is fairly flat, therefore earthworks to establish foundations for the inverters, substation and the battery storage area will be limited in scale.

A small level of earthworks may be required to establish the solar panels on sloping or undulating ground. Typically, the solar panels are able to follow the natural topography however there may be a few locations where some subtle localised contouring is required.

All loading and unloading of materials will be limited to laydown areas located adjacent to the primary access points.

Parking will be contained within the Site. All internal access, parking, and loading areas will be constructed to an all-weather, metalled surface with necessary stormwater control.

The piles will be galvanized steel with a matte finish and pile driven so no concrete foundations are required.

Due to the size of the Site, construction will occur sequentially, and one phase (e.g. pile driving of panels) will not need to be completed across the whole site prior to the next stage commencing.

The proposed planting should begin implementation at the first planting season (April / May or September / October) following commencement of construction and be completed by the end of the construction period.

The construction phase for the project is anticipated to take 24 months.

Construction effects will be temporary in nature and are unlikely to occur all at the same time in the same location during the construction phase. Overall, it is considered that there would be no more than temporary **moderate-high** adverse effects on the landscape character of the area during the construction phase.

Operation

On completion of the construction phase, there will be a broad change in landscape character from open, pastoral farmland to a landscape containing energy related infrastructure. The proposed solar farm will introduce numerous linear structures into a rural farming landscape that is currently open and expansive in character and that has been modified by extensive agricultural land use and forestry.

While the structures are relatively low in height, at less than 3 m, the scale of the overall proposal is very large. Potential landscape character effects will largely be related to the change from a predominately open, rural landscape to an energy landscape with a high density of built form.

At the same time, opportunities for the enhancement of the key wetlands and extensive blocks of additional planting as part of an agri-industrial environment have the potential to improve aspects of the existing modified landscape character.

The sensitivity of the Site to land use change of the nature proposed is considered to be low given it is a modified landscape, not identified as an ONL or ONF and contains no features that are character-defining when compared to the wider context.

The Site is located in the vicinity of other utilities with which it shares some characteristics such as the existing transmission line, Naseby substation and LeoLabs Kiwi Space Radar as well as the large scale, productive activity and dense coverage associated with the Naseby Forest.

However, the site is an open and expansive landscape, which will experience a high degree of change as the large expanse of open space within the Site boundaries will be reduced and the density of built structures, increased. One of the key features of the Proposal that will assist with its integration into the surrounding landscape character are through the dimensions and distribution of the panels and panel arrays which enable multi-layered use of the Site, including farming. The proposed solar panels will also have a relatively low profile with opportunities to be visually contained within and backdropped by the gently undulating topography.

Each solar panel has an approximate 1.6 m-1.7 m height when at its lowest, closest to horizontal (from sunset to sunrise). The panel height slowly increases and decreases over the day, peaking at an approximate height of 2.5 m-2.7 m around 8am – 10am and again at 4-6pm (depending on season). The solar panels are on piles which have a relatively small footprint and there are gaps of 6 m-8 m between rows of panels and larger gaps of 12 m between arrays. Pasture is to be maintained and sheep grazing will be used to manage the grass underneath the panels and frames, breaking up the density of built form and retaining key elements of a rural productive character as well as a degree of landform legibility.

The substation will introduce an area of taller, more densely located infrastructure. Its location reflects a balance between achieving generous boundary setbacks and visual screening by the existing shelterbelt, alongside proximity of the Site to the existing substation and high voltage line to the north. The taller elements within the switchyard will be viewed somewhat against the scale and context of this existing infrastructure.

Another key feature which will help integrate the Proposal into the landscape is through the proposed landscape mitigation that has been designed to respond to the different character and sensitivity of the Site and its frontages.

For example, the underlying folded landform of ridges and gullies will continue to be legible with large no-build areas on steep slopes and in the channels and depressions of the surveyed wetlands and waterways. Also, large development setbacks are provided from the road interfaces. Along the northwestern section of boundary, further exotic shelterbelt planting is proposed, in keeping with the existing shelterbelt along this Site boundary. However, it is recommended that this new section of planting be maintained at a lower height. While the proposed solar panels and mountain backdrop will largely become screened, a lower hedge height will retain qualities of light and vast skies and some opportunities for skyline views.

Along the eastern boundary with Ranfurly-Back Road where there are existing isolated indigenous dryland plants, the Mitigation Strategy recommends a native planting buffer. These lower plantings will also assist in maintaining opportunities for long views valued in this landscape. Existing shelterbelts will be monitored and maintained with infill and replacement planting as required.

Nevertheless, the proposed development would result in the modification of landscape character, primarily from open farmland to a predominance of structures associated with renewable energy infrastructure. The scale of landscape change would not be entirely uncharacteristic within the receiving landscape, such as the nearby example of the Naseby Forest, although the type of change will introduce new built elements.

Due to their relatively low height, road setbacks, no build areas and the ability for existing and proposed planting to considerably limit close views to the panels means that the overall impact upon landscape character will be largely limited to the Site. There will be a greater influence across the wider landscape where elevated views are available. However, where access to these views is available, the level of change will be experienced at long distances within a very broad landscape context.

The proposed solar farm is sited in proximity to other activities with similar characteristics, at the edge of the plains where they transition to the foothills and ranges beyond. It is considered that the proposed solar farm would have a **moderate** adverse effect on local landscape characteristics without mitigation, with effects reducing beyond the immediate Site context. When taking the large scale of proposed mitigation and enhancement planting into consideration, effects on landscape character within the immediate context will reduce to **low-moderate** as planting becomes established over the first 5 years. Effects on landscape character at the wider Basin context will reduce to **very low**.

5.2.2 Direct Landscape Effects / Biophysical effects

The assessment of biophysical effects has considered the nature and significance of modifications to landform, the wetlands and waterways, vegetation and natural systems.

Most of the topography within the Site will remain unchanged, with development on steeper, visually prominent slopes being avoided, helping the folded character of the landform to remain legible. However, there will be earthworks involved to construct the Site access tracks, to enable access across the site for the construction of the solar panels, substation and BESS areas and to enable trenching for the cabling required to connect the arrays. The solar panels will be installed via driven piles which will entail minimal earthworks.

The project will take a balanced approach to cut and fill. All cut material will be re-used within the site, and primarily compacted within access tracks or at the base of structures. In the event that any soil remains, this will be spread thinly across the site. No import or export of fill (excluding aggregate) will be required.

The adverse biophysical effects of the earthworks on the landscape during the construction will be **low** and temporary. The earthworks will occur progressively as the site is constructed. Where disturbance occurs in areas where no permanent above ground infrastructure is required (i.e cable trenching), the landform would be easily restored over a short timeframe and once revegetated (i.e with grass) there would be little perceptible change. Once completed, effects of the development of the Site on the topography or landform will reduce to **very low**.

Existing shelterbelts on the Site will be retained as part of the Proposal. If any other vegetation is required to be removed this would be in locations required to accommodate accessways or cable trenching and is expected to be minimal. The solar arrays and associated earthworks will be set back from the surveyed wetlands and waterways.

Large blocks of planting are proposed to assist with softening and screening views to help integrate the development within the surrounding landscape. The large blocks of proposed mitigation planting together with the enhancement/regeneration of the key wetland areas will greatly increase the indigenous vegetation in the area, creating **beneficial** biophysical landscape effects once established.

5.2.3 Summary of Landscape Effects

The Site is not located within or adjacent to an ONL or SAL in the CODP but is part of the wider ‘Other Rural Landscapes’.

The wider area has recreational, cultural and historic values with many notable heritage buildings and sites which are spatially and topographically separated from the Site and will not be impacted. While the plains and area in the vicinity of the Site is not considered wild or

notably remote, the surrounding mountain ranges comprise large areas of public conservation land, including areas identified as Outstanding Natural Landscapes, with these attributes.

The nearest area of ONL is approximately 6 km from the Site at the closest point. Due to the elevation of these ranges, visibility of the Site may be possible from some locations.

Where these elevated, long distance views to the Site are available, perimeter mitigation planting will provide minimal screening due to the angle of view and there is potential for the whole site to be visible. However, by avoiding development and planting in large internal areas such as around the central wetland and on several of the key faces, the coverage of built form is broken up and the folded landscape pattern is emphasised.

The contrast of the dark colour of the panels against the lighter pasture increases its prominence but the bands and layers of coniferous shelterbelts provide a similar contrast and form part of the landscape context.

The scale of the Site and the area proposed for solar farm development are large in the context of other existing built form in the area; the future conversion of the Site from a traditional rural land use to a renewable energy landscape will lead to a large shift in the character at the Site.

The magnitude of change within the Site and local area will be high as activity on the Site changes from rural, extensive pastoral to large scale renewable energy infrastructure land use.

The Site's proximity to the approved Solar Bay farm and Naseby Forest means that the Proposal occurs in an area where there is an existing utilitarian/working character that occurs at a large scale. However, the proposal introduces built form rather than exotic vegetation.

The distribution of the panels across the Site includes a level of response to the character of the Site itself, its landform and its boundary interfaces.

The panels, spacing between the arrays and no build areas also enables the landscape to continue to flow under and through the Site somewhat. The proposed solar farm will not compromise the ability to undertake agricultural activities on the Site or within the wider area and the mitigation planting will soften and largely screen the appearance of the built form on the Site. The scale of indigenous planting proposed, both dryland and wetland species, will increase biodiversity landscape values to this Site.

The surrounding mountain ranges are identified as ONL and the values of the basin landscape have been described as providing the stage for appreciating them as a backdrop. Therefore, while exotic shelterbelts are part of this landscape, open landscapes with the ability for long views to the ranges, are also key attributes and the mitigation strategy recommends planting that will ensure opportunities to enjoy these views across the Site to continue in places while also enhancing biodiversity.

Overall, adverse effects of the solar farm on the Site and local landscape without mitigation are considered **moderate**, reducing to **low** in the context of the wider Maniototo Basin. With the proposed mitigation and enhancement planting, landscape effects within the immediate context will reduce to **low-moderate** overall and **very low** in the context of the wider Basin.

5.3 Visual Effects

Visual amenity effects are influenced by a number of factors including the nature of the proposal, the landscape absorption capability and the character of the site and the surrounding area. Visual amenity effects are also dependent on distance between the viewer and the proposal, the complexity of the intervening landscape and the nature of the view.

While the proposed Site area is extensive, covering some 660 ha, the nature of the development is such that visual impacts are likely to be relatively contained within the Site and local area.

A number of publicly accessible representative viewpoints were selected within the visual catchment to assist with the assessment. They are shown in **Site Context Photographs 1-18** in the Graphic Supplement.

Views from private dwellings within approximately 3km of the Site have been assessed however at this distance, where visible, the Project will either typically be very difficult to discern or viewed within a wider context.

An additional specific site visit was undertaken to four neighbouring properties (Dwellings 2-5) with the purpose of helping to better understand the nature of available views. Representative photographs are included as **Private Viewpoint Photographs 19-24** in the Graphic Supplement.

A digital model has also been prepared to assist with determining the level of visual effect. The model includes the location of the proposed rows of panels and some key sections of proposed mitigation planting; both features have been extruded up as solid blocks to their respective heights (2.8m for the arrays and varying heights to test the screen planting). These have been added to the existing terrain, together with point cloud data which provides a representation of the existing intervening vegetation.

All these viewpoint locations are mapped on **Figure 4** of the Graphic Supplement.

A visual analysis was undertaken to inform development of a landscape mitigation strategy (refer to **Figures 7, and 7A-D** in the Graphic Supplement for detail). The key visual sensitivities and opportunities identified with this Site are:

- Some existing shelterbelts are aligned with Site boundaries while others are internal. They break up the Site, preventing views to full extent of the Proposal. They also provide dark backdrops that will help to visually integrate panels in some views.
- There are gaps and thin areas in some shelterbelts where trees are failing or have failed, enabling close partial glimpses of the Site.
- A high level of visibility to the undulating slopes in the southwest corner due to a gap in vegetation/shelterbelts and the elevation within the Site, including from a short section of SH85.
- A high level of visibility to and from the north end of Site on Ranfurly-Naseby Road, due to elevation, proximity to Site, and openness of views extending across a large area of the Site, including the proposed substation.
- Potential cumulative visual effects due to proximity of approved solar farm on Fennessy Road close to northern end of the Site (refer to **section 5.4** below for the assessment of cumulative effects).
- There is limited existing screening vegetation within the Site along Ranfurly Back Road with the exception of some internal east-west orientated shelterbelts towards the southeast corner. Together with the rolling landform, these internal shelterbelts prevent views to the full extent of the Proposal.
- The rolling, folded topography on the Site means there are some ridges with visually prominent faces. The undulating topography also creates screening in the central low-lying areas.

In response to this analysis, mitigation has been proposed as part of the development design and is taken into account in the assessment, and includes:

- Planting up the northern slopes at the tip of the triangular Site to extend the existing exotic tree planting and help restrict visibility from the elevated viewpoint on Ranfurly-Naseby Road (north of intersection with Fennessy Road).
- Adding further shelterbelt planting along Ranfurly-Naseby Road to screen views from the road including from elevated viewpoints north of the Site. It is proposed to maintain this new northern planting at a height of approximately 3m to balance effective screening of the panel arrays with retaining a sense of the vast skies that are valued in this landscape.
- Establishing native planting along much of the boundary with Ranfurly Back Road. The purpose of the planting is not to provide continuous tall screening but to break up views so that only small parts of the Site can be seen at a time, to ensure the built pattern and form does not dominate the landscape while ensuring a sense of openness is retained.,. By planting a section of the Ranfurly Back Road boundary, it will also provide a backdrop to visually integrate panels on the more elevated ridge in views from the Ranfurly-Naseby Road.
- Establishing native planting and wetland enhancement planting at the southwest corner to improve natural character and biodiversity values at the Site and screen and break up views from Ranfurly-Naseby Road and SH85. The purpose of this planting in this location is to reduce the potential viewshaft into the Site while ensuring a sense of openness and a distant viewing opportunity is retained. Close views will be screened by the proposed planting while more distant views on prominent slopes will be broken up and softened by the taller species to ensure the built pattern and form does not dominate the landscape.
- Setting back the solar panels at least 50 m-60 m from the Ranfurly-Naseby Road at the north end of the Site so that the panels become less visually apparent and integrate more readily into the wider setting, regardless of the time it may take to establish any screening vegetation.
- Filling any gaps where trees have failed in the existing perimeter shelterbelt along Ranfurly-Naseby Road with replacement trees and maintaining other existing shelterbelts on Site.
- Setting back the solar panels at least 20 m-30 m from the Ranfurly Back Road, particularly towards the southeast corner of the Site due to the topography increasing the prominence of panels in views from the road in this location.

5.3.1 Effects from public vantage points

To assess the overall nature and level of visual effects, the potential visual sensitivity of identified viewing audiences was considered together with the overall magnitude of change resulting from the proposed development.

When assessing visual effects, it is important to highlight that views of a development do not necessarily equate to adverse visual effects. Visual impact is not always negative and a change in view is not automatically unacceptable. Views of the solar farm development will also change throughout the day as the panels tilt to follow the sun.

To help understand the effects of the proposed development, the assessment has included the preparation of a cross section from a representative viewpoint on Ranfurly-Naseby Road (see **Figure 5F** in the Graphic Supplement), showing the proposed solar farm in its landscape context with mitigation (year 5).

There are a relatively limited number of roads and recreation areas where views towards the proposed solar farm may be available:

Long-distance views (over 1km from nearest Site boundary):

The topography and vegetation within and surrounding the Site is such that visual impacts are likely to be relatively contained to within the Site and area surrounding the Site boundary, out to approximately 1 km.

Nevertheless, long-distance publicly accessible views such as from Ridge Road (approximately 4.5 km away) and from further away in the surrounding foothills and ranges, may be possible due to their elevation above the Site. In these views, while the Site is extensive, it will appear as part of a much wider view due to the distance (refer to **Site Context Photograph 1** in the Graphic Supplement). Layers of vegetation form the middle ground of the view from Ridge Road, with a narrow band of the Site partially visible beyond and between. The dark panels of the proposed solar farm development may appear as a large, dark mass with gaps of pasture and wetland planting where there are larger no-build areas. Adverse visual effects from these elevated distant views are considered to range from **very low** to **low (**from those most elevated viewpoints where a greater extent of the Site is likely to be visible).

Other potential long-distance publicly accessible views include roads in the wider plains such as State Highway 85, travelling east or west at distances of approximately 1 km away at the closest viewpoint (refer to **Site Context Photographs 2-4** in the Graphic Supplement) and views from Bypass Road, travelling southeast or northwest at distances of approximately 1 km at the closest viewpoint (refer to **Site Context Photograph 18** in the Graphic Supplement). These viewpoints are located at a similar elevation to the Site and therefore the proposed solar development would not be seen in its entirety.

In these views, there are multiple layers of shelterbelts and other vegetation that form the mid-ground, largely screening the Site. Where views comprise prominent slopes such as from the SH85 viewpoint in **Site Context Photograph 2** in the Graphic Supplement, those steep slopes will largely remain undeveloped, reducing the visual density of the blocks of structures so that where the solar farm is visible in gaps, it will typically appear as a narrow strip of built form, replacing the existing pasture, viewed against a backdrop of shelterbelts.

SH85 is a key, highly frequented transport route. However, viewers will be travelling at speeds of up to 100 km / hour, and in views from these distances the detail of individual solar panels will not be visible but will appear as dark bands amid the bands and layers of surrounding shelterbelts, partially screened and broken up by the lower native planting mix in the midground.

Occasional glimpses to the proposed solar farm will be possible from Bypass Road at distances greater than approximately 1 km. However, the layers of intervening vegetation including existing shelterbelts within the Site, limit visibility.

Overall, adverse visual effects are considered to range from **very low** to **low** from these transient viewpoints.

Views from recreational areas:

The ranges to the north and east comprise large areas of public conservation land. However they are quiet, backcountry destinations, more than 6 km from the Site. Any views will typically

be in the context of the range of land uses across the wider Maniototo Basin and would comprise a small and distant part of the view. The dark panels of the proposed solar farm development may appear as a dark mass with gaps of pasture and wetland planting where there are larger no-build areas. The dark colour will contrast with the light pasture but is similar to the dark appearance of exotic coniferous vegetation such as the nearby forestry, helping to visually absorb and tie the proposed solar farm to this landscape.

There are unlikely to be views available from the Central Otago Rail Trail which is approximately 3 km to the south at the closest point, with intervening vegetation and landform screening the Site.

Views from the Naseby Forest Trails, approximately 2 km to the northeast, and the Naseby Golf Course (approximately 700 m away) will be largely screened due to the topography and the tall trees within these areas.

Should any glimpses be possible such as in winter when any deciduous vegetation will be more transparent, the dark panels of the solar farm will be very difficult to discern at these distances.

Adverse visual effects are considered to be **very low** from these viewpoints.

Views from the west:

- Naseby Link Road and Gimmerburn Naseby Road (unsealed, 300 m-1500 m away)

  The proposed solar farm will largely be screened in views from these local gravel roads due to intervening shelterbelts, including the shelterbelt (consisting mostly of evergreen conifers) along part of the western Site boundary. Partial glimpses may be available towards the north end of the Site, primarily when approaching the intersection with Fennessy Road. Once the proposed mitigation planting becomes established at this end of the western boundary, views to the proposed panels will be softened and become screened over time. Maintaining this exotic shelterbelt at a height of approximately 3 m is preferred for this section to retain opportunities for long views to the skyline of the ranges beyond.

- Fennessy Road (intersects with Ranfurly-Naseby Road which borders the Site, refer to **Site Context Photograph 9-11** in the Graphic Supplement).

  Views to the north end of the solar farm will be largely screened from Fennessy Road, by intervening vegetation such as the shelterbelts along Gimmerburn Naseby Road. Where partial views or glimpses are available for short distances, travelling southeast towards the Site, they will not appear out of context in this location where it will be viewed amongst the other existing infrastructure along this road.

Overall, adverse visual effects from Naseby Link Road, Gimmerburn Naseby Road and Fennessy Road are considered to be **very low**.

- Ranfurly-Naseby Road (borders Site)
    - Approach from south (refer to **Site Context Photograph 5** in the Graphic Supplement)

      The existing photograph illustrates a view from **Ranfurly-Naseby Road** looking northeast, representing views approaching the Site when travelling north. The immediate foreground of the view is outside the Site boundary, which is set back approximately 100 m from this viewpoint. A waterway/wetland crosses the midground just beyond the small grouping of trees in the centre of the

photograph. Beyond this feature, the southwest facing slopes and low rise of the nearest ridge landform are visible, backdropped by shelterbelts and the mountain ranges beyond.

A large setback to the nearest panels of an additional approximately 200 m-300 m is proposed, beyond the identified wetland, to avoid close, foreground views of the development from Ranfurly-Naseby Road, regardless of the time it may take for mitigation planting to mature.

Native planting is proposed to provide screening in the midground of views from Ranfurly-Naseby Road. Planting will represent a mixed palette with the tallest species capable of reaching approx. 8 m-12 m in height on maturity to break up and largely screen views to the panel arrays, particularly those on the closer lower slopes. Views to panels on higher, more distant slopes will be screened and broken up by the taller planting species. Some open glimpses will remain above the lower plant species, retaining views from this location to the distant mountains and skyline.

Planting will enhance the waterway/wetland area, with positive effects for natural character and landscape.

- Central section (refer to **Site Context Photographs 6** in the Graphic Supplement)

  Views from the central section of the Ranfurly-Naseby Road will be screened by the existing shelterbelt along part of this western boundary. However there are gaps and thin areas where trees are failing or have failed, enabling close partial glimpses of the Site.

  Replacement planting will be undertaken where there are gaps or where there are trees that are failing and need to be removed.

- Northern section, travelling north (refer to **Site Context Photograph 7** in the Graphic Supplement)

  The western shelterbelt stops some 1.3 km before the northern end of the Site where there are currently open views across the Site, whether travelling both north or south.

  It is proposed to extend the existing exotic shelterbelt northward along the Naseby-Ranfurly Road/Site boundary. These exotics will provide quicker screening and are consistent with the existing character of this roadside. However it is recommended that this section of shelterbelt planting be maintained at a height of approximately 3 m. While the extent of existing open views to the distant mountains will be reduced, maintaining the hedge to a lower height will retain a sense of openness, big skies and the mountain backdrop to the north.

  A large setback from road is proposed at unplanted north end of Site (approx. 50 m-60 m) to avoid close, foreground views of the development from Ranfurly-Naseby Road regardless of time required to establish mitigation vegetation.

- Northern section, travelling south (refer to **Site Context Photograph 8-9** in the Graphic Supplement)

  The existing photograph illustrates a view from Ranfurly-Naseby Road looking south, showing a high level of visibility to the north end of the Site, including the

substation location and transmission line route, due to this elevated viewpoint and the lack of vegetation within the northern end of the Site. The central shelterbelt breaks up views to the south end of the Site and will provide a dark backdrop to absorb taller infrastructure elements.

It is proposed to plant exotic trees on the hill slopes to screen views to the closest panels from this viewpoint. Distant panels are likely to remain visible but softened and broken up the intervening planting once established. These elevated views will be available for a short section of less than 200 m while typically travelling at speed.

Overall, visual effects from Ranfurly-Naseby Road, travelling north or south, are assessed as varying between **very low** to **moderate-high** temporary effects during construction, reducing to **moderate** once the construction phase is complete. It is considered that visual effects will reduce to **low** to **low-moderate** overall once planting is established. The highest effects will be from the northern elevated section of road, while travelling south.

Views from the east:

- Ranfurly Back Road (unsealed, borders site)

  The existing photograph illustrates the view from a location towards the north end of **Ranfurly Back Road** looking southwest across a gully to the nearest Site boundary, broadly representative of the angle (but not distance) of view from Dwelling 3 (refer to **Site Context Photograph 12** in the Graphic Supplement).

  There is an existing stand of exotic trees on the terrace and gully slopes at this northeast corner of the Site. The trees partially screen views to the Site from Ranfurly Back Road. These planted gully slopes and terrace area will not be developed as part of the proposal other than through further planting. This will retain a large visual buffer of 200 m from Ranfurly Back Road and ensure views continue to be screened.

  A strip of planting is proposed along the Site boundary to the west of the existing vegetation, as an extension of the existing pocket of trees, to increase the level of screening.

- The existing photographs from the central section of Ranfurly Back Road illustrate views looking north/northeast towards Naseby Forest and Hawkdun Range with the Site in the foreground to the left of the road (refer to **Site Context Photographs 13-14** in the Graphic Supplement).

  There is limited existing screening vegetation within the Site along Ranfurly Back Road with the exception of some internal east-west orientated shelterbelts towards the southeast corner of the Site.

  The typical setback proposed from the Ranfurly Back Road boundary is approximately 20 m-30 m. This will allow space for the proposed planting and reduce the level of visibility in close, foreground views of the development from the road, regardless of the time it may take to establish mitigation vegetation.

  The proposed setback increases towards the southern end of the Site to some 130 m, creating a large visual buffer from the road and retaining the legibility of the shallow gully landform.

  Native planting is proposed to provide screening along the boundary in the foreground of views from Ranfurly-Back Road. Planting will predominantly represent a dryland

palette with the tallest species capable of reaching approximately 8 m-12 m in height on maturity, with positive landscape and amenity effects.

- Views towards the Site from the southern end of Ranfurly Back Road are illustrated in **Site Context Photographs 15-17** showing undulating character of the topography in this part of the Site. Linear shelterbelts help to visually break up the extent of the Site.

  There is no existing screening vegetation between the Site boundary and adjacent Ranfurly Back Road in this location so open views into parts of the Site are possible. However, there are several existing east-west orientated exotic shelterbelts within the southeast corner of the Site including a shelterbelt along part of the southern boundary. While there are small gaps in most of the shelterbelts, overall they provide effective visual screens, breaking up the Site.

  Together with the rolling landform, these internal shelterbelts prevent views to the full extent of the Proposal from Ranfurly Back Road. They also provide dark backdrops that will help to visually integrate the panels from some views.

  The existing shelterbelt along the southern Site boundary will screen views from Ranfurly Back Road for users approaching the Site as they travel north.

  Development will typically be set back some 30 m inside the shelterbelt along the southern boundary. Along the Ranfurly Back Road boundary, setbacks will increase to between 120 m-250 m, to avoid development on the wetland and adjacent steep slope and reduce visibility. Additional shelterbelt planting is proposed within the Site for a length of approximately 300 m along Ranfurly Back Road.

Overall, visual effects from Ranfurly Back Road, travelling north or south, are assessed as varying between **very low** to **moderate-high** temporary effects during construction, reducing to **moderate** once the construction phase is complete. It is considered that visual effects will reduce to **low** to **low-moderate** overall once planting is established.

5.3.2 Effects from private vantage points

An assessment of the visual prominence of the proposal from several houses on properties adjoining the site or within proximity of the Site was undertaken. This assessment assigned a degree of effect, based on the following: visibility and proximity to the Site (to the nearest built-up edge within the Site); the apparent orientation of the house and the nature of the view, including any existing or proposed vegetation that might provide full or partial screening of views.

The assessment is based on observations from public roads, use of aerial photos and also use of photographs taken from publicly accessible viewpoints.

The findings are presented in an appended table (**Appendix 2**) which also provides reference to the Glint and Glare Study (**Appendix 3**) undertaken for the Site by ITP. A summary of the findings in relation to individual properties is provided below.

A map showing the locations of the properties is provided in **Figure 4**.

The majority of dwellings surrounding the proposed solar farm are between 1 km-3 km away and either set back from the adjacent roads, orientated away from the main direction of view or have a number of intervening buildings or vegetation that assist to curtail or truncate views. Visual effect from these properties is assessed as **very low**. Refer to **Appendix 2** for the full assessment.

The closest properties (up to approximately 1 km away) are assessed below. Dwelling 1 has been excluded due to the residents being one of the two Project landowners leasing land to Helios for this development. Through their support for the development, distance of the dwelling and natural features in between the dwelling and the solar farm, no concerns were raised by the Project landowners on the need for the screening of the solar farm from their dwelling.

Dwelling 2 (see Private Viewpoint Photograph 19 in the Graphic Supplement**):**

Dwelling 2 is located immediately north, approximately 130 m from the nearest Site boundary. Site with a deck enabling elevated views to the south. The dwelling is elevated but set back from the edge of the slope so that close views to the Site are screened. The dwelling and gardens are partially enclosed by mature hedging, also limiting views. Existing vegetation within the Site (a large stand of trees on slope at northern end and internal shelterbelts) adds further screening.

From southeast orientated windows, decking and garden area, a portion of the northwest extent of the Proposal will be visible (to the right of the intervening trees). A narrow viewshaft to the left of these trees will also be available towards a central portion of the Site.

In views further from the dwelling such as the adjacent front paddock, the available viewshaft will widen with distant views available incorporating the eastern extent of the Site. While a broad 'width' or east-west horizontal extent of the Site will be visible from this location, the north-south vertical 'depth' will appear as a foreshortened band, reducing the apparent proportion of visible change within the view.

The substation will be largely screened from these views.

Views will be long-distance with the nearest visible panels approximately **1200 m** away so that the panels will appear as a thin dark band with gaps of pasture and wetland planting between arrays where there 'no-build' areas. Panels will typically be backdropped by distant shelterbelts and the ranges beyond.

Planting to further reduce this level of visibility is proposed (see the cross section in **Figure 5E Section Elevation 1** in the Graphic Supplement) along sections of the northern Site boundary (including the northeast corner) to screen closer panel arrays over time. Views to some central and more distant panels will remain but are not likely to be readily noticeable due to their small proportion of the overall view and distance, particularly from the dwelling/immediate outdoor living viewpoint location. It is recommended that trees planted on the Ranfurly-Naseby Road boundary and lower hill slopes at this northwest corner should be allowed to grow to mature height to provide maximum screening for those travelling south on Ranfurly-Naseby Road. However, trees planted at the top of the slope, closest to Dwelling 2 can be maintained to a lower height if requested.

Final details regarding location of pines and the height to which they are maintained in the vicinity of the shared Site boundary can be worked through with these landowners when developing the Landscape Management Plan (see **section 6.0 Recommendations**).

There is potential for **low-moderate** to **moderate** temporary visual effects on Dwelling 2 during construction, primarily associated with movement on Site and construction of the substation and switchyard area. Effects will reduce to **low-moderate** at most on completion and reduce to **low** once mitigation planting has established.

Dwelling 3: (see Private Viewpoint Photograph 21 in the Graphic Supplement**):**

Dwelling 3 is located approximately 580 m from the northeast corner of the Site. The dwelling is largely surrounded by mature hedging to the north, west and south, almost entirely screening potential views to the Site.

Existing vegetation on the east side of the gully (within the northeast corner of the Site) and proposed planting on the west side of the gully (extending west for approximately 380 m along the Site boundary) will continue to ensure views are largely screened should hedging be removed. Topography screens views further west.

Visual effects are assessed as **very low** due to the limited visibility and distance.

Dwelling 4: (see Private Viewpoint Photographs 22 and 23 in the Graphic Supplement**)**

Dwelling 4 is located approximately 400m from the southeast corner of Site. The dwelling is elevated but set back from the edge of the slope so that close views to the Site are screened. Substantial mature hedging surrounds much of the dwelling and garden, also screening potential views particularly to the southwest extent of the Site. However, in the vicinity of the dwelling, views will be available to the north /northwest from a north facing window (understood to be the main bedroom window) and as you move north, away from the dwelling such as from the carpark/entrance garden area.

From the vicinity of the window location, glimpses of a portion of the northeast extent of the Proposal will be visible in the gaps between and just above the existing intervening on-site shelterbelt. Effects during the construction phase will typically be reduced through a combination of distance and screening from this shelterbelt.

In views from further north such as the northeastern edge of the carpark/entrance area, the available viewshaft will widen to the west with distant views available incorporating the central and north-western extent of the Site. On-site rolling topography will screen some of the westernmost panel arrays and the lower components of the substation. The taller elements of the substation are likely to be visible and will be backdropped by the western shelterbelt and vegetation and hills beyond. Views to the arrays to the northeast will be glimpsed in the gaps between and just above the existing intervening on-site shelterbelt.

While a broad ‘width’ or east-west horizontal extent of the Site will be visible from this carpark/garden location, the north-south vertical ‘depth’ will appear as a foreshortened band, reducing the apparent proportion of visible change within the view.

Views from both locations will be long-distance with the nearest visible panels approximately **900 m** away. The panels will appear as a thin dark band with gaps of pasture between arrays where there ‘no-build’ areas. The ‘band’ will typically be backdropped by distant vegetation and the ranges beyond.

Planting to further soften and reduce the level of visibility is proposed (see the cross section in **Figure 5E Section Elevation 2** in the Graphic Supplement) along the eastern Site boundary to screen closer arrays over time. Due to the lower contour level at the southeast Site boundary, planting will need to reach at least 8 m-10 m to begin to screen panels from the carpark/garden viewing location. At this height, glimpses to distant panels will remain above the proposed planting but will appear as a small proportion of the overall view and distance. As the existing intervening trees continue to grow, they will also screen more of the panels, including appearing above the intervening hill crest.

Screening could be achieved more quickly through planting on the property such as along the garden fence line should the owners wish. It is estimated that plants would need to reach heights of approximately 1.8 m-2.4 m to largely screen the Site from views in this location.

There is potential for up to **low-moderate** to **moderate** temporary visual effects on Dwelling 4 during construction. Effects will be **low** to **low-moderate** on completion and reduce to **low** after 5 years with additional growth of the existing shelterbelt and proposed mitigation infill planting.

Dwelling 5 (see Private Viewpoint Photograph 24 in the Graphic Supplement**)**

Dwelling 5 is located approximately 1150 m southwest of the Site. The dwelling is orientated broadly northwest in an open garden setting. There are multiple intervening shelterbelts and stands of trees including within the Site. Oblique glimpses to the Site may be available, primarily in winter due to deciduous trees. Views would be at very long distances and it is likely that the panel arrays would not be readily noticeable, particularly as proposed infill shelterbelt planting becomes established.

Visual effects are assessed as **very low** due to the limited visibility and distance.

5.3.3 Glint and Glare

The Glint and Glare Study concludes that no significant impacts are predicted upon road safety or residential amenity.

Road safety

The summary table of modelling shows that glare potential is possible towards four of the identified road receptors and five observation points.

Low or no impact is predicted for seven of the road receptors identified in the Study. A high impact is predicted for Ranfurly-Naseby Road and Ranfurly Back Road which means that mitigation is not required but is recommended to reduce impacts. This mitigation can be provided either in the form of a change in tracking operation of the panels (refer section 3.4.2 of the Glint and Glare Study) or implementing screening in the form of planting (refer section 3.4.3 of the Glint and Glare Study).

In this case, boundary planting is proposed along Ranfurly-Naseby Road and Ranfurly Back Road as part of the wider Mitigation Strategy (described in **section 2.3 Mitigation and Restoration Strategy** and set out in **Figure 5** of the Graphic Supplement) to both screen and break up views and reduce impacts of glint and glare.

Residential amenity

Of the 16 dwelling observation points, 11 are predicted to have no glare issues.

For five dwellings, potential glare has been identified:

- For Dwelling Nos. 9 and 10 (OP12 and OP14 in the Glint and Glare Study) low potential for glare has been identified for durations of 10-11mins on some winter mornings. The effect is considered Low.
- For Dwelling Nos. 5 and 11 (OP13 and OP15 in the Glint and Glare Study), mainly green / low potential for glare was recorded (approximately 6-8 hours per year). However there was also some yellow / potential glare recorded of up to 5 minutes in mid-May between 08:15hrs and 08:45hrs and again between mid-June to early August between 08:15hrs and 09:30hrs for Dwelling 5. The effect is considered Low.
- For one dwelling, No. 4 (OP05), yellow / potential for glare durations of up to 15mins per day have been recorded during late afternoon in winter, between 6 May and 7 July. However, the model indicates an annual total of 566 mins of green glare including 408mins of yellow glare which is less than 10 hours a year overall. Based on the Table

provided (Table 1) in **section 1.2 Other Technical Reports** of the Study, this level of effect is considered low-moderate.

Some existing vegetation (as mapped in the Study) was included in the modelling however the existing vegetation around Dwelling 4 (OP05) was not accounted for. The extent of existing hedging considerably truncates views from the dwelling, reducing glint and glare effects to **low**.

5.3.4 Summary of Visual Effects

Overall, adverse visual effects resulting from the proposal are relatively contained to roads and private properties within the Site and area which surrounds the Site boundary, out to approximately 1 km.

Where occasional long distance views of more than 6 km to the Site may be available from distant elevated hill slopes, the benefits of perimeter mitigation screening will be limited due to the angle of view and there is potential for the whole site to be visible. However, by avoiding development in large internal areas such as around the central wetland and on several of the key faces, and infill planting within internal shelterbelts, the coverage of built form is broken up. Any views will typically be in the context of the range of land uses across the wider Maniototo/ Māniatoto Basin and would comprise a small and distant part of the view.

Middle distance views towards the Site are typically broken up and largely screened from southerly (southwest to southeast) directions.

At the scale of the immediate local landscape, the tall vegetation largely appears as bands and layers, partially enclosing and separating large open spaces and giving a perception of distance and scale. While the dark colour of the panels contrasts with the surrounding lighter pasture, the colour will visually integrate with surrounding coniferous vegetation.

However, just as it doesn't require a big change in level to provide effective screening in an otherwise relatively flat landscape, the inverse is also the case. With a small increase in elevation such as the low ridges folded across the Site, their slopes can be visible above the surrounding flatter landscape.

Within this setting, the finer, folded grain of the Site comprises a series of low, broad backed ridges and gullies. The southwest and east of the site are most undulating with a broad central north-south 'spine' of flatter, lower-lying land, including a large wetland area.

The southern portion of the Site is partially broken up by layers of multiple shelterbelts, predominantly orientated east-west. A well-established shelterbelt also lines approximately half the western perimeter of the Site along the Ranfurly-Naseby Road. Juncus spp. have been identified in the wetland areas with grey scrub in some of the gullies and along the boundaries.

This means views from close to the Site:

- Will be screened where established shelterbelt trees are in place such as from parts of Ranfurly-Naseby Road;
- Will be partially screened and broken up where there is undulating topography such as from parts of Ranfurly Back Road;
- Will be possible where there are gaps in the shelterbelt and where vegetation is limited and there are elevated viewing opportunities such as the north end of Ranfurly-Naseby Road and from much of Ranfurly Back Road.

Where views are possible, development on flat land lower slopes will be screened through low mitigation planting along the perimeter.

Where views are possible towards elevated ridge slopes, development will be avoided as much as possible on these slopes; where panels are located on or partially on these slopes, the slopes will be planted to soften and screen the panels.

Where adverse visual effects are possible from public vantage points, these range from **very low** to **moderate-high** from for views from local roads during the construction phase where large machinery and site activity would be visible, prior to the establishment of mitigation planting along the Site boundaries. Once the construction phase is complete and mitigation is established, effects will reduce to **very low** to **low**.

For private dwellings located within 1 km of the site (excluding Project landowners), it is considered that adverse visual effects during construction will range between **low-moderate** to **moderate** at times from the vicinity of two properties (Dwellings 2 and 4) reducing to **low-moderate** in views from immediately outside the dwelling once the construction phase is completed.

Visual effects from Dwellings 3 and 5 will be **very low** during construction and in the operational phase due to the level of screening and distance from the Site.

For all other properties assessed within approximately 3 km of the site, visual effects are considered to be **very low** at most due to distance and oblique, screened or filtered views.

Once becoming established (at 5 years) proposed planting will result in **low** visual effects from Dwelling 2 and 4. In views away from the dwellings, closer to the Site such as from the adjacent paddock and garden/carpark area, views will widen and visual effects are likely to increase.

Based on the assessment of visual effects above, a summary of the identified level of visual effects during construction and at completion is set out in Table 7 below:

Table 7: Visual assessment summary

Photo Ref #	Viewing Audience	Level of Visual Effects[26] during construction	Level of Visual Effects after completion (5 yrs)
Views from public vantage points			
1,2, 18	Long distance	Very low to Moderate	Very low to Low
1	Recreation areas	Very low to Low-moderate	Very low to Low
10A, 10B	Naseby Link Road, Gimmerburn Naseby Road and Fennessy Road	Very low to Moderate-high	Very low
5-8	Ranfurly-Naseby Road	Very low to Moderate-high	Low
12-17	Ranfurly Back Road	Very low to Moderate-high	Low

[26] Level of Effect: Very Low, Low, Moderate-Low, Moderate, Moderate-High, High, Very High

Views from private dwelling vantage points within approximately 1km (excluding landowners)			
19	Dwelling 2	Low-moderate to Moderate	Low
21	Dwelling 3	Very Low	Very Low
22	Dwelling 4	Low-moderate to Moderate	Low
24	Dwelling 5	Very Low	Very Low

5.4 Potential Cumulative Effects

One other solar farm has recently been granted consent in proximity to the proposed development that is the subject of this assessment.

The approved Solar Bay solar farm site is located on a 54.5 ha site at the intersection of Gimmerburn Naseby Road and Fennessy Road (approximately 330 m from the closest point to the Site (see **Figure 8** below and **Figure 6** in the Graphic Supplement) and would comprise 105,150 solar panels at a maximum tilted height of 4.53 m above ground level. Ten inverters will also be located within the site. Planting is to be established around the perimeter of the site.

There is potential for cumulative landscape and visual effects to occur as a result of the proposal.

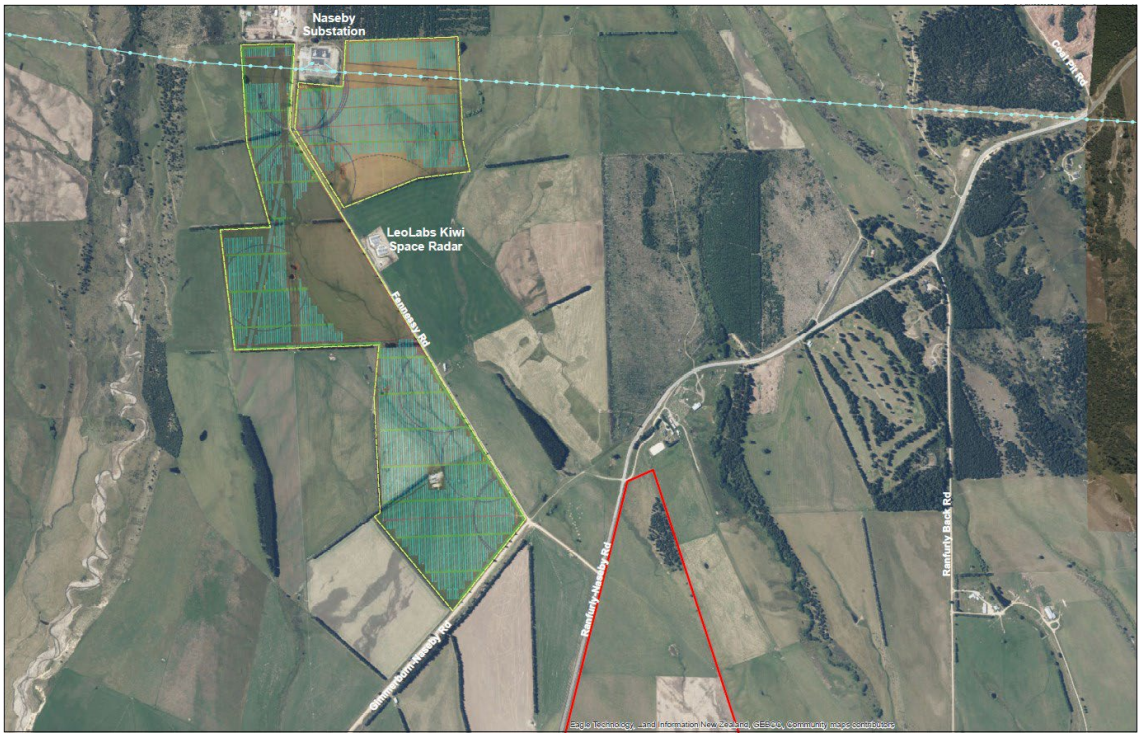


Figure 8: Location of approved Solar Bay solar farm (source: Boffa Miskell)

5.4.1 Cumulative effects on landscape values

Should the consented Solar Bay development be constructed, it would introduce solar farms as an occasional land use within the rural environment surrounding the proposed solar farm Site. Development of the Helios Proposal would further reinforce this character but would not materially change the defining characteristics of the receiving rural landscape. This is due in part to the containment of each solar farm by existing and proposed screen planting so that once established, their influence does not extend across large areas of landscape and to the linear configuration of the Solar Bay site which extends away from the proposed Site, separated by rural landscape. The continuation of sheep grazing beneath the panels at both sites further assists in maintaining agricultural activities that form part of this rural landscape. The cumulative effect on the character of the landscape is considered to be **low-moderate**.

5.4.2 Cumulative visual effects

Views into the site are currently across fenced paddocks and surrounding shelterbelts to Mount Ida and the Ida Range. Should the approved solar farm be established, there are conditions of the Solar Bay resource consent that no development is to be undertaken within this area until the proposed native planting is fully established and attains a minimum height of 3 m. Glimpses of the solar panels may be possible above the native planting in places. The landscape assessment for the now consented solar farm notes that once fully established, and over 5m in height, the proposed landscape mitigation will ensure complete screening, with views dominated instead by evergreen native plantings.[27]

The solar farms will have most potential to be visible together, within the immediate surrounds of the local access roads, Ranfurly-Naseby Road, Gimmerburn-Naseby Road and Fennessy Road. There will also be views from the driveway to Dwelling 2 (refer to **Private Viewpoint Photograph 20** in the Graphic Supplement)

Ranfurly-Naseby Road and Dwelling 2 driveway

Opportunities for the most extensive cumulative views are likely from a short section of this road and from the driveway access to Dwelling 2 in elevated locations north of Fennessy Road. Brief views incorporating parts of both solar farms on either side of the road will be possible while travelling south. The extent of views quickly diminishes as the viewer proceeds south, downhill.

In addition, the proposed mitigation planting at both solar farms will, once fully established, provide substantial screening from this location as demonstrated by the numerous existing *Pinus species* shelterbelts throughout both sites and wider surrounds.

The degree of potential adverse cumulative effects from these locations will be **low-moderate,** once planting is established**.**

Gimmerburn-Naseby Road and Fennessy Road

Views to the proposed Helios Site are largely screened from Gimmerburn-Naseby Road until arrival at the intersection with Fennessy Road. Views form this location are oblique so the two farms will not be viewed together but seen when turning from one direction to the other.

When travelling on Fennessy Road towards the Solar Bay farm, the Helios Site will be behind the viewer. When travelling towards the Helios Site, there is potential to see both solar farms when west of the Gimmerburn-Naseby Road intersection. However, the extent of visibility is

[27] Rough Milne Mitchell Landscape Architects Limited. Landscape Assessment Report. Proposed Solar Farm, 216 Fennessy Road, Naseby. Date: 08 July 2022

limited due to the panels being set back from the northern Site boundary and the intervening shelterbelts. In addition, the proposed mitigation planting at both solar farms will provide substantial screening over time.

The consented and proposed solar farm developments will not appear out of context in this location where they will adjoin or be viewed against existing infrastructure such as the substation and transmission lines.

Consequently, the degree of cumulative effects from this location will be **low,** reducing to **very low** once planting is established**.**

5.5 Response to Statutory Provisions

The landscape effects are interpreted against the following outcomes sought in the key relevant CODP Section 4 provisions.

Section 4 – Rural Resource Area

4.3.3 Objective - Landscape and Amenity Values

To maintain and where practicable enhance rural amenity values created by the open space, landscape, natural character and built environment values of the District's rural environment, and to maintain the open natural character of the hills and ranges.

Policy 4.4.2 – Landscape Amenity Values

To manage the effects of land use activities and subdivision to ensure that adverse effects on the open space, landscape, natural character, and amenity values of the rural environment are avoided, remedied, or mitigated through:

(a) - The design and location of structures and works, particularly in respect of the open natural character of hills and ranges, skylines, prominent places, and natural features.

(b) - Development which is compatible with the surrounding environment including the amenity values of adjoining properties.

(e) - The location of tree planting, particularly in respect of landscape values, natural features, and ecological values.

Policy 4.4.10 – Rural Subdivision and Development

4.4.10 Policy – Rural Subdivision and Development

To ensure that the subdivision and use of land in the Rural Resource Area avoids, remedies or mitigates adverse effects on:

(a) - The open space, landscape and natural character amenity values of the rural environment in particular the hills and ranges,

(b) - The natural character and values of the District's wetlands, lakes, rivers and their margins,

(c) - The production and amenity values of neighbouring properties,

(d) - The safety and efficiency of the roading network,

(e) - The loss of soils with special qualities,

(f) - The ecological values of significant indigenous vegetation and significant habitats of indigenous fauna,

(g) - The heritage and cultural values of the District,

(h) - The water quality of the District's surface and groundwater resources, and

(i) - Public access to or along the rivers and lakes of the District, particularly through the use of minimum (and average) allotment sizes, particularly through the use of minimum (and average) allotment sizes.

Assessment Response

The proposed solar farm is located on low, slightly undulating topography that comprises typical farmland, not on the district's hills, ranges, skylines, prominent places, or natural features.

The Site will transition from a rural productive landscape to that of a landscape containing energy infrastructure. The large expanse of open space will be reduced to areas between solar panels and enclosed to a greater extent by the recommended planting. Grazing animals, such as sheep, will continue to manage the pasture underneath the panels and frames. The presence of grazing animals maintains a sense of the rural character of the Site. Nevertheless, the proposed solar farm will reduce rural amenity values of the rural environment, particularly those related to open space within the immediate context of the Site. However, the topography and vegetation within and surrounding the Site is such that visibility is relatively contained to within the Site and area surrounding the Site boundary, out to approximately 1km. Where there are wider publicly accessible, elevated views such as from the surrounding foothills and ranges, access is limited and views are from long distances, typically upwards of 6km. There is also a degree of compatibility with the context of other utilities in the vicinity of the Site such as the existing transmission line, substation and radar as well as the large scale, productive activity and dense coverage associated with the Naseby Forest.

In addition, mitigation planting is proposed which once fully established, will soften, break up and over time, substantially screen the development from neighbouring public and private viewpoints. The proposed exotic planting will be seen in the context of existing shelterbelts while the proposed native planting may have beneficial effects on rural amenity over time. Planting has been chosen and will be maintained as required so as to maintain views of the hills, ranges and skylines.

The proposed native planting and wetland enhancement planting will enhance the level of natural character and physical landscape values on the Site.

Once planting is established, the proposal will adversely affect landscape values to **no more than low-moderate overall.**

Section 13 – Infrastructure, Energy and Utilities

13.3.35 Objective - Landscape and Amenity Values

To maintain and where practicable enhance rural amenity values created by the open space, landscape, natural character and built environment values of the District's rural environment.

Policy 13.4.4 – Development of Utilities

To ensure that the design, location, and operation of utilities including the transmission network, having regard to specific locational and operational efficiency requirements, recognises and provides for the following matters, where relevant:

(a) The avoidance, remedying or mitigation of the adverse effects of noise, vibration, lightspill and glare on the environment.

(b) The avoidance, remedying or mitigation of adverse effects on landscape values.

(c) The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna and statutorily managed sports fish and game, water bodies and their margins.

(d) The avoidance, remedying or mitigation of any significant increase in risk to the safety of the public.

(e) The maintenance of the efficient operation of other utilities and infrastructure.

(f) The protection of the integrity of significant heritage values.

(g) The protection of the integrity of sites of importance to Kai Tahu ki Otago.

Assessment Response

Solar farms represent a type of production activity that features a grid pattern of built form directly associated with electricity infrastructure; it is not yet a traditional form of development in rural New Zealand landscapes but it is not uncommon for them to be located within a rural environment. Solar farms do need to be located in proximity to or with the ability to connect to the National Grid. There is approval for another solar farm (Solar Bay) nearby.

The proposed solar farm is not located within an area identified as an ONL or with high landscape and amenity values, significant indigenous vegetation and habitats, or identified heritage and cultural values. These values are present in the wider receiving environment and from a landscape perspective, will not be impacted. There will be beneficial effects on localised natural character values due to the scale of proposed wetland planting and other large areas of native screen planting proposed.

The appended Glint and Glare Study concludes that no significant impacts are predicted upon road safety or residential amenity. A high impact is predicted for Ranfurly-Naseby Road and Ranfurly Back Road and a moderate impact predicted for Dwelling 4. However these will be reduced through proposed mitigation screen planting.

CODP Rural Resource Area - Assessment Matters

3. Other Rural Landscapes
Other rural landscapes are described by CODC as *'those landscapes in the Rural Resource Area that are not identified as being in any other landscape category, as listed above or in the Upper Manorburn/Lake Onslow Landscape Management Area.'*

CODP Rural Resource Area - Other Rural Landscapes.
Significant Issue *- Central Otago's Unique and Distinctive Landscape. The Central Otago District contains many unique and distinctive landscapes. While those landscapes are constantly evolving through natural processes, farming and other land use activities the semi-arid, rocky nature of the landscape means it can be vulnerable to visual effects of new structures (including telecommunication masts, wind farms, transmission line pylons, and other large structures), cultivation of tussock grasslands, large scale earthworks, new roads, residential built development on elevated land, establishing woodlots, production forestry or shelter belts on elevated land and wilding tree spread. Subdivision is often the precursor of land use activities such as those listed above. The District's built heritage, particularly in the form of cottages and ruins, and remnants of the early goldmining era, has also made a significant contribution to the landscape values of Central Otago.*

The following assessment matters for Discretionary Activities under Rule 4.7.4(iii) are considered in regard to the proposed solar farm development.

1. The effects of subdivision and future development on:

- *Open space, landscape, natural character and amenity values.*
- *Reserves, all public conservation land managed by the Department of Conservation and recreation facilities, including the provision and maintenance of such facilities.*
- *Heritage sites, including archaeological sites and waahi tapu, and heritage landscapes.*
- *Sites, lakes and rivers and their margins and other features of cultural value to Kai Tahu ki Otago.*
- *Notable trees, and areas of significant indigenous fauna, and*
- *The natural character of water bodies and their margins.*

Assessment Response

The Site is located at the edge of the basin landscape and is not within an ONL or SAL in the CODP. There are no reserves, recreational activities, heritage sites, notable trees, or significant habitats within the Site. Those in the vicinity such as the Historic Town Centre at Naseby, are spatially and topographically separated from the Site and will not be impacted. The proposed development of the Site will lead to a large shift in the level of open space and in the landscape character from a traditional rural land use to a productive energy landscape. The magnitude of change within the Site and local area will be high.

However, while the scale of new built modification will be apparent, modified rural activities already prevail at the Site and there is a degree of compatibility with the existing characteristics of other activities in the vicinity of the Site such as the existing transmission line, substation and radar as well as the approved solar farm and large scale, productive activity and dense coverage associated with the Naseby Forest.

The distribution of the panels across the Site includes a level of response to the character of the Site itself, its landform and its boundary interfaces. The proposed solar farm will not compromise the ability to undertake rural agricultural activities on the Site or within the wider area and the mitigation planting will soften and largely screen the appearance of the built form on the Site. The proposed mitigation planting will ensure opportunities to enjoy open views across the Site remain.

No identified wetland will be built on and due to the proposed setback buffer and fencing, any disturbance will be minimised. The large scale of proposed mitigation planting together with the enhancement/regeneration of the key wetland areas will greatly increase the indigenous vegetation in the area, creating beneficial landscape effects once established.

The visual catchment is relatively contained to the immediate context of the Site. While the total size of the proposed Site is 660 ha, it is broken up into smaller areas by topography and vegetation; the folded landform and existing shelterbelts restrict views to the whole development, limiting visibility and potential effects on visual amenity.

2. Potential for visual absorption of future built development with particular attention being given to those areas identified as outstanding natural landscapes and significant amenity landscapes on the planning maps.

The site is not identified as, or adjacent to an ONL or SAL. The nearest area of ONL is approximately 6km from the Site at the closest point. Due to the elevation of these ranges, visibility of the Site may be possible from some locations within areas of ONL. These ranges comprise large areas of public conservation land, however they are quiet, backcountry destinations. Any views will typically be in the context of the range of land uses across the wider Maniototo Basin and would comprise a small and distant part of the view.

The dark panels of the proposed solar farm development may appear as a large, dark mass with gaps of pasture and wetland planting where there are larger no-build areas. The dark

colour will contrast with the light pasture but is similar to the dark appearance of exotic coniferous vegetation such as the nearby forestry, helping to visually tie the proposed solar farm to this landscape.

3. Capability for sustainable use of the productive land and soil resource.

The Site predominantly consists of improved pasture and short rotation cropland that is regularly mechanically cultivated and grazed by sheep and beef cattle. Aside from a small number of scattered plants, indigenous vegetation has been fully removed from the paddocks. The proposed solar farm will allow for the production of solar energy within an area of high recorded mean sunshine hours while rural productive activity will continue in the form of sheep grazing under the solar panels. It is understood that at the end of the intended 35-year operational lifespan, the solar farm will be dismantled and the site will be reinstated to its original pre-construction condition.

4. The potential for reverse sensitivity effects and methods to address such effects on existing rural production activities and on existing infrastructure, including the use of separation distances and yards.

Properties surrounding the Site are used largely for similar agricultural grazing purposes. Other land uses include forestry, tourism, recreation, conservation, as well as residential. Overall, dwellings are sparsely located and at some distance to the Site with five residential buildings (including one of the Project land-owners') within approximately 1km of the Site boundary. There are also existing energy-related land uses nearby including a consented but not yet built Solar Bay 50MW solar farm on Fennessy Road.

To assist with screening views of the solar panels and integrating the proposed development with the surrounding rural landscape, a combination of setbacks, screen planting and wetland restoration are proposed.

5, 6. Not applicable.

7. The location, design and construction of access, and its adequacy for the intended use of the allotments.

A total of four site accesses are proposed. Three will be from Ranfurly-Naseby Road and the fourth will be from Ranfurly Back Road as shown in **Figure 7**. Accesses 1 and 2 will be the primary access points to be used by heavy vehicles during construction. Accesses 3 and 4 are to be secondary access points and will not be used by heavy vehicles.

New sections of internal access tracks will be required which will be formed by the placement of subbase aggregate, approximately 3.5 m-4.0 m wide.

Together with upgrades to existing access tracks, the total length of internal access tracks (new and existing) will be approximately 27 km. Earthworks will be completed in stages and progressively rehabilitated to minimise the amount of soil exposed at any one time. All access tracks will be finished in an all-weather metalled surface. For the purpose of this assessment, it is assumed[28] that there will be no works undertaken within or near waterways, including in relation to existing vehicle crossings.

All site works will be undertaken in accordance with the Construction Methodology as outlined in the AEE **Appendix 6**

[28] Based on information provided to Boffa Miskell by Helios on 1 November 2023.

8. The provision of an adequate utility services, (including roading), and in particular the location, design, and construction of these services.

The Site is located close to the Transpower Naseby Substation and the Roxburgh to Livingstone 220 kV transmission line which is part of the National Grid. Access and roading on Site is described above.

9. Earthworks necessary to prepare the site for occupation and/or use.

Most of the topography within the Site will remain unchanged, however there will be earthworks involved to construct the access tracks, to enable construction of the substation and BESS areas and to enable trenching for the cabling required to connect the arrays. The solar panels will be installed via driven piles which will entail minimal earthworks. The solar arrays and associated earthworks will be set back from the surveyed wetlands and waterways.

The earthworks will occur progressively as the site is constructed and where disturbance occurs in areas where no permanent above ground infrastructure is required (i.e., cable trenching), the landform will be restored and grassed with little perceptible change.

10, 11, 12, 13. Not applicable.

14. The identification of potential building platforms that are encouraged in locations that will maintain the open Central Otago District Plan 20 February 2019 Page 4:56 Rural Resource Area natural character of hills and ranges, without compromising the landscape and amenity values of prominent hillsides and terraces.
Refer to above response 4.3.3 Objective - Landscape and Amenity Values and Policy 4.4.2 – Landscape Amenity Values.

15. Not applicable.

16. Whether or not the applicant will commit or has committed to work or services as environmental compensation (such as the control of wilding pines) and if so committed, whether it is or will be:
• to remedy at least in part any adverse effects of onsite works; or
• on the site or within the same general area, landscape, or environment as the proposed activity; and/or
• effective by way of conditions, bond, or covenant; and/or
• the product of public consultation or participation.

New strategic blocks of screen planting and wetland restoration are proposed as part of the Project (refer to the Graphic Supplement, **Figure 5A: Landscape Mitigation Plan**).

The proposed planting will be a mix of native species in some locations and faster growing exotic evergreen shelterbelt species in other locations where additional height is needed and to infill existing shelterbelts. This will provide screening for year-round visual mitigation and enhance biodiversity and natural character on the Site. Together these areas account for approximately 25 ha of the Site.

17. The appropriate size of any allotment bearing in mind any of the above factors.

The proposed solar farm will introduce a high density of linear structures into a rural farming landscape that is currently open and expansive. While the structures are relatively low in height, at less than 3 m, the scale of the overall proposal is very large. This will lead to broad change in landscape character from open, pastoral farmland to a landscape containing energy related infrastructure.

However, the sensitivity of the Site to land use change of the nature proposed is considered to be low given it is a modified landscape at the edge of the basin landscape, not identified as an ONL or ONF and contains no features that are character-defining when compared to the wider context. The Site is also located in the vicinity of other utilities with which it shares some characteristics including the large scale, productive activity and dense coverage associated with the Naseby Forest.

At the same time, the Project has been designed in a manner so as to minimise impacts of its scale on the landscape and natural character values as far as practicable. This will be done through opportunities for the enhancement of the key wetlands and extensive blocks of additional planting. As part of an agri-industrial environment, this has the potential to improve aspects of the character of the landscape.

One of the key features of the Proposal that will assist with its integration into the surrounding landscape character are through the dimensions and distribution of the panels and panel arrays which enable multi-layered use of the Site, including farming. This helps retain key elements of a rural productive character as well as a degree of landform legibility.

6.0 Recommendations

As described throughout the assessment, mitigation planting is proposed at the Site as part of the Project, with both a native palette and exotic shelterbelt species. Refer to **section 2.3** under the Proposal Description and the Landscape Mitigation Plan and proposed planting palette (**Figures 5A-5F** of the Graphic Supplement) for details.

Where feasible, the following recommendations are made in relation to the proposed ecological/mitigation planting:

- The existing Site boundary shelterbelts and vegetation should all be retained to provide screening for the proposal. It is understood that this planting is associated with the ownership of the Site.
- Mitigation planting should begin within the first planting season (April / May or September / October) following commencement of construction and completed by the end of the construction period. The timeframe for planting should prioritise planting along boundaries closest to dwellings 2 and 4 and along the Ranfurly-Naseby Road.
- In regard to the proposed native planting, locally appropriate indigenous species will be used where possible and practicable. Species selected are also tolerant of dry and extreme conditions and have a low fire-prevalence.
- Irrigation and ongoing monitoring and maintenance of the proposed and existing planting including the fenced wetland areas will be required to promote the continued health, growth and longer-term stability of plants, particularly in this environment. Regular watering/irrigation over first 5 years following planting will be essential for plant growth in this environment. Protective wind shelters are also recommended.
- While the Landscape Mitigation Plan **in Figure 5A** of the Graphic Supplement provides the high level plan, the preparation of a Landscape Management Plan is also recommended as part of the Proposal. The Landscape Management Plan should set out both the establishment phase and the ongoing routine monitoring and maintenance

necessary such as weed removal. The Plan should also detail mitigation and enhancement planting areas required for the Project, including details of layout, species, grades, numbers, spacing, eco-sourcing, and a programme and specification for implementation and maintenance. This may include requirements for occasional pruning to maintain viewshafts and 'spot' planting to 'fill in any gaps' that may be evident at ground level in between the trunks of the individual trees. Replacement planting with evergreen species will be undertaken where there are gaps or where there are trees that are failing and need to be removed.

- The intent with the native mixed planting is to achieve 'drifts' of tree and shrub planting intertwined with a mix of species and plant sizes. It is proposed that new plantings be implemented at spaces that allow for established plant sizes while achieving this varied, natural outcome. The aim is to avoid an 'avenue' effect and to ensure the planting looks as natural as possible.

The following additional recommendations are made to reduce the adverse landscape and visual effects of the proposal:

- The materials and colour of onsite buildings and structures will, where practical, have a Light Reflectivity Value (LRV) of less than 30% and be in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape such as in a natural range of browns, greens and greys to complement the tones found in the rural surroundings;
- Areas of soil disturbed by the project would be rehabilitated progressively or immediately post-construction, reducing views of bare soil;
- Night lighting would be minimised to the maximum extent possible (i.e., manually operated safety lighting at main component locations).

7.0 Conclusions

Helios seek land use consent from Central Otago District Council for the construction, operation, and maintenance of a solar farm at a site of approximately 660 ha between Ranfurly-Naseby Road and Ranfurly Back Road, Naseby. The Site comprises an area of improved, grazed farmland which is zoned Rural Resource Area within the Central Otago District Plan. The Site is within an overlay of Other Rural Landscapes which signifies there are no Outstanding or Significant landscapes or features which relate to the Site.

The key features of the project comprise the solar panels, substation and supporting electrical infrastructure/equipment, buildings, lighting, underground cabling, access and internal roading, fencing and landscaping.

Agricultural operations in the form of sheep grazing within the property will continue.

As identified in the relevant statutory provisions of the CODP, the policies and objectives seek to maintain and enhance rural character and amenity values in rural areas.

A number of modified wetlands have been identified within the Site which contribute natural character values to the Site at different levels. The solar arrays and associated earthworks will be set back from the surveyed wetlands and waterways and a total of some 14 ha of

enhancement planting is proposed within the two large wetland areas. Overall, following completion, the adverse effects on natural character values will be **very low** and the proposed removal of stock from the wetlands and restoration planting will result in **beneficial** effects on the natural systems, characteristics and qualities of the Site over time.

There would be no more than temporary **moderate-high** adverse effects on the landscape that will be internal to the Site during the construction phase due to the progressive disturbance to the Site and level of activity such as the movement of construction vehicles and people working on the Site, to install the structures. There would be localised direct **very low** adverse effects on the physical landscape due to the earthworks required within the site. These effects would be highly localised to areas within the Site. Once any disturbed areas have been rehabilitated and proposed mitigation planting established, this would offset any loss to site vegetation resulting in **beneficial** physical landscape effects.

Overall, adverse effects of the solar farm on the Site and local landscape without mitigation are considered **moderate**, reducing to **low** in the context of the wider Maniototo Basin. The large blocks of planting including wetland fencing and improvements proposed, will greatly increase the indigenous vegetation and biophysical landscape values in the immediate area (with an estimated total of 25 ha additional native dryland and wetland planting). As this becomes established, while a degree of landscape change will continue to be experienced, landscape effects within the immediate context will reduce to **low-moderate** overall and very low in the context of the wider Basin.

The main viewing audience includes a small number of private properties and road users of sections of Ranfurly-Naseby Road, Ranfurly Back Road, Fennessy Road, Bypass Road and SH85 located within approximately 1 km of the Site. There will also be occasional longer distance views such as from Ridge Road.

During construction, adverse visual effects on views from roads range between **very low** and **moderate** and are temporary in nature. Over time, mitigation planting will gradually reduce these effects to **low-moderate** to **very low** as the proposed development would be softened and at least partially screened in views from the road.

For private dwellings located within 1 km of the site (excluding Project landowners), it is considered that adverse visual effects during construction will range between **low-moderate** to **moderate** at times from the vicinity of two properties (Dwellings 2 and 4) reducing to **low-moderate** in views from immediately outside the dwelling once the construction phase is completed.

Visual effects from Dwellings 3 and 5 will be **very low** during construction and in the operational phase due to the level of screening and distance from the Site.

For all other properties assessed within approximately 3 km of the site, visual effects are considered to be **very low** at most due to distance and oblique, screened or filtered views.

Once becoming established (at 5 years) proposed planting will result in **low** visual effects from Dwelling 2 and 4. In views away from the dwellings, closer to the Site such as from the adjacent paddock and garden/carpark area, views will widen and visual effects are likely to increase.

Appendix 1:

Method Statement

22 November 2023

This assessment method statement is consistent with the methodology (high-level system of concepts, principles, and approaches) of 'Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines', Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022. The assessment provides separate chapters to discuss landscape, visual and natural character effects where relevant, but is referred to throughout as a Landscape Effects Assessment in accordance with these Guidelines. Specifically, the assessment of effects has examined the following:

- *The existing landscape;*
- *The nature of effect;*
- *The level of effect; and*
- *The significance of effect.*

The Existing Landscape

The first step of assessment entails examining the existing landscape in which potential effects may occur. This aspect of the assessment describes and interprets the specific landscape character and values which may be impacted by the proposal alongside its natural character where relevant as set out further below. The existing landscape is assessed at a scale(s) commensurate with the potential nature of effects. It includes an understanding of the visual catchment and viewing audience relating to the proposal including key representative public views. This aspect of the assessment entails both desk-top review (including drawing upon area-based landscape assessments where available) and field work/site surveys to examine and describe the specific factors and interplay of relevant attributes or dimensions, as follows:

Physical – relevant natural and human features and processes;

Perceptual – direct human sensory experience and its broader interpretation; and

Associative – intangible meanings and associations that influence how places are perceived.

Engagement with tāngata whenua

As part of the analysis of the existing landscape, the assessment should seek to identify relevant mana whenua (where possible) and describe the nature and extent of engagement, together with any relevant sources informing an understanding of the existing landscape from a Te Ao Māori perspective.

Statutory and Non-Statutory Provisions

The relevant provisions facilitating change also influence the consequent nature and level of effects. Relevant provisions encompass objectives and policies drawn from a broader analysis of the statutory context and which may anticipate change and certain outcomes for identified landscape values.

The Nature of Effect

The nature of effect assesses the outcome of the proposal within the landscape. The nature of effect is considered in terms of whether effects are positive (beneficial) or negative (adverse) in the context within which they occur. Neutral effects may also occur where landscape or visual change is benign.

It should be emphasised that a change in a landscape (or view of a landscape) does not, of itself, necessarily constitute an adverse landscape effect. Landscapes are dynamic and are constantly changing in both subtle and more dramatic transformational ways; these changes are both natural and human induced. What is important when assessing and managing landscape change is that adverse effects are avoided or sufficiently mitigated to ameliorate adverse effects. The aim is to maintain or enhance the environment through appropriate design outcomes, recognising that both the nature and level of effects may change over time.

The Level of Effect

Where the nature of effect is assessed as **'adverse'**, the assessment quantifies the level (degree or magnitude) of adverse effect. The level of effect has not been quantified where the nature of effect is neutral or beneficial. Assessing the level of effect entails professional judgement based on expertise and experience provided with explanations and reasons. The identified level of adverse natural character, landscape and visual effects adopts a universal seven-point scale from **very low** to **very high** consistent with Te Tangi a te Manu Guidelines and reproduced below.

Landscape Effects

A landscape effect relates to the change on a landscape's character and its inherent values and in the context of what change can be anticipated in that landscape in relation to relevant zoning and policy. The level of effect is influenced by the size or spatial scale, geographical extent, duration and reversibility of landscape change on the characteristics and values within the specific context in which they occur.

Visual Effects

Visual effects are a subset of landscape effects. They are consequence of changes to landscape values as experienced in views. To assess where visual effects of the proposal may occur requires an identification of the area from where the proposal may be visible from, and the specific viewing audience(s) affected. Visual effects are assessed with respect to landscape character and values. This can be influenced by several factors such as distance, orientation of the view, duration, extent of view occupied, screening and backdrop, as well as the potential change that could be anticipated in the view as a result of zone / policy provisions of relevant statutory plans.

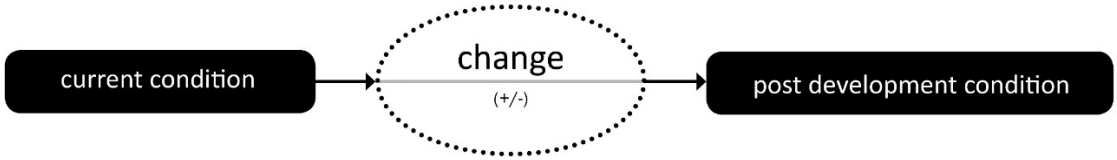
Natural Character Effects

Natural Character, under the RMA, specifically relates to *'the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development'*. Therefore, the assessment of natural character effects only involves examining the proposed changes to natural elements, patterns and process which may occur in relevant landscape / seascape contexts.

As with assessing landscape effects, the first step when assessing natural character effects involves identifying the relevant physical and experiential characteristics and qualities which occur and may be affected by a proposal at a commensurate scale. This can be supported through the input of technical disciplines such as geomorphology, hydrology, marine, freshwater, and terrestrial ecology as well as input from tāngata whenua. An understanding of natural character considers the level of naturalness and essentially reflects the current condition of the environment assessed in relation to the seven-point scale. A higher level of natural character means the waterbody and/or margin is less modified and vice versa.

A natural character effect is a change to the current condition of parts of the environment where natural character occurs. Change can be negative or positive. The resultant natural character effect is influenced by the existing level of naturalness within which change is proposed; a greater level of effect will generally occur when the proposal reduces the naturalness of a less modified environment. In short, the process of assessing natural character effects can be summarised as follows:

- Identify the characteristics and qualities which contribute to natural character within a relevant context and defined spatial scale(s), including the existing level of naturalness;
- Describe the changes to identified characteristics and qualities and the consequent level of natural character anticipated (post proposal); and
- Determine the overall level of effect based on the consequence of change.



The Significance of Effects

Decision makers assessing resource consent applications must evaluate if the effect on individuals or the environment is less than minor[29] or if an adverse effect on the environment is no more than minor[30]. For non-complying activities, consent can only be granted if the s104D 'gateway test' is satisfied, ensuring adverse effects are minor or align with planning objectives. In these situations, the assessment may be required to translate the level of effect in terms of RMA terminology.

This assessment has adopted the following scale applied to relevant RMA circumstances[31] (refer to diagram below), acknowledging low and very low adverse effects generally equate to 'less than minor' and high / very high effects generally equate to significant[32].

[29] RMA, Section 95E

[30] RMA, Section 95E

[31] Seven-point level of effect scale. Source: Te tangi a te Manu, Pg. 15

[32] The term 'significant adverse effects' applies to specific RMA situations, including the consideration of alternatives for Notices of Requirement and AEEs, as well as assessing natural character effects under the NZ Coastal Policy Statement.

Appendix 2: Visual Impact Tables from Dwellings

Dwellings

Ref.	Dwelling address	Distance to Site / panel arrays (approx. metres)	Apparent extent of visibility[33] and orientation	Glint and glare[34]	During construction	Completion		Notes
					Level of Visual Effect[35]	Level of Visual Effect at Year 1	Level of Visual Effect at Year 5	
1	48 Ranfurly-Naseby Road, Ranfurly, Central Otago	45 m / 80 m	Glimpse; East/ Northeast	No glare predicted	Landowner - Excluded	Landowner - Excluded	Landowner - Excluded	Property located near the southwest corner of the Site with dwelling/s surrounded by substantial hedging and garden planting. Potential close views of the Site will be largely screened by this intervening vegetation. However there may be wider more distant views to the northeast between trees. The residents are one of the two landowners leasing land to Helios for this development. No concerns were raised by the landowners on the need for the screening of the solar farm from their dwelling and as a result, no screening is proposed and the property is excluded from the Assessment.
2	512 Ranfurly-Naseby Road	140 m / 450 m	Small amount to	No glare predicted	Low-moderate	Low-moderate	Low	Property is located immediately north of Site with a deck enabling elevated views to the south. The steep drop away of the intervening terrace

[33] Extent of visibility: Full (almost all the Site is visible), Partial (up to half of the Site is visible), Small Amount (approximately 20% of the Site is visible), Glimpse (very small, i.e. less than 10% of the Site is visible), Truncated (or no views)

[34] See Appendix 3 Naseby Solar Farm Glint and Glare Study

[35] Significance of Effects: Very Low, Low, Moderate-Low, Moderate, Moderate-High, High, Very High

Ref.	Dwelling address	Distance to Site / panel arrays (approx. metres)	Apparent extent of visibility[33] and orientation	Glint and glare[34]	During construction	Completion		Notes
					Level of Visual Effect[35]	Level of Visual Effect at Year 1	Level of Visual Effect at Year 5	
			Partial; South		to Moderate			landform screens views to the closest panels. Dwelling and gardens are partially enclosed by mature hedging, also limiting views. Existing vegetation within the Site (a large stand of trees on slope at northern end and internal shelterbelts) adds further screening. From southeast orientated windows, decking and garden area, a portion of the northwest extent of the Proposal will be visible (to the right of the intervening trees). A narrow viewshaft to the left of these trees will also be available towards a central portion of the Site. In views further from the dwelling such as the adjacent front paddock, the available viewshaft will widen with distant views available incorporating the eastern extent of the Site. While a broad 'width' or east-west horizontal extent of the Site will be visible from this location, the north-south vertical 'depth' will appear as a foreshortened band, reducing the apparent proportion of visible change within the view. The substation will be largely screened from these views. Views will be long-distance with the nearest visible panels approximately **1200 m** away so that the panels will appear as a thin dark band with gaps of pasture and wetland planting between arrays where there 'no-build' areas. Panels will typically be backdropped by distant shelterbelts and the ranges beyond. Planting to further reduce this level of visibility is proposed along sections of the northern Site

Ref.	Dwelling address	Distance to Site / panel arrays (approx. metres)	Apparent extent of visibility[33] and orientation	Glint and glare[34]	During construction	Completion		Notes
					Level of Visual Effect[35]	Level of Visual Effect at Year 1	Level of Visual Effect at Year 5	
								boundary (including the northeast corner) to screen panel arrays. Views to some central and more distant panels may remain but are not likely to be readily noticeable due to their small proportion of the overall view and distance, particularly from the dwelling/immediate outdoor living viewpoint location.
3	788 Ranfurly Back Road	580 m / 660 m	Truncated (no view) to glimpses; Southwest	No glare predicted	Very Low	Very Low	Very Low	Property is located near the northeast corner of the Site. The dwelling is largely surrounded by mature hedging to the north, west and south, screening potential views to the Site. Existing vegetation on the east side of the gully (within the northeast corner of the Site) and proposed planting on the west side of the gully (extending west for approximately 380m along the Site boundary) will continue to ensure views are largely screened should hedging be removed. Topography screens views further west.
4	366 Ranfurly Back Road	380 m / 440 m	Small amount to partial; North/ Northwest	Low-moderate (up to 15 minutes of yellow glare between 3:45pm and 5:30pm, from 6 May to 7 July)	Low-Moderate to Moderate	Low-Moderate	Low	Property is located near southeast corner of Site. The steep drop away of the intervening landform screens views to the closest panels. Substantial mature hedging surrounds much of the dwelling and garden, also screening potential views particularly to the southwest extent of the Site. However, in the vicinity of the dwelling, views will be available to the north /northwest from a north facing window (understood to be the main bedroom window) and as you move north, away from the dwelling such as from the carpark/entrance garden area. From the vicinity of the window location, glimpses of a portion of the northeast extent of the Proposal will be visible in the gaps between and just above the

Ref.	Dwelling address	Distance to Site / panel arrays (approx. metres)	Apparent extent of visibility[33] and orientation	Glint and glare[34]	During construction	Completion		Notes
					Level of Visual Effect[35]	Level of Visual Effect at Year 1	Level of Visual Effect at Year 5	
								existing intervening on-site shelterbelt. Effects during the construction phase will typically be reduced through a combination of distance and screening from this shelterbelt. In views from further north such as the northeastern edge of the carpark/entrance area, the available viewshaft will widen to the west with distant views available incorporating the central and north-western extent of the Site. On-site rolling topography will screen some of the westernmost arrays and the lower components of the substation. The taller elements of the substation are likely to be visible and will be backdropped by the western shelterbelt and vegetation and hills beyond. Views to the panel arrays to the northeast will be glimpsed in the gaps between and just above the existing intervening on-site shelterbelt. While a broad 'width' or east-west horizontal extent of the Site will be visible from this carpark/garden location, the north-south vertical 'depth' will appear as a foreshortened band, reducing the apparent proportion of visible change within the view. Views from both locations will be long-distance with the nearest visible panels approximately **900 m** away. The panels will appear as a thin dark band with gaps of pasture between arrays where there 'no-build' areas. The 'band' will typically be backdropped by distant vegetation and the ranges beyond. Planting to further soften and reduce the level of visibility is proposed along the eastern Site boundary to screen closer panel arrays over time. Due to the

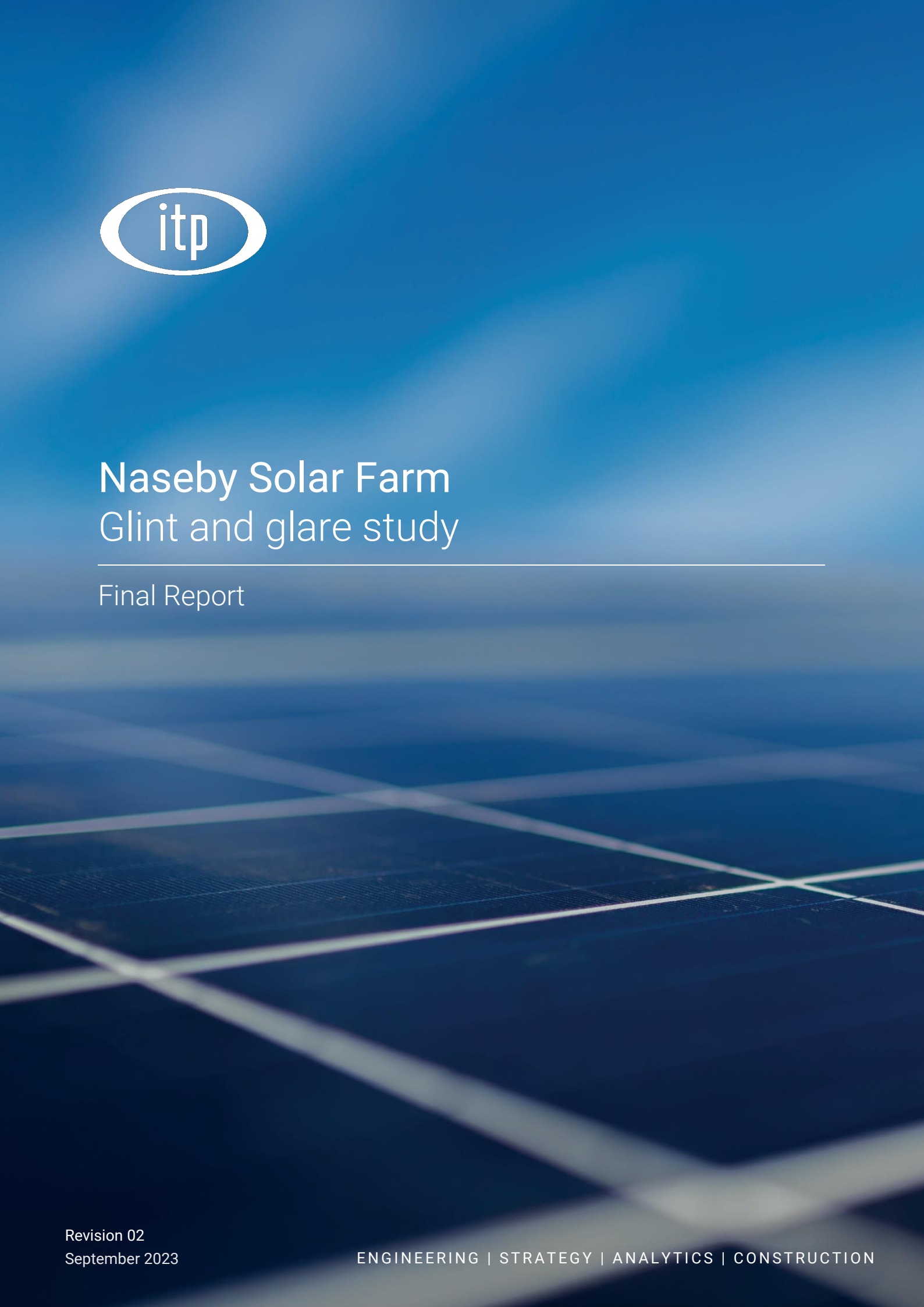
Ref.	Dwelling address	Distance to Site / panel arrays (approx. metres)	Apparent extent of visibility[33] and orientation	Glint and glare[34]	During construction	Completion		Notes
					Level of Visual Effect[35]	Level of Visual Effect at Year 1	Level of Visual Effect at Year 5	
								lower contour level at the southeast Site boundary, planting will need to reach at least 8 m-12 m to begin to screen panels from the carpark/garden viewing location. At this height, glimpses to distant panels will remain above the proposed planting but will appear as a small proportion of the overall view and distance. As the existing intervening trees continue to grow, they will also screen more of the panels, including appearing above the intervening hill crest. Screening could be achieved more quickly through planting on the property such as along the garden fence line. It is estimated that plants would need to reach heights of approximately 1.8 m-2.4 m to largely screen the Site from views in this location.
5	5 Bypass Road	1150 m/ 1200 m	Truncated (no view) to glimpses;	Low Up to 5 minutes of yellow glare - 8am and 8:45am, from 15-18 May; Up to 5 minutes of yellow glare 8am to 9.30am from 16 June to 5 August (OP15)	Very Low	Very Low	Very Low	Property is located southwest of the Site. Dwelling is orientated broadly northwest in an open garden setting. There are multiple intervening shelterbelts and stands of trees including within the Site. Oblique glimpses to the Site may be available, primarily in winter due to deciduous trees. Views would be at very long distances and it is likely that the panel arrays would not be readily noticeable, particularly as proposed infill shelterbelt planting becomes established.
6	793 Channel Road and 788 Ranfurly Back Road		None	Excluded because in				Dwelling appears screened from Site by intervening landform.

