Burrah Park

Glint and Glare Assessment

Prepared for HBB Property

June 2025

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HBB Property

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Executive Summary

This Burrah Park Glint and Glare Assessment has been prepared by EMM Consulting to accompany a State Significant Development Application (SSDA) for a Concept and Stage 1 SSDA for a Warehouse and Logistics Estate at 1953-2109 Elizaeth Drive, Badgerys Creek. The site is legally described as Lot 1 in Deposited Plan 1306448.

The applicant, the trustee for Burra Park Prop Trust 1 is a joint venture entity, with ISPT Core Fund and UniSuper each holding an equal share. HB&B and ISPT have been appointed as the development team to oversee the project's delivery. By leveraging the expertise of both organizations, the venture is well-positioned to maximise Burrah Park's value to the community.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the project (SSD- 70316465).

The assessment of glare from the proposed Burrah Park development indicates that glare from the roof-mounted solar panels have the potential to cause glare along all the surrounding roads and the flight path into the airport. Yellow glare, which has the capacity to cause momentary after-image in the eye, is predicted at the following locations:

- WSI flight path (approach path from north of the runway) – February to May and August to November between 4:00 and 6:00 pm
- Elizabeth Drive – April through August between 4:00 and 5:00 pm
- M 12 motorway – February and October between 5:30 and 6:45 pm
- M 12 westbound to the airport connection – November through February between 5:30 and 6:30 pm
- M 12 airport connection (between the M 12 and Elizabeth Drive) – April, and June through August between 3:30 and 5:00 pm.

The glare assessment of the buildings proposed in the masterplan indicates that there is potential for glare along the flight path, Elizabeth Drive, the M 12 motorway, the M 12 airport connection, and the airport entry. Yellow glare was predicted to occur at the following locations:

- Elizabeth Drive – All year between 5:00 and 8:00 am, and again at 4:30 to 7:00 pm
- M 12 westbound to the airport connection – All year between 4:30 and 7:30 am, and again at 11:00 am to noon
- M 12 airport connection (between the M 12 and Elizabeth Drive) – September through March between 5:00 and 7:30 pm.

This report has identified mitigation techniques using architectural treatments and landscape planting. Due to the severity of the glare (occurrences over the year and duration of each occurrence) the following measures are recommended for the development.

Aviation activities:

- No mitigation is necessary for aviation / airport activities.

Roads:

- Glare affecting roads surrounding the development would fall under the jurisdiction of Transport for NSW (TfNSW). While there is no guidance surrounding glare on roadways, it is assumed that a certain amount of

glare is unavoidable and is there for accepted. This report recommends that the yellow glare affecting roadways be mitigated.

- It is noted that mature trees in the locations shown on the masterplan may screen most of the glare from the roofs and walls of the buildings, however there are no existing trees along the roadways.

- In the absence of a screening tree canopy, architectural mitigation is needed in conjunction with tree planting. Architectural mitigation should include a combination of the following:

    - use darker colour tones along the upper wall sections

    - use materials with a matte finish

    - articulate the façade of the buildings to diffuse the reflected sunlight.

- The glare affecting the surrounding roads should be considered temporary as trees installed along the perimeter of the development will develop an effective screen. The proposed Burrah Park masterplan indicates that there would be sufficient landscape area between the project boundaries and the building structures to provide the screening required to mitigate the glare. Since the development layout provides for the necessary screening, adjustments to the building layouts would not be necessary.

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Photographs

No table of contents entries found.

Plates

No table of contents entries found.

1 Introduction

This report has been prepared to accompany an SSDA at 1953-2109 Elizabeth Drive, Badgerys Creek (SSD-70316465). The application seeks consent for a concept plan including future development lots and building footprints. The development also seeks consent for the Stage 1 works which will include bulk earthworks across the site, infrastructure delivery, road access/intersections, internal road construction, civil infrastructure and utilities, stormwater infrastructure works and the construction of three (3) warehouse buildings.

Specifically, development consent is sought for:

- Concept Plan
  - Concept Masterplan for the Burrah Park comprising warehouse buildings, internal road network layout, building locations, GFA, car parking, concept landscaping, building heights, setbacks, signage strategy, public art strategy, design excellence strategy and Connection with Country framework.
  - Developable area 131.45ha.
  - Total approximate GFA 63.00ha
- Stage 1 – site preparation works
  - Demolition and removal of existing structures and vegetation.
  - Heritage salvage works (if applicable).
  - Construction of roads, access infrastructure, including a signalised intersection with Elizabeth Drive.
  - Dam de-watering and de-commissioning.
  - Bulk earthworks, cut and fill, benching, battering and retaining walls.
  - Lead in infrastructure, utilities and servicing.
  - Stormwater infrastructure including construction of Sydney Water basins and Water Sensitive Urban Design (WSUD) elements.
- Stage 1 – Development
  - Construction and fit out of 3 warehouse buildings and ancillary office space.
  - Stormwater management, fencing and landscaping.
  - Internal road network, active transport network, public domain and open space.
  - Subdivision, and
  - Estate and on lot signage.
  - Total approximate GFA 85,864sqm
    - Warehouse 1.1 – 26,860sqm
    - Warehouse 1.2 – 31,443sqm

- Warehouse 3.1 – 27,561sqm

This report has been prepared to respond to the Western Sydney International (Nancy-Bird Walton) Airport (WSI) request for information (RFI) issued for the project, which states:

> A Glint and Glare Study is to be prepared and submitted to the Department of Planning, Housing and Infrastructure and WSI to understand the cumulative impact from materials used in the building together with the solar panels across the site. This will be required to be referred to CASA.

1.1 The Site

The key features of the site are summarised in Table 1.1 below.

Table 1.1 Key Features of site and locality

Descriptor	Site detail
Land Configuration	The site is legally described as Lot 1 in Deposited Plan 1306448. The site area is 171.84ha. The site generally slopes from high points adjacent to Elizabeth Drive (RL 75) to low points in the northeast corner (RL 40). Topography is characterised by a central ridgeline running from the central portion of the southern boundary towards the northeast.
Surrounding Land Use	Surrounding land uses include: M 12 Motorway and Metro (under construction) to the north and east with predominantly rural uses beyond Western Sydney Airport is under construction opposite the site on the southern side of Elizabeth Drive, Rural residential uses on the opposite side of Cosgroves Creek to the west.
Site Access and road network	The site is accessible from Elizabeth Drive, a State arterial road aligned in an east-west direction adjacent to the southern boundary.
Easements and Covenants	An easement for electricity purposes is located on the northern side of the site.
Services	The site has power and water available.
Acid Sulfate Soils	Not mapped.
Contamination	The site has the potential to be contaminated, due to the current agricultural land use. A Detailed Site Investigation will be submitted as part of the SSDA lodgement. As per previous Detailed Site Investigation prepared by Douglas Park, the site is appropriate for proposed development subject to remediation works undertaken.
Stormwater and Flooding	As indicated in the *Wianamatta (South) Creek Flood Study – Existing Conditions (Prepared by Advisian for Infrastructure NSW, November 2020)* the site is subject to 1:100 ARI (average recurrence interval) along the main creek lines of Cosgroves and Badgerys Creek.
Bushfire Prone Land	The site is classified as bushfire prone land. A bushfire report will be submitted with the SSDA.
Flora and Fauna	The site currently consists of cleared rural land with the occasional scattered Cumberland Plain Woodland, trees, weeds, and shrubs. Most of the site is certified under the Cumberland Plain Conservation Plan (CPCP)
Riparian Corridor	Cosgroves Creek and Oaky Creek run along the western part of the site, while Badgerys Creek runs along the eastern side. The proposed development is designed to generally avoid land zoned ENZ. The site contains multiple hydrolines and dams.

Table 1.1 Key Features of site and locality

Descriptor	Site detail
Aboriginal Heritage	Aboriginal objects have been identified along the Oakey Creek – Cosgroves Creek corridor along the entirety of the western study area boundary.
European Heritage	The site does not contain any State or locally significant heritage listed items. The site does form part of the former CSIRO McMaster Field Station which is identified as a potential heritage item under the Precinct Plan. The site is adjacent to the McGarvie Smith Farm which is identified as a local Heritage Item under the *State Environmental Planning Policy (Precincts—Western Parkland City) 2021*.

KEY

- Site boundary

Existing environment

- Major road
- Minor road
- Named watercourse
- Named waterbody
- Cadastral boundary

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2025); ABS (2021); DCSSS (2024); ESRI (2025); GA (2009)

0 1 2 km

GDA2020 MGA Zone 56

N

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Project location

Burrah Park
Glint and Glare Assessment
Figure 1.1

EMM
creating opportunities

1.2 Project elements pertaining to glare

The Burrah Park development is a warehouse and logistics estate comprising warehouse buildings and ancillary office space. Supporting infrastructure includes an internal road network, parking and supporting utilities infrastructure.

This report is based on the site layout and built form presented in the Burrah Park Urban Design Report, Revision F, prepared by Nettleton Tribe dated October 2024 (refer to Figure 1.2). The Urban Design Report indicates a shallow pitch to the roof with solar panels taking up small portions of the roof. The direction the roofs are sloping and the direction the solar panels are facing have been taken from the masterplan and illustrations in the Urban Design Report. Based on the Urban Design Report, the glint and glare assessment assumes:

- The buildings are three storeys with a ridge height of 14.6 m
- The lower third of the building is made of dark, low reflective materials
- The upper two-thirds of the building is made of light colours.

Given the above designs, this assessment has used the following parameters:

- Roof level – ridgeline at 14.6 m above ground level
- Roof pitch of 5 degrees
- Solar panel orientation is either 10 degrees or 100 degrees east of north depending on the building orientation on the site (refer to Figure 1.2 and Figure 1.3)
- At most, only half of any building's roof surface is taken up with solar panels. This is based on the renderings in the Urban Design Report (refer to Figure 1.3)
- The upper two thirds of the walls are light coloured and reflective (refer to Figure 1.4).

This glint and glare assessment measures the potential for glare from the solar panels along major transport routes, aviation approach and take off paths, passenger terminal building, and representative residences near the development.

Figure 1.2 Burrah Park Masterplan

Source: Nettleton Tribe, October 2024

Figure 1.3 Illustration showing the solar panel placement and roof orientations

Source: Nettleton Tribe, October 2024

Figure 1.4 Typical façade on the buildings

Source: Nettleton Tribe, October 2024

1.3 Reflectivity and glare

Glint and glare are potential impacts of sunlight reflecting off the proposed solar project elements. When sunlight is reflected off a smooth, reflective surface, it can result in glint or glare. Glint refers to short, momentary periods of intense levels of exposure to reflection. Glare refers to sustained or continuous periods of exposure to excessive brightness, but at a reduced level of intensity. Glint is a quick reflection or flash of light, while glare is experience for a longer period of time. Both of these can be annoying and dangerous in certain situations by causing momentary blindness.

Reflection in the form of glint and glare will only be possible when direct sunlight occurs. Therefore, in those instances where glint and glare from the project elements may occur, people will also likely experience direct sunlight, which will be a significantly brighter and more intense source of light than reflections. Nonetheless, glint and glare may result from the project and may have an impact on receptors (dwellings within proximity of the development, motorists travelling along the local road network, and aviation traffic approaching the new airport).

1.4 Reflectivity

Generally, the light reflected is diminished by first hitting the substrate that reflected it. Since solar cells are designed to absorb light energy to create electrical currents, they will only reflect a portion of the sunlight that falls on them.

Typically, solar panels are constructed from a treated glass that is designed to minimise reflection and maximise the amount of light transmitted through the glass to the receptor. Typical treated glass that is used for solar cells reflects about 4% of the light that hits the cell. This is equivalent to a water body (pond or lake), which is considered to be a fairly low amount of reflection.

1.5 Angle of reflection

The angle of reflection of light off a reflective surface is directly related to the angle of incidence of the light from the source. In the case of a PV array, the sunlight will reflect off the panel at the same angle as it arrives from the sun. If the panel is stationary, as is the case for this development, the sun's angle relative to the solar panel will vary by time of day and therefore reflect toward the west in the morning and eastward in the evening.

The seasonal change of the sun's movements will vary the reflection angles as well. As the sun moves southward in the summer months, the reflection will move northward, and vice versa in the winter months (when the sun is north of the equator). This movement changes the reflection angle in a north-south direction.

2 Glare analysis

A glare analysis was performed using specialised software (ForgeSolar), which is attached to this report in Appendix A. The calculations were based on the description in Section 1.2 and the solar array properties outlined below:

- solar panels fixed to the roof at the same pitch and orientation of the roof
- smooth glass with anti-reflective coating
- light absorption efficiency and/or refractive index values varies with sun angle.

The software calculates the minutes of potential glare predicted at each location every day through the course of a year. The results indicate the number of minutes predicted at each location along with the type of glare expected. The classifications of glare from the software are:

- Green glare – glare is present with only a low potential for temporary after-image or flash blindness. This type of glare is considered a low impact.

- Yellow glare – glare has a moderate potential for temporary after-image or flash blindness. This type of glare is considered a moderate impact.

- Red glare – glare with high potential for permanent eye damage. This type of glare is considered a high impact.

The glare analysis produced by the software does not account for physical obstructions between the solar arrays and the residences and motorists. This includes the presence of buildings, trees, and other structures. It also assumes the weather is sunny each day for the duration of daylight hours. Therefore, a worst-case scenario is calculated.

Glare impact in this report were assessed for glare off the roof-mounted solar panels and external walls of the warehouse buildings as presented in the Urban Design Report. Plans for the new M 12 motorway and entry to the airport were unavailable and therefore the glare assessment is based on the road alignments at ground level.

2.1 Road receptors

The key considerations for quantifying impact significance for road users along state, local, or regional roads are:

- Where reflections originate from outside of the road user's main field of view (50 degrees either side of the direction of travel), or where the separation distance to the nearest visible reflecting panel is over 1km, the impact significance is low, and mitigation is not required.

- Where reflections are anticipated to occur within a road user's field of view, the potential impact is considered moderate. Expert evaluation of several mitigating factors is necessary to determine the extent of mitigation needed:

    - Assessment of visibility for drivers at higher elevations, particularly relevant for dual carriageways and highways.

    - Identification of whether the solar reflection originates directly in front of a road user, as such reflections pose a greater hazard.

    - Evaluation of the separation distance from the panel area, with larger distances reducing the glare's impact on the observer's field of view.

- Consideration of the position of the Sun, as glare effects coinciding with direct sunlight are less pronounced compared to those occurring at other angles.

- If reflections stem directly in front of a road user without further mitigating circumstances, the impact significance escalates to high, necessitating mitigation measures.

2.2 Aviation receptors

All air traffic control towers and take-off and landing approaches to any runway are considered aviation receptors. The WSI is located south of the Burrah Park development. Solar panels and other reflective surfaces from the development can create the possibility for glare instances that could affect aviation activities.

The key considerations for quantifying impact significance for aviation receptors are:

- Reflections that impact visibility from an air traffic control facility. The WSI does not have an air traffic control facility on site at the airport. Therefore, no assessment has been conducted for air traffic control.

- Reflections that impact pilots' visibility from aircraft are assessed up to a distance of 3.2 km. Where reflections originate from outside of the pilots' main field of view (50 degrees either side of the direction of travel), the impact significance is low, and mitigation is not required.