Ref.	Dwelling address	Distance to Site / panel arrays (approx. metres)	Apparent extent of visibility[33] and orientation	Glint and glare[34]	During construction	Completion		Notes
					Level of Visual Effect[35]	Level of Visual Effect at Year 1	Level of Visual Effect at Year 5	
				valley below array				
7	8365 Ranfurly-Wedderburn Road, Ranfurly	2600 m/	None to glimpse	No glare predicted	Very Low	Very Low	Very Low	Dwelling appears orientated broadly north. There are intervening shelterbelts including within the Site. Potential glimpses to the Site may be available, however views would be at very long distances and the panel arrays would be very difficult to discern, particularly as proposed infill shelterbelt planting becomes established.
8	8358 Ranfurly-Wedderburn Road, Ranfurly	2800 m/	None to truncated glimpse	No glare predicted	Very Low	Very Low	Very Low	Dwelling appears orientated broadly northeast in a planted garden setting. Views would be at very long distances beyond SH85 with intervening vegetation. It is likely that the panel arrays would be very difficult to discern, particularly as proposed infill planting reinforces the southern boundary shelterbelt.
9	8268 Ranfurly-Wedderburn Road, Ranfurly	2400 m/	None to truncated glimpse	Low Up to 11 minutes of Green glare (OP12)	Very Low	Very Low	Very Low	Dwelling appears orientated broadly northeast in a planted garden setting. Any views would be at very long distances beyond SH85 with intervening vegetation. It is likely that the panel arrays would be very difficult to discern. This will be reinforced as proposed infill shelterbelt planting reinforces the southern boundary.
10	8249 Ranfurly-Wedderburn Road, Ranfurly	1500 m/	None to truncated glimpse	Low Up to 10 minutes of green glare (OP14)	Very Low	Very Low	Very Low	Dwelling/s appear orientated broadly north within a treed setting. Views are likely to be screened by this vegetation however glimpses may be possible in winter due to deciduous trees. Views would be at very long distances and there are other intervening shelterbelts, including within the Site which would further curtail any glimpses, particularly as proposed infill shelterbelt planting becomes established.
11	8236 Ranfurly-Wedderburn Road, Ranfurly	1600 m/	None to truncated glimpse	Low Up to 2 minutes of	Very Low	Very Low	Very Low	Dwelling/s appear orientated broadly north within a partially treed setting. Any views would oblique, at very long distances beyond SH85 with intervening vegetation. It is likely that the panel arrays would be

Ref.	Dwelling address	Distance to Site / panel arrays (approx. metres)	Apparent extent of visibility[33] and orientation	Glint and glare[34]	During construction	Completion		Notes
					Level of Visual Effect[35]	Level of Visual Effect at Year 1	Level of Visual Effect at Year 5	
				yellow glare and 6.4 hours per year of green (OP13)				very difficult to discern and this will be reinforced as proposed infill shelterbelt planting reinforces the southern boundary.
12	205 Gimmerburn-Naseby Road, Ranfurly	2300 m	None to truncated glimpse	No glare predicted	Very Low	Very Low	Very Low	Dwelling appears orientated broadly northeast and surrounded by substantial hedging and garden planting. Views of the Site are likely to be screened due to this intervening vegetation, reinforced by further intervening shelterbelts including those on the west and southern boundary. Any potential glimpses would be from a very long distance and very difficult to discern.
13	256 Gimmerburn-Naseby Road, Ranfurly	3000 m	None to truncated glimpse	Not identified (none from road)	Very Low	Very Low	Very Low	Dwelling appears orientated broadly northeast with garden trees nearby, further groupings of trees to the northeast and other intervening vegetation, including shelterbelts on the west and southern boundary. The panels are not likely to be discernible.
14	73 Brinsdon Road, Ranfurly	2300 m	None to truncated glimpse	Not identified (none from road)	Very Low	Very Low	Very Low	Dwelling appears orientated broadly north and northwest but with open views to the east available. Views would be largely screened by intervening shelterbelts including along the western site boundary. This will be reinforced with proposed planting at the southwest corner. While there may be potential visibility to the elevated slopes/crests on the site, any views would be oblique, at very long distances beyond SH85 and it is likely that the panel arrays would be very difficult to discern.
15	146 Brinsdon Road, Ranfurly	3000 m	None to truncated glimpse	Not identified (none from road)	Very Low	Very Low	Very Low	Dwelling appears orientated broadly northwest, away from the Site. Stands of trees to the east, including proposed reinforced planting on the western site boundary are likely to curtail potential views. While there may be potential visibility to the elevated slopes/crests on the site, any views would

Ref.	Dwelling address	Distance to Site / panel arrays (approx. metres)	Apparent extent of visibility[33] and orientation	Glint and glare[34]	During construction	Completion		Notes
					Level of Visual Effect[35]	Level of Visual Effect at Year 1	Level of Visual Effect at Year 5	
								be at very long distances beyond SH85 and the panel arrays are not likely to be discernible.
16	885 Ranfurly Back Road, Naseby	1100 m	None	Excluded because of intervening trees and topography				Appears screened by multiple intervening layers of evergreen vegetation and landform.
17	581 Ranfurly-Naseby Road	1100 m	None to truncated glimpse	No glare predicted				Appears screened by multiple intervening layers of evergreen vegetation and landform.

Appendix 3: ITP Glint and Glare Study



Naseby Solar Farm
Glint and glare study

Final Report

Revision 02
September 2023

ENGINEERING | STRATEGY | ANALYTICS | CONSTRUCTION

DOCUMENT CONTROL

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ABOUT THIS REPORT

This report assesses the glint and glare impact of the proposed Naseby Solar Farm located between Naseby and Ranfurly, in Central Otago. It was commissioned by Helios Energy.

ABBREVIATIONS

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

TABLES

FIGURES

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1 INTRODUCTION

1.1 Overview

Helios Energy (Helios) has requested a glint and glare assessment for a proposed solar photovoltaic (PV) installation located between Naseby and Ranfurly, in Central Otago. This assessment will be submitted as part of the resource consent process for the project. It includes:

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

1.2 Glint and Glare

The United States Federal Aviation Administration (FAA) defines glint and glare as follows:[1]

- **Glint** is a momentary flash of bright light
- **Glare** is a continuous source of excessive brightness relative to ambient lighting.

Glint and glare can occur when light reflected off a surface (reflector) is viewed by a person (receptor). Glint typically occurs when either the receptor or the reflector is moving, while glare typically occurs when the reflector and receptor are completely, or nearly, stationary. For a transparent material (e.g., glass, water) the quantity of light reflected depends on the surface itself (i.e., material and texture), and the angle at which the light intercepts it (angle of incidence). More light is reflected at higher angles of incidence as shown in Figure 1.

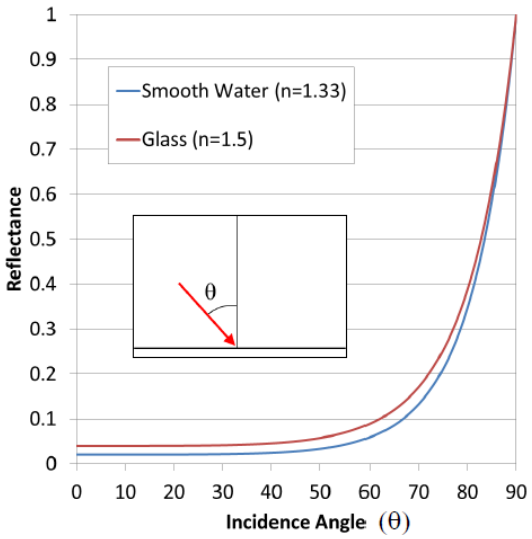

Figure 1: Angles of incidence and increased levels of reflected light

[1] Federal Aviation Administration [FAA], 2018

Potential visual impacts from glint and glare include distraction and temporary afterimage; at its worst, it can cause retinal burn. The ocular hazard caused by glint or glare is a function of:

1. The intensity of the glare upon the eye (retinal irradiance)
2. The subtended angle of the glare source (i.e., the extent to which the glare occupies the receptor's field of vision; dependent on size and distance of the reflector).

The severity of the ocular hazard can be divided into three levels, as shown in Figure 2:

- **Green glare**, which has low potential to cause temporary afterimage
- **Yellow glare**, which has potential to cause temporary afterimage
- **Red glare**, which can cause retinal burn and is not expected for PV.

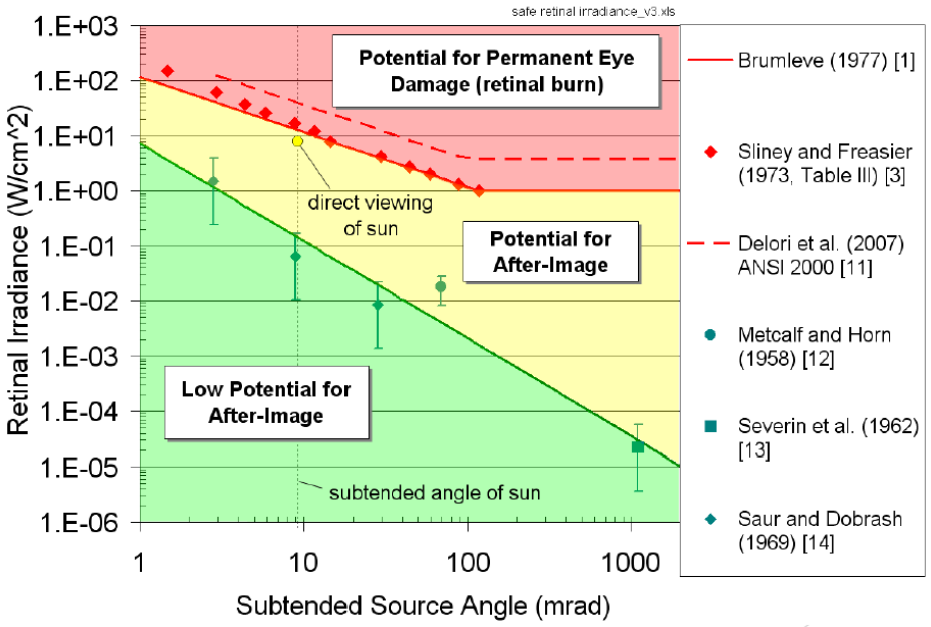

Figure 2: Classification of glare based on severity of ocular effects

1.3 Glare from Solar PV

Solar photovoltaic (PV) cells are designed to absorb as much light as possible to maximise efficiency (generally around 98% of the light received). To limit reflection, solar cells are constructed from dark, light-absorbing material and are treated with an anti-reflective coating. PV modules generate less glare than many other surfaces, as shown in Figure 3.

The small percentage of light reflected from PV modules varies depending on the angle of incidence. Figure 4 shows an example of this with a solar module. A larger angle of incidence will result in a higher percentage of reflected light.

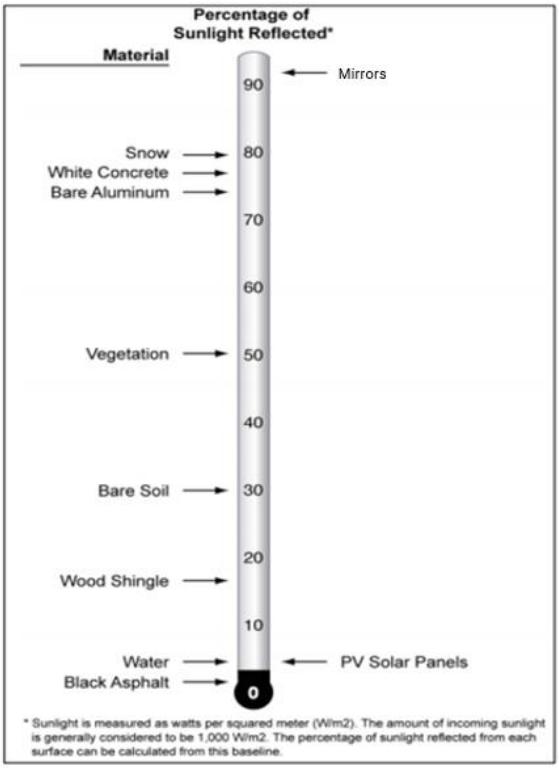

Figure 3: Typical percentage of sunlight reflected from different surfaces (Source: Adapted from Journal of Airport Management, 2014)

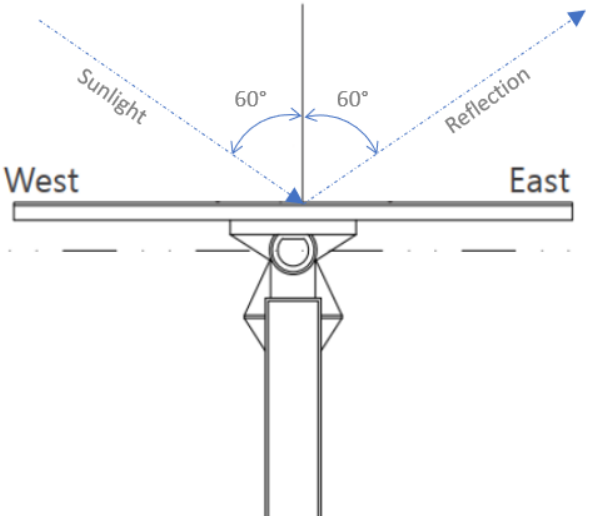

Figure 4: Typical sunlight reflection off the surface of a solar module

The two most common PV mounting structures are fixed tilt and single axis tracking. Fixed tilt arrays are stationary, while single axis tracking arrays rotate the receiving surface of the modules from east to west throughout the day as the sun moves across the sky.

In a fixed tilt PV array, since the sun is moving but the modules are stationary, the angle of incidence varies as the sun moves across the sky. It is smallest around noon when the sun is overhead and largest in the early morning and late afternoon when the sun is near the horizon. There is therefore a higher potential for glare at these times.

The angle of incidence for a single axis tracking system varies less as the reflective surface of the modules rotates on a horizontal axis to follow the sun. Single axis tracking arrays therefore generate less glare than fixed tilt arrays. The tracking varies throughout the year to match seasonal changes in the sun's path (see Figure 5).

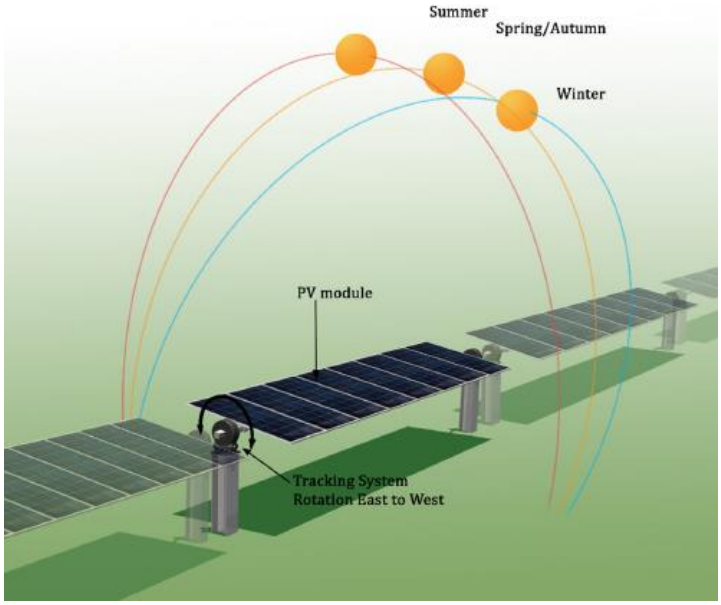

Figure 5: Sun position relative to PV modules on a horizontal single-axis tracking system

2 PROJECT DESCRIPTION

2.1 Site Overview

Helios is proposing a solar farm at the location described in Table 1. The site is located approximately 3.5 km southwest of the town of Naseby and 5 km north of the town of Ranfurly. An indicative layout is displayed in Figure 6.

Table 1: Site Information

Parameter	Description
Title No.	OT10B/11337, OT9C/187, OT13D/517, OT9C/619, OT13D/516
Address	Ranfurly-Naseby Road, Naseby New Zealand 9396
Council	Central Otago District Council
Project area	661 ha

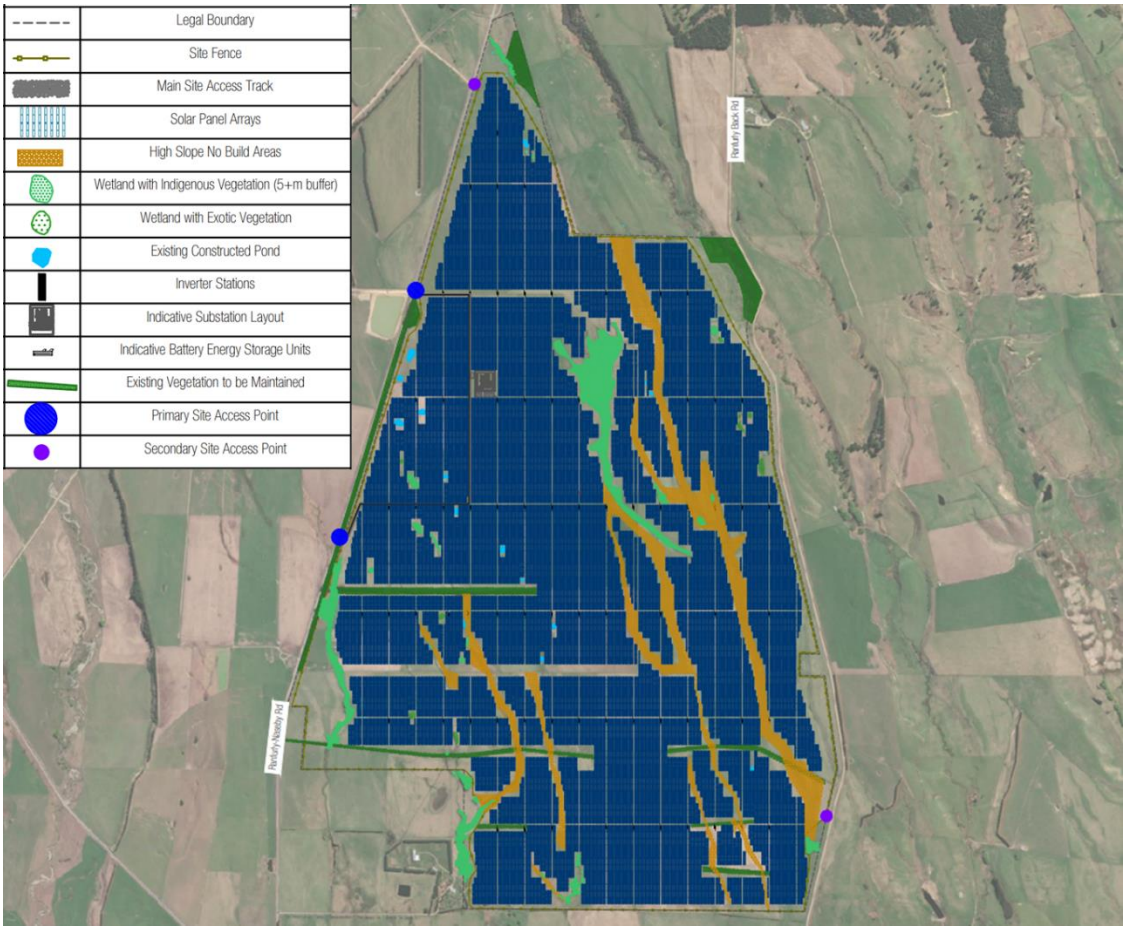

Figure 6: Naseby Solar Farm Preliminary PV layout

2.2 Solar Farm Details

Table 2 summarises the details of the proposed solar farm.

Table 2: Solar farm information

Parameter	Description
Solar farm name	Naseby Solar Farm
Capacity	339 MWp
Mounting system	Single-axis tracking

Helios is proposing to construct a solar farm with a DC capacity of 339 MWp on a 661 ha site. There will be approximately 551,000 solar modules installed in single-axis tracking tables running north to south. Panels are arranged in a portrait configuration, with tracker rows ranging from 52-104 modules in length. The solar farm will include 74 medium voltage (MV) inverters with a capacity of 4.2 MVA.

3 ANALYSIS

3.1 Overview

The Solar Glare Hazard Analysis Tool (SGHAT) was developed by Sandia National Laboratories to evaluate glare resulting from solar farms at different viewpoints, based on the location, orientation, and specifications of the PV modules. This tool was required by the United States FAA for glare hazard analysis near airports until 2021 and is also recognised by the Australian Government Civil Aviation Safety Authority (CASA).

The GlareGauge software uses SGHAT to provide an indication of the type of glare expected at each potential receptor. It runs with a simulation timestep of one minute. Glint lasting for less than one minute is unlikely to occur from the sun on PV modules due to their slow movement.

3.2 Assumptions

The visual impact of solar farms depends on the scale and type of infrastructure, the prominence and topography of the site relative to the surrounding environment, and any proposed screening measures to reduce visibility of the site. Our model includes selected obstructions[2] as described in Section 3.3.2.

Atmospheric conditions such as cloud cover influence light reflection and the resulting impact on visual receptors. GlareGauge does not model varying atmospheric conditions; instead, the model assumes clear sky conditions, with a peak direct normal irradiance (DNI) of 1,000 W/m^2 which varies throughout the day.

Table 3 details the parameters used in the SGHAT model. GlareGauge default settings were adopted for the analysis time interval, direct normal irradiance, observer eye characteristics and slope error. The height of the observation points for road users was assumed to be 1.5 m. The height for a person standing was assumed to be 1.65 m.

Table 3: SGHAT specification inputs

Parameters	Input
Time zone	UTC+12:00
Module surface material	Smooth glass with ARC (anti-reflective coating)
Module tracking	Single Axis Tracking with backtracking
Maximum tilt angle	±60˚

[2] In the GlareGauge model, obstructions are opaque barriers that block the transmission of incident and reflected light

Parameters	Input
Module axis orientation	0°
Height of modules above ground	1.7 m (height from the ground to the table centre)

3.3 Model construction

3.3.1 Study area

This assessment considers potential visual receptors (e.g., residences and road users) within 3 km of the site. There is no formal guidance on the maximum distance for glint and glare assessments; however, the significance of a reflection decreases with distance for two main reasons:

1. The solar farm appears smaller (smaller subtended angle), and glare has less impact
2. Visual obstructions (e.g., terrain, vegetation) may block the view of the solar farm

Glint and glare impacts beyond 3 km are highly unlikely. This choice of distance is conservative and is based on existing studies and assessment experience.

3.3.2 Model components

The model (see Figure 7) was constructed as follows:

- The array was divided into 13 separate PV objects based on the general arrangement and significant changes in topography (see Figure 8).
- Receptors were placed at 16 observation points and nine road routes (see Figure 9).
- Six observation points and two road routes were excluded (see Figure 10, and Appendix A).
- Obstructions included many lines of existing trees. All obstructions included in the model are displayed in Figure 9. The vegetation was modelled with an upper edge height of 10 m, a conservative estimate of mature tree height.

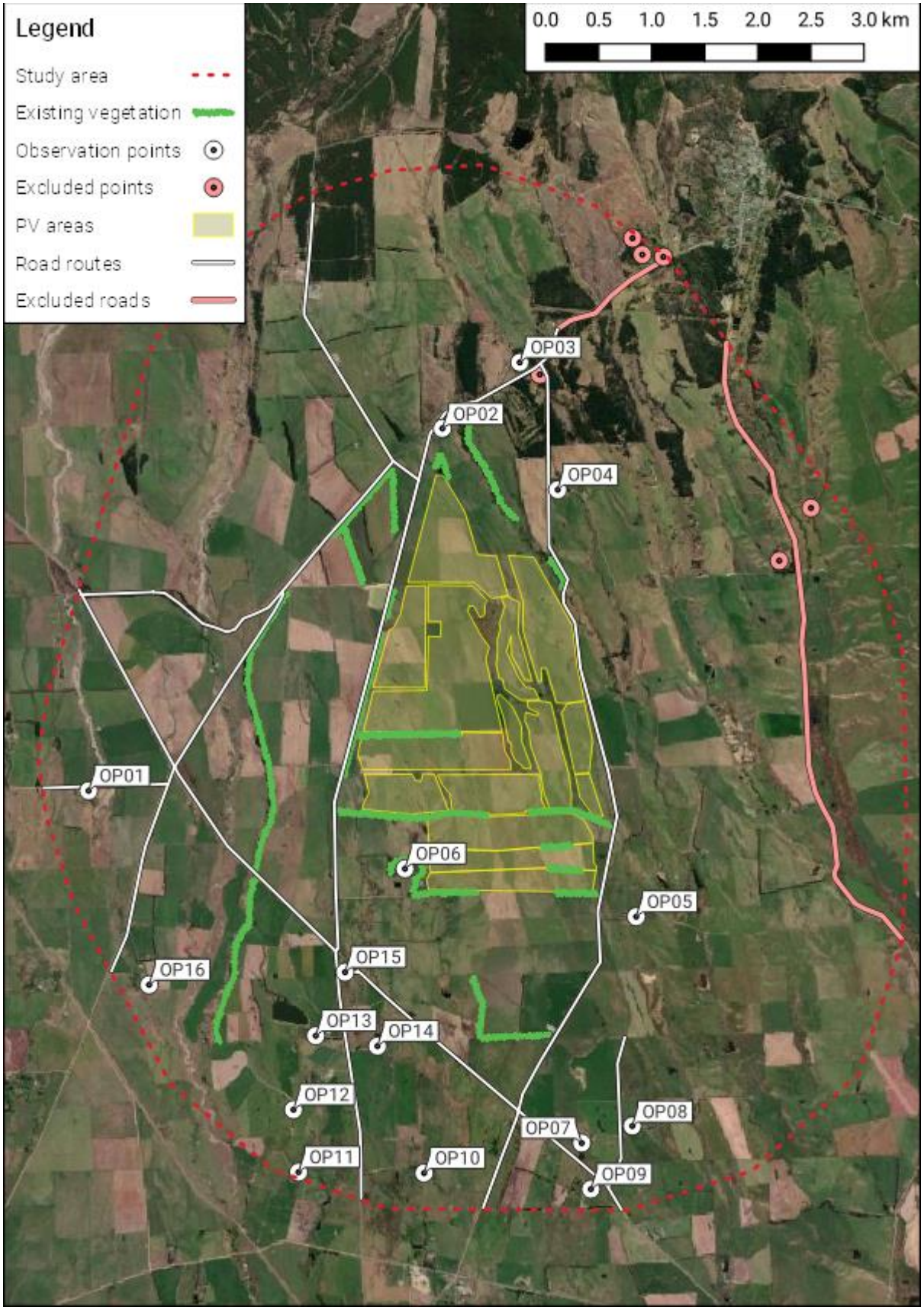

Figure 7: Model showing study area, arrays, receptors, and obstructions.

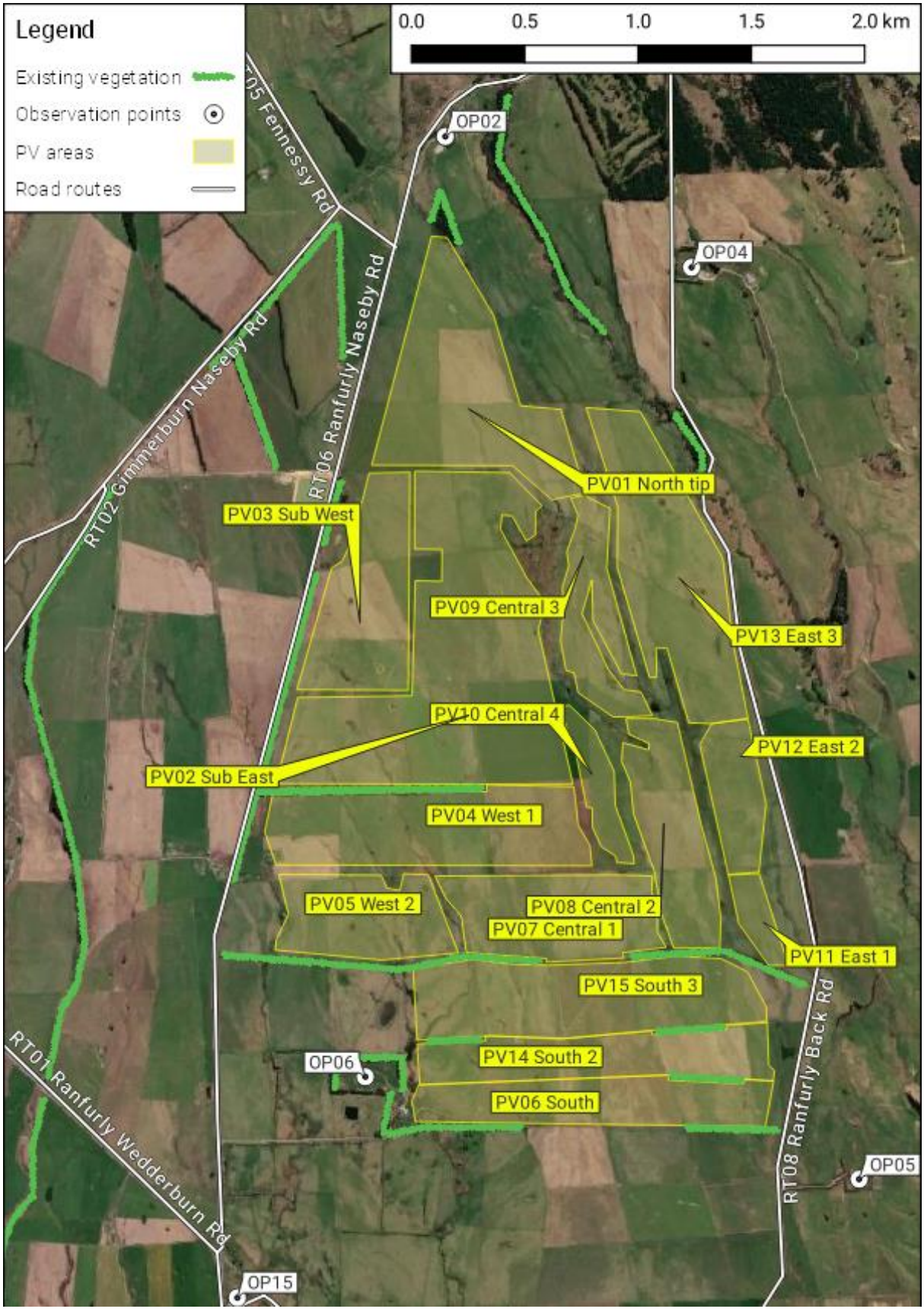

Figure 8: PV array sections

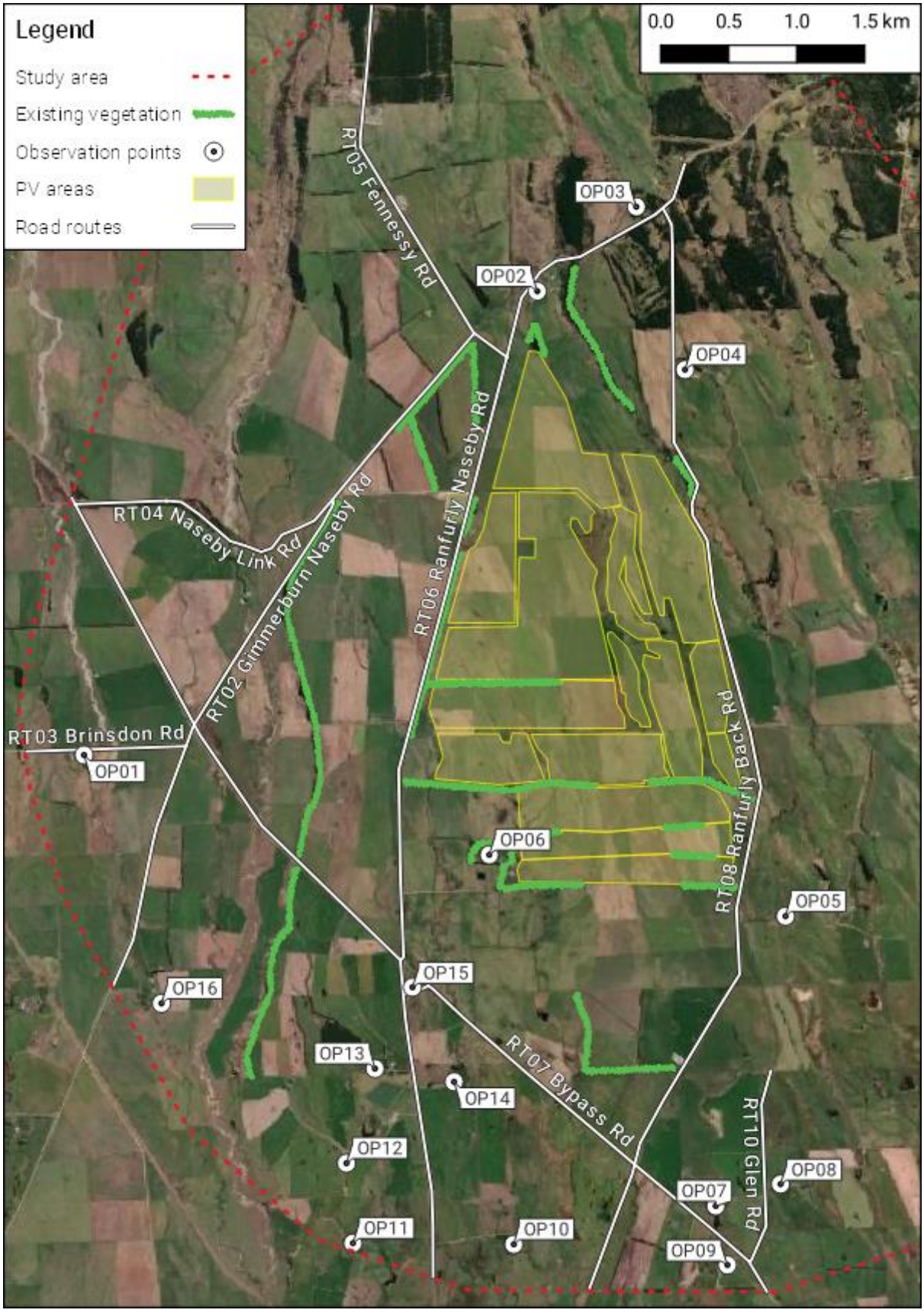

Figure 9: Receptors and obstructions

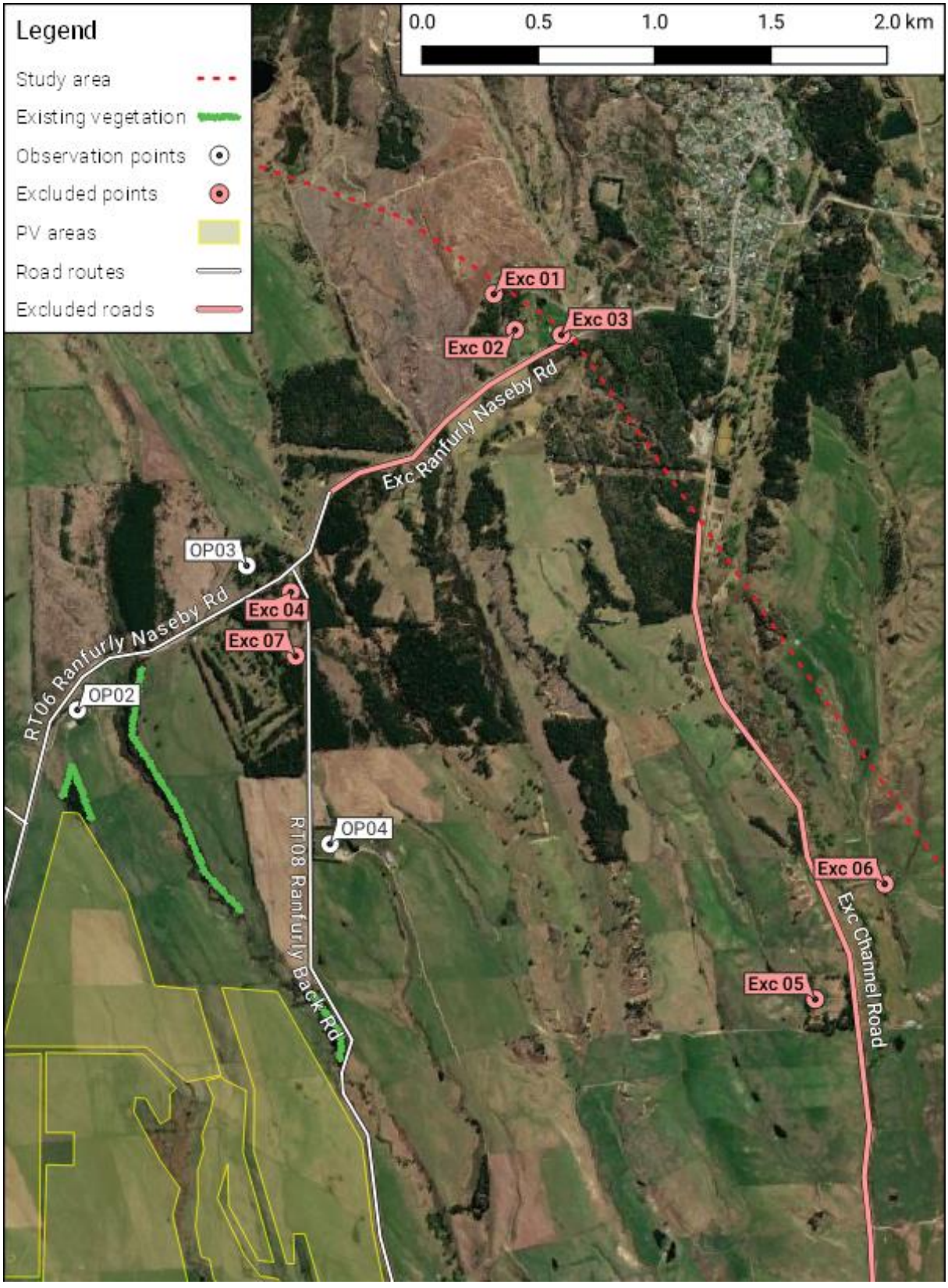

Figure 10: Excluded receptors. Exc 01 - Exc 04, Exc 07 and Ranfurly Naseby Rd were excluded because of intervening trees and topography. Exc 05, Exc 06 and Channel Rd were excluded because they are in a valley below the array.

3.4 Results

Our results are presented below for three cases:

1. **Base case:** mitigation measures
2. **Mitigation option 1:** Backtracking rest angle limits
3. **Mitigation option 2:** Additional vegetation screening

3.4.1 Base case

The results of the GlareGauge analysis are summarised in Table 4. The analysis identified 7,859 minutes (131 hours) of cumulative green glare, and 9,403 minutes (157 hours) of cumulative yellow glare spread across multiple routes and observation points.

The glare received each day varied across the year. For observation points where some glare occurred, the impact is described qualitatively. No observation points or routes received more than 55 minutes of glare in any single day. The time of day at which glare was observed varied between observation points and across the year. In general, most glare occurred in the early mornings or late evenings, when the array is backtracking.

Table 4: Glare potential at each receptor.

Receptor	Coordinates / Location	Green (min/yr)	Yellow (min/yr)	Daily glare potential
OP01	146 Ranfurly-Wedderburn Road	0	0	None
OP02	512 Ranfurly-Naseby Road	0	0	None
OP03	581 Ranfurly-Naseby Road	0	0	None
OP04	788 Ranfurly Back Road	0	0	None
OP05	366 Ranfurly Back Road	566	408	Up to 15 minutes of yellow glare between 3:45 pm and 5:30 pm, from 6 May to 7 July.
OP06	48 Ranfurly-Naseby Road	0	0	None
OP07	305 Bypass Road, Ranfurly	0	0	None
OP09	306 Bypass Road, Ranfurly	0	0	None
OP10	8365 Ranfurly-Wedderburn Road	0	0	None
OP11	8358 Ranfurly-Wedderburn Road	0	0	None
OP12	8268 Ranfurly-Wedderburn Road	349	0	Up to 11 minutes of green glare between 8:15 am and 9:00 am, from 14 May to 19 May. Up to 11 minutes of green glare between 8:15 am and 9:30 am, from 16 June to 27 July.
OP13	8236 Ranfurly-Wedderburn Road	382	41	Up to 2 minutes of yellow glare between 8:00 am and 8:45 am, from 15 May to 18 May. Up to 2 minutes of yellow glare between 8:00 am and 9:30 am, from 16 June to 5 August.
OP14	8249 Ranfurly-Wedderburn Road	361	0	Up to 10 minutes of green glare between 8:00 am and 9:00 am, from 15 May to 20 May. Up to 10 minutes of green glare between 8:15 am and 9:30 am, from 12 June to 26 July.

Receptor	Coordinates / Location	Green (min/yr)	Yellow (min/yr)	Daily glare potential
OP15	5 Bypass Road, Ranfurly	495	124	Up to 5 minutes of yellow glare between 8:00 am and 8:45 am, from 15 May to 18 May. Up to 5 minutes of yellow glare between 8:00 am and 9:30 am, from 16 June to 5 August.
OP16	205 Gimmerburn-Naseby Road	0	0	None
RT01	Ranfurly Wedderburn Rd	88	143	Up to 6 minutes of yellow glare between 8:45 am and 9:30 am, from 3 June to 9 July.
RT02	Gimmerburn Naseby Rd	0	0	None
RT03	Brinsdon Rd	0	0	None
RT04	Naseby Link Rd	0	0	None
RT05	Fennessy Rd	0	0	None
RT06	Ranfurly Naseby Rd	2,195	2,806	Up to 28 minutes of yellow glare between 7:00 am and 10:00 am, from 3 April to 8 September.
RT07	Bypass Rd	1,623	426	Up to 9 minutes of yellow glare between 7:15 am and 9:30 am, from 11 April to 31 August.
RT08	Ranfurly Back Rd	1,800	5,455	Up to 55 minutes of yellow glare between 10:30 am and 11:45 am, from 22 May to 22 July. Up to 55 minutes of yellow glare between 3:45 pm and 6:45 pm, from 1 April to 10 September.
RT10	Glen Rd	0	0	None
Total		**7,859**	**9,403**	

Ranfurly-Naseby Road received approximately 47 hours of cumulative yellow glare from several sources. The glare occurred on sections of the road adjacent to the solar farm that were not screened by existing vegetation. Selected plots of glare on the route are shown in Figure 11. Because Ranfurly-Naseby Road receives less than half an hour of yellow glare on any given day, and is a relatively low traffic road, we consider this glare to be low to moderate impact. Mitigation is not required but could be considered to reduce impact on local road users.

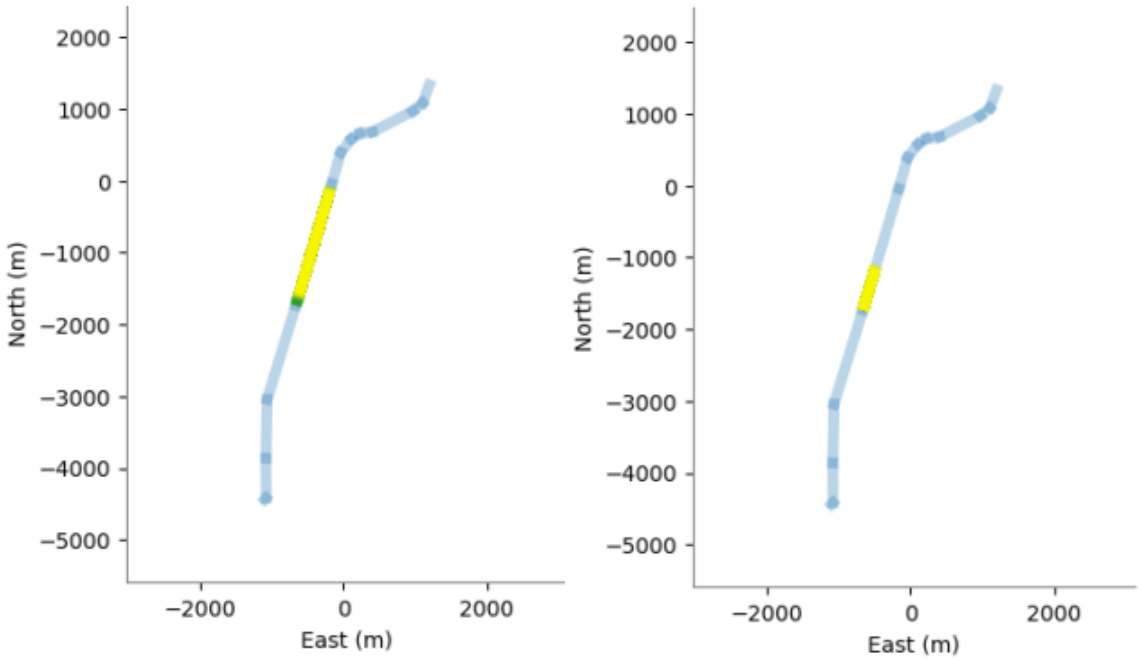

Figure 11: Yellow glare on Ranfurly-Naseby Road from PV01 North Tip (left), and PV03 Sub West (right). Other PV arrays caused additional glare on overlapping sections of the route. Full results are provided in Appendix A.

Ranfurly Back Road received about 91 hours of yellow glare from multiple sources. The glare occurred on several different sections of the route that were not screened by existing vegetation. Selected plots of glare on the route are shown in Figure 12. Because Ranfurly Back Road is a rural road with relatively low traffic volumes, we consider this glare to be low to moderate impact. Mitigation is not required but could be considered to reduce impact on local road users.

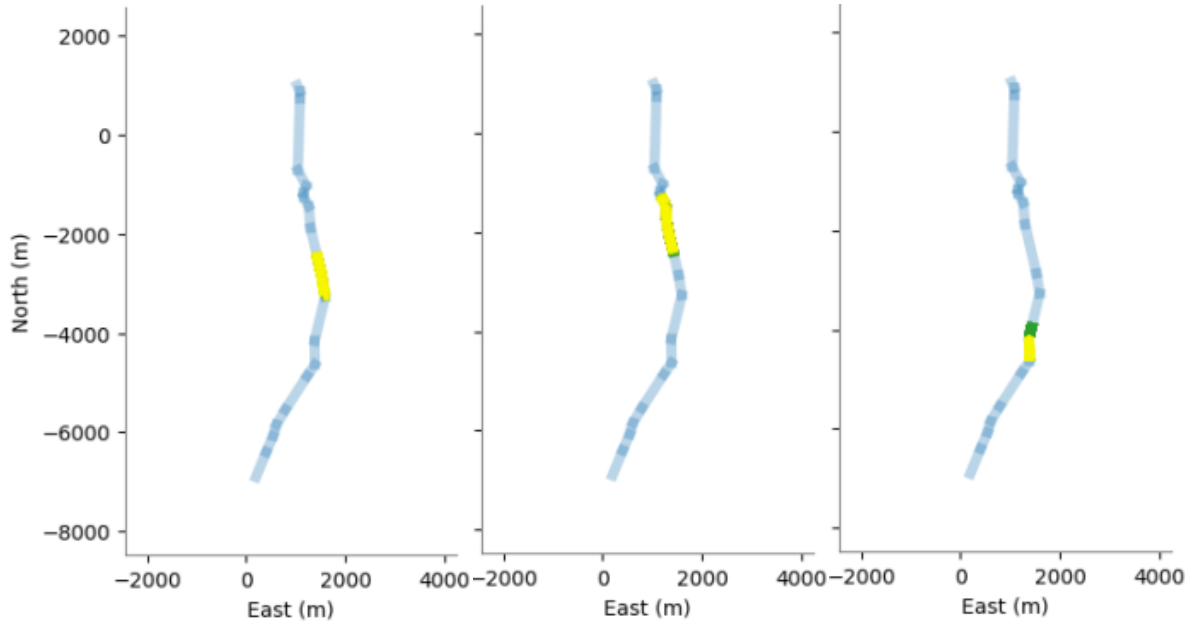

Figure 12: Yellow glare on Ranfurly Back Rd from PV08 (left), PV13 (centre), and PV06 (right). Other PV arrays caused additional glare on overlapping sections of the route. Full results are provided in Appendix A.

3.4.2 Backtracking rest angle mitigation

Most of the glare impact from single-axis tracking arrays occurs during backtracking. Limiting the minimum backtracking angle can significantly reduce glare. Assuming the chosen tracking system allows We modelled the array with several rest angles, and the glare results are summarised in Table 5 for a rest angle of 5° and in Table 6 for a rest angle of 10°. A rest angle of 10° eliminates all yellow glare.

Table 5: Glare results with 5 degree rest angle

Receptor	Coordinates / Location	Green (min/yr)	Yellow (min/yr)	Daily glare potential
OP05	-45.0868, 170.1291	151	4	Up to 1 minute of yellow glare between 4:30 pm and 5:30 pm, from 10 May to 9 June.
RT06	Ranfurly Naseby Rd	987	2,294	Up to 33 minutes of yellow glare between 7:30 am and 10:00 am, from 27 April to 16 August.
RT08	Ranfurly Back Rd	1,412	4,289	Up to 47 minutes of yellow glare between 10:30 am and 11:45 am, from 21 May to 23 July. Up to 47 minutes of yellow glare between 3:45 pm and 6:00 pm, from 20 April to 22 August.

Table 6: Glare results with 10 degree rest angle

Receptor	Coordinates / Location	Green (min/yr)	Yellow (min/yr)	Daily glare potential
RT08	Ranfurly Back Rd	1,266	0	Up to 30 minutes of green glare between 10:30 am and 11:45 am, from 21 May to 23 July.

3.4.3 Screening mitigation

Planting vegetation screens is an alternative mitigation measure. We built a model with selected receptors and a different set of obstructions[3] as shown in Figure 13. The model included about 5 km of new vegetation. The results of this model are summarised in Table 7 below and show that the proposed screens will provide effective mitigation. The residual glare is very low impact and does not require further mitigation.

Table 7: Glare results with additional screening

Receptor	Coordinates / Location	Green (min/yr)	Yellow (min/yr)	Daily glare potential
OP05	-45.087, 170.129	0	0	None
RT06	Ranfurly Naseby Rd	944	0	Up to 13 minutes of green glare between 7:45 am and 9:45 am, from 27 April to 16 August.
RT07	Bypass Rd	629	0	Up to 12 minutes of green glare between 8:30 am and 10:00 am, from 17 May to 27 July.
RT08	Ranfurly Back Rd	105	0	Up to 3 minutes of green glare between 4:45 pm and 6:15 pm, from 17 April to 24 May. Up to 3 minutes of green glare between 5:00 pm and 6:15 pm, from 19 July to 23 August.

[3] ForgeSolar allows a maximum of 10 obstruction objects in a single model

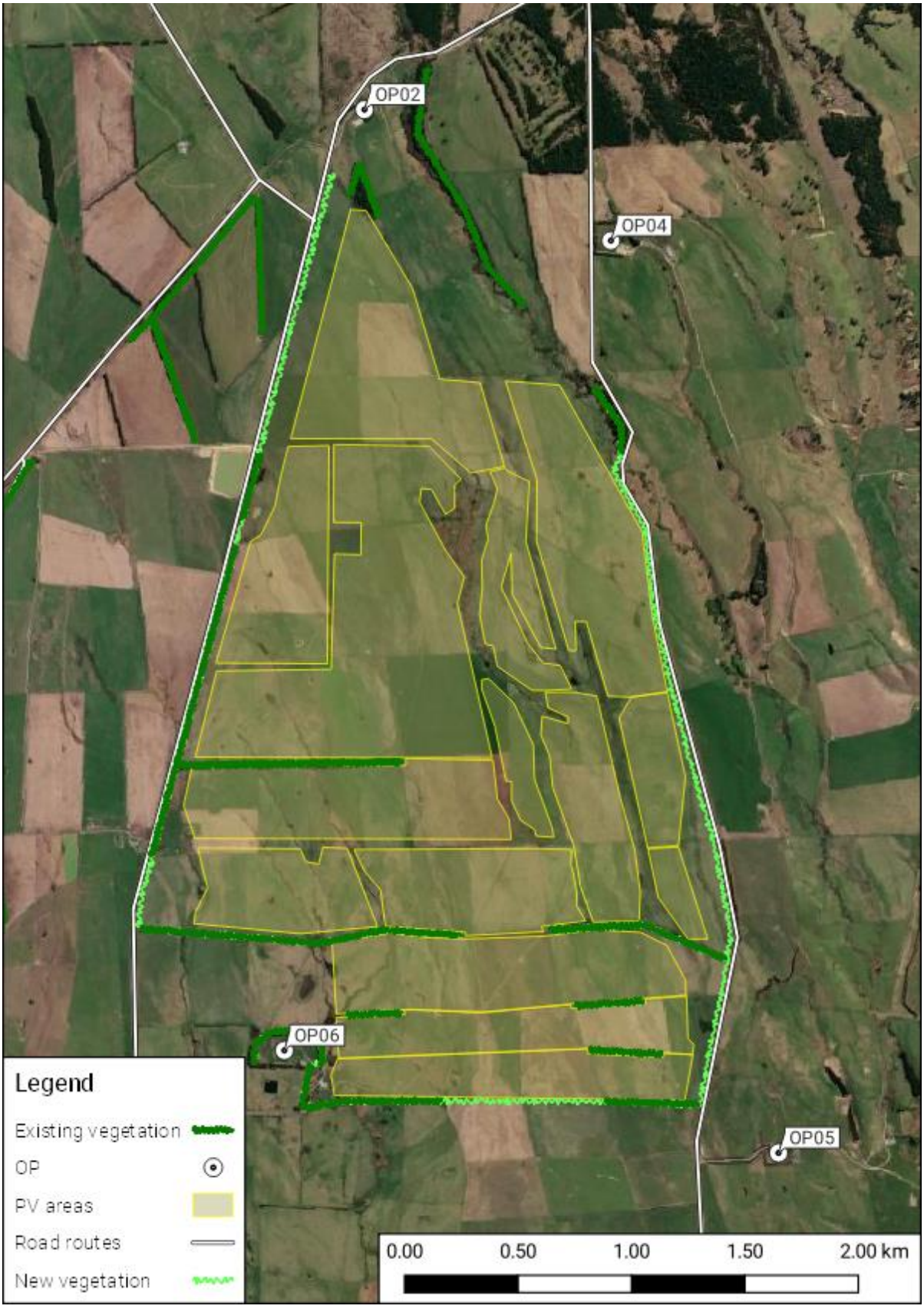

Figure 13: Extended vegetation screens with approximately 5 km new plantings The plantings include 1,750 m on the western edge, 2,200 m on the eastern edge, and 1,200 m on the southern edge.

4 SUMMARY

The results of the GlareGauge analysis indicated three observations points and four road routes received yellow glare. Yellow glare has the potential to cause afterimage to observers, while green glare has low potential to cause after image.

Ranfurly-Naseby Road and Ranfurly Back Road received the most glare, with up to 28 minutes and 55 minutes of yellow glare in a single day respectively. This glare is low to moderate impact due to the relatively low volume of local traffic. Mitigation is not required but could be considered to reduce the impact on local road users.

We assessed two mitigation options: limiting the backtracking angle, and planting vegetation screens. Limiting the backtracking angle significantly reduced the received glare. A rest angle of 10° eliminated all yellow glare. Vegetation screening could also be used to reduce glare. About 5 km of screening will substantially reduce received glare. Both options provide effective mitigation.

5 REFERENCES

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Thompson, R., Ave, I., Anne, D., Jan, M., David, S. and Robert, C., 2013. Interim policy, FAA review of solar energy system projects on federally obligated airports.

Barrett, S., Devita, P., Ho, C. and Miller, B., 2014. Energy technologies' compatibility with airports and airspace: Guidance for aviation and energy planners. Journal of Airport Management, 8(4), pp.318-326.

APPENDIX A. EXCLUDED ADDRESSES

Table 8: Excluded receptors

Receptor	Location	Justification
Exc 01	47 Wet Gully Road, Naseby	View of solar farm obscured by forest and topography
Exc 02	763 Ranfurly-Naseby Road	View of solar farm obscured by forest and topography
Exc 03	1 Wet Gully Road, Naseby	View of solar farm obscured by forest and topography
Exc 04	885 Ranfurly Back Road	View of solar farm obscured by forest and topography
Exc 05	793 Channel Road, Naseby	In a valley below the level of the array
Exc 06	788 Ranfurly Back Road	In a valley below the level of the array
Exc 07	873 Ranfurly-Naseby Road	View of solar farm obscured by forest and topography

APPENDIX B. FORGESOLAR GLARE ANALYSIS

We have attached the following analysis reports exported from ForgeSolar:

- **ForgeSolar – base case:** base case results described in 3.4.1
- **ForgeSolar – 5 deg rest angle:** analysis results for selected receptors with backtracking rest angle set to 5 degrees as described in 3.4.2
- **ForgeSolar – 10 deg rest angle:** analysis results for selected receptors with backtracking rest angle set to 10 degrees as described in 3.4.2
- **ForgeSolar – screening mitigation:** analysis results for selected receptors with vegetation screening as described in 3.4.3

FORGESOLAR GLARE ANALYSIS

Project: **23048 - Naseby SF**
Proposed 300 MW solar farm nearby Naseby, New Zealand.

Site configuration: **Naseby v2 - with luminance**

Client: Helios Energy

Site description: Updated model with eastern section broken into three sections based on slope change. Added luminance

Created 23 Aug, 2023
Updated 23 Aug, 2023
Time-step 1 minute
Timezone offset UTC12
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 100 MW to 1 GW
Site ID 98442.17105

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

Summary of Results

Glare with potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy	Peak Luminance
	°	°	min	hr	min	hr	kWh	cd/m²
PV01 North tip	SA tracking	SA tracking	657	10.9	1,287	21.4	-	1,978,383
PV02 Sub East	SA tracking	SA tracking	734	12.2	599	10.0	-	1,130,537
PV03 Sub West	SA tracking	SA tracking	961	16.0	1,354	22.6	-	2,152,888
PV04 West 1	SA tracking	SA tracking	80	1.3	35	0.6	-	1,258,215
PV05 West 2	SA tracking	SA tracking	375	6.2	753	12.6	-	1,621,580
PV06 South	SA tracking	SA tracking	4,146	69.1	2,460	41.0	-	2,226,401
PV07 Central 1	SA tracking	SA tracking	1,442	24.0	1	0.0	-	252,084
PV08 Central 2	SA tracking	SA tracking	1,916	31.9	1,434	23.9	-	1,251,087
PV09 Central 3	SA tracking	SA tracking	1,110	18.5	1,257	20.9	-	1,151,409
PV10 Central 4	SA tracking	SA tracking	262	4.4	5	0.1	-	292,414
PV11 East 1	SA tracking	SA tracking	1,413	23.6	510	8.5	-	1,562,785
PV12 East 2	SA tracking	SA tracking	338	5.6	393	6.5	-	2,113,375
PV13 East 3	SA tracking	SA tracking	1,790	29.8	3,144	52.4	-	3,312,700

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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT01 Ranfurly Wedderburn Rd	202	3.4	143	2.4
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0
RT03 Brinsdon Rd	0	0.0	0	0.0
RT04 Naseby Link Rd	0	0.0	0	0.0
RT05 Fennessy Rd	0	0.0	0	0.0
RT06 Ranfurly Naseby Rd	5,561	92.7	3,374	56.2
RT07 Bypass Rd	2,098	35.0	426	7.1

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT08 Ranfurly Back Rd	5,055	84.2	8,716	145.3
RT09 Glen Rd	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	684	11.4	408	6.8
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	349	5.8	0	0.0
OP 13	382	6.4	41	0.7
OP 14	361	6.0	0	0.0
OP 15	532	8.9	124	2.1
OP 16	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV01 North tip
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.048810	170.107064	560.00	1.70	561.70
2	-45.048874	170.107929	559.64	1.70	561.34
3	-45.052022	170.110373	559.00	1.70	560.70
4	-45.055653	170.111707	552.66	1.70	554.36
5	-45.055857	170.113963	554.00	1.70	555.70
6	-45.059202	170.115155	540.00	1.70	541.70
7	-45.059420	170.113270	539.00	1.70	540.70
8	-45.058011	170.111134	541.13	1.70	542.83
9	-45.057797	170.103258	546.00	1.70	547.70
10	-45.048810	170.107064	560.00	1.70	561.70

Name: PV02 Sub East
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.058092	170.105657	543.20	1.70	544.90
2	-45.058289	170.110985	540.00	1.70	541.70
3	-45.059642	170.112700	538.00	1.70	539.70
4	-45.059868	170.112336	538.00	1.70	539.70
5	-45.060793	170.112282	537.00	1.70	538.70
6	-45.061012	170.111761	537.00	1.70	538.70
7	-45.060007	170.111011	540.00	1.70	541.70
8	-45.059960	170.110454	539.00	1.70	540.70
9	-45.060506	170.110341	538.89	1.70	540.59
10	-45.062449	170.111690	535.40	1.70	537.10
11	-45.063515	170.112690	534.00	1.70	535.70
12	-45.064566	170.112248	532.00	1.70	533.70
13	-45.070734	170.113886	520.97	1.70	522.67
14	-45.070276	170.097282	520.00	1.70	521.70
15	-45.066897	170.098647	525.00	1.70	526.70
16	-45.066990	170.105054	528.51	1.70	530.21
17	-45.062432	170.105468	536.00	1.70	537.70
18	-45.062497	170.106947	536.00	1.70	537.70
19	-45.061230	170.107027	539.00	1.70	540.70
20	-45.061181	170.105492	538.12	1.70	539.82
21	-45.058092	170.105657	543.20	1.70	544.90

Name: PV03 Sub West
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.066581	170.098624	526.00	1.70	527.70
2	-45.066768	170.104852	530.00	1.70	531.70
3	-45.058124	170.105382	543.85	1.70	545.55
4	-45.058108	170.103096	545.00	1.70	546.70
5	-45.059332	170.102604	540.77	1.70	542.47
6	-45.060438	170.102246	539.00	1.70	540.70
7	-45.061561	170.101411	540.00	1.70	541.70
8	-45.061812	170.100812	539.87	1.70	541.57
9	-45.066581	170.098624	526.00	1.70	527.70

Name: PV04 West 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.073500	170.097099	517.00	1.70	518.70
2	-45.072170	170.096530	517.21	1.70	518.91
3	-45.070617	170.097082	519.00	1.70	520.70
4	-45.070902	170.109052	518.92	1.70	520.62
5	-45.070626	170.109053	519.00	1.70	520.70
6	-45.070826	170.113934	520.72	1.70	522.42
7	-45.072351	170.114093	519.00	1.70	520.70
8	-45.073172	170.114708	519.00	1.70	520.70
9	-45.073984	170.114786	518.00	1.70	519.70
10	-45.073500	170.097099	517.00	1.70	518.70

Name: PV05 West 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.073878	170.097237	516.61	1.70	518.31
2	-45.075202	170.097613	513.00	1.70	514.70
3	-45.075454	170.097712	512.04	1.70	513.74
4	-45.076438	170.096964	510.00	1.70	511.70
5	-45.076871	170.096879	509.00	1.70	510.70
6	-45.077419	170.102829	510.99	1.70	512.69
7	-45.077247	170.107133	512.97	1.70	514.67
8	-45.074105	170.105600	517.49	1.70	519.19
9	-45.074027	170.104231	519.08	1.70	520.78
10	-45.074687	170.103977	518.01	1.70	519.71
11	-45.074583	170.103269	517.00	1.70	518.70
12	-45.074053	170.102971	518.00	1.70	519.70
13	-45.073878	170.097237	516.61	1.70	518.31

Name: PV06 South
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.077761	170.104489	510.95	1.70	512.65
2	-45.080406	170.104589	499.25	1.70	500.95
3	-45.082428	170.104636	498.43	1.70	500.13
4	-45.083051	170.104219	497.00	1.70	498.70
5	-45.083870	170.104388	496.00	1.70	497.70
6	-45.084567	170.123974	496.09	1.70	497.79
7	-45.082358	170.124659	497.00	1.70	498.70
8	-45.082143	170.124309	497.00	1.70	498.70
9	-45.079934	170.124261	499.00	1.70	500.70
10	-45.078463	170.123307	503.68	1.70	505.38
11	-45.077837	170.121828	508.00	1.70	509.70
12	-45.077660	170.119401	509.00	1.70	510.70
13	-45.077805	170.116314	508.00	1.70	509.70
14	-45.077821	170.111947	509.00	1.70	510.70
15	-45.077694	170.109540	511.00	1.70	512.70
16	-45.077496	170.107925	512.06	1.70	513.76
17	-45.077761	170.104489	510.95	1.70	512.65

Name: PV07 Central 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.074164	170.105978	518.31	1.70	520.01
2	-45.075052	170.106525	518.00	1.70	519.70
3	-45.075800	170.107369	518.93	1.70	520.63
4	-45.077242	170.107573	513.09	1.70	514.79
5	-45.077687	170.111929	509.85	1.70	511.55
6	-45.077798	170.111925	509.00	1.70	510.70
7	-45.077745	170.116259	508.00	1.70	509.70
8	-45.077576	170.116290	509.00	1.70	510.70
9	-45.077468	170.118747	509.41	1.70	511.11
10	-45.076698	170.118305	512.00	1.70	513.70
11	-45.076165	170.118344	513.67	1.70	515.37
12	-45.075440	170.118197	515.02	1.70	516.72
13	-45.075073	170.118078	516.00	1.70	517.70
14	-45.074471	170.118147	517.90	1.70	519.60
15	-45.074382	170.116202	519.00	1.70	520.70
16	-45.074164	170.105978	518.31	1.70	520.01

Name: PV08 Central 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.077370	170.119202	510.00	1.70	511.70
2	-45.077406	170.121778	509.00	1.70	510.70
3	-45.076257	170.121897	513.00	1.70	514.70
4	-45.074586	170.121680	517.00	1.70	518.70
5	-45.072495	170.120974	518.00	1.70	519.70
6	-45.068427	170.119851	519.00	1.70	520.70
7	-45.068239	170.118583	519.00	1.70	520.70
8	-45.068201	170.116987	521.41	1.70	523.11
9	-45.068826	170.117113	519.00	1.70	520.70
10	-45.069221	170.118239	519.00	1.70	520.70
11	-45.069473	170.118187	519.00	1.70	520.70
12	-45.069147	170.116760	520.00	1.70	521.70
13	-45.069880	170.116650	519.00	1.70	520.70
14	-45.070723	170.117101	519.00	1.70	520.70
15	-45.071987	170.117217	519.00	1.70	520.70
16	-45.074311	170.118267	517.50	1.70	519.20
17	-45.075963	170.118570	514.00	1.70	515.70
18	-45.077370	170.119202	510.00	1.70	511.70

Name: PV09 Central 3
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.059387	170.114333	539.00	1.70	540.70
2	-45.059265	170.115199	540.00	1.70	541.70
3	-45.059380	170.115304	540.00	1.70	541.70
4	-45.059840	170.116514	540.81	1.70	542.51
5	-45.062208	170.116207	540.00	1.70	541.70
6	-45.066512	170.117671	531.00	1.70	532.70
7	-45.066430	170.116825	530.00	1.70	531.70
8	-45.064261	170.115332	535.00	1.70	536.70
9	-45.062652	170.115352	538.00	1.70	539.70
10	-45.063968	170.114731	535.00	1.70	536.70
11	-45.066216	170.116088	530.00	1.70	531.70
12	-45.067044	170.116923	527.93	1.70	529.63
13	-45.067168	170.117884	525.46	1.70	527.16
14	-45.068115	170.118464	520.00	1.70	521.70
15	-45.068136	170.116977	522.00	1.70	523.70
16	-45.068106	170.116241	522.46	1.70	524.16
17	-45.067109	170.114353	526.11	1.70	527.81
18	-45.066313	170.114171	528.00	1.70	529.70
19	-45.066204	170.113725	528.71	1.70	530.41
20	-45.065023	170.113472	531.46	1.70	533.16
21	-45.063966	170.113673	534.00	1.70	535.70
22	-45.062887	170.113691	536.00	1.70	537.70
23	-45.062067	170.114091	537.00	1.70	538.70
24	-45.061501	170.114006	537.00	1.70	538.70
25	-45.060574	170.114526	538.29	1.70	539.99
26	-45.060069	170.114712	539.00	1.70	540.70
27	-45.059387	170.114333	539.00	1.70	540.70

Name: PV10 Central 4
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.067625	170.113453	525.05	1.70	526.75
2	-45.067579	170.113839	525.00	1.70	526.70
3	-45.068602	170.115217	522.00	1.70	523.70
4	-45.070279	170.116219	520.00	1.70	521.70
5	-45.071627	170.116210	520.00	1.70	521.70
6	-45.073577	170.117104	520.00	1.70	521.70
7	-45.073960	170.117165	520.00	1.70	521.70
8	-45.073887	170.116186	519.00	1.70	520.70
9	-45.073631	170.116120	519.92	1.70	521.62
10	-45.073251	170.115361	519.00	1.70	520.70
11	-45.072455	170.114882	520.00	1.70	521.70
12	-45.071689	170.114918	520.00	1.70	521.70
13	-45.071665	170.114607	520.00	1.70	521.70
14	-45.069486	170.114103	523.00	1.70	524.70
15	-45.067987	170.113436	525.00	1.70	526.70
16	-45.067625	170.113453	525.05	1.70	526.75

Name: PV11 East 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.074546	170.122412	517.00	1.70	518.70
2	-45.074523	170.124127	519.00	1.70	520.70
3	-45.078347	170.125719	505.41	1.70	507.11
4	-45.078273	170.124324	504.09	1.70	505.79
5	-45.076486	170.122886	512.00	1.70	513.70
6	-45.074546	170.122412	517.00	1.70	518.70

Name: PV12 East 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.074469	170.124124	519.00	1.70	520.70
2	-45.074519	170.122397	517.00	1.70	518.70
3	-45.069331	170.121063	520.00	1.70	521.70
4	-45.068515	170.121784	523.00	1.70	524.70
5	-45.068389	170.123809	524.00	1.70	525.70
6	-45.071765	170.124656	521.00	1.70	522.70
7	-45.074469	170.124124	519.00	1.70	520.70

Name: PV13 East 3
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.055819	170.115377	554.65	1.70	556.35
2	-45.056058	170.118403	550.84	1.70	552.54
3	-45.061992	170.122721	540.00	1.70	541.70
4	-45.065305	170.123117	535.00	1.70	536.70
5	-45.068352	170.123810	524.00	1.70	525.70
6	-45.068521	170.121770	523.00	1.70	524.70
7	-45.068451	170.120486	520.68	1.70	522.38
8	-45.065467	170.119421	536.92	1.70	538.62
9	-45.065450	170.118805	535.00	1.70	536.70
10	-45.066604	170.118794	530.05	1.70	531.75
11	-45.066593	170.118385	530.35	1.70	532.05
12	-45.062204	170.116797	540.00	1.70	541.70
13	-45.059790	170.116950	541.00	1.70	542.70
14	-45.055819	170.115377	554.65	1.70	556.35

Route Receptors

Name: RT01 Ranfurly Wedderburn Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.109780	170.095016	455.00	1.50	456.50
2	-45.106423	170.095169	459.12	1.50	460.62
3	-45.104088	170.095173	462.00	1.50	463.50
4	-45.094654	170.093592	479.00	1.50	480.50
5	-45.092635	170.093292	484.00	1.50	485.50
6	-45.088769	170.093017	495.92	1.50	497.42
7	-45.079549	170.080539	500.00	1.50	501.50
8	-45.073362	170.075044	514.00	1.50	515.50
9	-45.057432	170.063924	543.00	1.50	544.50

Name: RT02 Gimmerburn Naseby Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.089776	170.066142	485.00	1.50	486.50
2	-45.086784	170.068160	490.94	1.50	492.44
3	-45.085296	170.068661	493.00	1.50	494.50
4	-45.080378	170.070329	500.00	1.50	501.50
5	-45.079302	170.070760	502.09	1.50	503.59
6	-45.072765	170.074522	515.00	1.50	516.50
7	-45.068995	170.078109	520.00	1.50	521.50
8	-45.065290	170.081673	528.00	1.50	529.50
9	-45.059834	170.087165	542.94	1.50	544.44
10	-45.058677	170.088145	546.00	1.50	547.50
11	-45.058385	170.088330	547.00	1.50	548.50
12	-45.058179	170.088207	548.00	1.50	549.50
13	-45.053802	170.093733	554.00	1.50	555.50
14	-45.050658	170.097967	559.00	1.50	560.50
15	-45.047508	170.102018	564.00	1.50	565.50

Name: RT03 Brinsdon Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.074077	170.058844	513.91	1.50	515.41
2	-45.074119	170.073767	512.00	1.50	513.50

Name: RT04 Naseby Link Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.057844	170.064157	542.00	1.50	543.50
2	-45.057842	170.072756	540.00	1.50	541.50
3	-45.057959	170.074150	540.00	1.50	541.50
4	-45.058833	170.075780	538.00	1.50	539.50
5	-45.060661	170.078560	535.00	1.50	536.50
6	-45.061042	170.080106	536.75	1.50	538.25
7	-45.061448	170.081421	537.00	1.50	538.50
8	-45.061227	170.082417	537.00	1.50	538.50
9	-45.060357	170.083409	538.00	1.50	539.50
10	-45.059955	170.085011	540.00	1.50	541.50
11	-45.059503	170.086495	541.85	1.50	543.35
12	-45.058241	170.088137	547.45	1.50	548.95

Name: RT05 Fennessy Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.025447	170.093573	616.00	1.50	617.50
2	-45.029547	170.092947	607.00	1.50	608.50
3	-45.034376	170.092044	598.00	1.50	599.50
4	-45.034933	170.092038	597.00	1.50	598.50
5	-45.037227	170.093838	594.00	1.50	595.50
6	-45.047463	170.101965	564.55	1.50	566.05
7	-45.049198	170.105046	559.00	1.50	560.50

Name: RT06 Ranfurly Naseby Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.088762	170.093057	495.90	1.50	497.40
2	-45.088559	170.093340	495.00	1.50	496.50
3	-45.083567	170.093306	498.54	1.50	500.04
4	-45.076195	170.093507	514.31	1.50	515.81
5	-45.064414	170.098616	533.00	1.50	534.50
6	-45.049207	170.104952	559.00	1.50	560.50
7	-45.045288	170.106531	578.00	1.50	579.50
8	-45.043605	170.108391	582.61	1.50	584.11
9	-45.042911	170.109898	578.00	1.50	579.50
10	-45.042701	170.112146	581.00	1.50	582.50
11	-45.040076	170.119316	581.26	1.50	582.76
12	-45.039086	170.121036	573.79	1.50	575.29
13	-45.036813	170.122208	575.35	1.50	576.85

Name: RT07 Bypass Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.090972	170.093365	489.00	1.50	490.50
2	-45.090933	170.094195	488.03	1.50	489.53
3	-45.090541	170.095555	487.13	1.50	488.63
4	-45.090748	170.095959	486.29	1.50	487.79
5	-45.092727	170.098722	480.00	1.50	481.50
6	-45.096583	170.104503	475.00	1.50	476.50
7	-45.102925	170.114345	464.00	1.50	465.50
8	-45.107526	170.121563	460.00	1.50	461.50
9	-45.109497	170.124524	459.00	1.50	460.50
10	-45.111562	170.126137	459.00	1.50	460.50

Name: RT08 Ranfurly Back Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.110942	170.109556	453.00	1.50	454.50
2	-45.106389	170.112183	459.47	1.50	460.97
3	-45.103451	170.113954	463.00	1.50	464.50
4	-45.101418	170.114791	467.00	1.50	468.50
5	-45.098679	170.117079	472.00	1.50	473.50
6	-45.092570	170.122667	479.00	1.50	480.50
7	-45.090513	170.124641	483.72	1.50	485.22
8	-45.086188	170.124560	495.00	1.50	496.50
9	-45.078203	170.127255	507.00	1.50	508.50
10	-45.074559	170.126436	520.00	1.50	521.50
11	-45.065651	170.123519	532.41	1.50	533.91
12	-45.061721	170.123052	539.81	1.50	541.31
13	-45.060075	170.121789	539.00	1.50	540.50
14	-45.059289	170.121752	537.01	1.50	538.51
15	-45.058024	170.122386	541.00	1.50	542.50
16	-45.055187	170.120273	549.99	1.50	551.49
17	-45.042159	170.120795	580.14	1.50	581.64
18	-45.040809	170.120798	580.00	1.50	581.50
19	-45.039777	170.120105	579.47	1.50	580.97

Name: RT09 Glen Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.109508	170.124593	459.00	1.50	460.50
2	-45.109465	170.124765	459.00	1.50	460.50
3	-45.107210	170.126279	459.00	1.50	460.50
4	-45.100395	170.126269	469.00	1.50	470.50
5	-45.099159	170.126246	472.00	1.50	473.50
6	-45.096952	170.127240	479.00	1.50	480.50

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-45.074452	170.064201	512.27	1.65
OP 2	2	-45.044875	170.108039	583.00	1.65
OP 3	3	-45.039527	170.117557	587.77	1.65
OP 4	4	-45.050412	170.121556	561.68	1.65
OP 5	5	-45.086779	170.129115	500.00	1.65
OP 6	6	-45.082021	170.101672	501.00	1.65
OP 7	7	-45.105774	170.121637	462.00	1.65
OP 8	8	-45.104479	170.127759	463.00	1.65
OP 9	9	-45.109701	170.122528	460.00	1.65
OP 10	10	-45.107832	170.102654	460.00	1.65
OP 11	11	-45.107370	170.087644	459.00	1.65
OP 12	12	-45.102070	170.087308	480.00	1.65
OP 13	13	-45.095882	170.090288	480.00	1.65
OP 14	14	-45.096945	170.097625	474.00	1.65
OP 15	15	-45.090592	170.094064	489.55	1.65
OP 16	16	-45.091058	170.070581	482.00	1.65

Obstruction Components

Name: OB01 Ex NE1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.056187	170.120305	540.34
2	-45.057823	170.121804	540.00
3	-45.058808	170.121676	538.86

Name: OB02 Ex N
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.048246	170.107048	562.03
2	-45.046986	170.107665	579.53
3	-45.049138	170.108595	560.72

Name: OB03 Ex W1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.074114	170.094634	516.00
2	-45.071887	170.095596	516.00
3	-45.070591	170.096190	518.00
4	-45.070757	170.108834	519.00
5	-45.070560	170.096210	518.00
6	-45.063423	170.099327	536.00
7	-45.061971	170.099974	538.29

Name: OB04 Ex W2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.058355	170.101524	545.00
2	-45.059423	170.101085	542.00

Name: OB05 Ex NE2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.043322	170.111633	579.75
2	-45.045873	170.110932	579.00
3	-45.049014	170.113476	559.69
4	-45.051380	170.114700	558.94
5	-45.052886	170.116610	559.00

Name: OB06 Ex NW1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.053549	170.101874	554.10
2	-45.048337	170.101916	563.00
3	-45.048180	170.101671	563.66
4	-45.052816	170.095785	556.00
5	-45.057789	170.097936	546.00
6	-45.052827	170.095750	556.00
7	-45.053708	170.094431	554.00

Name: OB07 Ex W3
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.058277	170.088758	546.31
2	-45.063060	170.084202	535.00
3	-45.065744	170.083580	528.00
4	-45.072948	170.085906	519.52
5	-45.076330	170.086244	519.00
6	-45.077978	170.085673	516.00
7	-45.078899	170.084814	511.92
8	-45.081626	170.083884	501.94

Name: OB08 Ex SW1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.082474	170.103800	499.00
2	-45.081301	170.103779	499.00
3	-45.081248	170.100933	500.18
4	-45.081765	170.100039	499.00
5	-45.082490	170.099964	498.00

Name: OB09 Ex S
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.091392	170.109269	482.00
2	-45.093804	170.110395	478.00
3	-45.096578	170.109851	474.00
4	-45.096506	170.118238	475.64

Name: OB10 Ex SW2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.082409	170.083641	500.03
2	-45.084314	170.082899	500.00
3	-45.086260	170.082823	500.00
4	-45.087188	170.081636	500.00
5	-45.087976	170.081148	500.00
6	-45.089212	170.080838	495.63
7	-45.090511	170.080880	489.00
8	-45.092183	170.079720	485.00
9	-45.094879	170.078306	480.00
10	-45.096227	170.078758	481.00

Glare Analysis Results

Summary of Results

Glare with potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy	Peak Luminance
	°	°	min	hr	min	hr	kWh	cd/m^2
PV01 North tip	SA tracking	SA tracking	657	10.9	1,287	21.4	-	1,978,383
PV02 Sub East	SA tracking	SA tracking	734	12.2	599	10.0	-	1,130,537
PV03 Sub West	SA tracking	SA tracking	961	16.0	1,354	22.6	-	2,152,888
PV04 West 1	SA tracking	SA tracking	80	1.3	35	0.6	-	1,258,215
PV05 West 2	SA tracking	SA tracking	375	6.2	753	12.6	-	1,621,580
PV06 South	SA tracking	SA tracking	4,146	69.1	2,460	41.0	-	2,226,401
PV07 Central 1	SA tracking	SA tracking	1,442	24.0	1	0.0	-	252,084
PV08 Central 2	SA tracking	SA tracking	1,916	31.9	1,434	23.9	-	1,251,087
PV09 Central 3	SA tracking	SA tracking	1,110	18.5	1,257	20.9	-	1,151,409
PV10 Central 4	SA tracking	SA tracking	262	4.4	5	0.1	-	292,414
PV11 East 1	SA tracking	SA tracking	1,413	23.6	510	8.5	-	1,562,785
PV12 East 2	SA tracking	SA tracking	338	5.6	393	6.5	-	2,113,375
PV13 East 3	SA tracking	SA tracking	1,790	29.8	3,144	52.4	-	3,312,700

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

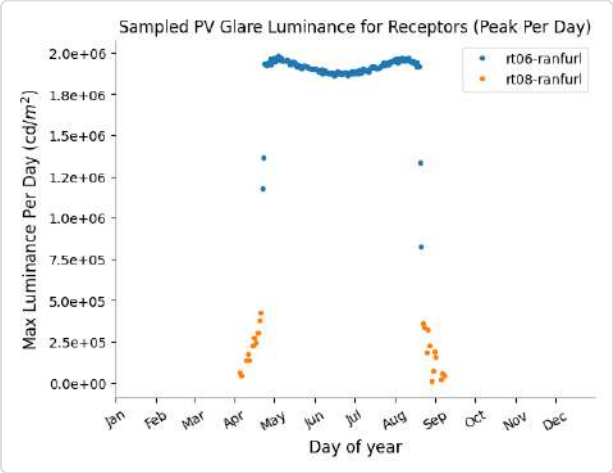
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT01 Ranfurly Wedderburn Rd	202	3.4	143	2.4
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0
RT03 Brinsdon Rd	0	0.0	0	0.0
RT04 Naseby Link Rd	0	0.0	0	0.0
RT05 Fennessy Rd	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT06 Ranfurly Naseby Rd	5,561	92.7	3,374	56.2
RT07 Bypass Rd	2,098	35.0	426	7.1
RT08 Ranfurly Back Rd	5,055	84.2	8,716	145.3
RT09 Glen Rd	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	684	11.4	408	6.8
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	349	5.8	0	0.0
OP 13	382	6.4	41	0.7
OP 14	361	6.0	0	0.0
OP 15	532	8.9	124	2.1
OP 16	0	0.0	0	0.0

PV: PV01 North tip potential temporary after-image

Receptor results ordered by category of glare

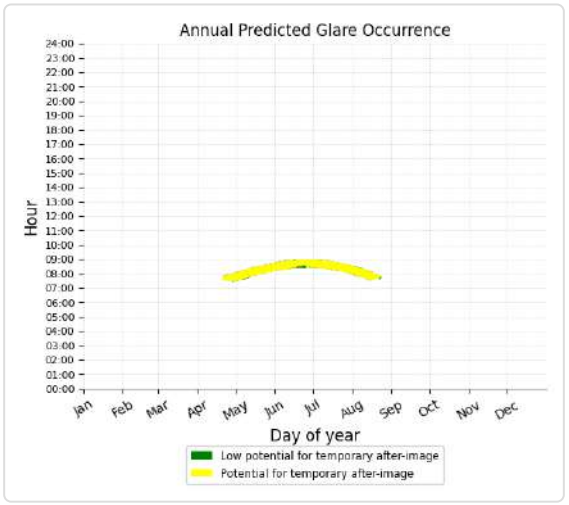
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	295	4.9	1,061	17.7	1,978,383
RT08 Ranfurly Back Rd	362	6.0	226	3.8	841,082
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

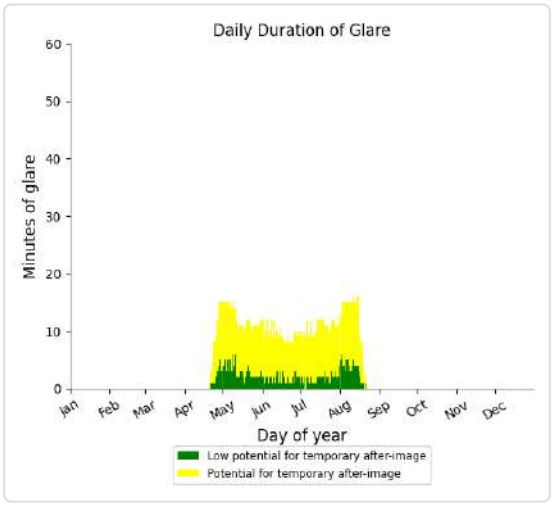

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt06-ranfurl
rt08-ranfurl
Max Luminance Per Day (cd/m²)
2.0e+06
1.8e+06
1.5e+06
1.2e+06
1.0e+06
7.5e+05
5.0e+05
2.5e+05
0.0e+00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

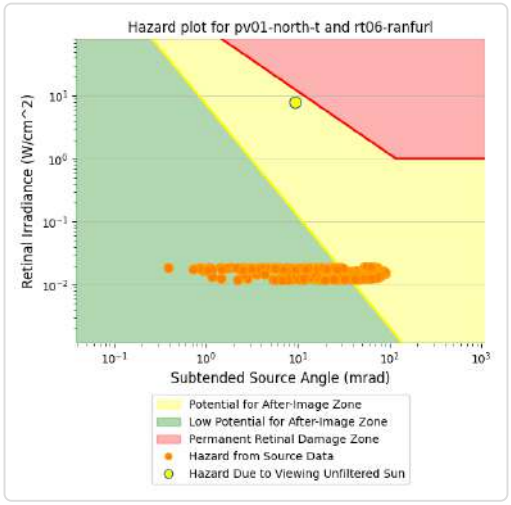
PV01 North tip and Route: RT06 Ranfurly Naseby Rd

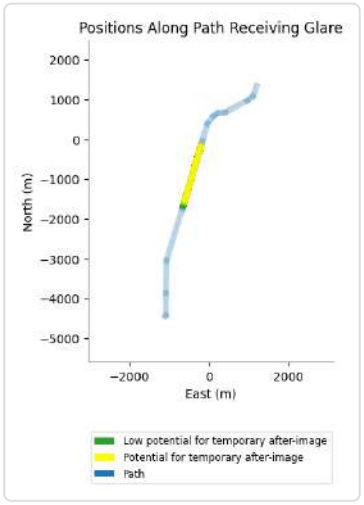
Yellow glare: 1,061 min.

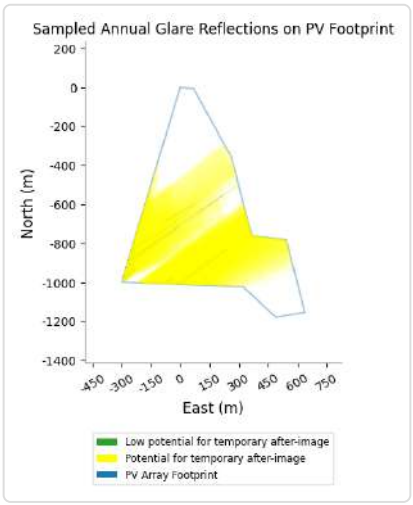
Green glare: 295 min.