2.3 Analysis receptors

Receptors identified and used for the glare assessment are listed in Table 2.1.

Table 2.1 Receptors used for the glare analysis

Receptor	Location	Receptor type
OP 1	Airport terminal building	Private
OP 2	852 Luddenham Road	Private
OP 3	775 Luddenham Road	Private
FP 1	WSI Runway approach (north of runway)	Flight path
FP 2	WSI Runway approach (south of runway)	Flight path
Runway	WSI runway	Flight path
Airport entry	Vehicular entry to airport	Roadway
Elizabeth Drive	South of subject site	Roadway
M 12	North of subject site	Roadway
M 12 West (to airport connection)	West of subject site	Roadway
M 12 airport connection	West of subject site	Roadway
Luddenham Road	East of subject site	Roadway

3 Glare analysis results

3.1 Solar panels

Glare analysis results indicate the WSI flight path approaching the airport from the north will be impacted by glare in the late afternoon for most of the year. The M 12 motorway and Elizabeth Drive would also be impacted by glare for large portions of the year. Table 3.1 summarises the amount of glare that each receptor is predicted to receive over the course of a year. It also breaks down the type of glare that is expected to be experienced. A diagram illustrating the locations of the glare is shown in Figure 3.1.

Note that only the receptors that were impacted by glare from the solar panels are shown in Table 3.1.

Table 3.1 Glare analysis results – solar panels

Location	Location name assigned by software	Glare from solar arrays			Glare timing (colour of cells indicates type of glare)		
		Green glare (minutes per year)	Yellow glare (minutes per year)	Red glare (minutes per year)	Time of year	Time of day	Max duration of glare per occurrence (minutes)
WSI flight path – north of runway	Flight Path: FP1	17,130	2,057	0	Aug – May	14:30 – 18:30	100
					Feb – May, Aug – Nov	16:00 – 18:00	60
Elizabeth Drive	Route: Elizabeth Drive	4,280	3,024	0	Jan – Mar, Sept – Nov Mar – Sep	05:00 – 06:30 15:30 – 17:30	15 35
					Apr – Aug	16:00 – 17:00	25
M 12	Route: M-12	4,462	195	0	Sep – Mar Sep – Apr	04:30 – 06:15 17:00 – 19:00	20 35
					Feb, Oct	17:30 – 18:45	15
M 12 westbound to airport connection	Route: M12-southbound	40	0	0	Oct – Mar	17:00 – 19:00	22
					Nov – Feb	17:30 – 18:30	10
M-12 airport connection	Route: M12 - Northbound	1,801	0	0	Sep – Mar May - Aug	17:30 – 19:00 15:45 – 17:00	10 35
					Apr, Jun – Aug	15:30 – 17:00	25
Luddenham Road	Route: Luddenham Road	161	0	0	Mar, Sep – Oct	05:30 – 06:15	10
775 Luddenham Road	OP 3	787	0	0	Oct – Feb	05:00 – 06:00	18

Note: Duration of "glare from solar arrays" may include duplicate times of glare from multiple solar array areas.

Figure 3.1 Solar panel glare areas

Figure 3.1 indicates the locations areas that are predicted to cause glare and receive glare from the solar panels as described below.

- Glare types:
  - Green areas indicate green glare
  - Yellow areas indicate yellow glare
- Green and yellow areas on the rooftops (within the masterplan area) indicate the type of glare from that array of solar panels
- Green and yellow areas outside the masterplan area indicate the type of glare experienced from those locations.
- Blue lines indicate flight paths and blue circles are dwellings and airport terminal receivers.

Table 3.2 below summarises the predicted impacts and mitigation requirement for the receptors where solar reflections are geometrically possible. Mitigation methods are discussed further in Section 5.

Table 3.2 Solar panel glare location impact significance

Receptor	Identified Screening (Desk based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended?
WSI flight path – north of runway	Views and glare will be possible based on the elevated position of the flight path. No screening is evident in the masterplan for the development.	Moderate	The flight path is very close to the proposed development and passes above the roofline. The flight path location would therefore experience glare when the sun is in the western sky. Yellow glare from the solar panels would occur during 4:00pm – 6:00pm, February through May, and August through November.	Yes. Refer Section 5.
Elizabeth Drive	The masterplan indicates there will be trees planted along the southern boundaries of the development. In time, when the trees reach the heights of the adjacent buildings, screening of glare from the roofs is expected.	Low	N/A	No
M 12	The masterplan indicates there will be trees planted along the northern boundaries of the development. In time, when the trees reach the heights of the adjacent buildings, screening of glare from the roofs is expected.	Low – green glare locations Moderate – areas with yellow glare	Locations along the M 12 are predicted to experience yellow glare all year. These locations are fairly short in distance and therefore the duration of glare experienced would be minimal as drivers pass through them. The glare would be experienced by drivers as they travel toward the sun. The brightness of the sun tends to reduce the effect of glare on observers.	Yes. Refer Section 5.
M 12 westbound to airport connection	The masterplan indicates there will be trees planted along the eastern boundaries of the development. In time, when the trees reach the heights of the adjacent buildings, screening of glare from the roofs is expected.	Low – green glare locations Moderate – areas with yellow glare	Locations along the M 12 are predicted to experience yellow glare all year. These locations are fairly short in distance and therefore the duration of glare experienced would be minimal as drivers pass through them.	Yes. Refer Section 5.
M-12 airport connection	The masterplan indicates there will be trees planted along the eastern boundaries of the development. In time, when the trees reach the heights of the adjacent buildings, screening of glare from the roofs is expected.	Low – green glare locations Moderate – areas with yellow glare	Locations along the M 12 are predicted to experience yellow glare all year. These locations are fairly short in distance and therefore the duration of glare experienced would be minimal as drivers pass through them.	Yes. Refer Section 5.
Luddenham Road	Existing trees along Cosgroves Creek and Oaky Creek provide screening from the development. The masterplan also shows wide swathes of planting adjacent to the creek in the future, which will bolster the existing screening.	Low	N/A	No

3.2 Building surfaces

Glare analysis results indicate the M 12 connection to the airport and Elizabeth Drive would be significantly impacted by glare from the buildings for large portions of the year. The M 12 is also expected to be impacted by glare in locations adjacent to the development. Table 3.1 summarises the amount of glare that each receptor is predicted to receive over the course of a year.

Note that only the receptors that were impacted by glare from the solar panels are shown in Table 3.1.

Table 3.3 Glare analysis results – vertical surfaces

Location	Location name assigned by software	Glare from solar arrays			Glare timing (colour of cells indicates type of glare)		
		Green glare (minutes per year)	Yellow glare (minutes per year)	Red glare (minutes per year)	Time of year	Time of day	Max duration of glare per occurrence (minutes)
WSI flight path – north of runway	Flight Path: FP1	153	0	0	Apr – May, Aug – Sep	Not specified	15
Elizabeth Drive	Route: Elizabeth Drive	2,431	9,396	0	All year Mar, Apr, Sep – Nov	04:30 – 07:30 17:00 – 18:30	30 30
					All year	05:00 – 08:00 16:30 – 19:00	75 75
M 12 westbound to airport connection	Route: M 12-southbound	404	10,768	0	May – Aug Oct – Mar	06:30 – 07:30 11:00 – 12:00	8
					All year	04:30 – 07:30 11:00 – 12:00	40
M-12 airport connection	Route: M 12 - West	297	2946	0	Apr, Sep	17:00 – 18:00	15
					Sep – Mar	17:00 – 19:30	20
Airport entry	Route: Airport entry	127	0	0	May, Jul	06:45 – 07:30	5

Table 3.4 below summarises the predicted impact significance and mitigation requirement for the receptors where solar reflections are geometrically possible. Mitigation methods are discussed further in Section 5

Table 3.4 Building surfaces glare location impact significance

Receptor	Identified Screening (Desk based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended?
WSI flight path – north of runway	Glare will be possible based on the location of the flight path relative to the surfaces. No screening is evident in the masterplan for the development.	Low	N/A	No

Table 3.4 Building surfaces glare location impact significance

Receptor	Identified Screening (Desk based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended?
Elizabeth Drive	The masterplan indicates there will be trees planted along the southern boundaries of the development. As the trees grow, their canopies will screen sunlight from hitting the building surface and they will screen reflections from the surfaces.	Moderate	Locations along Elizabeth Drive are predicted to experience yellow glare all year. The glare would be experienced by drivers as they travel toward the sun. The brightness of the sun tends to reduce the effect of glare on observers.	Yes. Refer to Section 5.
M 12 westbound to airport connection	The masterplan indicates there will be trees planted along the southern boundaries of the development. As the trees grow, their canopies will screen sunlight from hitting the building surface and they will screen reflections from the surfaces.	Moderate	Locations along the M 12 are predicted to experience yellow glare all year. The glare would be experienced by drivers as they travel toward the sun. The brightness of the sun tends to reduce the effect of glare on observers.	Yes. Refer to Section 5.
M 12 airport connection	The masterplan indicates there will be trees planted along the southern boundaries of the development. As the trees grow, their canopies will screen sunlight from hitting the building surface and they will screen reflections from the surfaces.	Moderate	Locations along the M 12 airport connection are predicted to experience yellow glare from September to March. The glare is expected to occur in the evenings for a maximum duration of 20 minutes.	Yes. Refer to Section 5.
Airport entry	The masterplan indicates there will be trees planted along the southern boundaries of the development	Low	N/A	No

4 Cumulative impacts

Cumulative impacts refer to the combined glare from multiple sources over a period of time, which can significantly affect visual comfort and potentially compromise safety. Glare may originate from various sources, including artificial lighting, reflective surfaces, or natural sunlight. Rather than assessing these impacts at a single point in time, a cumulative glare assessment evaluates the long-term effects of these multiple sources collectively. This comprehensive approach considers how the interaction of different glare sources contributes to visual discomfort, safety concerns, and, in some cases, environmental implications.

Assessing cumulative glare impacts takes into account developments of a similar nature that are planned near the Burrah Park development. While this assessment does not perform a cumulative impact assessment from all potential sources surrounding the development, it identifies potential for cumulative impacts on the receptors used for the glare assessment. The results are listed in Table 4.1.

Table 4.1 Significant developments near the Burrah Park development

DA Reference	Development Description	Receptor affected	Description of potential impact
DHL Warehouse and Logistics Facility (Southern Site)	Construction of two single storey warehouse buildings, landscaping works, associated vehicle crossings and drainage connection to the road drainage system, signage and wayfinding.	Flight path 1, Elizabeth Drive, Airport entry, M 12 airport connection, M 12	This site is within the Burrah Park development and has been included in the glare analysis
DHL Logistics Facility Badgerys Creek (North)	Construction of two single storey warehouse buildings, landscaping works, associated vehicle crossings and drainage connection to the road drainage system, signage and wayfinding.	Flight path 1, Elizabeth Drive, Airport entry, M 12 airport connection, M 12	This site is within the Burrah Park development and has been included in the glare analysis
Altis Warehousing Estate 2289-2309, 2311 Elizabeth Drive, Luddenham	Construction and operation of a warehouse and distribution estate.	Elizabeth Drive	Potential to extend the distance that glare is experienced along Elizabeth Drive
Elizabeth Enterprise Precinct – Stage 1 1669-1723 Elizabeth Drive, Badgerys Creek	Concept Masterplan and Stage1 Development for general industry and warehouse distribution centres	Elizabeth Drive	Potential to extend the distance that glare is experienced along Elizabeth Drive
Elizabeth Drive Upgrades	The upgraded road will provide two lanes in each direction together with a median island, landscaping and paths. The proposed upgrades relate to 11.4km of road.	Elizabeth Drive, FP 1, runway, airport entry, OP 1 (terminal building), and OP 2 (	There may be additional glare sources during construction of the upgrades. There is nil to low potential for cumulative glare impact on identified receptors.
Mixed Use Hotel and Commercial Development 1990 Elizabeth Drive, Badgerys Creek	A concept masterplan to support development for the purpose of tourist and visitor accommodation and commercial premises.	Elizabeth Drive	Potential to extend the distance that glare is experienced along Elizabeth Drive

DA Reference	Development Description	Receptor affected	Description of potential impact
WSI Airport	Staged proposal comprising the construction and operation of a new international airport.	Flight paths, runway, Elizabeth Drive, Airport entry, M 12 airport connection	Buildings proposed along the airport entry may cause glare for FP 1, Elizabeth Drive, and the entry road to the airport.
M 12 Motorway	A new dual-carriageway motorway to connect the M7 Motorway with the Western Sydney Airport and The Northern Road. The motorway will be initially two lanes in each direction, with capacity for an additional future lane in each direction.	M 12, Luddenham Road, OP 3 (775 Luddenham Road)	The M 12 is identified as a receptor. There is nil to low potential for cumulative glare impact on identified receptors.
Western Sydney Freight Line	Proposed dedicated freight rail line connection between the Western Parkland City and Port Botany. The new freight rail line will free up the Main West Rail Line to allow more passenger services over time.	None	No impacts anticipated
Sydney Metro – Western Sydney Airport	A new metro line to service Western Sydney International Airport, the Western Sydney Aerotropolis and interchanging with the T1 Western Line at St Marys	M 12, Elizabeth Drive	No impacts anticipated

5 Mitigation measures

A range of visual impact mitigation methods are available to reduce glare. Mitigation measures specific to the project have been identified and are outlined below.

5.1 Architectural finishes

External finishes on a building determine the amount of glare that can be reflected of the external surface. Generally, light coloured, glossy finishes tend to reflect sunlight, whereas matte finishes and darker colours reflect less light because they diffuse and absorb light.

Large flat surfaces will reflect light consistently across a large area in the surrounding landscape. Breaking up a large surface plane with different materials and smaller wall planes can diffuse the reflection and reduce the intensity of the glare.

The proposed Burrah Park masterplan indicates the buildings will be large with flat wall surfaces. They will have darker materials at ground level with white smooth surfaces along the upper two-thirds of the building. Although the final material selection is unknown at the writing of this report, the large white expanses of walls shown on the plans will maximise the glare from sunlight. To reduce glare from the external surfaces, the architectural treatment can use darker colour tones with a matte finish and articulate the façade to diffuse the reflected sunlight.

5.2 Vegetation retention

Existing trees can offer significant screening due to their size and density. As such, retaining as much of the mature vegetation as possible is recommended as part of a mitigation strategy.

The only significant vegetation on the site is along Cosgroves Creek and Oaky Creek, which run along the western boundary of the development. Maintaining these trees will provide a screen to block reflections from the rooftop solar panels and the vertical surfaces of the buildings toward the west.

5.3 Landscaping

The masterplan for Burrah Park shows significant planting within the development. Trees between buildings internal to the development are expected to screen any reflections from the vertical surfaces that are located away from the external boundaries. The vertical surfaces that would be expected to cause glare would be the walls adjacent to the external boundaries. The masterplan shows substantial planting along the external boundaries of the development. As these trees mature, they would be expected to screen sunlight from hitting the walls and they would screen reflections from the walls, reducing the glare impacts.

The built forms illustrated in the Urban Design Report indicate that some trees will grow tall enough to screen the glare from the rooftop solar panels. It is likely that, given the right species, trees would grow tall enough to screen reflections from the roof toward the surrounding roads (located at ground level). It is unlikely that trees would grow tall enough to screen the glare affecting the flight path.