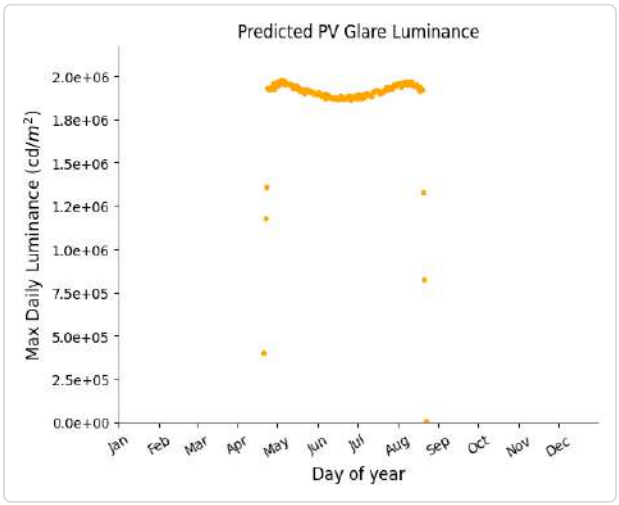








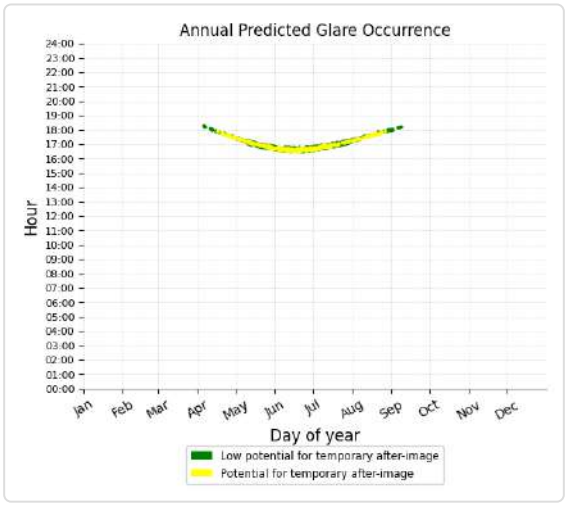


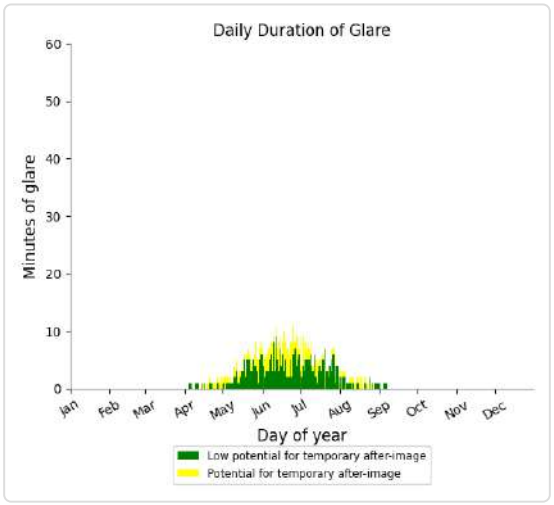


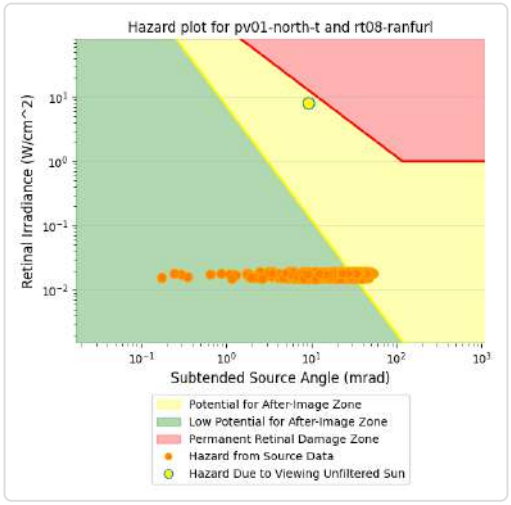
PV01 North tip and Route: RT08 Ranfurly Back Rd

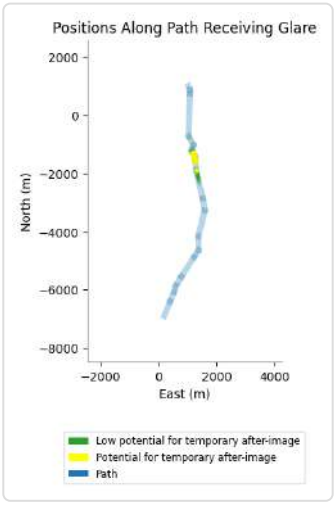
Yellow glare: 226 min.

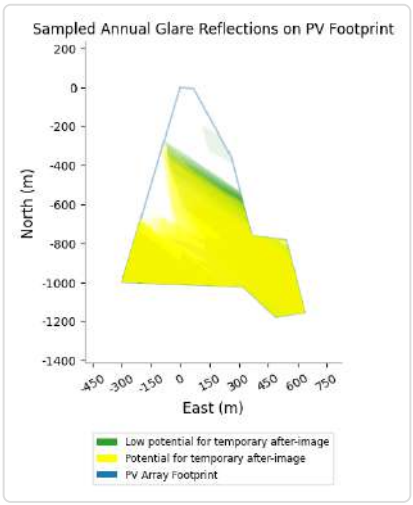
Green glare: 362 min.

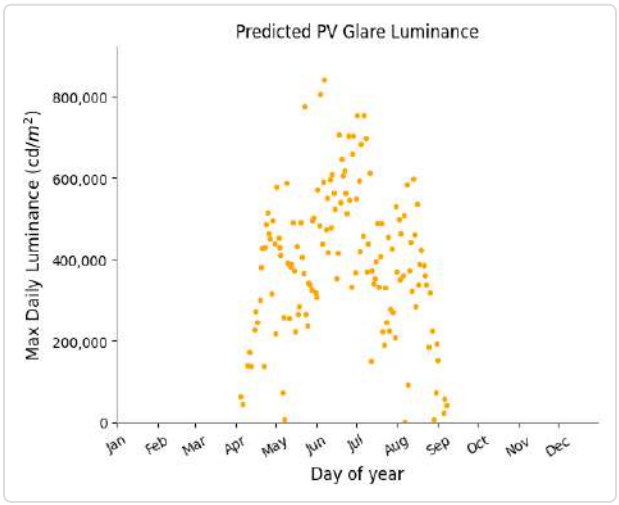












PV01 North tip and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV01 North tip and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV01 North tip and Route: RT03 Brinsdon Rd

No glare found

PV01 North tip and Route: RT04 Naseby Link Rd

No glare found

PV01 North tip and Route: RT05 Fennessy Rd

No glare found

PV01 North tip and Route: RT07 Bypass Rd

No glare found

PV01 North tip and Route: RT09 Glen Rd

No glare found

PV01 North tip and OP 1

No glare found

PV01 North tip and OP 2

No glare found

PV01 North tip and OP 3

No glare found

PV01 North tip and OP 4

No glare found

PV01 North tip and OP 5

No glare found

PV01 North tip and OP 6

No glare found

PV01 North tip and OP 7

No glare found

PV01 North tip and OP 8

No glare found

PV01 North tip and OP 9

No glare found

PV01 North tip and OP 10

No glare found

PV01 North tip and OP 11

No glare found

PV01 North tip and OP 12

No glare found

PV01 North tip and OP 13

No glare found

PV01 North tip and OP 14

No glare found

PV01 North tip and OP 15

No glare found

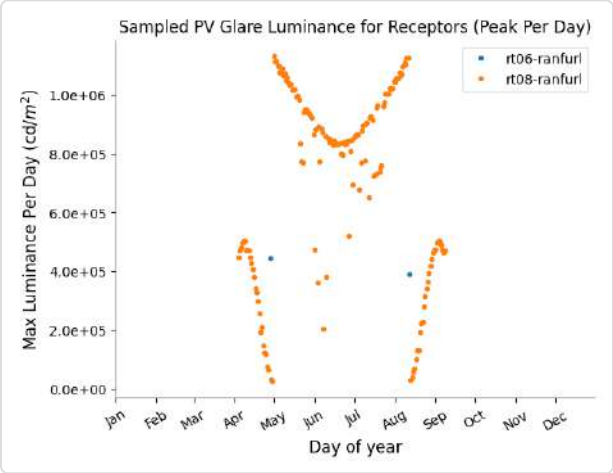
PV01 North tip and OP 16

No glare found

PV: PV02 Sub East potential temporary after-image

Receptor results ordered by category of glare

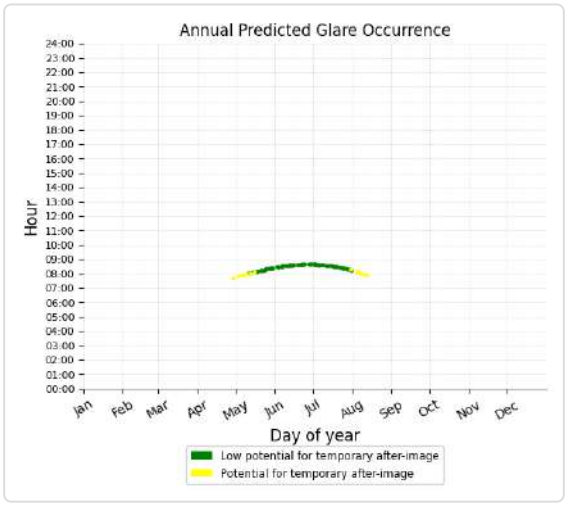
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	89	1.5	13	0.2	442,655
RT08 Ranfurly Back Rd	565	9.4	586	9.8	1,130,537
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 5	80	1.3	0	0.0	30,233
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

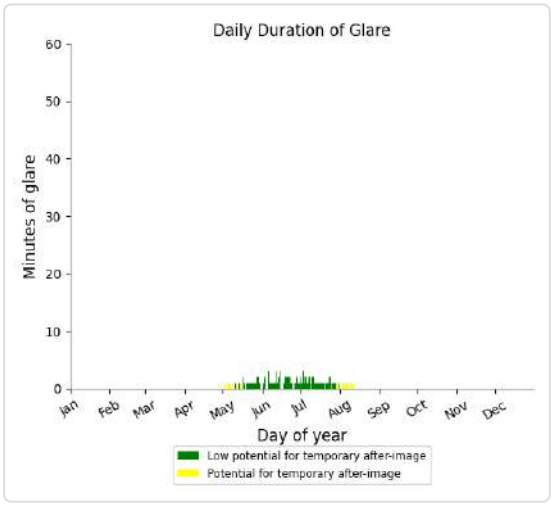

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt06-ranfurl
rt08-ranfurl
Max Luminance Per Day (cd/m²)
1.0e+06
8.0e+05
6.0e+05
4.0e+05
2.0e+05
0.0e+00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

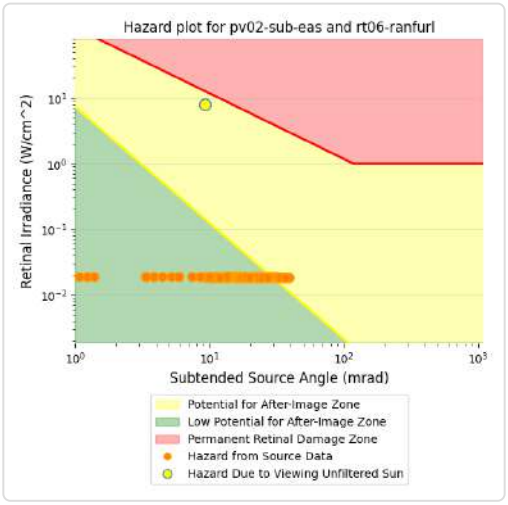
PV02 Sub East and Route: RT06 Ranfurly Naseby Rd

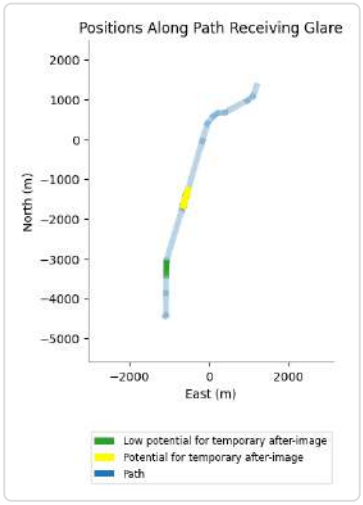
Yellow glare: 13 min.

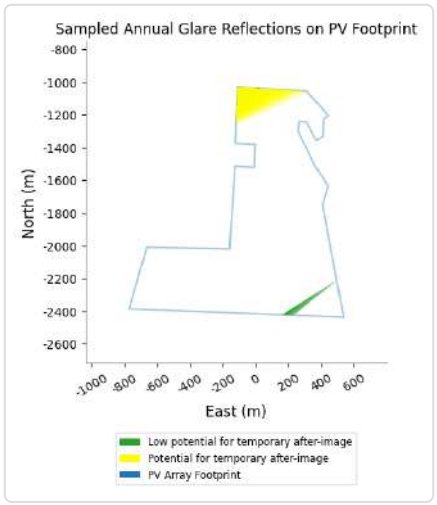
Green glare: 89 min.

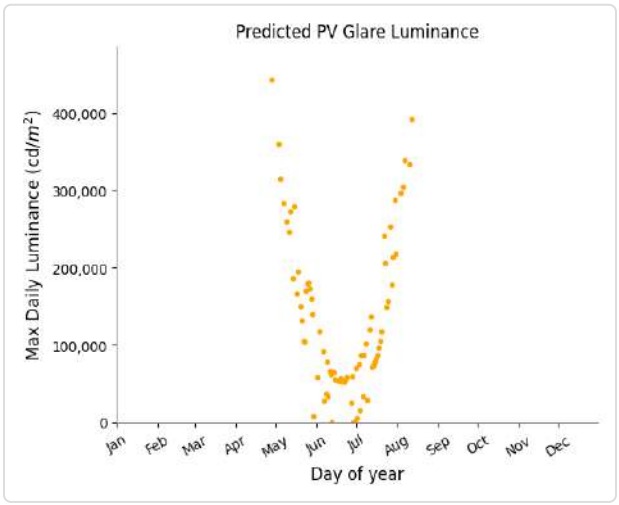








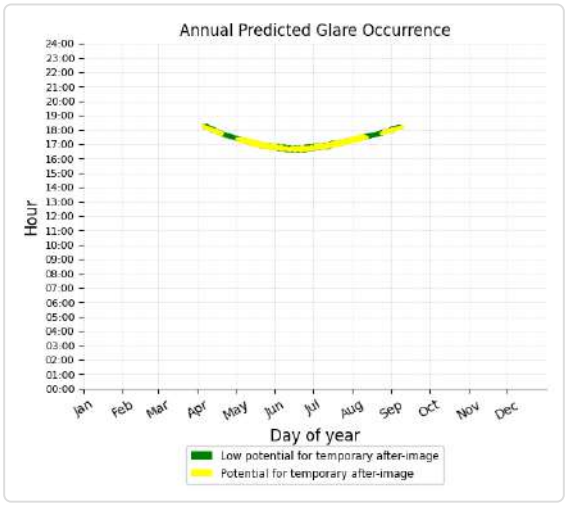


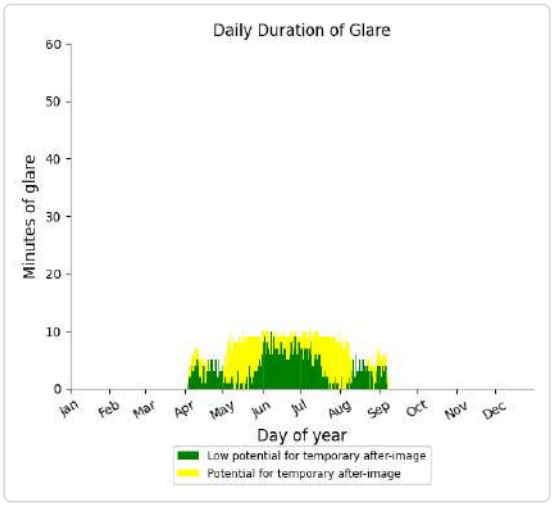


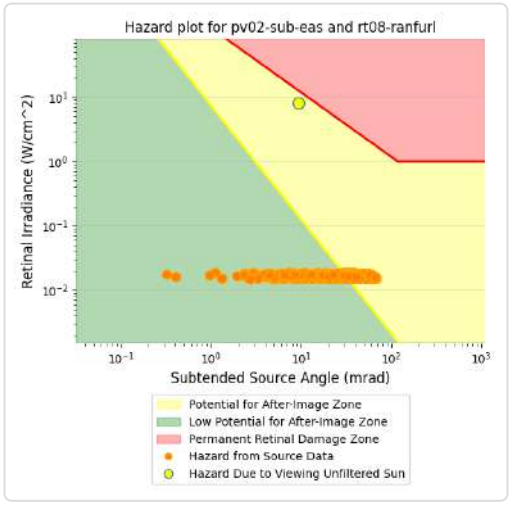
PV02 Sub East and Route: RT08 Ranfurly Back Rd

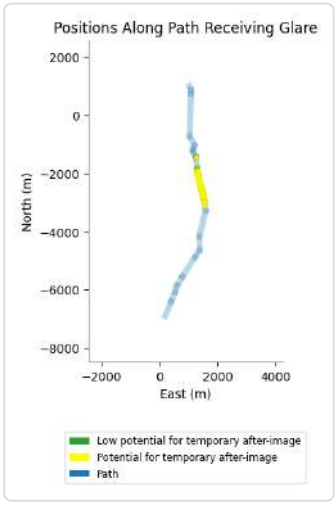
Yellow glare: 586 min.

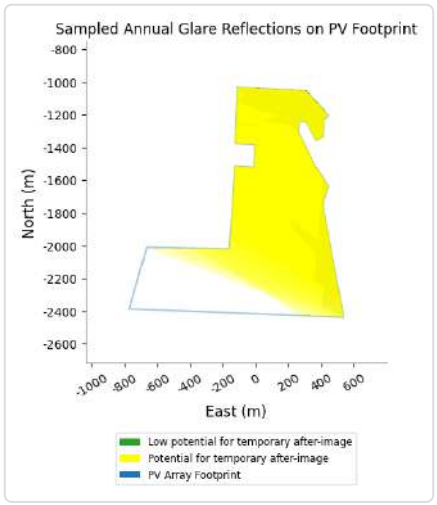
Green glare: 565 min.

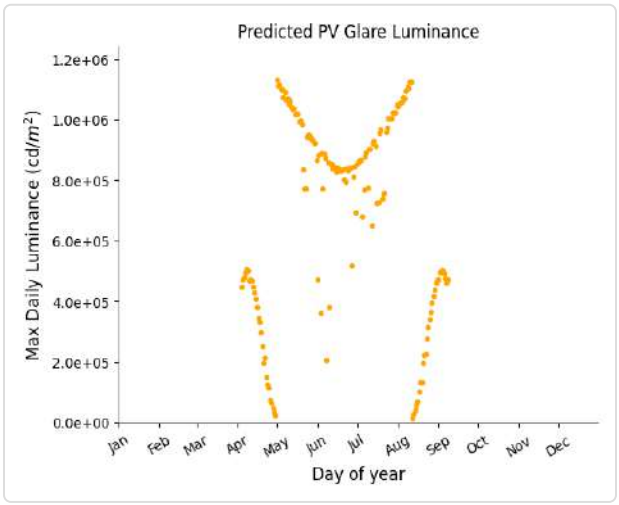












PV02 Sub East and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV02 Sub East and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV02 Sub East and Route: RT03 Brinsdon Rd

No glare found

PV02 Sub East and Route: RT04 Naseby Link Rd

No glare found

PV02 Sub East and Route: RT05 Fennessy Rd

No glare found

PV02 Sub East and Route: RT07 Bypass Rd

No glare found

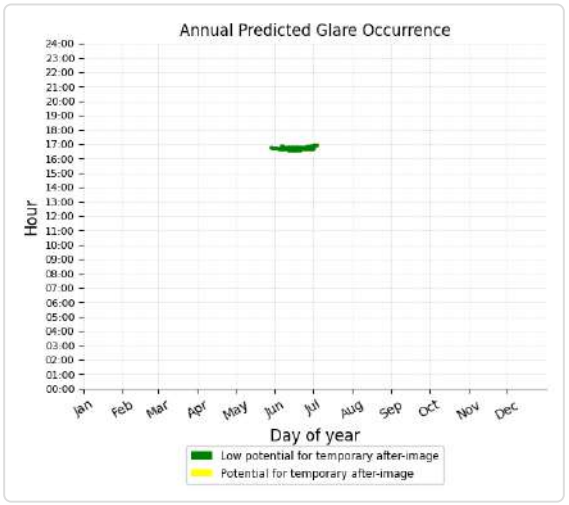
PV02 Sub East and Route: RT09 Glen Rd

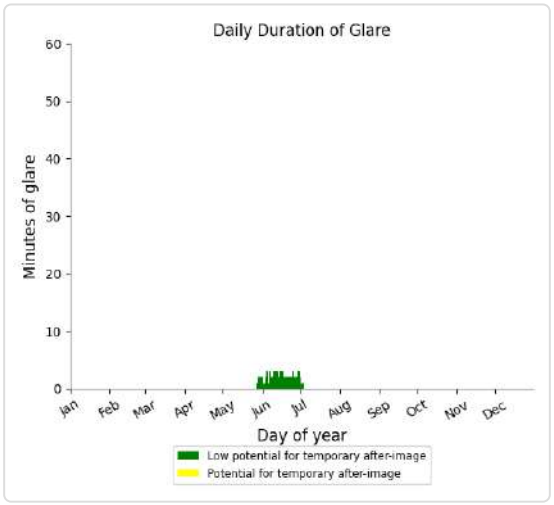
No glare found

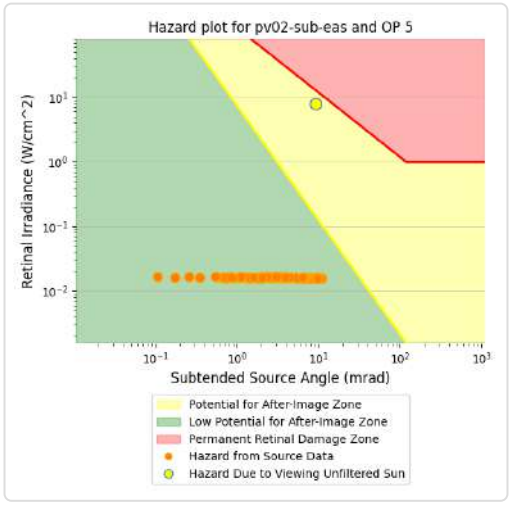
PV02 Sub East and OP 5

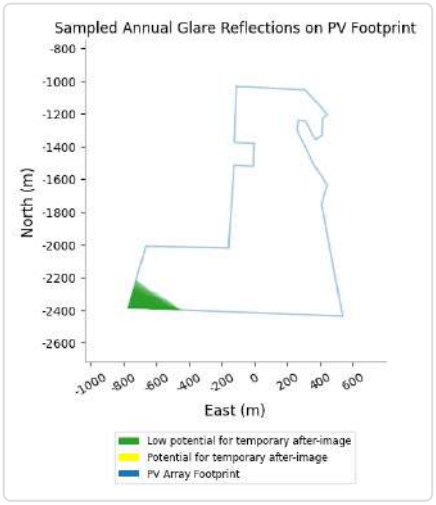
Yellow glare: none

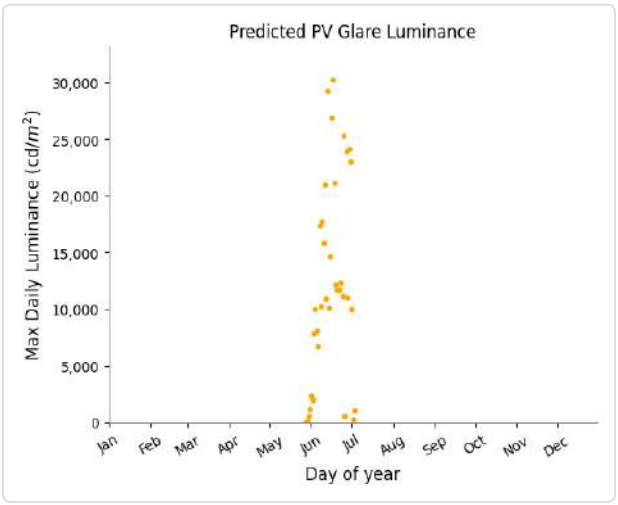
Green glare: 80 min.











PV02 Sub East and OP 1

No glare found

PV02 Sub East and OP 2

No glare found

PV02 Sub East and OP 3

No glare found

PV02 Sub East and OP 4

No glare found

PV02 Sub East and OP 6

No glare found

PV02 Sub East and OP 7

No glare found

PV02 Sub East and OP 8

No glare found

PV02 Sub East and OP 9

No glare found

PV02 Sub East and OP 10

No glare found

PV02 Sub East and OP 11

No glare found

PV02 Sub East and OP 12

No glare found

PV02 Sub East and OP 13

No glare found

PV02 Sub East and OP 14

No glare found

PV02 Sub East and OP 15

No glare found

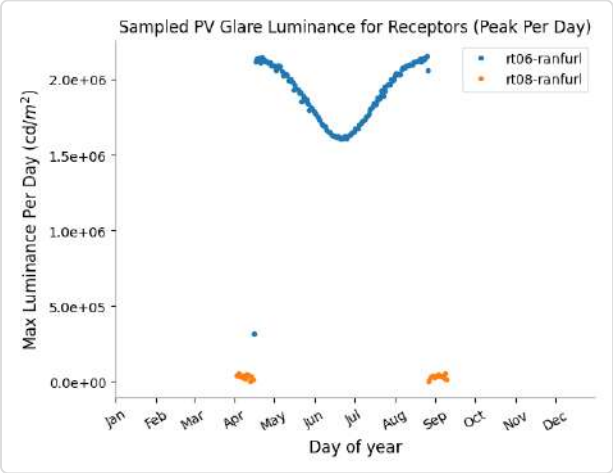
PV02 Sub East and OP 16

No glare found

PV: PV03 Sub West potential temporary after-image

Receptor results ordered by category of glare

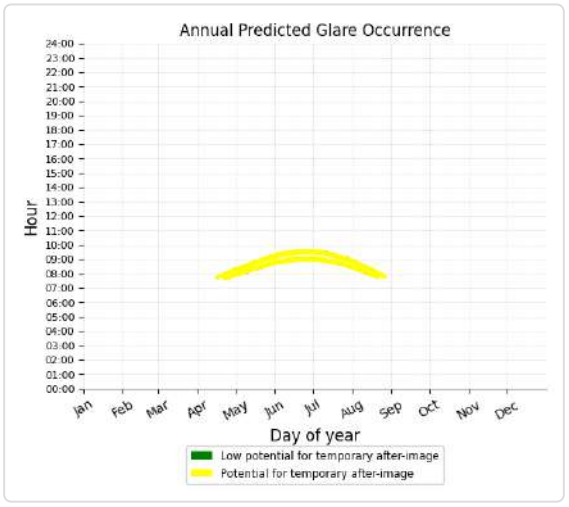
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	18	0.3	1,086	18.1	2,152,888
RT08 Ranfurly Back Rd	924	15.4	268	4.5	539,163
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 5	19	0.3	0	0.0	65,542
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

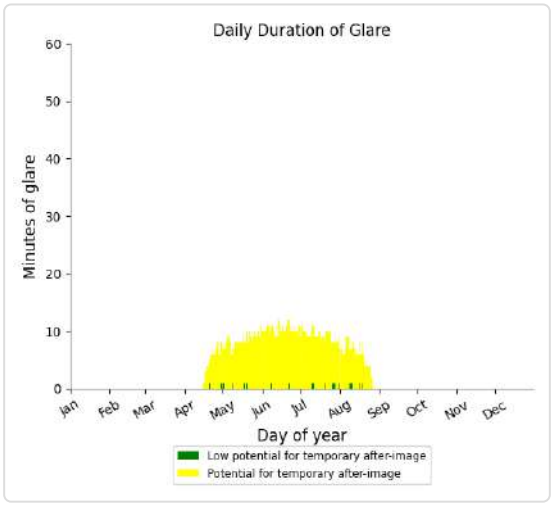

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt06-ranfurl
rt08-ranfurl
Max Luminance Per Day (cd/m²)
2.0e+06
1.5e+06
1.0e+06
5.0e+05
0.0e+00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

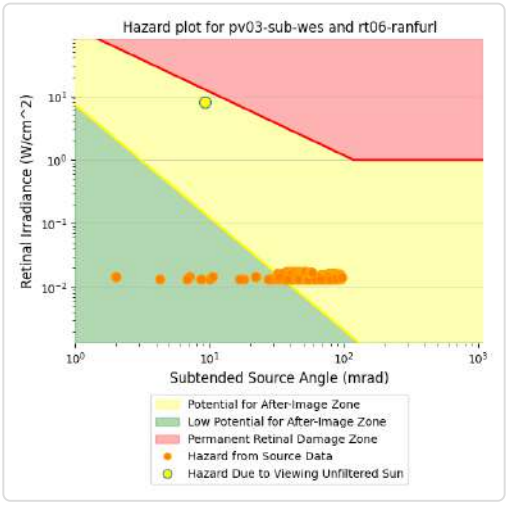
PV03 Sub West and Route: RT06 Ranfurly Naseby Rd

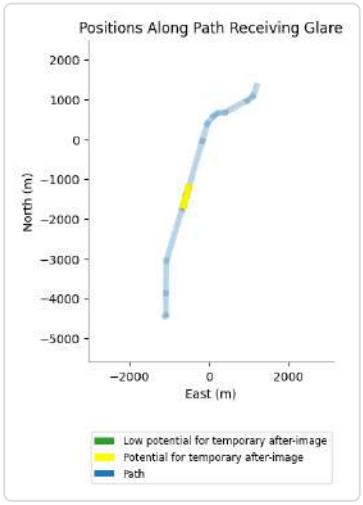
Yellow glare: 1,086 min.

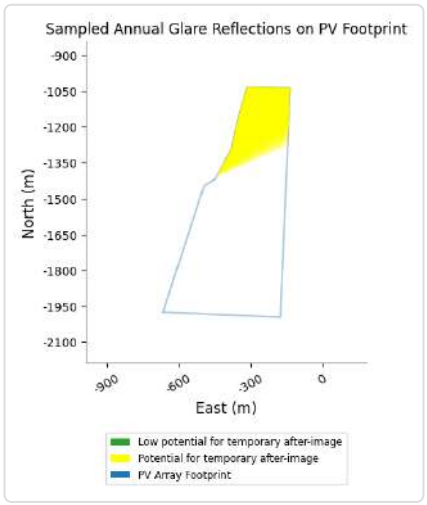
Green glare: 18 min.

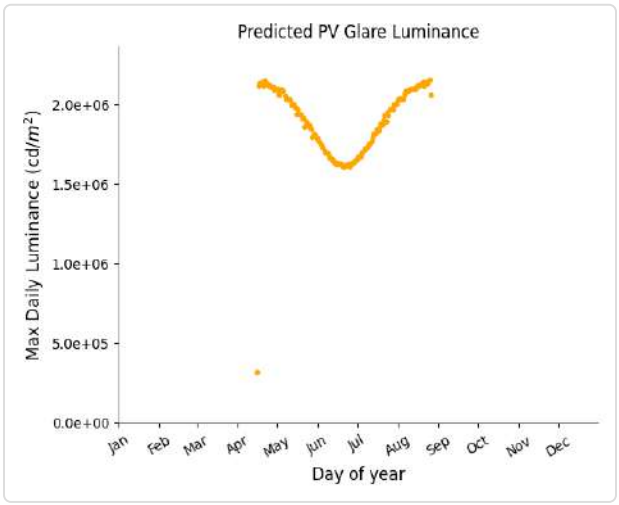








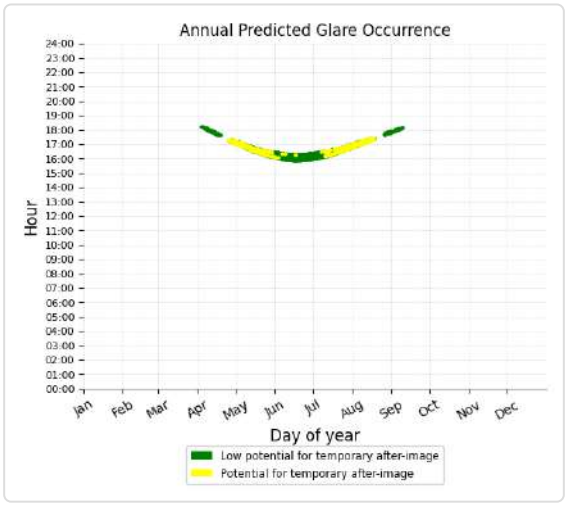


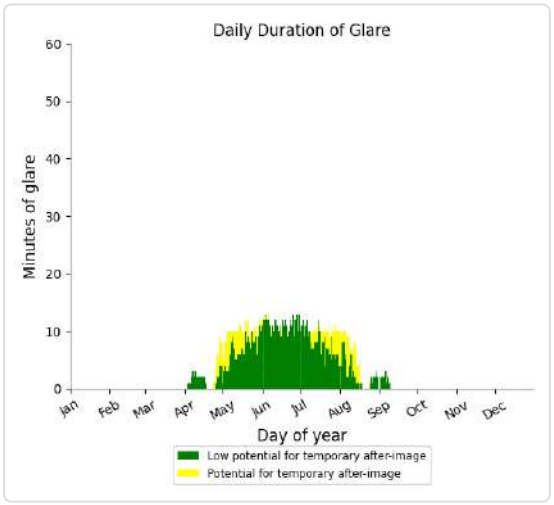


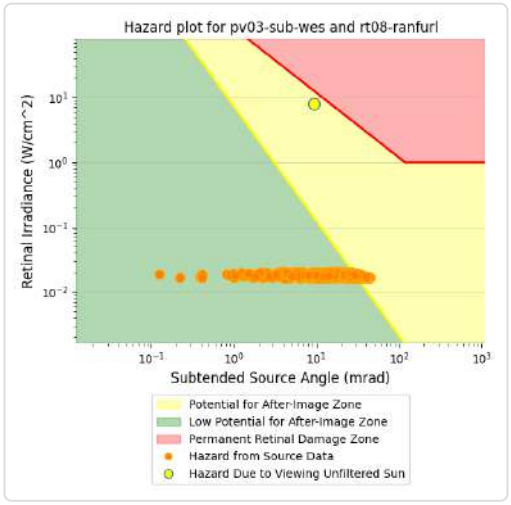
PV03 Sub West and Route: RT08 Ranfurly Back Rd

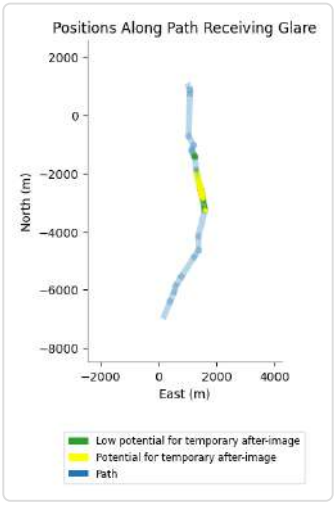
Yellow glare: 268 min.

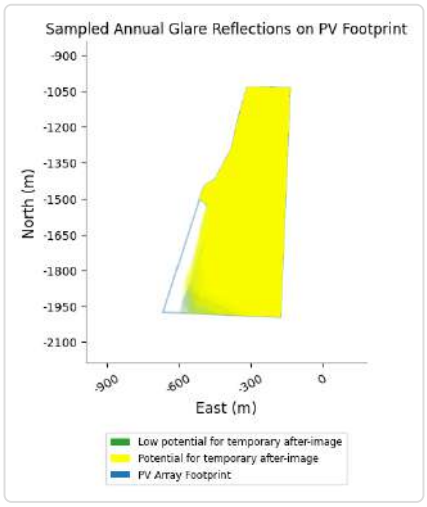
Green glare: 924 min.

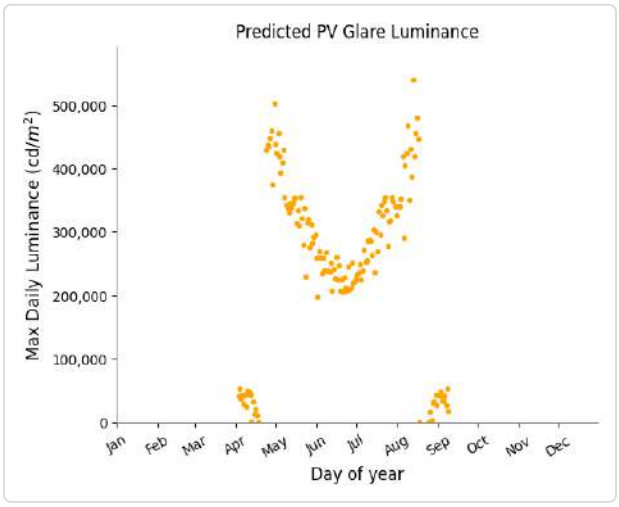












PV03 Sub West and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV03 Sub West and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV03 Sub West and Route: RT03 Brinsdon Rd

No glare found

PV03 Sub West and Route: RT04 Naseby Link Rd

No glare found

PV03 Sub West and Route: RT05 Fennessy Rd

No glare found

PV03 Sub West and Route: RT07 Bypass Rd

No glare found

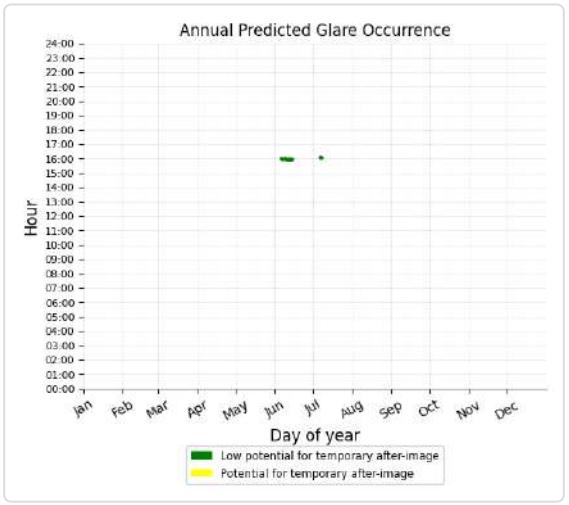
PV03 Sub West and Route: RT09 Glen Rd

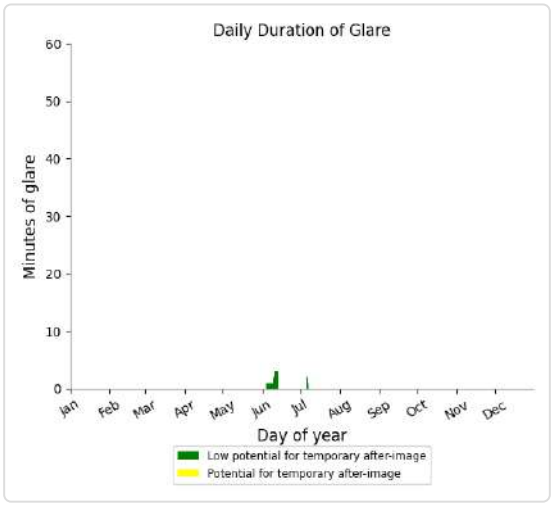
No glare found

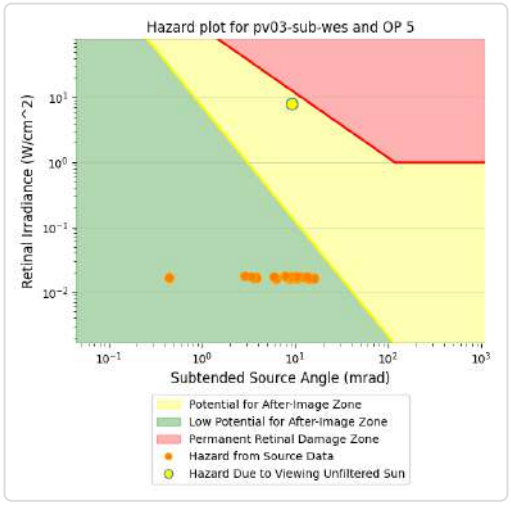
PV03 Sub West and OP 5

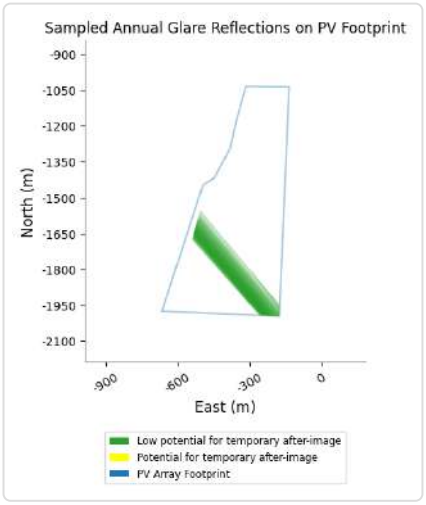
Yellow glare: none

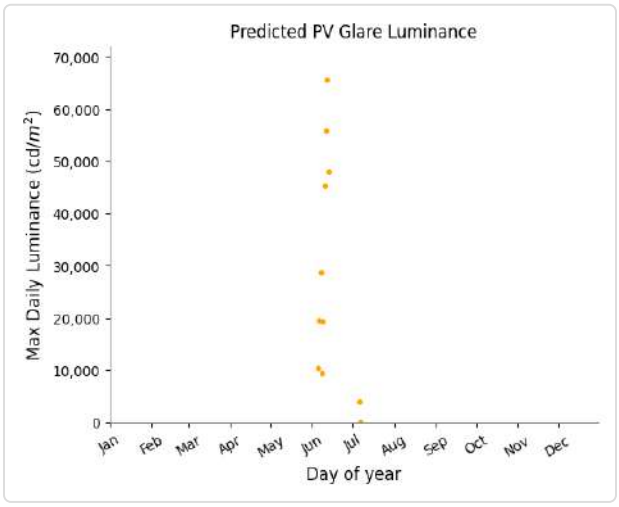
Green glare: 19 min.











PV03 Sub West and OP 1

No glare found

PV03 Sub West and OP 2

No glare found

PV03 Sub West and OP 3

No glare found

PV03 Sub West and OP 4

No glare found

PV03 Sub West and OP 6

No glare found

PV03 Sub West and OP 7

No glare found

PV03 Sub West and OP 8

No glare found

PV03 Sub West and OP 9

No glare found

PV03 Sub West and OP 10

No glare found

PV03 Sub West and OP 11

No glare found

PV03 Sub West and OP 12

No glare found

PV03 Sub West and OP 13

No glare found

PV03 Sub West and OP 14

No glare found

PV03 Sub West and OP 15

No glare found

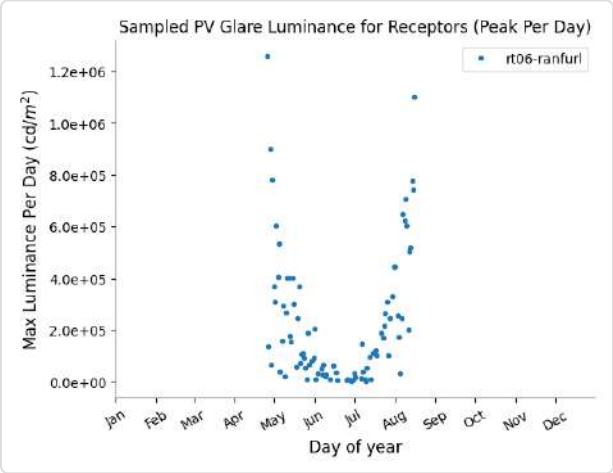
PV03 Sub West and OP 16

No glare found

PV: PV04 West 1 potential temporary after-image

Receptor results ordered by category of glare

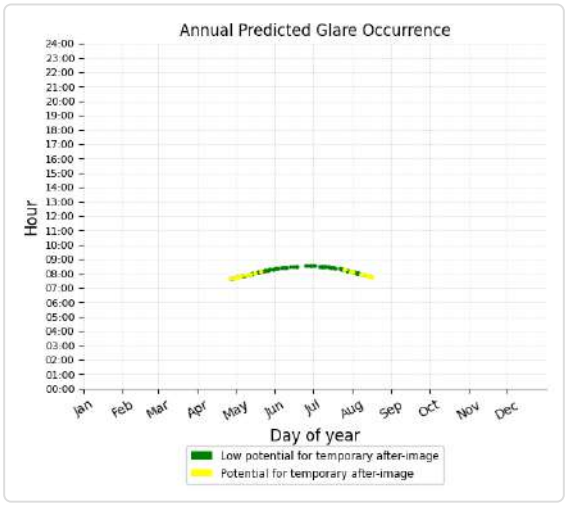
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	80	1.3	35	0.6	1,258,215
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

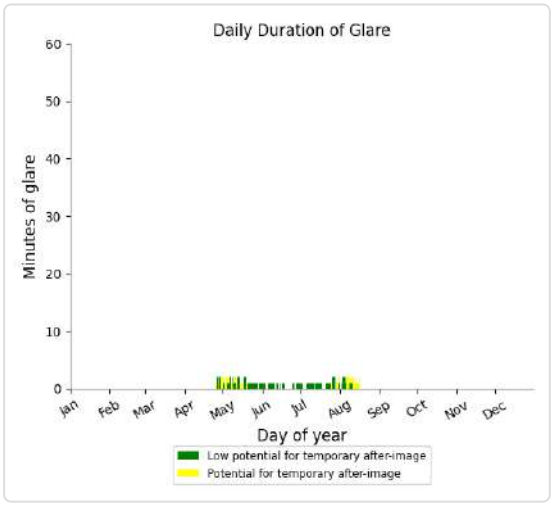

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt06-ranfurl
Max Luminance Per Day (cd/m²)
1.2e+06
1.0e+06
8.0e+05
6.0e+05
4.0e+05
2.0e+05
0.0e+00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

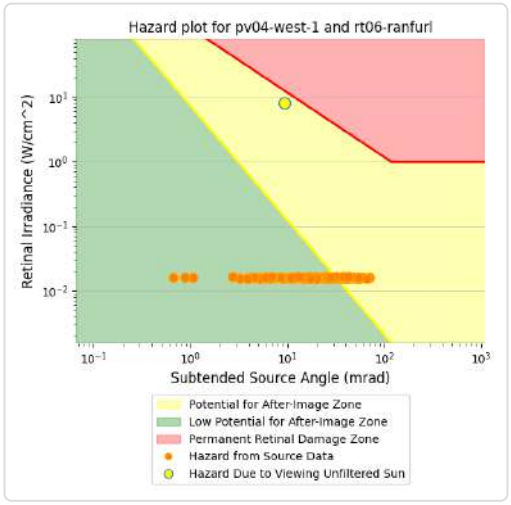
PV04 West 1 and Route: RT06 Ranfurly Naseby Rd

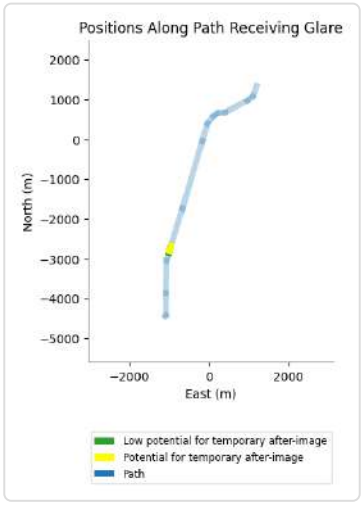
Yellow glare: 35 min.

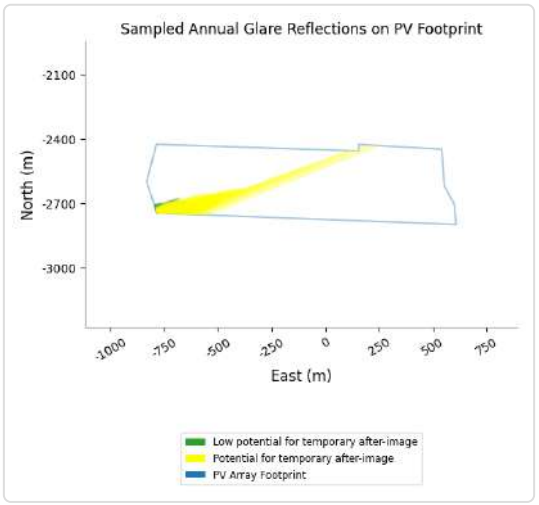
Green glare: 80 min.

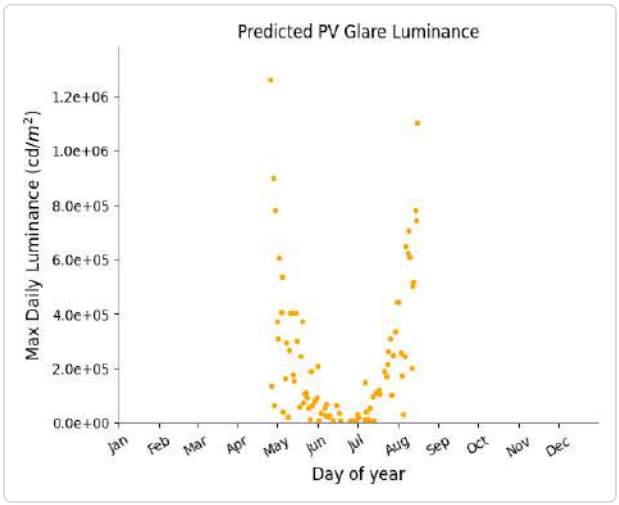












PV04 West 1 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV04 West 1 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV04 West 1 and Route: RT03 Brinsdon Rd

No glare found

PV04 West 1 and Route: RT04 Naseby Link Rd

No glare found

PV04 West 1 and Route: RT05 Fennessy Rd

No glare found

PV04 West 1 and Route: RT07 Bypass Rd

No glare found

PV04 West 1 and Route: RT08 Ranfurly Back Rd

No glare found

PV04 West 1 and Route: RT09 Glen Rd

No glare found

PV04 West 1 and OP 1

No glare found

PV04 West 1 and OP 2

No glare found

PV04 West 1 and OP 3

No glare found

PV04 West 1 and OP 4

No glare found

PV04 West 1 and OP 5

No glare found

PV04 West 1 and OP 6

No glare found

PV04 West 1 and OP 7

No glare found

PV04 West 1 and OP 8

No glare found

PV04 West 1 and OP 9

No glare found

PV04 West 1 and OP 10

No glare found

PV04 West 1 and OP 11

No glare found

PV04 West 1 and OP 12

No glare found

PV04 West 1 and OP 13

No glare found

PV04 West 1 and OP 14

No glare found

PV04 West 1 and OP 15

No glare found

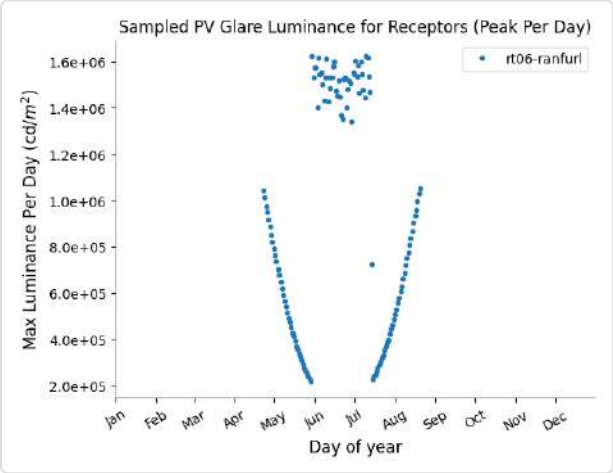
PV04 West 1 and OP 16

No glare found

PV: PV05 West 2 potential temporary after-image

Receptor results ordered by category of glare

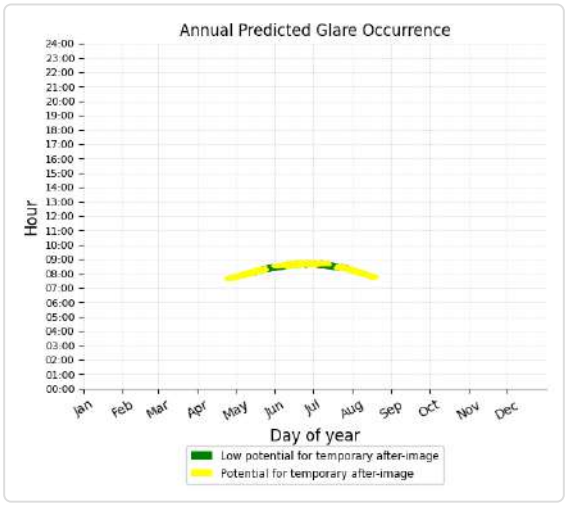
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	242	4.0	744	12.4	1,621,580
RT08 Ranfurly Back Rd	48	0.8	9	0.1	277,401
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 5	85	1.4	0	0.0	117,337
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

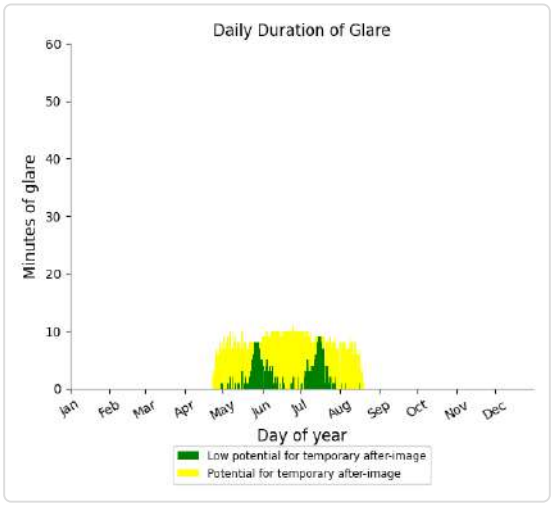

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt06-ranfurl
Max Luminance Per Day (cd/m²)
1.6e+06
1.4e+06
1.2e+06
1.0e+06
8.0e+05
6.0e+05
4.0e+05
2.0e+05
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

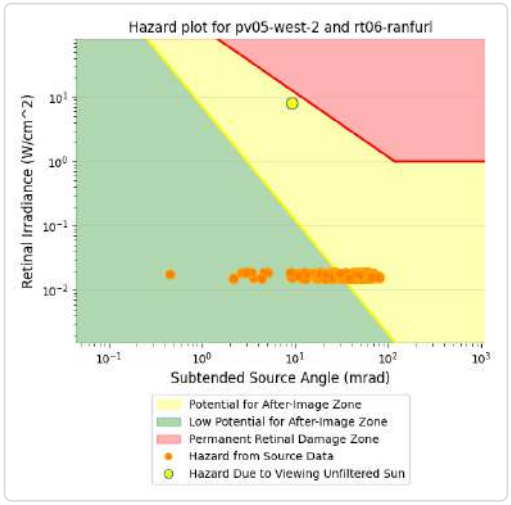
PV05 West 2 and Route: RT06 Ranfurly Naseby Rd

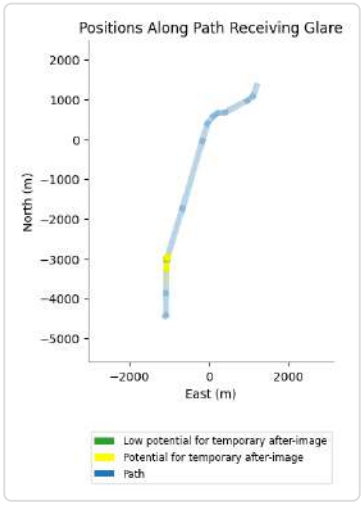
Yellow glare: 744 min.

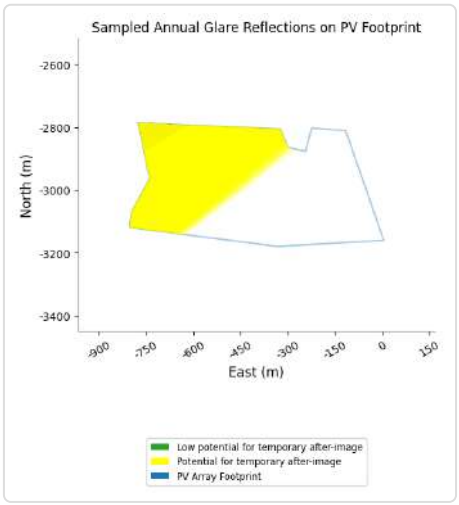
Green glare: 242 min.

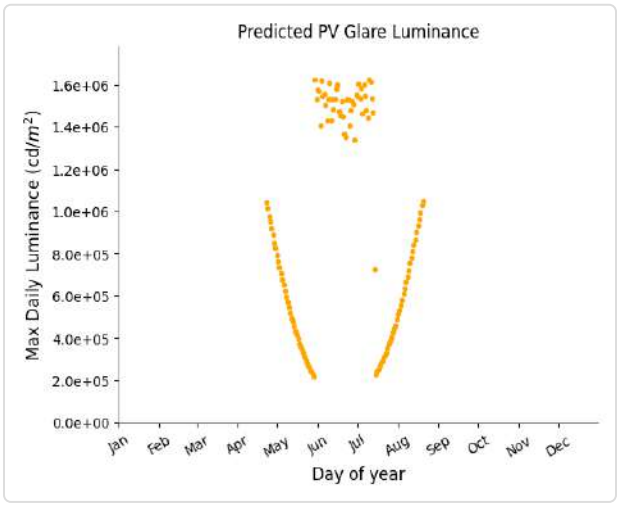








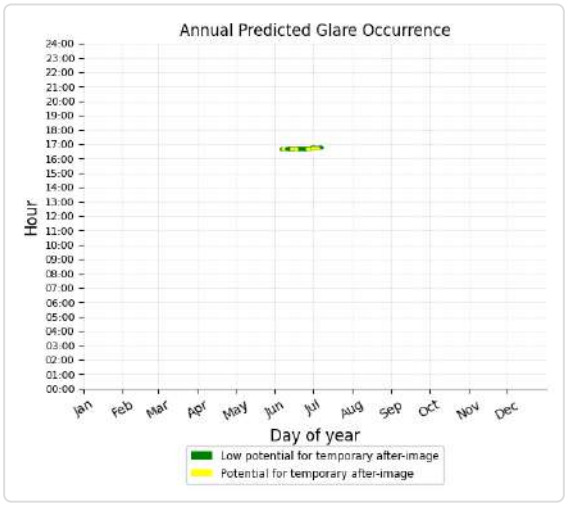


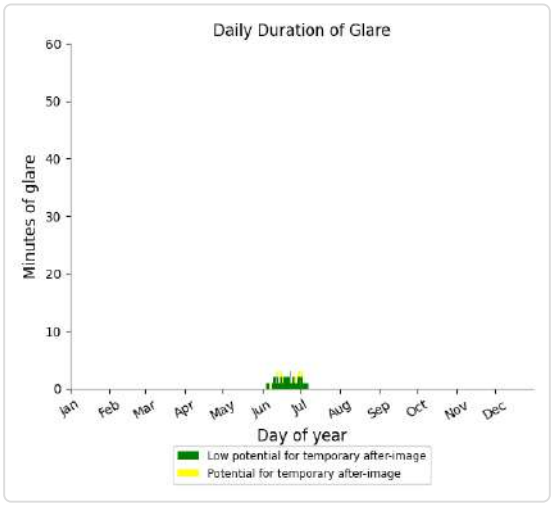


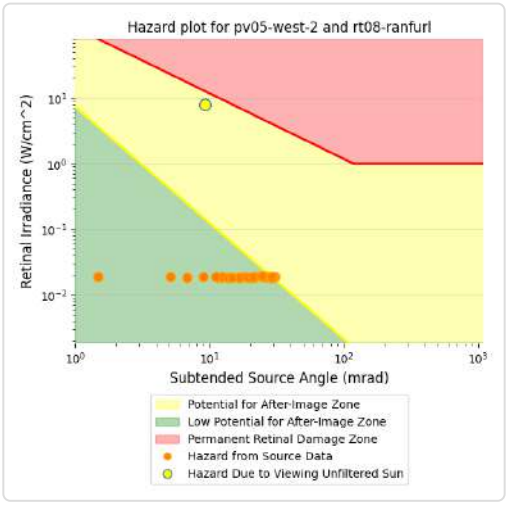
PV05 West 2 and Route: RT08 Ranfurly Back Rd

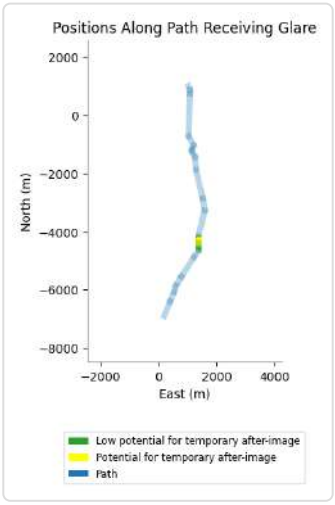
Yellow glare: 9 min.

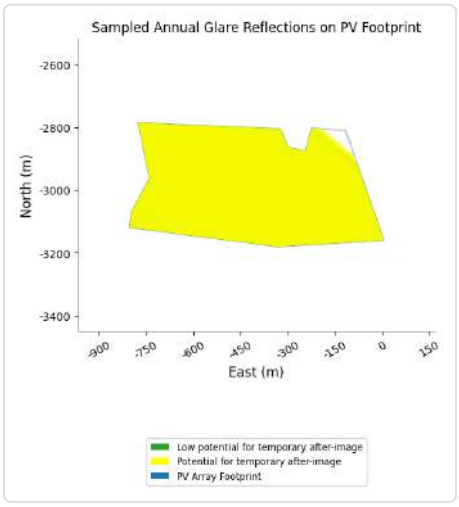
Green glare: 48 min.

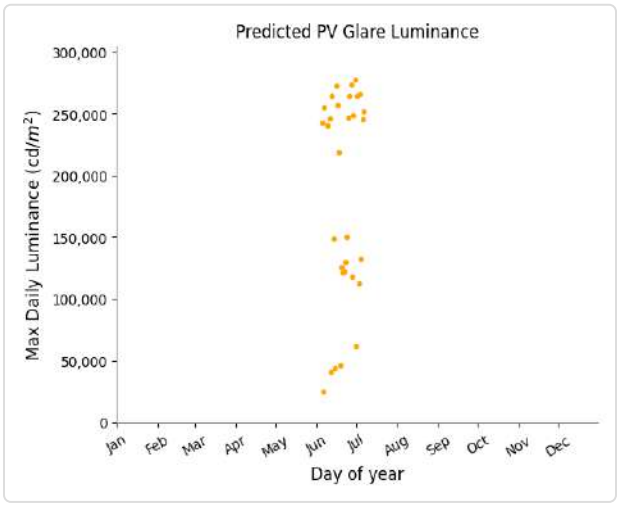












PV05 West 2 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV05 West 2 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV05 West 2 and Route: RT03 Brinsdon Rd

No glare found

PV05 West 2 and Route: RT04 Naseby Link Rd

No glare found

PV05 West 2 and Route: RT05 Fennessy Rd

No glare found

PV05 West 2 and Route: RT07 Bypass Rd

No glare found

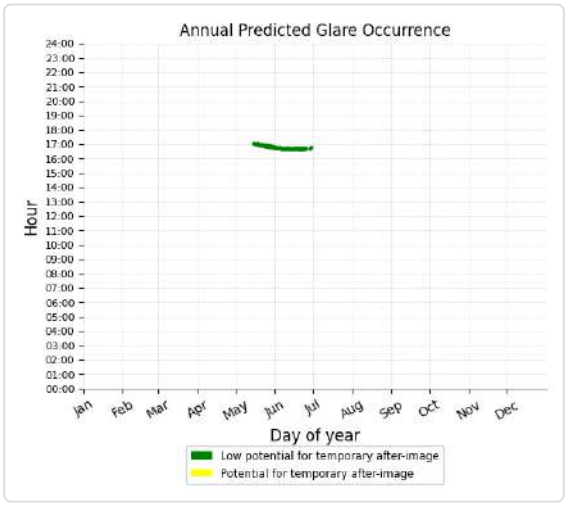
PV05 West 2 and Route: RT09 Glen Rd

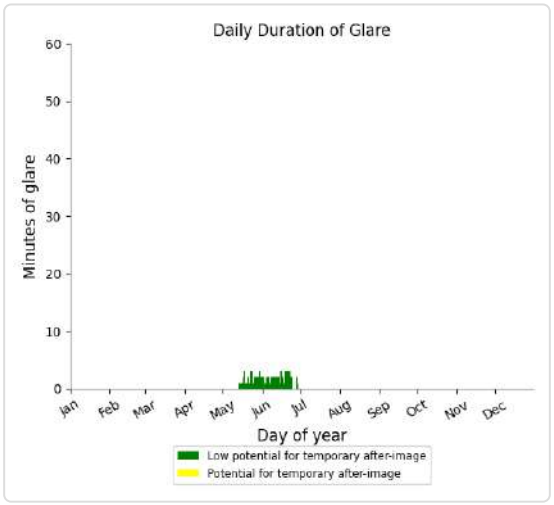
No glare found

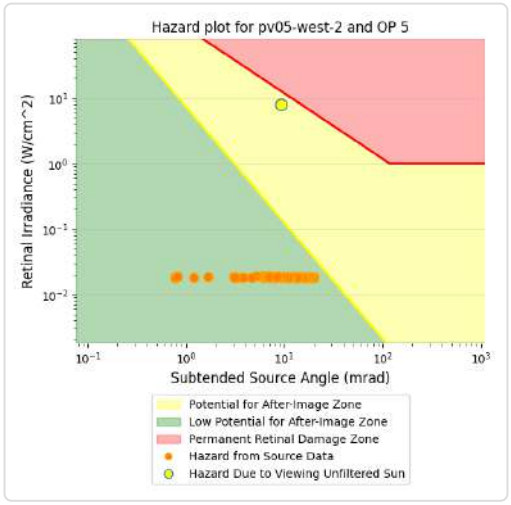
PV05 West 2 and OP 5

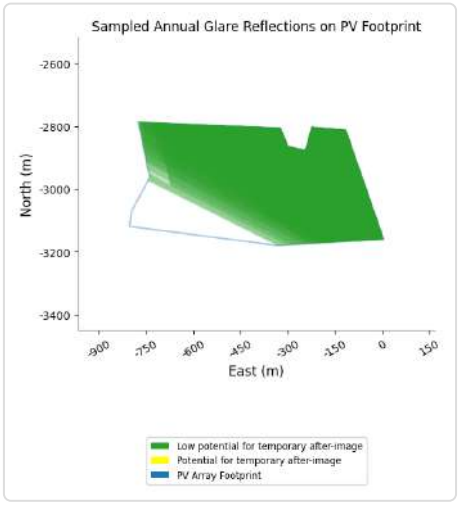
Yellow glare: none

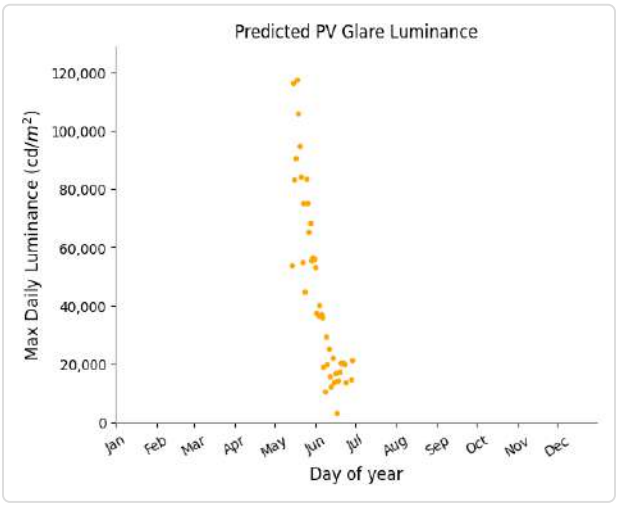
Green glare: 85 min.











PV05 West 2 and OP 1

No glare found

PV05 West 2 and OP 2

No glare found

PV05 West 2 and OP 3

No glare found

PV05 West 2 and OP 4

No glare found

PV05 West 2 and OP 6

No glare found

PV05 West 2 and OP 7

No glare found

PV05 West 2 and OP 8

No glare found

PV05 West 2 and OP 9

No glare found

PV05 West 2 and OP 10

No glare found

PV05 West 2 and OP 11

No glare found

PV05 West 2 and OP 12

No glare found

PV05 West 2 and OP 13

No glare found

PV05 West 2 and OP 14

No glare found

PV05 West 2 and OP 15

No glare found

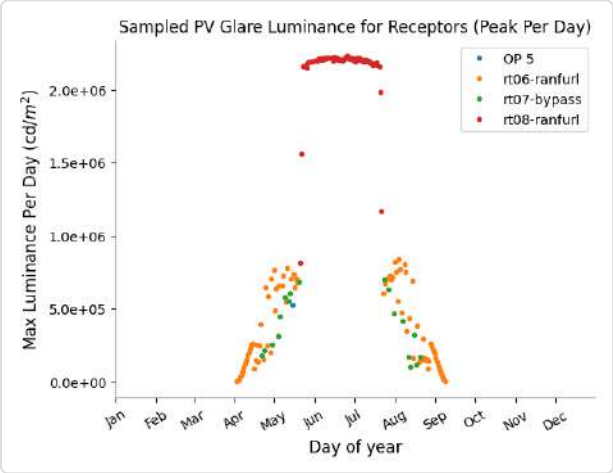
PV05 West 2 and OP 16

No glare found

PV: PV06 South potential temporary after-image

Receptor results ordered by category of glare

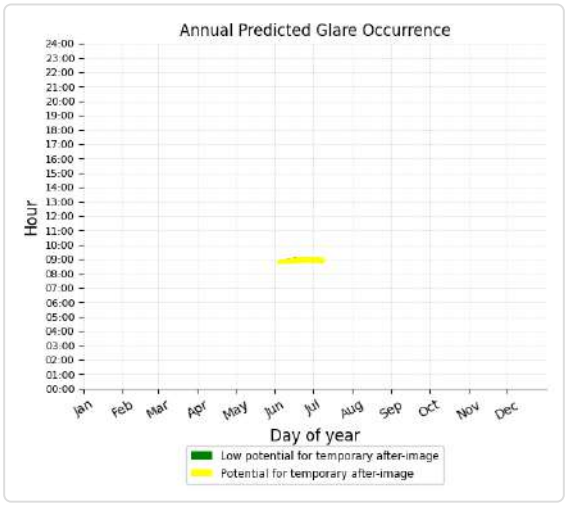
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	15	0.2	143	2.4	1,022,496
RT06 Ranfurly Naseby Rd	847	14.1	434	7.2	836,422
RT07 Bypass Rd	555	9.2	426	7.1	739,183
RT08 Ranfurly Back Rd	1,283	21.4	884	14.7	2,226,401
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 5	114	1.9	408	6.8	542,461
OP 13	335	5.6	41	0.7	319,127
OP 15	287	4.8	124	2.1	409,258
OP 12	349	5.8	0	0.0	221,557
OP 14	361	6.0	0	0.0	209,167
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

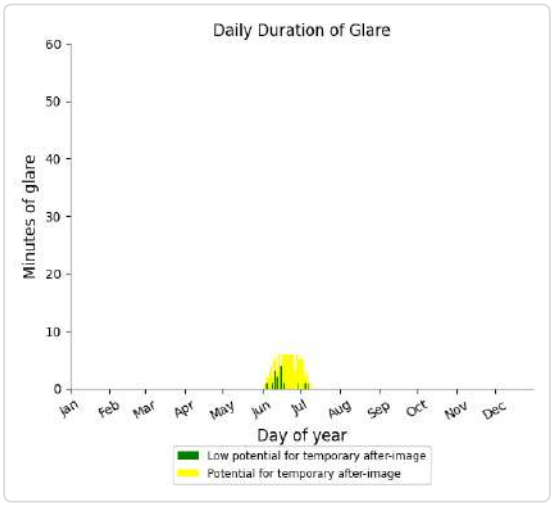

Sampled PV Glare Luminance for Receptors (Peak Per Day)
OP 5
rt06-ranfurl
rt07-bypass
rt08-ranfurl
Max Luminance Per Day (cd/m²)
2.0e+06
1.5e+06
1.0e+06
5.0e+05
0.0e+00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

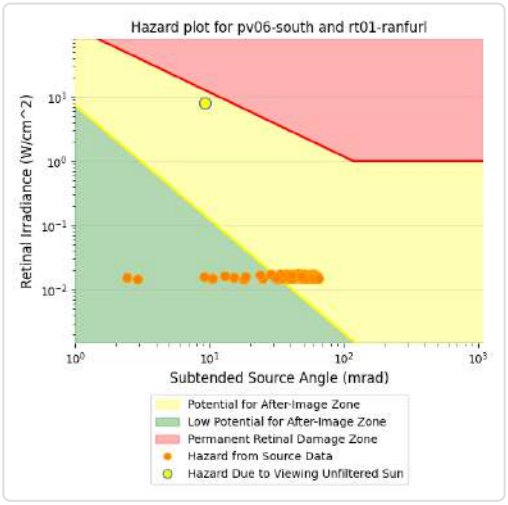
PV06 South and Route: RT01 Ranfurly Wedderburn Rd

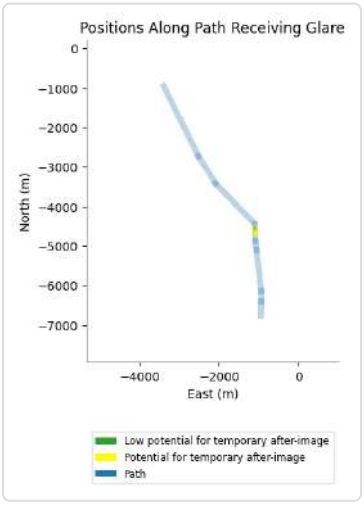
Yellow glare: 143 min.

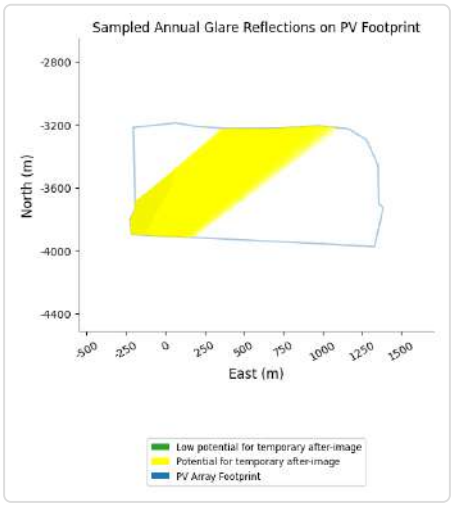
Green glare: 15 min.

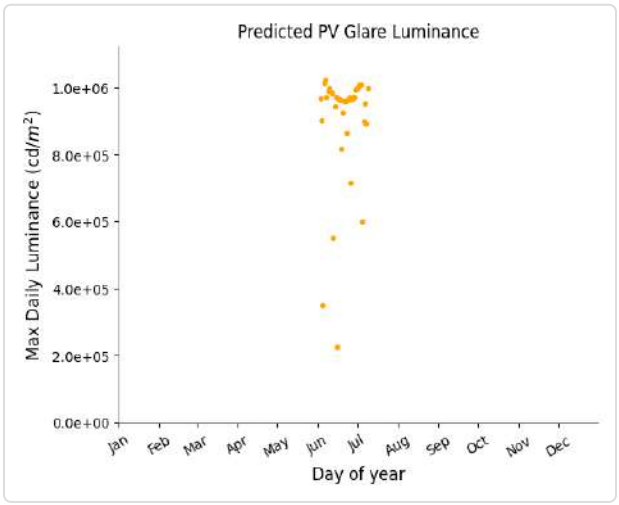








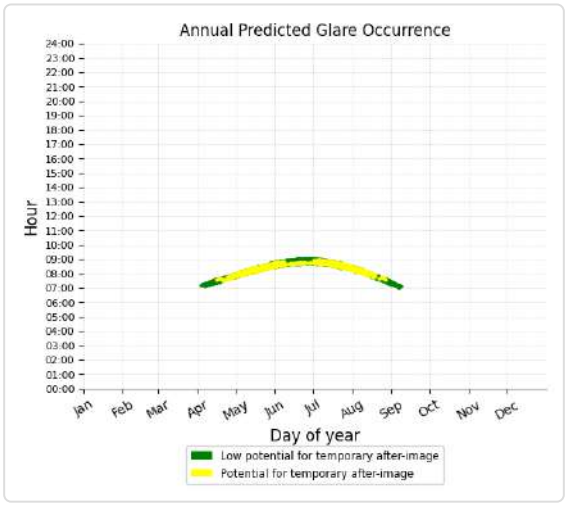


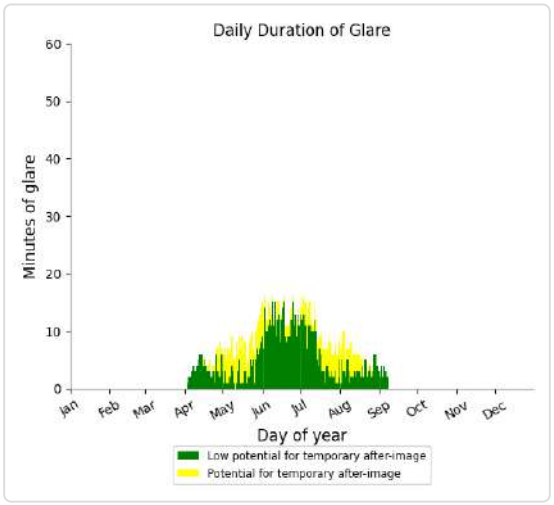


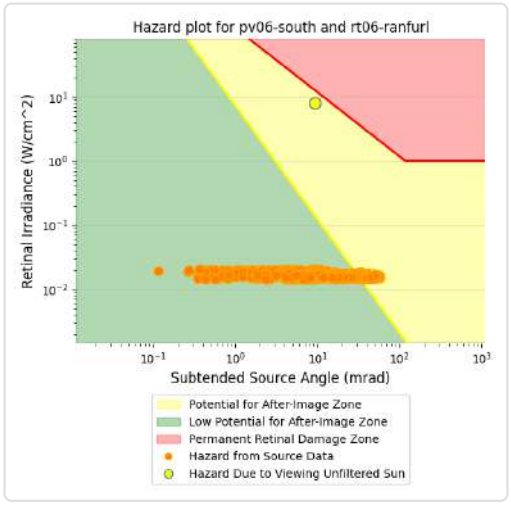
PV06 South and Route: RT06 Ranfurly Naseby Rd

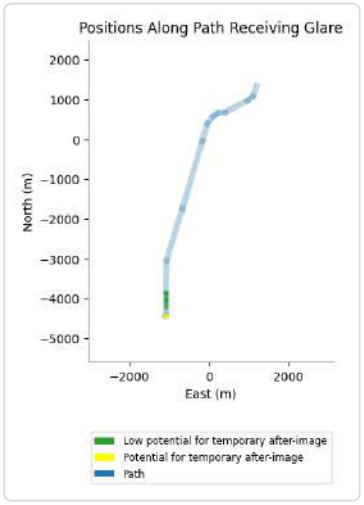
Yellow glare: 434 min.

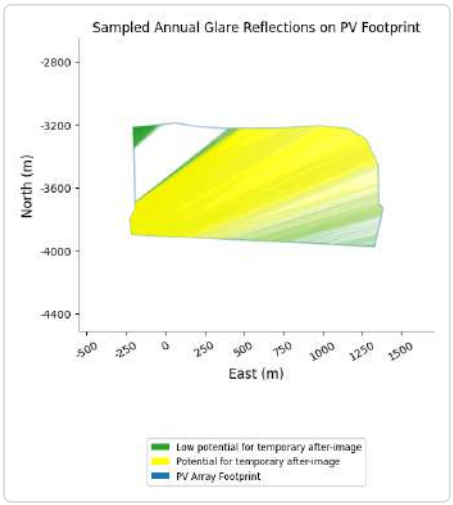
Green glare: 847 min.

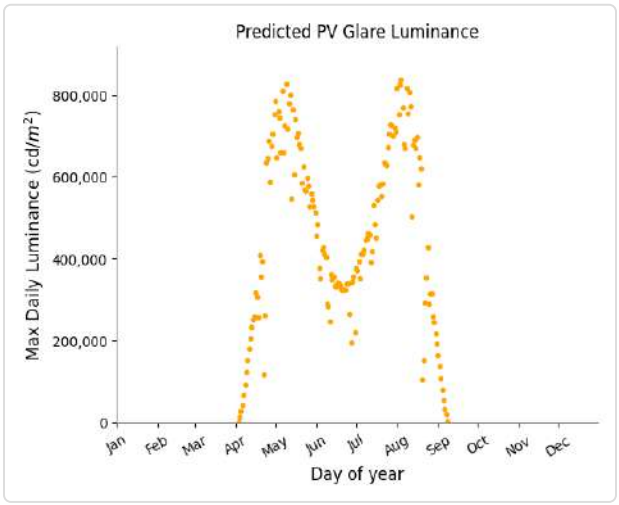








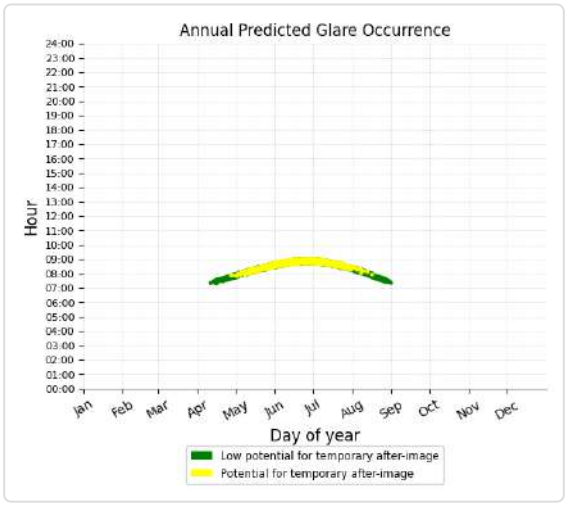


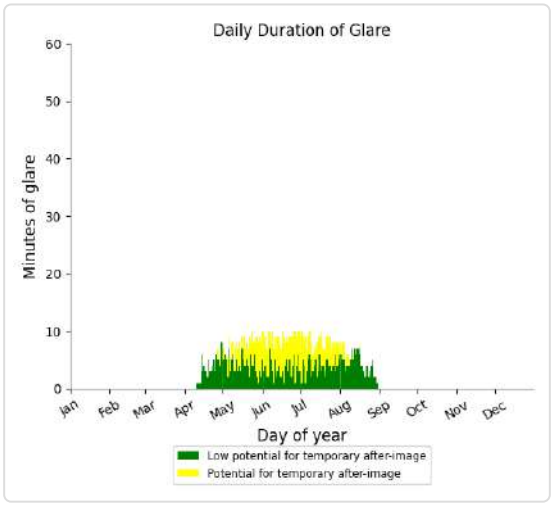


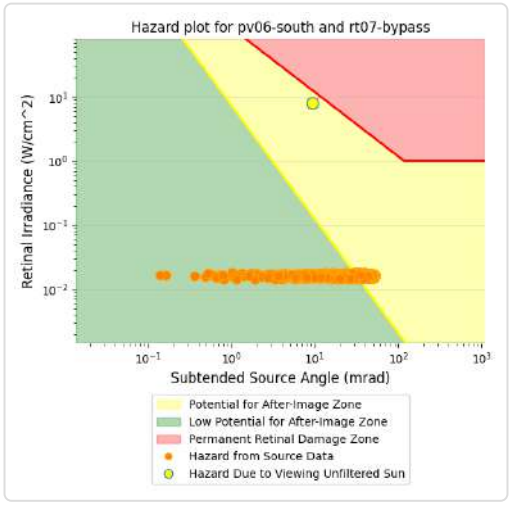
PV06 South and Route: RT07 Bypass Rd

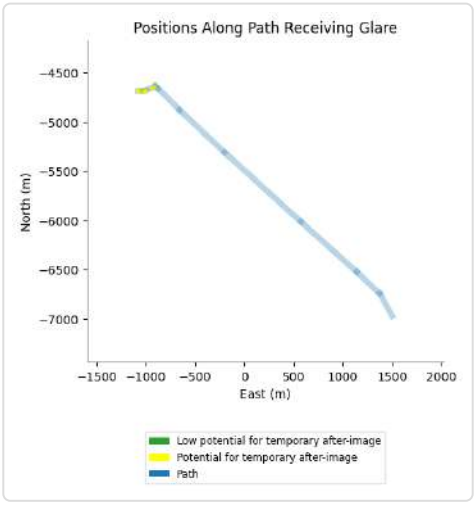
Yellow glare: 426 min.

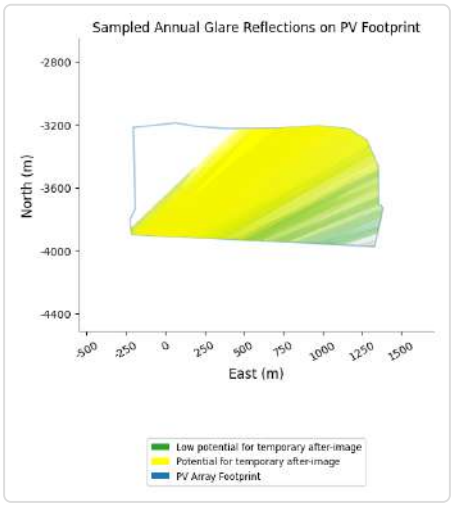
Green glare: 555 min.

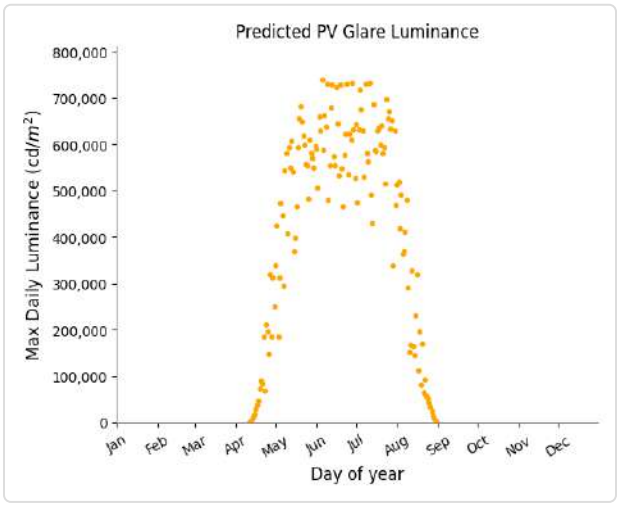








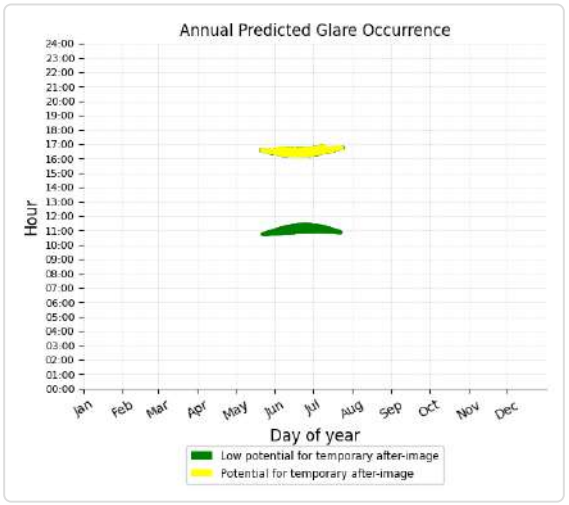


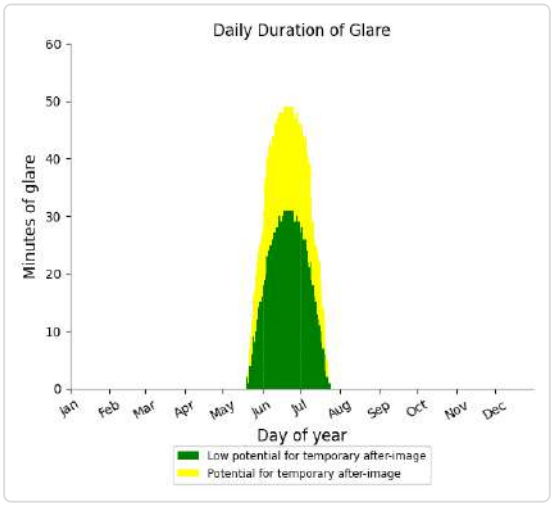


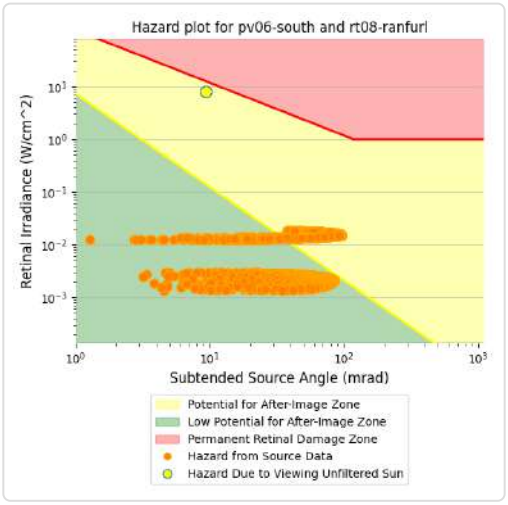
PV06 South and Route: RT08 Ranfurly Back Rd

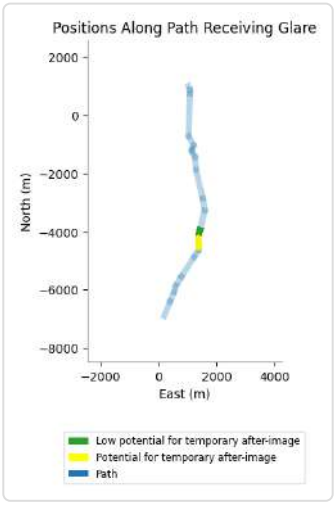
Yellow glare: 884 min.

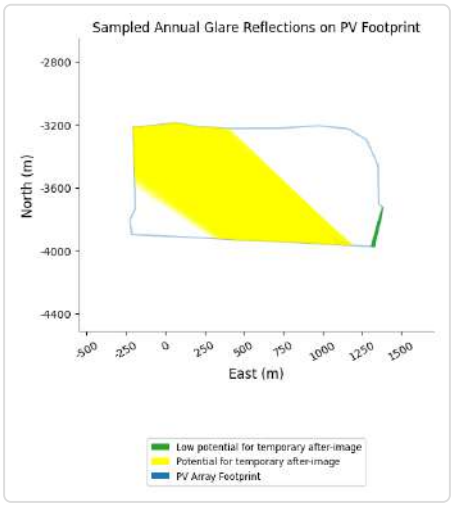
Green glare: 1,283 min.

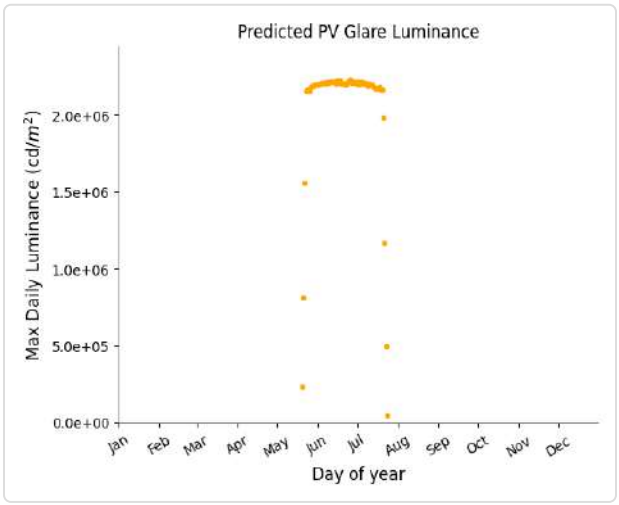












PV06 South and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV06 South and Route: RT03 Brinsdon Rd

No glare found

PV06 South and Route: RT04 Naseby Link Rd

No glare found

PV06 South and Route: RT05 Fennessy Rd

No glare found

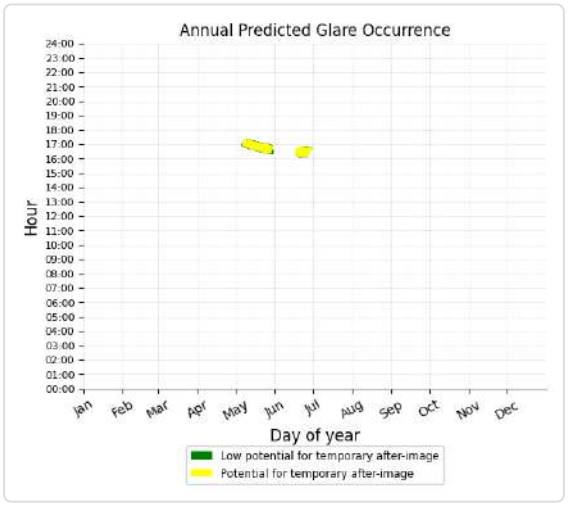
PV06 South and Route: RT09 Glen Rd

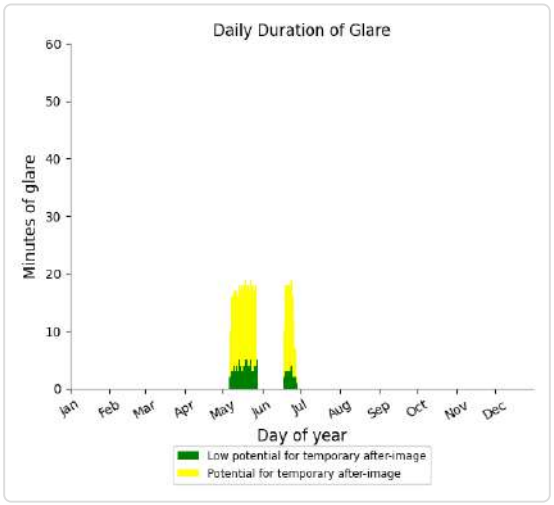
No glare found

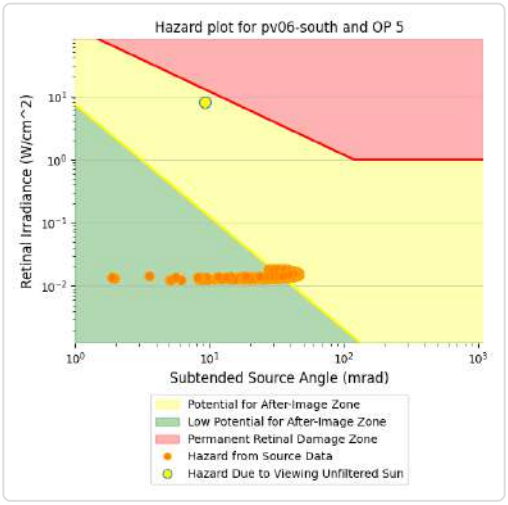
PV06 South and OP 5

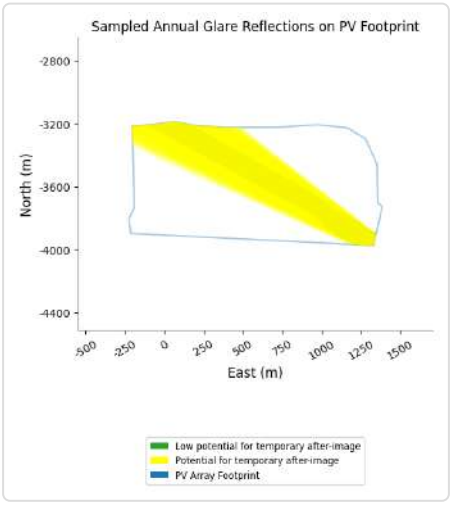
Yellow glare: 408 min.

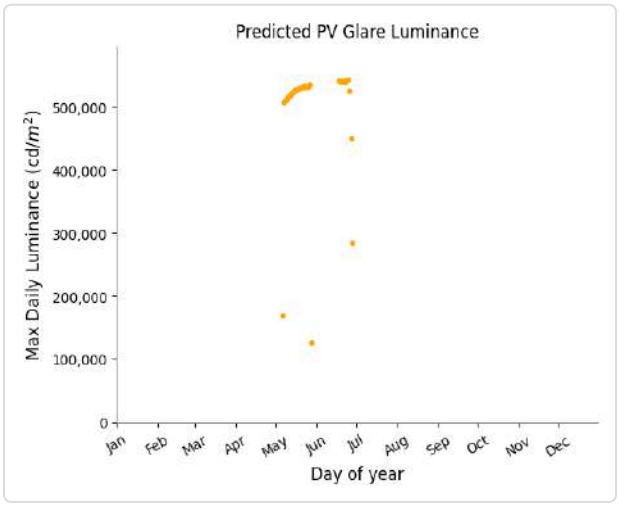
Green glare: 114 min.







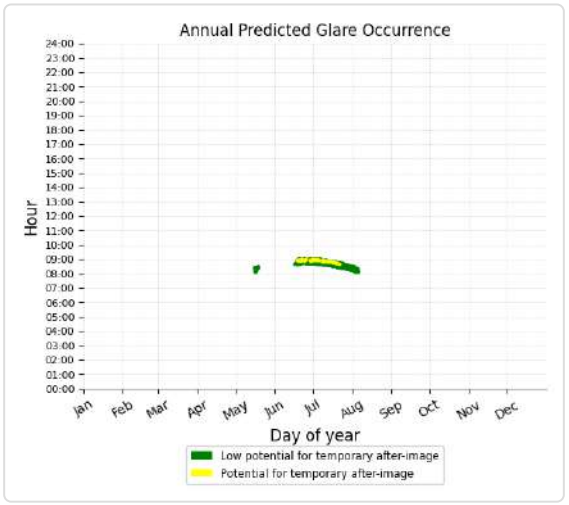


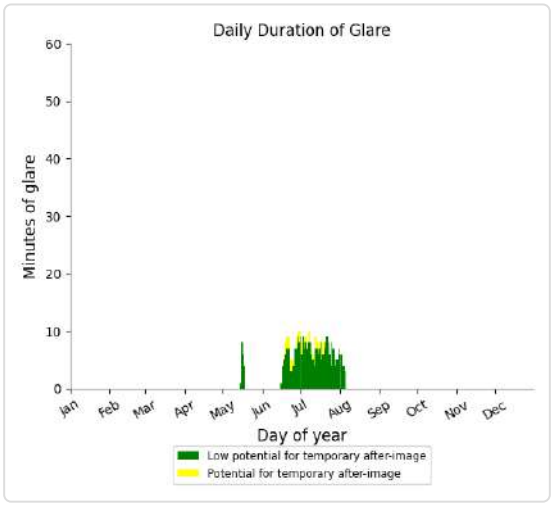


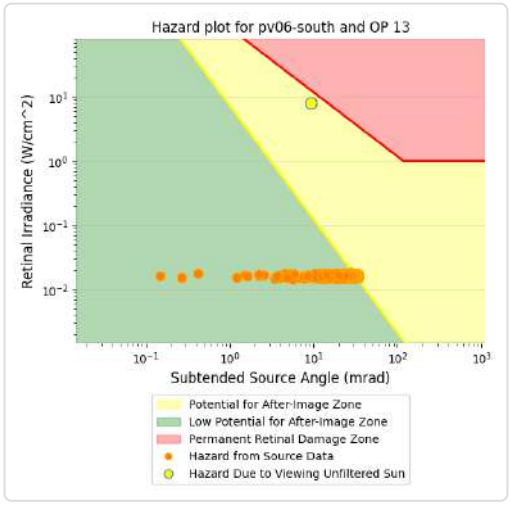
PV06 South and OP 13

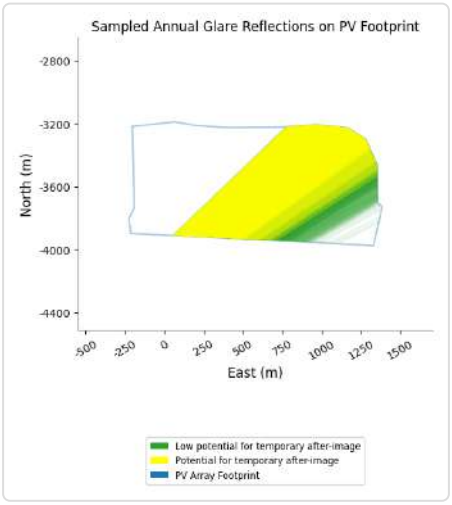
Yellow glare: 41 min.

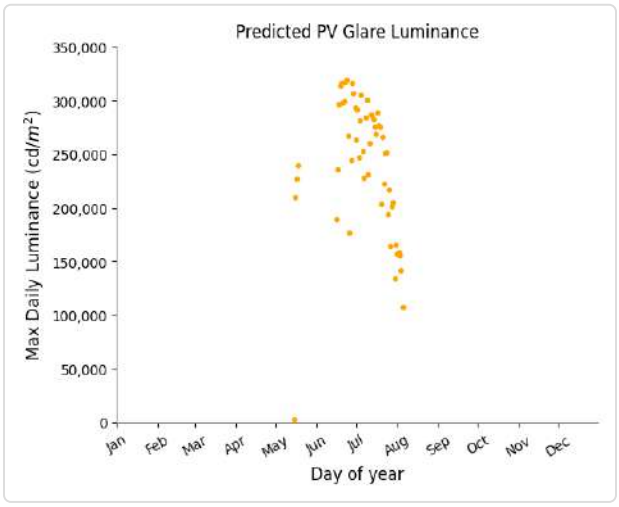
Green glare: 335 min.







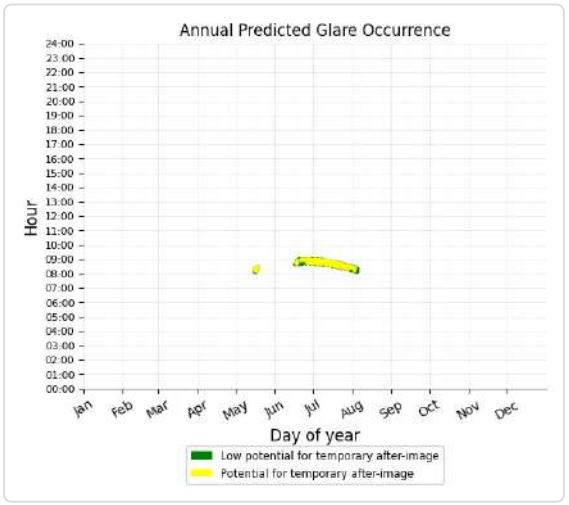


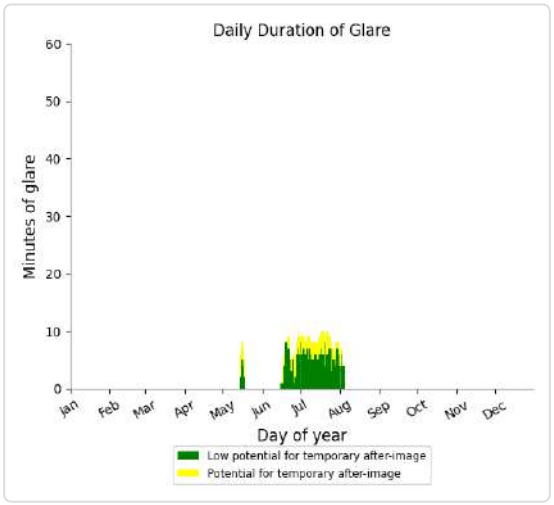


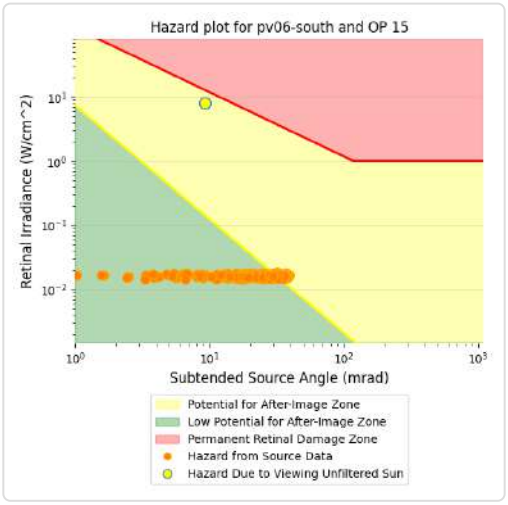
PV06 South and OP 15

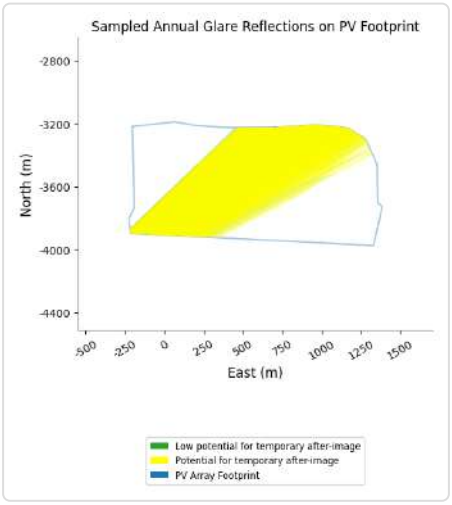
Yellow glare: 124 min.

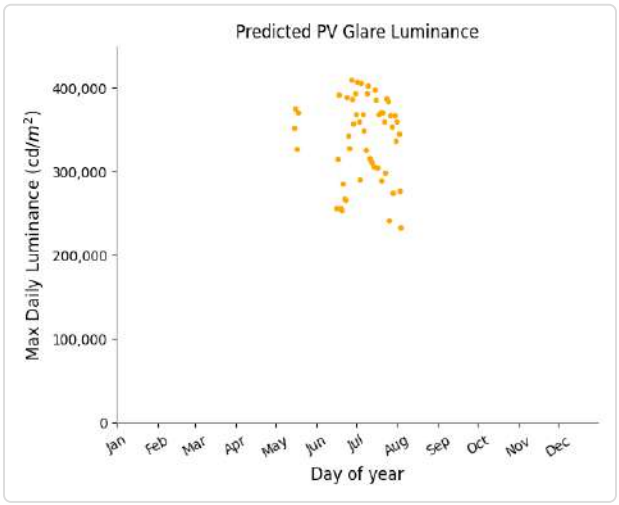
Green glare: 287 min.







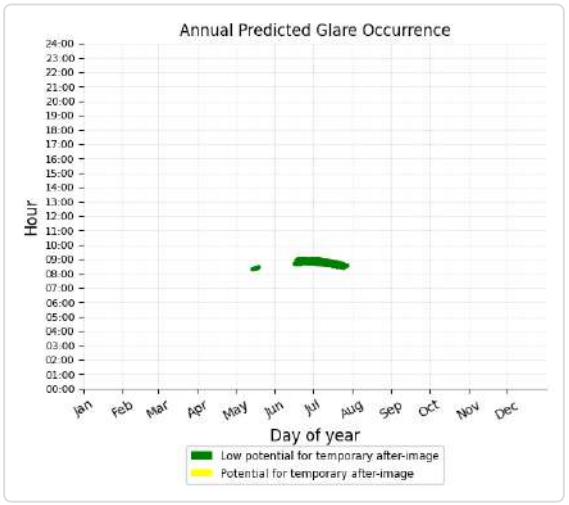


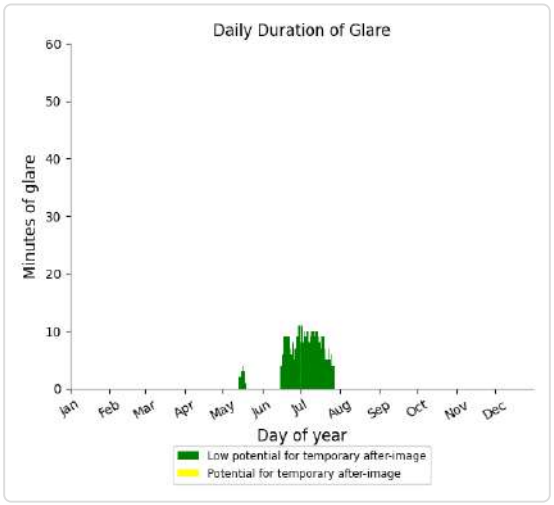


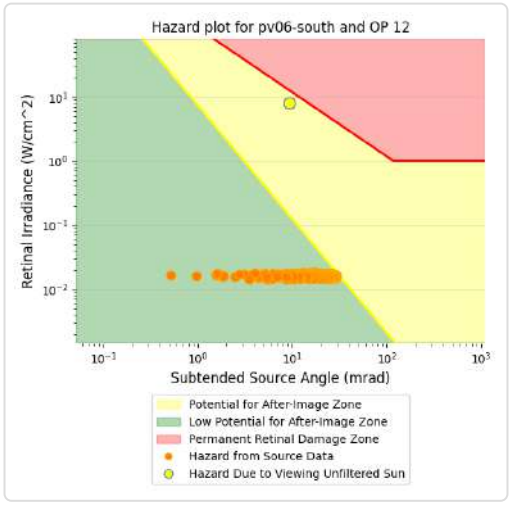
PV06 South and OP 12

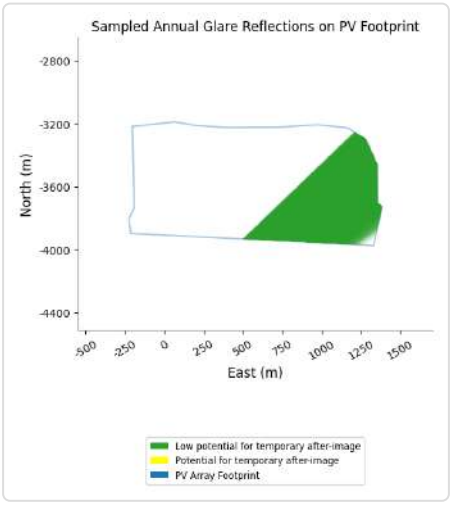
Yellow glare: none

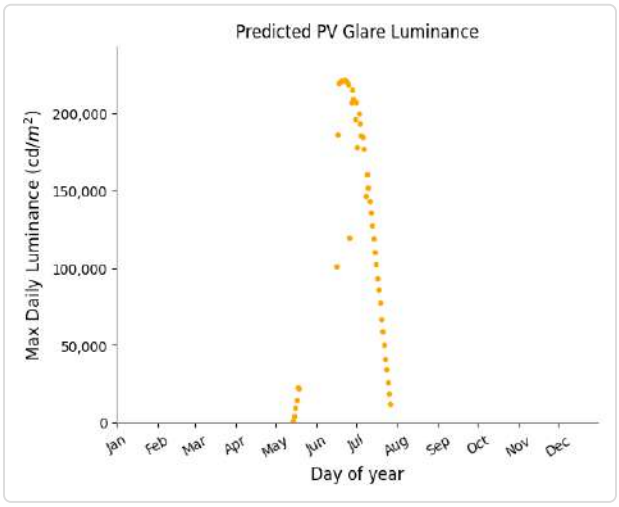
Green glare: 349 min.







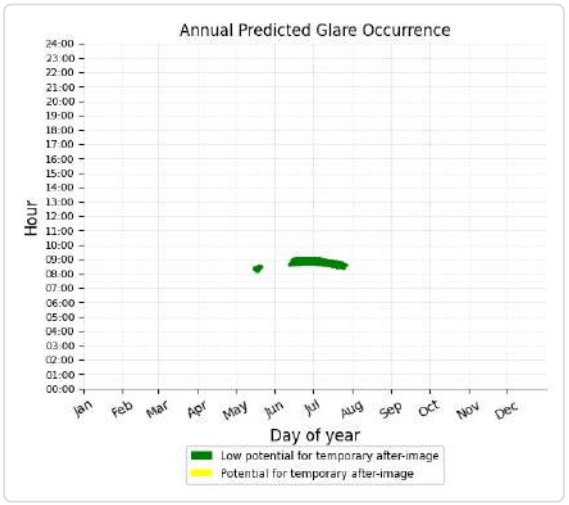


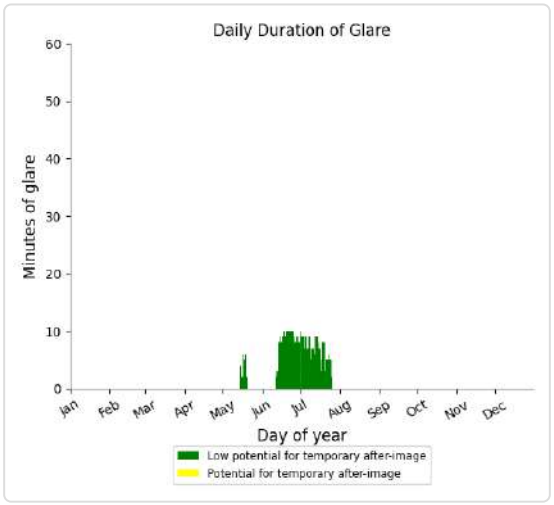


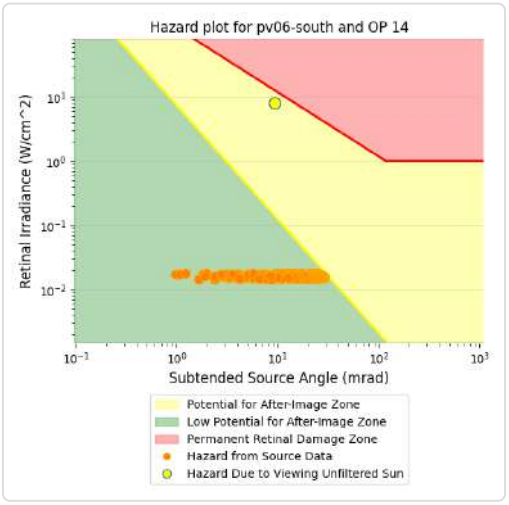
PV06 South and OP 14

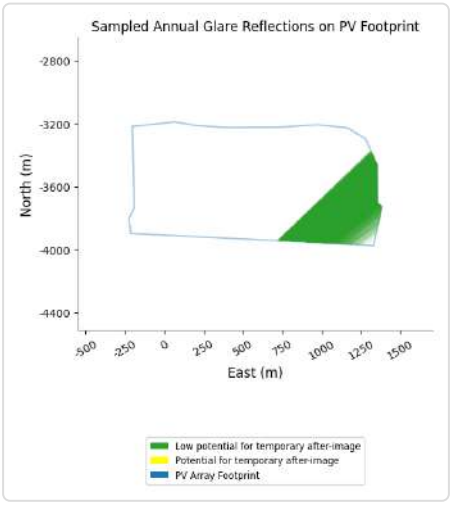
Yellow glare: none

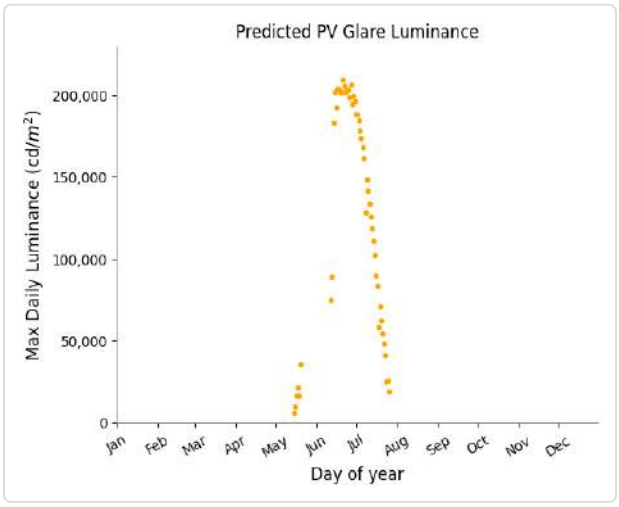
Green glare: 361 min.











PV06 South and OP 1

No glare found

PV06 South and OP 2

No glare found

PV06 South and OP 3

No glare found

PV06 South and OP 4

No glare found

PV06 South and OP 6

No glare found

PV06 South and OP 7

No glare found

PV06 South and OP 8

No glare found

PV06 South and OP 9

No glare found

PV06 South and OP 10

No glare found

PV06 South and OP 11

No glare found

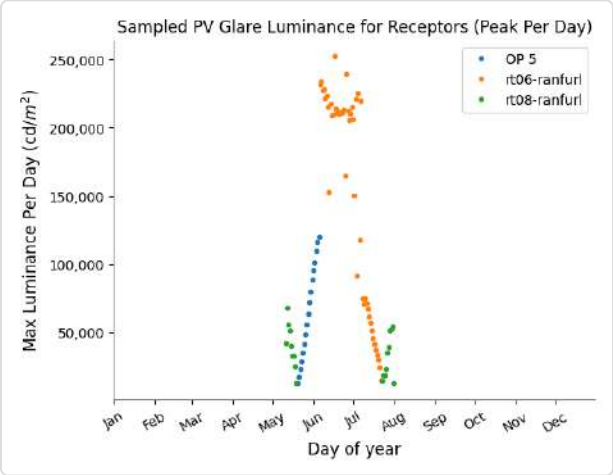
PV06 South and OP 16

No glare found

PV: PV07 Central 1 potential temporary after-image

Receptor results ordered by category of glare

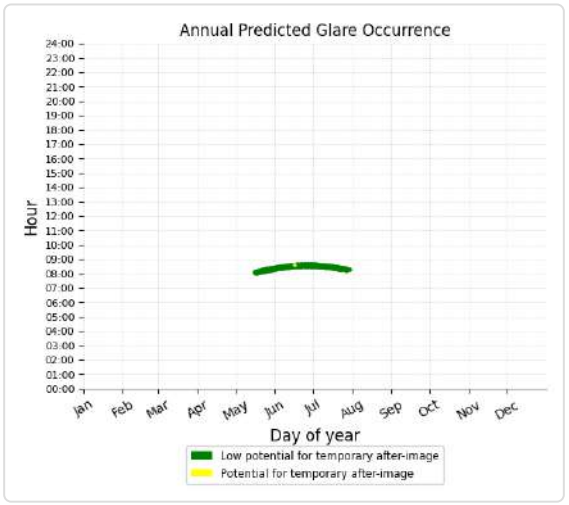
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	564	9.4	1	0.0	286,438
RT07 Bypass Rd	246	4.1	0	0.0	20,054
RT08 Ranfurly Back Rd	211	3.5	0	0.0	67,778
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 5	386	6.4	0	0.0	157,956
OP 15	35	0.6	0	0.0	5,396
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

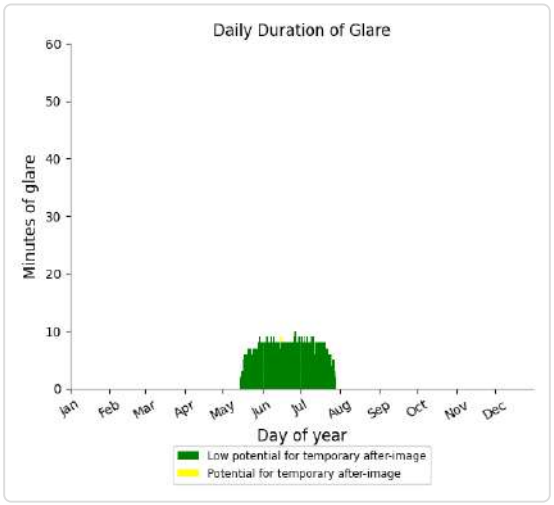

Sampled PV Glare Luminance for Receptors (Peak Per Day)
OP 5
rt06-ranfurl
rt08-ranfurl
Max Luminance Per Day (cd/m²)
250,000
200,000
150,000
100,000
50,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

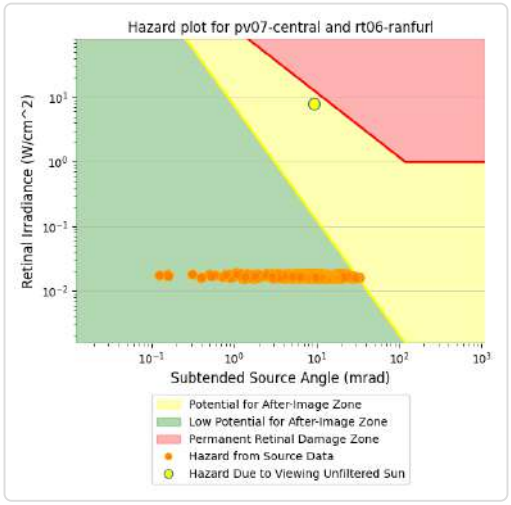
PV07 Central 1 and Route: RT06 Ranfurly Naseby Rd

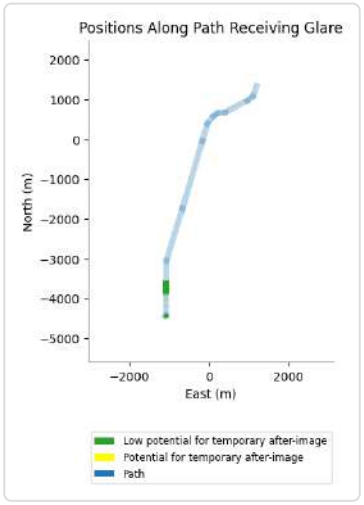
Yellow glare: 1 min.

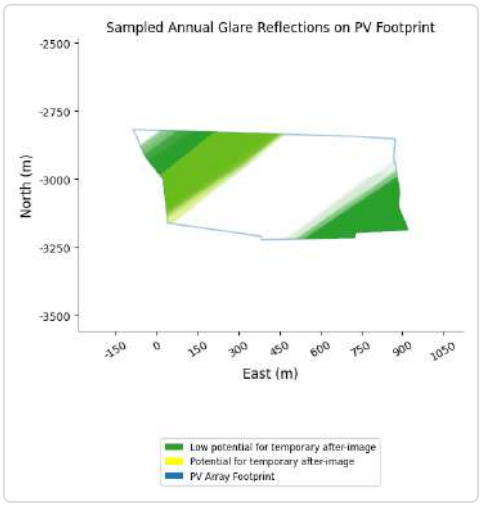
Green glare: 564 min.

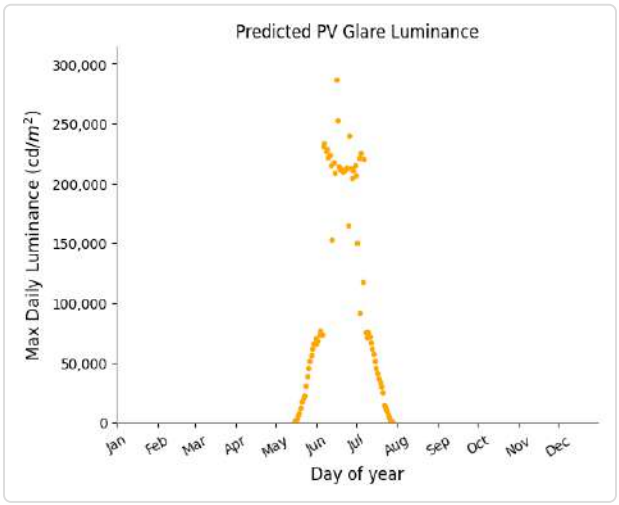








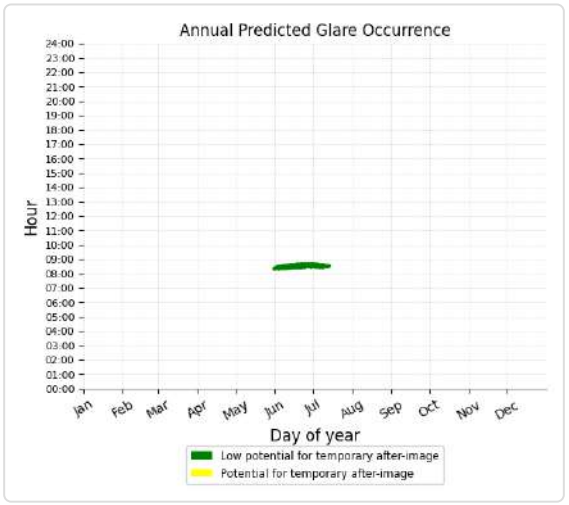


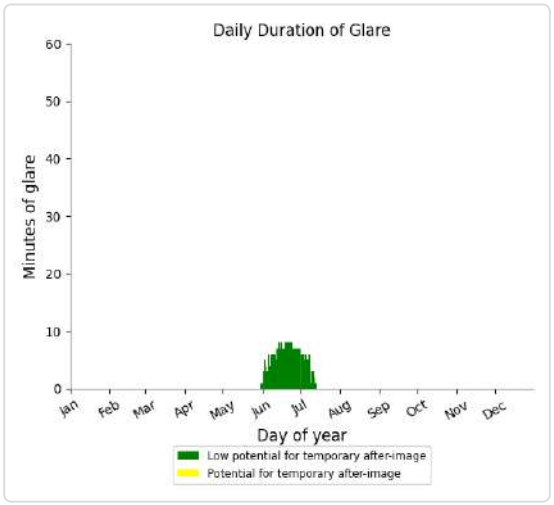


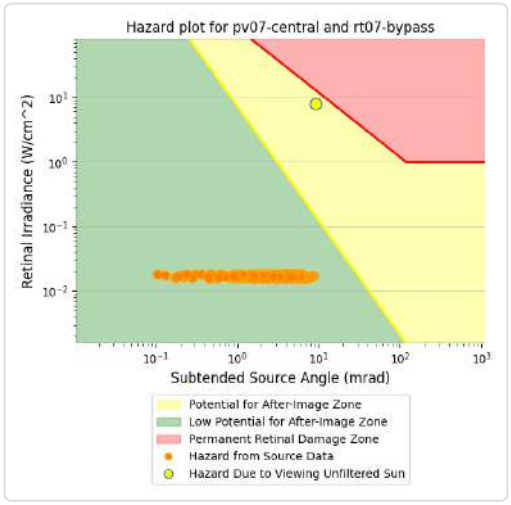
PV07 Central 1 and Route: RT07 Bypass Rd

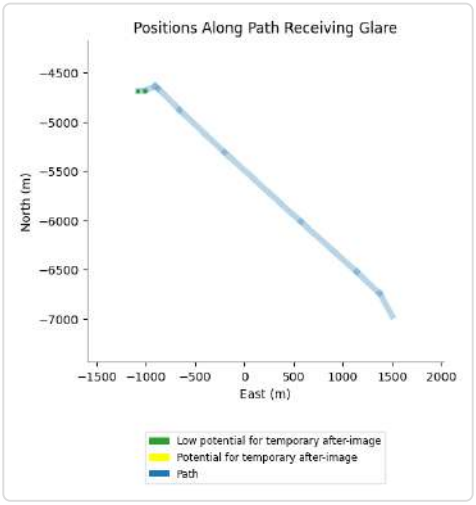
Yellow glare: none

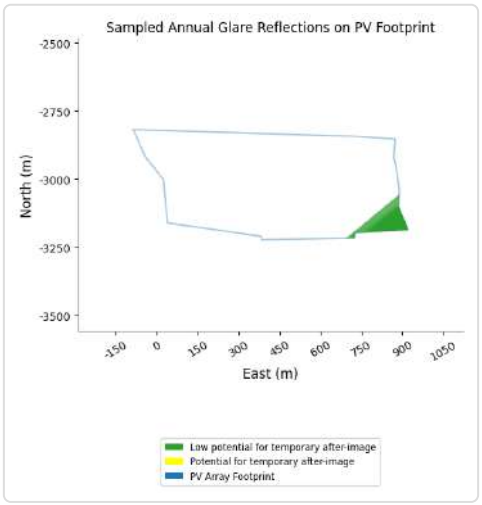
Green glare: 246 min.

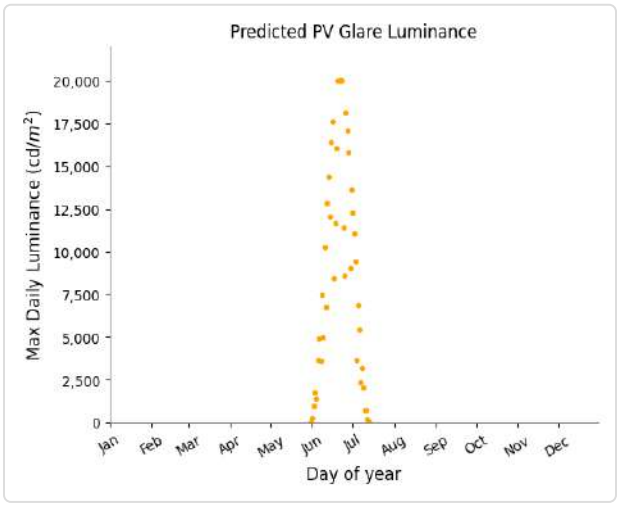








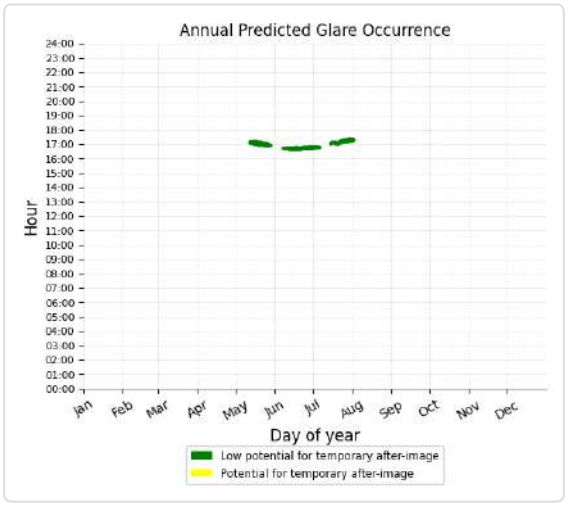


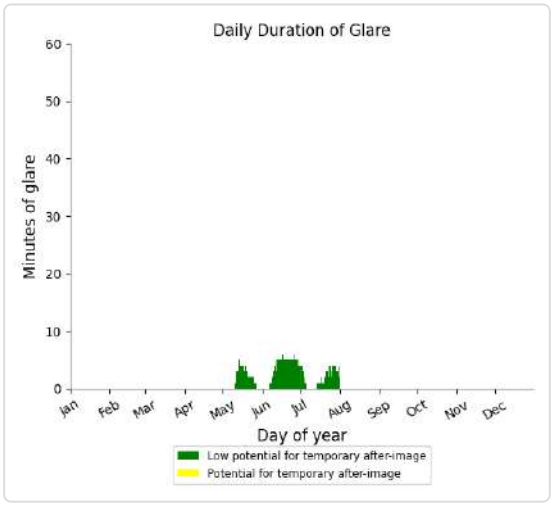


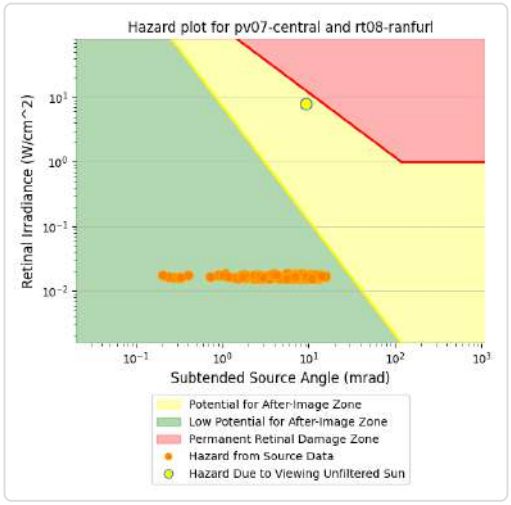
PV07 Central 1 and Route: RT08 Ranfurly Back Rd

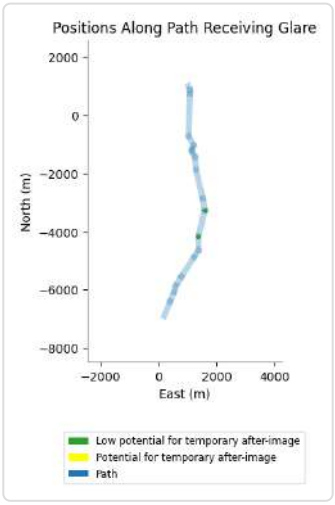
Yellow glare: none

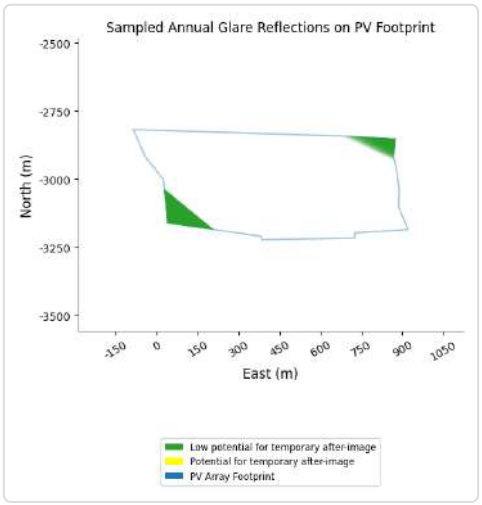
Green glare: 211 min.

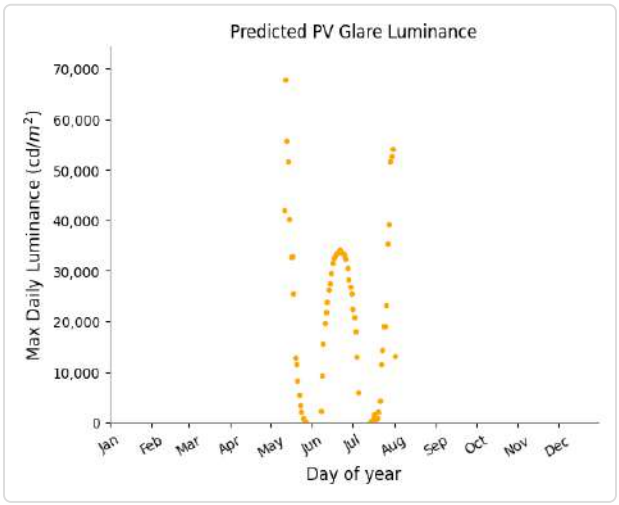












PV07 Central 1 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV07 Central 1 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV07 Central 1 and Route: RT03 Brinsdon Rd

No glare found

PV07 Central 1 and Route: RT04 Naseby Link Rd

No glare found

PV07 Central 1 and Route: RT05 Fennessy Rd

No glare found

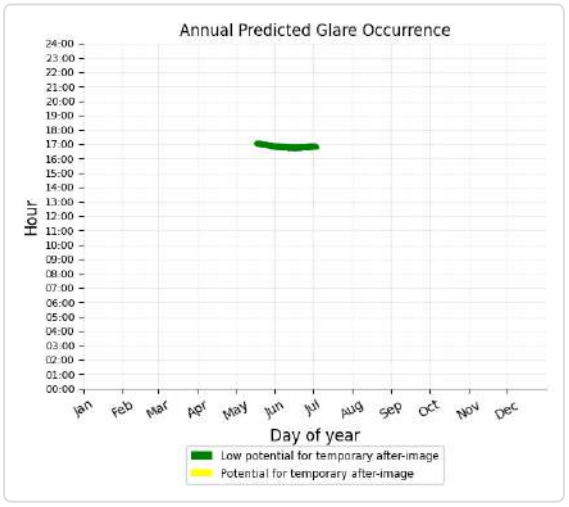
PV07 Central 1 and Route: RT09 Glen Rd

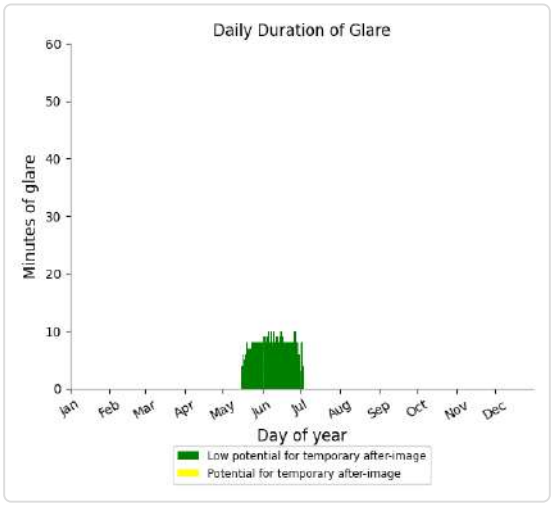
No glare found

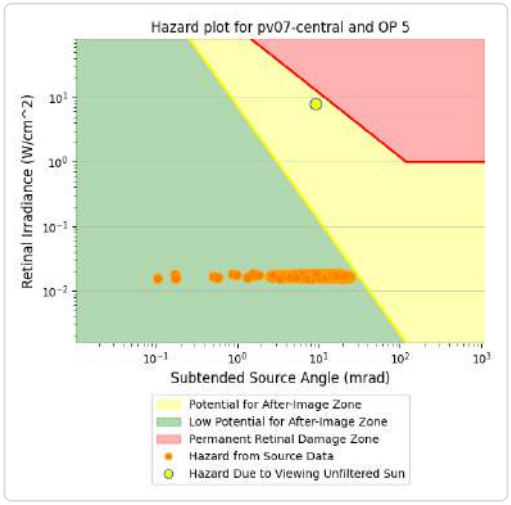
PV07 Central 1 and OP 5

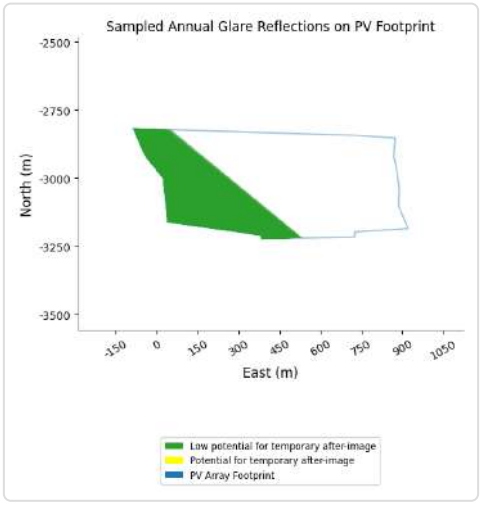
Yellow glare: none

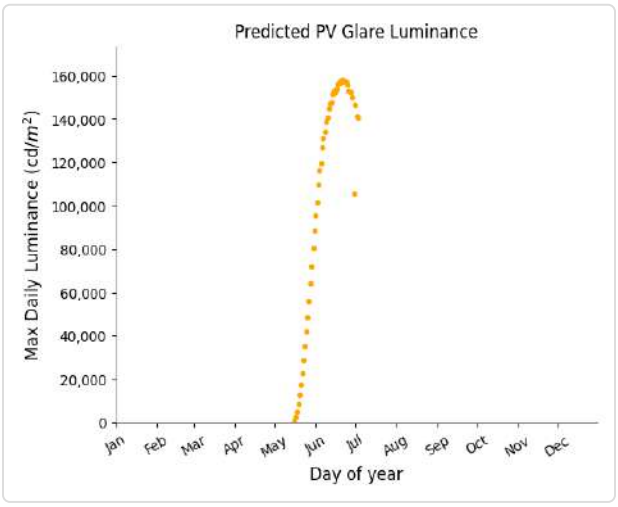
Green glare: 386 min.







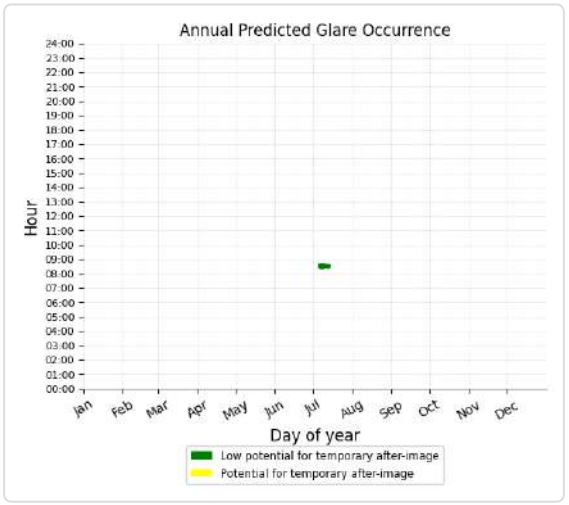


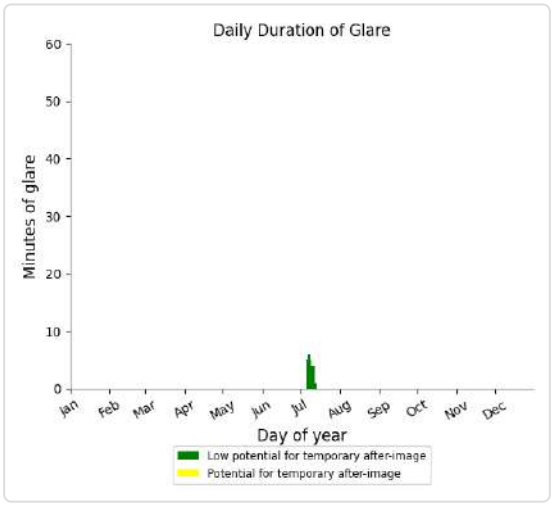


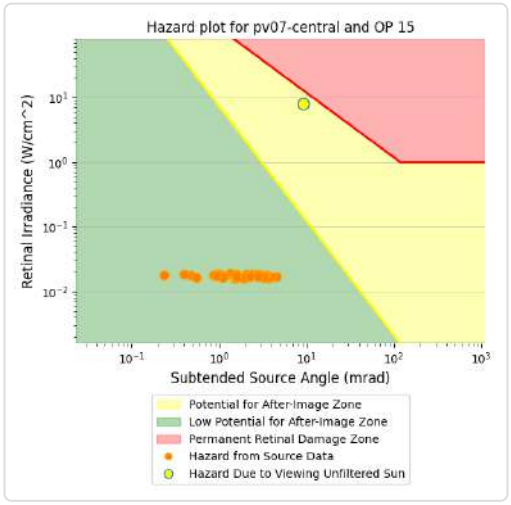
PV07 Central 1 and OP 15

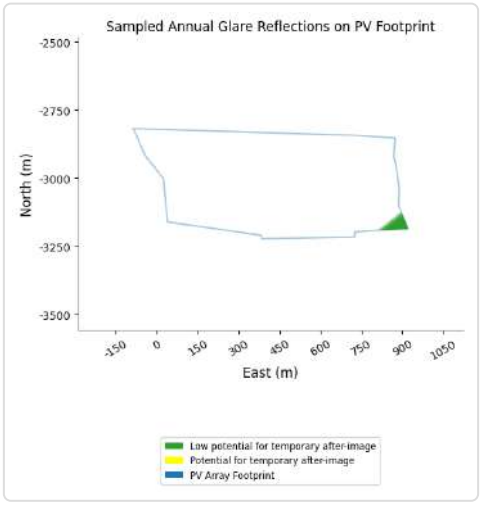
Yellow glare: none

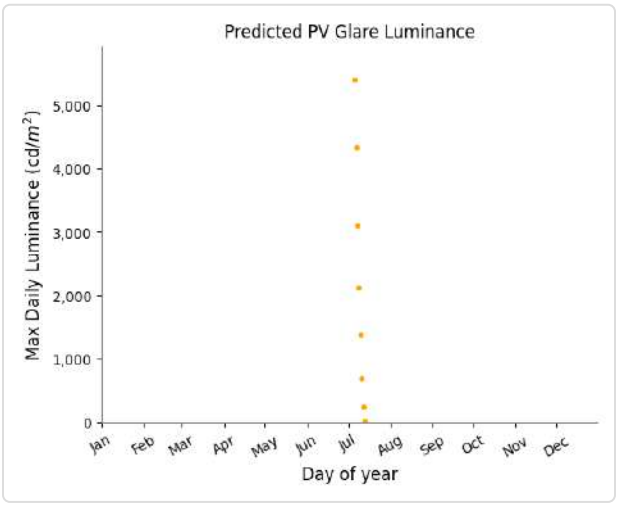
Green glare: 35 min.











PV07 Central 1 and OP 1

No glare found

PV07 Central 1 and OP 2

No glare found

PV07 Central 1 and OP 3

No glare found

PV07 Central 1 and OP 4

No glare found

PV07 Central 1 and OP 6

No glare found

PV07 Central 1 and OP 7

No glare found

PV07 Central 1 and OP 8

No glare found

PV07 Central 1 and OP 9

No glare found

PV07 Central 1 and OP 10

No glare found

PV07 Central 1 and OP 11

No glare found

PV07 Central 1 and OP 12

No glare found

PV07 Central 1 and OP 13

No glare found

PV07 Central 1 and OP 14

No glare found

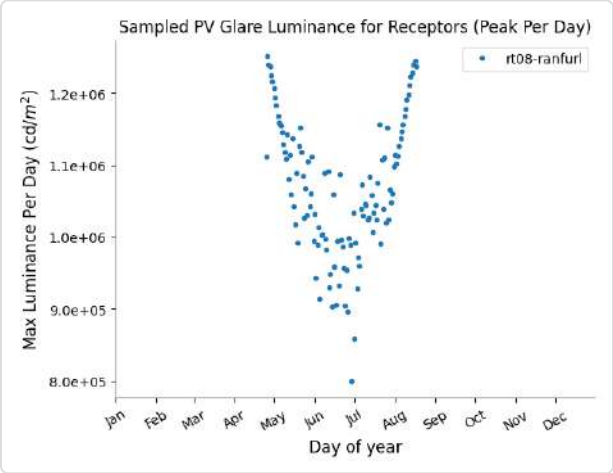
PV07 Central 1 and OP 16

No glare found

PV: PV08 Central 2 potential temporary after-image

Receptor results ordered by category of glare

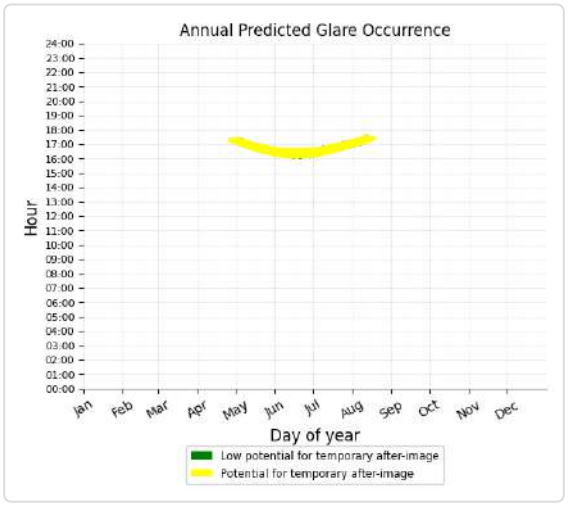
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	364	6.1	1,434	23.9	1,251,087
RT01 Ranfurly Wedderburn Rd	187	3.1	0	0.0	139,630
RT06 Ranfurly Naseby Rd	683	11.4	0	0.0	115,482
RT07 Bypass Rd	627	10.4	0	0.0	129,242
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 15	55	0.9	0	0.0	45,184
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

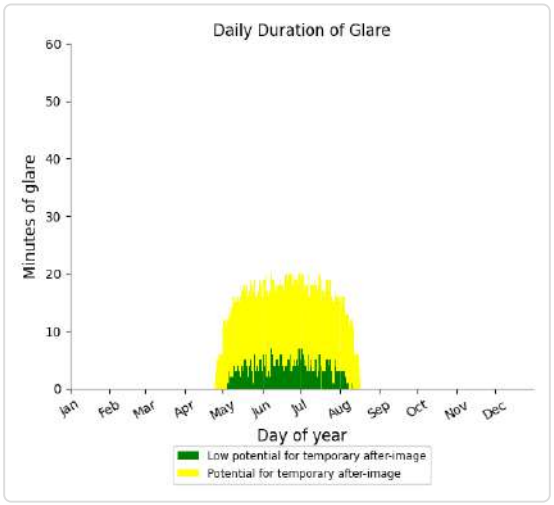

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt08-ranfurl
Max Luminance Per Day (cd/m²)
1.2e+06
1.1e+06
1.0e+06
9.0e+05
8.0e+05
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

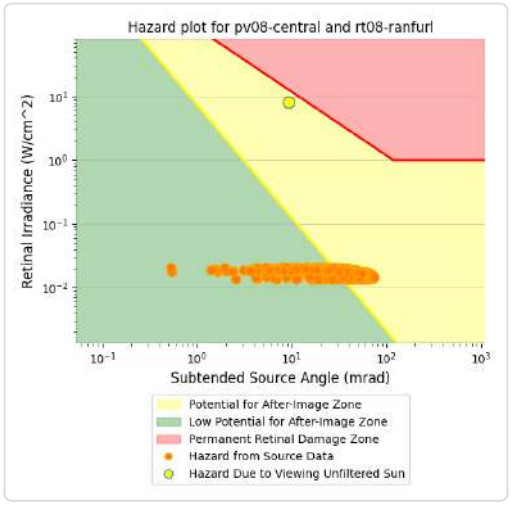
PV08 Central 2 and Route: RT08 Ranfurly Back Rd

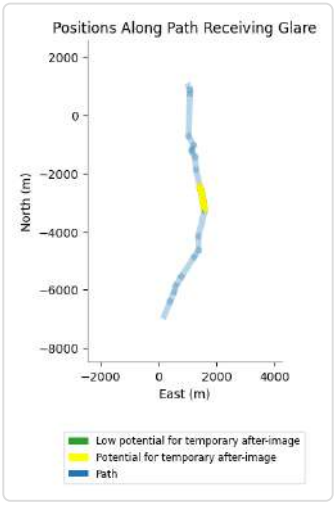
Yellow glare: 1,434 min.

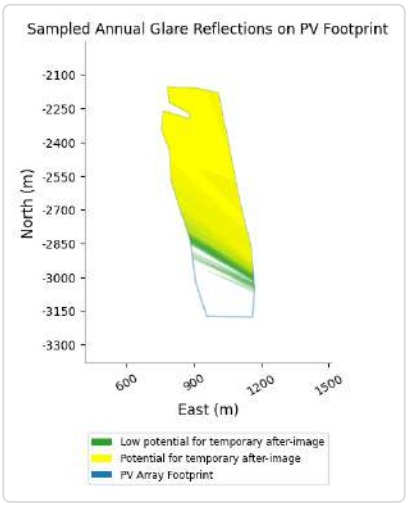
Green glare: 364 min.

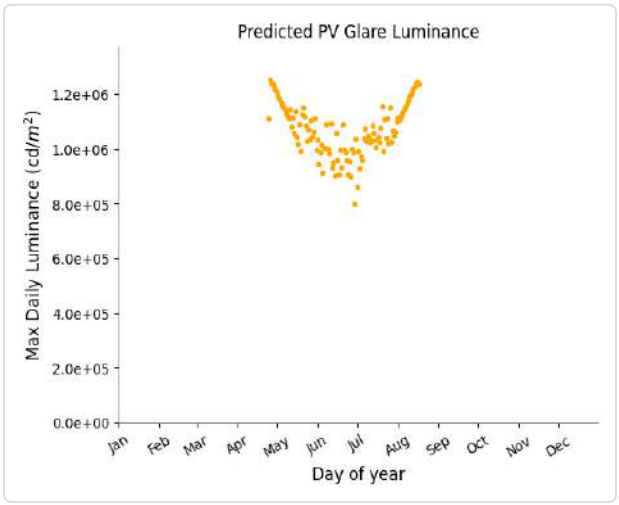








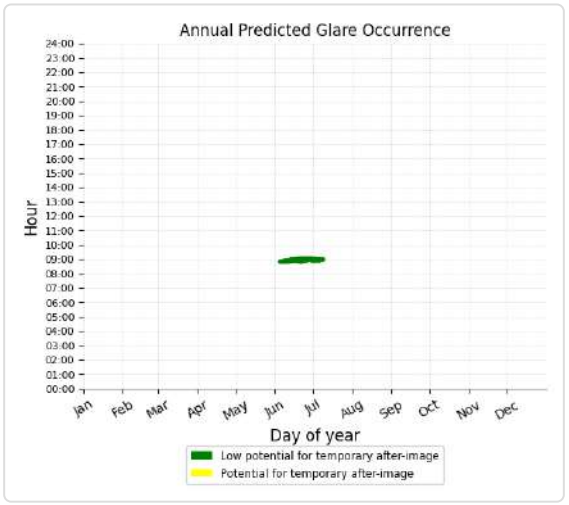


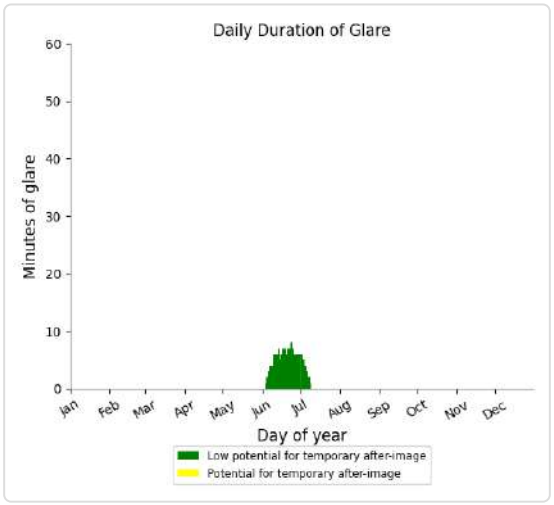


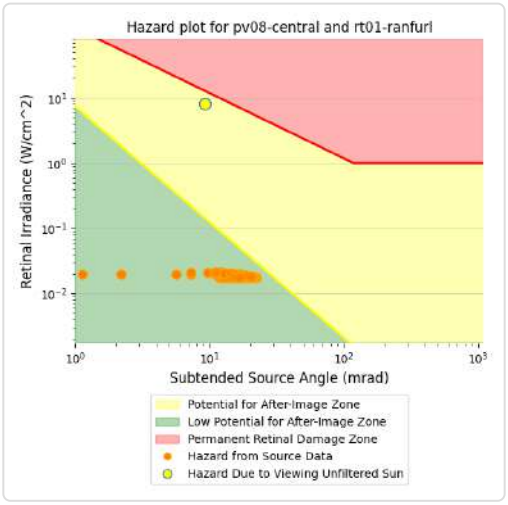
PV08 Central 2 and Route: RT01 Ranfurly Wedderburn Rd

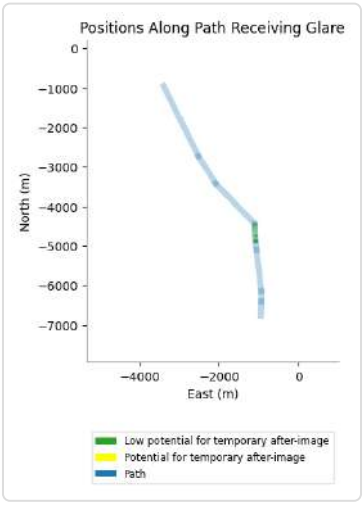
Yellow glare: none

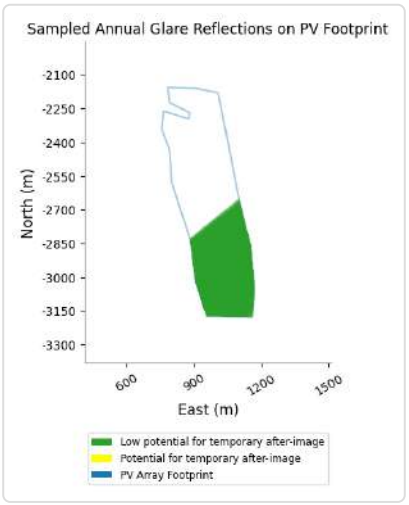
Green glare: 187 min.

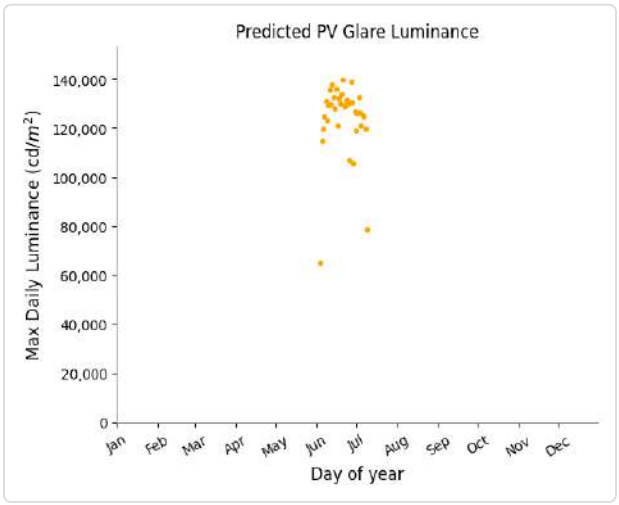








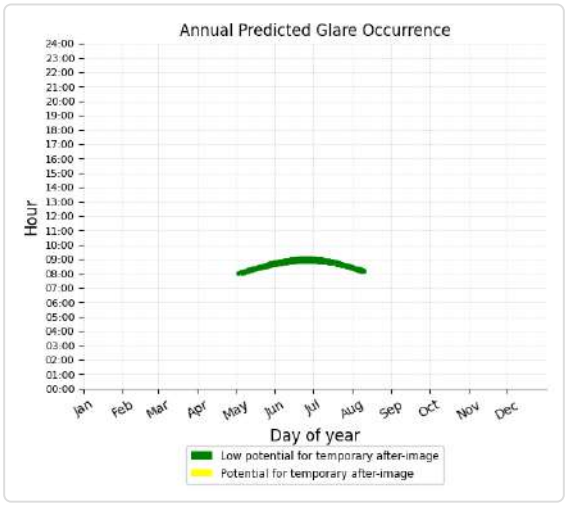


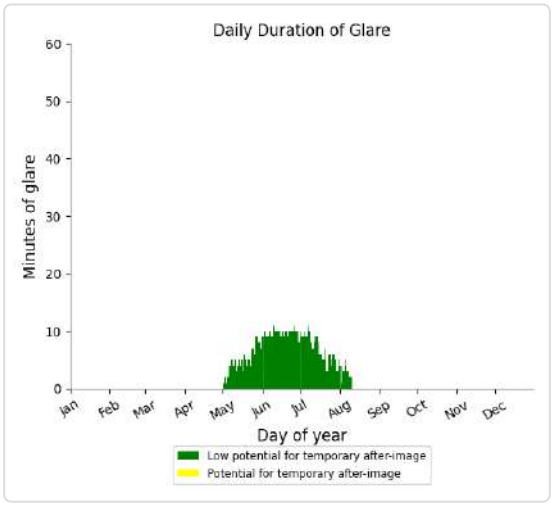


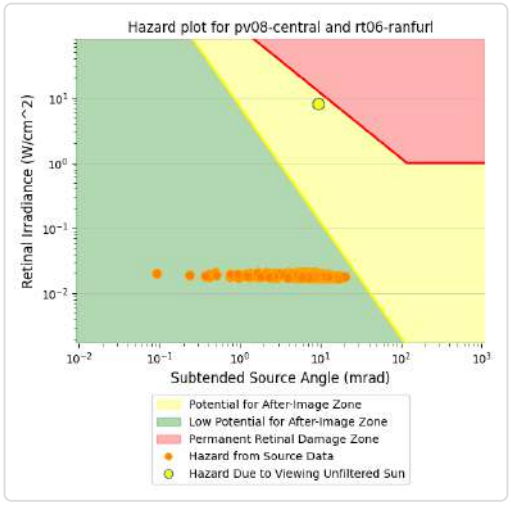
PV08 Central 2 and Route: RT06 Ranfurly Naseby Rd

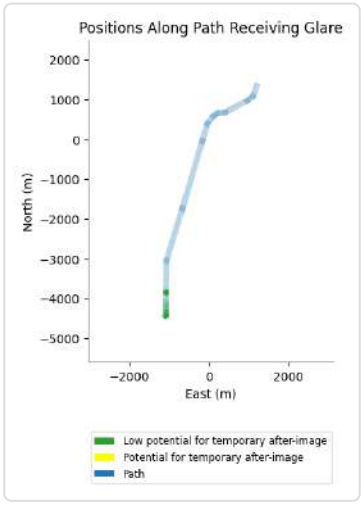
Yellow glare: none

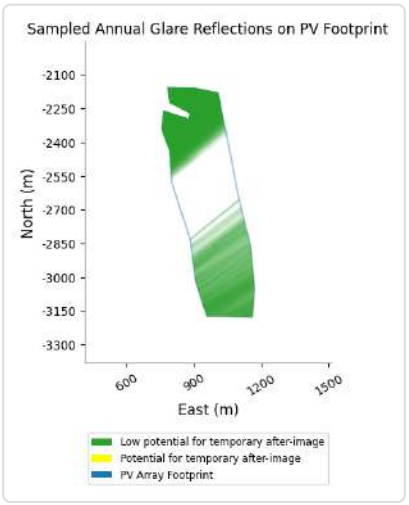
Green glare: 683 min.

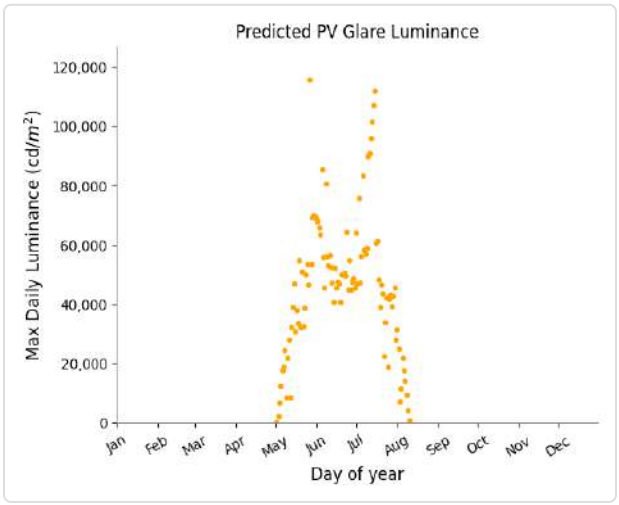








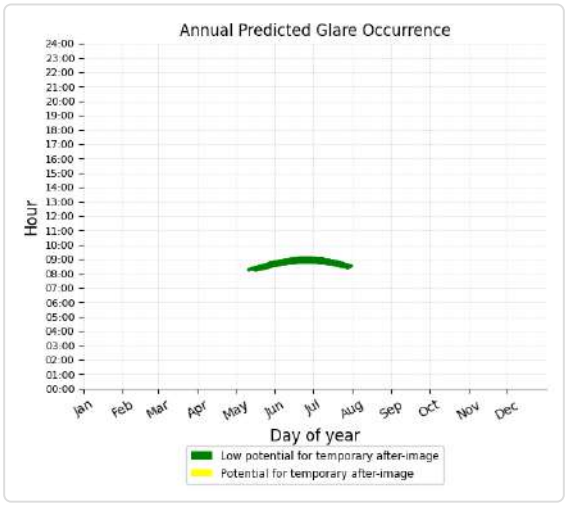


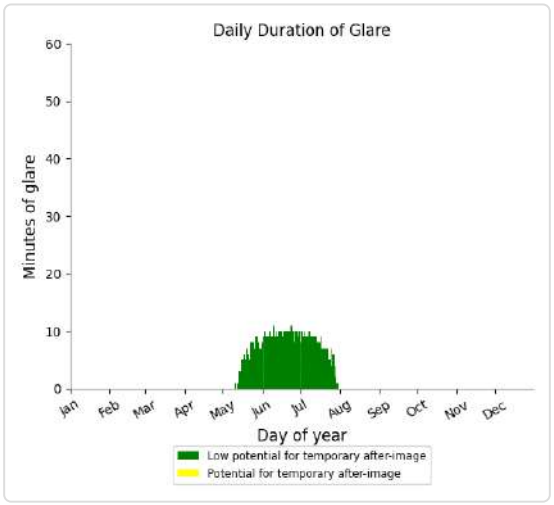


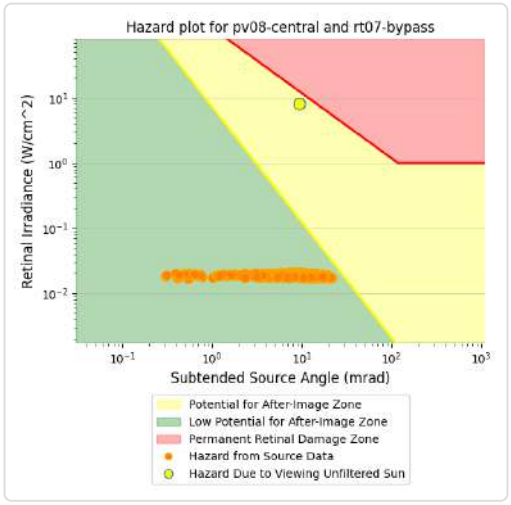
PV08 Central 2 and Route: RT07 Bypass Rd

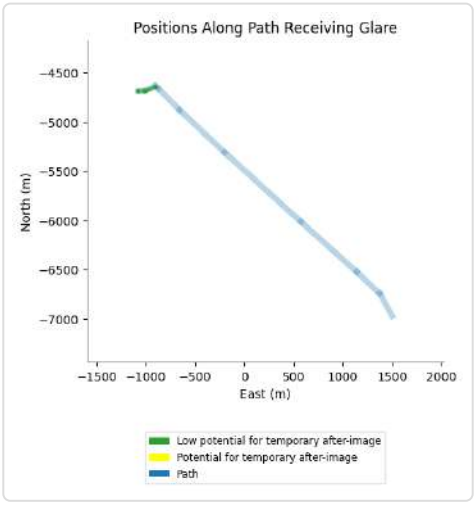
Yellow glare: none

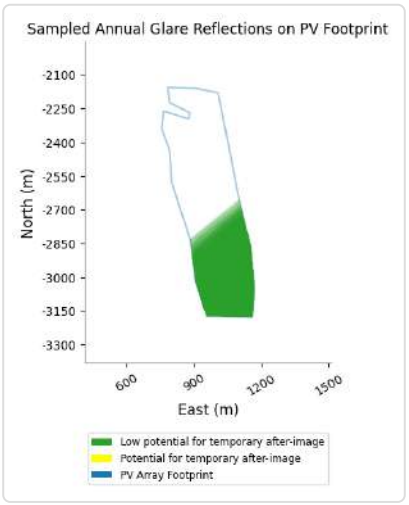
Green glare: 627 min.

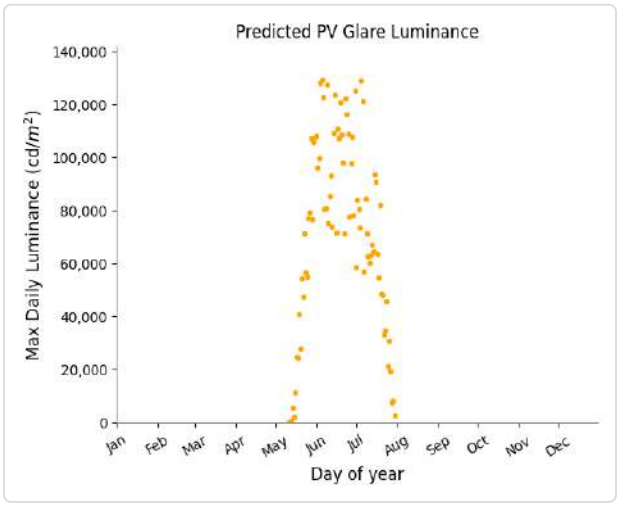












PV08 Central 2 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV08 Central 2 and Route: RT03 Brinsdon Rd

No glare found

PV08 Central 2 and Route: RT04 Naseby Link Rd

No glare found

PV08 Central 2 and Route: RT05 Fennessy Rd

No glare found

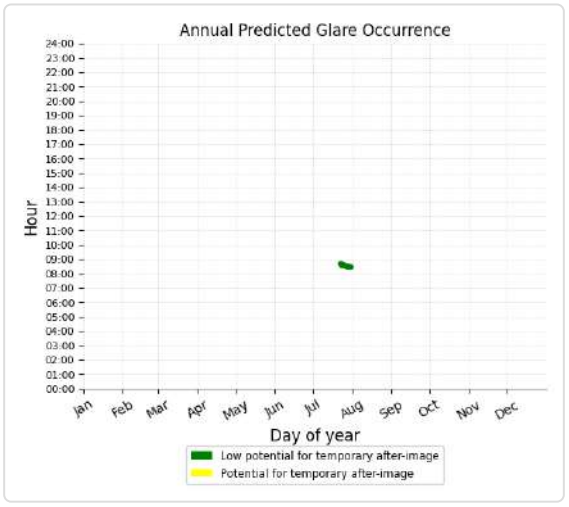
PV08 Central 2 and Route: RT09 Glen Rd

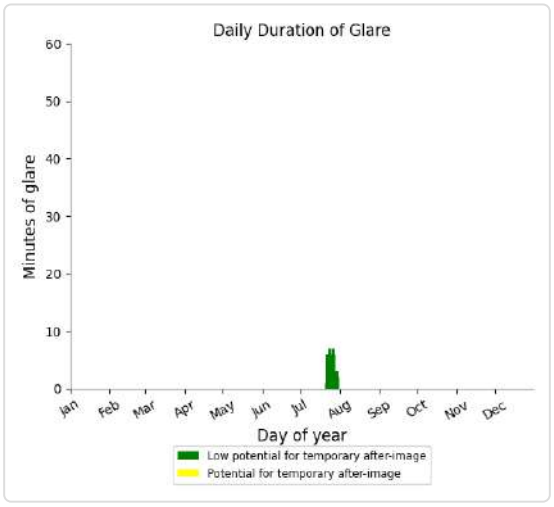
No glare found

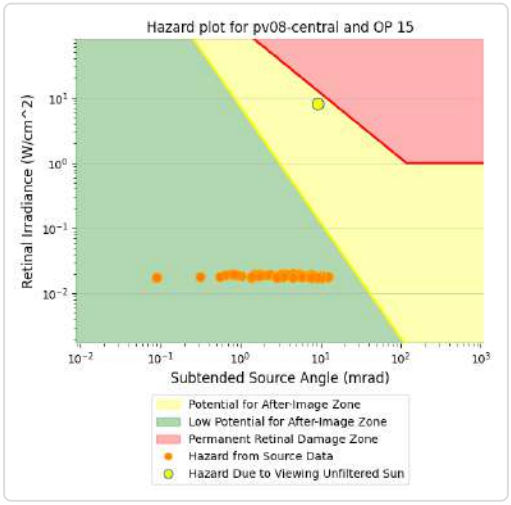
PV08 Central 2 and OP 15

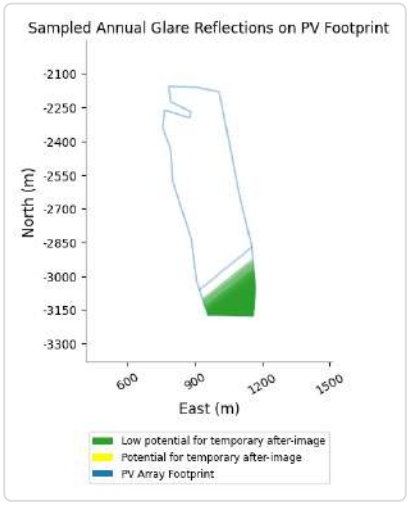
Yellow glare: none

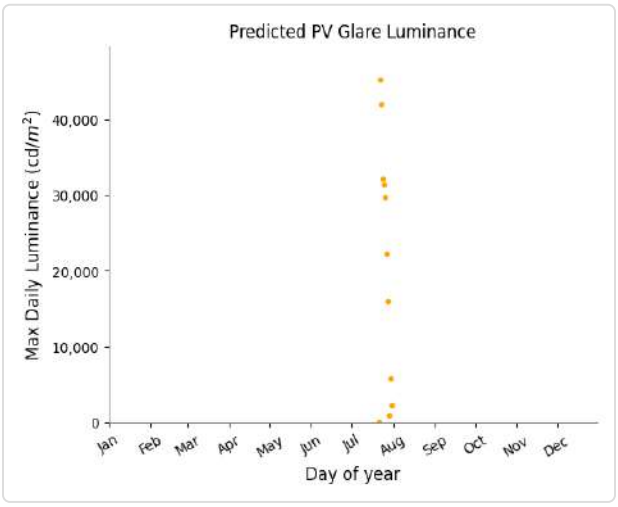
Green glare: 55 min.