5.4 Solar panel backtracking adjustments

Mitigation using solar panel tracking limits are not applicable to this development since the solar panels are mounted directly to the roof of the buildings.

5.5 Suggested mitigation measures

The locations that may experience yellow glare have been assigned a glare rating of moderate. While there is no definitive measure of glare that is acceptable or unacceptable for flight paths and roads in Australia, the United States Federal Aviation Administration (FAA) standards have been used for assessing glare from solar panels toward aviation activities. The FAA (FAA 2021) consents that green glare is acceptable for aircraft and air traffic control towers, while yellow glare should be mitigated. Using the FAA practice as a guide means that yellow glare identified in this assessment needs mitigation.

This glare assessment has identified mitigation techniques using architectural treatments and landscape planting. Due to the severity of the glare (occurrences over the year and duration of each occurrence) the following measures are recommended for the development.

Aviation activities:

- The FAA concedes that the effect of glare from solar panels on aeroplanes is similar to glare from water bodies and other buildings surrounding airports. It has therefore softened its stance on glare impacts from solar panels and no longer requires mitigation. The FAA however, stresses the importance of mitigating glare affecting air traffic control centres. The WSI will not have an air traffic control centre at the airport, which negates the need to mitigate glare from solar panels on airport operations.
    - No mitigation is necessary for aviation / airport activities.

Roads:

- Glare affecting roads surrounding the development would fall under the jurisdiction of Transport for NSW (TfNSW). While there is no guidance surrounding glare on roadways, it is assumed that a certain amount of glare is unavoidable and is there for accepted. This report recommends that the yellow glare affecting roadways be mitigated.
    - It is noted that mature trees in the locations shown on the masterplan may screen most of the glare from the roofs and walls of the buildings, however there are no existing trees along the roadways adjacent to the development. Assuming young trees are planted when the development is built, there will be a significant amount of time between construction and the formation of a tree canopy that screens glare.
    - In the absence of a screening tree canopy, architectural mitigation is needed in conjunction with tree planting. Architectural mitigation should include a combination of the following:
        - use darker colour tones along the upper wall sections
        - use materials with a matte finish
        - articulate the façade of the buildings to diffuse the reflected sunlight.

6 Conclusion

The assessment of glare from the proposed Burrah Park development indicates that glare from the roof-mounted solar panels have the potential to cause glare along all the surrounding roads and the flight path into the airport. Yellow glare, which has the capacity to cause momentary after-image in the eye, is predicted at the following locations:

- WSI flight path (approach path from north of the runway) – February to May and August to November between 4:00 and 6:00 pm
- Elizabeth Drive – April through August between 4:00 and 5:00 pm
- M 12 motorway – February and October between 5:30 and 6:45 pm
- M 12 westbound to the airport connection – November through February between 5:30 and 6:30 pm
- M 12 airport connection (between the M 12 and Elizabeth Drive) – April, and June through August between 3:30 and 5:00 pm.

The glare assessment of the buildings proposed in the masterplan indicates that there is potential for glare along the flight path, Elizabeth Drive, the M 12 motorway, the M 12 airport connection, and the airport entry. Yellow glare was predicted to occur at the following locations:

- Elizabeth Drive – All year between 5:00 and 8:00 am, and again at 4:30 to 7:00 pm
- M 12 westbound to the airport connection – All year between 4:30 and 7:30 am, and again at 11:00 am to noon
- M 12 airport connection (between the M 12 and Elizabeth Drive) – September through March between 5:00 and 7:30 pm.

This report has identified mitigation techniques using architectural treatments and landscape planting. Due to the severity of the glare (occurrences over the year and duration of each occurrence) the following measures are recommended for the development.

Aviation activities:

- No mitigation is necessary for aviation / airport activities.

Roads:

- Glare affecting roads surrounding the development would fall under the jurisdiction of Transport for NSW (TfNSW). While there is no guidance surrounding glare on roadways, it is assumed that a certain amount of glare is unavoidable and is there for accepted. This report recommends that the yellow glare affecting roadways be mitigated.
    - It is noted that mature trees in the locations shown on the masterplan may screen most of the glare from the roofs and walls of the buildings, however there are no existing trees along the roadways.
    - In the absence of a screening tree canopy, architectural mitigation is needed in conjunction with tree planting. Architectural mitigation should include a combination of the following:
        - use darker colour tones along the upper wall sections

- use materials with a matte finish
- articulate the façade of the buildings to diffuse the reflected sunlight.

- The glare affecting the surrounding roads should be considered temporary as trees installed along the perimeter of the development will develop an effective screen. The proposed Burrah Park masterplan indicates that there would be sufficient landscape area between the project boundaries and the building structures to provide the screening required to mitigate the glare. Since the development layout provides for the necessary screening, adjustments to the building layouts would not be necessary.

References

Federal Aviation Administration (2021), *Federal Aviation Administration Policy: Review of Solar Energy System Projects on Federally-Obligated Airports.*

ForgeSolar, forgesolar.com, April 2025.

Nettleton Tribe (October 2024), *Burrah Park Urban Design Report, Revision F.*

NSW Department of Planning and Environment (2023), *Western Sydney Aerotropolis Precinct Plan*.

NSW Department of Planning and Environment (2022), *Western Sydney Aerotropolis Development Control Plan 2022*

The Western Sydney Planning Partnership (2020), Western Sydney Aerotropolis Plan.

Appendix A
ForgeSolar results

EMM
creating opportunities

FORGESOLAR GLARE ANALYSIS

Project: **Burrah Park SSDA**
Site configuration: **Burrah Park - Solar - East**

Created 08 Apr, 2025
Updated 09 Apr, 2025
Time-step 1 minute
Timezone offset UTC10
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 1 MW to 5 MW
Site ID 146189.24576

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
	°	°	min	hr	min	hr	kWh
Lot 2b	5.0	10.0	5,248	87.5	2,057	34.3	-
Lot 2b - Central	5.0	100.0	7,092	118.2	0	0.0	-
Lot 2b - E	5.0	100.0	13,531	225.5	4,066	67.8	-
Lot 2b - NE	5.0	100.0	7,764	129.4	0	0.0	-
Lot 2b - S	5.0	100.0	9,159	152.7	0	0.0	-
Lot 2b - SE	5.0	100.0	23,440	390.7	726	12.1	-
Lot 2b - SW	5.0	10.0	7,018	117.0	0	0.0	-
Lot 2b - W	5.0	100.0	6,698	111.6	0	0.0	-
Lot 4a - E	5.0	100.0	15,309	255.2	1,663	27.7	-
Lot 4a - W	5.0	100.0	8,891	148.2	439	7.3	-
Lot 4b - E	5.0	100.0	15,941	265.7	54	0.9	-
Lot 4b - W	5.0	100.0	9,444	157.4	0	0.0	-
Lot 5b	5.0	10.0	5,945	99.1	0	0.0	-
Lot 5b - E	5.0	10.0	10,099	168.3	0	0.0	-
Lot5b - N	5.0	100.0	6,903	115.0	0	0.0	-
Lot 5b - NW	5.0	100.0	3,134	52.2	0	0.0	-
Lot 5b - SE	5.0	100.0	12,046	200.8	36	0.6	-
Lot 5c	5.0	10.0	8,602	143.4	25	0.4	-
Lot 6a - E	5.0	10.0	7,545	125.8	167	2.8	-
Lot 6a - W	5.0	10.0	8,464	141.1	195	3.2	-

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

Airport Entry	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	21,606	360.1	0	0.0
Luddenham Road	343	5.7	0	0.0
M-12	24,351	405.9	362	6.0
M12 - northbound	11,609	193.5	74	1.2
M12 - southbound	5,067	84.5	25	0.4
Runway	0	0.0	0	0.0
FP 1	127,828	2,130.5	8,967	149.4
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	1,469	24.5	0	0.0

Component Data

PV Arrays

Name: Lot 2b
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 10.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.869873	150.730408	70.73	12.00	82.73
2	-33.865806	150.731175	61.52	12.00	73.52
3	-33.865895	150.731771	59.36	12.00	71.36
4	-33.869939	150.730923	69.01	12.00	81.01

Name: Lot 2b - Central
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.869499	150.734044	64.72	12.00	76.72
2	-33.869468	150.733786	65.38	12.00	77.38
3	-33.869962	150.733668	64.87	12.00	76.87
4	-33.869993	150.733942	64.49	12.00	76.49

Name: Lot 2b - E
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.868730	150.736589	67.16	12.00	79.16
2	-33.870752	150.736160	69.98	12.00	81.98
3	-33.870685	150.735661	69.63	12.00	81.63
4	-33.868650	150.736090	66.34	12.00	78.34

Name: Lot 2b - NE
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.868433	150.735225	64.77	12.00	76.77
2	-33.869183	150.735054	64.48	12.00	76.48
3	-33.869134	150.734724	64.35	12.00	76.35
4	-33.868386	150.734895	64.58	12.00	76.58

Name: Lot 2b - S
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.870058	150.734610	64.19	12.00	76.19
2	-33.870441	150.734543	66.06	12.00	78.06
3	-33.870466	150.734774	66.09	12.00	78.09
4	-33.870085	150.734844	64.89	12.00	76.89

Name: Lot 2b - SE
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.869091	150.738412	75.16	12.00	87.16
2	-33.869029	150.737919	72.22	12.00	84.22
3	-33.870300	150.737642	71.86	12.00	83.86
4	-33.870361	150.738149	72.01	12.00	84.01

Name: Lot 2b - SW
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 10.0°
Rated power: -
Panel material: Smooth glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.869957	150.732881	68.73	12.00	80.73
2	-33.870202	150.732827	68.95	12.00	80.95
3	-33.870033	150.731564	71.57	12.00	83.57
4	-33.869785	150.731618	71.28	12.00	83.28

Name: Lot 2b - W
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.869456	150.732962	67.13	12.00	79.13
2	-33.868320	150.733203	64.08	12.00	76.08
3	-33.868262	150.732844	64.20	12.00	76.20
4	-33.869420	150.732591	67.16	12.00	79.16

Name: Lot 4a - E
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.866645	150.738254	66.76	12.00	78.76
2	-33.868293	150.737953	73.99	12.00	85.99
3	-33.868173	150.737116	70.05	12.00	82.05
4	-33.866565	150.737427	67.93	12.00	79.93

Name: Lot 4a - W
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.866405	150.735706	64.92	12.00	76.92
2	-33.867999	150.735449	66.76	12.00	78.76
3	-33.867879	150.734542	63.58	12.00	75.58
4	-33.866316	150.734853	63.58	12.00	75.58

Name: Lot 4b - E
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.864037	150.738811	65.05	12.00	77.05
2	-33.865720	150.738473	63.96	12.00	75.96
3	-33.865582	150.737594	63.89	12.00	75.89
4	-33.863934	150.737942	62.63	12.00	74.63

Name: Lot 4b - W
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.863730	150.736133	64.38	12.00	76.38
2	-33.865338	150.735838	67.07	12.00	79.07
3	-33.865231	150.734931	65.86	12.00	77.86
4	-33.863619	150.735291	66.39	12.00	78.39

Name: Lot 5b
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 10.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.862009	150.734570	64.82	12.00	76.82
2	-33.862276	150.736436	63.41	12.00	75.41
3	-33.862847	150.736302	64.00	12.00	76.00
4	-33.862593	150.734430	64.65	12.00	76.65

Name: Lot 5b - E
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 10.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.863222	150.739277	62.89	12.00	74.89
2	-33.862937	150.737281	58.99	12.00	70.99
3	-33.862366	150.737421	59.37	12.00	71.37
4	-33.862629	150.739379	61.30	12.00	73.30

Name: Lot5b - N
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.861799	150.734197	63.01	12.00	75.01
2	-33.863407	150.733736	63.16	12.00	75.16
3	-33.863327	150.733323	59.50	12.00	71.50
4	-33.861732	150.733800	61.01	12.00	73.01

Name: Lot 5b - NW
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.861590	150.732951	60.07	12.00	72.07
2	-33.862125	150.732780	60.13	12.00	72.13
3	-33.862053	150.732468	59.70	12.00	71.70
4	-33.861523	150.732640	58.93	12.00	70.93

Name: Lot 5b - SE
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.863530	150.741208	62.89	12.00	74.89
2	-33.863330	150.739598	63.33	12.00	75.33
3	-33.863762	150.739529	64.60	12.00	76.60
4	-33.863962	150.741116	63.96	12.00	75.96

Name: Lot 5c
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 10.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.861328	150.738917	58.51	12.00	70.51
2	-33.861501	150.739899	58.68	12.00	70.68
3	-33.861252	150.739963	58.57	12.00	70.57
4	-33.861016	150.739722	58.49	12.00	70.49
5	-33.860829	150.739054	58.58	12.00	70.58

Name: Lot 6a - E
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 10.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.860165	150.737063	57.38	12.00	69.38
2	-33.860655	150.736982	59.23	12.00	71.23
3	-33.860437	150.735271	60.90	12.00	72.90
4	-33.859942	150.735378	57.77	12.00	69.77

Name: Lot 6a - W
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 10.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.859430	150.731851	51.60	12.00	63.60
2	-33.859768	150.734534	57.07	12.00	69.07
3	-33.860290	150.734432	58.25	12.00	70.25
4	-33.859929	150.731744	51.76	12.00	63.76

Route Receptors

Name: Airport Entry
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.881880	150.735957	62.58	1.20	63.78
2	-33.880063	150.739970	65.47	1.20	66.67
3	-33.878567	150.741708	56.29	1.20	57.49
4	-33.877035	150.742716	54.98	1.20	56.18
5	-33.872278	150.743918	55.14	1.20	56.34

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

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.864571	150.707868	72.48	1.20	73.68
2	-33.865070	150.710443	66.52	1.20	67.72
3	-33.866459	150.714391	62.40	1.20	63.60
4	-33.868419	150.716708	58.93	1.20	60.13
5	-33.869096	150.718725	59.68	1.20	60.88
6	-33.870094	150.726236	67.67	1.20	68.87
7	-33.871626	150.738166	65.31	1.20	66.51
8	-33.871662	150.741213	60.57	1.20	61.77
9	-33.872054	150.744475	53.65	1.20	54.85
10	-33.873372	150.752586	46.36	1.20	47.56
11	-33.874690	150.760225	62.47	1.20	63.67

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

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.857810	150.725537	60.51	1.20	61.71
2	-33.858505	150.724979	61.76	1.20	62.96
3	-33.861570	150.723670	59.47	1.20	60.67
4	-33.862015	150.723327	59.16	1.20	60.36
5	-33.862603	150.722683	59.77	1.20	60.97
6	-33.867859	150.716353	58.97	1.20	60.17

Name: M-12
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.854366	150.711274	79.98	1.20	81.18
2	-33.854972	150.717025	85.15	1.20	86.35
3	-33.857752	150.728397	55.11	1.20	56.31
4	-33.859071	150.734277	54.55	1.20	55.75
5	-33.859463	150.738096	54.04	1.20	55.24
6	-33.859605	150.742731	66.03	1.20	67.23
7	-33.858910	150.751121	47.65	1.20	48.85
8	-33.858803	150.755906	43.40	1.20	44.60
9	-33.858999	150.759146	42.13	1.20	43.33
10	-33.860104	150.766206	37.84	1.20	39.04