PV08 Central 2 and OP 1

No glare found

PV08 Central 2 and OP 2

No glare found

PV08 Central 2 and OP 3

No glare found

PV08 Central 2 and OP 4

No glare found

PV08 Central 2 and OP 5

No glare found

PV08 Central 2 and OP 6

No glare found

PV08 Central 2 and OP 7

No glare found

PV08 Central 2 and OP 8

No glare found

PV08 Central 2 and OP 9

No glare found

PV08 Central 2 and OP 10

No glare found

PV08 Central 2 and OP 11

No glare found

PV08 Central 2 and OP 12

No glare found

PV08 Central 2 and OP 13

No glare found

PV08 Central 2 and OP 14

No glare found

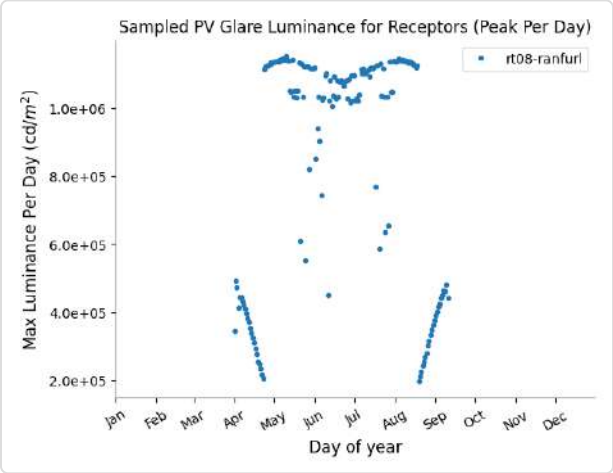
PV08 Central 2 and OP 16

No glare found

PV: PV09 Central 3 potential temporary after-image

Receptor results ordered by category of glare

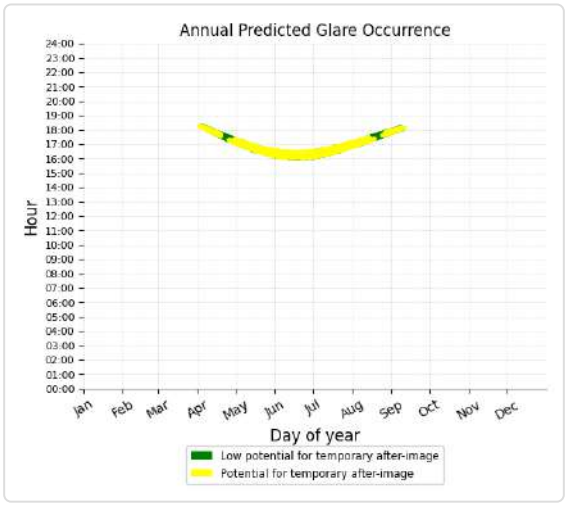
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	416	6.9	1,257	20.9	1,151,409
RT06 Ranfurly Naseby Rd	694	11.6	0	0.0	113,495
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

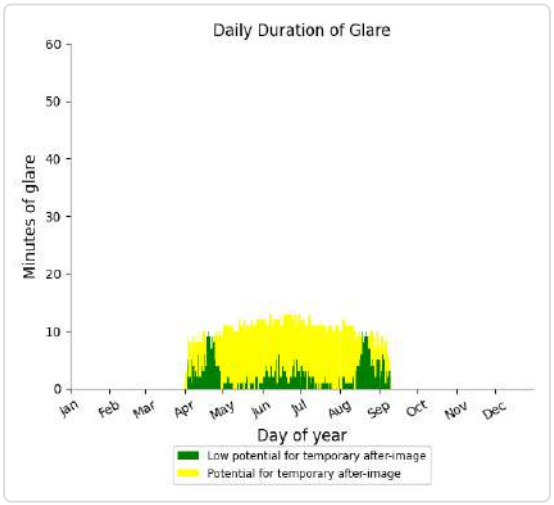

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt08-ranfurl
Max Luminance Per Day (cd/m²)
1.0e+06
8.0e+05
6.0e+05
4.0e+05
2.0e+05
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

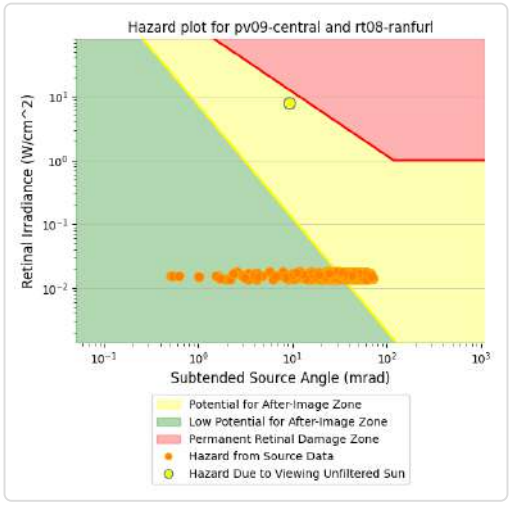
PV09 Central 3 and Route: RT08 Ranfurly Back Rd

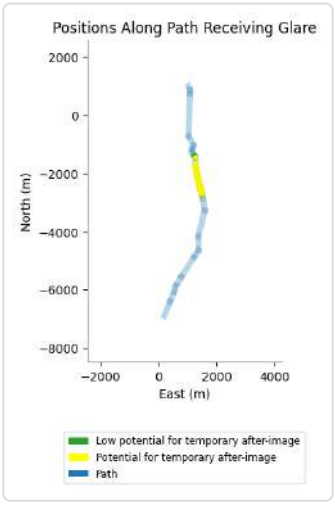
Yellow glare: 1,257 min.

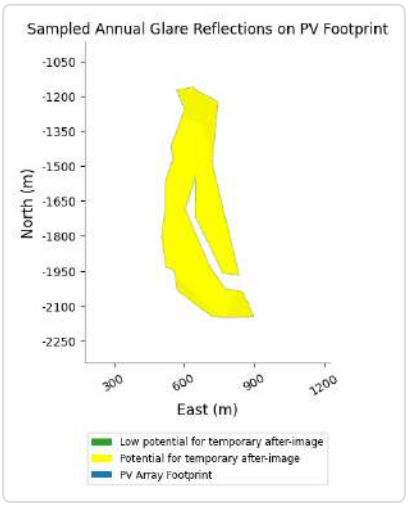
Green glare: 416 min.

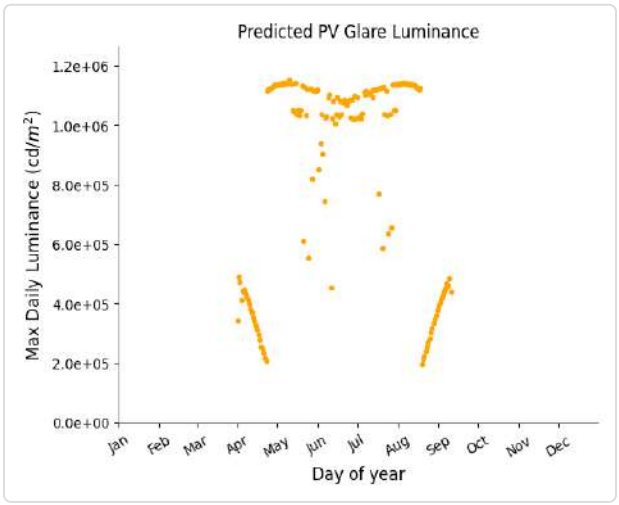








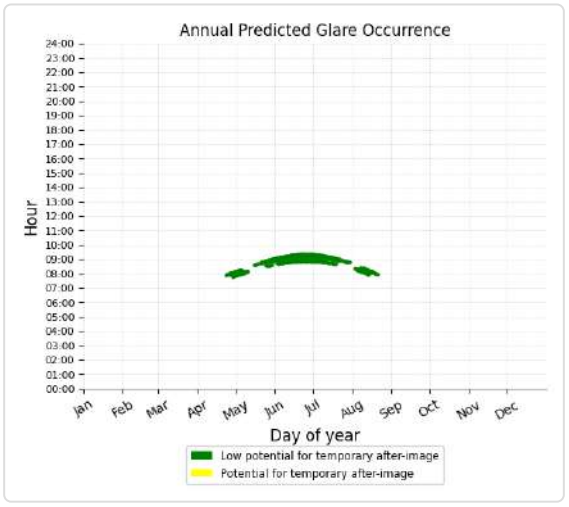


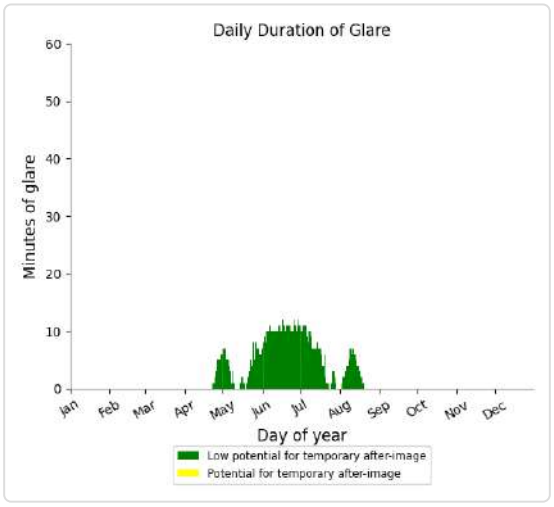


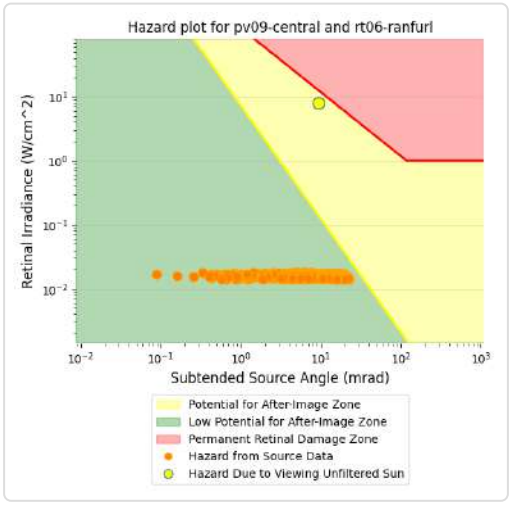
PV09 Central 3 and Route: RT06 Ranfurly Naseby Rd

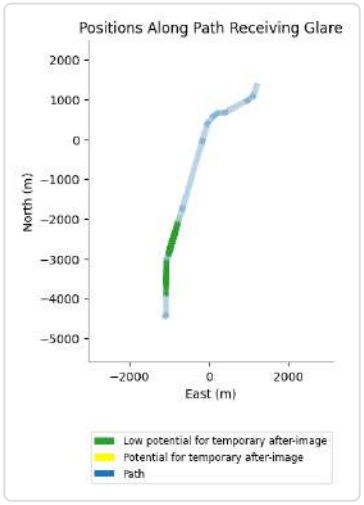
Yellow glare: none

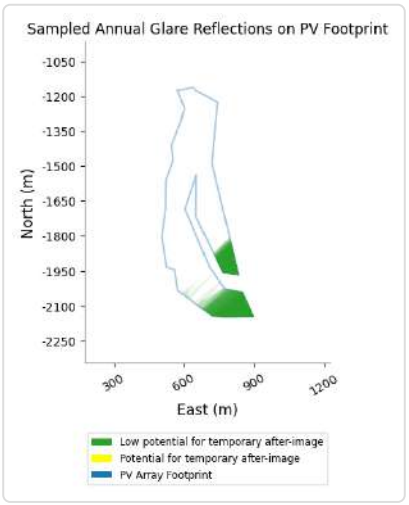
Green glare: 694 min.

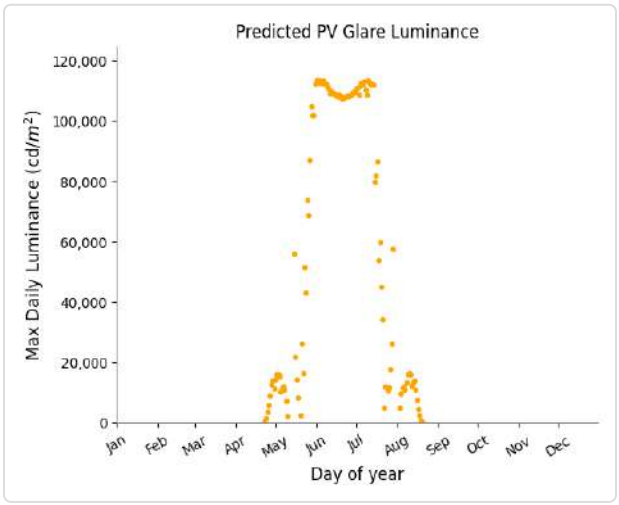












PV09 Central 3 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV09 Central 3 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV09 Central 3 and Route: RT03 Brinsdon Rd

No glare found

PV09 Central 3 and Route: RT04 Naseby Link Rd

No glare found

PV09 Central 3 and Route: RT05 Fennessy Rd

No glare found

PV09 Central 3 and Route: RT07 Bypass Rd

No glare found

PV09 Central 3 and Route: RT09 Glen Rd

No glare found

PV09 Central 3 and OP 1

No glare found

PV09 Central 3 and OP 2

No glare found

PV09 Central 3 and OP 3

No glare found

PV09 Central 3 and OP 4

No glare found

PV09 Central 3 and OP 5

No glare found

PV09 Central 3 and OP 6

No glare found

PV09 Central 3 and OP 7

No glare found

PV09 Central 3 and OP 8

No glare found

PV09 Central 3 and OP 9

No glare found

PV09 Central 3 and OP 10

No glare found

PV09 Central 3 and OP 11

No glare found

PV09 Central 3 and OP 12

No glare found

PV09 Central 3 and OP 13

No glare found

PV09 Central 3 and OP 14

No glare found

PV09 Central 3 and OP 15

No glare found

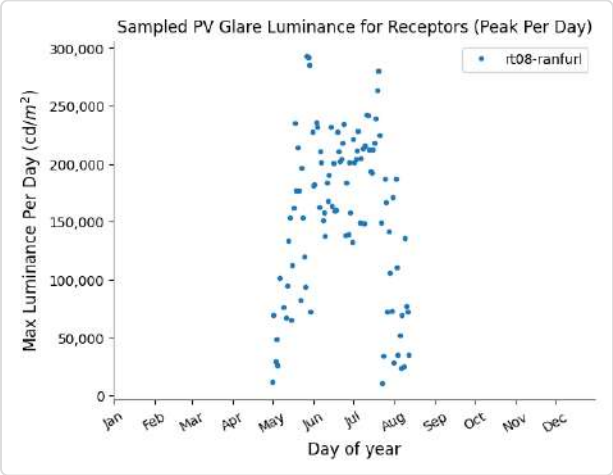
PV09 Central 3 and OP 16

No glare found

PV: PV10 Central 4 potential temporary after-image

Receptor results ordered by category of glare

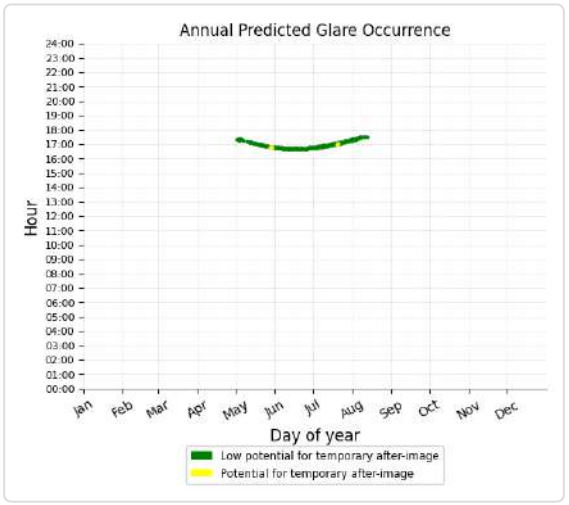
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	211	3.5	5	0.1	292,414
RT06 Ranfurly Naseby Rd	51	0.8	0	0.0	31,703
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

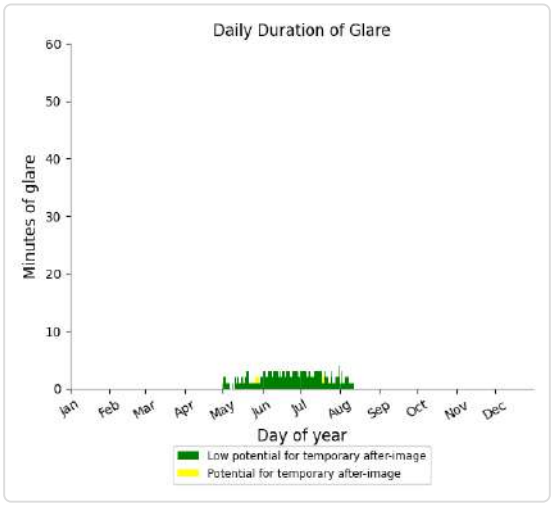

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt08-ranfurl
Max Luminance Per Day (cd/m²)
300,000
250,000
200,000
150,000
100,000
50,000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

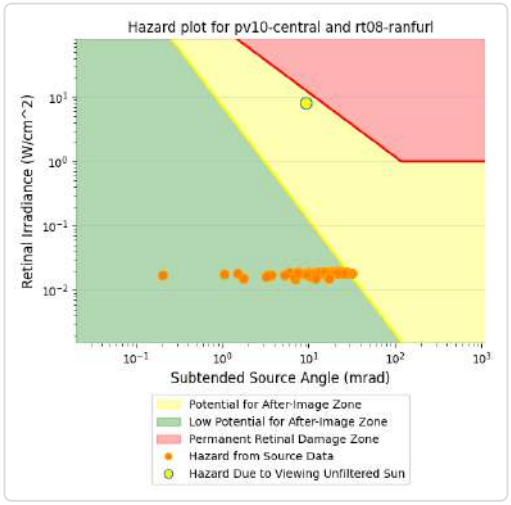
PV10 Central 4 and Route: RT08 Ranfurly Back Rd

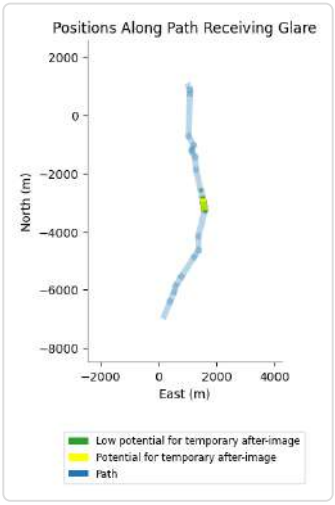
Yellow glare: 5 min.

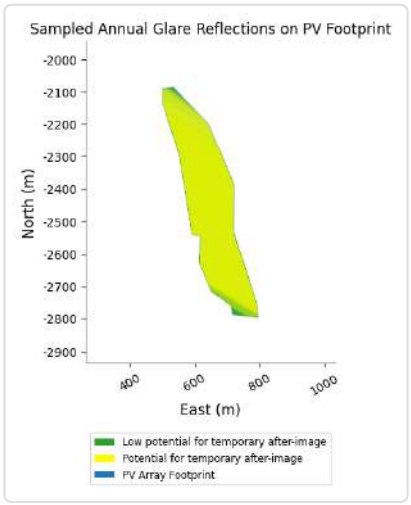
Green glare: 211 min.

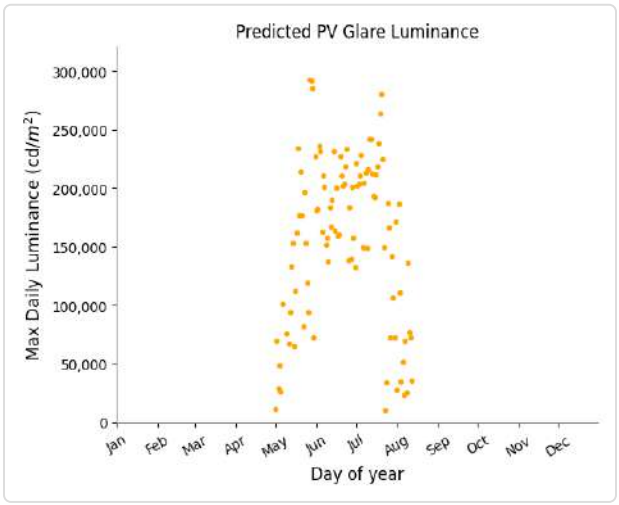








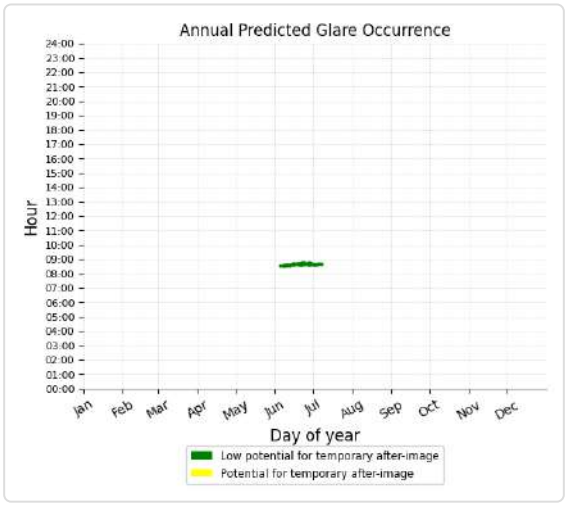


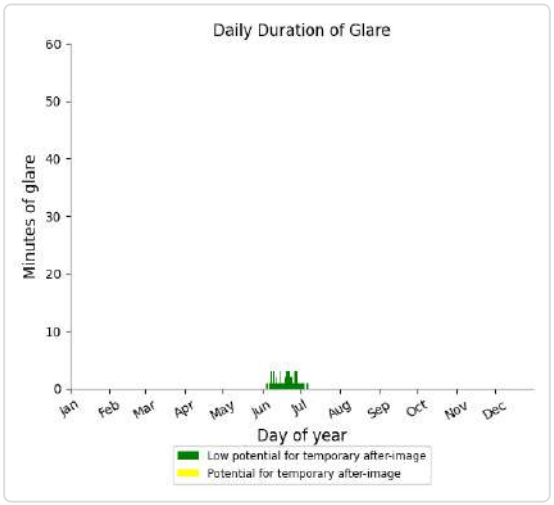


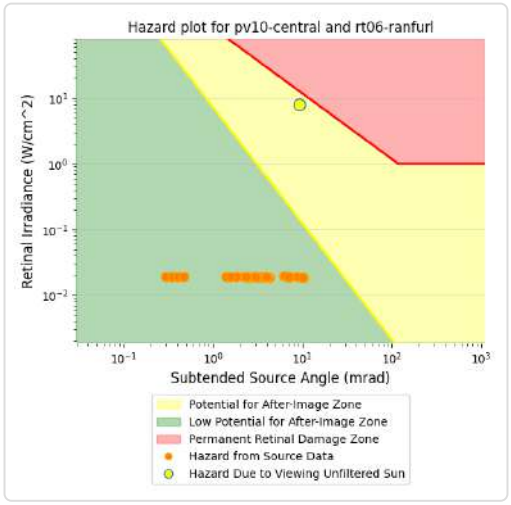
PV10 Central 4 and Route: RT06 Ranfurly Naseby Rd

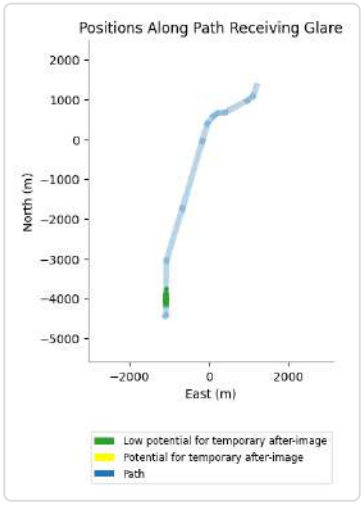
Yellow glare: none

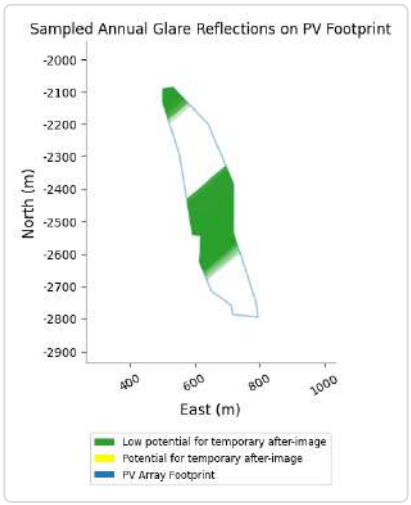
Green glare: 51 min.

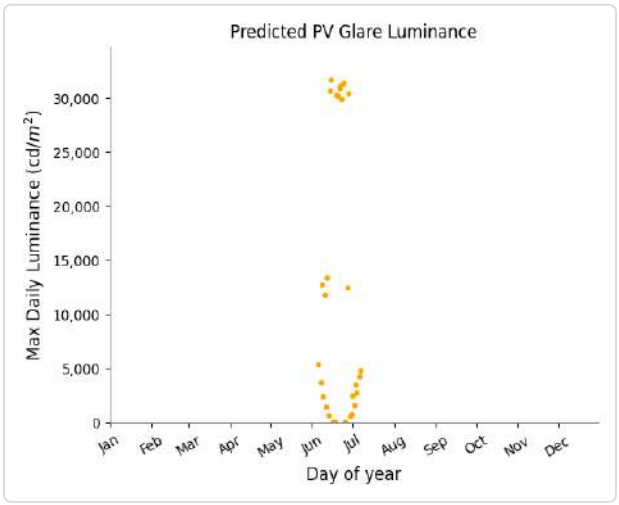












PV10 Central 4 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV10 Central 4 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV10 Central 4 and Route: RT03 Brinsdon Rd

No glare found

PV10 Central 4 and Route: RT04 Naseby Link Rd

No glare found

PV10 Central 4 and Route: RT05 Fennessy Rd

No glare found

PV10 Central 4 and Route: RT07 Bypass Rd

No glare found

PV10 Central 4 and Route: RT09 Glen Rd

No glare found

PV10 Central 4 and OP 1

No glare found

PV10 Central 4 and OP 2

No glare found

PV10 Central 4 and OP 3

No glare found

PV10 Central 4 and OP 4

No glare found

PV10 Central 4 and OP 5

No glare found

PV10 Central 4 and OP 6

No glare found

PV10 Central 4 and OP 7

No glare found

PV10 Central 4 and OP 8

No glare found

PV10 Central 4 and OP 9

No glare found

PV10 Central 4 and OP 10

No glare found

PV10 Central 4 and OP 11

No glare found

PV10 Central 4 and OP 12

No glare found

PV10 Central 4 and OP 13

No glare found

PV10 Central 4 and OP 14

No glare found

PV10 Central 4 and OP 15

No glare found

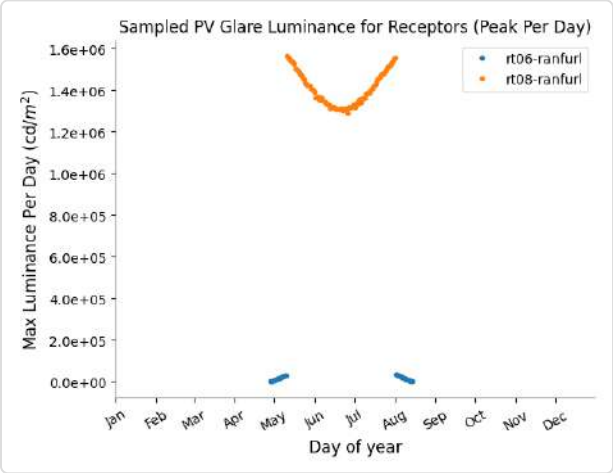
PV10 Central 4 and OP 16

No glare found

PV: PV11 East 1 potential temporary after-image

Receptor results ordered by category of glare

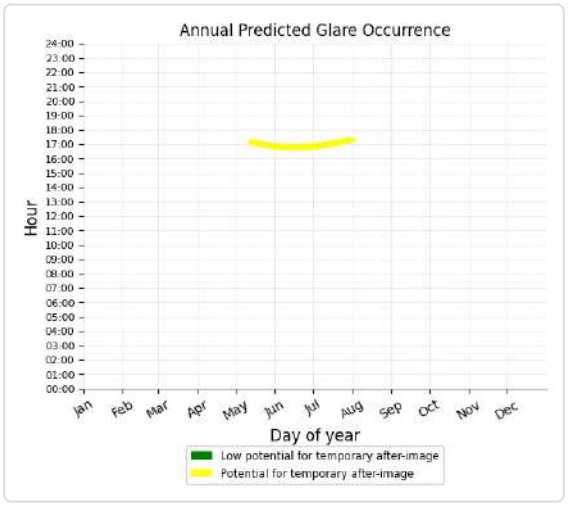
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	14	0.2	510	8.5	1,562,785
RT06 Ranfurly Naseby Rd	560	9.3	0	0.0	37,922
RT07 Bypass Rd	637	10.6	0	0.0	44,511
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 13	47	0.8	0	0.0	7,539
OP 15	155	2.6	0	0.0	35,239
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

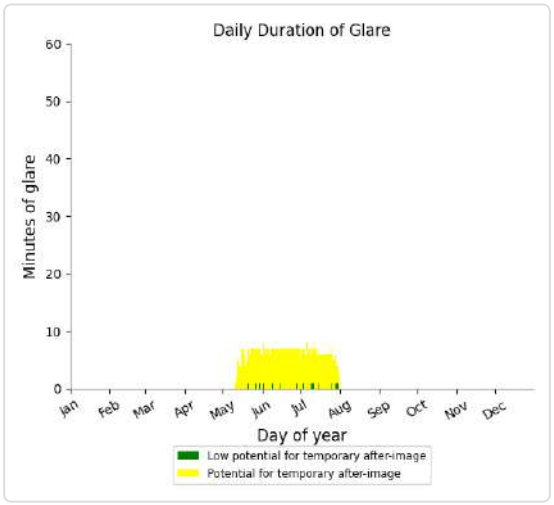

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt06-ranfurl
rt08-ranfurl
Max Luminance Per Day (cd/m²)
1.6e+06
1.4e+06
1.2e+06
1.0e+06
8.0e+05
6.0e+05
4.0e+05
2.0e+05
0.0e+00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

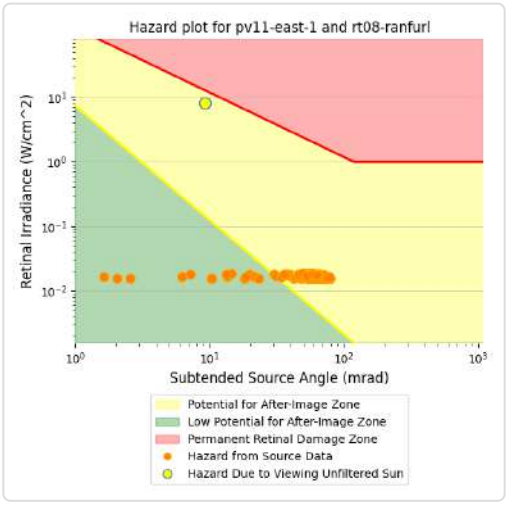
PV11 East 1 and Route: RT08 Ranfurly Back Rd

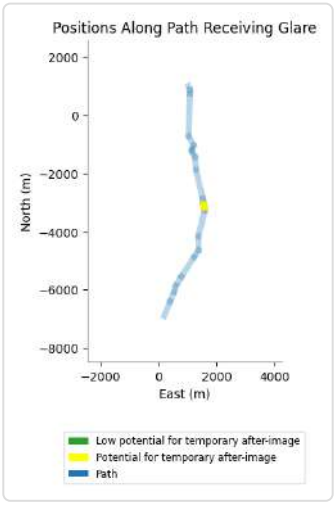
Yellow glare: 510 min.

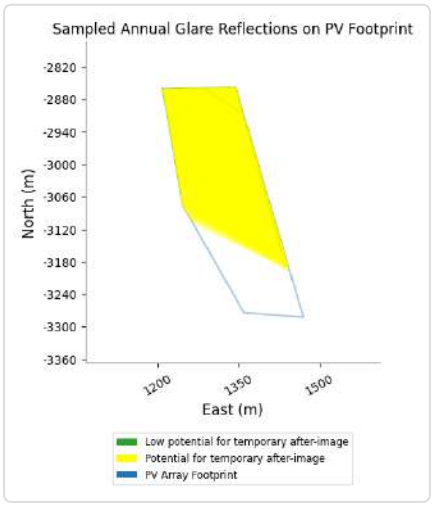
Green glare: 14 min.

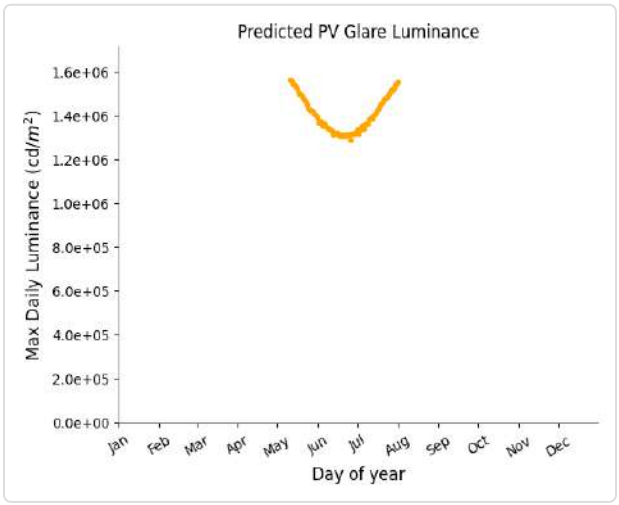








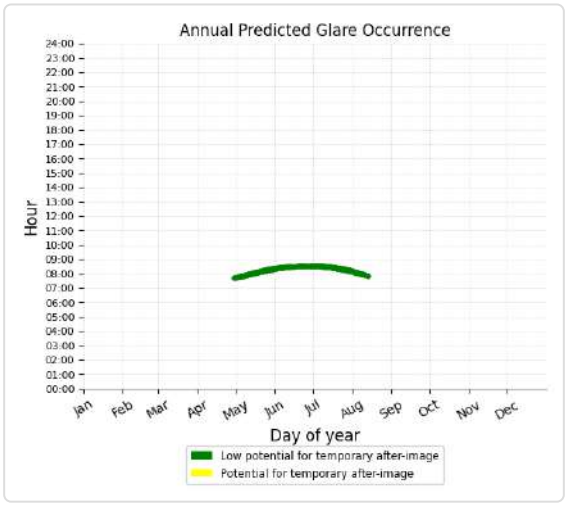


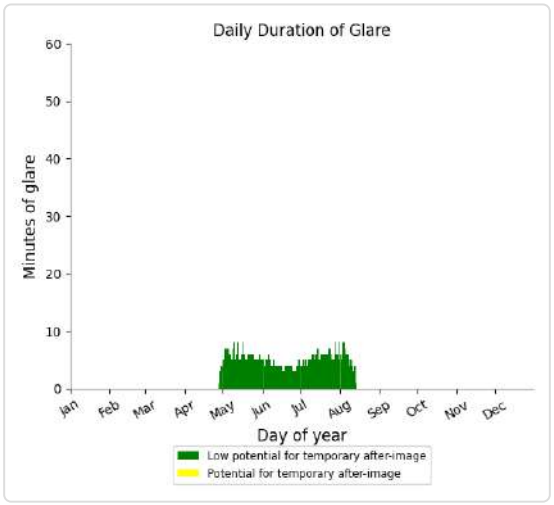


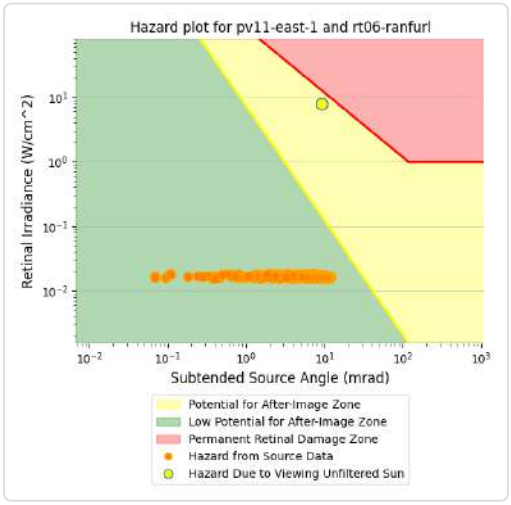
PV11 East 1 and Route: RT06 Ranfurly Naseby Rd

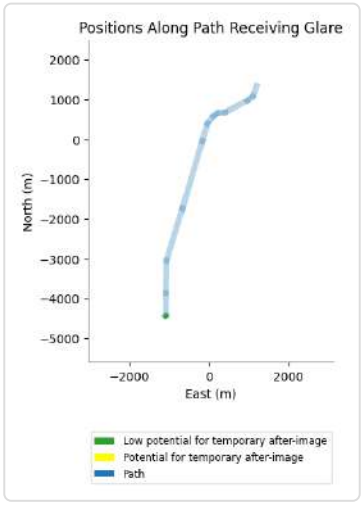
Yellow glare: none

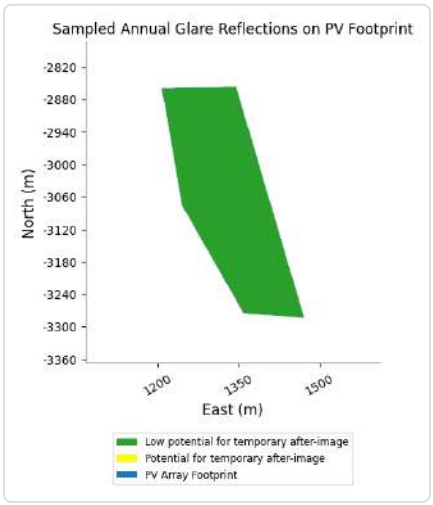
Green glare: 560 min.

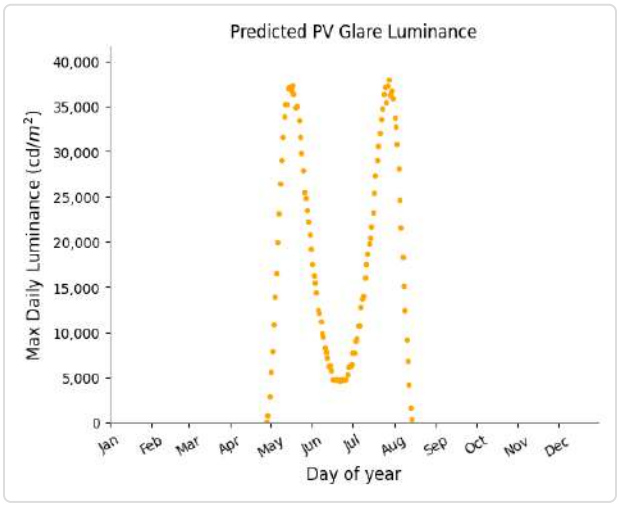








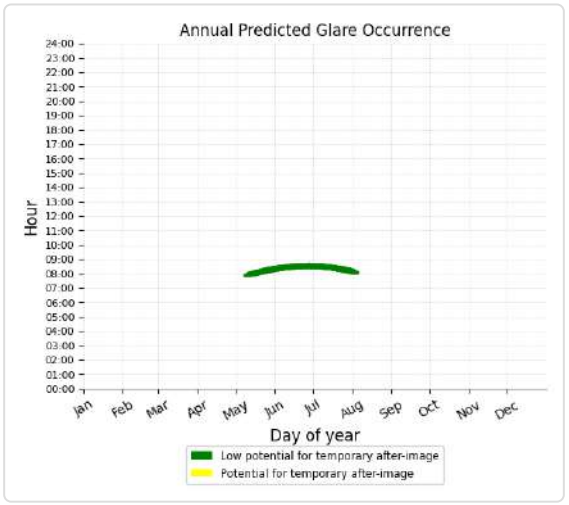


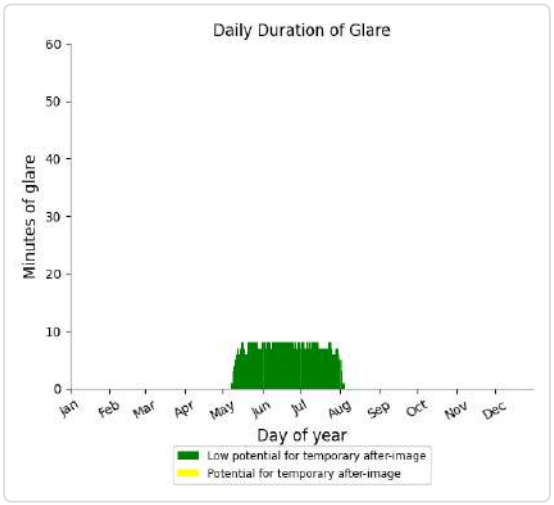


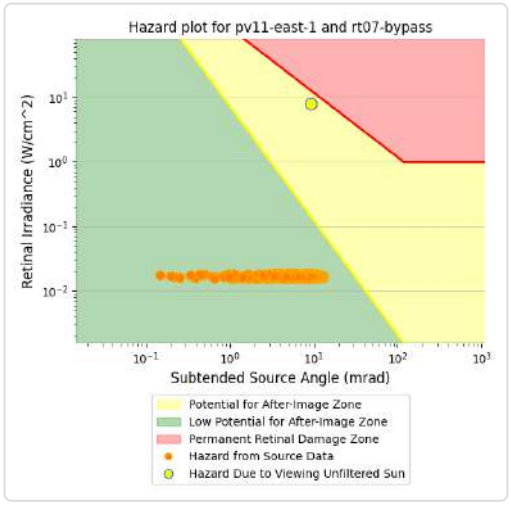
PV11 East 1 and Route: RT07 Bypass Rd

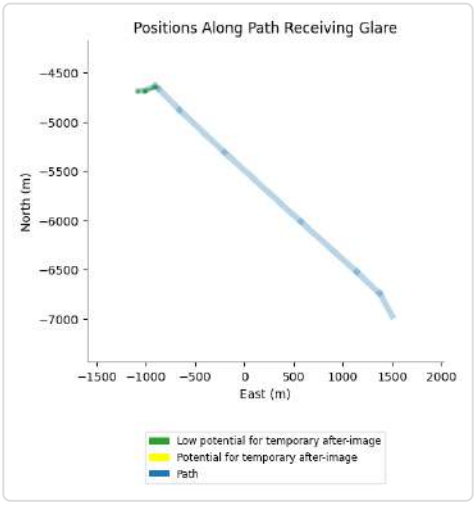
Yellow glare: none

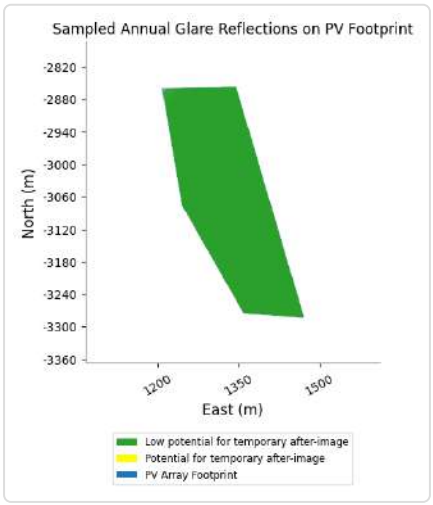
Green glare: 637 min.

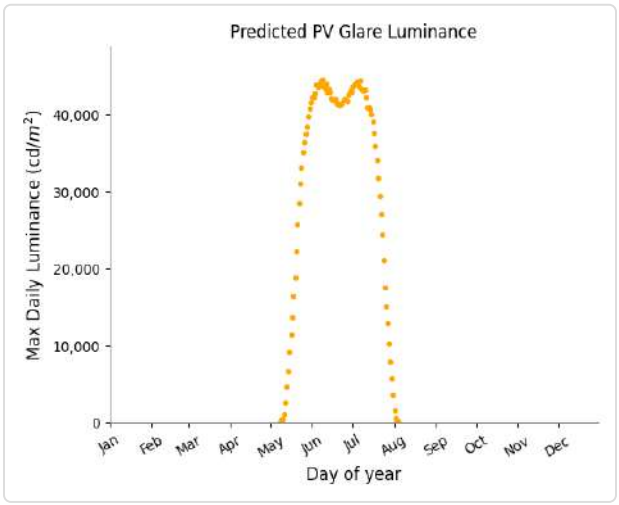












PV11 East 1 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV11 East 1 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV11 East 1 and Route: RT03 Brinsdon Rd

No glare found

PV11 East 1 and Route: RT04 Naseby Link Rd

No glare found

PV11 East 1 and Route: RT05 Fennessy Rd

No glare found

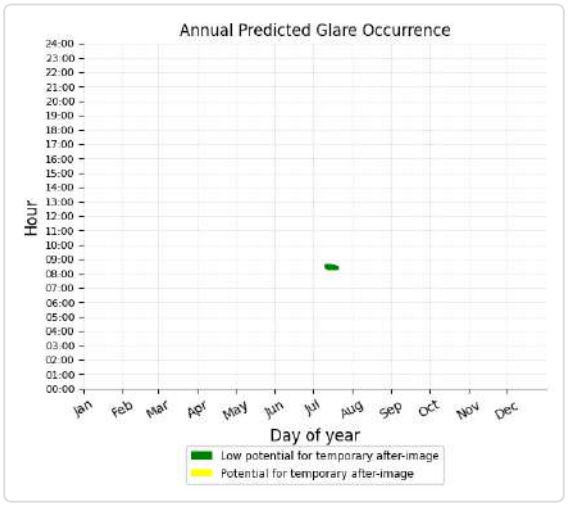
PV11 East 1 and Route: RT09 Glen Rd

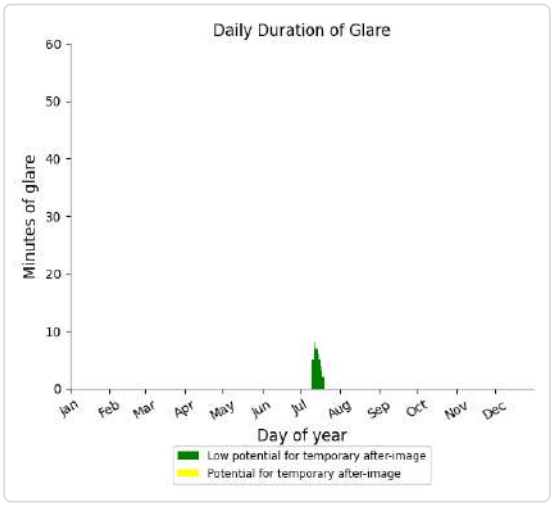
No glare found

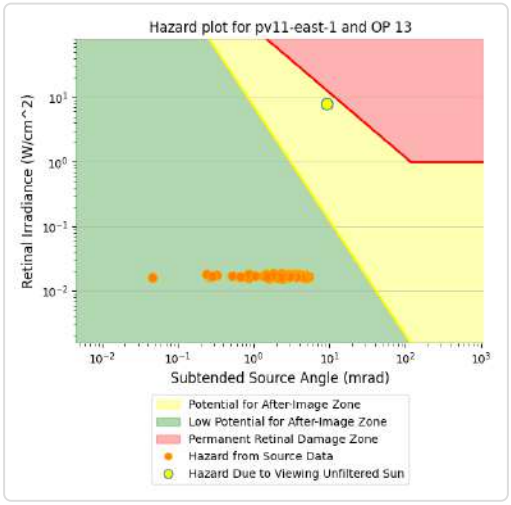
PV11 East 1 and OP 13

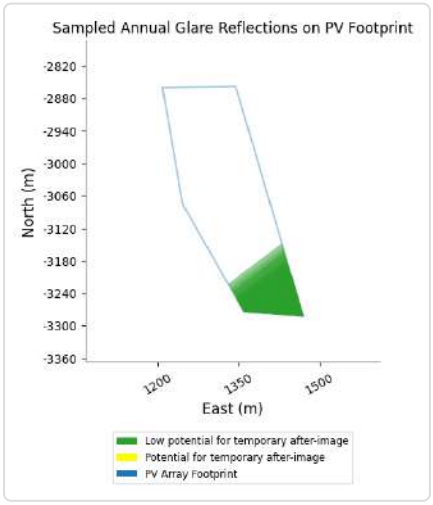
Yellow glare: none

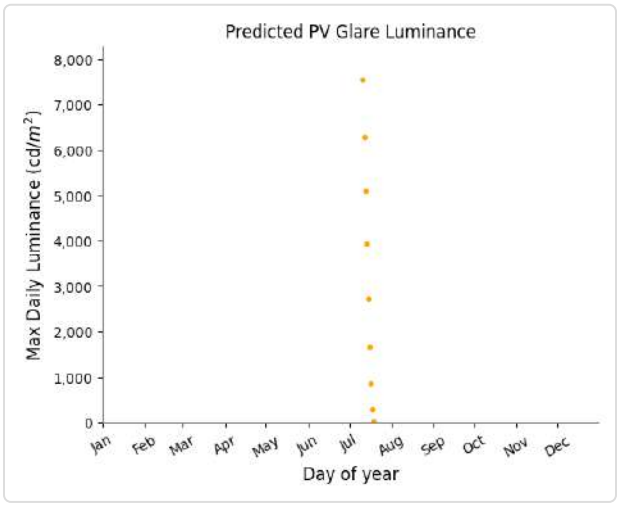
Green glare: 47 min.







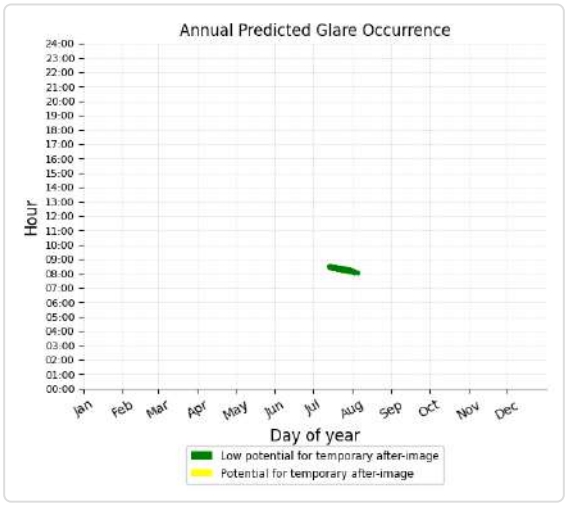


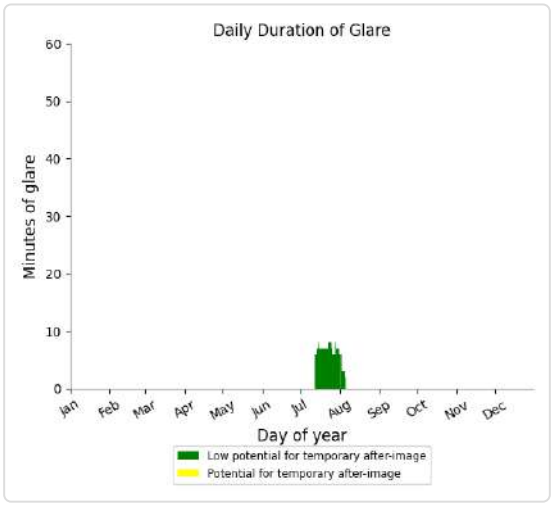


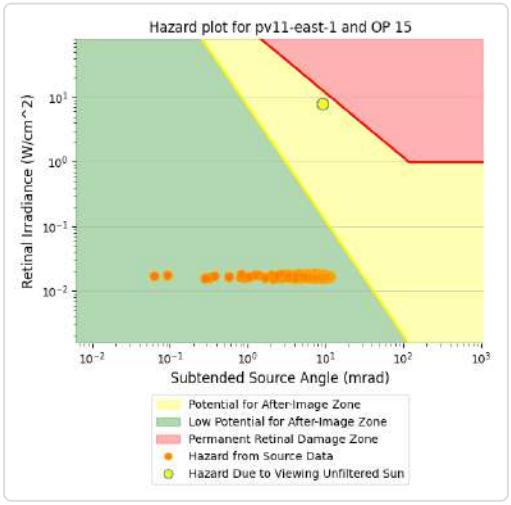
PV11 East 1 and OP 15

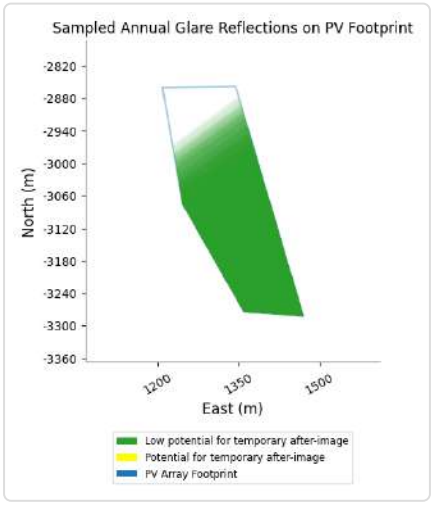
Yellow glare: none

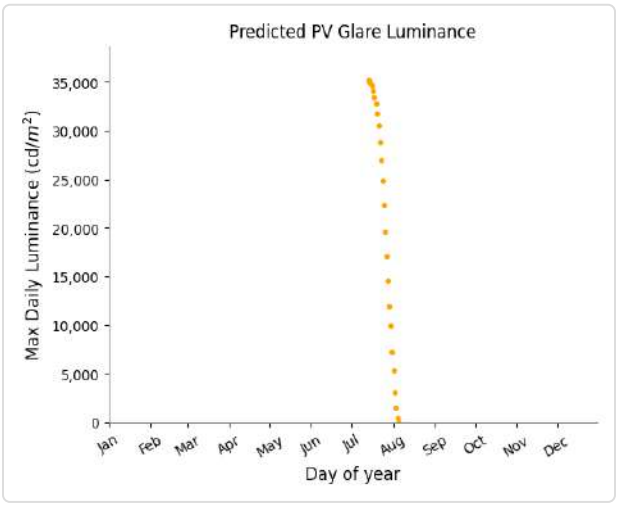
Green glare: 155 min.











PV11 East 1 and OP 1

No glare found

PV11 East 1 and OP 2

No glare found

PV11 East 1 and OP 3

No glare found

PV11 East 1 and OP 4

No glare found

PV11 East 1 and OP 5

No glare found

PV11 East 1 and OP 6

No glare found

PV11 East 1 and OP 7

No glare found

PV11 East 1 and OP 8

No glare found

PV11 East 1 and OP 9

No glare found

PV11 East 1 and OP 10

No glare found

PV11 East 1 and OP 11

No glare found

PV11 East 1 and OP 12

No glare found

PV11 East 1 and OP 14

No glare found

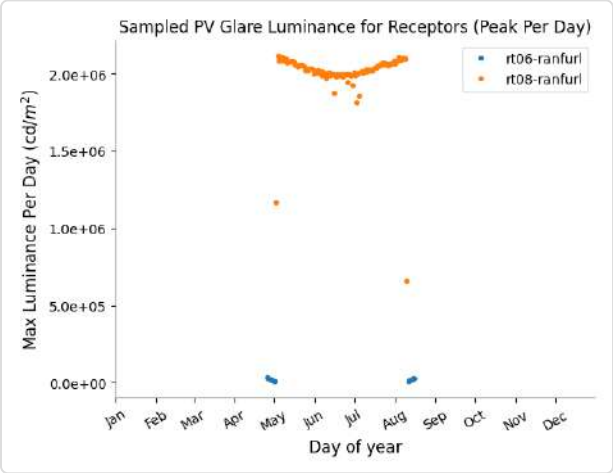
PV11 East 1 and OP 16

No glare found

PV: PV12 East 2 potential temporary after-image

Receptor results ordered by category of glare

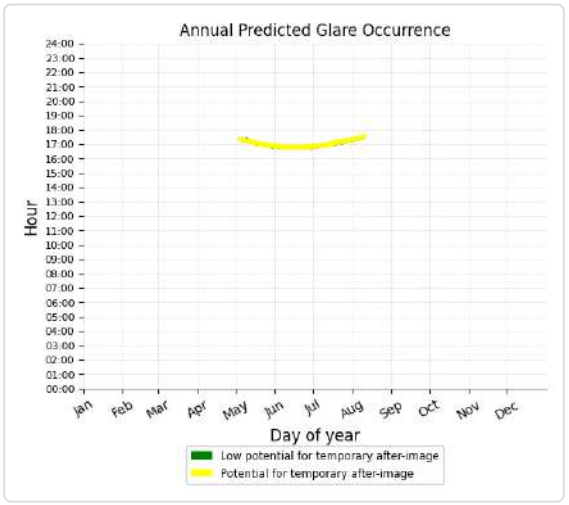
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	54	0.9	393	6.5	2,113,375
RT06 Ranfurly Naseby Rd	251	4.2	0	0.0	34,171
RT07 Bypass Rd	33	0.6	0	0.0	977
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

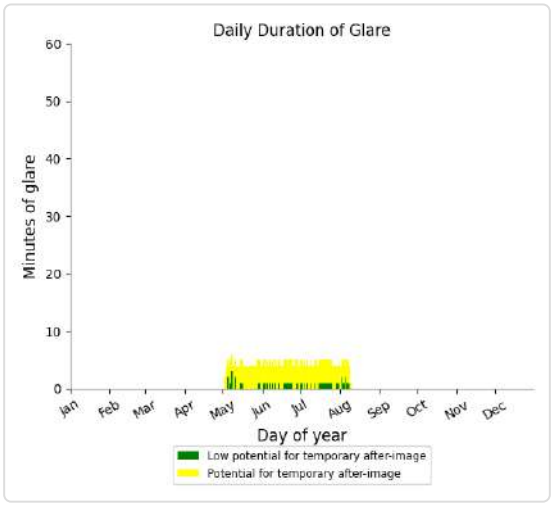

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt06-ranfurl
rt08-ranfurl
Max Luminance Per Day (cd/m²)
2.0e+06
1.5e+06
1.0e+06
5.0e+05
0.0e+00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

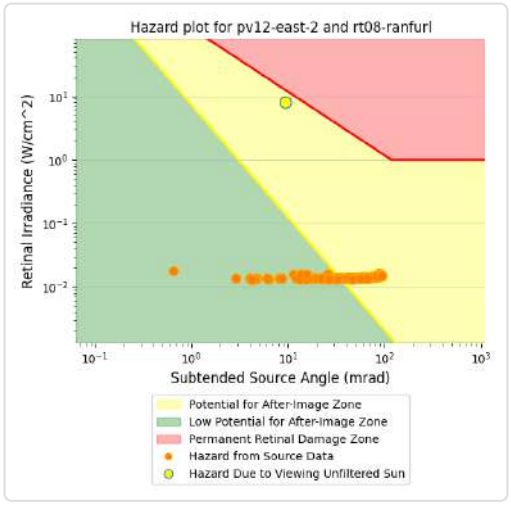
PV12 East 2 and Route: RT08 Ranfurly Back Rd

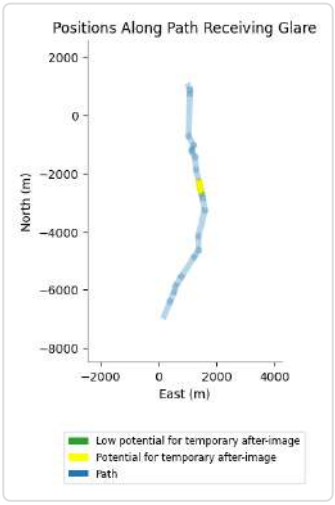
Yellow glare: 393 min.

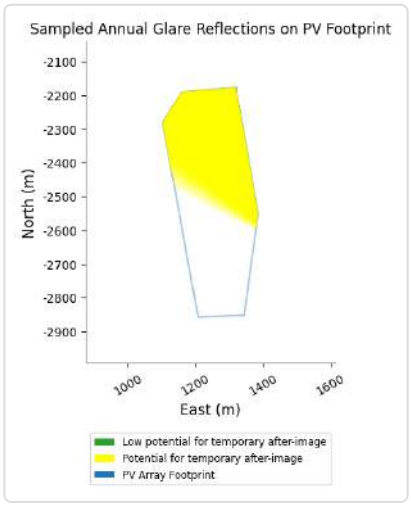
Green glare: 54 min.

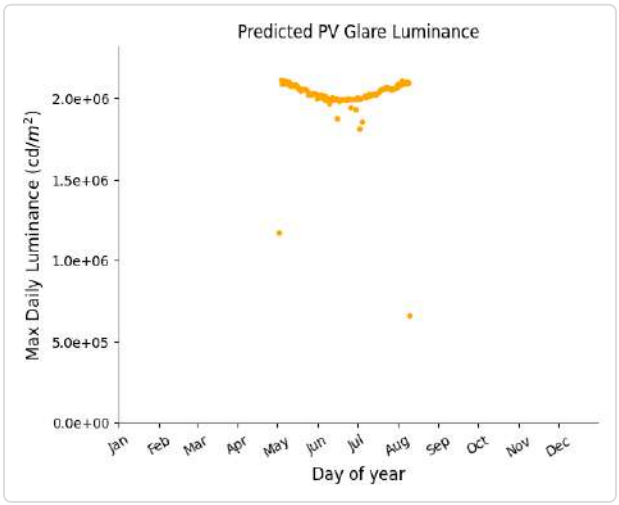








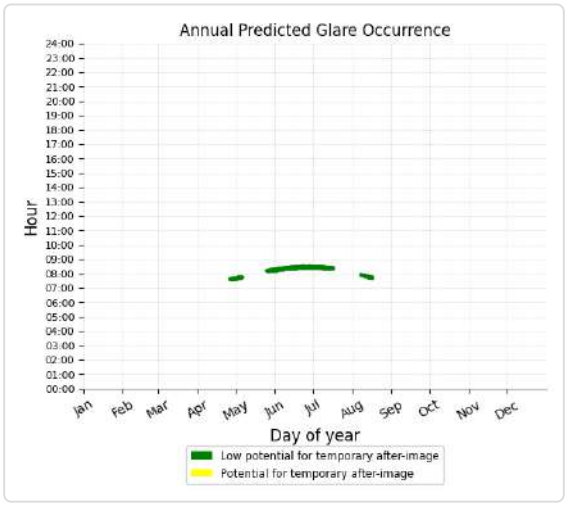


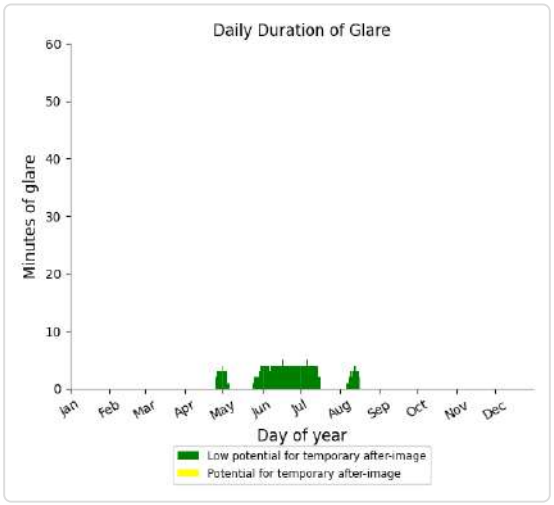


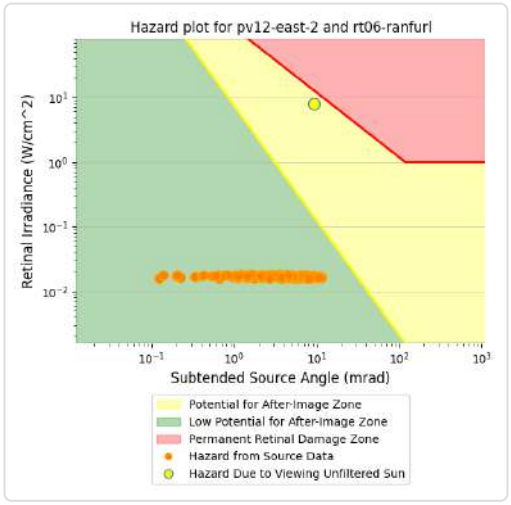
PV12 East 2 and Route: RT06 Ranfurly Naseby Rd

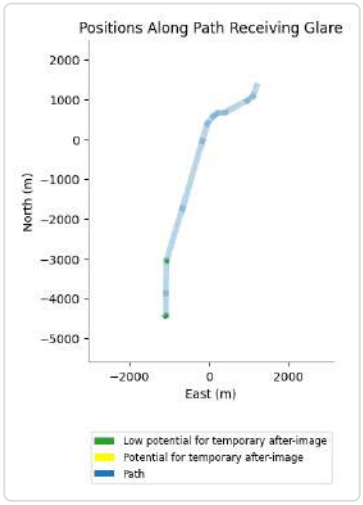
Yellow glare: none

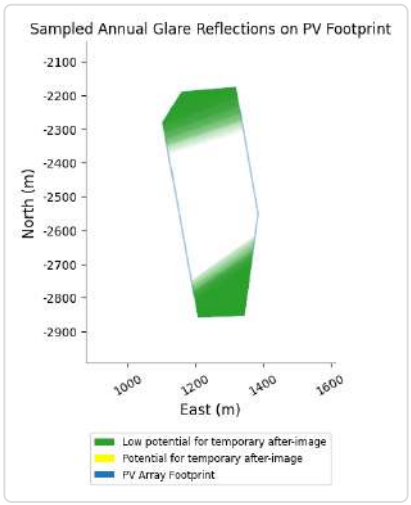
Green glare: 251 min.

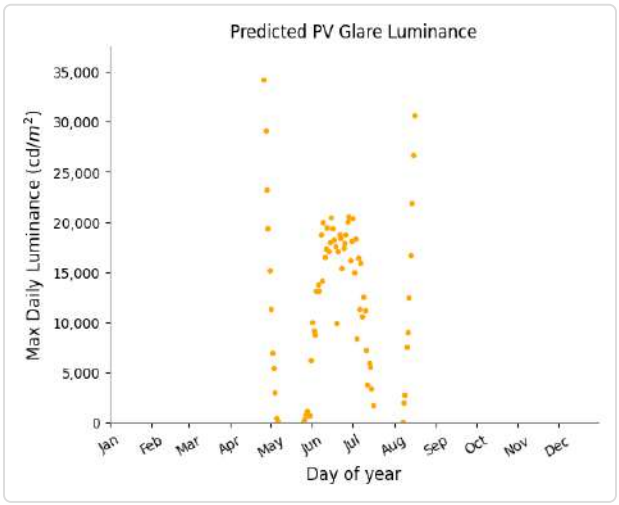








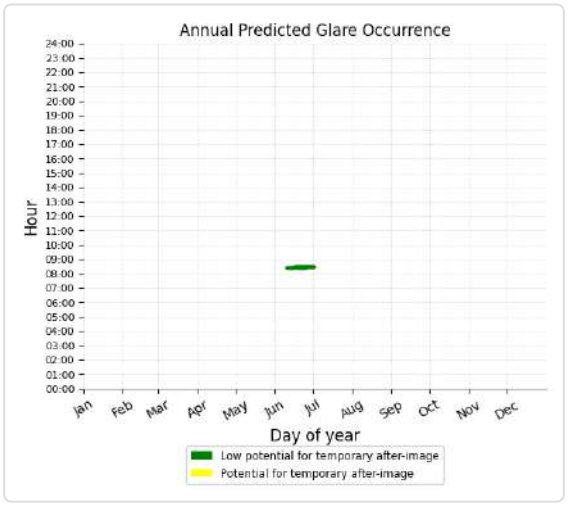


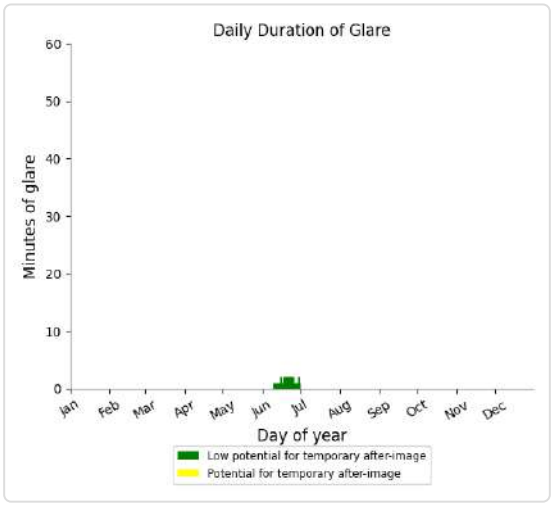


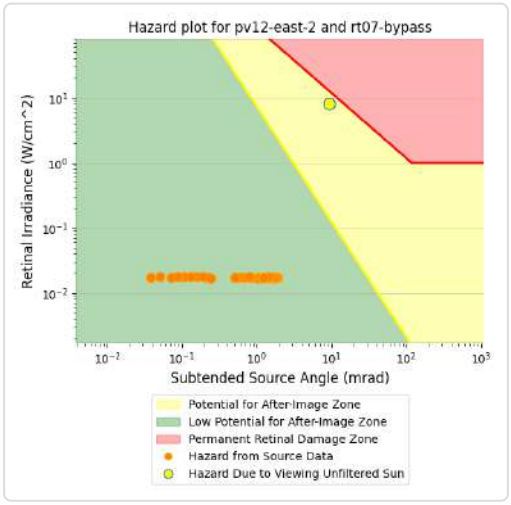
PV12 East 2 and Route: RT07 Bypass Rd

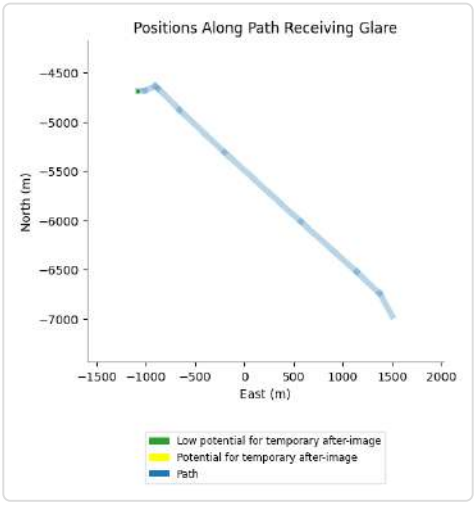
Yellow glare: none

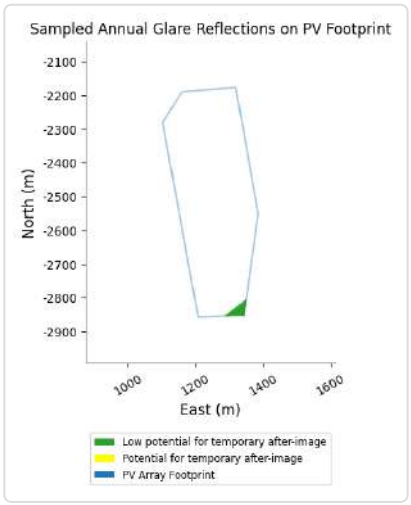
Green glare: 33 min.

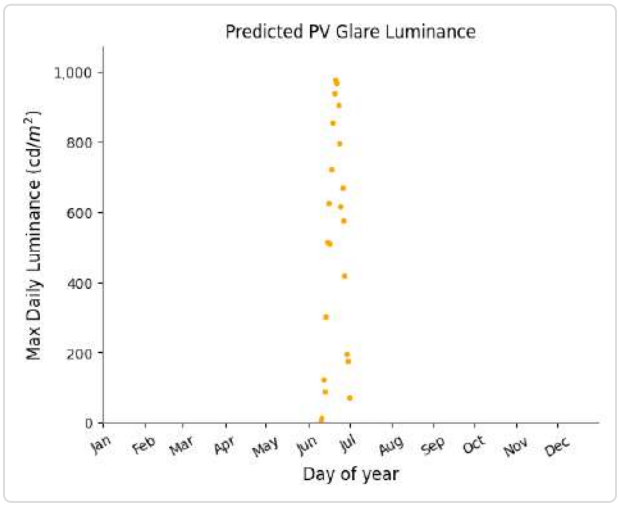












PV12 East 2 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV12 East 2 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV12 East 2 and Route: RT03 Brinsdon Rd

No glare found

PV12 East 2 and Route: RT04 Naseby Link Rd

No glare found

PV12 East 2 and Route: RT05 Fennessy Rd

No glare found

PV12 East 2 and Route: RT09 Glen Rd

No glare found

PV12 East 2 and OP 1

No glare found

PV12 East 2 and OP 2

No glare found

PV12 East 2 and OP 3

No glare found

PV12 East 2 and OP 4

No glare found

PV12 East 2 and OP 5

No glare found

PV12 East 2 and OP 6

No glare found

PV12 East 2 and OP 7

No glare found

PV12 East 2 and OP 8

No glare found

PV12 East 2 and OP 9

No glare found

PV12 East 2 and OP 10

No glare found

PV12 East 2 and OP 11

No glare found

PV12 East 2 and OP 12

No glare found

PV12 East 2 and OP 13

No glare found

PV12 East 2 and OP 14

No glare found

PV12 East 2 and OP 15

No glare found

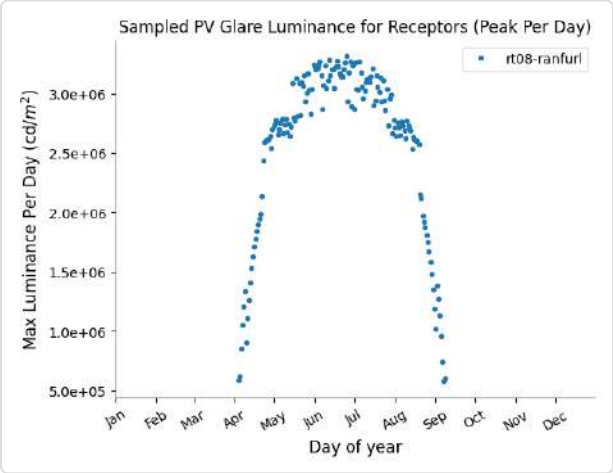
PV12 East 2 and OP 16

No glare found

PV: PV13 East 3 potential temporary after-image

Receptor results ordered by category of glare

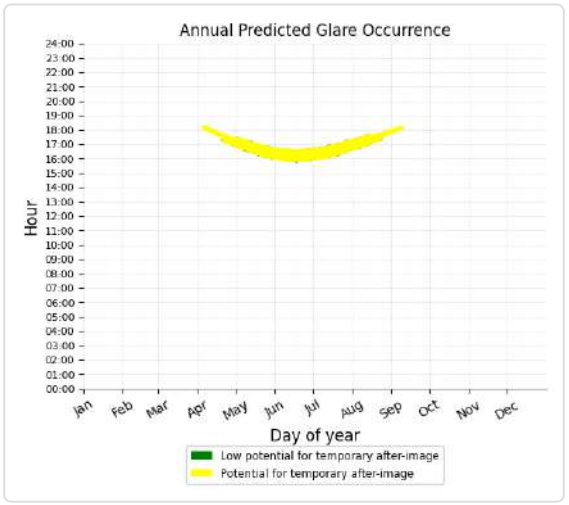
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	603	10.1	3,144	52.4	3,312,700
RT06 Ranfurly Naseby Rd	1,187	19.8	0	0.0	197,780
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

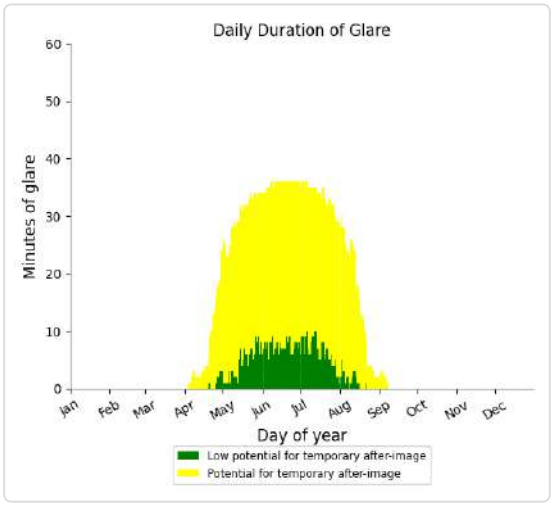

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt08-ranfurl
Max Luminance Per Day (cd/m²)
3.0e+06
2.5e+06
2.0e+06
1.5e+06
1.0e+06
5.0e+05
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

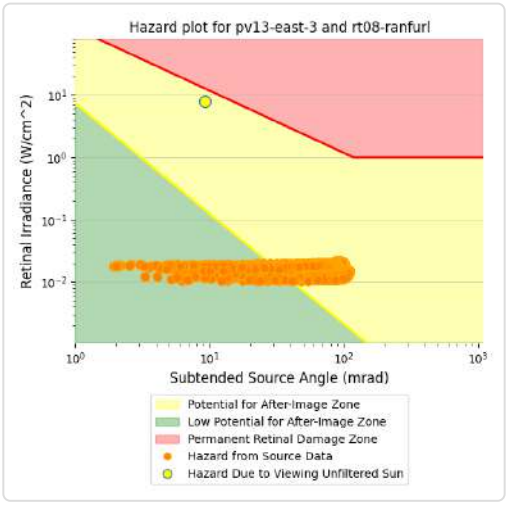
PV13 East 3 and Route: RT08 Ranfurly Back Rd

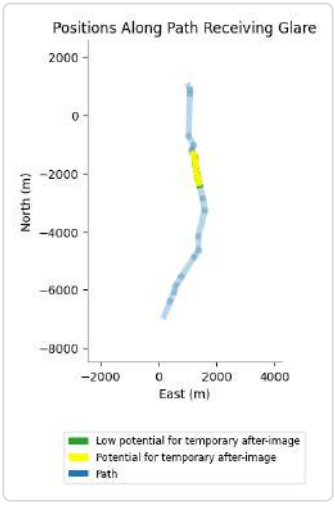
Yellow glare: 3,144 min.

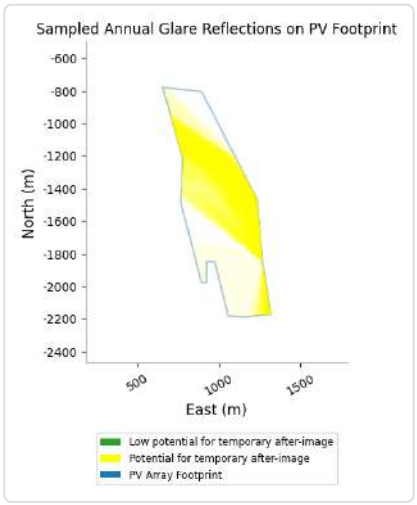
Green glare: 603 min.

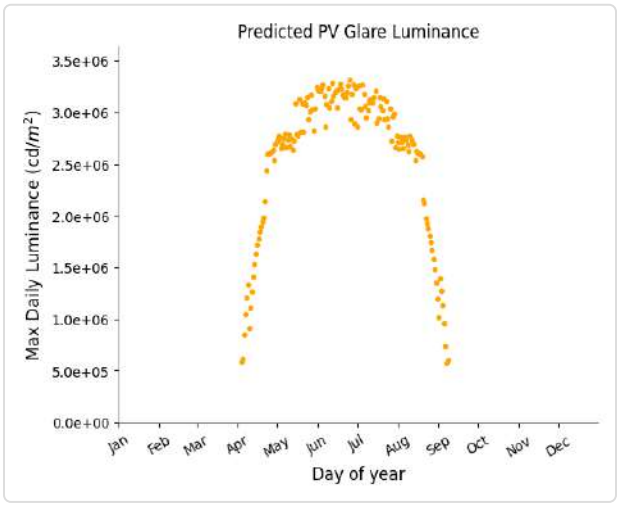








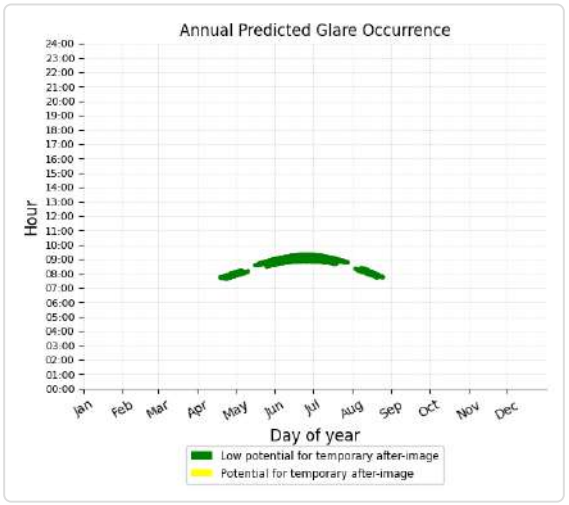


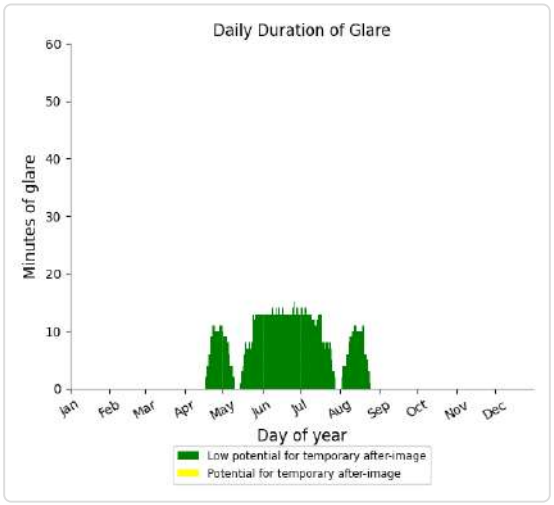


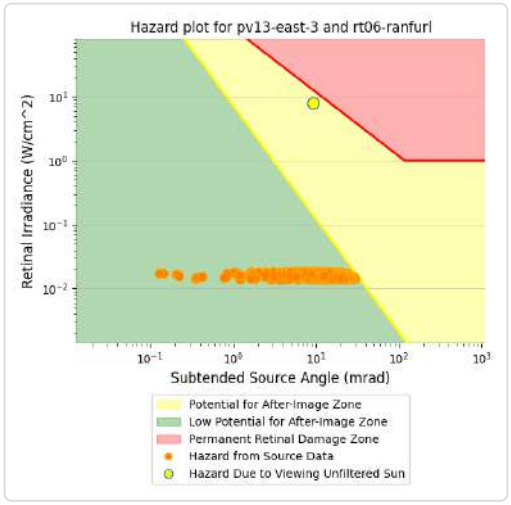
PV13 East 3 and Route: RT06 Ranfurly Naseby Rd

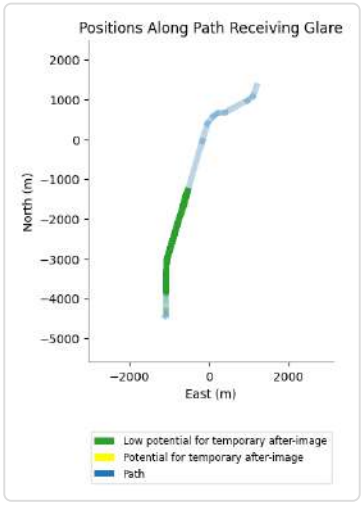
Yellow glare: none

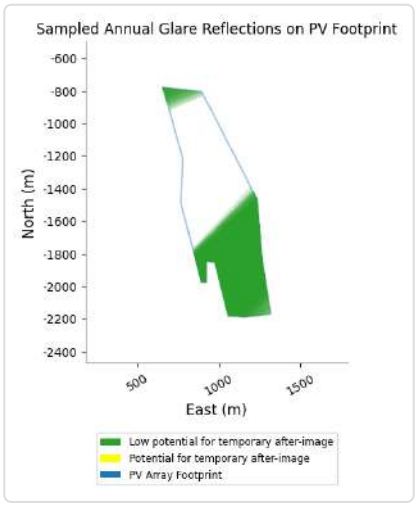
Green glare: 1,187 min.

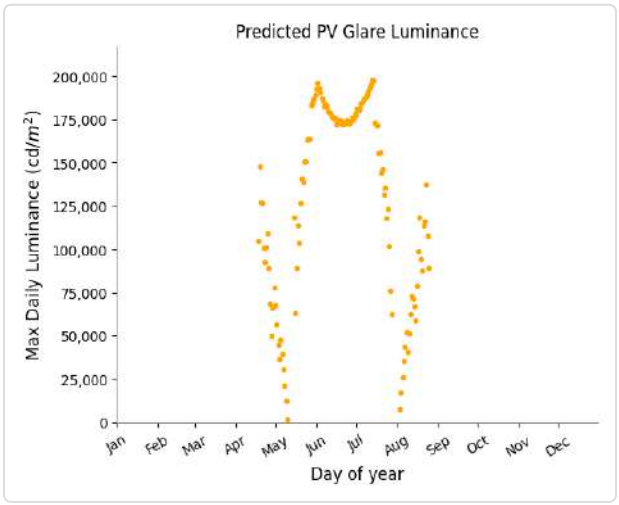












PV13 East 3 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV13 East 3 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV13 East 3 and Route: RT03 Brinsdon Rd

No glare found

PV13 East 3 and Route: RT04 Naseby Link Rd

No glare found

PV13 East 3 and Route: RT05 Fennessy Rd

No glare found

PV13 East 3 and Route: RT07 Bypass Rd

No glare found

PV13 East 3 and Route: RT09 Glen Rd

No glare found

PV13 East 3 and OP 1

No glare found

PV13 East 3 and OP 2

No glare found

PV13 East 3 and OP 3

No glare found

PV13 East 3 and OP 4

No glare found

PV13 East 3 and OP 5

No glare found

PV13 East 3 and OP 6

No glare found

PV13 East 3 and OP 7

No glare found

PV13 East 3 and OP 8

No glare found

PV13 East 3 and OP 9

No glare found

PV13 East 3 and OP 10

No glare found

PV13 East 3 and OP 11

No glare found

PV13 East 3 and OP 12

No glare found

PV13 East 3 and OP 13

No glare found

PV13 East 3 and OP 14

No glare found

PV13 East 3 and OP 15

No glare found

PV13 East 3 and OP 16

No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

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

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

FORGESOLAR GLARE ANALYSIS

Project: **23048 - Naseby SF**
Proposed 300 MW solar farm nearby Naseby, New Zealand.

Site configuration: **Naseby v3 - 5 deg rest angle**

Client: Helios Energy

Site description: As per Naseby v2 model, but with 5 deg rest angle for all PV arrays

Created 30 Aug, 2023
Updated 30 Aug, 2023
Time-step 1 minute
Timezone offset UTC12
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 100 MW to 1 GW
Site ID 99130.17105

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

Summary of Results

Glare with potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy	Peak Luminance
	°	°	min	hr	min	hr	kWh	cd/m²
PV01 North tip	SA tracking	SA tracking	222	3.7	0	0.0	-	193,221
PV02 Sub East	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV03 Sub West	SA tracking	SA tracking	39	0.7	2,294	38.2	-	1,989,319
PV04 West 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV05 West 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV06 South	SA tracking	SA tracking	1,880	31.3	798	13.3	-	1,270,053
PV07 Central 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV08 Central 2	SA tracking	SA tracking	149	2.5	703	11.7	-	1,021,545
PV09 Central 3	SA tracking	SA tracking	1,090	18.2	1,119	18.6	-	1,061,551
PV10 Central 4	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV11 East 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV12 East 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV13 East 3	SA tracking	SA tracking	1,028	17.1	3,962	66.0	-	2,895,449

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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0
RT03 Brinsdon Rd	0	0.0	0	0.0
RT04 Naseby Link Rd	0	0.0	0	0.0
RT05 Fennessy Rd	0	0.0	0	0.0
RT06 Ranfurly Naseby Rd	1,973	32.9	2,294	38.2
RT07 Bypass Rd	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT08 Ranfurly Back Rd	2,284	38.1	6,578	109.6
RT09 Glen Rd	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	151	2.5	4	0.1
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

Component Data

PV Arrays

Name: PV01 North tip
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.048810	170.107064	560.00	1.70	561.70
2	-45.048874	170.107929	559.64	1.70	561.34
3	-45.052022	170.110373	559.00	1.70	560.70
4	-45.055653	170.111707	552.66	1.70	554.36
5	-45.055857	170.113963	554.00	1.70	555.70
6	-45.059202	170.115155	540.00	1.70	541.70
7	-45.059420	170.113270	539.00	1.70	540.70
8	-45.058011	170.111134	541.13	1.70	542.83
9	-45.057797	170.103258	546.00	1.70	547.70
10	-45.048810	170.107064	560.00	1.70	561.70

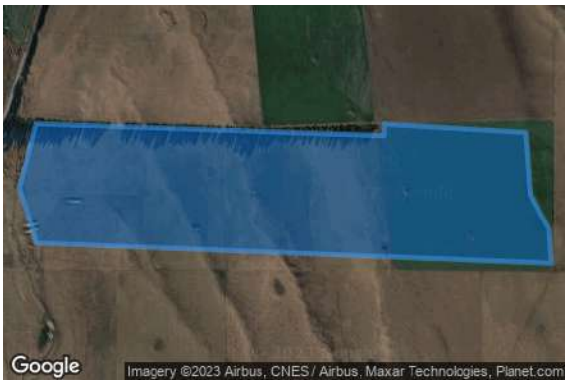
Name: PV02 Sub East
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.058092	170.105657	543.20	1.70	544.90
2	-45.058289	170.110985	540.00	1.70	541.70
3	-45.059642	170.112700	538.00	1.70	539.70
4	-45.059868	170.112336	538.00	1.70	539.70
5	-45.060793	170.112282	537.00	1.70	538.70
6	-45.061012	170.111761	537.00	1.70	538.70
7	-45.060007	170.111011	540.00	1.70	541.70
8	-45.059960	170.110454	539.00	1.70	540.70
9	-45.060506	170.110341	538.89	1.70	540.59
10	-45.062449	170.111690	535.40	1.70	537.10
11	-45.063515	170.112690	534.00	1.70	535.70
12	-45.064566	170.112248	532.00	1.70	533.70
13	-45.070734	170.113886	520.97	1.70	522.67
14	-45.070276	170.097282	520.00	1.70	521.70
15	-45.066897	170.098647	525.00	1.70	526.70
16	-45.066990	170.105054	528.51	1.70	530.21
17	-45.062432	170.105468	536.00	1.70	537.70
18	-45.062497	170.106947	536.00	1.70	537.70
19	-45.061230	170.107027	539.00	1.70	540.70
20	-45.061181	170.105492	538.12	1.70	539.82
21	-45.058092	170.105657	543.20	1.70	544.90

Name: PV03 Sub West
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.066581	170.098624	526.00	1.70	527.70
2	-45.066768	170.104852	530.00	1.70	531.70
3	-45.058124	170.105382	543.85	1.70	545.55
4	-45.058108	170.103096	545.00	1.70	546.70
5	-45.059332	170.102604	540.77	1.70	542.47
6	-45.060438	170.102246	539.00	1.70	540.70
7	-45.061561	170.101411	540.00	1.70	541.70
8	-45.061812	170.100812	539.87	1.70	541.57
9	-45.066581	170.098624	526.00	1.70	527.70

Name: PV04 West 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.073500	170.097099	517.00	1.70	518.70
2	-45.072170	170.096530	517.21	1.70	518.91
3	-45.070617	170.097082	519.00	1.70	520.70
4	-45.070902	170.109052	518.92	1.70	520.62
5	-45.070626	170.109053	519.00	1.70	520.70
6	-45.070826	170.113934	520.72	1.70	522.42
7	-45.072351	170.114093	519.00	1.70	520.70
8	-45.073172	170.114708	519.00	1.70	520.70
9	-45.073984	170.114786	518.00	1.70	519.70
10	-45.073500	170.097099	517.00	1.70	518.70

Name: PV05 West 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.073878	170.097237	516.61	1.70	518.31
2	-45.075202	170.097613	513.00	1.70	514.70
3	-45.075454	170.097712	512.04	1.70	513.74
4	-45.076438	170.096964	510.00	1.70	511.70
5	-45.076871	170.096879	509.00	1.70	510.70
6	-45.077419	170.102829	510.99	1.70	512.69
7	-45.077247	170.107133	512.97	1.70	514.67
8	-45.074105	170.105600	517.49	1.70	519.19
9	-45.074027	170.104231	519.08	1.70	520.78
10	-45.074687	170.103977	518.01	1.70	519.71
11	-45.074583	170.103269	517.00	1.70	518.70
12	-45.074053	170.102971	518.00	1.70	519.70
13	-45.073878	170.097237	516.61	1.70	518.31

Name: PV06 South
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.077761	170.104489	510.95	1.70	512.65
2	-45.080406	170.104589	499.25	1.70	500.95
3	-45.082428	170.104636	498.43	1.70	500.13
4	-45.083051	170.104219	497.00	1.70	498.70
5	-45.083870	170.104388	496.00	1.70	497.70
6	-45.084567	170.123974	496.09	1.70	497.79
7	-45.082358	170.124659	497.00	1.70	498.70
8	-45.082143	170.124309	497.00	1.70	498.70
9	-45.079934	170.124261	499.00	1.70	500.70
10	-45.078463	170.123307	503.68	1.70	505.38
11	-45.077837	170.121828	508.00	1.70	509.70
12	-45.077660	170.119401	509.00	1.70	510.70
13	-45.077805	170.116314	508.00	1.70	509.70
14	-45.077821	170.111947	509.00	1.70	510.70
15	-45.077694	170.109540	511.00	1.70	512.70
16	-45.077496	170.107925	512.06	1.70	513.76
17	-45.077761	170.104489	510.95	1.70	512.65

Name: PV07 Central 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.074164	170.105978	518.31	1.70	520.01
2	-45.075052	170.106525	518.00	1.70	519.70
3	-45.075800	170.107369	518.93	1.70	520.63
4	-45.077242	170.107573	513.09	1.70	514.79
5	-45.077687	170.111929	509.85	1.70	511.55
6	-45.077798	170.111925	509.00	1.70	510.70
7	-45.077745	170.116259	508.00	1.70	509.70
8	-45.077576	170.116290	509.00	1.70	510.70
9	-45.077468	170.118747	509.41	1.70	511.11
10	-45.076698	170.118305	512.00	1.70	513.70
11	-45.076165	170.118344	513.67	1.70	515.37
12	-45.075440	170.118197	515.02	1.70	516.72
13	-45.075073	170.118078	516.00	1.70	517.70
14	-45.074471	170.118147	517.90	1.70	519.60
15	-45.074382	170.116202	519.00	1.70	520.70
16	-45.074164	170.105978	518.31	1.70	520.01

Name: PV08 Central 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.077370	170.119202	510.00	1.70	511.70
2	-45.077406	170.121778	509.00	1.70	510.70
3	-45.076257	170.121897	513.00	1.70	514.70
4	-45.074586	170.121680	517.00	1.70	518.70
5	-45.072495	170.120974	518.00	1.70	519.70
6	-45.068427	170.119851	519.00	1.70	520.70
7	-45.068239	170.118583	519.00	1.70	520.70
8	-45.068201	170.116987	521.41	1.70	523.11
9	-45.068826	170.117113	519.00	1.70	520.70
10	-45.069221	170.118239	519.00	1.70	520.70
11	-45.069473	170.118187	519.00	1.70	520.70
12	-45.069147	170.116760	520.00	1.70	521.70
13	-45.069880	170.116650	519.00	1.70	520.70
14	-45.070723	170.117101	519.00	1.70	520.70
15	-45.071987	170.117217	519.00	1.70	520.70
16	-45.074311	170.118267	517.50	1.70	519.20
17	-45.075963	170.118570	514.00	1.70	515.70
18	-45.077370	170.119202	510.00	1.70	511.70

Name: PV09 Central 3
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.059387	170.114333	539.00	1.70	540.70
2	-45.059265	170.115199	540.00	1.70	541.70
3	-45.059380	170.115304	540.00	1.70	541.70
4	-45.059840	170.116514	540.81	1.70	542.51
5	-45.062208	170.116207	540.00	1.70	541.70
6	-45.066512	170.117671	531.00	1.70	532.70
7	-45.066430	170.116825	530.00	1.70	531.70
8	-45.064261	170.115332	535.00	1.70	536.70
9	-45.062652	170.115352	538.00	1.70	539.70
10	-45.063968	170.114731	535.00	1.70	536.70
11	-45.066216	170.116088	530.00	1.70	531.70
12	-45.067044	170.116923	527.93	1.70	529.63
13	-45.067168	170.117884	525.46	1.70	527.16
14	-45.068115	170.118464	520.00	1.70	521.70
15	-45.068136	170.116977	522.00	1.70	523.70
16	-45.068106	170.116241	522.46	1.70	524.16
17	-45.067109	170.114353	526.11	1.70	527.81
18	-45.066313	170.114171	528.00	1.70	529.70
19	-45.066204	170.113725	528.71	1.70	530.41
20	-45.065023	170.113472	531.46	1.70	533.16
21	-45.063966	170.113673	534.00	1.70	535.70
22	-45.062887	170.113691	536.00	1.70	537.70
23	-45.062067	170.114091	537.00	1.70	538.70
24	-45.061501	170.114006	537.00	1.70	538.70
25	-45.060574	170.114526	538.29	1.70	539.99
26	-45.060069	170.114712	539.00	1.70	540.70
27	-45.059387	170.114333	539.00	1.70	540.70

Name: PV10 Central 4
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.067625	170.113453	525.05	1.70	526.75
2	-45.067579	170.113839	525.00	1.70	526.70
3	-45.068602	170.115217	522.00	1.70	523.70
4	-45.070279	170.116219	520.00	1.70	521.70
5	-45.071627	170.116210	520.00	1.70	521.70
6	-45.073577	170.117104	520.00	1.70	521.70
7	-45.073960	170.117165	520.00	1.70	521.70
8	-45.073887	170.116186	519.00	1.70	520.70
9	-45.073631	170.116120	519.92	1.70	521.62
10	-45.073251	170.115361	519.00	1.70	520.70
11	-45.072455	170.114882	520.00	1.70	521.70
12	-45.071689	170.114918	520.00	1.70	521.70
13	-45.071665	170.114607	520.00	1.70	521.70
14	-45.069486	170.114103	523.00	1.70	524.70
15	-45.067987	170.113436	525.00	1.70	526.70
16	-45.067625	170.113453	525.05	1.70	526.75

Name: PV11 East 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.074546	170.122412	517.00	1.70	518.70
2	-45.074523	170.124127	519.00	1.70	520.70
3	-45.078347	170.125719	505.41	1.70	507.11
4	-45.078273	170.124324	504.09	1.70	505.79
5	-45.076486	170.122886	512.00	1.70	513.70
6	-45.074546	170.122412	517.00	1.70	518.70

Name: PV12 East 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.074469	170.124124	519.00	1.70	520.70
2	-45.074519	170.122397	517.00	1.70	518.70
3	-45.069331	170.121063	520.00	1.70	521.70
4	-45.068515	170.121784	523.00	1.70	524.70
5	-45.068389	170.123809	524.00	1.70	525.70
6	-45.071765	170.124656	521.00	1.70	522.70
7	-45.074469	170.124124	519.00	1.70	520.70

Name: PV13 East 3
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.35
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	-45.055819	170.115377	554.65	1.70	556.35
2	-45.056058	170.118403	550.84	1.70	552.54
3	-45.061992	170.122721	540.00	1.70	541.70
4	-45.065305	170.123117	535.00	1.70	536.70
5	-45.068352	170.123810	524.00	1.70	525.70
6	-45.068521	170.121770	523.00	1.70	524.70
7	-45.068451	170.120486	520.68	1.70	522.38
8	-45.065467	170.119421	536.92	1.70	538.62
9	-45.065450	170.118805	535.00	1.70	536.70
10	-45.066604	170.118794	530.05	1.70	531.75
11	-45.066593	170.118385	530.35	1.70	532.05
12	-45.062204	170.116797	540.00	1.70	541.70
13	-45.059790	170.116950	541.00	1.70	542.70
14	-45.055819	170.115377	554.65	1.70	556.35

Route Receptors

Name: RT01 Ranfurly Wedderburn Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.109780	170.095016	455.00	1.50	456.50
2	-45.106423	170.095169	459.12	1.50	460.62
3	-45.104088	170.095173	462.00	1.50	463.50
4	-45.094654	170.093592	479.00	1.50	480.50
5	-45.092635	170.093292	484.00	1.50	485.50
6	-45.088769	170.093017	495.92	1.50	497.42
7	-45.079549	170.080539	500.00	1.50	501.50
8	-45.073362	170.075044	514.00	1.50	515.50
9	-45.057432	170.063924	543.00	1.50	544.50

Name: RT02 Gimmerburn Naseby Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.089776	170.066142	485.00	1.50	486.50
2	-45.086784	170.068160	490.94	1.50	492.44
3	-45.085296	170.068661	493.00	1.50	494.50
4	-45.080378	170.070329	500.00	1.50	501.50
5	-45.079302	170.070760	502.09	1.50	503.59
6	-45.072765	170.074522	515.00	1.50	516.50
7	-45.068995	170.078109	520.00	1.50	521.50
8	-45.065290	170.081673	528.00	1.50	529.50
9	-45.059834	170.087165	542.94	1.50	544.44
10	-45.058677	170.088145	546.00	1.50	547.50
11	-45.058385	170.088330	547.00	1.50	548.50
12	-45.058179	170.088207	548.00	1.50	549.50
13	-45.053802	170.093733	554.00	1.50	555.50
14	-45.050658	170.097967	559.00	1.50	560.50
15	-45.047508	170.102018	564.00	1.50	565.50

Name: RT03 Brinsdon Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.074077	170.058844	513.91	1.50	515.41
2	-45.074119	170.073767	512.00	1.50	513.50

Name: RT04 Naseby Link Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.057844	170.064157	542.00	1.50	543.50
2	-45.057842	170.072756	540.00	1.50	541.50
3	-45.057959	170.074150	540.00	1.50	541.50
4	-45.058833	170.075780	538.00	1.50	539.50
5	-45.060661	170.078560	535.00	1.50	536.50
6	-45.061042	170.080106	536.75	1.50	538.25
7	-45.061448	170.081421	537.00	1.50	538.50
8	-45.061227	170.082417	537.00	1.50	538.50
9	-45.060357	170.083409	538.00	1.50	539.50
10	-45.059955	170.085011	540.00	1.50	541.50
11	-45.059503	170.086495	541.85	1.50	543.35
12	-45.058241	170.088137	547.45	1.50	548.95

Name: RT05 Fennessy Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.025447	170.093573	616.00	1.50	617.50
2	-45.029547	170.092947	607.00	1.50	608.50
3	-45.034376	170.092044	598.00	1.50	599.50
4	-45.034933	170.092038	597.00	1.50	598.50
5	-45.037227	170.093838	594.00	1.50	595.50
6	-45.047463	170.101965	564.55	1.50	566.05
7	-45.049198	170.105046	559.00	1.50	560.50

Name: RT06 Ranfurly Naseby Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.088762	170.093057	495.90	1.50	497.40
2	-45.088559	170.093340	495.00	1.50	496.50
3	-45.083567	170.093306	498.54	1.50	500.04
4	-45.076195	170.093507	514.31	1.50	515.81
5	-45.064414	170.098616	533.00	1.50	534.50
6	-45.049207	170.104952	559.00	1.50	560.50
7	-45.045288	170.106531	578.00	1.50	579.50
8	-45.043605	170.108391	582.61	1.50	584.11
9	-45.042911	170.109898	578.00	1.50	579.50
10	-45.042701	170.112146	581.00	1.50	582.50
11	-45.040076	170.119316	581.26	1.50	582.76
12	-45.039086	170.121036	573.79	1.50	575.29
13	-45.036813	170.122208	575.35	1.50	576.85

Name: RT07 Bypass Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.090972	170.093365	489.00	1.50	490.50
2	-45.090933	170.094195	488.03	1.50	489.53
3	-45.090541	170.095555	487.13	1.50	488.63
4	-45.090748	170.095959	486.29	1.50	487.79
5	-45.092727	170.098722	480.00	1.50	481.50
6	-45.096583	170.104503	475.00	1.50	476.50
7	-45.102925	170.114345	464.00	1.50	465.50
8	-45.107526	170.121563	460.00	1.50	461.50
9	-45.109497	170.124524	459.00	1.50	460.50
10	-45.111562	170.126137	459.00	1.50	460.50

Name: RT08 Ranfurly Back Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.110942	170.109556	453.00	1.50	454.50
2	-45.106389	170.112183	459.47	1.50	460.97
3	-45.103451	170.113954	463.00	1.50	464.50
4	-45.101418	170.114791	467.00	1.50	468.50
5	-45.098679	170.117079	472.00	1.50	473.50
6	-45.092570	170.122667	479.00	1.50	480.50
7	-45.090513	170.124641	483.72	1.50	485.22
8	-45.086188	170.124560	495.00	1.50	496.50
9	-45.078203	170.127255	507.00	1.50	508.50
10	-45.074559	170.126436	520.00	1.50	521.50
11	-45.065651	170.123519	532.41	1.50	533.91
12	-45.061721	170.123052	539.81	1.50	541.31
13	-45.060075	170.121789	539.00	1.50	540.50
14	-45.059289	170.121752	537.01	1.50	538.51
15	-45.058024	170.122386	541.00	1.50	542.50
16	-45.055187	170.120273	549.99	1.50	551.49
17	-45.042159	170.120795	580.14	1.50	581.64
18	-45.040809	170.120798	580.00	1.50	581.50
19	-45.039777	170.120105	579.47	1.50	580.97

Name: RT09 Glen Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.109508	170.124593	459.00	1.50	460.50
2	-45.109465	170.124765	459.00	1.50	460.50
3	-45.107210	170.126279	459.00	1.50	460.50
4	-45.100395	170.126269	469.00	1.50	470.50
5	-45.099159	170.126246	472.00	1.50	473.50
6	-45.096952	170.127240	479.00	1.50	480.50

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-45.074452	170.064201	512.27	1.65
OP 2	2	-45.044875	170.108039	583.00	1.65
OP 3	3	-45.039527	170.117557	587.77	1.65
OP 4	4	-45.050412	170.121556	561.68	1.65
OP 5	5	-45.086779	170.129115	500.00	1.65
OP 6	6	-45.082021	170.101672	501.00	1.65
OP 7	7	-45.105774	170.121637	462.00	1.65
OP 8	8	-45.104479	170.127759	463.00	1.65
OP 9	9	-45.109701	170.122528	460.00	1.65
OP 10	10	-45.107832	170.102654	460.00	1.65
OP 11	11	-45.107370	170.087644	459.00	1.65
OP 12	12	-45.102070	170.087308	480.00	1.65
OP 13	13	-45.095882	170.090288	480.00	1.65
OP 14	14	-45.096945	170.097625	474.00	1.65
OP 15	15	-45.090592	170.094064	489.55	1.65
OP 16	16	-45.091058	170.070581	482.00	1.65

Obstruction Components

Name: OB01 Ex NE1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.056187	170.120305	540.34
2	-45.057823	170.121804	540.00
3	-45.058808	170.121676	538.86

Name: OB02 Ex N
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.048246	170.107048	562.03
2	-45.046986	170.107665	579.53
3	-45.049138	170.108595	560.72

Name: OB03 Ex W1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.074114	170.094634	516.00
2	-45.071887	170.095596	516.00
3	-45.070591	170.096190	518.00
4	-45.070757	170.108834	519.00
5	-45.070560	170.096210	518.00
6	-45.063423	170.099327	536.00
7	-45.061971	170.099974	538.29

Name: OB04 Ex W2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.058355	170.101524	545.00
2	-45.059423	170.101085	542.00

Name: OB05 Ex NE2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.043322	170.111633	579.75
2	-45.045873	170.110932	579.00
3	-45.049014	170.113476	559.69
4	-45.051380	170.114700	558.94
5	-45.052886	170.116610	559.00

Name: OB06 Ex NW1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.053549	170.101874	554.10
2	-45.048337	170.101916	563.00
3	-45.048180	170.101671	563.66
4	-45.052816	170.095785	556.00
5	-45.057789	170.097936	546.00
6	-45.052827	170.095750	556.00
7	-45.053708	170.094431	554.00

Name: OB07 Ex W3
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.058277	170.088758	546.31
2	-45.063060	170.084202	535.00
3	-45.065744	170.083580	528.00
4	-45.072948	170.085906	519.52
5	-45.076330	170.086244	519.00
6	-45.077978	170.085673	516.00
7	-45.078899	170.084814	511.92
8	-45.081626	170.083884	501.94

Name: OB08 Ex SW1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.082474	170.103800	499.00
2	-45.081301	170.103779	499.00
3	-45.081248	170.100933	500.18
4	-45.081765	170.100039	499.00
5	-45.082490	170.099964	498.00

Name: OB09 Ex S
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.091392	170.109269	482.00
2	-45.093804	170.110395	478.00
3	-45.096578	170.109851	474.00
4	-45.096506	170.118238	475.64

Name: OB10 Ex SW2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.082409	170.083641	500.03
2	-45.084314	170.082899	500.00
3	-45.086260	170.082823	500.00
4	-45.087188	170.081636	500.00
5	-45.087976	170.081148	500.00
6	-45.089212	170.080838	495.63
7	-45.090511	170.080880	489.00
8	-45.092183	170.079720	485.00
9	-45.094879	170.078306	480.00
10	-45.096227	170.078758	481.00

Glare Analysis Results

Summary of Results

Glare with potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy	Peak Luminance
	°	°	min	hr	min	hr	kWh	cd/m^2
PV01 North tip	SA tracking	SA tracking	222	3.7	0	0.0	-	193,221
PV02 Sub East	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV03 Sub West	SA tracking	SA tracking	39	0.7	2,294	38.2	-	1,989,319
PV04 West 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV05 West 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV06 South	SA tracking	SA tracking	1,880	31.3	798	13.3	-	1,270,053
PV07 Central 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV08 Central 2	SA tracking	SA tracking	149	2.5	703	11.7	-	1,021,545
PV09 Central 3	SA tracking	SA tracking	1,090	18.2	1,119	18.6	-	1,061,551
PV10 Central 4	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV11 East 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV12 East 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV13 East 3	SA tracking	SA tracking	1,028	17.1	3,962	66.0	-	2,895,449

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

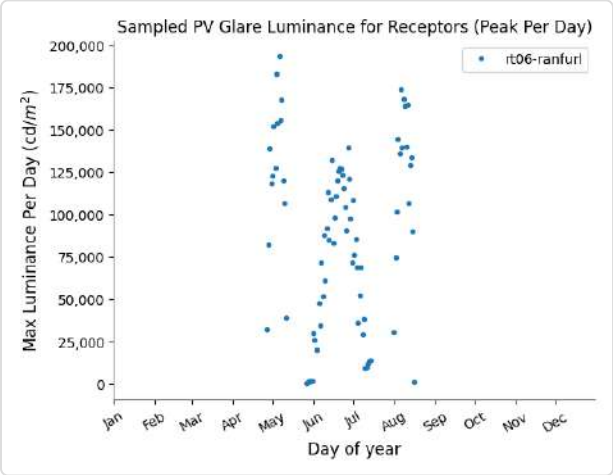
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0
RT03 Brinsdon Rd	0	0.0	0	0.0
RT04 Naseby Link Rd	0	0.0	0	0.0
RT05 Fennessy Rd	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT06 Ranfurly Naseby Rd	1,973	32.9	2,294	38.2
RT07 Bypass Rd	0	0.0	0	0.0
RT08 Ranfurly Back Rd	2,284	38.1	6,578	109.6
RT09 Glen Rd	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	151	2.5	4	0.1
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

PV: PV01 North tip low potential for temporary after-image

Receptor results ordered by category of glare

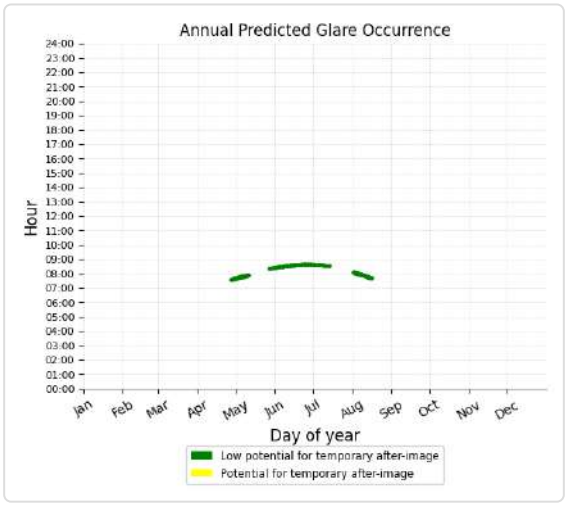
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	222	3.7	0	0.0	193,221
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

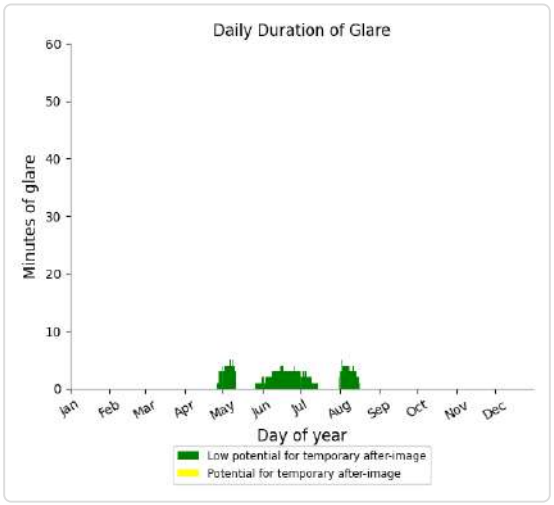

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt06-ranfurl
Max Luminance Per Day (cd/m²)
200,000
175,000
150,000
125,000
100,000
75,000
50,000
25,000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

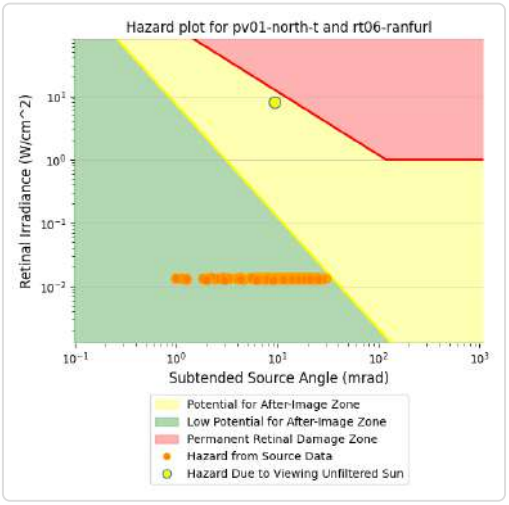
PV01 North tip and Route: RT06 Ranfurly Naseby Rd

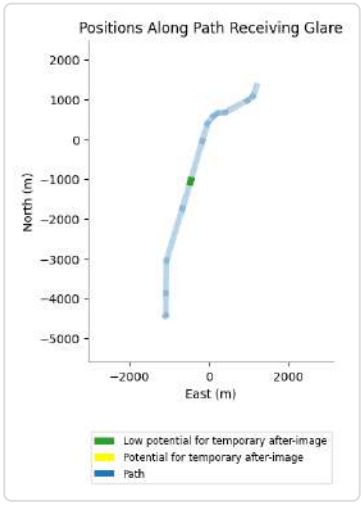
Yellow glare: none

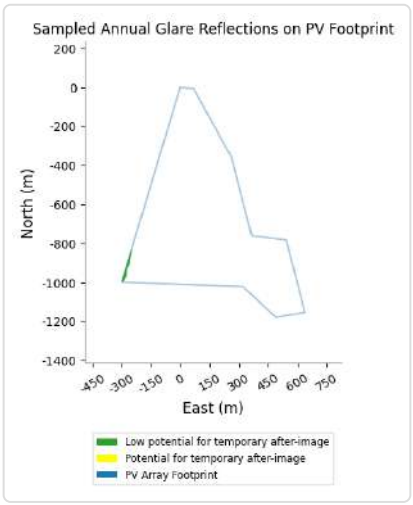
Green glare: 222 min.

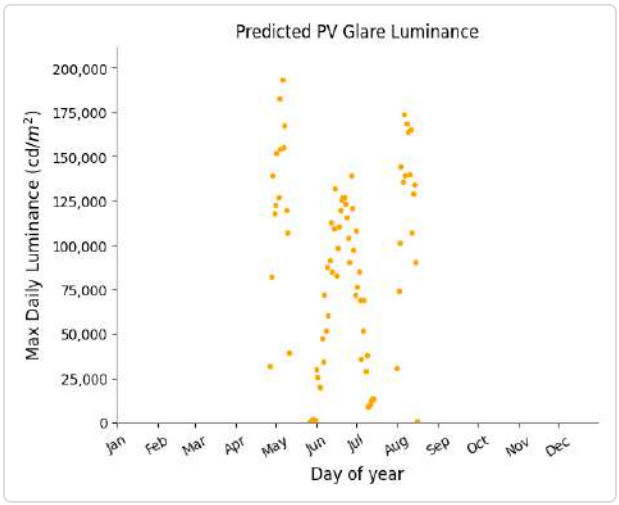












PV01 North tip and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV01 North tip and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV01 North tip and Route: RT03 Brinsdon Rd

No glare found

PV01 North tip and Route: RT04 Naseby Link Rd

No glare found

PV01 North tip and Route: RT05 Fennessy Rd

No glare found

PV01 North tip and Route: RT07 Bypass Rd

No glare found

PV01 North tip and Route: RT08 Ranfurly Back Rd

No glare found

PV01 North tip and Route: RT09 Glen Rd

No glare found

PV01 North tip and OP 1

No glare found

PV01 North tip and OP 2

No glare found

PV01 North tip and OP 3

No glare found

PV01 North tip and OP 4

No glare found

PV01 North tip and OP 5

No glare found

PV01 North tip and OP 6

No glare found

PV01 North tip and OP 7

No glare found

PV01 North tip and OP 8

No glare found

PV01 North tip and OP 9

No glare found

PV01 North tip and OP 10

No glare found

PV01 North tip and OP 11

No glare found

PV01 North tip and OP 12

No glare found

PV01 North tip and OP 13

No glare found

PV01 North tip and OP 14

No glare found

PV01 North tip and OP 15

No glare found

PV01 North tip and OP 16

No glare found

PV: PV02 Sub East no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV02 Sub East and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV02 Sub East and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV02 Sub East and Route: RT03 Brinsdon Rd

No glare found

PV02 Sub East and Route: RT04 Naseby Link Rd

No glare found

PV02 Sub East and Route: RT05 Fennessy Rd

No glare found

PV02 Sub East and Route: RT06 Ranfurly Naseby Rd

No glare found

PV02 Sub East and Route: RT07 Bypass Rd

No glare found

PV02 Sub East and Route: RT08 Ranfurly Back Rd

No glare found

PV02 Sub East and Route: RT09 Glen Rd

No glare found

PV02 Sub East and OP 1

No glare found

PV02 Sub East and OP 2

No glare found

PV02 Sub East and OP 3

No glare found

PV02 Sub East and OP 4

No glare found

PV02 Sub East and OP 5

No glare found

PV02 Sub East and OP 6

No glare found

PV02 Sub East and OP 7

No glare found

PV02 Sub East and OP 8

No glare found

PV02 Sub East and OP 9

No glare found

PV02 Sub East and OP 10

No glare found

PV02 Sub East and OP 11

No glare found

PV02 Sub East and OP 12

No glare found

PV02 Sub East and OP 13

No glare found

PV02 Sub East and OP 14

No glare found

PV02 Sub East and OP 15

No glare found

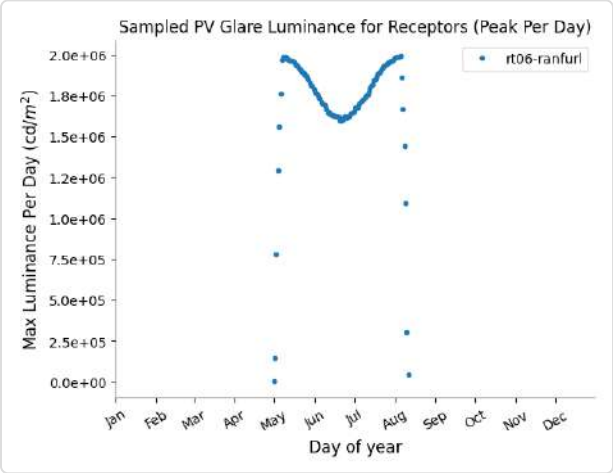
PV02 Sub East and OP 16

No glare found

PV: PV03 Sub West potential temporary after-image

Receptor results ordered by category of glare

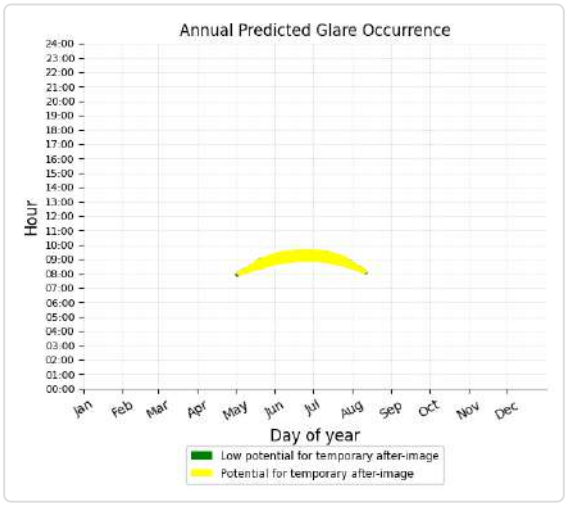
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	39	0.7	2,294	38.2	1,989,319
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

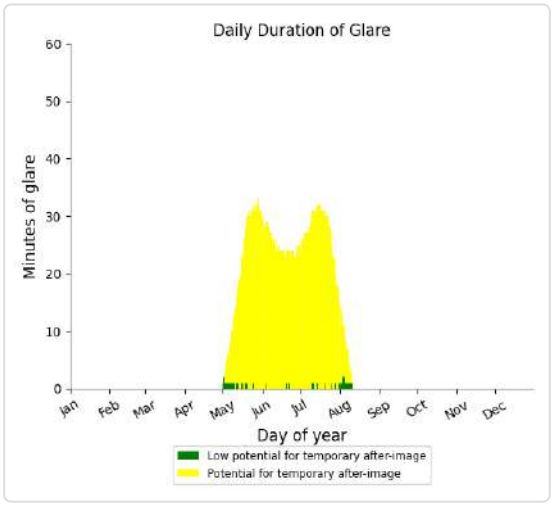

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt06-ranfurl
Max Luminance Per Day (cd/m²)
2.0e+06
1.8e+06
1.5e+06
1.2e+06
1.0e+06
7.5e+05
5.0e+05
2.5e+05
0.0e+00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

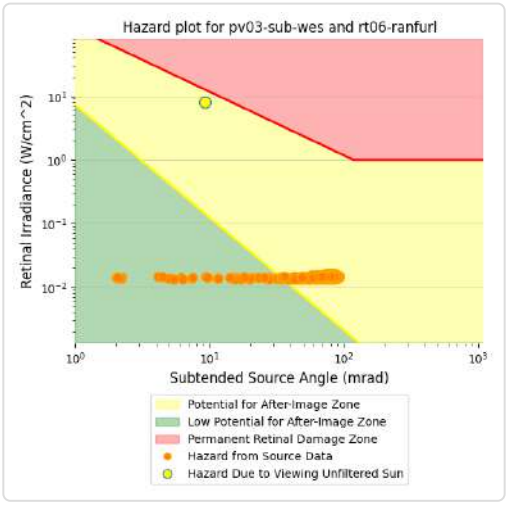
PV03 Sub West and Route: RT06 Ranfurly Naseby Rd

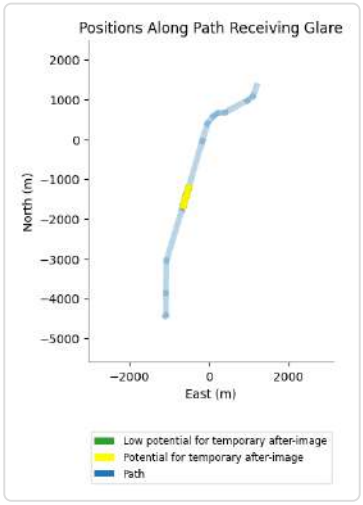
Yellow glare: 2,294 min.

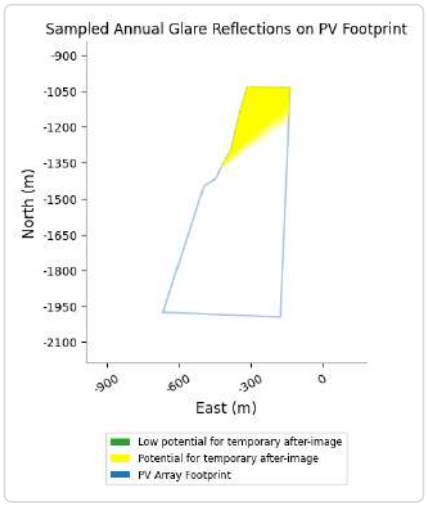
Green glare: 39 min.

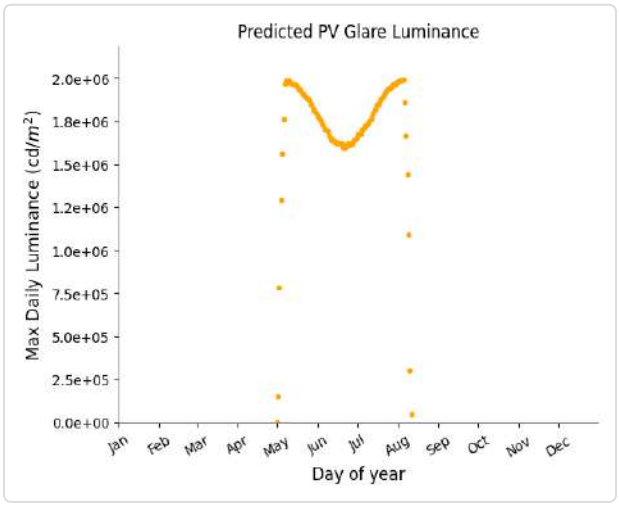












PV03 Sub West and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV03 Sub West and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV03 Sub West and Route: RT03 Brinsdon Rd

No glare found

PV03 Sub West and Route: RT04 Naseby Link Rd

No glare found

PV03 Sub West and Route: RT05 Fennessy Rd

No glare found

PV03 Sub West and Route: RT07 Bypass Rd

No glare found

PV03 Sub West and Route: RT08 Ranfurly Back Rd

No glare found

PV03 Sub West and Route: RT09 Glen Rd

No glare found

PV03 Sub West and OP 1

No glare found

PV03 Sub West and OP 2

No glare found

PV03 Sub West and OP 3

No glare found

PV03 Sub West and OP 4

No glare found

PV03 Sub West and OP 5

No glare found

PV03 Sub West and OP 6

No glare found

PV03 Sub West and OP 7

No glare found

PV03 Sub West and OP 8

No glare found

PV03 Sub West and OP 9

No glare found

PV03 Sub West and OP 10

No glare found

PV03 Sub West and OP 11

No glare found

PV03 Sub West and OP 12

No glare found

PV03 Sub West and OP 13

No glare found

PV03 Sub West and OP 14

No glare found

PV03 Sub West and OP 15

No glare found

PV03 Sub West and OP 16

No glare found

PV: PV04 West 1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV04 West 1 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV04 West 1 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV04 West 1 and Route: RT03 Brinsdon Rd

No glare found

PV04 West 1 and Route: RT04 Naseby Link Rd

No glare found

PV04 West 1 and Route: RT05 Fennessy Rd

No glare found

PV04 West 1 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV04 West 1 and Route: RT07 Bypass Rd

No glare found

PV04 West 1 and Route: RT08 Ranfurly Back Rd

No glare found

PV04 West 1 and Route: RT09 Glen Rd

No glare found

PV04 West 1 and OP 1

No glare found

PV04 West 1 and OP 2

No glare found

PV04 West 1 and OP 3

No glare found

PV04 West 1 and OP 4

No glare found

PV04 West 1 and OP 5

No glare found

PV04 West 1 and OP 6

No glare found

PV04 West 1 and OP 7

No glare found

PV04 West 1 and OP 8

No glare found

PV04 West 1 and OP 9

No glare found

PV04 West 1 and OP 10

No glare found

PV04 West 1 and OP 11

No glare found

PV04 West 1 and OP 12

No glare found

PV04 West 1 and OP 13

No glare found

PV04 West 1 and OP 14

No glare found

PV04 West 1 and OP 15

No glare found

PV04 West 1 and OP 16

No glare found

PV: PV05 West 2 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV05 West 2 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV05 West 2 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV05 West 2 and Route: RT03 Brinsdon Rd

No glare found

PV05 West 2 and Route: RT04 Naseby Link Rd

No glare found

PV05 West 2 and Route: RT05 Fennessy Rd

No glare found

PV05 West 2 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV05 West 2 and Route: RT07 Bypass Rd

No glare found

PV05 West 2 and Route: RT08 Ranfurly Back Rd

No glare found

PV05 West 2 and Route: RT09 Glen Rd

No glare found

PV05 West 2 and OP 1

No glare found

PV05 West 2 and OP 2

No glare found

PV05 West 2 and OP 3

No glare found

PV05 West 2 and OP 4

No glare found

PV05 West 2 and OP 5

No glare found

PV05 West 2 and OP 6

No glare found

PV05 West 2 and OP 7

No glare found

PV05 West 2 and OP 8

No glare found

PV05 West 2 and OP 9

No glare found

PV05 West 2 and OP 10

No glare found

PV05 West 2 and OP 11

No glare found

PV05 West 2 and OP 12

No glare found

PV05 West 2 and OP 13

No glare found

PV05 West 2 and OP 14

No glare found

PV05 West 2 and OP 15

No glare found

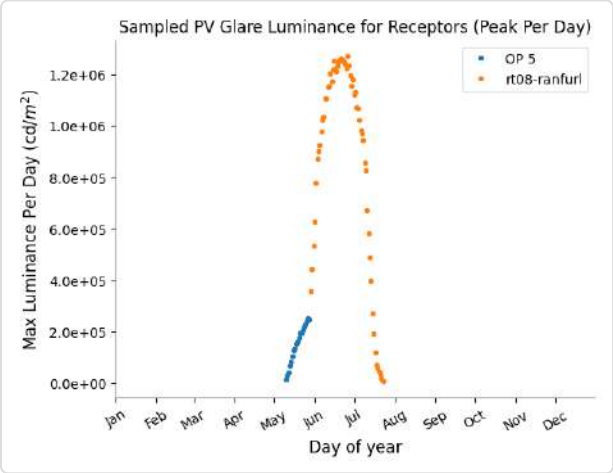
PV05 West 2 and OP 16

No glare found

PV: PV06 South potential temporary after-image

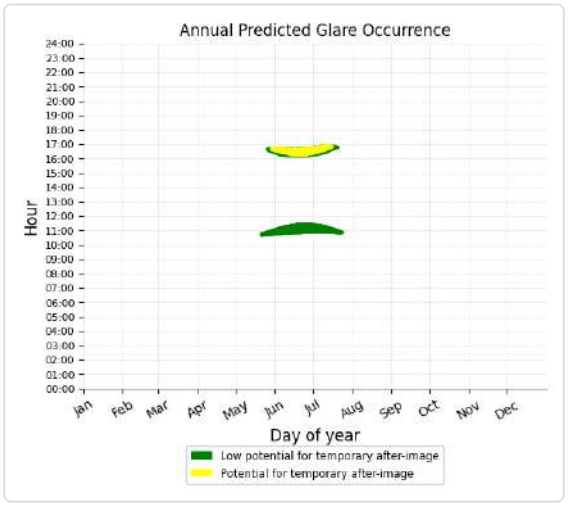
Receptor results ordered by category of glare

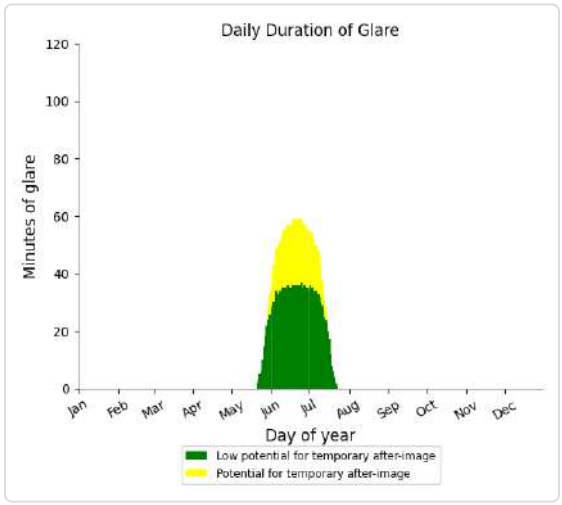
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	1,729	28.8	794	13.2	1,270,053
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 5	151	2.5	4	0.1	290,403
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

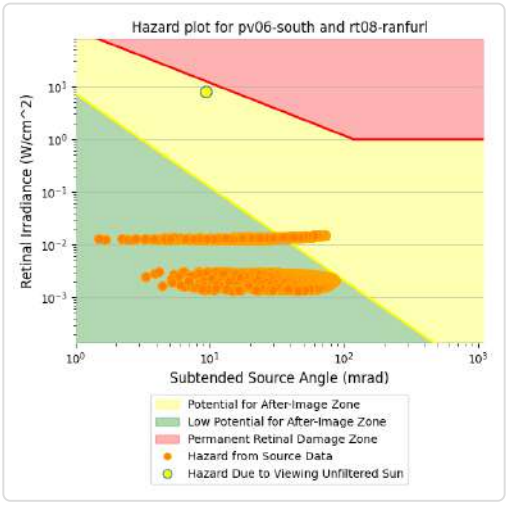

Sampled PV Glare Luminance for Receptors (Peak Per Day)
OP 5
rt08-ranfurl
Max Luminance Per Day (cd/m²)
1.2e+06
1.0e+06
8.0e+05
6.0e+05
4.0e+05
2.0e+05
0.0e+00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

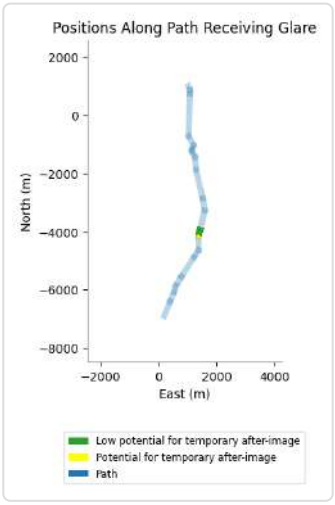
PV06 South and Route: RT08 Ranfurly Back Rd

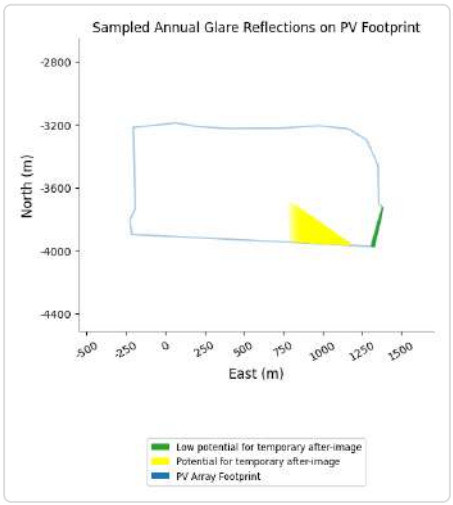
Yellow glare: 794 min.
Green glare: 1,729 min.

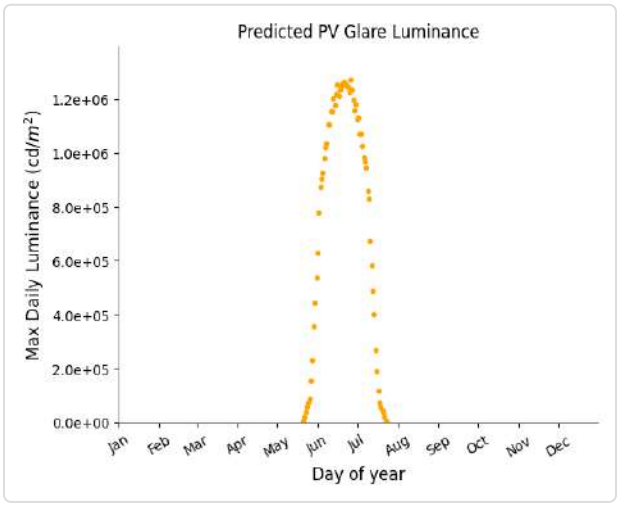












PV06 South and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV06 South and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV06 South and Route: RT03 Brinsdon Rd

No glare found

PV06 South and Route: RT04 Naseby Link Rd

No glare found

PV06 South and Route: RT05 Fennessy Rd

No glare found

PV06 South and Route: RT06 Ranfurly Naseby Rd

No glare found

PV06 South and Route: RT07 Bypass Rd

No glare found

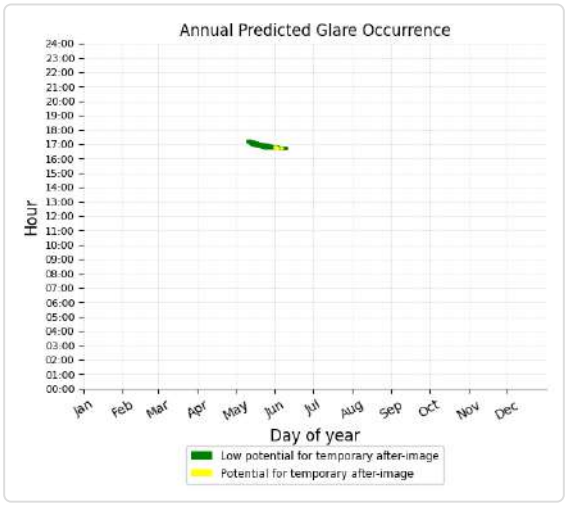
PV06 South and Route: RT09 Glen Rd

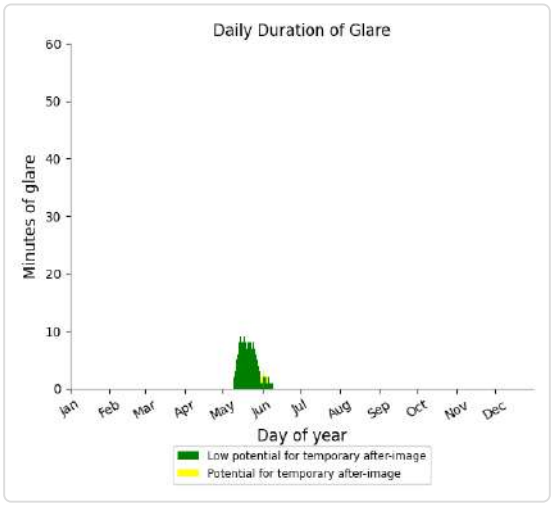
No glare found

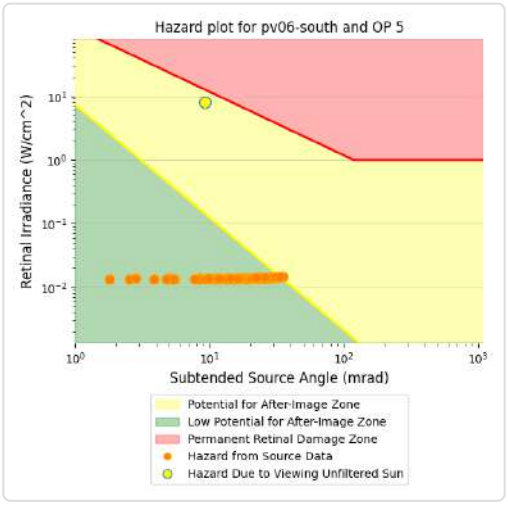
PV06 South and OP 5

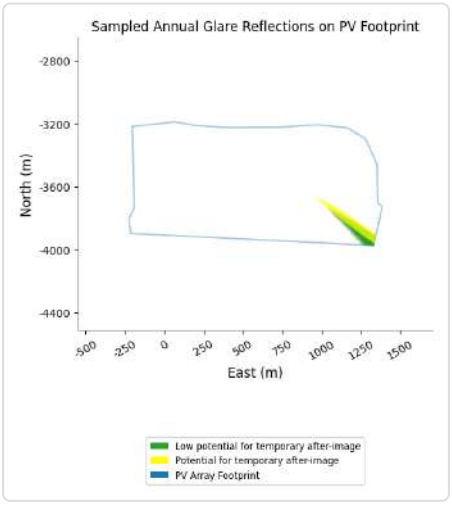
Yellow glare: 4 min.

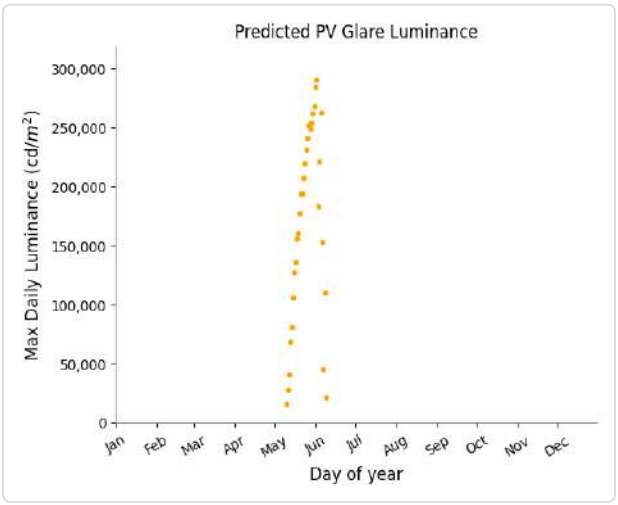
Green glare: 151 min.











PV06 South and OP 1

No glare found

PV06 South and OP 2

No glare found

PV06 South and OP 3

No glare found

PV06 South and OP 4

No glare found

PV06 South and OP 6

No glare found

PV06 South and OP 7

No glare found

PV06 South and OP 8

No glare found

PV06 South and OP 9

No glare found

PV06 South and OP 10

No glare found

PV06 South and OP 11

No glare found

PV06 South and OP 12

No glare found

PV06 South and OP 13

No glare found

PV06 South and OP 14

No glare found

PV06 South and OP 15

No glare found

PV06 South and OP 16

No glare found

PV: PV07 Central 1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV07 Central 1 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV07 Central 1 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV07 Central 1 and Route: RT03 Brinsdon Rd

No glare found

PV07 Central 1 and Route: RT04 Naseby Link Rd

No glare found

PV07 Central 1 and Route: RT05 Fennessy Rd

No glare found

PV07 Central 1 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV07 Central 1 and Route: RT07 Bypass Rd

No glare found

PV07 Central 1 and Route: RT08 Ranfurly Back Rd

No glare found

PV07 Central 1 and Route: RT09 Glen Rd

No glare found

PV07 Central 1 and OP 1

No glare found

PV07 Central 1 and OP 2

No glare found

PV07 Central 1 and OP 3

No glare found

PV07 Central 1 and OP 4

No glare found

PV07 Central 1 and OP 5

No glare found

PV07 Central 1 and OP 6

No glare found

PV07 Central 1 and OP 7

No glare found

PV07 Central 1 and OP 8

No glare found

PV07 Central 1 and OP 9

No glare found

PV07 Central 1 and OP 10

No glare found

PV07 Central 1 and OP 11

No glare found

PV07 Central 1 and OP 12

No glare found

PV07 Central 1 and OP 13

No glare found

PV07 Central 1 and OP 14

No glare found

PV07 Central 1 and OP 15

No glare found

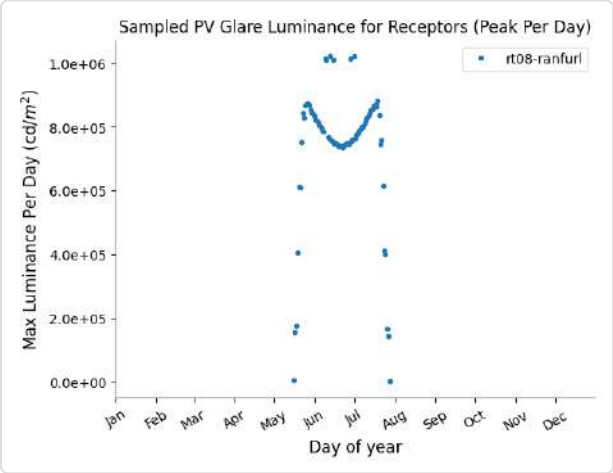
PV07 Central 1 and OP 16

No glare found

PV: PV08 Central 2 potential temporary after-image

Receptor results ordered by category of glare

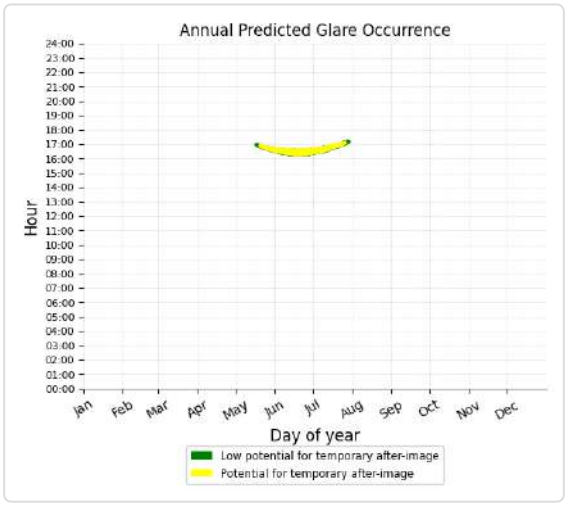
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	149	2.5	703	11.7	1,021,545
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

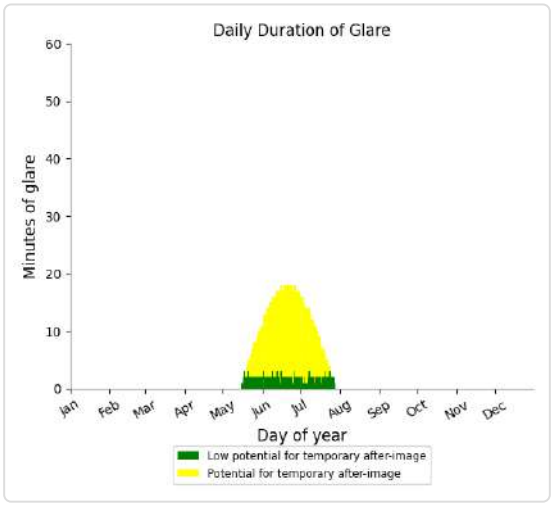

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt08-ranfurl
Max Luminance Per Day (cd/m²)
1.0e+06
8.0e+05
6.0e+05
4.0e+05
2.0e+05
0.0e+00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

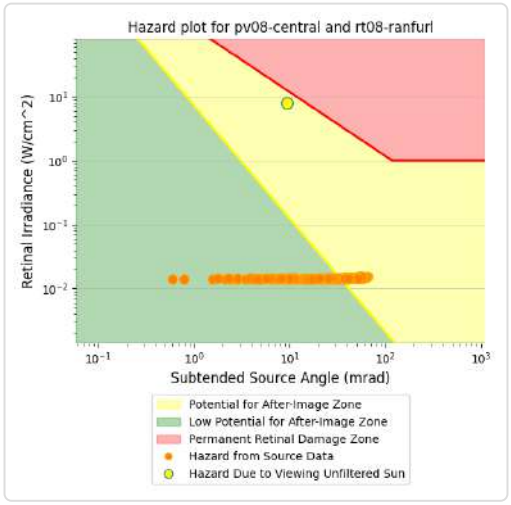
PV08 Central 2 and Route: RT08 Ranfurly Back Rd

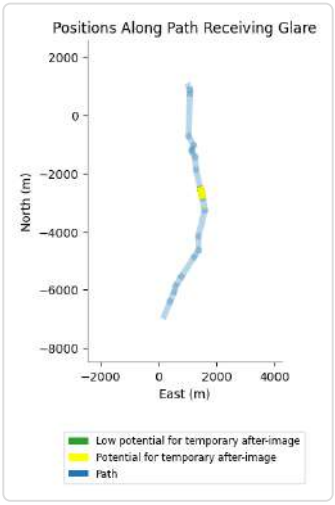
Yellow glare: 703 min.

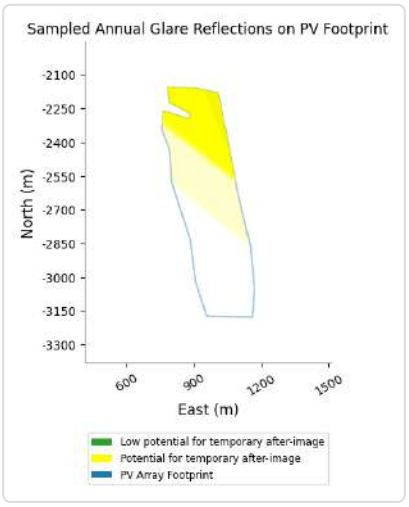
Green glare: 149 min.

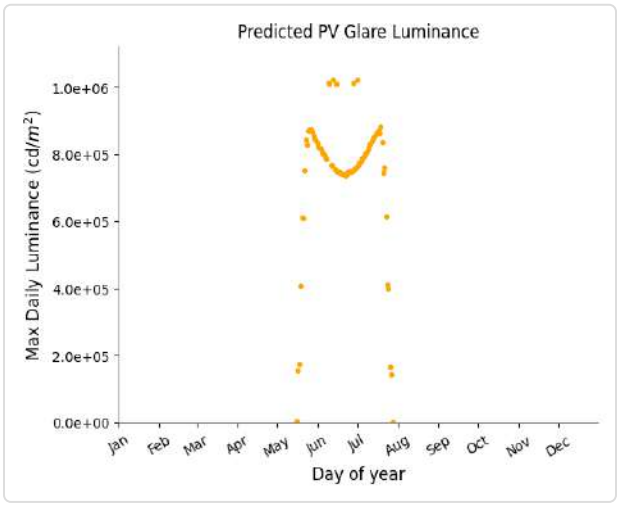












PV08 Central 2 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV08 Central 2 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV08 Central 2 and Route: RT03 Brinsdon Rd

No glare found

PV08 Central 2 and Route: RT04 Naseby Link Rd

No glare found

PV08 Central 2 and Route: RT05 Fennessy Rd

No glare found

PV08 Central 2 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV08 Central 2 and Route: RT07 Bypass Rd

No glare found

PV08 Central 2 and Route: RT09 Glen Rd

No glare found

PV08 Central 2 and OP 1

No glare found

PV08 Central 2 and OP 2

No glare found

PV08 Central 2 and OP 3

No glare found

PV08 Central 2 and OP 4

No glare found

PV08 Central 2 and OP 5

No glare found

PV08 Central 2 and OP 6

No glare found

PV08 Central 2 and OP 7

No glare found

PV08 Central 2 and OP 8

No glare found

PV08 Central 2 and OP 9

No glare found

PV08 Central 2 and OP 10

No glare found

PV08 Central 2 and OP 11

No glare found

PV08 Central 2 and OP 12

No glare found

PV08 Central 2 and OP 13

No glare found

PV08 Central 2 and OP 14

No glare found

PV08 Central 2 and OP 15

No glare found

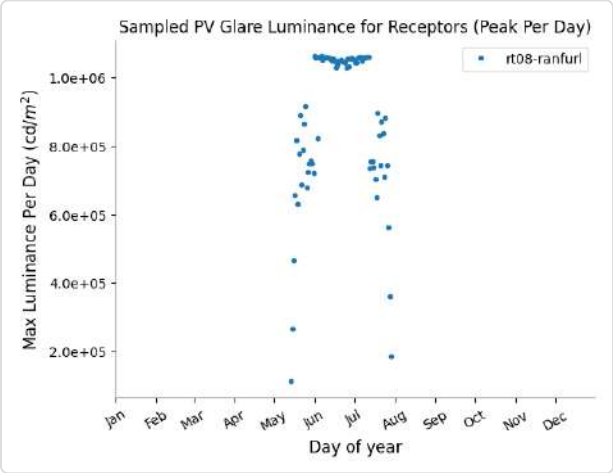
PV08 Central 2 and OP 16

No glare found

PV: PV09 Central 3 potential temporary after-image

Receptor results ordered by category of glare

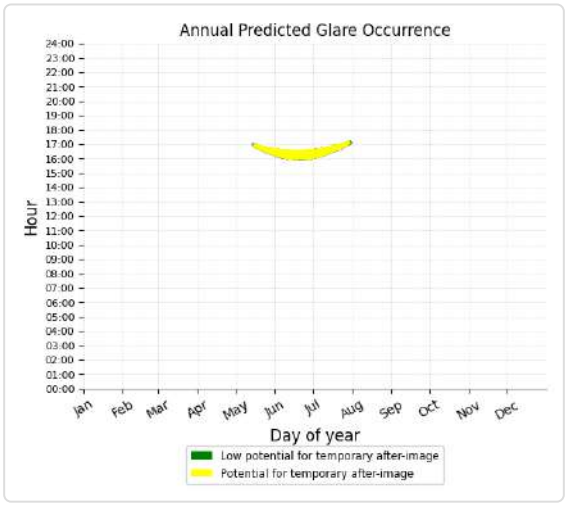
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	266	4.4	1,119	18.6	1,061,551
RT06 Ranfurly Naseby Rd	824	13.7	0	0.0	106,424
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

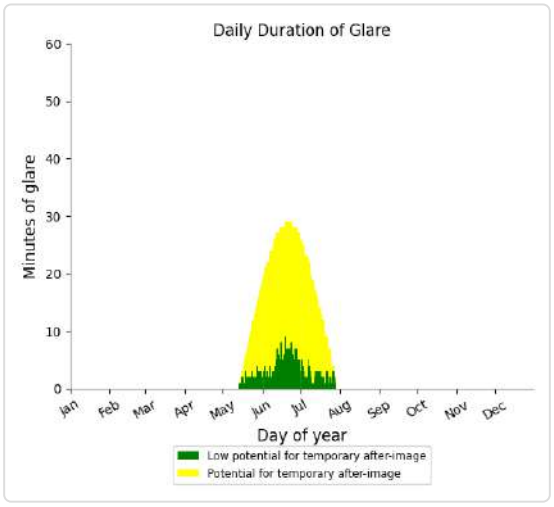

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt08-ranfurl
Max Luminance Per Day (cd/m²)
1.0e+06
8.0e+05
6.0e+05
4.0e+05
2.0e+05
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

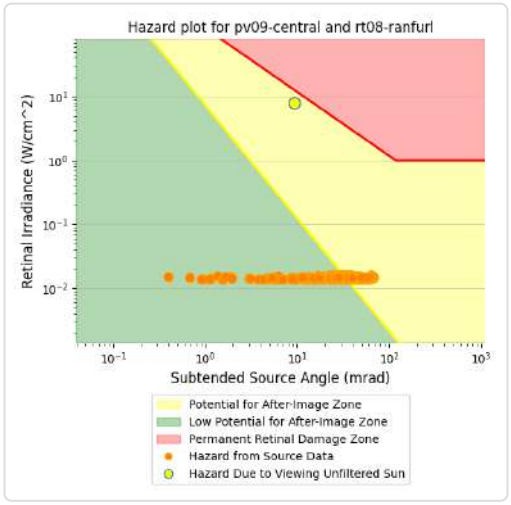
PV09 Central 3 and Route: RT08 Ranfurly Back Rd

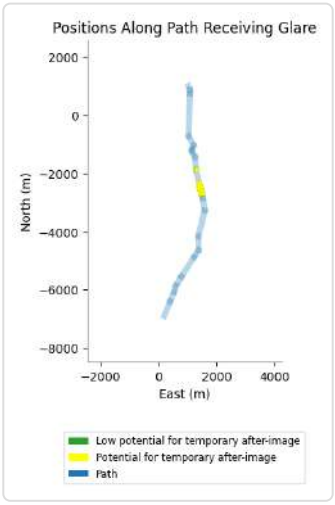
Yellow glare: 1,119 min.

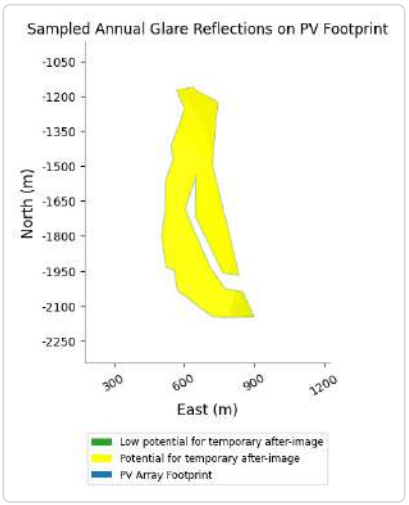
Green glare: 266 min.

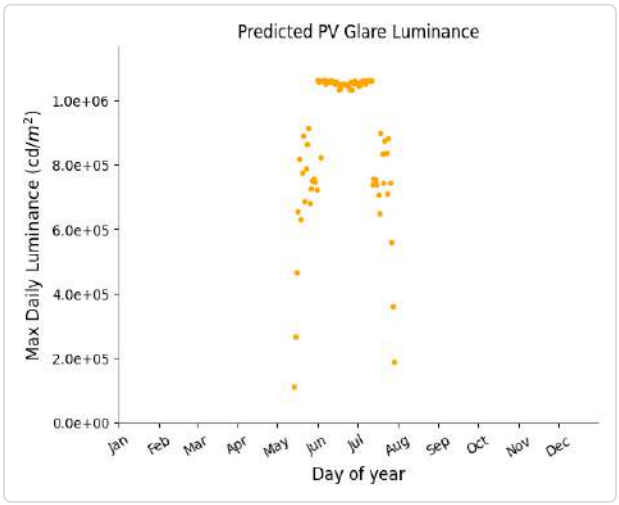








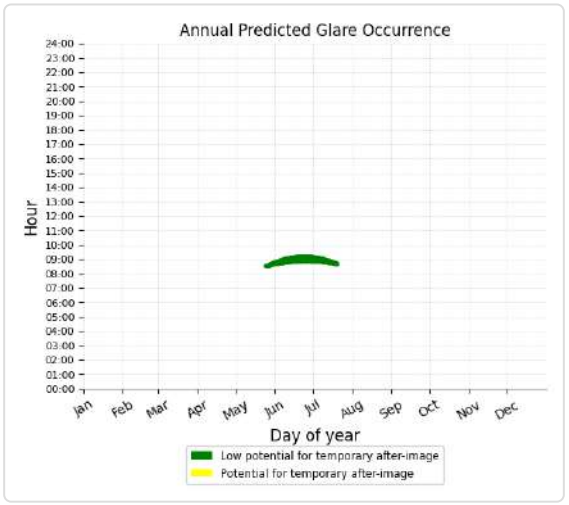


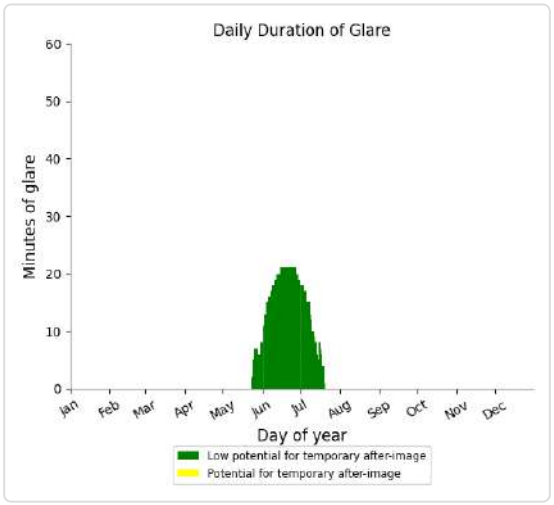


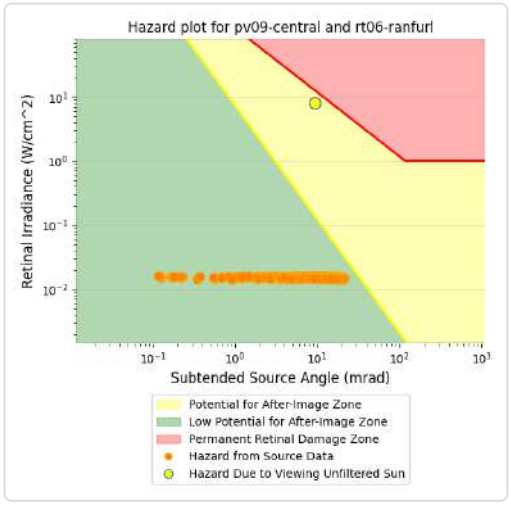
PV09 Central 3 and Route: RT06 Ranfurly Naseby Rd

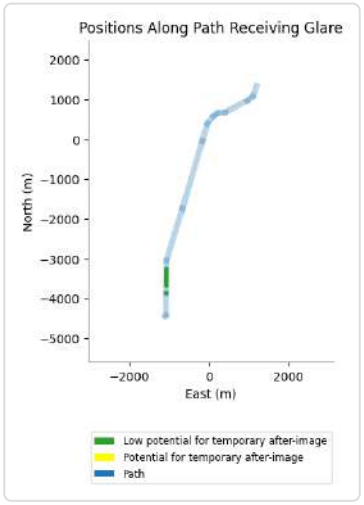
Yellow glare: none

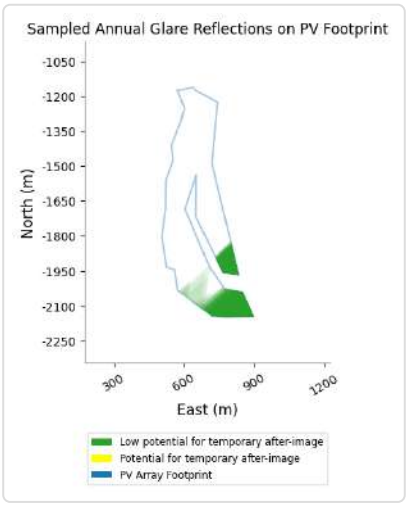
Green glare: 824 min.

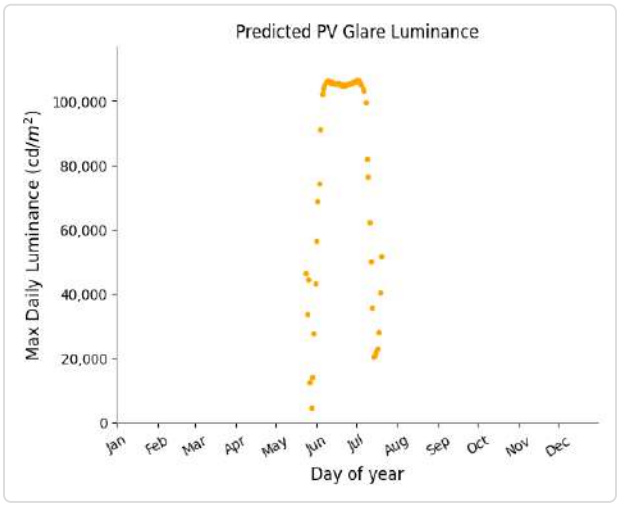












PV09 Central 3 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV09 Central 3 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV09 Central 3 and Route: RT03 Brinsdon Rd

No glare found

PV09 Central 3 and Route: RT04 Naseby Link Rd

No glare found

PV09 Central 3 and Route: RT05 Fennessy Rd

No glare found

PV09 Central 3 and Route: RT07 Bypass Rd

No glare found

PV09 Central 3 and Route: RT09 Glen Rd

No glare found

PV09 Central 3 and OP 1

No glare found

PV09 Central 3 and OP 2

No glare found

PV09 Central 3 and OP 3

No glare found

PV09 Central 3 and OP 4

No glare found

PV09 Central 3 and OP 5

No glare found

PV09 Central 3 and OP 6

No glare found

PV09 Central 3 and OP 7

No glare found

PV09 Central 3 and OP 8

No glare found

PV09 Central 3 and OP 9

No glare found

PV09 Central 3 and OP 10

No glare found

PV09 Central 3 and OP 11

No glare found

PV09 Central 3 and OP 12

No glare found

PV09 Central 3 and OP 13

No glare found

PV09 Central 3 and OP 14

No glare found

PV09 Central 3 and OP 15

No glare found

PV09 Central 3 and OP 16

No glare found

PV: PV10 Central 4 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV10 Central 4 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV10 Central 4 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV10 Central 4 and Route: RT03 Brinsdon Rd

No glare found

PV10 Central 4 and Route: RT04 Naseby Link Rd

No glare found

PV10 Central 4 and Route: RT05 Fennessy Rd

No glare found

PV10 Central 4 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV10 Central 4 and Route: RT07 Bypass Rd

No glare found

PV10 Central 4 and Route: RT08 Ranfurly Back Rd

No glare found

PV10 Central 4 and Route: RT09 Glen Rd

No glare found

PV10 Central 4 and OP 1

No glare found

PV10 Central 4 and OP 2

No glare found

PV10 Central 4 and OP 3

No glare found

PV10 Central 4 and OP 4

No glare found

PV10 Central 4 and OP 5

No glare found

PV10 Central 4 and OP 6

No glare found

PV10 Central 4 and OP 7

No glare found

PV10 Central 4 and OP 8

No glare found

PV10 Central 4 and OP 9

No glare found

PV10 Central 4 and OP 10

No glare found

PV10 Central 4 and OP 11

No glare found

PV10 Central 4 and OP 12

No glare found

PV10 Central 4 and OP 13

No glare found

PV10 Central 4 and OP 14

No glare found

PV10 Central 4 and OP 15

No glare found

PV10 Central 4 and OP 16

No glare found

PV: PV11 East 1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV11 East 1 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV11 East 1 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV11 East 1 and Route: RT03 Brinsdon Rd

No glare found

PV11 East 1 and Route: RT04 Naseby Link Rd

No glare found

PV11 East 1 and Route: RT05 Fennessy Rd

No glare found

PV11 East 1 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV11 East 1 and Route: RT07 Bypass Rd

No glare found

PV11 East 1 and Route: RT08 Ranfurly Back Rd

No glare found

PV11 East 1 and Route: RT09 Glen Rd

No glare found

PV11 East 1 and OP 1

No glare found

PV11 East 1 and OP 2

No glare found

PV11 East 1 and OP 3

No glare found

PV11 East 1 and OP 4

No glare found

PV11 East 1 and OP 5

No glare found

PV11 East 1 and OP 6

No glare found

PV11 East 1 and OP 7

No glare found

PV11 East 1 and OP 8

No glare found

PV11 East 1 and OP 9

No glare found

PV11 East 1 and OP 10

No glare found

PV11 East 1 and OP 11

No glare found

PV11 East 1 and OP 12

No glare found

PV11 East 1 and OP 13

No glare found

PV11 East 1 and OP 14

No glare found

PV11 East 1 and OP 15

No glare found

PV11 East 1 and OP 16

No glare found

PV: PV12 East 2 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV12 East 2 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV12 East 2 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV12 East 2 and Route: RT03 Brinsdon Rd

No glare found

PV12 East 2 and Route: RT04 Naseby Link Rd

No glare found

PV12 East 2 and Route: RT05 Fennessy Rd

No glare found

PV12 East 2 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV12 East 2 and Route: RT07 Bypass Rd

No glare found

PV12 East 2 and Route: RT08 Ranfurly Back Rd

No glare found

PV12 East 2 and Route: RT09 Glen Rd

No glare found

PV12 East 2 and OP 1

No glare found

PV12 East 2 and OP 2

No glare found

PV12 East 2 and OP 3

No glare found

PV12 East 2 and OP 4

No glare found

PV12 East 2 and OP 5

No glare found

PV12 East 2 and OP 6

No glare found

PV12 East 2 and OP 7

No glare found

PV12 East 2 and OP 8

No glare found

PV12 East 2 and OP 9

No glare found

PV12 East 2 and OP 10

No glare found

PV12 East 2 and OP 11

No glare found

PV12 East 2 and OP 12

No glare found

PV12 East 2 and OP 13

No glare found

PV12 East 2 and OP 14

No glare found

PV12 East 2 and OP 15

No glare found

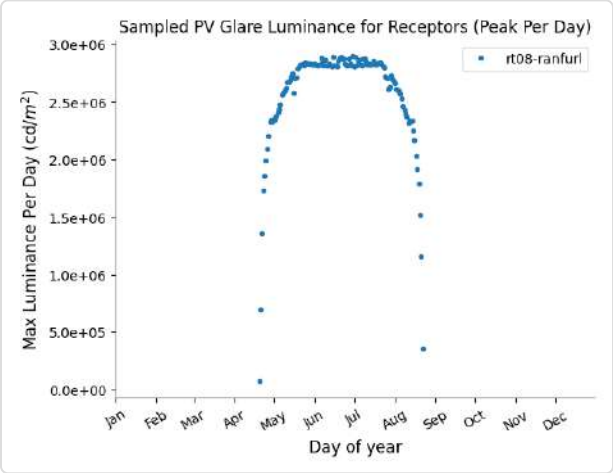
PV12 East 2 and OP 16

No glare found

PV: PV13 East 3 potential temporary after-image

Receptor results ordered by category of glare

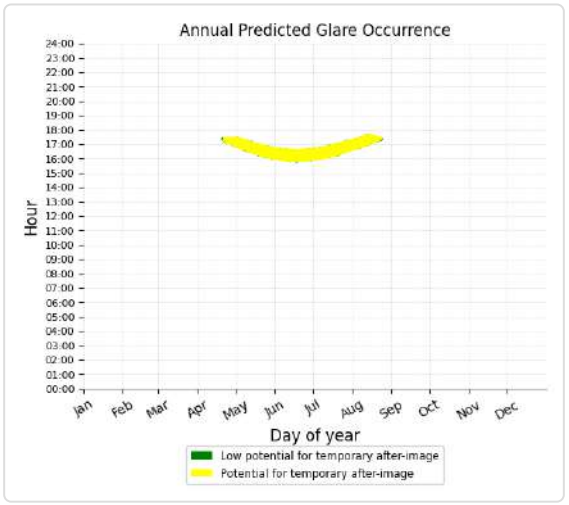
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	140	2.3	3,962	66.0	2,895,449
RT06 Ranfurly Naseby Rd	888	14.8	0	0.0	180,457
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

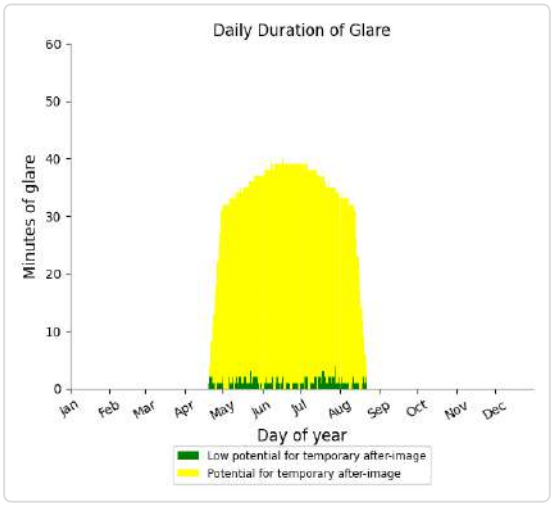

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt08-ranfurl
Max Luminance Per Day (cd/m²)
3.0e+06
2.5e+06
2.0e+06
1.5e+06
1.0e+06
5.0e+05
0.0e+00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

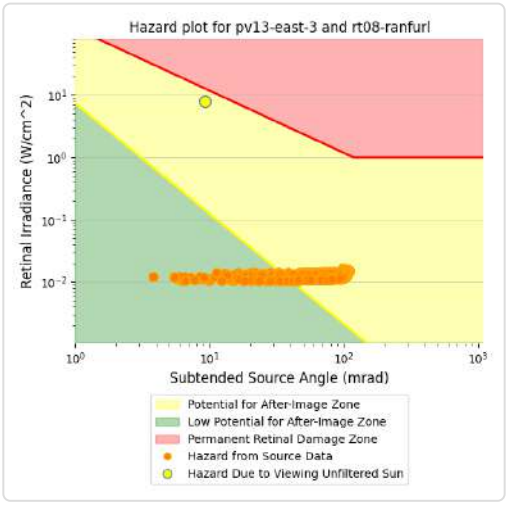
PV13 East 3 and Route: RT08 Ranfurly Back Rd

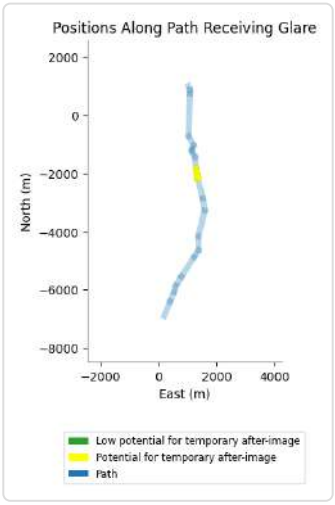
Yellow glare: 3,962 min.

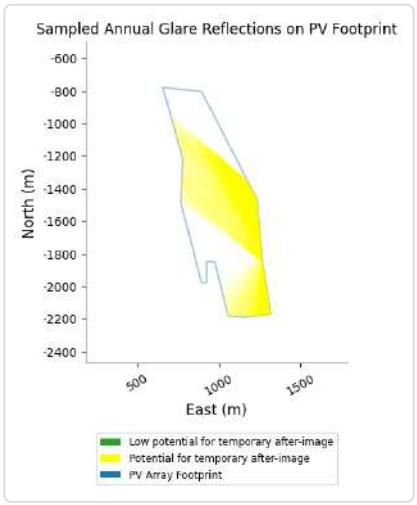
Green glare: 140 min.

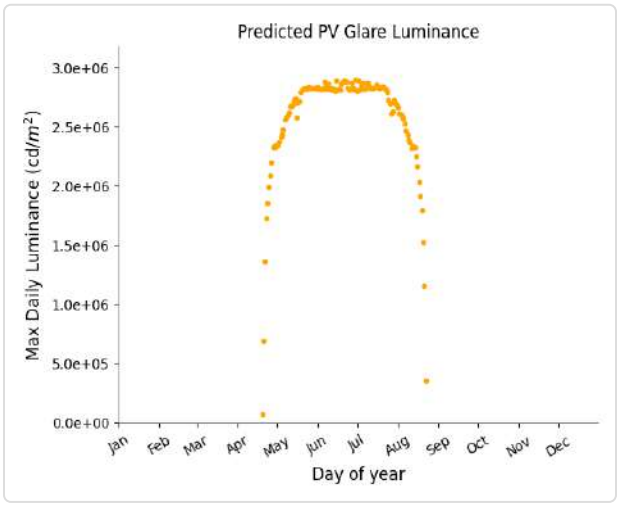








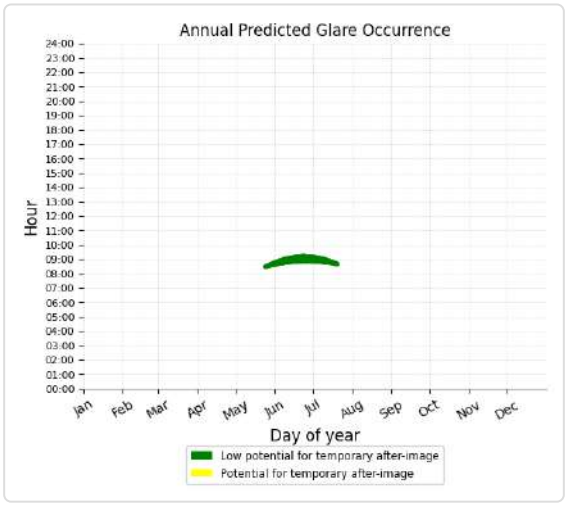


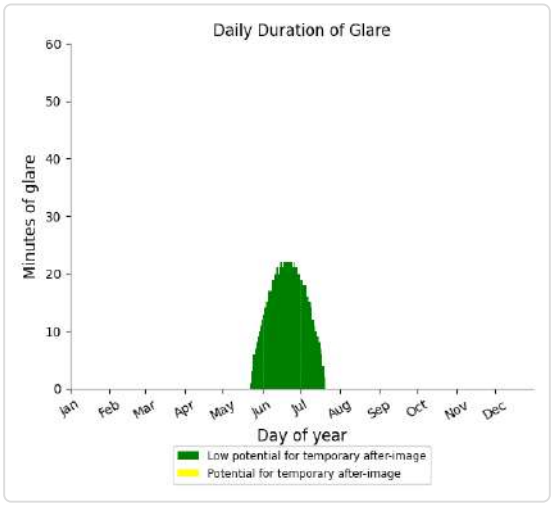


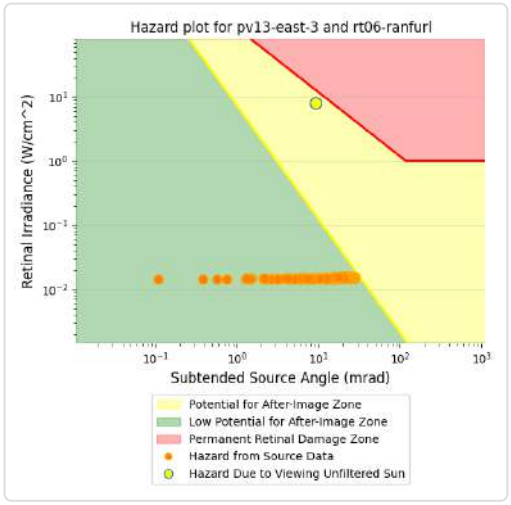
PV13 East 3 and Route: RT06 Ranfurly Naseby Rd

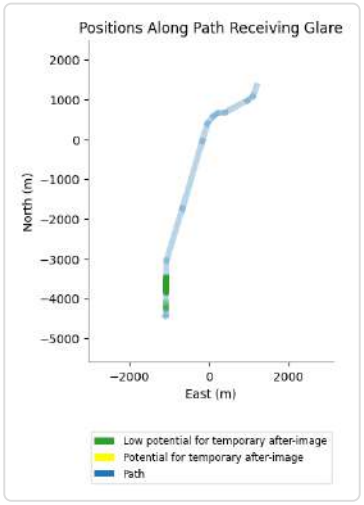
Yellow glare: none

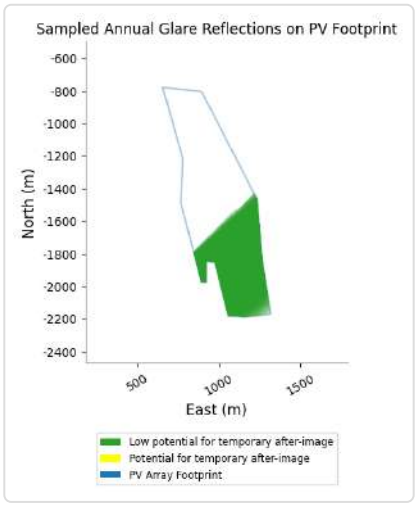
Green glare: 888 min.