Name: M12 - northbound
Path type: One-way (toward increasing index)
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.871498	150.744026	55.36	1.20	56.56
2	-33.869431	150.744068	59.02	1.20	60.22
3	-33.867364	150.743639	68.47	1.20	69.67
4	-33.862536	150.742094	61.17	1.20	62.37
5	-33.861288	150.741579	61.93	1.20	63.13
6	-33.860487	150.740657	61.96	1.20	63.16
7	-33.859899	150.739369	56.53	1.20	57.73
8	-33.859685	150.738039	54.13	1.20	55.33

Name: M12 - southbound
Path type: One-way (toward increasing index)
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.859471	150.746879	66.89	1.20	68.09
2	-33.859720	150.744841	70.10	1.20	71.30
3	-33.860398	150.743468	68.68	1.20	69.88
4	-33.861360	150.742802	63.79	1.20	64.99
5	-33.862482	150.742674	62.75	1.20	63.95
6	-33.864513	150.743189	68.79	1.20	69.99
7	-33.867150	150.743918	68.68	1.20	69.88

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

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.890589	150.698321	102.34	10.00	112.34
2	-33.875697	150.729006	77.95	10.00	87.95

Flight Path Receptors

Name: FP 1
Description:
Threshold height: 15 m
Direction: 240.1°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-33.875293	150.729945	79.04	15.24	94.28
Two-mile	-33.860881	150.760169	45.77	217.19	262.97

Name: FP 2
Description:
Threshold height: 15 m
Direction: 60.1°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-33.891395	150.696738	88.58	15.24	103.82
Two-mile	-33.905829	150.666524	64.83	207.67	272.50

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-33.886006	150.719408	79.12	10.00
OP 2	2	-33.865614	150.719816	59.66	1.60
OP 3	3	-33.858389	150.725975	63.56	1.60

Obstruction Components

Name: Obstruction 1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.860583	150.731560	52.85
2	-33.859394	150.731818	51.28
3	-33.859741	150.734602	56.98
4	-33.860396	150.734452	58.75

Name: Obstruction 10
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.870127	150.734877	64.95
2	-33.870497	150.734791	66.50
3	-33.870417	150.734094	65.72
4	-33.869989	150.734185	64.24

Name: Obstruction 11
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.870034	150.733981	64.65
2	-33.869940	150.733208	67.09
3	-33.869446	150.733332	66.44

Name: Obstruction 12
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.869749	150.732988	67.68
2	-33.870234	150.732865	68.75
3	-33.870043	150.731492	71.64
4	-33.869441	150.731637	69.37

Name: Obstruction 13
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.869978	150.730975	69.26
2	-33.869822	150.729838	72.61
3	-33.865755	150.730540	59.68

Name: Obstruction 14
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.869940	150.728767	75.28
2	-33.869744	150.727383	69.77
3	-33.866955	150.728038	62.31

Name: Obstruction 15
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.869699	150.726911	69.22
2	-33.869227	150.723510	60.29

Name: Obstruction 16
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.866129	150.724654	55.73
2	-33.866646	150.723860	55.95
3	-33.868490	150.723420	59.38
4	-33.868615	150.724246	61.25

Name: Obstruction 17
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.863047	150.729192	54.38
2	-33.862851	150.728334	53.52
3	-33.862967	150.728055	53.80
4	-33.864873	150.727562	57.30

Name: Obstruction 18
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.861541	150.733001	60.40
2	-33.861417	150.732315	57.71
3	-33.862040	150.732121	58.28
4	-33.862192	150.732787	60.65

Name: Obstruction 2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.860752	150.735133	61.61
2	-33.859888	150.735337	57.69
3	-33.860129	150.737128	57.32
4	-33.861167	150.736951	60.67

Name: Obstruction 3
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.861666	150.738743	58.50
2	-33.860792	150.739011	58.59
3	-33.860988	150.739752	58.49
4	-33.861242	150.740009	58.62
5	-33.861848	150.739827	58.69

Name: Obstruction 4
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.862324	150.737377	59.72
2	-33.862591	150.739453	60.69
3	-33.863696	150.739254	64.57

Name: Obstruction 5
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.863282	150.739565	63.11
2	-33.863500	150.741255	62.46
3	-33.864351	150.741073	64.79

Name: Obstruction 6
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.863834	150.737854	62.32
2	-33.863959	150.738905	64.78
3	-33.865794	150.738530	63.95

Name: Obstruction 7
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.866400	150.736717	67.32
2	-33.866587	150.738348	65.47
3	-33.868378	150.737993	74.27
4	-33.868146	150.736341	66.46

Name: Obstruction 8
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.868930	150.737398	69.80
2	-33.869064	150.738471	75.31
3	-33.870400	150.738181	71.82
4	-33.871006	150.737414	68.73

Name: Obstruction 9
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.868881	150.736604	67.61
2	-33.870783	150.736186	70.05
3	-33.870654	150.735091	67.27
4	-33.868595	150.735569	64.74

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
	°	°	min	hr	min	hr	kWh
Lot 2b	5.0	10.0	5,248	87.5	2,057	34.3	-
Lot 2b - Central	5.0	100.0	7,092	118.2	0	0.0	-
Lot 2b - E	5.0	100.0	13,531	225.5	4,066	67.8	-
Lot 2b - NE	5.0	100.0	7,764	129.4	0	0.0	-
Lot 2b - S	5.0	100.0	9,159	152.7	0	0.0	-
Lot 2b - SE	5.0	100.0	23,440	390.7	726	12.1	-
Lot 2b - SW	5.0	10.0	7,018	117.0	0	0.0	-
Lot 2b - W	5.0	100.0	6,698	111.6	0	0.0	-
Lot 4a - E	5.0	100.0	15,309	255.2	1,663	27.7	-
Lot 4a - W	5.0	100.0	8,891	148.2	439	7.3	-
Lot 4b - E	5.0	100.0	15,941	265.7	54	0.9	-
Lot 4b - W	5.0	100.0	9,444	157.4	0	0.0	-
Lot 5b	5.0	10.0	5,945	99.1	0	0.0	-
Lot 5b - E	5.0	10.0	10,099	168.3	0	0.0	-
Lot5b - N	5.0	100.0	6,903	115.0	0	0.0	-
Lot 5b - NW	5.0	100.0	3,134	52.2	0	0.0	-
Lot 5b - SE	5.0	100.0	12,046	200.8	36	0.6	-
Lot 5c	5.0	10.0	8,602	143.4	25	0.4	-
Lot 6a - E	5.0	10.0	7,545	125.8	167	2.8	-
Lot 6a - W	5.0	10.0	8,464	141.1	195	3.2	-

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
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	21,606	360.1	0	0.0
Luddenham Road	343	5.7	0	0.0
M-12	24,351	405.9	362	6.0
M12 - northbound	11,609	193.5	74	1.2
M12 - southbound	5,067	84.5	25	0.4
Runway	0	0.0	0	0.0
FP 1	127,828	2,130.5	8,967	149.4
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	1,469	24.5	0	0.0

PV: Lot 2b potential temporary after-image

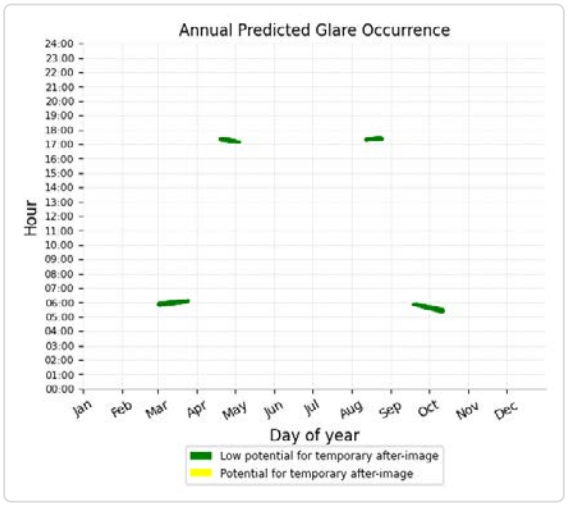
Receptor results ordered by category of glare

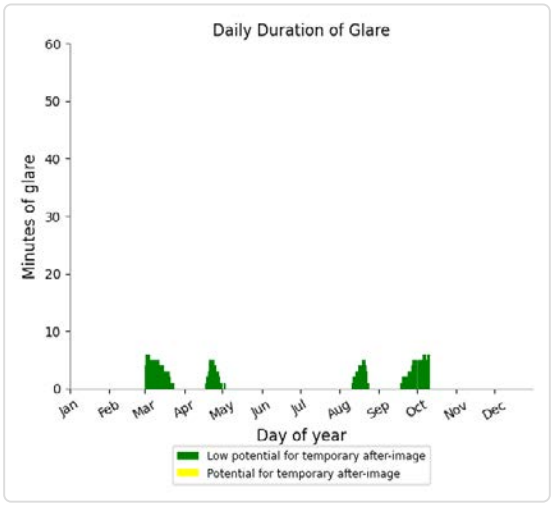
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	285	4.8	0	0.0
Luddenham Road	161	2.7	0	0.0
Airport Entry	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	4,802	80.0	2,057	34.3
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

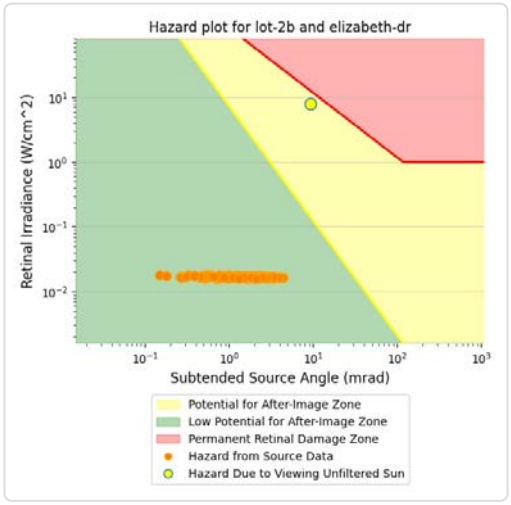
Lot 2b and Route: Elizabeth Drive

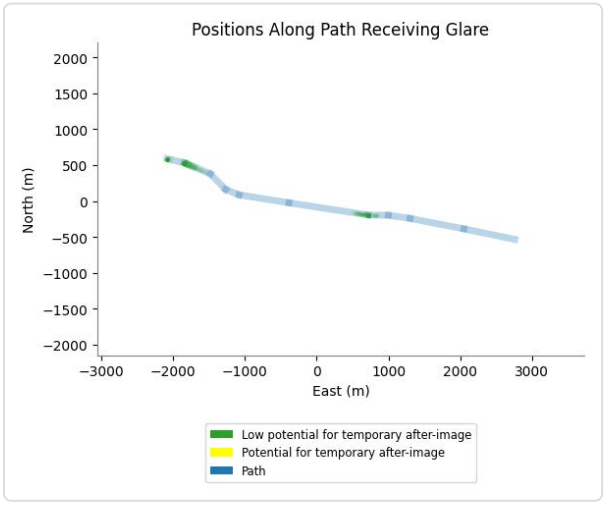
Yellow glare: none

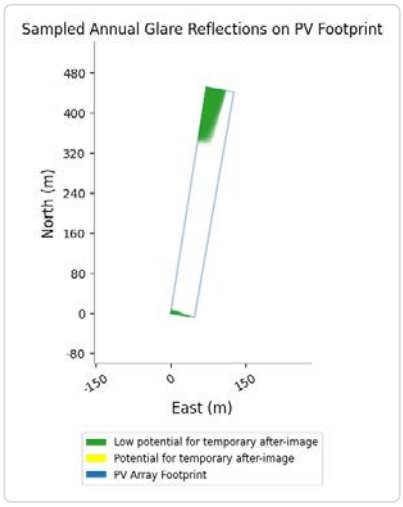
Green glare: 285 min.







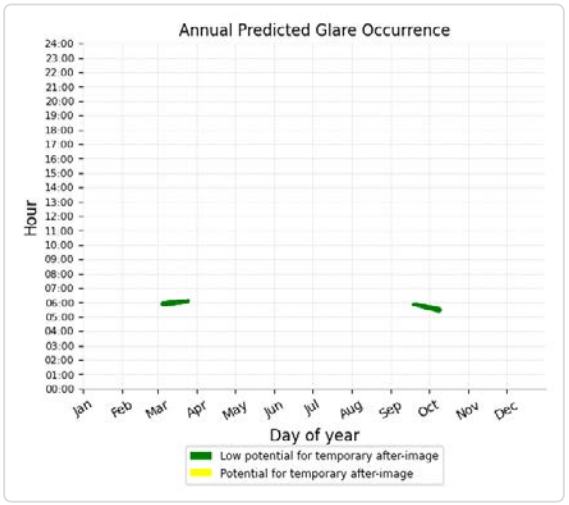


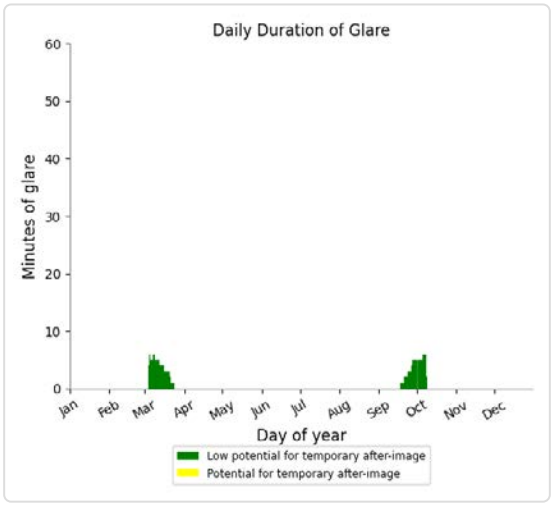


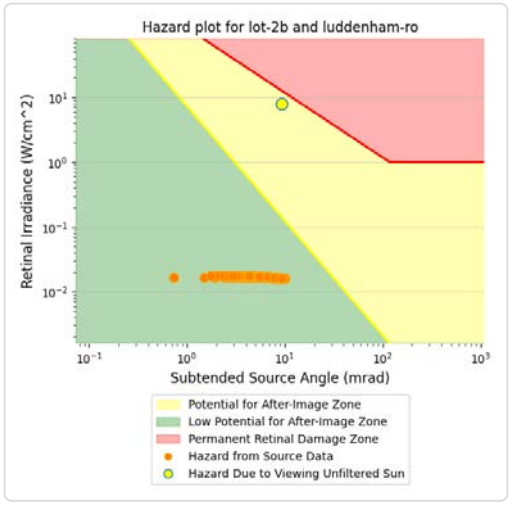
Lot 2b and Route: Luddenham Road

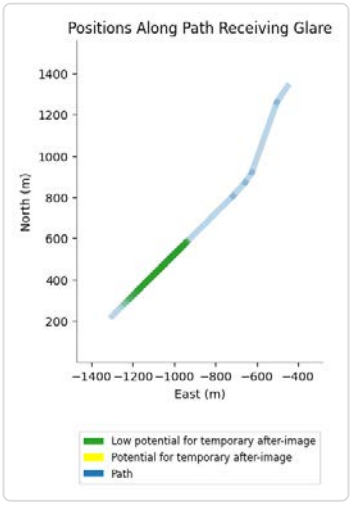
Yellow glare: none

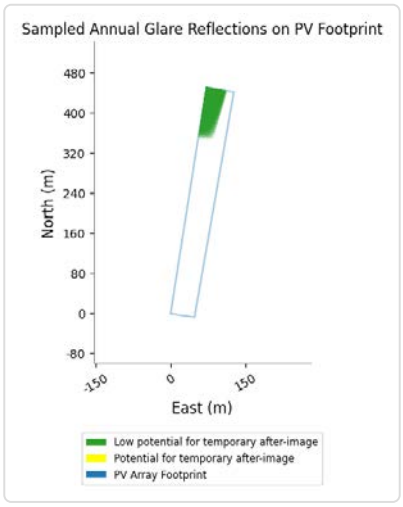
Green glare: 161 min.











Lot 2b and Route: Airport Entry

No glare found

Lot 2b and Route: M-12

No glare found

Lot 2b and Route: M12 - northbound

No glare found

Lot 2b and Route: M12 - southbound

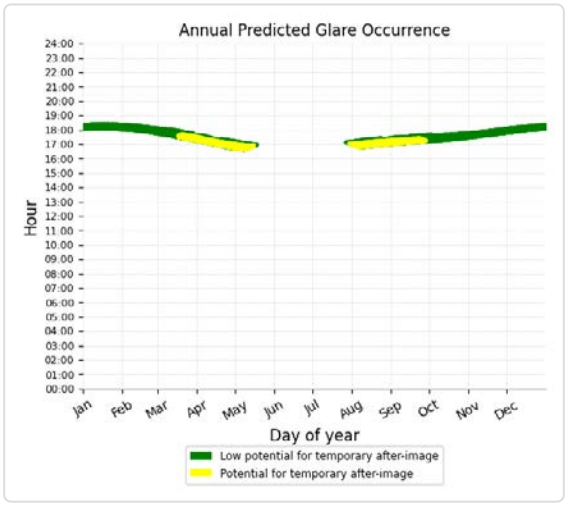
No glare found

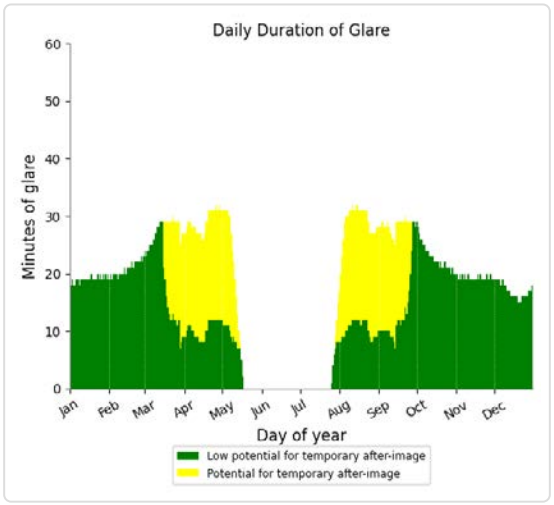
Lot 2b and Route: Runway

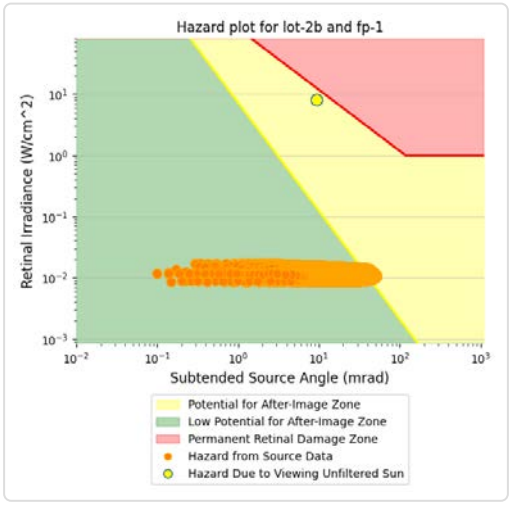
No glare found

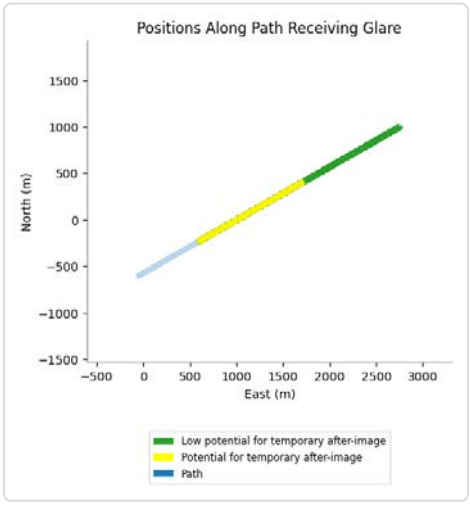
Lot 2b and FP: FP 1

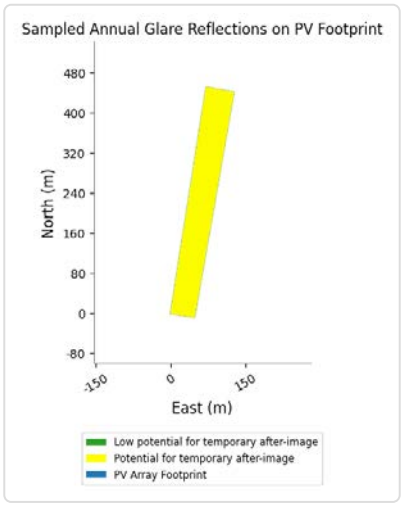
Yellow glare: 2,057 min.
Green glare: 4,802 min.

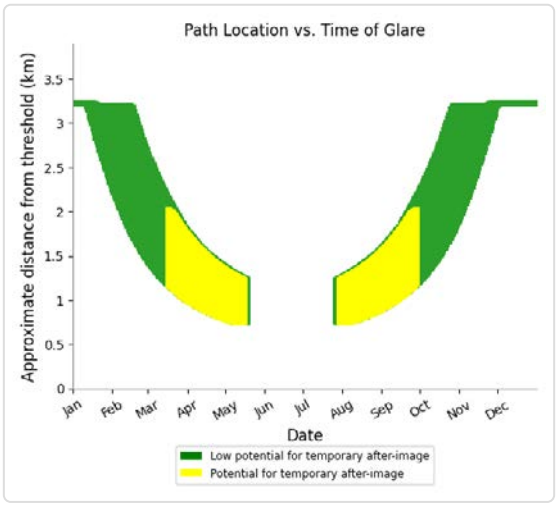












Lot 2b and FP: FP 2

No glare found

Lot 2b and OP 1

No glare found

Lot 2b and OP 2

No glare found

Lot 2b and OP 3

No glare found

PV: Lot 2b - Central low potential for temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	7,092	118.2	0	0.0
FP 2	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

Lot 2b - Central and Route: Airport Entry

No glare found

Lot 2b - Central and Route: Elizabeth Drive

No glare found

Lot 2b - Central and Route: Luddenham Road

No glare found

Lot 2b - Central and Route: M-12

No glare found

Lot 2b - Central and Route: M12 - northbound

No glare found

Lot 2b - Central and Route: M12 - southbound

No glare found

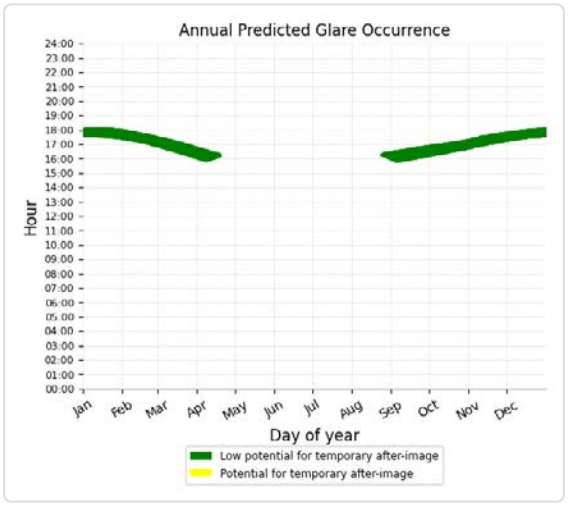
Lot 2b - Central and Route: Runway

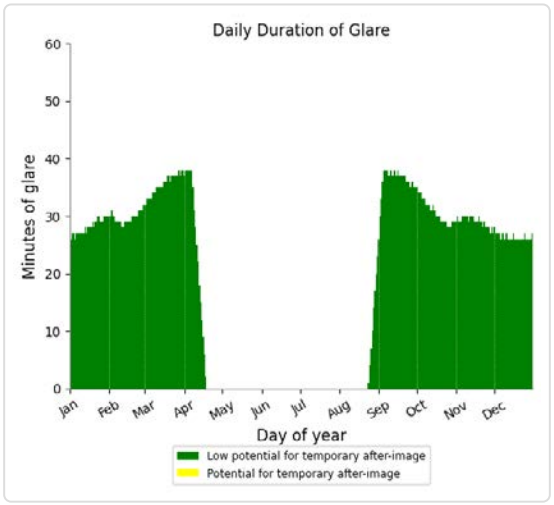
No glare found

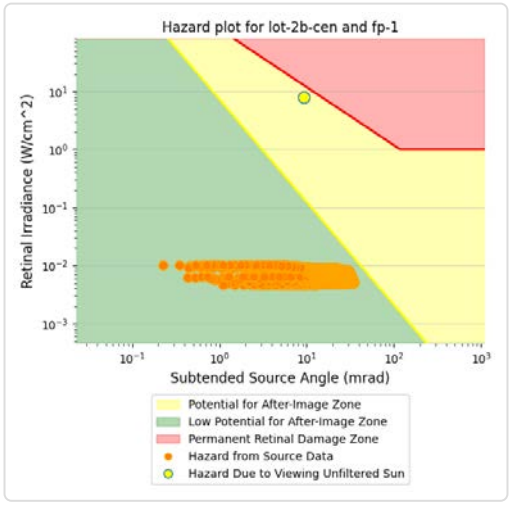
Lot 2b - Central and FP: FP 1

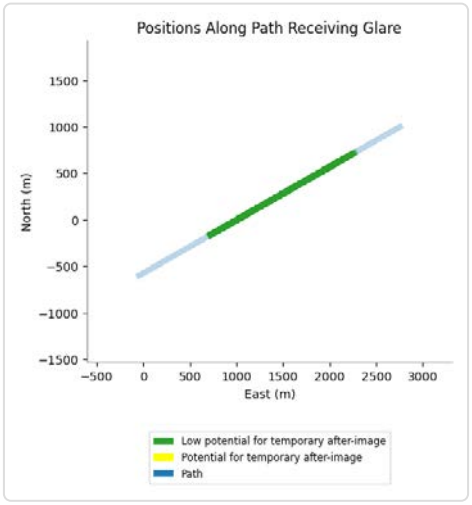
Yellow glare: none

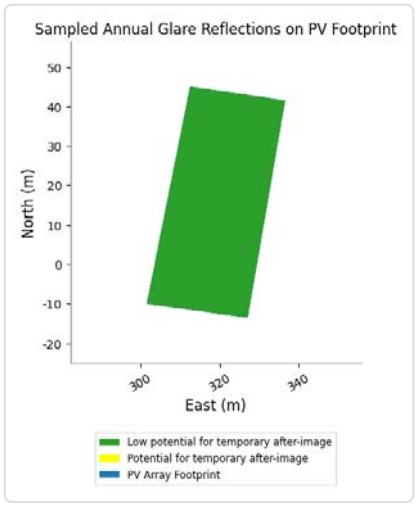
Green glare: 7,092 min.

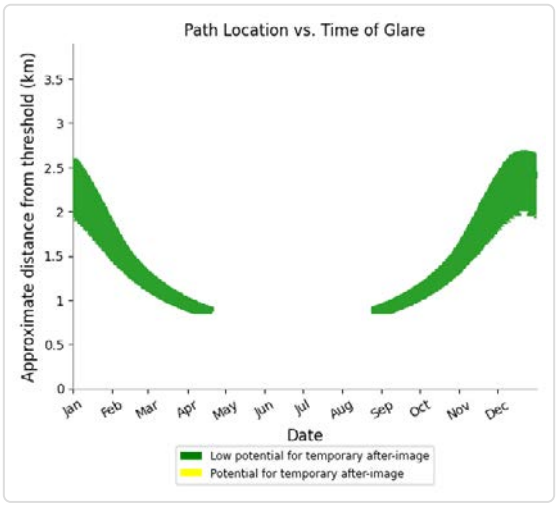












Lot 2b - Central and FP: FP 2

No glare found

Lot 2b - Central and OP 1

No glare found

Lot 2b - Central and OP 2

No glare found

Lot 2b - Central and OP 3

No glare found

PV: Lot 2b - E potential temporary after-image

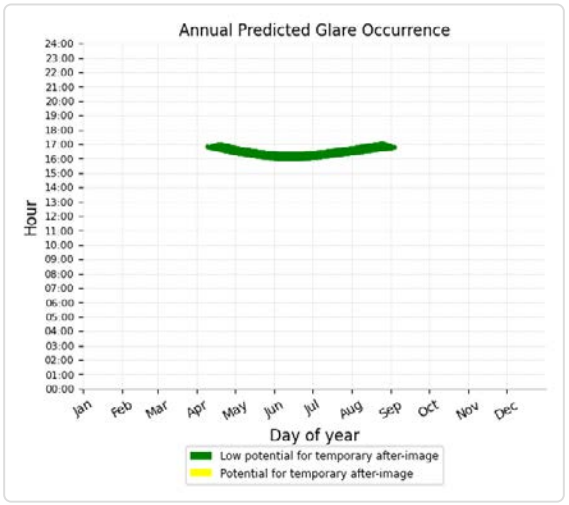
Receptor results ordered by category of glare

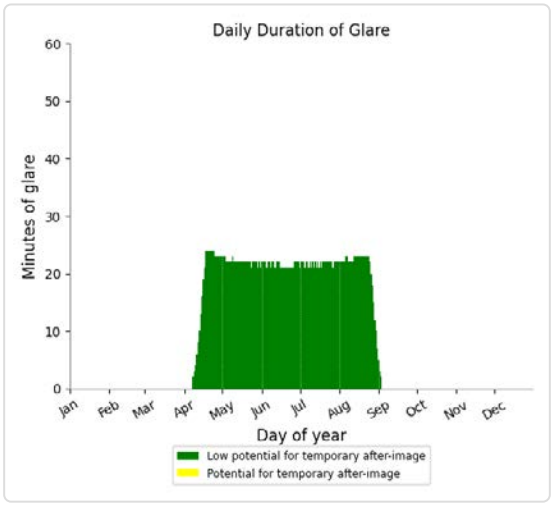
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	3,065	51.1	0	0.0
M-12	1,682	28.0	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	8,784	146.4	4,066	67.8
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