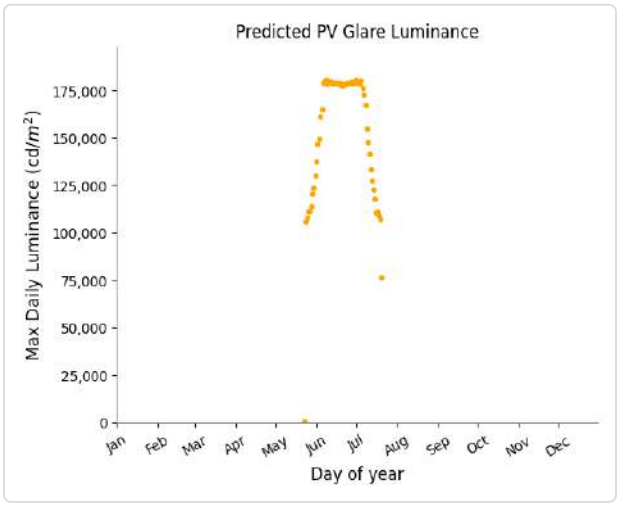












PV13 East 3 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV13 East 3 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV13 East 3 and Route: RT03 Brinsdon Rd

No glare found

PV13 East 3 and Route: RT04 Naseby Link Rd

No glare found

PV13 East 3 and Route: RT05 Fennessy Rd

No glare found

PV13 East 3 and Route: RT07 Bypass Rd

No glare found

PV13 East 3 and Route: RT09 Glen Rd

No glare found

PV13 East 3 and OP 1

No glare found

PV13 East 3 and OP 2

No glare found

PV13 East 3 and OP 3

No glare found

PV13 East 3 and OP 4

No glare found

PV13 East 3 and OP 5

No glare found

PV13 East 3 and OP 6

No glare found

PV13 East 3 and OP 7

No glare found

PV13 East 3 and OP 8

No glare found

PV13 East 3 and OP 9

No glare found

PV13 East 3 and OP 10

No glare found

PV13 East 3 and OP 11

No glare found

PV13 East 3 and OP 12

No glare found

PV13 East 3 and OP 13

No glare found

PV13 East 3 and OP 14

No glare found

PV13 East 3 and OP 15

No glare found

PV13 East 3 and OP 16

No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

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

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

FORGESOLAR GLARE ANALYSIS

Project: **23048 - Naseby SF**
Proposed 300 MW solar farm nearby Naseby, New Zealand.

Site configuration: **Naseby v3 - 10 deg rest angle**

Client: Helios Energy

Site description: As per Naseby v2 model, but with 5 deg rest angle for all PV arrays

Created 30 Aug, 2023
Updated 30 Aug, 2023
Time-step 1 minute
Timezone offset UTC12
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 100 MW to 1 GW
Site ID 99140.17105

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

Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy	Peak Luminance
	°	°	min	hr	min	hr	kWh	cd/m^2
PV01 North tip	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV02 Sub East	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV03 Sub West	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV04 West 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV05 West 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV06 South	SA tracking	SA tracking	1,266	21.1	0	0.0	-	246,397
PV07 Central 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV08 Central 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV09 Central 3	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV10 Central 4	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV11 East 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV12 East 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV13 East 3	SA tracking	SA tracking	0	0.0	0	0.0	-	0

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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0
RT03 Brinsdon Rd	0	0.0	0	0.0
RT04 Naseby Link Rd	0	0.0	0	0.0
RT05 Fennessy Rd	0	0.0	0	0.0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0
RT07 Bypass Rd	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT08 Ranfurly Back Rd	1,266	21.1	0	0.0
RT09 Glen Rd	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

Component Data

PV Arrays

Name: PV01 North tip
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.048810	170.107064	560.00	1.70	561.70
2	-45.048874	170.107929	559.64	1.70	561.34
3	-45.052022	170.110373	559.00	1.70	560.70
4	-45.055653	170.111707	552.66	1.70	554.36
5	-45.055857	170.113963	554.00	1.70	555.70
6	-45.059202	170.115155	540.00	1.70	541.70
7	-45.059420	170.113270	539.00	1.70	540.70
8	-45.058011	170.111134	541.13	1.70	542.83
9	-45.057797	170.103258	546.00	1.70	547.70
10	-45.048810	170.107064	560.00	1.70	561.70

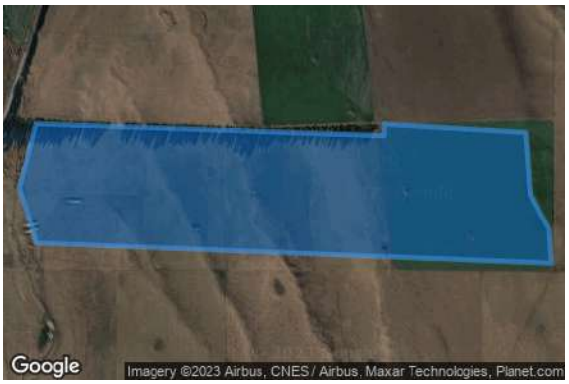
Name: PV02 Sub East
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.058092	170.105657	543.20	1.70	544.90
2	-45.058289	170.110985	540.00	1.70	541.70
3	-45.059642	170.112700	538.00	1.70	539.70
4	-45.059868	170.112336	538.00	1.70	539.70
5	-45.060793	170.112282	537.00	1.70	538.70
6	-45.061012	170.111761	537.00	1.70	538.70
7	-45.060007	170.111011	540.00	1.70	541.70
8	-45.059960	170.110454	539.00	1.70	540.70
9	-45.060506	170.110341	538.89	1.70	540.59
10	-45.062449	170.111690	535.40	1.70	537.10
11	-45.063515	170.112690	534.00	1.70	535.70
12	-45.064566	170.112248	532.00	1.70	533.70
13	-45.070734	170.113886	520.97	1.70	522.67
14	-45.070276	170.097282	520.00	1.70	521.70
15	-45.066897	170.098647	525.00	1.70	526.70
16	-45.066990	170.105054	528.51	1.70	530.21
17	-45.062432	170.105468	536.00	1.70	537.70
18	-45.062497	170.106947	536.00	1.70	537.70
19	-45.061230	170.107027	539.00	1.70	540.70
20	-45.061181	170.105492	538.12	1.70	539.82
21	-45.058092	170.105657	543.20	1.70	544.90

Name: PV03 Sub West
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.066581	170.098624	526.00	1.70	527.70
2	-45.066768	170.104852	530.00	1.70	531.70
3	-45.058124	170.105382	543.85	1.70	545.55
4	-45.058108	170.103096	545.00	1.70	546.70
5	-45.059332	170.102604	540.77	1.70	542.47
6	-45.060438	170.102246	539.00	1.70	540.70
7	-45.061561	170.101411	540.00	1.70	541.70
8	-45.061812	170.100812	539.87	1.70	541.57
9	-45.066581	170.098624	526.00	1.70	527.70

Name: PV04 West 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.073500	170.097099	517.00	1.70	518.70
2	-45.072170	170.096530	517.21	1.70	518.91
3	-45.070617	170.097082	519.00	1.70	520.70
4	-45.070902	170.109052	518.92	1.70	520.62
5	-45.070626	170.109053	519.00	1.70	520.70
6	-45.070826	170.113934	520.72	1.70	522.42
7	-45.072351	170.114093	519.00	1.70	520.70
8	-45.073172	170.114708	519.00	1.70	520.70
9	-45.073984	170.114786	518.00	1.70	519.70
10	-45.073500	170.097099	517.00	1.70	518.70

Name: PV05 West 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.073878	170.097237	516.61	1.70	518.31
2	-45.075202	170.097613	513.00	1.70	514.70
3	-45.075454	170.097712	512.04	1.70	513.74
4	-45.076438	170.096964	510.00	1.70	511.70
5	-45.076871	170.096879	509.00	1.70	510.70
6	-45.077419	170.102829	510.99	1.70	512.69
7	-45.077247	170.107133	512.97	1.70	514.67
8	-45.074105	170.105600	517.49	1.70	519.19
9	-45.074027	170.104231	519.08	1.70	520.78
10	-45.074687	170.103977	518.01	1.70	519.71
11	-45.074583	170.103269	517.00	1.70	518.70
12	-45.074053	170.102971	518.00	1.70	519.70
13	-45.073878	170.097237	516.61	1.70	518.31

Name: PV06 South
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.077761	170.104489	510.95	1.70	512.65
2	-45.080406	170.104589	499.25	1.70	500.95
3	-45.082428	170.104636	498.43	1.70	500.13
4	-45.083051	170.104219	497.00	1.70	498.70
5	-45.083870	170.104388	496.00	1.70	497.70
6	-45.084567	170.123974	496.09	1.70	497.79
7	-45.082358	170.124659	497.00	1.70	498.70
8	-45.082143	170.124309	497.00	1.70	498.70
9	-45.079934	170.124261	499.00	1.70	500.70
10	-45.078463	170.123307	503.68	1.70	505.38
11	-45.077837	170.121828	508.00	1.70	509.70
12	-45.077660	170.119401	509.00	1.70	510.70
13	-45.077805	170.116314	508.00	1.70	509.70
14	-45.077821	170.111947	509.00	1.70	510.70
15	-45.077694	170.109540	511.00	1.70	512.70
16	-45.077496	170.107925	512.06	1.70	513.76
17	-45.077761	170.104489	510.95	1.70	512.65

Name: PV07 Central 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.074164	170.105978	518.31	1.70	520.01
2	-45.075052	170.106525	518.00	1.70	519.70
3	-45.075800	170.107369	518.93	1.70	520.63
4	-45.077242	170.107573	513.09	1.70	514.79
5	-45.077687	170.111929	509.85	1.70	511.55
6	-45.077798	170.111925	509.00	1.70	510.70
7	-45.077745	170.116259	508.00	1.70	509.70
8	-45.077576	170.116290	509.00	1.70	510.70
9	-45.077468	170.118747	509.41	1.70	511.11
10	-45.076698	170.118305	512.00	1.70	513.70
11	-45.076165	170.118344	513.67	1.70	515.37
12	-45.075440	170.118197	515.02	1.70	516.72
13	-45.075073	170.118078	516.00	1.70	517.70
14	-45.074471	170.118147	517.90	1.70	519.60
15	-45.074382	170.116202	519.00	1.70	520.70
16	-45.074164	170.105978	518.31	1.70	520.01

Name: PV08 Central 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.077370	170.119202	510.00	1.70	511.70
2	-45.077406	170.121778	509.00	1.70	510.70
3	-45.076257	170.121897	513.00	1.70	514.70
4	-45.074586	170.121680	517.00	1.70	518.70
5	-45.072495	170.120974	518.00	1.70	519.70
6	-45.068427	170.119851	519.00	1.70	520.70
7	-45.068239	170.118583	519.00	1.70	520.70
8	-45.068201	170.116987	521.41	1.70	523.11
9	-45.068826	170.117113	519.00	1.70	520.70
10	-45.069221	170.118239	519.00	1.70	520.70
11	-45.069473	170.118187	519.00	1.70	520.70
12	-45.069147	170.116760	520.00	1.70	521.70
13	-45.069880	170.116650	519.00	1.70	520.70
14	-45.070723	170.117101	519.00	1.70	520.70
15	-45.071987	170.117217	519.00	1.70	520.70
16	-45.074311	170.118267	517.50	1.70	519.20
17	-45.075963	170.118570	514.00	1.70	515.70
18	-45.077370	170.119202	510.00	1.70	511.70

Name: PV09 Central 3
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.059387	170.114333	539.00	1.70	540.70
2	-45.059265	170.115199	540.00	1.70	541.70
3	-45.059380	170.115304	540.00	1.70	541.70
4	-45.059840	170.116514	540.81	1.70	542.51
5	-45.062208	170.116207	540.00	1.70	541.70
6	-45.066512	170.117671	531.00	1.70	532.70
7	-45.066430	170.116825	530.00	1.70	531.70
8	-45.064261	170.115332	535.00	1.70	536.70
9	-45.062652	170.115352	538.00	1.70	539.70
10	-45.063968	170.114731	535.00	1.70	536.70
11	-45.066216	170.116088	530.00	1.70	531.70
12	-45.067044	170.116923	527.93	1.70	529.63
13	-45.067168	170.117884	525.46	1.70	527.16
14	-45.068115	170.118464	520.00	1.70	521.70
15	-45.068136	170.116977	522.00	1.70	523.70
16	-45.068106	170.116241	522.46	1.70	524.16
17	-45.067109	170.114353	526.11	1.70	527.81
18	-45.066313	170.114171	528.00	1.70	529.70
19	-45.066204	170.113725	528.71	1.70	530.41
20	-45.065023	170.113472	531.46	1.70	533.16
21	-45.063966	170.113673	534.00	1.70	535.70
22	-45.062887	170.113691	536.00	1.70	537.70
23	-45.062067	170.114091	537.00	1.70	538.70
24	-45.061501	170.114006	537.00	1.70	538.70
25	-45.060574	170.114526	538.29	1.70	539.99
26	-45.060069	170.114712	539.00	1.70	540.70
27	-45.059387	170.114333	539.00	1.70	540.70

Name: PV10 Central 4
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.067625	170.113453	525.05	1.70	526.75
2	-45.067579	170.113839	525.00	1.70	526.70
3	-45.068602	170.115217	522.00	1.70	523.70
4	-45.070279	170.116219	520.00	1.70	521.70
5	-45.071627	170.116210	520.00	1.70	521.70
6	-45.073577	170.117104	520.00	1.70	521.70
7	-45.073960	170.117165	520.00	1.70	521.70
8	-45.073887	170.116186	519.00	1.70	520.70
9	-45.073631	170.116120	519.92	1.70	521.62
10	-45.073251	170.115361	519.00	1.70	520.70
11	-45.072455	170.114882	520.00	1.70	521.70
12	-45.071689	170.114918	520.00	1.70	521.70
13	-45.071665	170.114607	520.00	1.70	521.70
14	-45.069486	170.114103	523.00	1.70	524.70
15	-45.067987	170.113436	525.00	1.70	526.70
16	-45.067625	170.113453	525.05	1.70	526.75

Name: PV11 East 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.074546	170.122412	517.00	1.70	518.70
2	-45.074523	170.124127	519.00	1.70	520.70
3	-45.078347	170.125719	505.41	1.70	507.11
4	-45.078273	170.124324	504.09	1.70	505.79
5	-45.076486	170.122886	512.00	1.70	513.70
6	-45.074546	170.122412	517.00	1.70	518.70

Name: PV12 East 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.074469	170.124124	519.00	1.70	520.70
2	-45.074519	170.122397	517.00	1.70	518.70
3	-45.069331	170.121063	520.00	1.70	521.70
4	-45.068515	170.121784	523.00	1.70	524.70
5	-45.068389	170.123809	524.00	1.70	525.70
6	-45.071765	170.124656	521.00	1.70	522.70
7	-45.074469	170.124124	519.00	1.70	520.70

Name: PV13 East 3
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 10.0°
Ground Coverage Ratio: 0.35
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	-45.055819	170.115377	554.65	1.70	556.35
2	-45.056058	170.118403	550.84	1.70	552.54
3	-45.061992	170.122721	540.00	1.70	541.70
4	-45.065305	170.123117	535.00	1.70	536.70
5	-45.068352	170.123810	524.00	1.70	525.70
6	-45.068521	170.121770	523.00	1.70	524.70
7	-45.068451	170.120486	520.68	1.70	522.38
8	-45.065467	170.119421	536.92	1.70	538.62
9	-45.065450	170.118805	535.00	1.70	536.70
10	-45.066604	170.118794	530.05	1.70	531.75
11	-45.066593	170.118385	530.35	1.70	532.05
12	-45.062204	170.116797	540.00	1.70	541.70
13	-45.059790	170.116950	541.00	1.70	542.70
14	-45.055819	170.115377	554.65	1.70	556.35

Route Receptors

Name: RT01 Ranfurly Wedderburn Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.109780	170.095016	455.00	1.50	456.50
2	-45.106423	170.095169	459.12	1.50	460.62
3	-45.104088	170.095173	462.00	1.50	463.50
4	-45.094654	170.093592	479.00	1.50	480.50
5	-45.092635	170.093292	484.00	1.50	485.50
6	-45.088769	170.093017	495.92	1.50	497.42
7	-45.079549	170.080539	500.00	1.50	501.50
8	-45.073362	170.075044	514.00	1.50	515.50
9	-45.057432	170.063924	543.00	1.50	544.50

Name: RT02 Gimmerburn Naseby Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.089776	170.066142	485.00	1.50	486.50
2	-45.086784	170.068160	490.94	1.50	492.44
3	-45.085296	170.068661	493.00	1.50	494.50
4	-45.080378	170.070329	500.00	1.50	501.50
5	-45.079302	170.070760	502.09	1.50	503.59
6	-45.072765	170.074522	515.00	1.50	516.50
7	-45.068995	170.078109	520.00	1.50	521.50
8	-45.065290	170.081673	528.00	1.50	529.50
9	-45.059834	170.087165	542.94	1.50	544.44
10	-45.058677	170.088145	546.00	1.50	547.50
11	-45.058385	170.088330	547.00	1.50	548.50
12	-45.058179	170.088207	548.00	1.50	549.50
13	-45.053802	170.093733	554.00	1.50	555.50
14	-45.050658	170.097967	559.00	1.50	560.50
15	-45.047508	170.102018	564.00	1.50	565.50

Name: RT03 Brinsdon Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.074077	170.058844	513.91	1.50	515.41
2	-45.074119	170.073767	512.00	1.50	513.50

Name: RT04 Naseby Link Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.057844	170.064157	542.00	1.50	543.50
2	-45.057842	170.072756	540.00	1.50	541.50
3	-45.057959	170.074150	540.00	1.50	541.50
4	-45.058833	170.075780	538.00	1.50	539.50
5	-45.060661	170.078560	535.00	1.50	536.50
6	-45.061042	170.080106	536.75	1.50	538.25
7	-45.061448	170.081421	537.00	1.50	538.50
8	-45.061227	170.082417	537.00	1.50	538.50
9	-45.060357	170.083409	538.00	1.50	539.50
10	-45.059955	170.085011	540.00	1.50	541.50
11	-45.059503	170.086495	541.85	1.50	543.35
12	-45.058241	170.088137	547.45	1.50	548.95

Name: RT05 Fennessy Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.025447	170.093573	616.00	1.50	617.50
2	-45.029547	170.092947	607.00	1.50	608.50
3	-45.034376	170.092044	598.00	1.50	599.50
4	-45.034933	170.092038	597.00	1.50	598.50
5	-45.037227	170.093838	594.00	1.50	595.50
6	-45.047463	170.101965	564.55	1.50	566.05
7	-45.049198	170.105046	559.00	1.50	560.50

Name: RT06 Ranfurly Naseby Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.088762	170.093057	495.90	1.50	497.40
2	-45.088559	170.093340	495.00	1.50	496.50
3	-45.083567	170.093306	498.54	1.50	500.04
4	-45.076195	170.093507	514.31	1.50	515.81
5	-45.064414	170.098616	533.00	1.50	534.50
6	-45.049207	170.104952	559.00	1.50	560.50
7	-45.045288	170.106531	578.00	1.50	579.50
8	-45.043605	170.108391	582.61	1.50	584.11
9	-45.042911	170.109898	578.00	1.50	579.50
10	-45.042701	170.112146	581.00	1.50	582.50
11	-45.040076	170.119316	581.26	1.50	582.76
12	-45.039086	170.121036	573.79	1.50	575.29
13	-45.036813	170.122208	575.35	1.50	576.85

Name: RT07 Bypass Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.090972	170.093365	489.00	1.50	490.50
2	-45.090933	170.094195	488.03	1.50	489.53
3	-45.090541	170.095555	487.13	1.50	488.63
4	-45.090748	170.095959	486.29	1.50	487.79
5	-45.092727	170.098722	480.00	1.50	481.50
6	-45.096583	170.104503	475.00	1.50	476.50
7	-45.102925	170.114345	464.00	1.50	465.50
8	-45.107526	170.121563	460.00	1.50	461.50
9	-45.109497	170.124524	459.00	1.50	460.50
10	-45.111562	170.126137	459.00	1.50	460.50

Name: RT08 Ranfurly Back Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.110942	170.109556	453.00	1.50	454.50
2	-45.106389	170.112183	459.47	1.50	460.97
3	-45.103451	170.113954	463.00	1.50	464.50
4	-45.101418	170.114791	467.00	1.50	468.50
5	-45.098679	170.117079	472.00	1.50	473.50
6	-45.092570	170.122667	479.00	1.50	480.50
7	-45.090513	170.124641	483.72	1.50	485.22
8	-45.086188	170.124560	495.00	1.50	496.50
9	-45.078203	170.127255	507.00	1.50	508.50
10	-45.074559	170.126436	520.00	1.50	521.50
11	-45.065651	170.123519	532.41	1.50	533.91
12	-45.061721	170.123052	539.81	1.50	541.31
13	-45.060075	170.121789	539.00	1.50	540.50
14	-45.059289	170.121752	537.01	1.50	538.51
15	-45.058024	170.122386	541.00	1.50	542.50
16	-45.055187	170.120273	549.99	1.50	551.49
17	-45.042159	170.120795	580.14	1.50	581.64
18	-45.040809	170.120798	580.00	1.50	581.50
19	-45.039777	170.120105	579.47	1.50	580.97

Name: RT09 Glen Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.109508	170.124593	459.00	1.50	460.50
2	-45.109465	170.124765	459.00	1.50	460.50
3	-45.107210	170.126279	459.00	1.50	460.50
4	-45.100395	170.126269	469.00	1.50	470.50
5	-45.099159	170.126246	472.00	1.50	473.50
6	-45.096952	170.127240	479.00	1.50	480.50

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-45.074452	170.064201	512.27	1.65
OP 2	2	-45.044875	170.108039	583.00	1.65
OP 3	3	-45.039527	170.117557	587.77	1.65
OP 4	4	-45.050412	170.121556	561.68	1.65
OP 5	5	-45.086779	170.129115	500.00	1.65
OP 6	6	-45.082021	170.101672	501.00	1.65
OP 7	7	-45.105774	170.121637	462.00	1.65
OP 8	8	-45.104479	170.127759	463.00	1.65
OP 9	9	-45.109701	170.122528	460.00	1.65
OP 10	10	-45.107832	170.102654	460.00	1.65
OP 11	11	-45.107370	170.087644	459.00	1.65
OP 12	12	-45.102070	170.087308	480.00	1.65
OP 13	13	-45.095882	170.090288	480.00	1.65
OP 14	14	-45.096945	170.097625	474.00	1.65
OP 15	15	-45.090592	170.094064	489.55	1.65
OP 16	16	-45.091058	170.070581	482.00	1.65

Obstruction Components

Name: OB01 Ex NE1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.056187	170.120305	540.34
2	-45.057823	170.121804	540.00
3	-45.058808	170.121676	538.86

Name: OB02 Ex N
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.048246	170.107048	562.03
2	-45.046986	170.107665	579.53
3	-45.049138	170.108595	560.72

Name: OB03 Ex W1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.074114	170.094634	516.00
2	-45.071887	170.095596	516.00
3	-45.070591	170.096190	518.00
4	-45.070757	170.108834	519.00
5	-45.070560	170.096210	518.00
6	-45.063423	170.099327	536.00
7	-45.061971	170.099974	538.29

Name: OB04 Ex W2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.058355	170.101524	545.00
2	-45.059423	170.101085	542.00

Name: OB05 Ex NE2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.043322	170.111633	579.75
2	-45.045873	170.110932	579.00
3	-45.049014	170.113476	559.69
4	-45.051380	170.114700	558.94
5	-45.052886	170.116610	559.00

Name: OB06 Ex NW1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.053549	170.101874	554.10
2	-45.048337	170.101916	563.00
3	-45.048180	170.101671	563.66
4	-45.052816	170.095785	556.00
5	-45.057789	170.097936	546.00
6	-45.052827	170.095750	556.00
7	-45.053708	170.094431	554.00

Name: OB07 Ex W3
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.058277	170.088758	546.31
2	-45.063060	170.084202	535.00
3	-45.065744	170.083580	528.00
4	-45.072948	170.085906	519.52
5	-45.076330	170.086244	519.00
6	-45.077978	170.085673	516.00
7	-45.078899	170.084814	511.92
8	-45.081626	170.083884	501.94

Name: OB08 Ex SW1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.082474	170.103800	499.00
2	-45.081301	170.103779	499.00
3	-45.081248	170.100933	500.18
4	-45.081765	170.100039	499.00
5	-45.082490	170.099964	498.00

Name: OB09 Ex S
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.091392	170.109269	482.00
2	-45.093804	170.110395	478.00
3	-45.096578	170.109851	474.00
4	-45.096506	170.118238	475.64

Name: OB10 Ex SW2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.082409	170.083641	500.03
2	-45.084314	170.082899	500.00
3	-45.086260	170.082823	500.00
4	-45.087188	170.081636	500.00
5	-45.087976	170.081148	500.00
6	-45.089212	170.080838	495.63
7	-45.090511	170.080880	489.00
8	-45.092183	170.079720	485.00
9	-45.094879	170.078306	480.00
10	-45.096227	170.078758	481.00

Glare Analysis Results

Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy	Peak Luminance
	°	°	min	hr	min	hr	kWh	cd/m^2
PV01 North tip	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV02 Sub East	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV03 Sub West	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV04 West 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV05 West 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV06 South	SA tracking	SA tracking	1,266	21.1	0	0.0	-	246,397
PV07 Central 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV08 Central 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV09 Central 3	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV10 Central 4	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV11 East 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV12 East 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV13 East 3	SA tracking	SA tracking	0	0.0	0	0.0	-	0

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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0
RT03 Brinsdon Rd	0	0.0	0	0.0
RT04 Naseby Link Rd	0	0.0	0	0.0
RT05 Fennessy Rd	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0
RT07 Bypass Rd	0	0.0	0	0.0
RT08 Ranfurly Back Rd	1,266	21.1	0	0.0
RT09 Glen Rd	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

PV: PV01 North tip no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV01 North tip and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV01 North tip and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV01 North tip and Route: RT03 Brinsdon Rd

No glare found

PV01 North tip and Route: RT04 Naseby Link Rd

No glare found

PV01 North tip and Route: RT05 Fennessy Rd

No glare found

PV01 North tip and Route: RT06 Ranfurly Naseby Rd

No glare found

PV01 North tip and Route: RT07 Bypass Rd

No glare found

PV01 North tip and Route: RT08 Ranfurly Back Rd

No glare found

PV01 North tip and Route: RT09 Glen Rd

No glare found

PV01 North tip and OP 1

No glare found

PV01 North tip and OP 2

No glare found

PV01 North tip and OP 3

No glare found

PV01 North tip and OP 4

No glare found

PV01 North tip and OP 5

No glare found

PV01 North tip and OP 6

No glare found

PV01 North tip and OP 7

No glare found

PV01 North tip and OP 8

No glare found

PV01 North tip and OP 9

No glare found

PV01 North tip and OP 10

No glare found

PV01 North tip and OP 11

No glare found

PV01 North tip and OP 12

No glare found

PV01 North tip and OP 13

No glare found

PV01 North tip and OP 14

No glare found

PV01 North tip and OP 15

No glare found

PV01 North tip and OP 16

No glare found

PV: PV02 Sub East no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV02 Sub East and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV02 Sub East and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV02 Sub East and Route: RT03 Brinsdon Rd

No glare found

PV02 Sub East and Route: RT04 Naseby Link Rd

No glare found

PV02 Sub East and Route: RT05 Fennessy Rd

No glare found

PV02 Sub East and Route: RT06 Ranfurly Naseby Rd

No glare found

PV02 Sub East and Route: RT07 Bypass Rd

No glare found

PV02 Sub East and Route: RT08 Ranfurly Back Rd

No glare found

PV02 Sub East and Route: RT09 Glen Rd

No glare found

PV02 Sub East and OP 1

No glare found

PV02 Sub East and OP 2

No glare found

PV02 Sub East and OP 3

No glare found

PV02 Sub East and OP 4

No glare found

PV02 Sub East and OP 5

No glare found

PV02 Sub East and OP 6

No glare found

PV02 Sub East and OP 7

No glare found

PV02 Sub East and OP 8

No glare found

PV02 Sub East and OP 9

No glare found

PV02 Sub East and OP 10

No glare found

PV02 Sub East and OP 11

No glare found

PV02 Sub East and OP 12

No glare found

PV02 Sub East and OP 13

No glare found

PV02 Sub East and OP 14

No glare found

PV02 Sub East and OP 15

No glare found

PV02 Sub East and OP 16

No glare found

PV: PV03 Sub West no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV03 Sub West and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV03 Sub West and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV03 Sub West and Route: RT03 Brinsdon Rd

No glare found

PV03 Sub West and Route: RT04 Naseby Link Rd

No glare found

PV03 Sub West and Route: RT05 Fennessy Rd

No glare found

PV03 Sub West and Route: RT06 Ranfurly Naseby Rd

No glare found

PV03 Sub West and Route: RT07 Bypass Rd

No glare found

PV03 Sub West and Route: RT08 Ranfurly Back Rd

No glare found

PV03 Sub West and Route: RT09 Glen Rd

No glare found

PV03 Sub West and OP 1

No glare found

PV03 Sub West and OP 2

No glare found

PV03 Sub West and OP 3

No glare found

PV03 Sub West and OP 4

No glare found

PV03 Sub West and OP 5

No glare found

PV03 Sub West and OP 6

No glare found

PV03 Sub West and OP 7

No glare found

PV03 Sub West and OP 8

No glare found

PV03 Sub West and OP 9

No glare found

PV03 Sub West and OP 10

No glare found

PV03 Sub West and OP 11

No glare found

PV03 Sub West and OP 12

No glare found

PV03 Sub West and OP 13

No glare found

PV03 Sub West and OP 14

No glare found

PV03 Sub West and OP 15

No glare found

PV03 Sub West and OP 16

No glare found

PV: PV04 West 1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV04 West 1 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV04 West 1 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV04 West 1 and Route: RT03 Brinsdon Rd

No glare found

PV04 West 1 and Route: RT04 Naseby Link Rd

No glare found

PV04 West 1 and Route: RT05 Fennessy Rd

No glare found

PV04 West 1 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV04 West 1 and Route: RT07 Bypass Rd

No glare found

PV04 West 1 and Route: RT08 Ranfurly Back Rd

No glare found

PV04 West 1 and Route: RT09 Glen Rd

No glare found

PV04 West 1 and OP 1

No glare found

PV04 West 1 and OP 2

No glare found

PV04 West 1 and OP 3

No glare found

PV04 West 1 and OP 4

No glare found

PV04 West 1 and OP 5

No glare found

PV04 West 1 and OP 6

No glare found

PV04 West 1 and OP 7

No glare found

PV04 West 1 and OP 8

No glare found

PV04 West 1 and OP 9

No glare found

PV04 West 1 and OP 10

No glare found

PV04 West 1 and OP 11

No glare found

PV04 West 1 and OP 12

No glare found

PV04 West 1 and OP 13

No glare found

PV04 West 1 and OP 14

No glare found

PV04 West 1 and OP 15

No glare found

PV04 West 1 and OP 16

No glare found

PV: PV05 West 2 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV05 West 2 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV05 West 2 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV05 West 2 and Route: RT03 Brinsdon Rd

No glare found

PV05 West 2 and Route: RT04 Naseby Link Rd

No glare found

PV05 West 2 and Route: RT05 Fennessy Rd

No glare found

PV05 West 2 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV05 West 2 and Route: RT07 Bypass Rd

No glare found

PV05 West 2 and Route: RT08 Ranfurly Back Rd

No glare found

PV05 West 2 and Route: RT09 Glen Rd

No glare found

PV05 West 2 and OP 1

No glare found

PV05 West 2 and OP 2

No glare found

PV05 West 2 and OP 3

No glare found

PV05 West 2 and OP 4

No glare found

PV05 West 2 and OP 5

No glare found

PV05 West 2 and OP 6

No glare found

PV05 West 2 and OP 7

No glare found

PV05 West 2 and OP 8

No glare found

PV05 West 2 and OP 9

No glare found

PV05 West 2 and OP 10

No glare found

PV05 West 2 and OP 11

No glare found

PV05 West 2 and OP 12

No glare found

PV05 West 2 and OP 13

No glare found

PV05 West 2 and OP 14

No glare found

PV05 West 2 and OP 15

No glare found

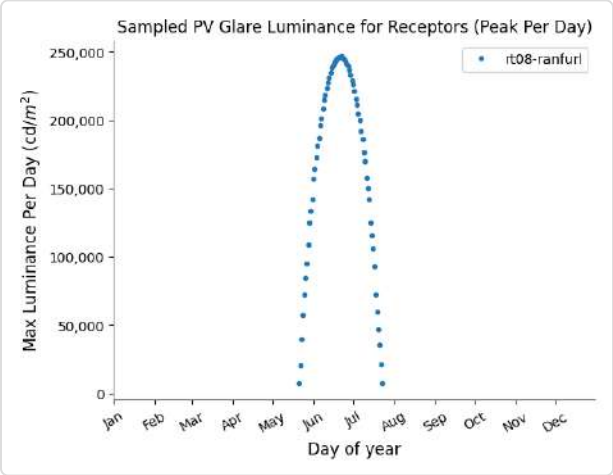
PV05 West 2 and OP 16

No glare found

PV: PV06 South low potential for temporary after-image

Receptor results ordered by category of glare

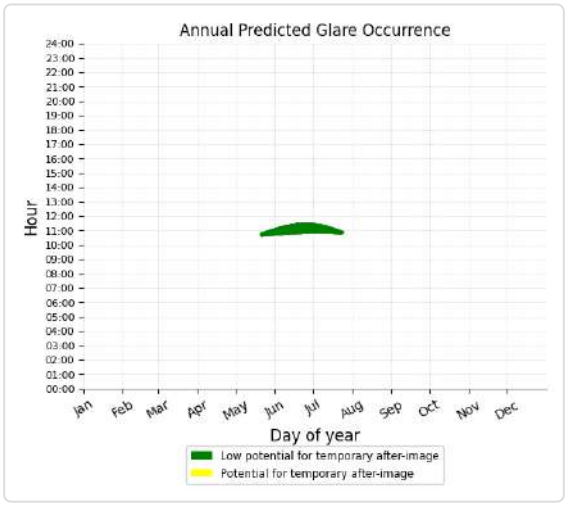
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	1,266	21.1	0	0.0	246,397
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

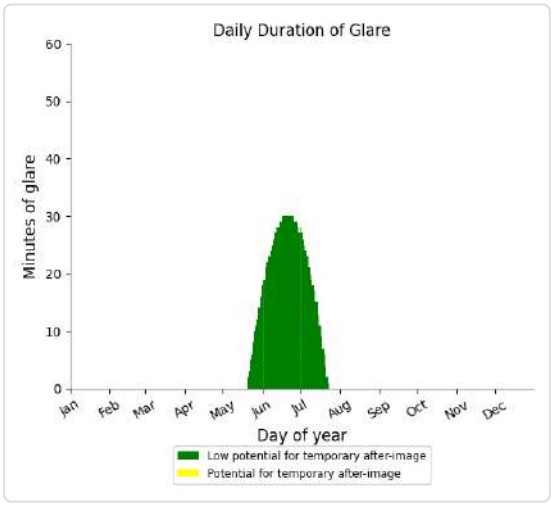

Sampled PV Glare Luminance for Receptors (Peak Per Day)
rt08-ranfurl
Max Luminance Per Day (cd/m²)
250,000
200,000
150,000
100,000
50,000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of year

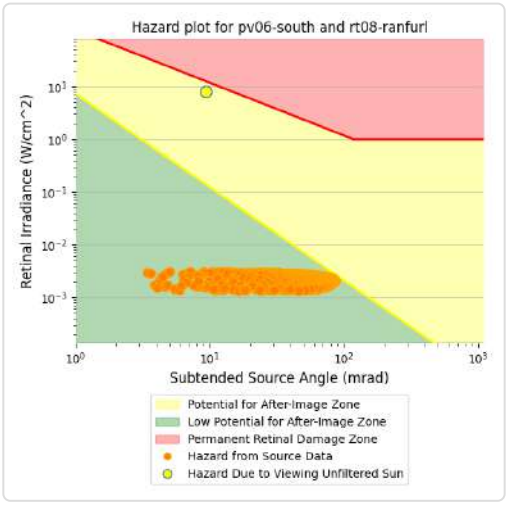
PV06 South and Route: RT08 Ranfurly Back Rd

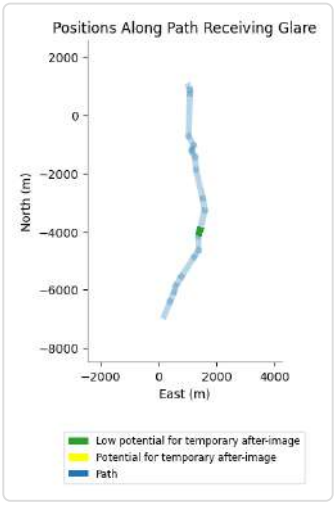
Yellow glare: none

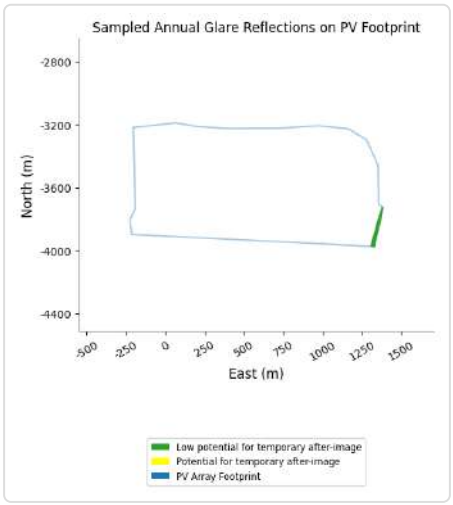
Green glare: 1,266 min.

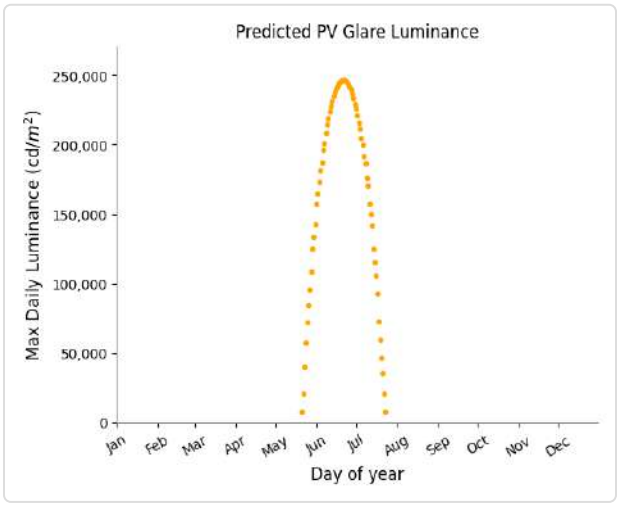












PV06 South and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV06 South and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV06 South and Route: RT03 Brinsdon Rd

No glare found

PV06 South and Route: RT04 Naseby Link Rd

No glare found

PV06 South and Route: RT05 Fennessy Rd

No glare found

PV06 South and Route: RT06 Ranfurly Naseby Rd

No glare found

PV06 South and Route: RT07 Bypass Rd

No glare found

PV06 South and Route: RT09 Glen Rd

No glare found

PV06 South and OP 1

No glare found

PV06 South and OP 2

No glare found

PV06 South and OP 3

No glare found

PV06 South and OP 4

No glare found

PV06 South and OP 5

No glare found

PV06 South and OP 6

No glare found

PV06 South and OP 7

No glare found

PV06 South and OP 8

No glare found

PV06 South and OP 9

No glare found

PV06 South and OP 10

No glare found

PV06 South and OP 11

No glare found

PV06 South and OP 12

No glare found

PV06 South and OP 13

No glare found

PV06 South and OP 14

No glare found

PV06 South and OP 15

No glare found

PV06 South and OP 16

No glare found

PV: PV07 Central 1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV07 Central 1 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV07 Central 1 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV07 Central 1 and Route: RT03 Brinsdon Rd

No glare found

PV07 Central 1 and Route: RT04 Naseby Link Rd

No glare found

PV07 Central 1 and Route: RT05 Fennessy Rd

No glare found

PV07 Central 1 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV07 Central 1 and Route: RT07 Bypass Rd

No glare found

PV07 Central 1 and Route: RT08 Ranfurly Back Rd

No glare found

PV07 Central 1 and Route: RT09 Glen Rd

No glare found

PV07 Central 1 and OP 1

No glare found

PV07 Central 1 and OP 2

No glare found

PV07 Central 1 and OP 3

No glare found

PV07 Central 1 and OP 4

No glare found

PV07 Central 1 and OP 5

No glare found

PV07 Central 1 and OP 6

No glare found

PV07 Central 1 and OP 7

No glare found

PV07 Central 1 and OP 8

No glare found

PV07 Central 1 and OP 9

No glare found

PV07 Central 1 and OP 10

No glare found

PV07 Central 1 and OP 11

No glare found

PV07 Central 1 and OP 12

No glare found

PV07 Central 1 and OP 13

No glare found

PV07 Central 1 and OP 14

No glare found

PV07 Central 1 and OP 15

No glare found

PV07 Central 1 and OP 16

No glare found

PV: PV08 Central 2 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV08 Central 2 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV08 Central 2 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV08 Central 2 and Route: RT03 Brinsdon Rd

No glare found

PV08 Central 2 and Route: RT04 Naseby Link Rd

No glare found

PV08 Central 2 and Route: RT05 Fennessy Rd

No glare found

PV08 Central 2 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV08 Central 2 and Route: RT07 Bypass Rd

No glare found

PV08 Central 2 and Route: RT08 Ranfurly Back Rd

No glare found

PV08 Central 2 and Route: RT09 Glen Rd

No glare found

PV08 Central 2 and OP 1

No glare found

PV08 Central 2 and OP 2

No glare found

PV08 Central 2 and OP 3

No glare found

PV08 Central 2 and OP 4

No glare found

PV08 Central 2 and OP 5

No glare found

PV08 Central 2 and OP 6

No glare found

PV08 Central 2 and OP 7

No glare found

PV08 Central 2 and OP 8

No glare found

PV08 Central 2 and OP 9

No glare found

PV08 Central 2 and OP 10

No glare found

PV08 Central 2 and OP 11

No glare found

PV08 Central 2 and OP 12

No glare found

PV08 Central 2 and OP 13

No glare found

PV08 Central 2 and OP 14

No glare found

PV08 Central 2 and OP 15

No glare found

PV08 Central 2 and OP 16

No glare found

PV: PV09 Central 3 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV09 Central 3 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV09 Central 3 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV09 Central 3 and Route: RT03 Brinsdon Rd

No glare found

PV09 Central 3 and Route: RT04 Naseby Link Rd

No glare found

PV09 Central 3 and Route: RT05 Fennessy Rd

No glare found

PV09 Central 3 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV09 Central 3 and Route: RT07 Bypass Rd

No glare found

PV09 Central 3 and Route: RT08 Ranfurly Back Rd

No glare found

PV09 Central 3 and Route: RT09 Glen Rd

No glare found

PV09 Central 3 and OP 1

No glare found

PV09 Central 3 and OP 2

No glare found

PV09 Central 3 and OP 3

No glare found

PV09 Central 3 and OP 4

No glare found

PV09 Central 3 and OP 5

No glare found

PV09 Central 3 and OP 6

No glare found

PV09 Central 3 and OP 7

No glare found

PV09 Central 3 and OP 8

No glare found

PV09 Central 3 and OP 9

No glare found

PV09 Central 3 and OP 10

No glare found

PV09 Central 3 and OP 11

No glare found

PV09 Central 3 and OP 12

No glare found

PV09 Central 3 and OP 13

No glare found

PV09 Central 3 and OP 14

No glare found

PV09 Central 3 and OP 15

No glare found

PV09 Central 3 and OP 16

No glare found

PV: PV10 Central 4 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV10 Central 4 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV10 Central 4 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV10 Central 4 and Route: RT03 Brinsdon Rd

No glare found

PV10 Central 4 and Route: RT04 Naseby Link Rd

No glare found

PV10 Central 4 and Route: RT05 Fennessy Rd

No glare found

PV10 Central 4 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV10 Central 4 and Route: RT07 Bypass Rd

No glare found

PV10 Central 4 and Route: RT08 Ranfurly Back Rd

No glare found

PV10 Central 4 and Route: RT09 Glen Rd

No glare found

PV10 Central 4 and OP 1

No glare found

PV10 Central 4 and OP 2

No glare found

PV10 Central 4 and OP 3

No glare found

PV10 Central 4 and OP 4

No glare found

PV10 Central 4 and OP 5

No glare found

PV10 Central 4 and OP 6

No glare found

PV10 Central 4 and OP 7

No glare found

PV10 Central 4 and OP 8

No glare found

PV10 Central 4 and OP 9

No glare found

PV10 Central 4 and OP 10

No glare found

PV10 Central 4 and OP 11

No glare found

PV10 Central 4 and OP 12

No glare found

PV10 Central 4 and OP 13

No glare found

PV10 Central 4 and OP 14

No glare found

PV10 Central 4 and OP 15

No glare found

PV10 Central 4 and OP 16

No glare found

PV: PV11 East 1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV11 East 1 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV11 East 1 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV11 East 1 and Route: RT03 Brinsdon Rd

No glare found

PV11 East 1 and Route: RT04 Naseby Link Rd

No glare found

PV11 East 1 and Route: RT05 Fennessy Rd

No glare found

PV11 East 1 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV11 East 1 and Route: RT07 Bypass Rd

No glare found

PV11 East 1 and Route: RT08 Ranfurly Back Rd

No glare found

PV11 East 1 and Route: RT09 Glen Rd

No glare found

PV11 East 1 and OP 1

No glare found

PV11 East 1 and OP 2

No glare found

PV11 East 1 and OP 3

No glare found

PV11 East 1 and OP 4

No glare found

PV11 East 1 and OP 5

No glare found

PV11 East 1 and OP 6

No glare found

PV11 East 1 and OP 7

No glare found

PV11 East 1 and OP 8

No glare found

PV11 East 1 and OP 9

No glare found

PV11 East 1 and OP 10

No glare found

PV11 East 1 and OP 11

No glare found

PV11 East 1 and OP 12

No glare found

PV11 East 1 and OP 13

No glare found

PV11 East 1 and OP 14

No glare found

PV11 East 1 and OP 15

No glare found

PV11 East 1 and OP 16

No glare found

PV: PV12 East 2 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV12 East 2 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV12 East 2 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV12 East 2 and Route: RT03 Brinsdon Rd

No glare found

PV12 East 2 and Route: RT04 Naseby Link Rd

No glare found

PV12 East 2 and Route: RT05 Fennessy Rd

No glare found

PV12 East 2 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV12 East 2 and Route: RT07 Bypass Rd

No glare found

PV12 East 2 and Route: RT08 Ranfurly Back Rd

No glare found

PV12 East 2 and Route: RT09 Glen Rd

No glare found

PV12 East 2 and OP 1

No glare found

PV12 East 2 and OP 2

No glare found

PV12 East 2 and OP 3

No glare found

PV12 East 2 and OP 4

No glare found

PV12 East 2 and OP 5

No glare found

PV12 East 2 and OP 6

No glare found

PV12 East 2 and OP 7

No glare found

PV12 East 2 and OP 8

No glare found

PV12 East 2 and OP 9

No glare found

PV12 East 2 and OP 10

No glare found

PV12 East 2 and OP 11

No glare found

PV12 East 2 and OP 12

No glare found

PV12 East 2 and OP 13

No glare found

PV12 East 2 and OP 14

No glare found

PV12 East 2 and OP 15

No glare found

PV12 East 2 and OP 16

No glare found

PV: PV13 East 3 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT01 Ranfurly Wedderburn Rd	0	0.0	0	0.0	0
RT02 Gimmerburn Naseby Rd	0	0.0	0	0.0	0
RT03 Brinsdon Rd	0	0.0	0	0.0	0
RT04 Naseby Link Rd	0	0.0	0	0.0	0
RT05 Fennessy Rd	0	0.0	0	0.0	0
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
RT09 Glen Rd	0	0.0	0	0.0	0
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 3	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 6	0	0.0	0	0.0	0
OP 7	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0

PV13 East 3 and Route: RT01 Ranfurly Wedderburn Rd

No glare found

PV13 East 3 and Route: RT02 Gimmerburn Naseby Rd

No glare found

PV13 East 3 and Route: RT03 Brinsdon Rd

No glare found

PV13 East 3 and Route: RT04 Naseby Link Rd

No glare found

PV13 East 3 and Route: RT05 Fennessy Rd

No glare found

PV13 East 3 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV13 East 3 and Route: RT07 Bypass Rd

No glare found

PV13 East 3 and Route: RT08 Ranfurly Back Rd

No glare found

PV13 East 3 and Route: RT09 Glen Rd

No glare found

PV13 East 3 and OP 1

No glare found

PV13 East 3 and OP 2

No glare found

PV13 East 3 and OP 3

No glare found

PV13 East 3 and OP 4

No glare found

PV13 East 3 and OP 5

No glare found

PV13 East 3 and OP 6

No glare found

PV13 East 3 and OP 7

No glare found

PV13 East 3 and OP 8

No glare found

PV13 East 3 and OP 9

No glare found

PV13 East 3 and OP 10

No glare found

PV13 East 3 and OP 11

No glare found

PV13 East 3 and OP 12

No glare found

PV13 East 3 and OP 13

No glare found

PV13 East 3 and OP 14

No glare found

PV13 East 3 and OP 15

No glare found

PV13 East 3 and OP 16

No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

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

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

FORGESOLAR GLARE ANALYSIS

Project: **23048 - Naseby SF**
Proposed 300 MW solar farm nearby Naseby, New Zealand.

Site configuration: **Yellow Glare with screening v2b**

Client: Helios Energy

Site description: Yellow receptors. Adjusted screening

Created 11 Sep, 2023
Updated 11 Sep, 2023
Time-step 1 minute
Timezone offset UTC12
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 100 MW to 1 GW
Site ID 99936.17105

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

Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy	Peak Luminance
	°	°	min	hr	min	hr	kWh	cd/m²
PV01 North tip	SA tracking	SA tracking	105	1.8	0	0.0	-	51,248
PV02 Sub East	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV03 Sub West	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV04 West 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV05 West 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV06 South	SA tracking	SA tracking	932	15.5	0	0.0	-	193,130
PV07 Central 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV08 Central 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV09 Central 3	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV10 Central 4	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV11 East 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV12 East 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV13 East 3	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV14 South 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV15 South 3	SA tracking	SA tracking	641	10.7	0	0.0	-	103,482

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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT06 Ranfurly Naseby Rd	944	15.7	0	0.0
RT07 Bypass Rd	629	10.5	0	0.0
RT08 Ranfurly Back Rd	105	1.8	0	0.0
OP 5	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV01 North tip
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.048810	170.107064	560.00	1.70	561.70
2	-45.048874	170.107929	559.64	1.70	561.34
3	-45.052022	170.110373	559.00	1.70	560.70
4	-45.055653	170.111707	552.66	1.70	554.36
5	-45.055857	170.113963	554.00	1.70	555.70
6	-45.059202	170.115155	540.00	1.70	541.70
7	-45.059420	170.113270	539.00	1.70	540.70
8	-45.058011	170.111134	541.13	1.70	542.83
9	-45.057797	170.103258	546.00	1.70	547.70
10	-45.048810	170.107064	560.00	1.70	561.70

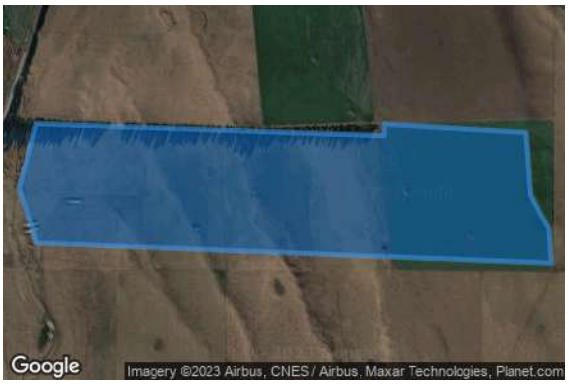
Name: PV02 Sub East
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.058092	170.105657	543.20	1.70	544.90
2	-45.058289	170.110985	540.00	1.70	541.70
3	-45.059642	170.112700	538.00	1.70	539.70
4	-45.059868	170.112336	538.00	1.70	539.70
5	-45.060793	170.112282	537.00	1.70	538.70
6	-45.061012	170.111761	537.00	1.70	538.70
7	-45.060007	170.111011	540.00	1.70	541.70
8	-45.059960	170.110454	539.00	1.70	540.70
9	-45.060506	170.110341	538.89	1.70	540.59
10	-45.062449	170.111690	535.40	1.70	537.10
11	-45.063515	170.112690	534.00	1.70	535.70
12	-45.064566	170.112248	532.00	1.70	533.70
13	-45.070734	170.113886	520.97	1.70	522.67
14	-45.070276	170.097282	520.00	1.70	521.70
15	-45.066897	170.098647	525.00	1.70	526.70
16	-45.066990	170.105054	528.51	1.70	530.21
17	-45.062432	170.105468	536.00	1.70	537.70
18	-45.062497	170.106947	536.00	1.70	537.70
19	-45.061230	170.107027	539.00	1.70	540.70
20	-45.061181	170.105492	538.12	1.70	539.82
21	-45.058092	170.105657	543.20	1.70	544.90

Name: PV03 Sub West
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.066581	170.098624	526.00	1.70	527.70
2	-45.066768	170.104852	530.00	1.70	531.70
3	-45.058124	170.105382	543.85	1.70	545.55
4	-45.058108	170.103096	545.00	1.70	546.70
5	-45.059332	170.102604	540.77	1.70	542.47
6	-45.060438	170.102246	539.00	1.70	540.70
7	-45.061561	170.101411	540.00	1.70	541.70
8	-45.061812	170.100812	539.87	1.70	541.57
9	-45.066581	170.098624	526.00	1.70	527.70

Name: PV04 West 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.073500	170.097099	517.00	1.70	518.70
2	-45.072170	170.096530	517.21	1.70	518.91
3	-45.070617	170.097082	519.00	1.70	520.70
4	-45.070902	170.109052	518.92	1.70	520.62
5	-45.070626	170.109053	519.00	1.70	520.70
6	-45.070826	170.113934	520.72	1.70	522.42
7	-45.072351	170.114093	519.00	1.70	520.70
8	-45.073172	170.114708	519.00	1.70	520.70
9	-45.073984	170.114786	518.00	1.70	519.70
10	-45.073500	170.097099	517.00	1.70	518.70

Name: PV05 West 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.073878	170.097237	516.61	1.70	518.31
2	-45.075202	170.097613	513.00	1.70	514.70
3	-45.075454	170.097712	512.04	1.70	513.74
4	-45.076438	170.096964	510.00	1.70	511.70
5	-45.076871	170.096879	509.00	1.70	510.70
6	-45.077419	170.102829	510.99	1.70	512.69
7	-45.077247	170.107133	512.97	1.70	514.67
8	-45.074105	170.105600	517.49	1.70	519.19
9	-45.074027	170.104231	519.08	1.70	520.78
10	-45.074687	170.103977	518.01	1.70	519.71
11	-45.074583	170.103269	517.00	1.70	518.70
12	-45.074053	170.102971	518.00	1.70	519.70
13	-45.073878	170.097237	516.61	1.70	518.31

Name: PV06 South
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.082753	170.124527	497.00	1.70	498.70
2	-45.082675	170.122909	499.00	1.70	500.70
3	-45.082832	170.122830	498.98	1.70	500.68
4	-45.082591	170.118667	499.00	1.70	500.70
5	-45.082385	170.118630	499.00	1.70	500.70
6	-45.082428	170.104636	498.43	1.70	500.13
7	-45.083051	170.104219	497.00	1.70	498.70
8	-45.083870	170.104388	496.00	1.70	497.70
9	-45.084567	170.123974	496.09	1.70	497.79
10	-45.082753	170.124527	497.00	1.70	498.70

Name: PV07 Central 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.074164	170.105978	518.31	1.70	520.01
2	-45.075052	170.106525	518.00	1.70	519.70
3	-45.075800	170.107369	518.93	1.70	520.63
4	-45.077242	170.107573	513.09	1.70	514.79
5	-45.077597	170.112054	509.89	1.70	511.59
6	-45.077738	170.112031	509.05	1.70	510.75
7	-45.077681	170.116399	508.00	1.70	509.70
8	-45.077476	170.116308	509.00	1.70	510.70
9	-45.077318	170.118780	510.00	1.70	511.70
10	-45.076698	170.118305	512.00	1.70	513.70
11	-45.076165	170.118344	513.67	1.70	515.37
12	-45.075440	170.118197	515.02	1.70	516.72
13	-45.075073	170.118078	516.00	1.70	517.70
14	-45.074471	170.118147	517.90	1.70	519.60
15	-45.074382	170.116202	519.00	1.70	520.70
16	-45.074164	170.105978	518.31	1.70	520.01

Name: PV08 Central 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.077370	170.119202	510.00	1.70	511.70
2	-45.077406	170.121778	509.00	1.70	510.70
3	-45.076257	170.121897	513.00	1.70	514.70
4	-45.074586	170.121680	517.00	1.70	518.70
5	-45.072495	170.120974	518.00	1.70	519.70
6	-45.068427	170.119851	519.00	1.70	520.70
7	-45.068239	170.118583	519.00	1.70	520.70
8	-45.068201	170.116987	521.41	1.70	523.11
9	-45.068826	170.117113	519.00	1.70	520.70
10	-45.069221	170.118239	519.00	1.70	520.70
11	-45.069473	170.118187	519.00	1.70	520.70
12	-45.069147	170.116760	520.00	1.70	521.70
13	-45.069880	170.116650	519.00	1.70	520.70
14	-45.070723	170.117101	519.00	1.70	520.70
15	-45.071987	170.117217	519.00	1.70	520.70
16	-45.074311	170.118267	517.50	1.70	519.20
17	-45.075963	170.118570	514.00	1.70	515.70
18	-45.077370	170.119202	510.00	1.70	511.70

Name: PV09 Central 3
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.059387	170.114333	539.00	1.70	540.70
2	-45.059265	170.115199	540.00	1.70	541.70
3	-45.059380	170.115304	540.00	1.70	541.70
4	-45.059840	170.116514	540.81	1.70	542.51
5	-45.062208	170.116207	540.00	1.70	541.70
6	-45.066512	170.117671	531.00	1.70	532.70
7	-45.066430	170.116825	530.00	1.70	531.70
8	-45.064261	170.115332	535.00	1.70	536.70
9	-45.062652	170.115352	538.00	1.70	539.70
10	-45.063968	170.114731	535.00	1.70	536.70
11	-45.066216	170.116088	530.00	1.70	531.70
12	-45.067044	170.116923	527.93	1.70	529.63
13	-45.067168	170.117884	525.46	1.70	527.16
14	-45.068115	170.118464	520.00	1.70	521.70
15	-45.068136	170.116977	522.00	1.70	523.70
16	-45.068106	170.116241	522.46	1.70	524.16
17	-45.067109	170.114353	526.11	1.70	527.81
18	-45.066313	170.114171	528.00	1.70	529.70
19	-45.066204	170.113725	528.71	1.70	530.41
20	-45.065023	170.113472	531.46	1.70	533.16
21	-45.063966	170.113673	534.00	1.70	535.70
22	-45.062887	170.113691	536.00	1.70	537.70
23	-45.062067	170.114091	537.00	1.70	538.70
24	-45.061501	170.114006	537.00	1.70	538.70
25	-45.060574	170.114526	538.29	1.70	539.99
26	-45.060069	170.114712	539.00	1.70	540.70
27	-45.059387	170.114333	539.00	1.70	540.70

Name: PV10 Central 4
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.067625	170.113453	525.05	1.70	526.75
2	-45.067579	170.113839	525.00	1.70	526.70
3	-45.068602	170.115217	522.00	1.70	523.70
4	-45.070279	170.116219	520.00	1.70	521.70
5	-45.071627	170.116210	520.00	1.70	521.70
6	-45.073577	170.117104	520.00	1.70	521.70
7	-45.073960	170.117165	520.00	1.70	521.70
8	-45.073887	170.116186	519.00	1.70	520.70
9	-45.073631	170.116120	519.92	1.70	521.62
10	-45.073251	170.115361	519.00	1.70	520.70
11	-45.072455	170.114882	520.00	1.70	521.70
12	-45.071689	170.114918	520.00	1.70	521.70
13	-45.071665	170.114607	520.00	1.70	521.70
14	-45.069486	170.114103	523.00	1.70	524.70
15	-45.067987	170.113436	525.00	1.70	526.70
16	-45.067625	170.113453	525.05	1.70	526.75

Name: PV11 East 1
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.074546	170.122412	517.00	1.70	518.70
2	-45.074523	170.124127	519.00	1.70	520.70
3	-45.078204	170.125582	506.00	1.70	507.70
4	-45.078184	170.124479	505.00	1.70	506.70
5	-45.076486	170.122886	512.00	1.70	513.70
6	-45.074546	170.122412	517.00	1.70	518.70

Name: PV12 East 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.074469	170.124124	519.00	1.70	520.70
2	-45.074519	170.122397	517.00	1.70	518.70
3	-45.069331	170.121063	520.00	1.70	521.70
4	-45.068515	170.121784	523.00	1.70	524.70
5	-45.068389	170.123809	524.00	1.70	525.70
6	-45.071765	170.124656	521.00	1.70	522.70
7	-45.074469	170.124124	519.00	1.70	520.70

Name: PV13 East 3
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.055819	170.115377	554.65	1.70	556.35
2	-45.056058	170.118403	550.84	1.70	552.54
3	-45.061992	170.122721	540.00	1.70	541.70
4	-45.065305	170.123117	535.00	1.70	536.70
5	-45.068352	170.123810	524.00	1.70	525.70
6	-45.068521	170.121770	523.00	1.70	524.70
7	-45.068451	170.120486	520.68	1.70	522.38
8	-45.065467	170.119421	536.92	1.70	538.62
9	-45.065450	170.118805	535.00	1.70	536.70
10	-45.066604	170.118794	530.05	1.70	531.75
11	-45.066593	170.118385	530.35	1.70	532.05
12	-45.062204	170.116797	540.00	1.70	541.70
13	-45.059790	170.116950	541.00	1.70	542.70
14	-45.055819	170.115377	554.65	1.70	556.35

Name: PV14 South 2
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.080785	170.104637	499.00	1.70	500.70
2	-45.080761	170.108502	503.05	1.70	504.75
3	-45.080604	170.108437	503.92	1.70	505.62
4	-45.080580	170.108810	504.00	1.70	505.70
5	-45.080799	170.112708	501.00	1.70	502.70
6	-45.080612	170.117795	499.83	1.70	501.53
7	-45.080748	170.117793	499.02	1.70	500.72
8	-45.080671	170.121975	499.00	1.70	500.70
9	-45.080501	170.121976	499.00	1.70	500.70
10	-45.080440	170.124286	499.00	1.70	500.70
11	-45.082130	170.124279	497.00	1.70	498.70
12	-45.082365	170.124599	497.00	1.70	498.70
13	-45.082775	170.124492	497.00	1.70	498.70
14	-45.082578	170.122093	500.00	1.70	501.70
15	-45.082376	170.118745	499.00	1.70	500.70
16	-45.082406	170.104707	498.93	1.70	500.63
17	-45.080785	170.104637	499.00	1.70	500.70

Name: PV15 South 3
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.35
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	-45.077803	170.104558	510.56	1.70	512.26
2	-45.077517	170.107874	512.00	1.70	513.70
3	-45.077757	170.109927	511.00	1.70	512.70
4	-45.077861	170.112071	509.00	1.70	510.70
5	-45.077863	170.116336	507.87	1.70	509.57
6	-45.077680	170.119375	508.96	1.70	510.66
7	-45.077848	170.121849	507.98	1.70	509.68
8	-45.078406	170.123282	504.00	1.70	505.70
9	-45.079811	170.124256	499.04	1.70	500.74
10	-45.080399	170.124253	499.00	1.70	500.70
11	-45.080604	170.117371	500.00	1.70	501.70
12	-45.080783	170.112833	501.00	1.70	502.70
13	-45.080568	170.108694	504.00	1.70	505.70
14	-45.080651	170.104651	499.00	1.70	500.70
15	-45.077803	170.104558	510.56	1.70	512.26

Route Receptors

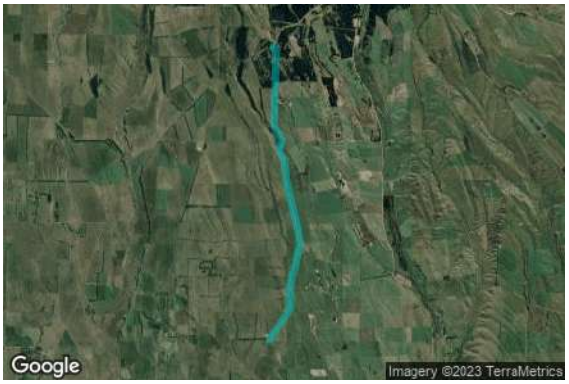
Name: RT06 Ranfurly Naseby Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.088762	170.093057	495.90	1.50	497.40
2	-45.088559	170.093340	495.00	1.50	496.50
3	-45.083567	170.093306	498.54	1.50	500.04
4	-45.076195	170.093507	514.31	1.50	515.81
5	-45.064414	170.098616	533.00	1.50	534.50
6	-45.049207	170.104952	559.00	1.50	560.50
7	-45.045288	170.106531	578.00	1.50	579.50
8	-45.043605	170.108391	582.61	1.50	584.11
9	-45.042911	170.109898	578.00	1.50	579.50
10	-45.042701	170.112146	581.00	1.50	582.50
11	-45.040076	170.119316	581.26	1.50	582.76
12	-45.039086	170.121036	573.79	1.50	575.29
13	-45.036813	170.122208	575.35	1.50	576.85

Name: RT07 Bypass Rd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.090972	170.093365	489.00	1.50	490.50
2	-45.090933	170.094195	488.03	1.50	489.53
3	-45.090541	170.095555	487.13	1.50	488.63
4	-45.090748	170.095959	486.29	1.50	487.79
5	-45.092727	170.098722	480.00	1.50	481.50

Name: RT08 Ranfurly Back Rd
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-45.096614	170.119070	476.00	1.50	477.50
2	-45.092570	170.122667	479.00	1.50	480.50
3	-45.090513	170.124641	483.72	1.50	485.22
4	-45.086188	170.124560	495.00	1.50	496.50
5	-45.078203	170.127255	507.00	1.50	508.50
6	-45.074559	170.126436	520.00	1.50	521.50
7	-45.065651	170.123519	532.41	1.50	533.91
8	-45.061721	170.123052	539.81	1.50	541.31
9	-45.060075	170.121789	539.00	1.50	540.50
10	-45.059289	170.121752	537.01	1.50	538.51
11	-45.058024	170.122386	541.00	1.50	542.50
12	-45.055187	170.120273	549.99	1.50	551.49
13	-45.042159	170.120795	580.14	1.50	581.64
14	-45.040809	170.120798	580.00	1.50	581.50
15	-45.039777	170.120105	579.47	1.50	580.97

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 5	5	-45.086779	170.129115	500.00	1.65

Obstruction Components

Name: OB01 Existing NE 1 plus 700m
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.056187	170.120305	540.34
2	-45.057823	170.121804	540.00
3	-45.058808	170.121676	538.86
4	-45.059572	170.121278	539.45
5	-45.060654	170.121988	539.00
6	-45.061812	170.122899	540.00
7	-45.062834	170.122976	540.00
8	-45.064356	170.123133	537.00
9	-45.065300	170.123280	535.00

Name: OB03 Existing West 1 plus 550m
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.076923	170.093770	512.00
2	-45.075911	170.093918	514.58
3	-45.072337	170.095460	516.00
4	-45.070591	170.096190	518.00
5	-45.070757	170.108834	519.00
6	-45.070560	170.096210	518.00
7	-45.063423	170.099327	536.00
8	-45.061971	170.099974	538.29
9	-45.060030	170.100811	540.00

Name: OB04 Existing West 2 plus 1200m
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.047355	170.106141	571.04
2	-45.049383	170.105237	559.47
3	-45.054139	170.103205	553.00
4	-45.056827	170.102097	548.00
5	-45.058172	170.101548	545.00
6	-45.059942	170.100874	540.65

Name: OB08 Existing SW
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.084261	170.110408	498.00
2	-45.084124	170.104814	496.00
3	-45.084303	170.103094	497.00
4	-45.084164	170.102473	497.46
5	-45.082694	170.103023	500.00
6	-45.082513	170.103724	499.32
7	-45.081301	170.103779	499.00
8	-45.081248	170.100933	500.18
9	-45.081765	170.100039	499.00
10	-45.082490	170.099964	498.00

Name: OB11 Ex Internal 1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.076989	170.093923	512.00
2	-45.077774	170.103284	510.00
3	-45.077811	170.103994	510.00
4	-45.077386	170.107554	513.00
5	-45.077437	170.108276	513.00
6	-45.077711	170.111760	509.61

Name: OB12 Ex Internal 2 plus 1500m
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.077626	170.116770	508.54
2	-45.077549	170.122028	509.00
3	-45.079035	170.126557	504.30
4	-45.078115	170.126884	507.00
5	-45.076000	170.126439	514.54
6	-45.074121	170.126051	520.86
7	-45.072382	170.125354	520.00
8	-45.069818	170.124546	523.00
9	-45.068469	170.124119	524.00
10	-45.065251	170.123256	535.00

Name: OB13 Ex Internal 3
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.080705	170.105243	500.00
2	-45.080695	170.108209	503.00

Name: OB15 Ex Internal 4
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.080657	170.118074	499.00
2	-45.080569	170.121833	499.00

Name: OB15 Ex Internal 5
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.082422	170.118743	499.00
2	-45.082703	170.122782	499.00

Name: OB16 Ex Internal 6 plus 1200m
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-45.084250	170.110454	498.00
2	-45.084504	170.119692	498.02
3	-45.084773	170.124788	495.00
4	-45.081997	170.125678	498.53
5	-45.080242	170.126248	502.00
6	-45.078990	170.126718	505.00

Glare Analysis Results

Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy	Peak Luminance
	°	°	min	hr	min	hr	kWh	cd/m^2
PV01 North tip	SA tracking	SA tracking	105	1.8	0	0.0	-	51,248
PV02 Sub East	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV03 Sub West	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV04 West 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV05 West 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV06 South	SA tracking	SA tracking	932	15.5	0	0.0	-	193,130
PV07 Central 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV08 Central 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV09 Central 3	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV10 Central 4	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV11 East 1	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV12 East 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV13 East 3	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV14 South 2	SA tracking	SA tracking	0	0.0	0	0.0	-	0
PV15 South 3	SA tracking	SA tracking	641	10.7	0	0.0	-	103,482

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

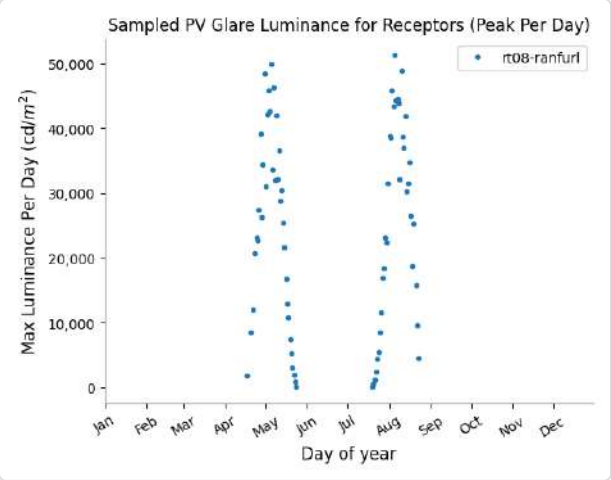
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
RT06 Ranfurly Naseby Rd	944	15.7	0	0.0
RT07 Bypass Rd	629	10.5	0	0.0
RT08 Ranfurly Back Rd	105	1.8	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 5	0	0.0	0	0.0

PV: PV01 North tip low potential for temporary after-image

Receptor results ordered by category of glare

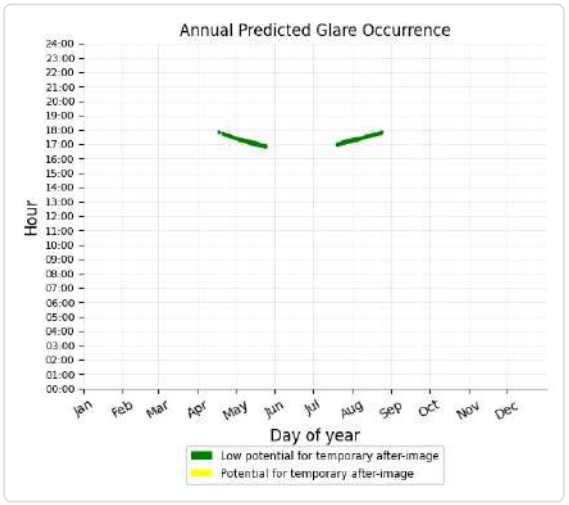
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT08 Ranfurly Back Rd	105	1.8	0	0.0	51,248
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

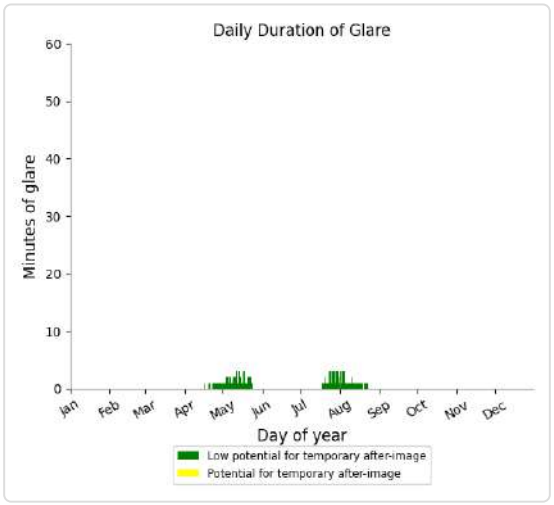


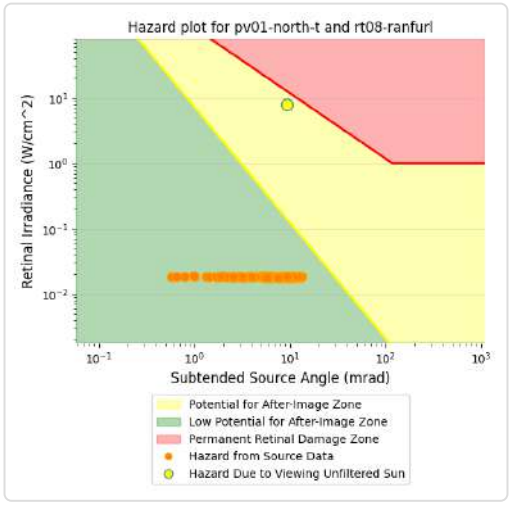
PV01 North tip and Route: RT08 Ranfurly Back Rd

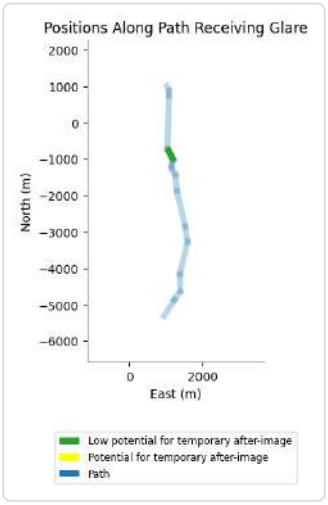
Yellow glare: none

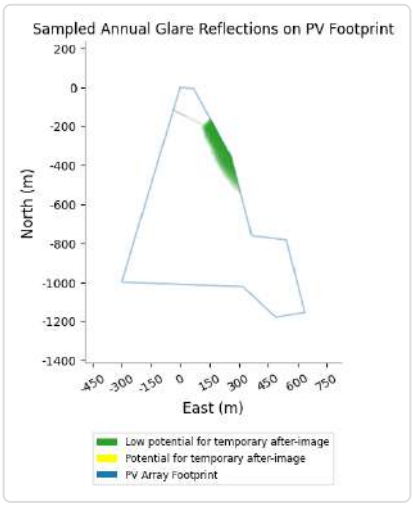
Green glare: 105 min.

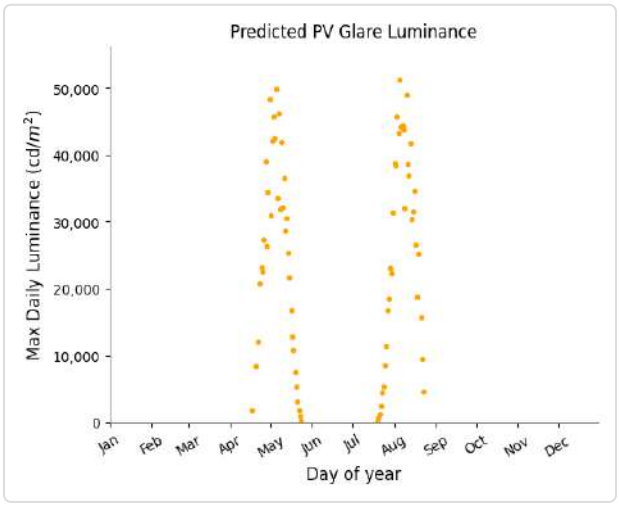












PV01 North tip and Route: RT06 Ranfurly Naseby Rd

No glare found

PV01 North tip and Route: RT07 Bypass Rd

No glare found

PV01 North tip and OP 5

No glare found

PV: PV02 Sub East no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV02 Sub East and Route: RT06 Ranfurly Naseby Rd

No glare found

PV02 Sub East and Route: RT07 Bypass Rd

No glare found

PV02 Sub East and Route: RT08 Ranfurly Back Rd

No glare found

PV02 Sub East and OP 5

No glare found

PV: PV03 Sub West no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV03 Sub West and Route: RT06 Ranfurly Naseby Rd

No glare found

PV03 Sub West and Route: RT07 Bypass Rd

No glare found

PV03 Sub West and Route: RT08 Ranfurly Back Rd

No glare found

PV03 Sub West and OP 5

No glare found

PV: PV04 West 1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV04 West 1 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV04 West 1 and Route: RT07 Bypass Rd

No glare found

PV04 West 1 and Route: RT08 Ranfurly Back Rd

No glare found

PV04 West 1 and OP 5

No glare found

PV: PV05 West 2 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV05 West 2 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV05 West 2 and Route: RT07 Bypass Rd

No glare found

PV05 West 2 and Route: RT08 Ranfurly Back Rd

No glare found

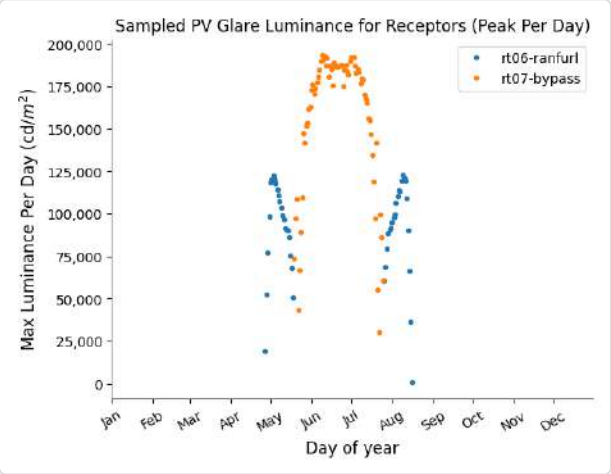
PV05 West 2 and OP 5

No glare found

PV: PV06 South low potential for temporary after-image

Receptor results ordered by category of glare

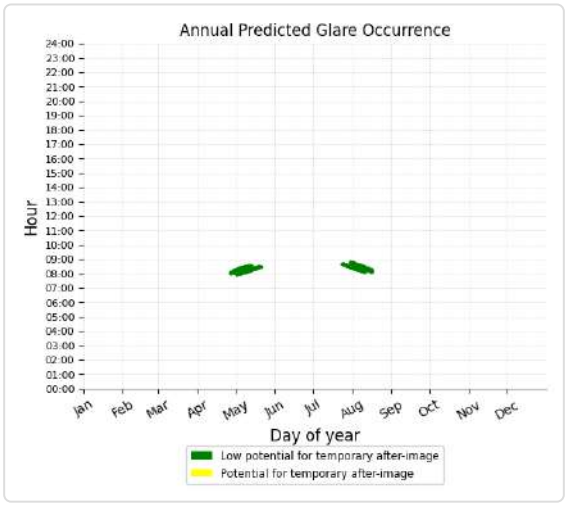
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	303	5.0	0	0.0	122,696
RT07 Bypass Rd	629	10.5	0	0.0	193,130
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

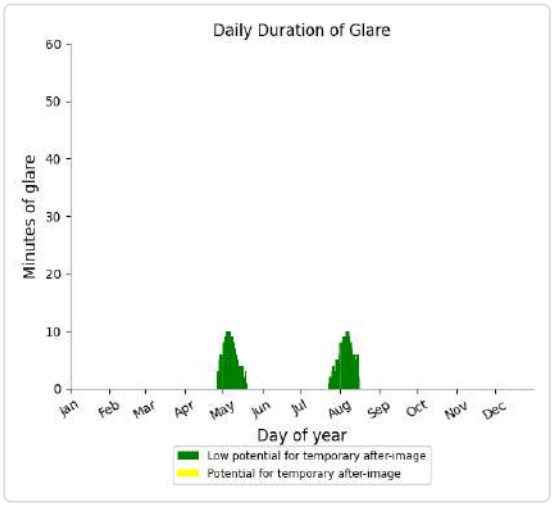


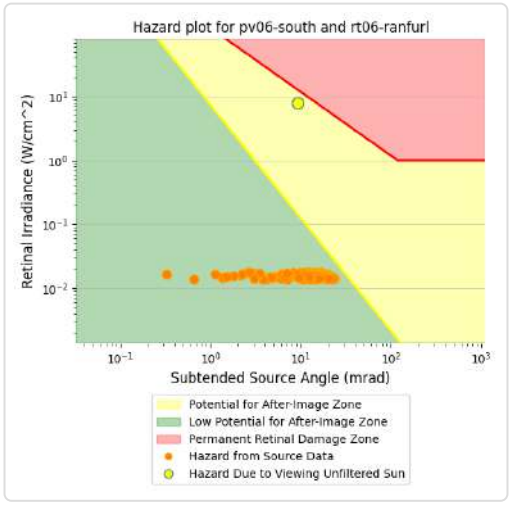
PV06 South and Route: RT06 Ranfurly Naseby Rd

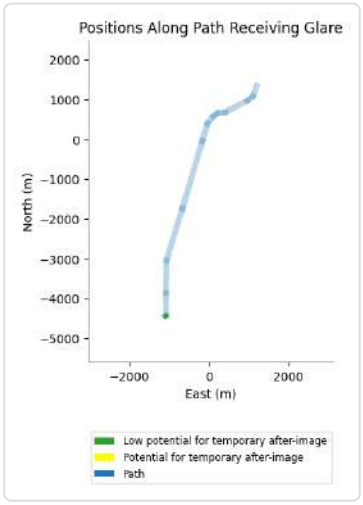
Yellow glare: none

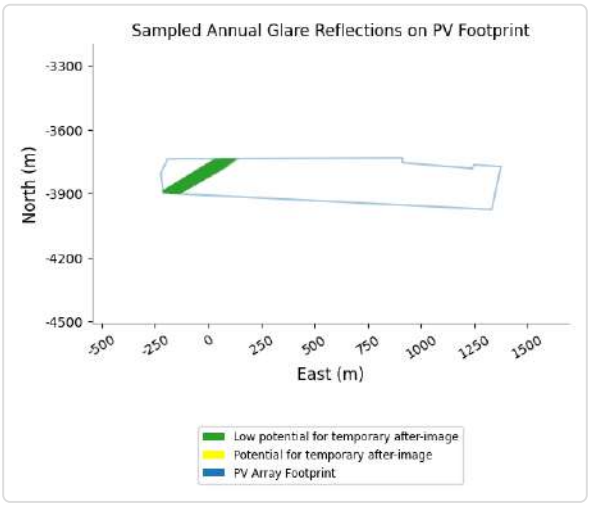
Green glare: 303 min.