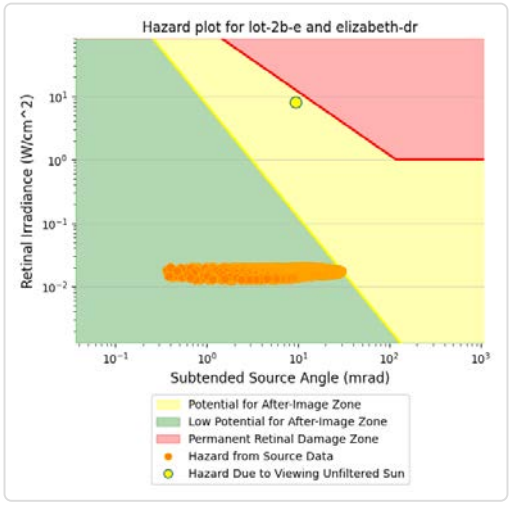
Lot 2b - E and Route: Elizabeth Drive

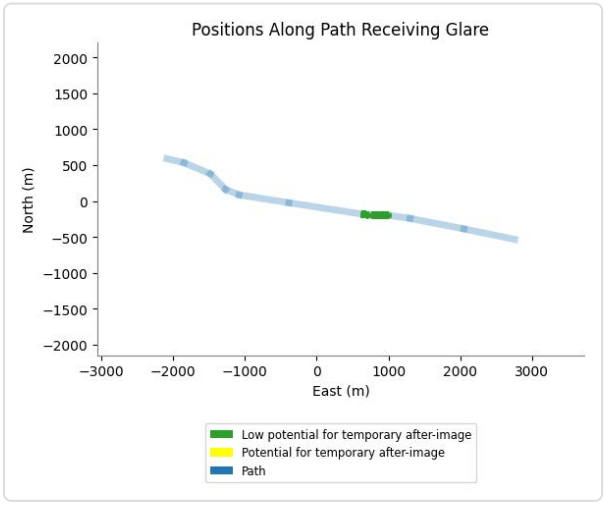
Yellow glare: none

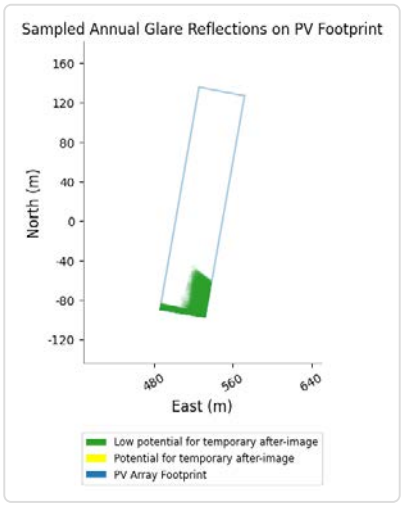
Green glare: 3,065 min.







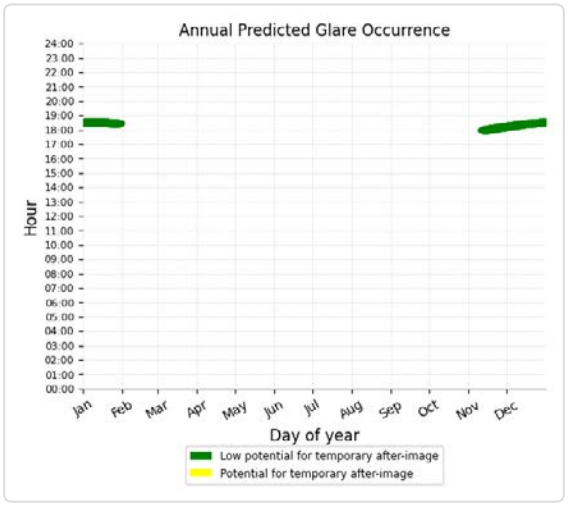


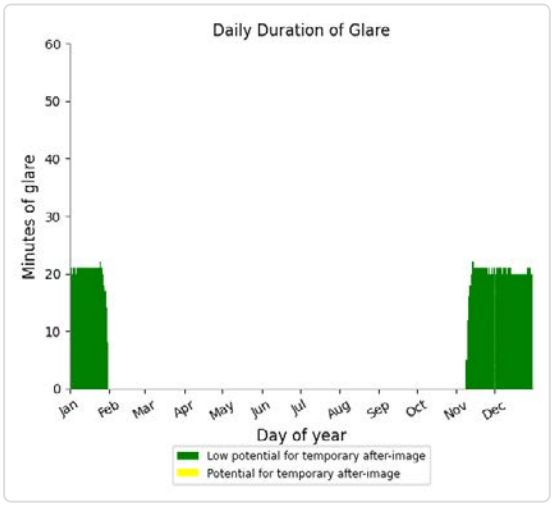


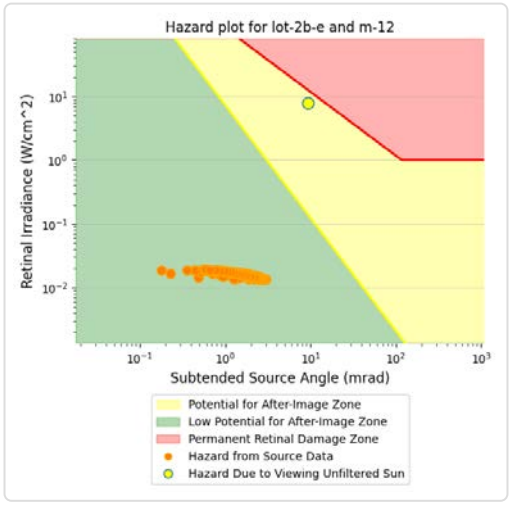
Lot 2b - E and Route: M-12

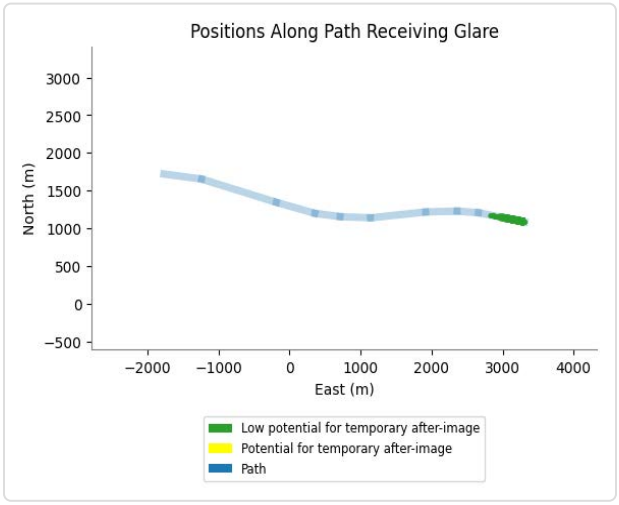
Yellow glare: none

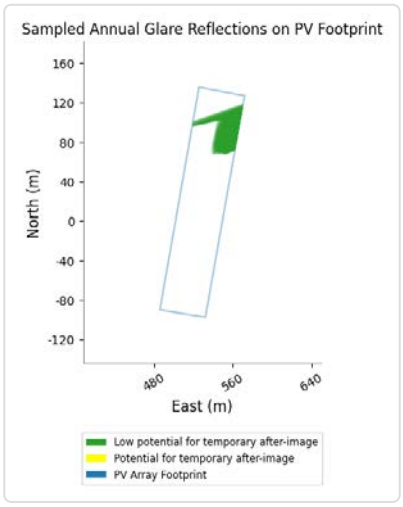
Green glare: 1,682 min.











Lot 2b - E and Route: Airport Entry

No glare found

Lot 2b - E and Route: Luddenham Road

No glare found

Lot 2b - E and Route: M12 - northbound

No glare found

Lot 2b - E and Route: M12 - southbound

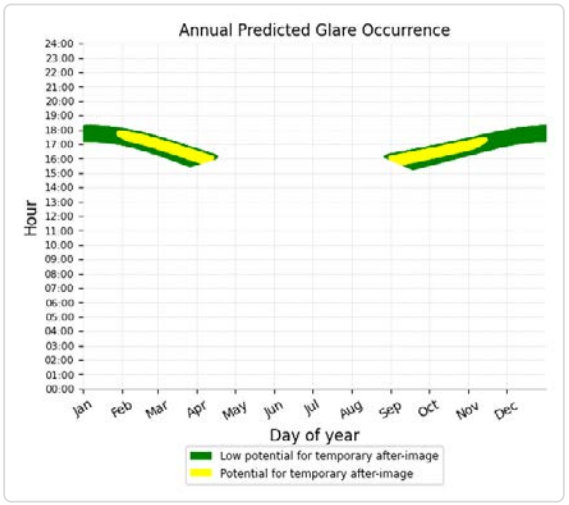
No glare found

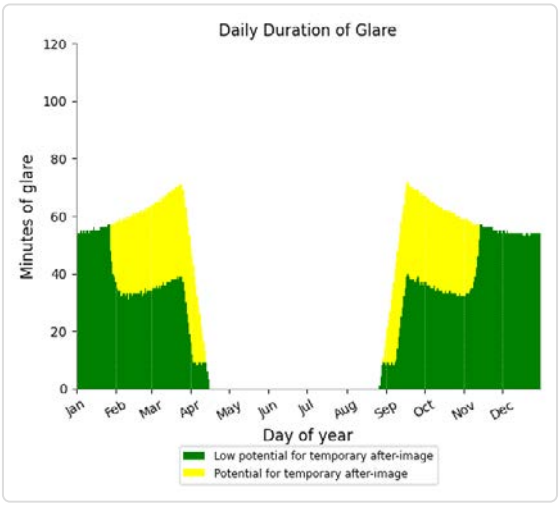
Lot 2b - E and Route: Runway

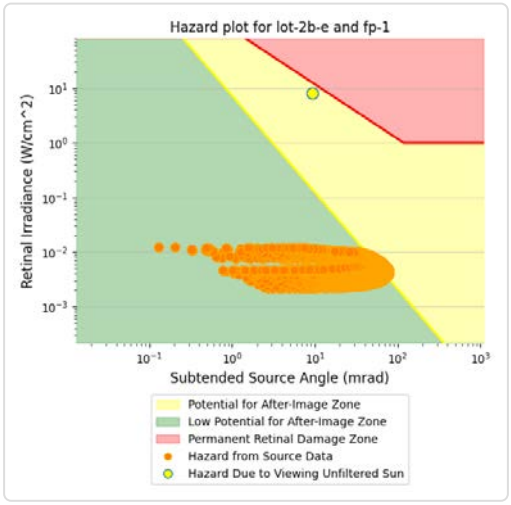
No glare found

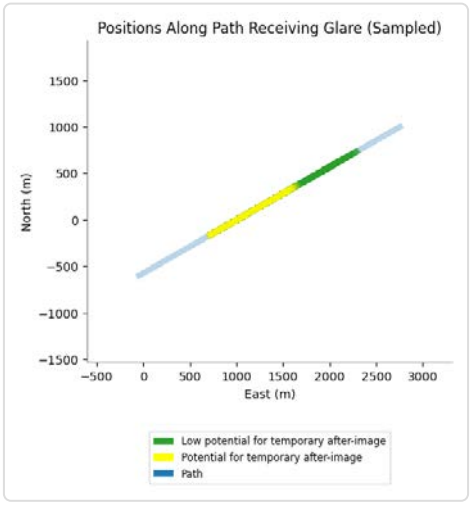
Lot 2b - E and FP: FP 1

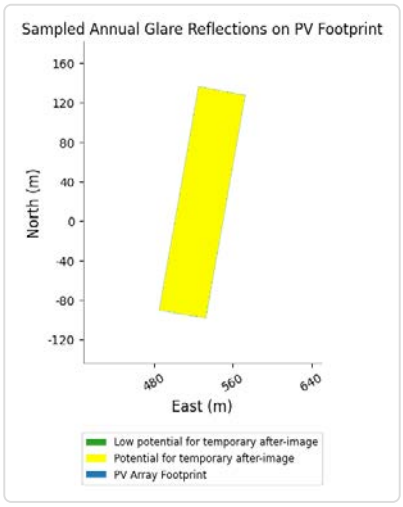
Yellow glare: 4,066 min.
Green glare: 8,784 min.

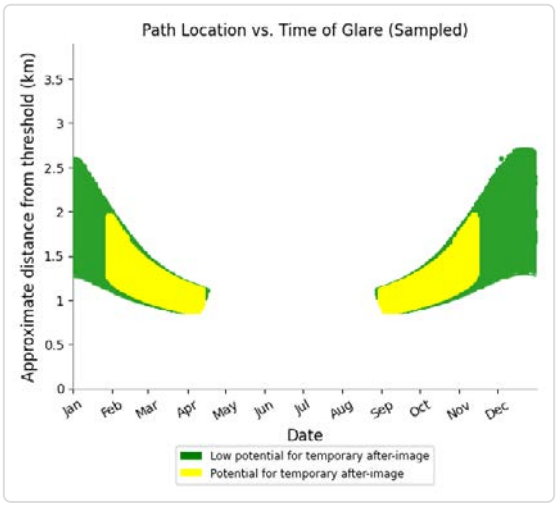












Lot 2b - E and FP: FP 2

No glare found

Lot 2b - E and OP 1

No glare found

Lot 2b - E and OP 2

No glare found

Lot 2b - E and OP 3

No glare found

PV: Lot 2b - NE low potential for temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	7,764	129.4	0	0.0
FP 2	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

Lot 2b - NE and Route: Airport Entry

No glare found

Lot 2b - NE and Route: Elizabeth Drive

No glare found

Lot 2b - NE and Route: Luddenham Road

No glare found

Lot 2b - NE and Route: M-12

No glare found

Lot 2b - NE and Route: M12 - northbound

No glare found

Lot 2b - NE and Route: M12 - southbound

No glare found

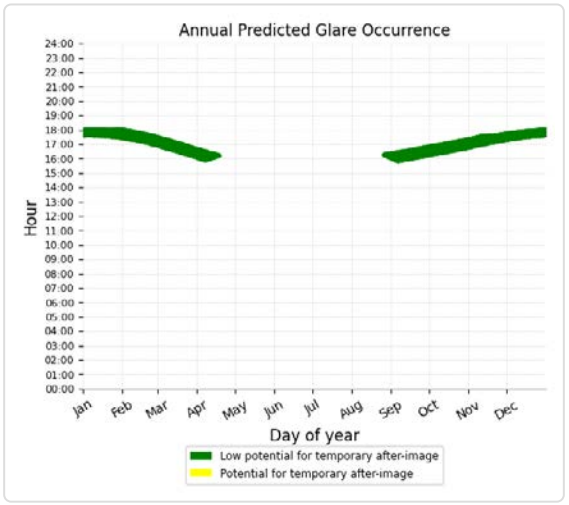
Lot 2b - NE and Route: Runway

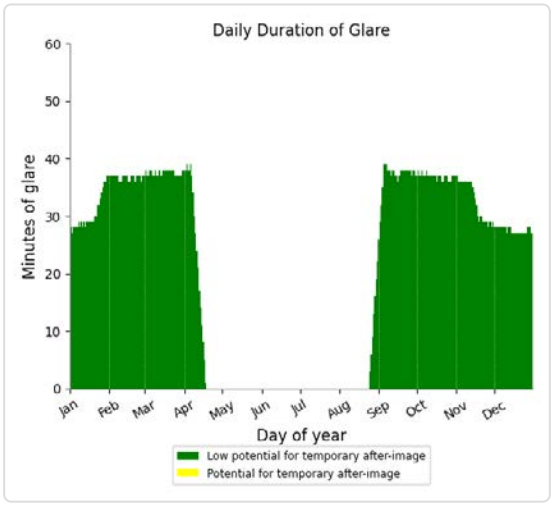
No glare found

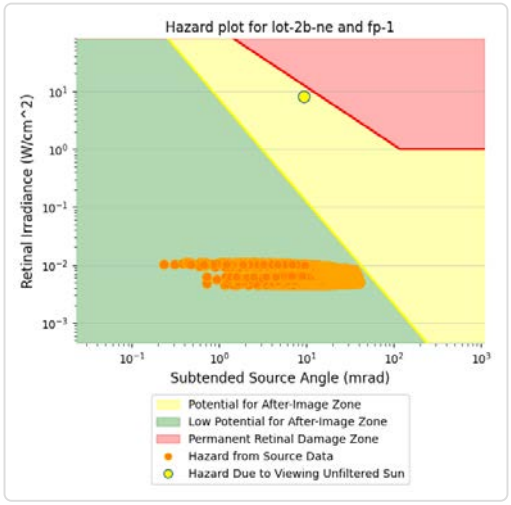
Lot 2b - NE and FP: FP 1

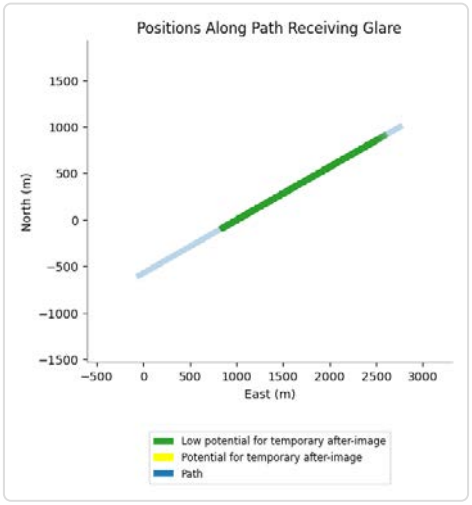
Yellow glare: none

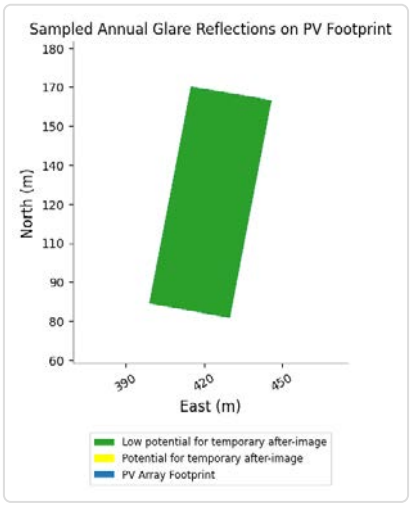
Green glare: 7,764 min.

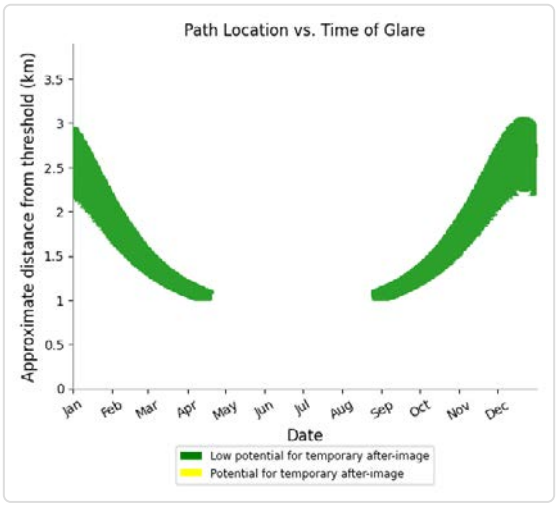












Lot 2b - NE and FP: FP 2

No glare found

Lot 2b - NE and OP 1

No glare found

Lot 2b - NE and OP 2

No glare found

Lot 2b - NE and OP 3

No glare found

PV: Lot 2b - S low potential for temporary after-image

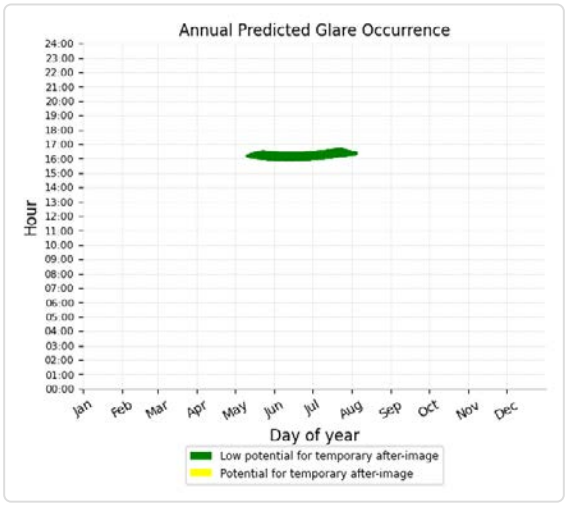
Receptor results ordered by category of glare

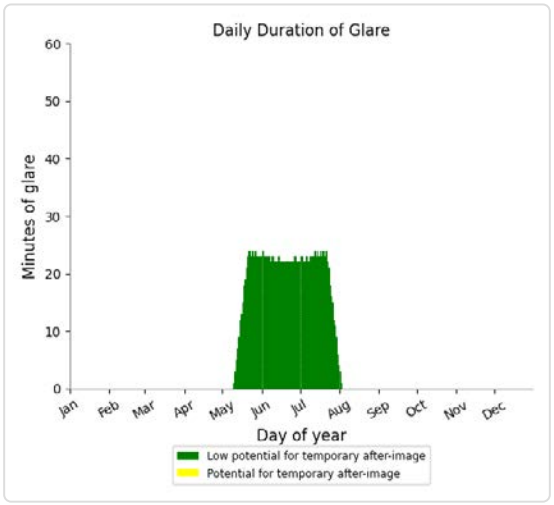
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	1,700	28.3	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	7,459	124.3	0	0.0
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

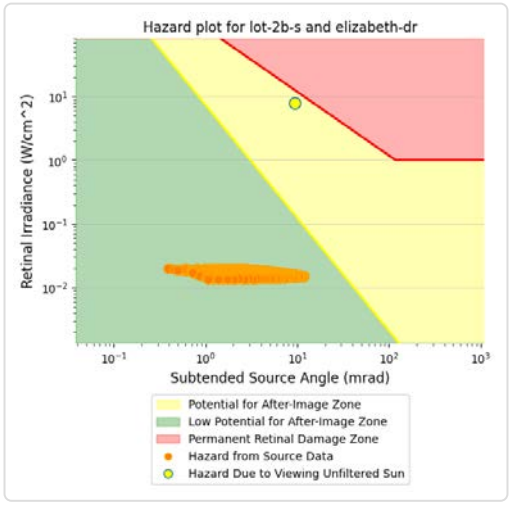
Lot 2b - S and Route: Elizabeth Drive

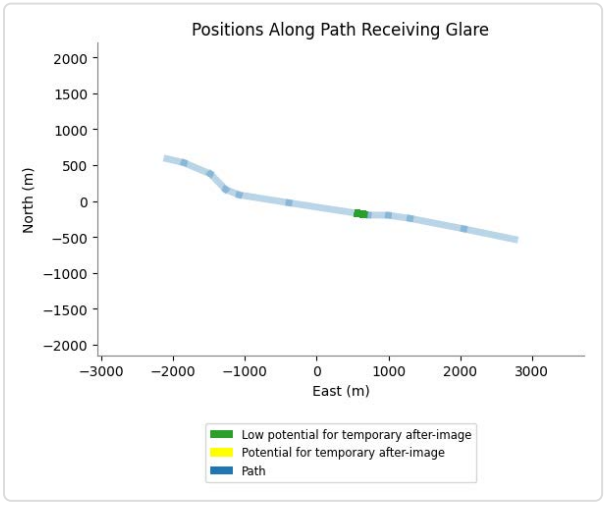
Yellow glare: none

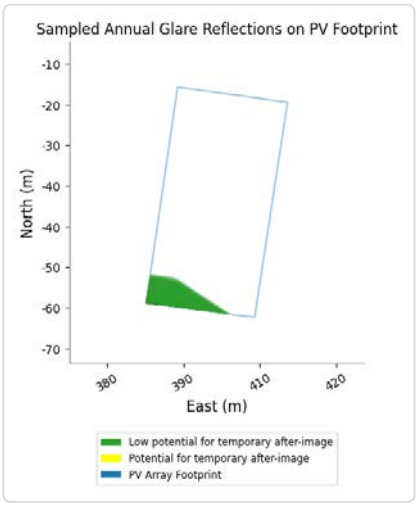
Green glare: 1,700 min.











Lot 2b - S and Route: Airport Entry

No glare found

Lot 2b - S and Route: Luddenham Road

No glare found

Lot 2b - S and Route: M-12

No glare found

Lot 2b - S and Route: M12 - northbound

No glare found

Lot 2b - S and Route: M12 - southbound

No glare found

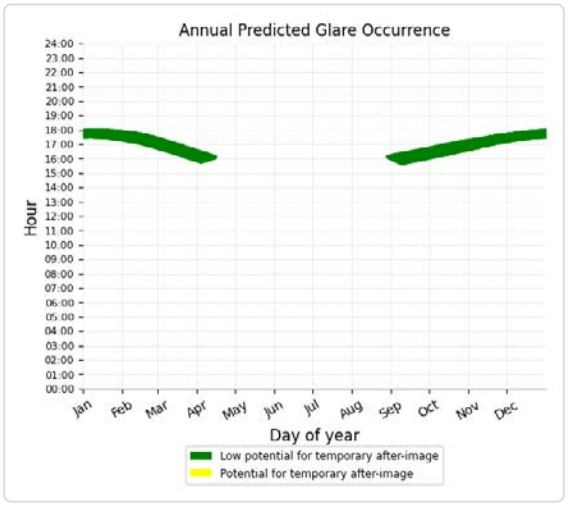
Lot 2b - S and Route: Runway

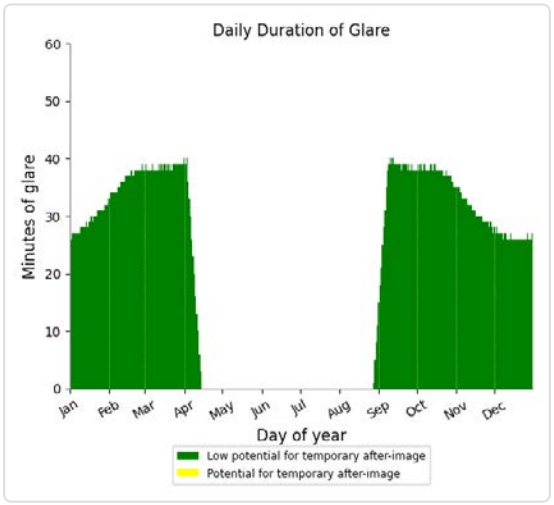
No glare found

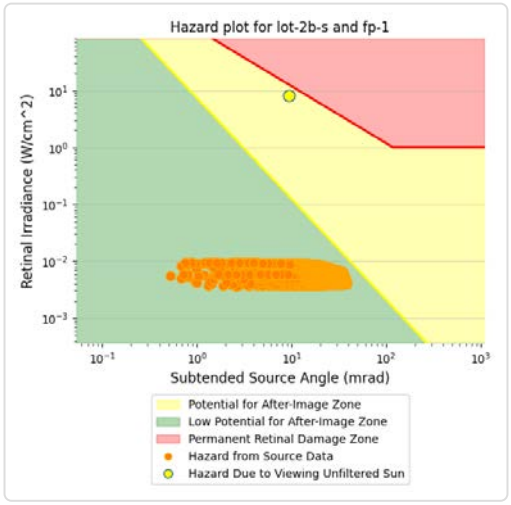
Lot 2b - S and FP: FP 1

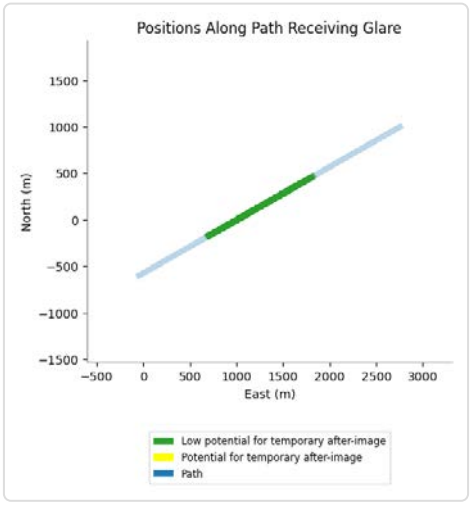
Yellow glare: none

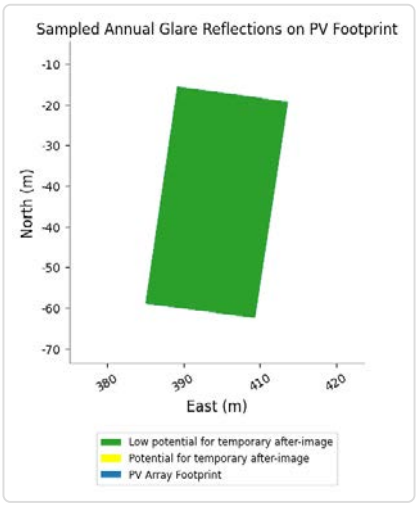
Green glare: 7,459 min.