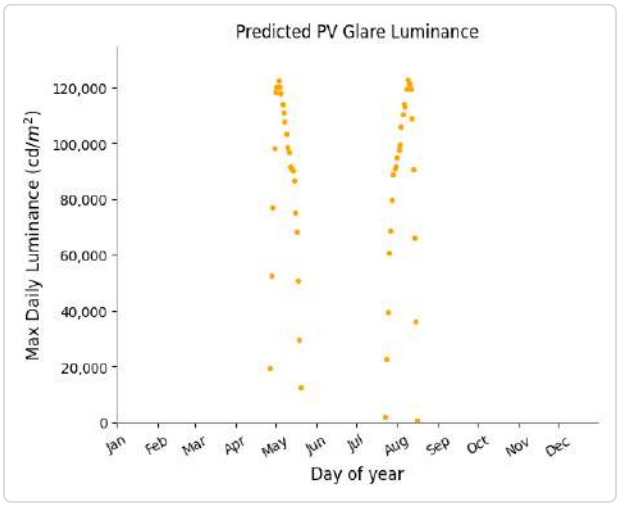








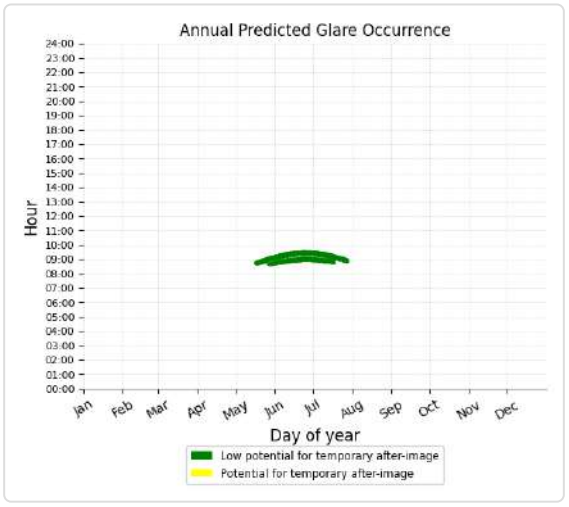


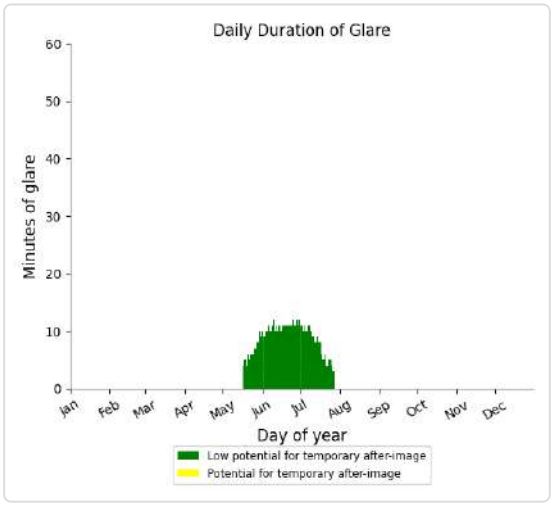


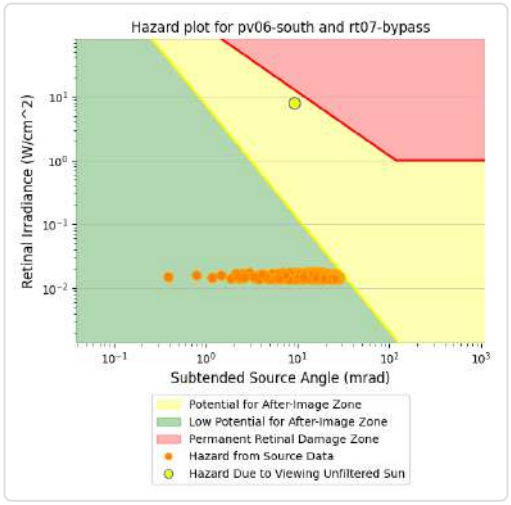
PV06 South and Route: RT07 Bypass Rd

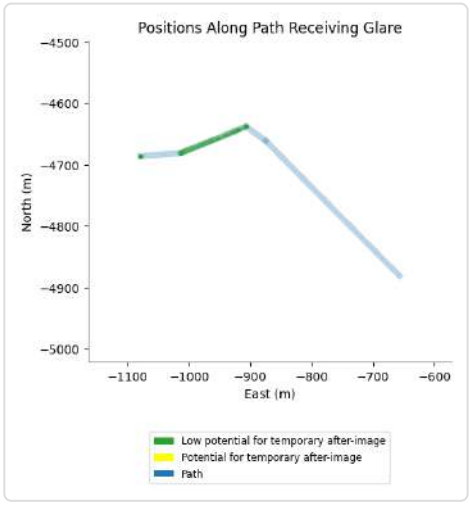
Yellow glare: none

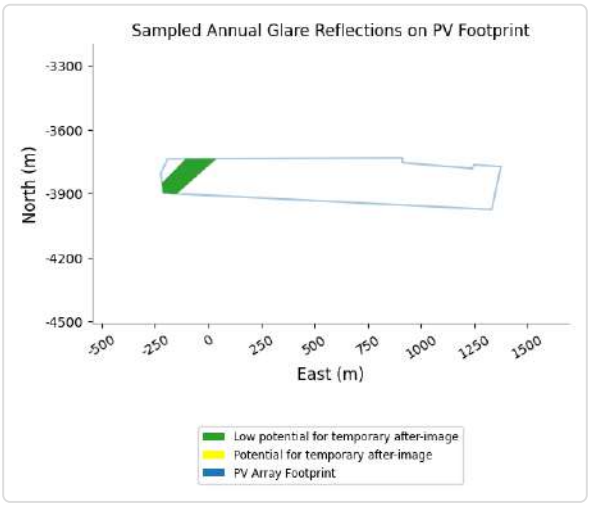
Green glare: 629 min.

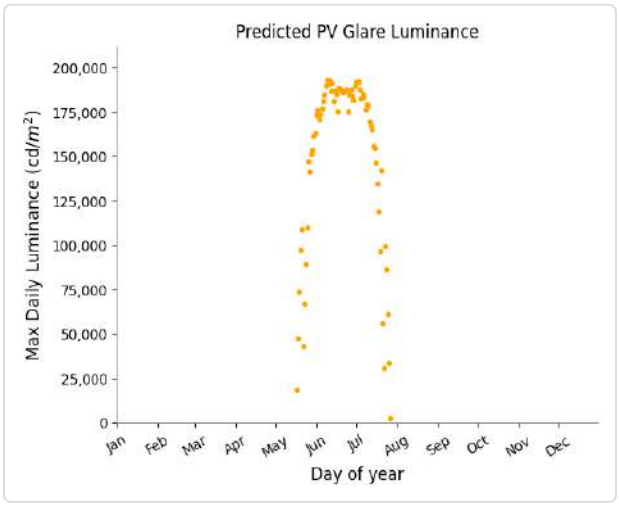












PV06 South and Route: RT08 Ranfurly Back Rd

No glare found

PV06 South and OP 5

No glare found

PV: PV07 Central 1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV07 Central 1 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV07 Central 1 and Route: RT07 Bypass Rd

No glare found

PV07 Central 1 and Route: RT08 Ranfurly Back Rd

No glare found

PV07 Central 1 and OP 5

No glare found

PV: PV08 Central 2 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV08 Central 2 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV08 Central 2 and Route: RT07 Bypass Rd

No glare found

PV08 Central 2 and Route: RT08 Ranfurly Back Rd

No glare found

PV08 Central 2 and OP 5

No glare found

PV: PV09 Central 3 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV09 Central 3 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV09 Central 3 and Route: RT07 Bypass Rd

No glare found

PV09 Central 3 and Route: RT08 Ranfurly Back Rd

No glare found

PV09 Central 3 and OP 5

No glare found

PV: PV10 Central 4 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV10 Central 4 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV10 Central 4 and Route: RT07 Bypass Rd

No glare found

PV10 Central 4 and Route: RT08 Ranfurly Back Rd

No glare found

PV10 Central 4 and OP 5

No glare found

PV: PV11 East 1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV11 East 1 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV11 East 1 and Route: RT07 Bypass Rd

No glare found

PV11 East 1 and Route: RT08 Ranfurly Back Rd

No glare found

PV11 East 1 and OP 5

No glare found

PV: PV12 East 2 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV12 East 2 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV12 East 2 and Route: RT07 Bypass Rd

No glare found

PV12 East 2 and Route: RT08 Ranfurly Back Rd

No glare found

PV12 East 2 and OP 5

No glare found

PV: PV13 East 3 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV13 East 3 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV13 East 3 and Route: RT07 Bypass Rd

No glare found

PV13 East 3 and Route: RT08 Ranfurly Back Rd

No glare found

PV13 East 3 and OP 5

No glare found

PV: PV14 South 2 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	0	0.0	0	0.0	0
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

PV14 South 2 and Route: RT06 Ranfurly Naseby Rd

No glare found

PV14 South 2 and Route: RT07 Bypass Rd

No glare found

PV14 South 2 and Route: RT08 Ranfurly Back Rd

No glare found

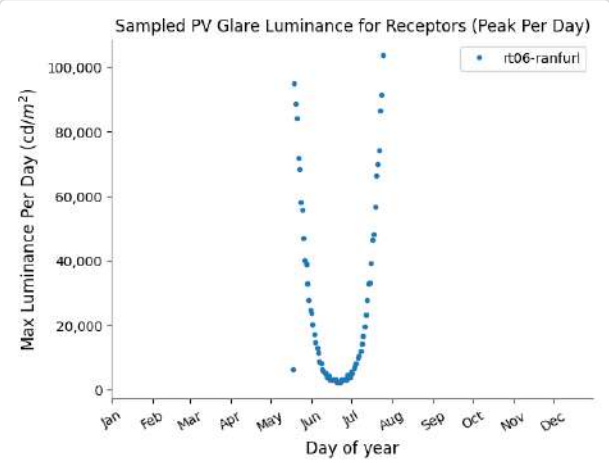
PV14 South 2 and OP 5

No glare found

PV: PV15 South 3 low potential for temporary after-image

Receptor results ordered by category of glare

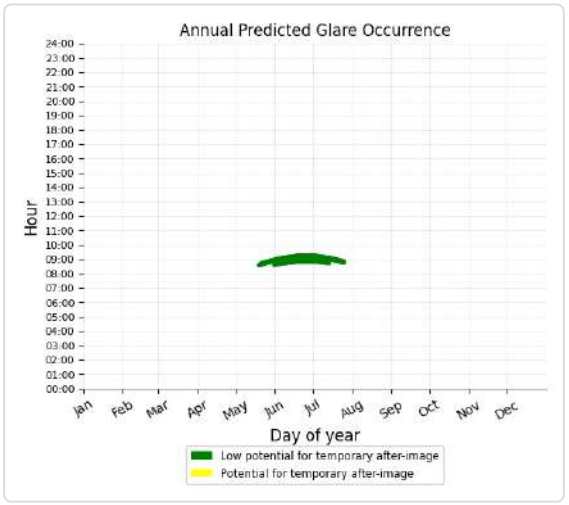
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m^2
RT06 Ranfurly Naseby Rd	641	10.7	0	0.0	103,482
RT07 Bypass Rd	0	0.0	0	0.0	0
RT08 Ranfurly Back Rd	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0

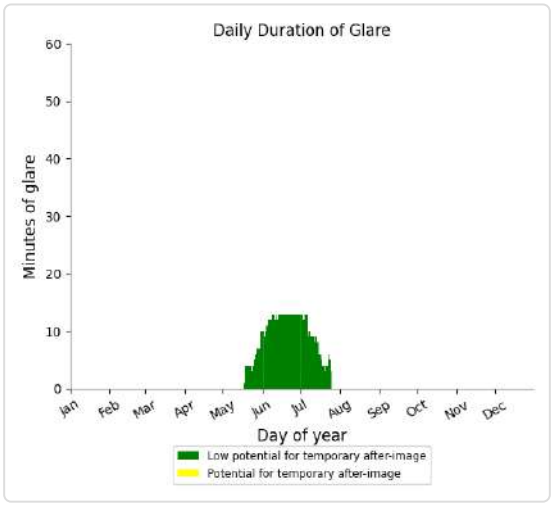


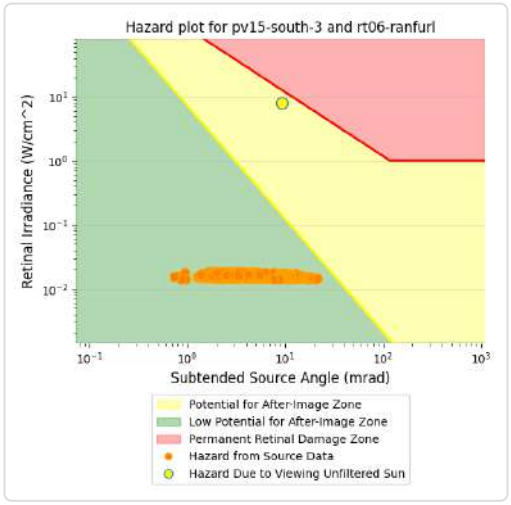
PV15 South 3 and Route: RT06 Ranfurly Naseby Rd

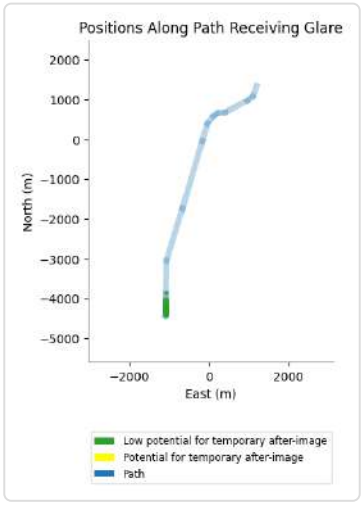
Yellow glare: none

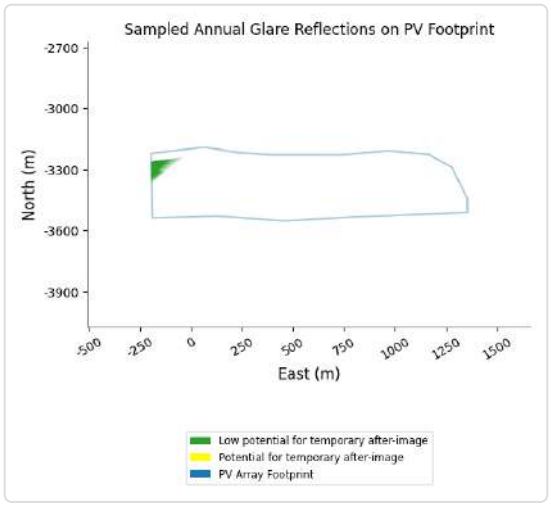
Green glare: 641 min.

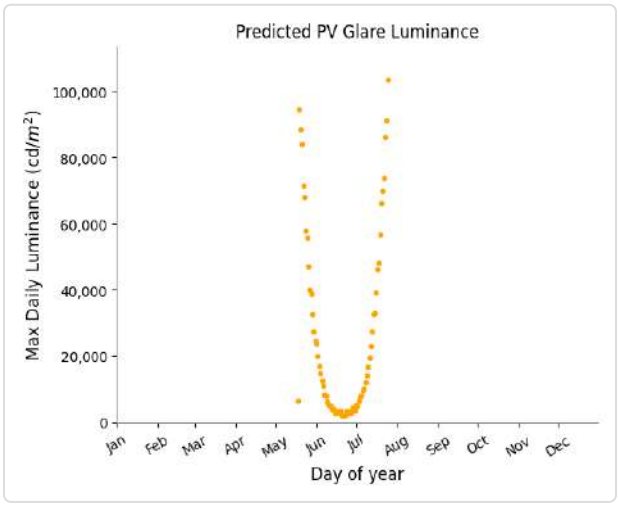












PV15 South 3 and Route: RT07 Bypass Rd

No glare found

PV15 South 3 and Route: RT08 Ranfurly Back Rd

No glare found

PV15 South 3 and OP 5

No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

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

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

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Boffa Miskell is a leading New Zealand environmental consultancy with nine offices throughout Aotearoa. We work with a wide range of local, international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, Te Hīhiri (cultural advisory), engagement, transport advisory, climate change, graphics, and mapping. Over the past five decades we have built a reputation for creativity, professionalism, innovation, and excellence by understanding each project's interconnections with the wider environmental, social, cultural, and economic context.

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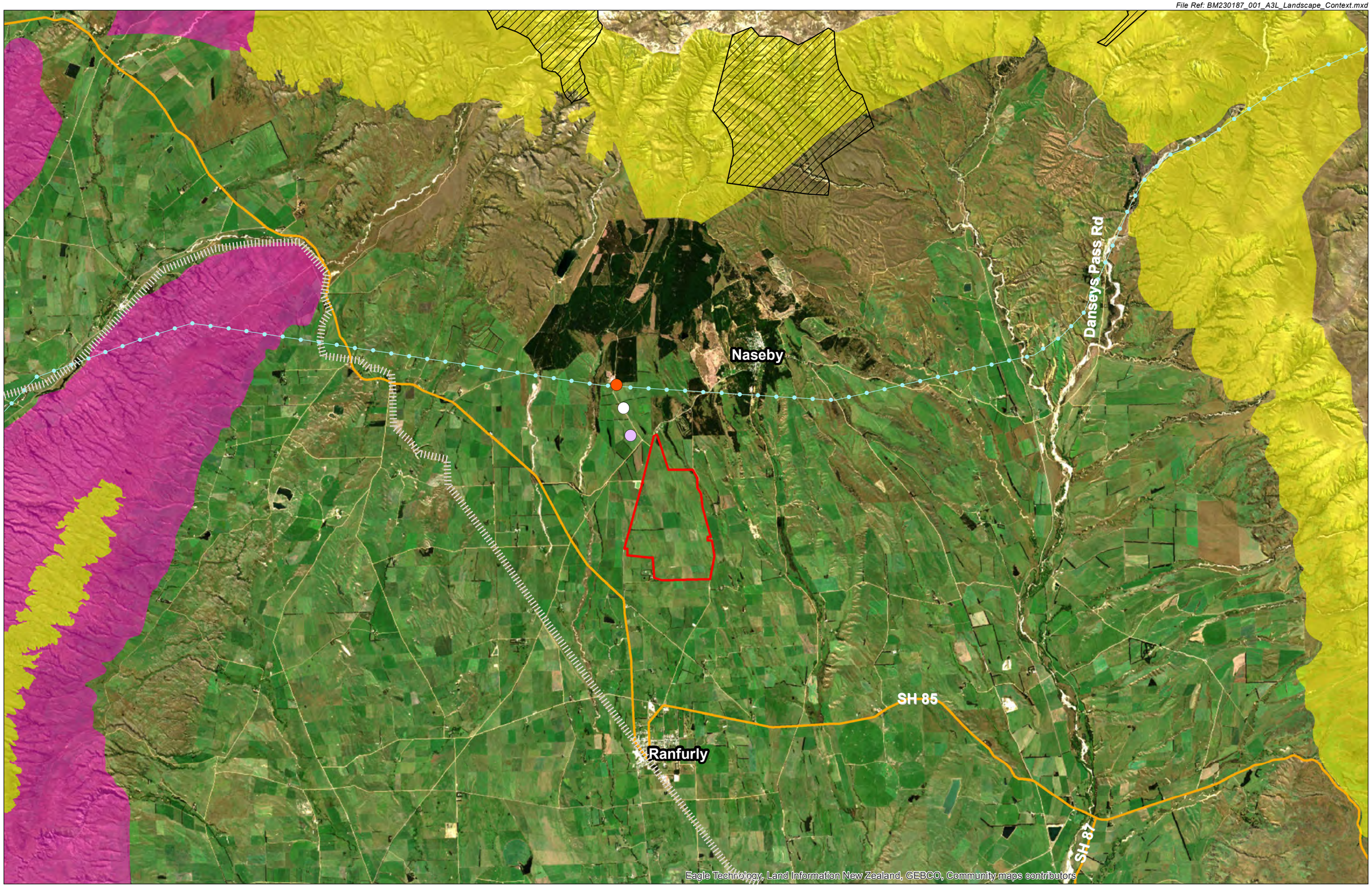
HELIOS MĀNIATOTO SOLAR FARM

GRAPHIC SUPPLEMENT

28 FEBRUARY 2024

CONTENTS

File Ref: BM230187_001_A3L_Landscape_Context.mxd



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0 4,000 m

1:100,000 @ A3

Data Sources:
Eagles Technologies, LINZ Data Service, and Central Otago District Council.
Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Site Boundary
- State Highway
- Outstanding Natural Landscape
- Significant Amenity Landscape
- Significant Natural Value
- Transmission Lines
- Naseby Substation
- LeoLabs Kiwi Space Radar
- Approved Solar Bay Solar Farm
- Central Otago Rail Trail

HELIOS MĀNIATOTO SOLAR FARM

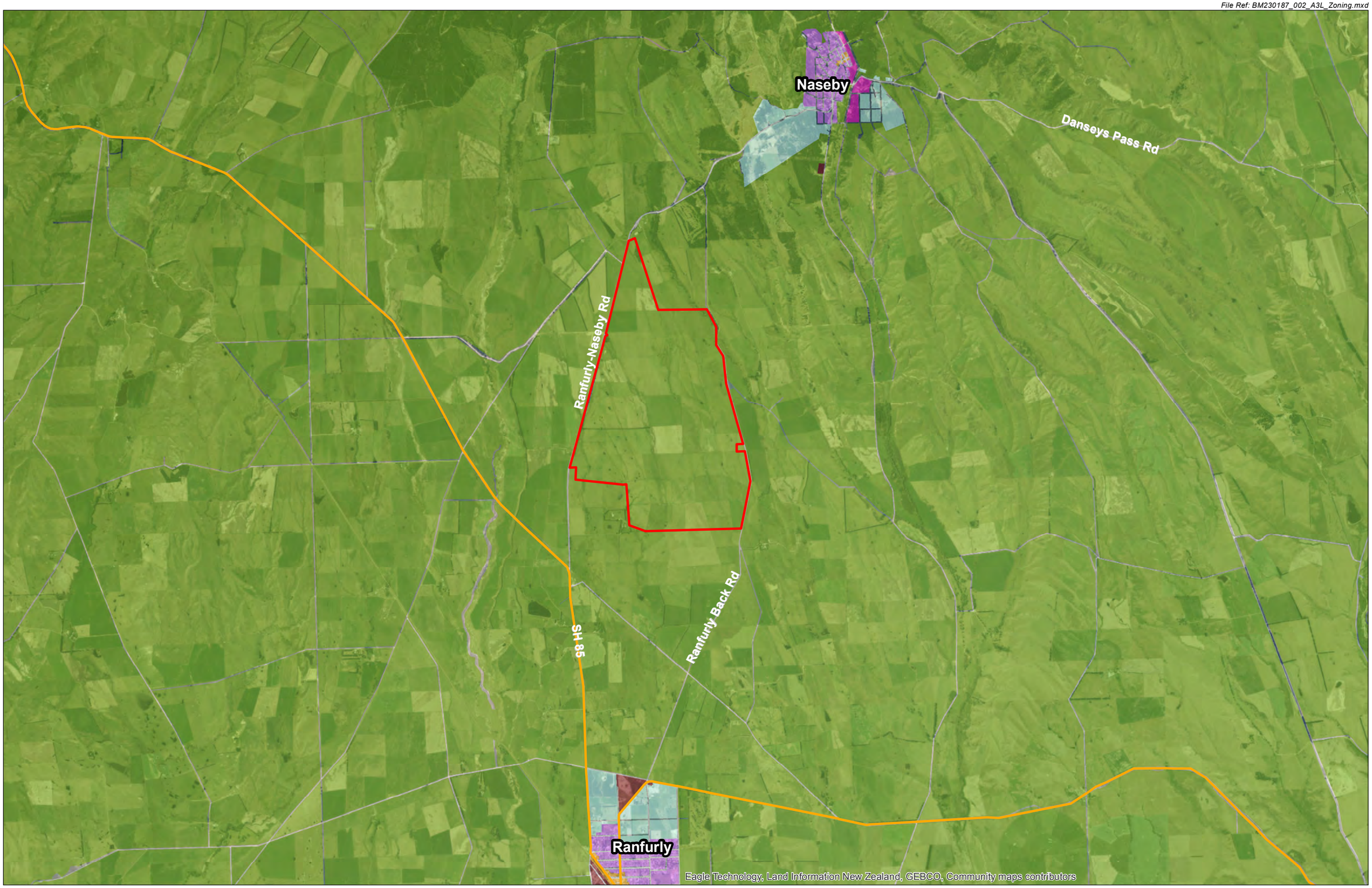
Landscape Context

Date: 24 November 2023 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc

Figure 1



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0 2,000 m

1:50,000 @ A3

Data Sources:
Eagles Technologies, LINZ Data Service, and Central Otago District

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Site Boundary
- Business Area
- Industrial Area
- Residential Area
- Residential Resource Area
- Rural Residential Area
- Rural Resource Area
- State Highway 85

HELIOS MĀNIATOTO SOLAR FARM

Zoning

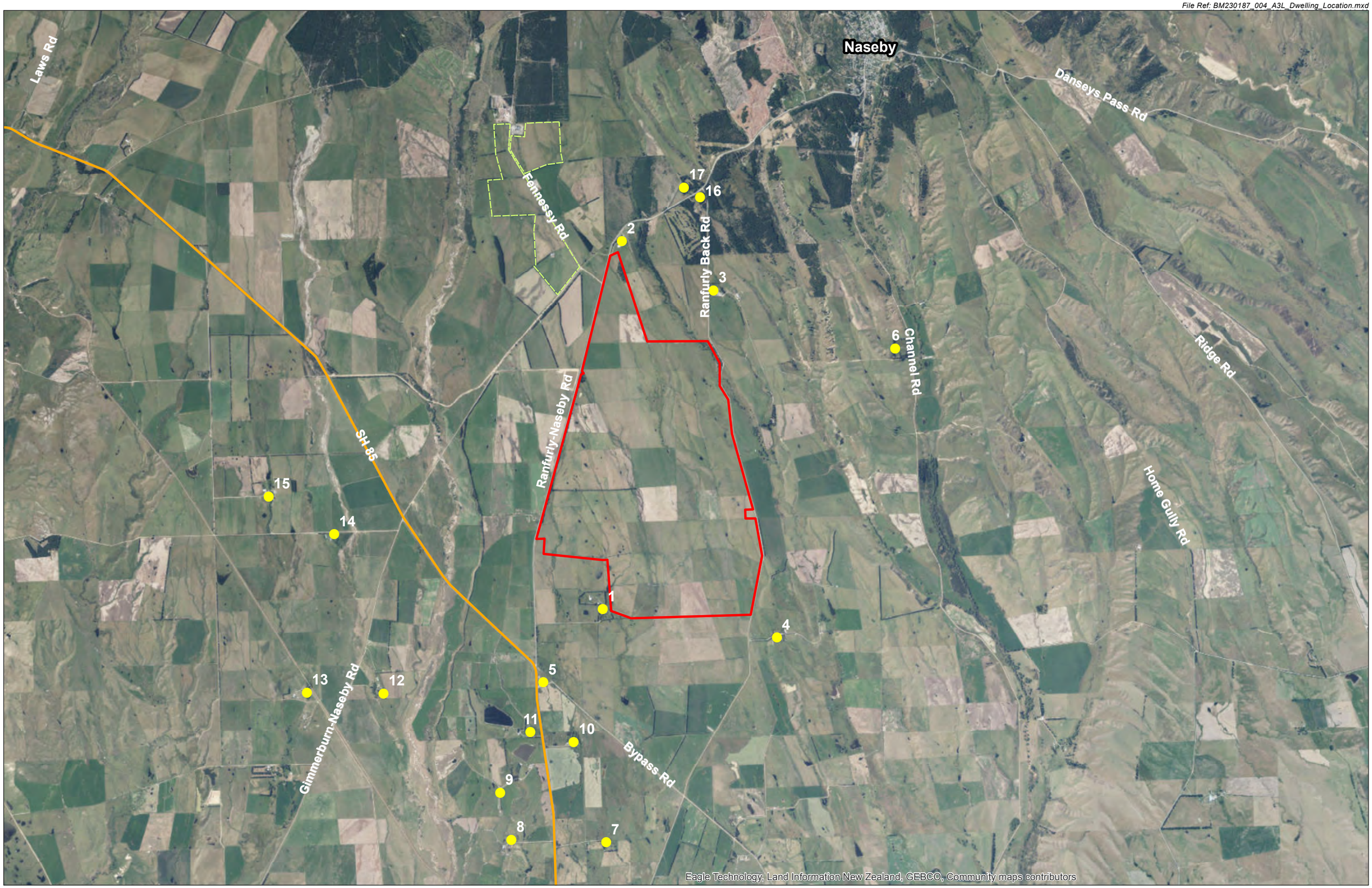
Date: 24 November 2023 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc

Figure 2

File Ref: BM230187_004_A3L_Dwelling_Location.mxd



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0 2,000 m

1:40,000 @ A3

Data Sources:
Eagles Technologies, and LINZ Data Service.

Projection: New Zealand Transverse Mercator

LEGEND

- Site Boundary
- Approved Solar Bay Solar Farm
- State Highway 85
- Dwellings 1 - 17

HELIOS MĀNIATOTO SOLAR FARM

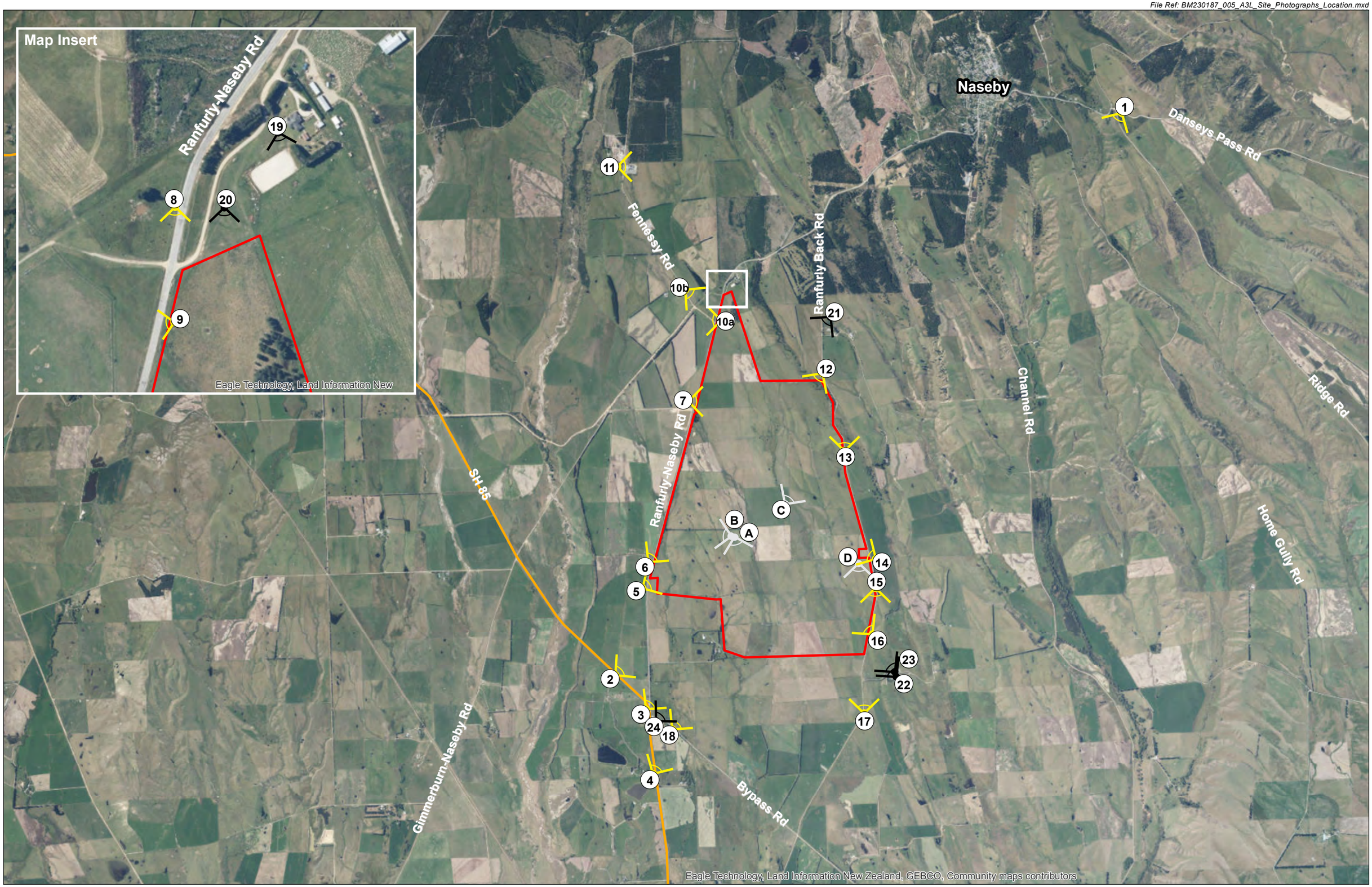
Dwelling Location

Date: 24 November 2023 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc

Figure 3



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0 2,000 m

1:40,000 @ A3

Data Sources:
Eagles Technologies, and LINZ Data Service.

Projection: New Zealand Transverse Mercator

LEGEND

- Site Boundary
- State Highway 85
- Site Appraisal Photographs A - D (Photograph D does not have GPS information)
- Site Context Photographs 1 - 18
- Private Viewpoint Photographs 19 - 24

HELIOS MĀNIATOTO SOLAR FARM

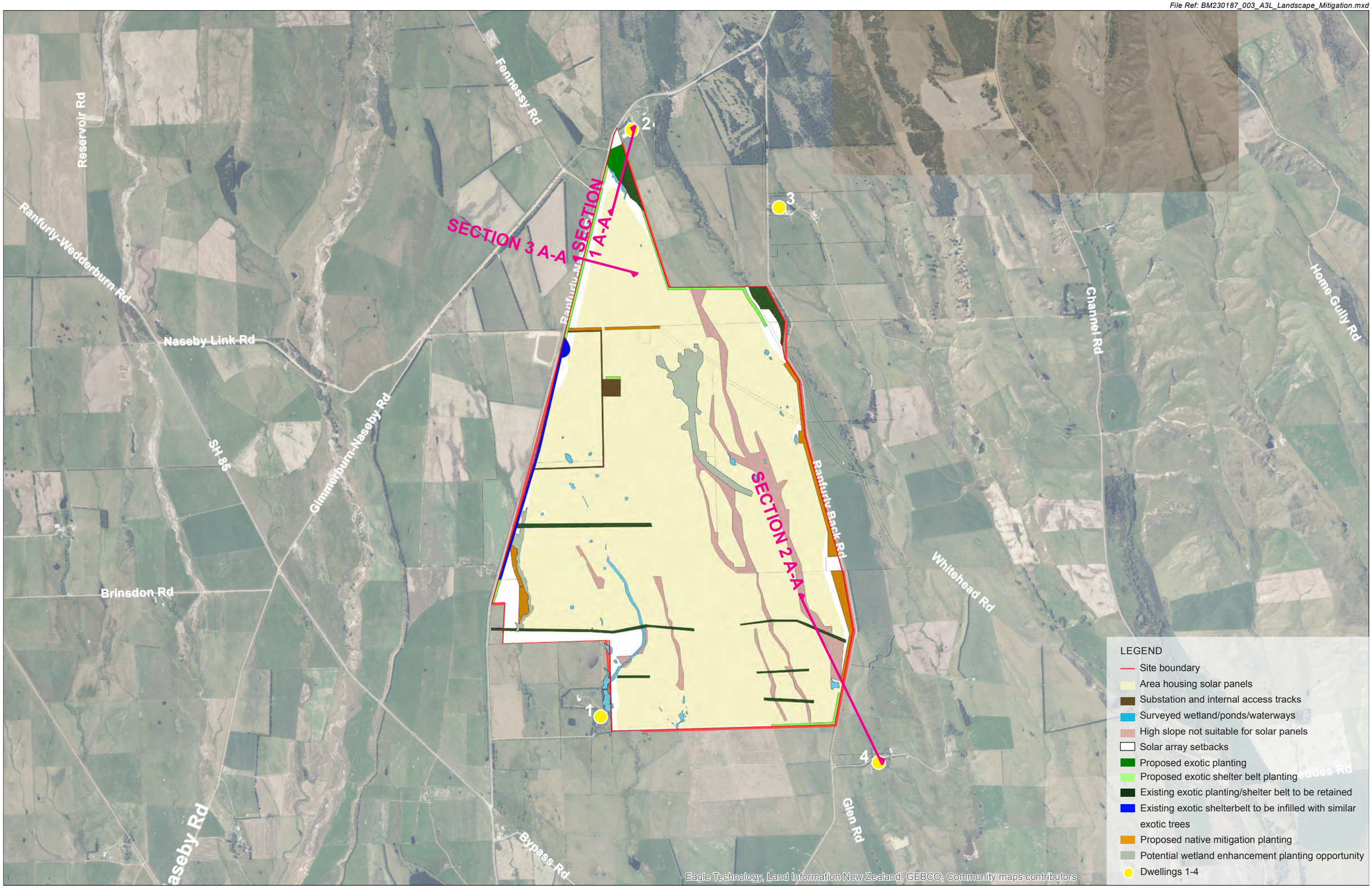
Site Photographs Location

Date: 01 February 2024 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc

Figure 4



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0 1,000 m

1:25,000 @ A3

Data Sources:
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Projection: New Zealand Transverse Mercator

HELIOS MĀNIATOTO SOLAR FARM

Landscape Mitigation

Date: 24 November 2023 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: HBI | Checked: SMc

Figure 5A

POTENTIAL EXOTIC SHETLER BELTS

Cedrus atlantica
Atlantic Cedar
H: 8m
W:5m
Root size: 8m max spread approx

Cupressus macrocarpa
Macrocarpa
H:25m
W:7m
Root size: 15m max spread approx

POTENTIAL MIXED HEIGHT NATIVE MITIGATION PLANTING

Coprosma crassifolia
Coprosma
H: 4m
W: 2m

Coprosma intertexta
Tangled Coprosma
H: 2m
W: 2m

Coprosma propinqua
Minigmingi
H: 5m
W: 2.5m

Chionochloa rubra
Red Tussock
H: 1.5m
W: 1.5m

Chionochloa rigida
Narrow-leaved Snow Tussock
H: 1.5m
W: 1.5m

Corokia cotoneaster
Korokia
H: 3m
W: 2m

Carmichaelia petriei
Desert broom
H: 2.5m
W: 2m

Discaria toumatou
Matagouri
H: 5m
W: 3m

Griselinia littoralis
Kapuka
H: 6m
W: 2.5m

Leptospermum scoparium
Manuka
H: 4m
W: 3m

Muehlenbeckia complexa
Shrub pohuehue
H: 2m
W: 3m

Ozothamnus leptophyllus
Cottonwood
H: 2m
W: 2m

Pittosporum tenuifolium
Kōhūhū
H: 6m
W: 3m

Plagianthus regius
Ribbonwood
H: 12m
W: 4m

Psuedopanax crassifolius
Horoeka
H: 12m
W: 3m

Sophora microphylla
Kowhai
H: 8m
W: 3m

Veronica salicifolia
Koromiki
H: 2m
W: 2m

POTENTIAL WETLAND PLANTING

Aciphylla subflabellata
Grassland spaniard
H: 0.6m
W: 0.6m

Carex coriacea
NZ Swamp Sedge
H: 0.6m
W: 2m

Carex kaloides
Kaloides Sedge
H: 1m

Carex secta
Purei
H: 1.5m
W: 1.5m

Juncus distegus
Wiwi
H: 0.75m

Phormium tenax
Harakeke
H: 2m
W: 3m

Schoenus pauciflorus
Bog Rush
H: 0.5m
W: 0.5m

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Proposed Planting Palette

Date: 01 February 2024 | Revision: 0

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Figure 5B

*Width varies but plantings to be implemented at spaces that allow for established plant sizes while achieving a varied, natural outcome. The aim is to avoid an 'avenue' effect and to ensure the planting looks as natural as possible.

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Indicative Sections - Native Species Planting Mitigation

0 2m

1:80 @ A3

Date: 01 February 2024 | Revision: 0

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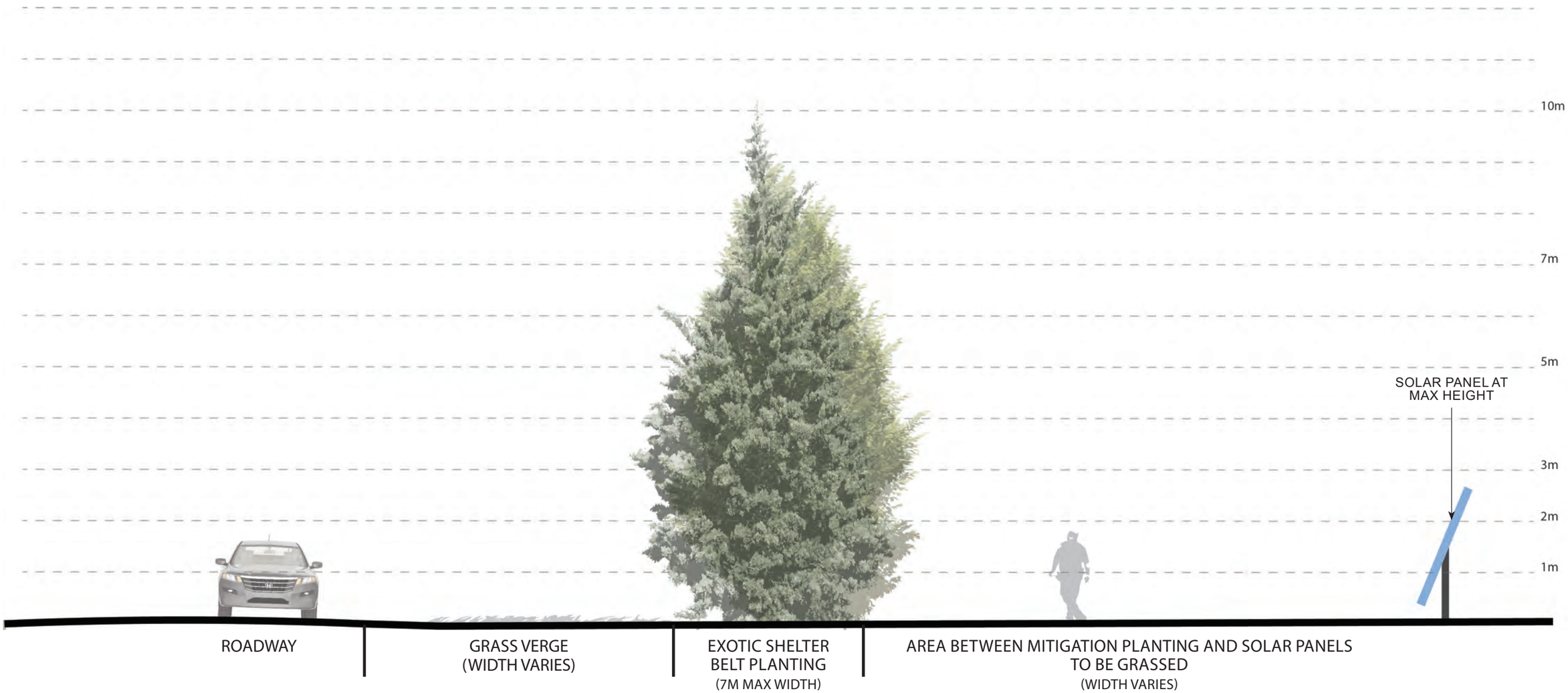
Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: ETa | Checked: SMc

Figure 5C



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Indicative Sections - Exotic Shelterbelt Planting Mitigation

0 2m

1:80 @ A3

Date: 01 February 2024 | Revision: 0

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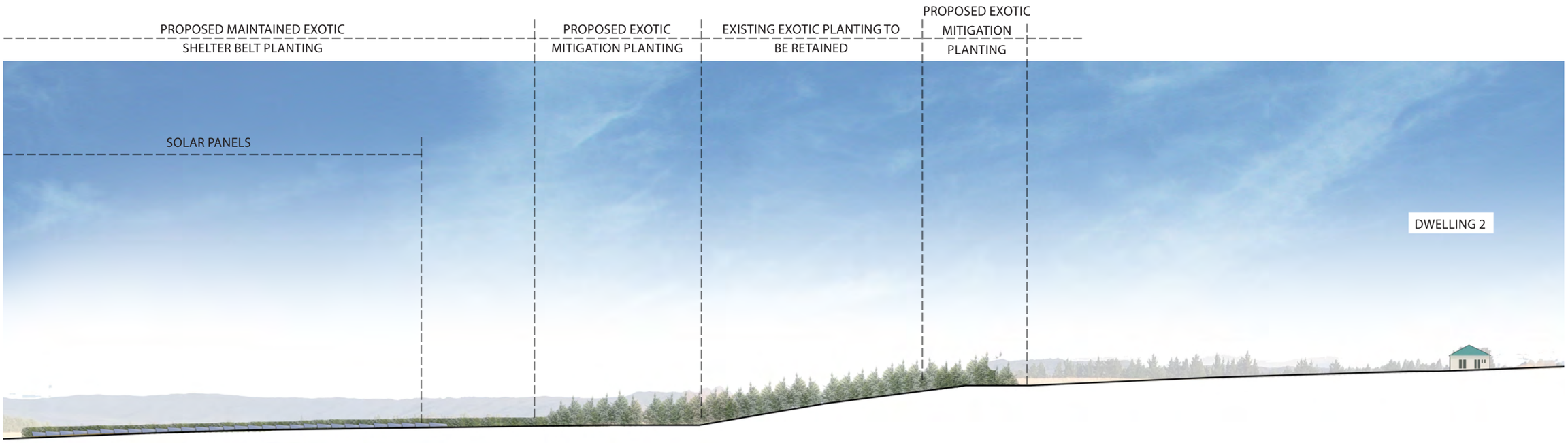
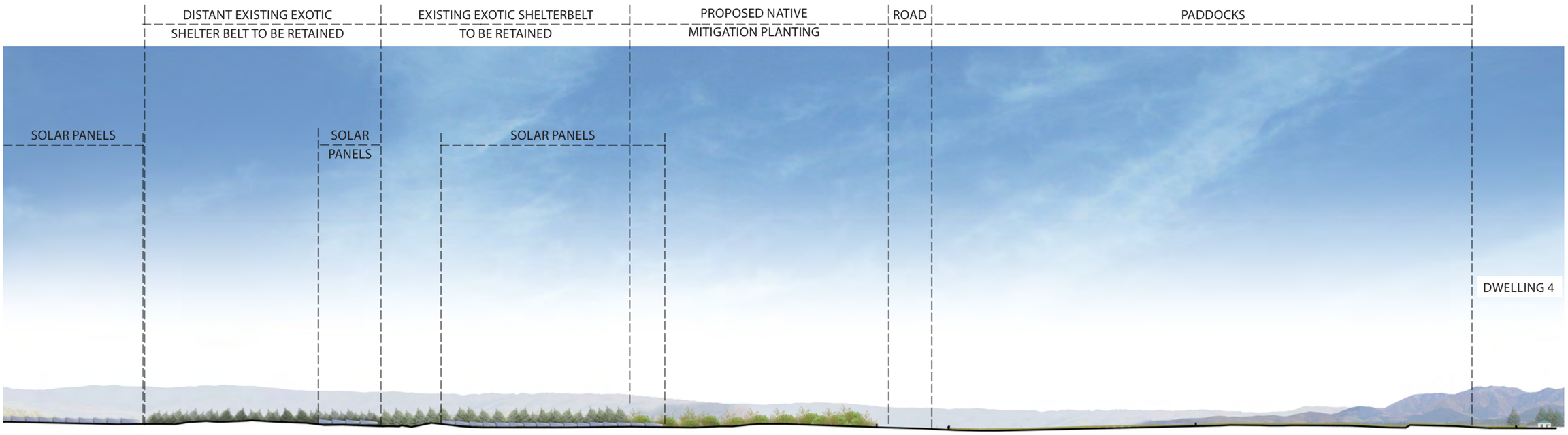
Figure 5D



SECTION ELEVATION 1 A-A: 2:2,000 @A3



SECTION ELEVATION 2 A-A: 2:4,000 @A3

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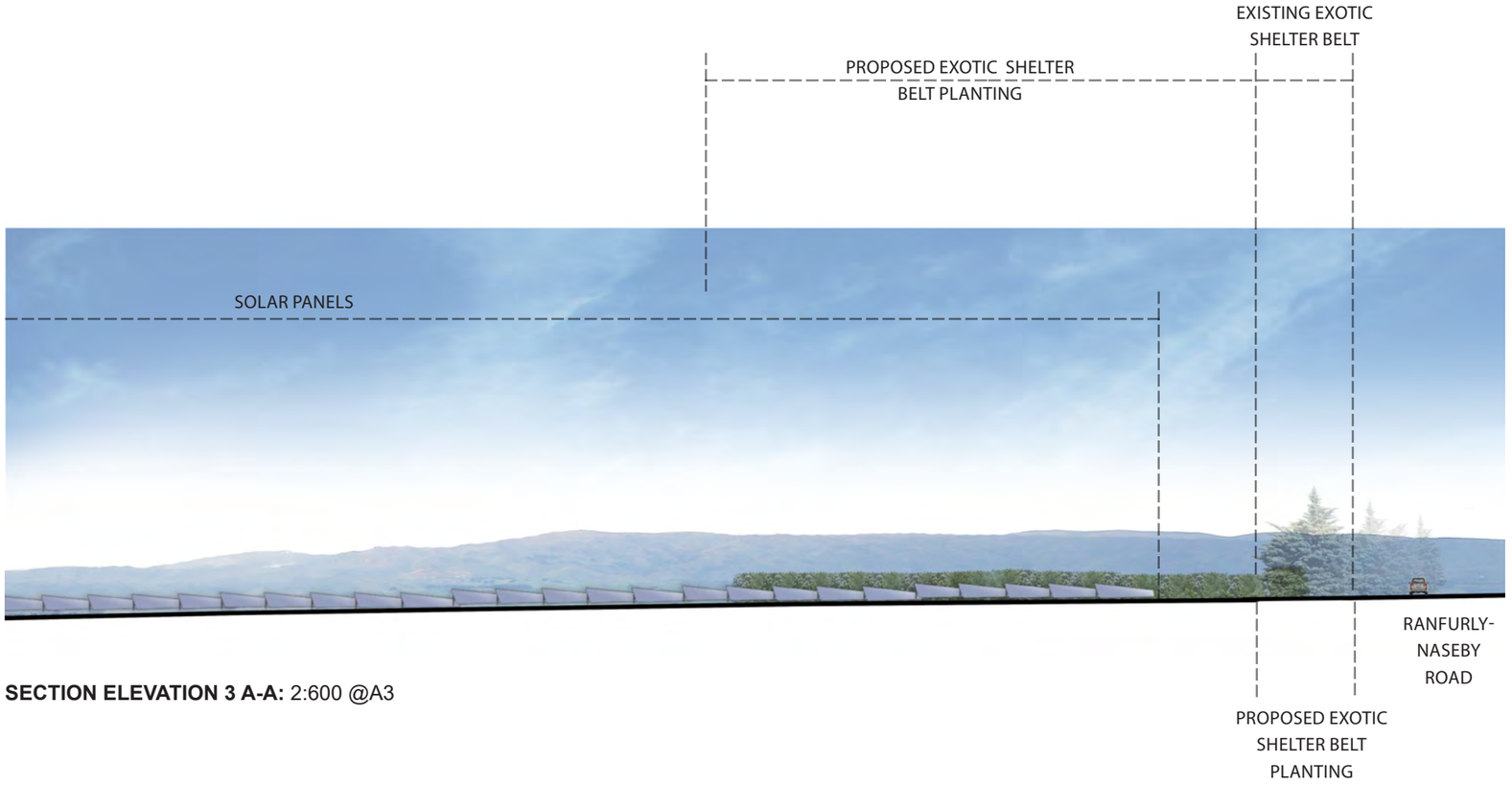
Section Elevations

Date: 01 February 2024 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: ETa | Checked: SMc

Figure 5E



SECTION ELEVATION 3 A-A: 2:600 @A3

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Section Elevations

Date: 01 February 2024 | Revision: 0

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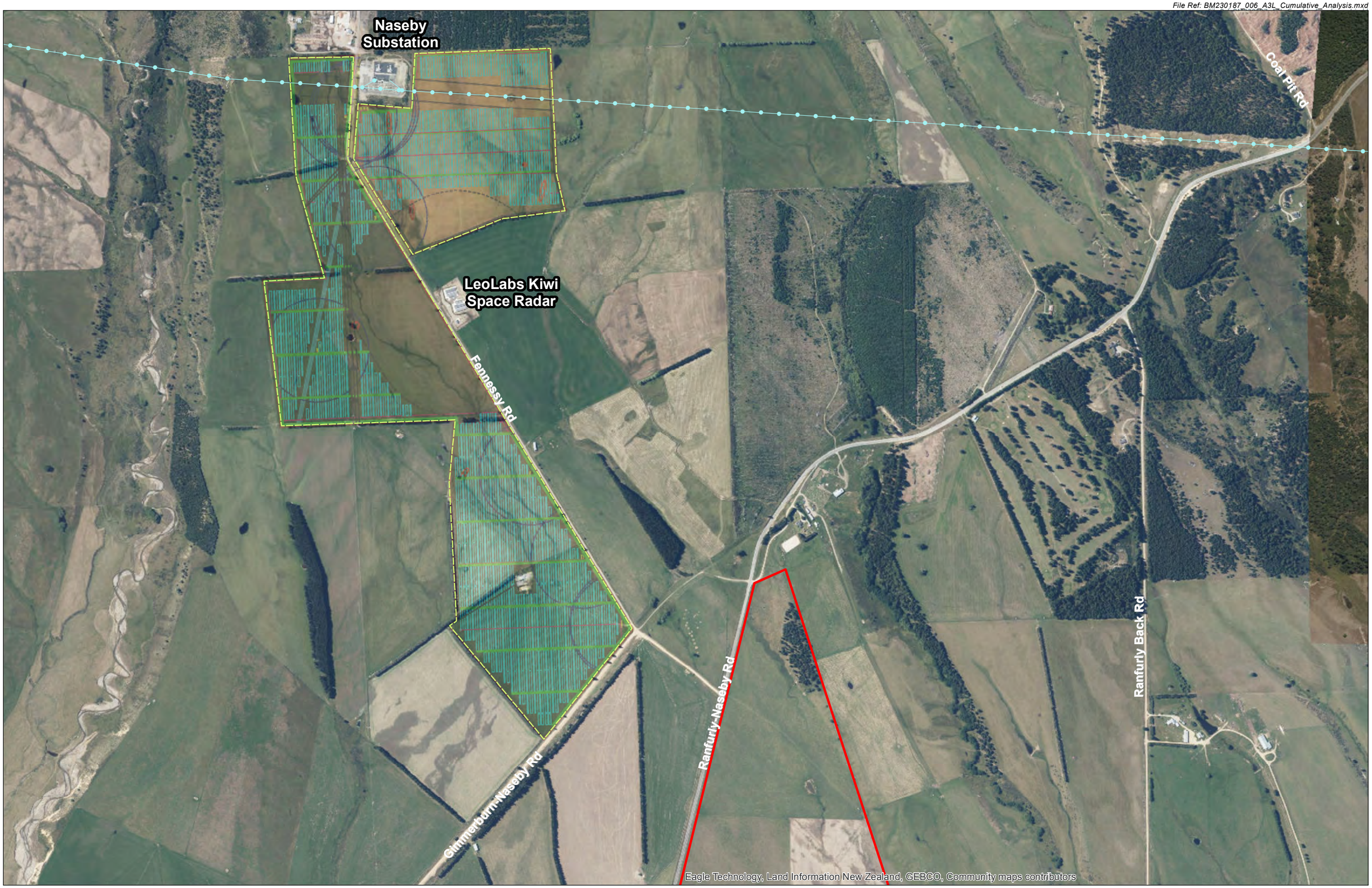
Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: ETa | Checked: SMc

Figure 5F



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0 400 m

1:10,000 @ A3

Data Sources:
Eagles Technologies, and LINZ Data Service.

Projection: New Zealand Transverse Mercator

LEGEND

- Site Boundary
- Transmission Lines
- Approved Solar Bay solar farm

HELIOS MĀNIATOTO SOLAR FARM

Cumulative Analysis

Date: 24 November 2023 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

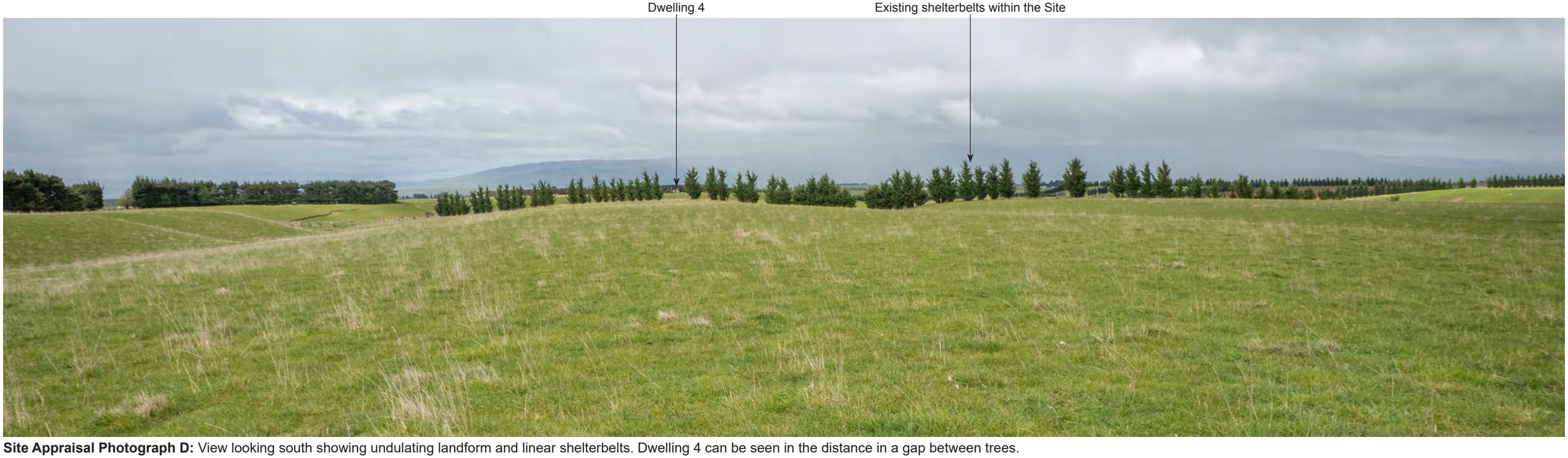
Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc

Figure 6

Site Appraisal Photograph A: View looking southeast showing the undulating landform and layers of vegetation to the south including linear shelterbelts within the Site.

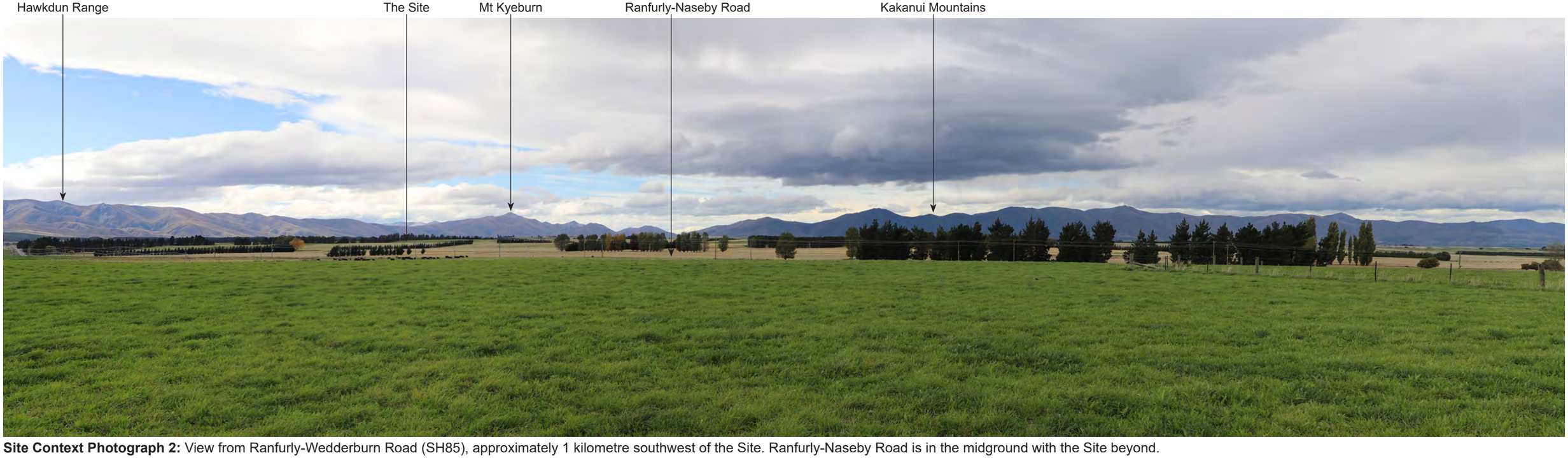
Site Appraisal Photograph B: View looking west showing one of the tall east-west pine shelterbelts that break up the Site.

Site Appraisal Photograph C: View looking northeast showing the identified wetland area located between low ridges near the centre of the Site.



Site Appraisal Photograph D: View looking south showing undulating landform and linear shelterbelts. Dwelling 4 can be seen in the distance in a gap between trees.

Site Context Photograph 1: View from Ridge Road, approximately 4.5 kilometres northeast of the Site. Naseby dwellings amongst trees to the right of the photograph and Transmission line in the midground. The Site can be glimpsed in the distance, largely screened by intervening vegetation.



Site Context Photograph 2: View from Ranfurly-Wedderburn Road (SH85), approximately 1 kilometre southwest of the Site. Ranfurly-Naseby Road is in the midground with the Site beyond.

Site Context Photograph 3: View from Ranfurly-Wedderburn Road (SH85), approximately 1.1 kilometres southwest of the Site.

Site Context Photograph 4: View from Ranfurly-Wedderburn Road (SH85), approximately 1.6 kilometres southwest of the Site.

Site Context Photograph 5: View from Ranfurly-Naseby Road, approximately 100 metres west of the Site.

Site Context Photograph 6: View from Ranfurly-Naseby Road immediately west of the Site.

Site Context Photograph 7: View from Ranfurly-Naseby Road, immediately west of the Site.

Site Context Photograph 8: View from Ranfurly-Naseby Road, approximately 135 metres northwest of the Site.

Site Context Photograph 9: View from Ranfurly-Naseby Road, immediately northwest of the Site, looking towards Fennessy Road with the LeoLabs Kiwi Space Station visible to the right of the photograph.

Site Context Photograph 10a: View from Ranfurly-Naseby Road, immediately northwest of the Site, looking down Fennessy Road.

Site Context Photograph 10b: View from Fennessy Road, approximately 375 metres northwest of the Site.

Site Context Photograph 11: View from Fennessy Road to the existing substation, approximately 1.8 kilometres northwest of the Site.

Site Context Photograph 12: View from Ranfurly Back Road, approximately 20 metres northeast of the Site, looking across the gully to the nearest Site boundary.

Site Context Photograph 13: View from Ranfurly Back Road, immediately east of the Site, looking towards Naseby Forest and Hawkdun Range with Site in the foreground to the left of the road.

Site Context Photograph 14: View fom Ranfurly Back Road, immediately southeast of the Site, looking across the Site with Hawkdun Range and Rough Ridge in the distance.

Site Context Photograph 15: View from Ranfurly Back Road, immediately southeast of the Site. Dwelling 4 partially visible to left of photograph.

Site Context Photograph 16: View from Ranfurly Back Road, immediately southeast of the Site, looking towards one of the folds between ridges showing the legibility of the landform and the linear shelterbelts that visually break up the Site.

Site Context Photograph 17: View from Ranfurly Back Road, approximately 670 metres southeast of the Site, looking towards the Site showing the elevated location of Dwelling 4 to the right.

Site Context Photograph 18: View from Bypass Road, approximately 1 kilometre southwest of the Site.

Private Viewpoint Photograph 19: View immediately outside Dwelling 2, approximately 140 metres north of the Site. The Site is partially screened by existing vegetation both within the Site and the property.

Approximate outline of the Site
Approximate extent of solar panel

Private Viewpoint Photograph 20: View from driveway of Dwelling 2, approximately 50 metres north of the Site.

Approximate outline of the Site
Approximate extent of solar panel

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Private Viewpoint Photographs 19 - 20

Date: 01 February 2024 | Revision: 0

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Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc

Private Viewpoint Photograph 21: View from Dwelling 3, approximately 600 metres northeast of the Site. The Site is largely screened by the existing vegetation within the property.

Approximate outline of the Site
Approximate extent of solar panel

Private Viewpoint Photograph 22: View immediately outside bedroom window of Dwelling 4, approximately 370 metres southeast of the Site.

Approximate outline of the Site
Approximate extent of solar panel

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Private Viewpoint Photographs 21 - 22

Date: 01 February 2024 | Revision: 0

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Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc

Private Viewpoint Photograph 23: View towards the Site is more visible from carpark area of Dwelling 4, approximately 365 metres southeast of the Site.

Approximate outline of the Site
Approximate extent of solar panel

Private Viewpoint Photograph 24: View from Dwelling 5, approximately 1 kilometres southwest of the Site. The Site is largely screened by existing vegetation.

Approximate outline of the Site
Approximate extent of solar panel

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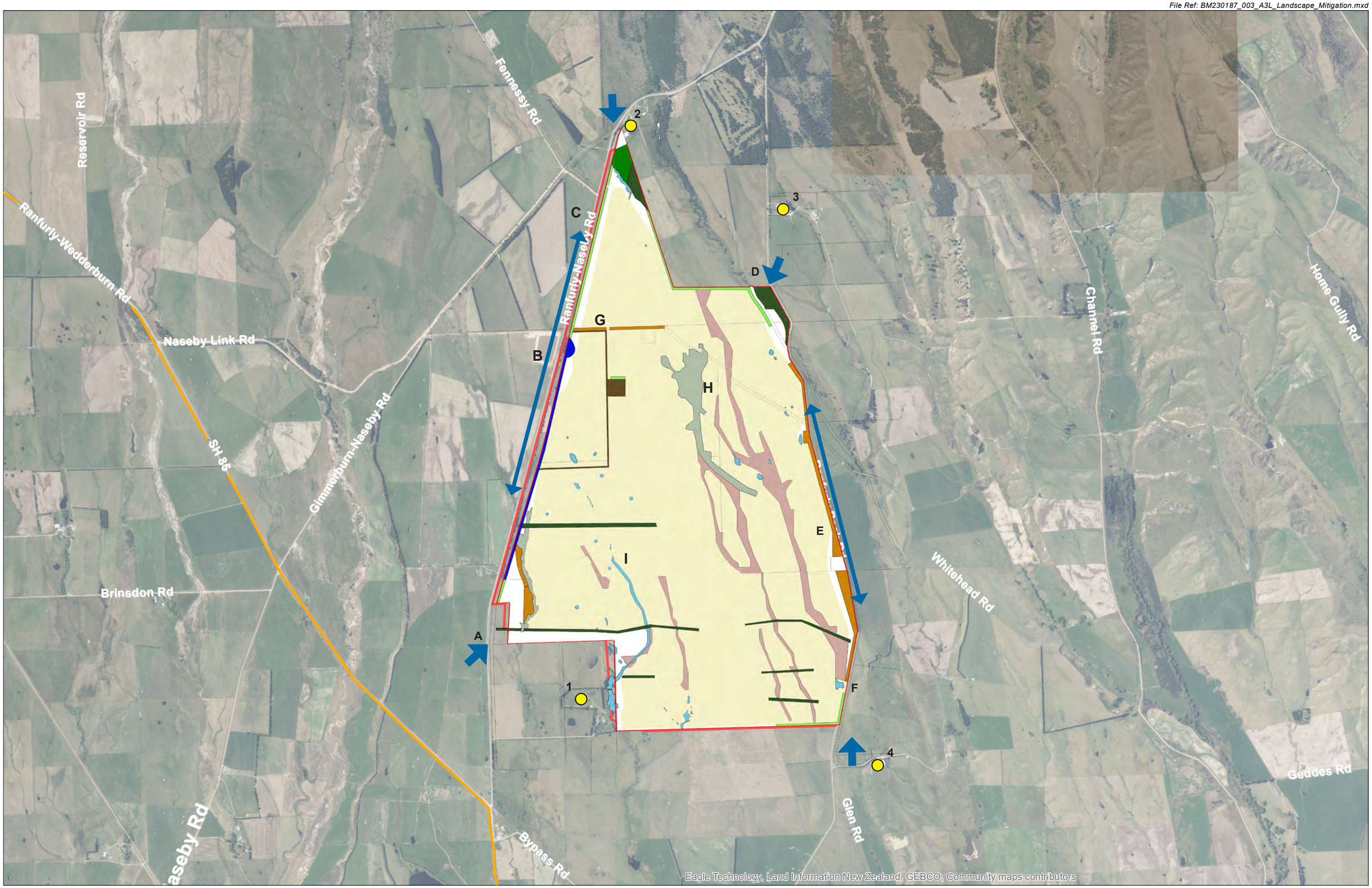
Private Viewpoint Photographs 23 - 24

Date: 01 February 2024 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc



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0 1,000 m

1:25,000 @ A3

Data Sources:
Eagles Technologies, and LINZ Data Service.

Projection: New Zealand Transverse Mercator

LEGEND

Site Boundary

State Highway 85

HELIOS MĀNIATOTO SOLAR FARM

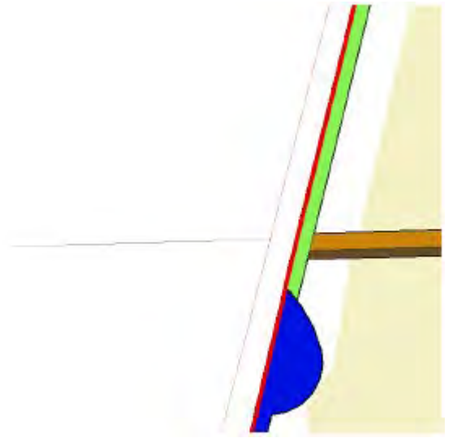
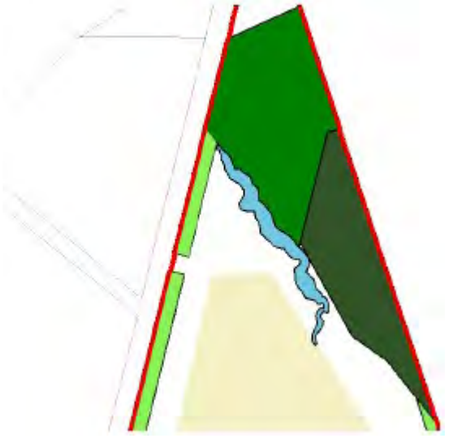
Landscape Mitigation Analysis

Date: 24 November 2023 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: HBI | Checked: SMc

Figure 7

	VISUAL ANALYSIS	MITIGATION STRATEGY
AREA A: Southwest corner 	**Existing Vegetation:** • Some existing shelterbelts are aligned with Site boundaries while others are internal. They break up the Site, preventing views to full extent of the Proposal. They also provide dark backdrops that will help visually integrate panels in some views. • Existing north-south orientated shelterbelt along Ranfurly-Naseby Road boundary will largely screen adjacent views from road. However there are gaps and thin areas where trees are failing or have failed, enabling close partial glimpses of the Site. • East-west shelterbelt on southern boundary also screens views to Site from Ranfurly-Naseby Road for users approaching the Site as they travel north. • These shelterbelts also partially screen and break up views from SH 85. • There is a gap of approximately 330m between shelterbelts at the southwest corner where open views to part of the Site are possible. • A waterway/wetland area follows the foot of the slope in this southwest corner.	**Existing Shelterbelts** • Existing gaps in shelterbelts will be infilled and existing north-south shelterbelt will be extended south to reduce viewshaft. **Setback and no-build areas:** • A large road setback of approx. 200m-300m is proposed, beyond the identified wetland, to avoid close, foreground views of the development from Ranfurly-Naseby Road, regardless of the time it may take for mitigation planting to mature. **Planting:** • Mixed native planting is proposed to provide screening in the midground of views from Ranfurly-Naseby Road. A higher proportion of tall species is recommended in this location, capable of reaching 8m-12m to screen views to low slopes and break up and soften views to more distant panels on higher slopes while mainting glimpses to mountain backdrop. • Wetland enhancement planting is also proposed to enhance the waterway/wetland area, with positive effects for natural character and landscape.
AREA B: Ranfurly-Naseby Road 	**Existing Vegetation:** • The existing shelterbelt on the Ranfurly-Naseby Road boundary stops some 1.3km before the northern end of the Site where there are currently open views across the Site, whether travelling both north or south.	**Existing Shelterbelts:** • Replacement planting will be undertaken where there are gaps or where there are trees that are failing and need to be removed. **Setback and no-build areas:** • Setbacks of 20m-50m from road are proposed along the Ranfurly-Naseby Road interface and 350m from the substation to avoid close, foreground views of the development, regardless of time required to establish mitigation vegetation. **Planting:** • Exotic shelterbelt planting is proposed along this northern Site boundary to screen views to proposed development. The proposed planting will appear as a continuation of the existing shelterbelt however it is recommended that the new planting be maintained at a height of approximately 3m to retain a sense of big skies and long distance views where possible.
AREA C: Northwest boundary 	**Existing Vegetation:** • There is an existing stand of exotic trees on slope at the northern tip of the Site, above the location of proposed development. The top of this slope is approximately 20m above the waterway/wetland at the base. • The stand of exotic trees partially screen the Site in views southeast from Ranfurly-Naseby Road and Dwelling 2. • The trees also provide dark backdrops that will help to visually integrate the panels and tie the landscape into the forested setting beyond in northbound views from Ranfurly-Naseby Road.	**Existing Trees:** • Existing stand of trees will be retained. **Setback and no-build areas:** • The area comprises a wetland and sloping hillside which will not be developed as part of the proposal. This provides a buffer for neighbours at Dwelling 2 of approximately 450m to the nearest panels. **Planting:** • Exotic pine planting is proposed to continue all the way east along the northern shared boundary with the Dwelling 2 neighbours, at their request (also see Area D below). It is recommended that trees planted on the Ranfurly-Naseby Road boundary and lower hill slopes at this northwest corner should be allowed to grow to mature height to provide maximum screening for those travelling south on Ranfurly-Naseby Road. However trees planted at the top of the slope, closest to Dwelling 2 can be maintained to a lower height if requested.

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LEGEND

- Site boundary
- Area housing solar panels
- Substation and internal access tracks
- Surveyed wetland/ponds/waterways
- High slope not suitable for solar panels
- Solar array setbacks
- Proposed exotic shelterbelt planting
- Existing exotic planting/shelterbelt to be retained
- Existing exotic shelterbelt to be infilled with similar exotic trees
- Proposed native mitigation planting
- Potential prominent crest native mitigation planting
- Potential low bund mitigation planting

HELIOS MANIOTOTO SOLAR FARM

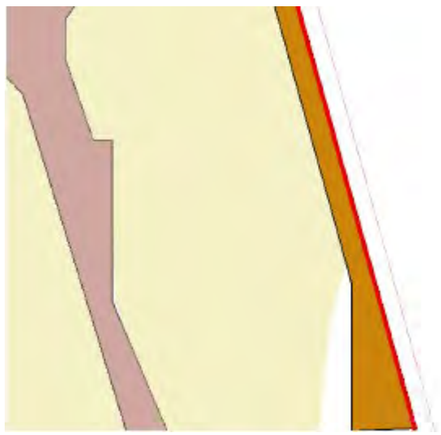
Landscape Mitigation Analysis Plan (Area A - C)

Date: February 2024 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc

Figure 7A

	VISUAL ANALYSIS	MITIGATION STRATEGY
AREA D: North and northeast corner 	**Existing Vegetation:** • There is an existing stand of exotic trees on a terrace and gully slopes at the northeast corner of the Site. • The trees partially screen views to the Site from Ranfurly Back Road and in potential southwest views from Dwelling 3 and will be retained. • The Site and the neighbouring northern Dowling property (Dwelling 2) are at a similar elevation at this northeast corner. However much of the Site further to the west is at the base of a terrace scarp, some 10-20m below the northern property. There is limited existing vegetation along the shared northern boundary between this northeast corner and the stand of exotic trees at the northwest corner (see Area C) allowing open views to the Site from the wider Dowling property.	**Setback and no-build areas:** • These planted gully slopes and terrace area will not be developed as part of the proposal other than through further planting. This will retain a large visual buffer of 200m from Ranfurly Back Road and ensure views continue to be screened. **Planting:** • A strip of planting is proposed along the Site boundary to the west of the existing vegetation, as an extension of the existing pocket of trees, to increase the level of screening from Ranfurly Back Road and in potential views from Dwelling 3. • Exotic pine planting is proposed to continue west all the way along the northern shared boundary with the Dwelling 2 neighbours, at their request (see Area C above) to asist with screening from their wider property. A section of this planting will be 10-12m below the neighbouring northern property, limiting the effectiveness of screening from this location.
AREA E: Ranfurly Back Road 	**Existing Vegetation:** • There is limited existing screening vegetation within the Site along Ranfurly Back Road with the exception of some internal east-west orientated shelterbelts towards the southeast corner of the Site which are described further in the following section (Mitigation Area F). • There are sparse, isolated indigenous dryland shrubs along the fencelines.	**Setback and no-build areas:** • The typical setback proposed from the Ranfurly Back Road boundary is approx. 20m-30m. This will allow space for the proposed planting and reduce the level of visibility in close, foreground views of the development from the road, regardless of the time it may take to establish mitigation vegetation. • The proposed setback increases towards the southern end of the Site to approx. 130m, creating a large visual buffer from the road and retaining the legibility of the shallow gully landform. **Planting:** • Native planting is proposed to provide screening along the boundary in the foreground of views from Ranfurly-Back Road. Planting will predominantly represent a dryland palette to complement existing sparse dryland shrubs with positive landscape effects. Species will largely be between 3m-4m but will include taller species capable of reaching approximately 12m in height on maturity.
AREA F: Southeast corner 	**Existing Vegetation:** • There is no existing screening vegetation along the adjacent Ranfurly Back Road boundary in this location so open views into parts of the Site are possible. • However, there are several existing east-west orientated exotic shelterbelts within the southeast corner of the Site including a shelterbelt along part of the southern boundary. While there are small gaps in most of the shelterbelts, overall they provide effective visual screens, breaking up the Site. • Together with the rolling landform, these internal shelterbelts prevent views to the full extent of the Proposal from Ranfurly-Back Road and in potential views from Dwelling 4. They also provide dark backdrops that will help to visually integrate the panels from some views. • The existing shelterbelt along the southern Site boundary will screen views from Ranfurly Back Road for users approaching the Site as they travel north.	**Setback and no-build areas:** • Development will be set back some 12-25m inside the shelterbelt along the southern boundary. Along the Ranfurly Back Road boundary, setbacks will increase to between 120m-250m, to avoid development on the wetland and adjacent steep slope and reduce visibility. **Planting:** • Infill planting of existing shelterbelts within the Site is proposed to reduce gaps. An additional shelterbelt is also proposed to extend for a length of approximately 300m along Ranfurly Back Road. The shelterbelt will extend from the existing shelterbelt on the southern boundary north to approximately the wetland to increase the level of screening over time from garden viewpoints at Dwelling 4.

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LEGEND

- Site boundary
- Area housing solar panels
- Substation and internal access tracks
- Surveyed wetland/ponds/waterways
- High slope not suitable for solar panels
- Solar array setbacks
- Proposed exotic shelterbelt planting
- Existing exotic planting/shelterbelt to be retained
- Existing exotic shelterbelt to be infilled with similar exotic trees
- Proposed native mitigation planting
- Potential prominent crest native mitigation planting
- Potential low bund mitigation planting

HELIOS MANIOTOTO SOLAR FARM

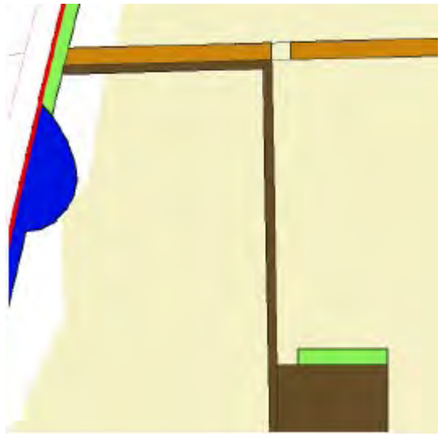
Landscape Mitigation Analysis Plan (Area D - F)

Date: February 2024 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc

Figure 7B

	VISUAL ANALYSIS	MITIGATION STRATEGY
AREA G: Internal shelterbelt 	**Existing Vegetation:** • There is limited existing screening vegetation within the northern end of the Site so there is potential for open views to a large extent of the Proposal, including the sub-station site, from Ranfurly-Naseby Road. • Proposed mitigation planting along the road boundary (Mitigation Area B) will largely screen these close, level views.	**Planting:** • Further screening or breaking up of the Site is proposed where there is potential for views above or between the proposed roadside planting, primarily for south-bound travellers at the elevated viewing location north of the Site. • Therefore, an internal strip of native planting, orientated east-west, is proposed along the south side of Access 2 between Ranfurly-Naseby Road and the Central Wetland to break up these potential expansive views, and create positive landscape effects. • A short row of tall exotic trees is also proposed along the north side of the proposed substation to screen views to, and reduce the sense of scale of the taller substation infrastructure.
AREA H: Central Wetland 	**Existing Vegetation:** • A large wetland area with existing indigenous vegetation has been identified towards the centre of the Site and will not be developed. • This large, undeveloped area will not typically be visible from immediately surrounding vantage points however it is of a scale that has potential to be discernible from potential elevated viewing areas such as recreational areas (including Outstanding Natural Landscapes) in the very distant but elevated ranges.	**Planting:** It is proposed to further utilise this opportunity to fence the waterway from stock and enhance with appropriate wetland planting to create positive natural character and landscape effects. The wetland area provides a large (11 ha) no-build area within the Site and retains some legibility of the landform and wetland feature.

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LEGEND

- Site boundary
- Area housing solar panels
- Substation and internal access tracks
- Surveyed wetland/ponds/waterways
- High slope not suitable for solar panels
- Solar array setbacks
- Proposed exotic shelterbelt planting
- Existing exotic planting/shelterbelt to be retained
- Existing exotic shelterbelt to be infilled with similar exotic trees
- Proposed native mitigation planting
- Potential prominent crest native mitigation planting
- Potential low bund mitigation planting

HELIOS MANIOTOTO SOLAR FARM

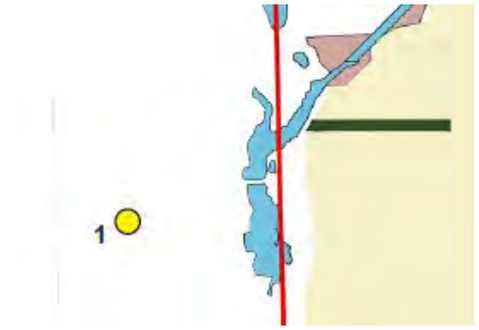
Landscape Mitigation Analysis Plan (Area G - H)

Date: February 2024 | Revision: 0

Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc

Figure 7C

	VISUAL ANALYSIS	MITIGATION STRATEGY
DWELLING 1 	• Approximately 250m to nearest panels to the east and 500m to nearest panels to the north. • Dwelling 1 appears to be surrounded by mature hedging, screening views to the Site. • Should the hedging be removed, views to the north would be distant and largely screened by on-site shelterbelts while development to the northeast and east would be visible in medium to distant views.	• No specific mitigation is proposed. The residents are one of the two landowners leasing land to Helios for this development. Through their support for the development, distance of the dwelling and natural features in between the dwelling and the solar farm, no concerns were raised on the need for the screening of the solar farm from their dwelling.
DWELLING 2 	• Approximately 450m to nearest panels to the southwest. • Dwelling 2 is partially enclosed by mature hedging, screening some views to the Site. A portion of the northeast extent of the Proposal will be visible.	• Exotic pine planting is proposed on the hillside to break up and screen elevated southbound views from both Ranfurly-Naseby Road and Dwelling 2. It is recommended that trees planted on the Ranfurly-Naseby Road boundary and lower hill slopes at this northwest corner should be allowed to grow to mature height to provide maximum screening for those travelling south on Ranfurly-Naseby Road. However trees planted at the top of the slope, closest to Dwelling 2 can be maintained to a lower height if requested.
DWELLING 3 	• Approximately 650m to nearest panels to the southwest. • Dwelling 3 is surrounded by mature hedging, screening views to the Site.	• Additional planting is proposed on the west side of the gully, extending west along the Site boundary for approx. 280m to the crest of the ridge. This is primarily a response to mitigate closer views from Ranfurly Back Road but will also serve as mitigation for Dwelling 3 if required. • Planting is currently shown in the form of continuous exotic shelterbelt planting but a native planting mix could also be suitable in the vicinity of the gully.
DWELLING 4 	• Approximately 450m to nearest panels to the northwest. • Dwelling appears to be surrounded by mature hedging, screening views to the Site. • Should the hedging be removed, views to the northwest would be distant with the full extent of the Site broken up by on-site shelterbelts.	• Planting to fill gaps in existing shelterbelts and additional exotic shelterbelt planting is proposed within the Site. The new section of planting will extend for a length of approximately 300m along Ranfurly Back Road. This is primarily a response to mitigate closer views from the road but over time, will also screen views from some garden areas for Dwelling 4.

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LEGEND

- Site boundary
- Area housing solar panels
- Surveyed wetland/ponds/waterways
- High slope not suitable for solar panels
- Solar array setbacks
- Proposed exotic shelterbelt planting
- Existing exotic planting/shelterbelt to be retained
- Proposed native mitigation planting
- Dwellings 1-4

HELIOS MANIOTOTO SOLAR FARM

Landscape Mitigation Analysis Plan (Dwelling 1 - 4)

Date: February 2024 | Revision: 0

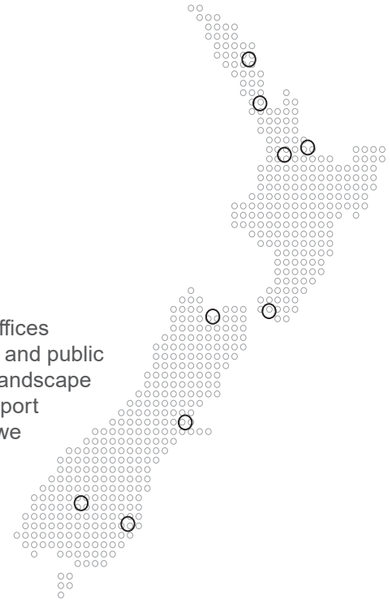
Plan prepared for Helios Energy Ltd by Boffa Miskell Limited

Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: SCh | Checked: SMc

Figure 7D

Together. Shaping Better Places.

Boffa Miskell is a leading New Zealand environmental consultancy with nine offices throughout Aotearoa. We work with a wide range of local, international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, Te Hīhiri (cultural advisory), engagement, transport advisory, climate change, graphics and mapping. Over the past five decades we have built a reputation for creativity, professionalism, innovation and excellence by understanding each project's interconnections with the wider environmental, social, cultural and economic context.



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