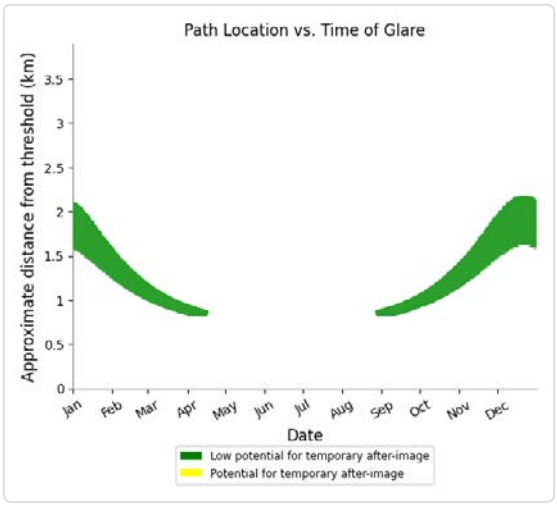












Lot 2b - S and FP: FP 2

No glare found

Lot 2b - S and OP 1

No glare found

Lot 2b - S and OP 2

No glare found

Lot 2b - S and OP 3

No glare found

PV: Lot 2b - SE potential temporary after-image

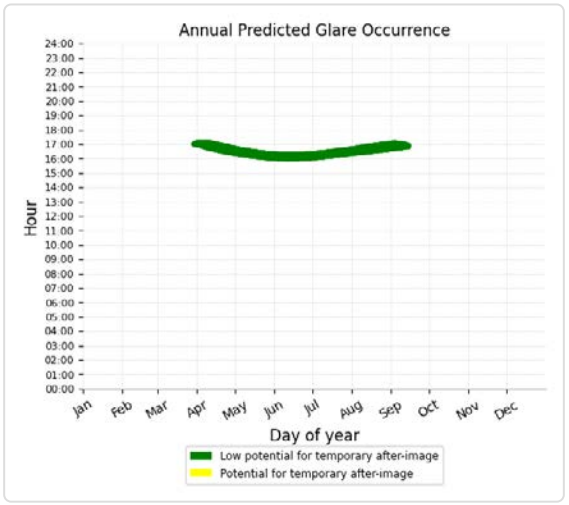
Receptor results ordered by category of glare

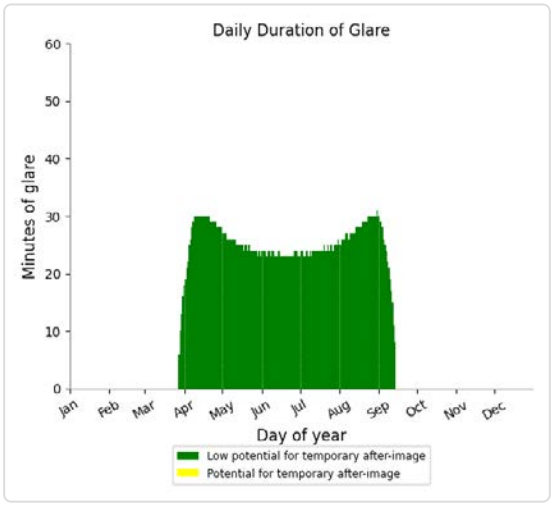
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	4,280	71.3	0	0.0
M-12	2,030	33.8	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	17,130	285.5	726	12.1
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

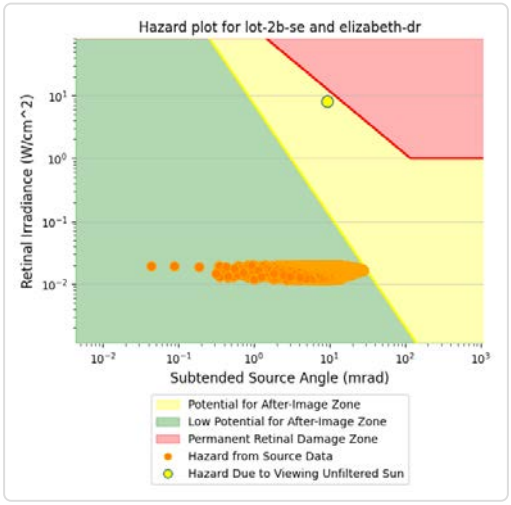
Lot 2b - SE and Route: Elizabeth Drive

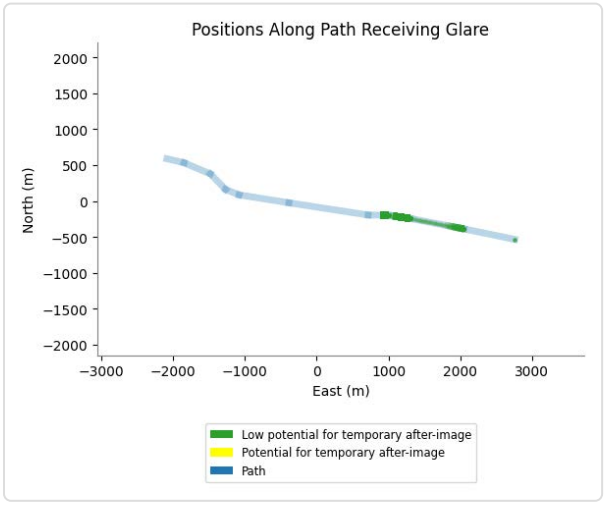
Yellow glare: none

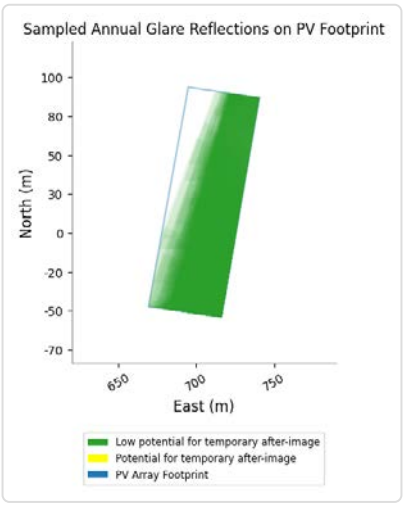
Green glare: 4,280 min.







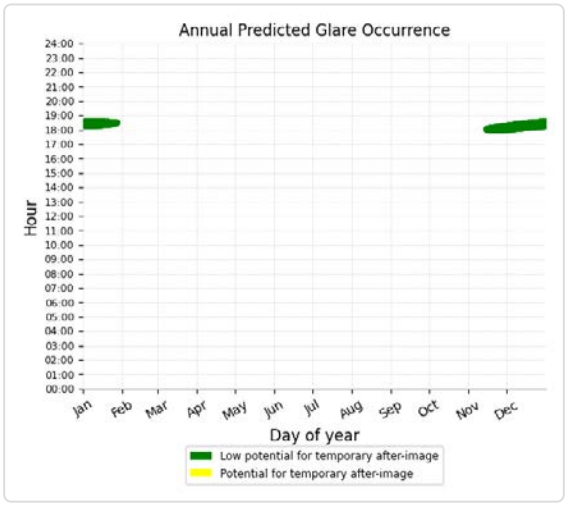


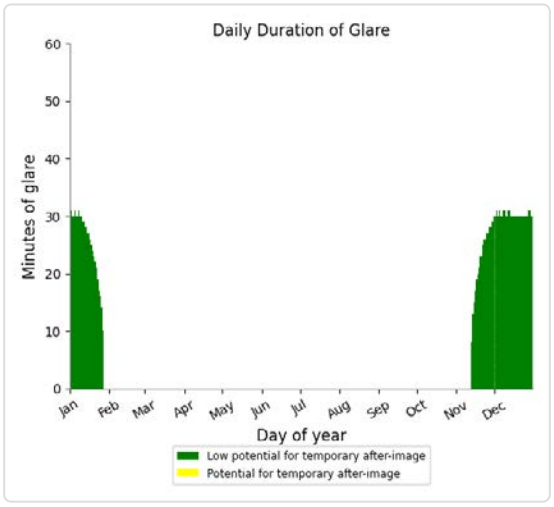


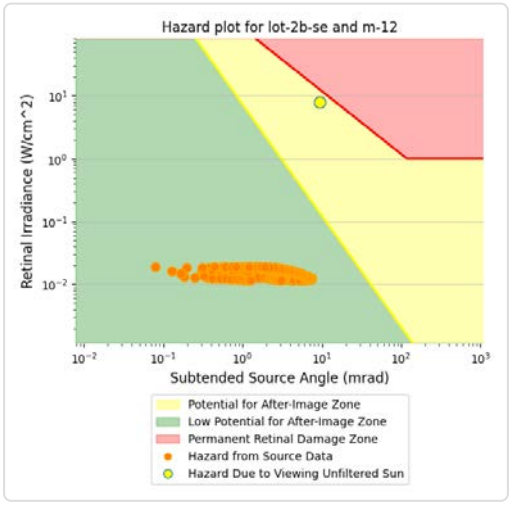
Lot 2b - SE and Route: M-12

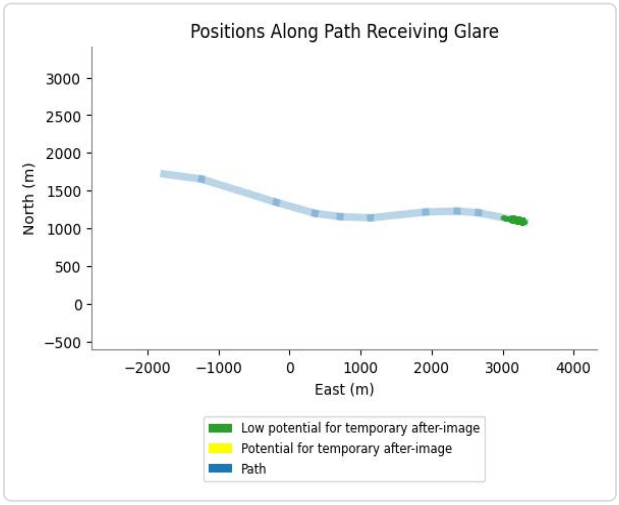
Yellow glare: none

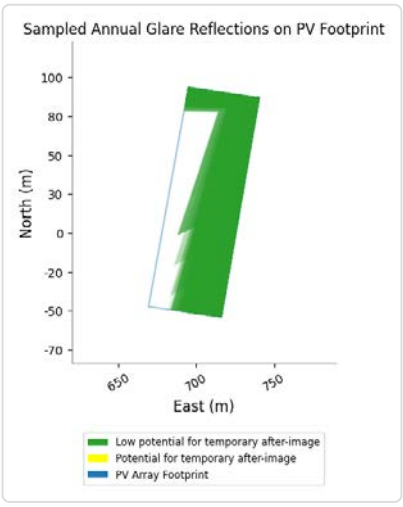
Green glare: 2,030 min.











Lot 2b - SE and Route: Airport Entry

No glare found

Lot 2b - SE and Route: Luddenham Road

No glare found

Lot 2b - SE and Route: M12 - northbound

No glare found

Lot 2b - SE and Route: M12 - southbound

No glare found

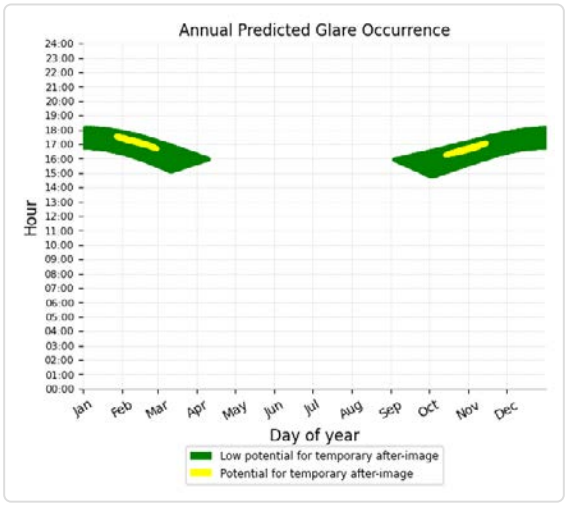
Lot 2b - SE and Route: Runway

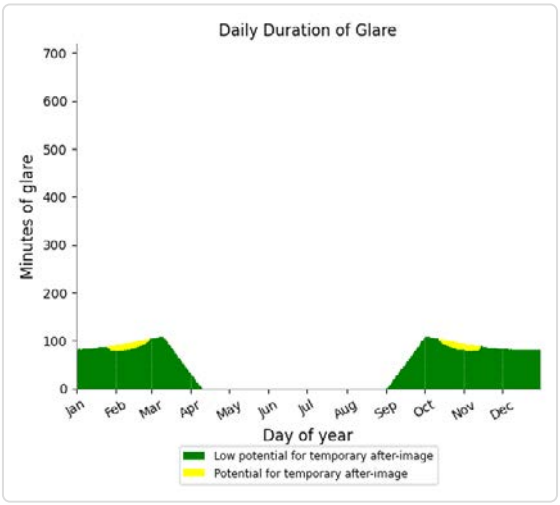
No glare found

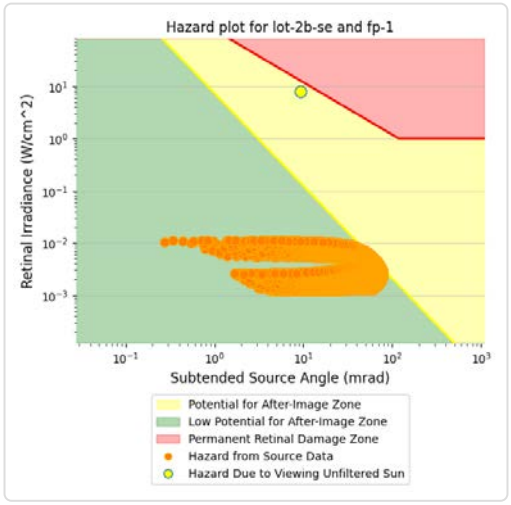
Lot 2b - SE and FP: FP 1

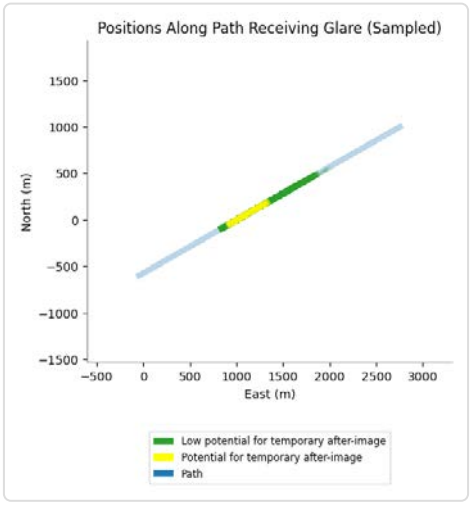
Yellow glare: 726 min.

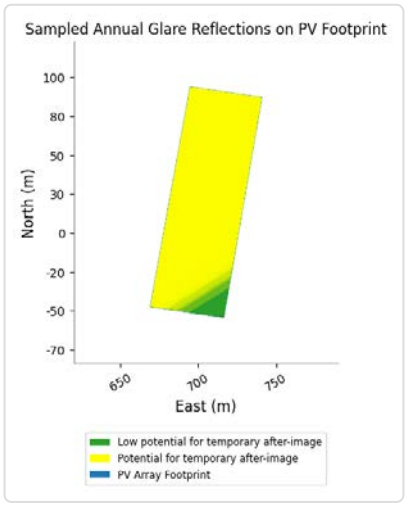
Green glare: 17,130 min.

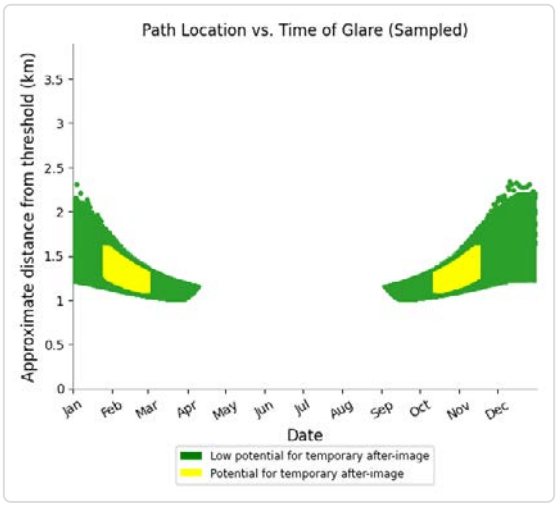












Lot 2b - SE and FP: FP 2

No glare found

Lot 2b - SE and OP 1

No glare found

Lot 2b - SE and OP 2

No glare found

Lot 2b - SE and OP 3

No glare found

PV: Lot 2b - SW low potential for temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	7,018	117.0	0	0.0
FP 2	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

Lot 2b - SW and Route: Airport Entry

No glare found

Lot 2b - SW and Route: Elizabeth Drive

No glare found

Lot 2b - SW and Route: Luddenham Road

No glare found

Lot 2b - SW and Route: M-12

No glare found

Lot 2b - SW and Route: M12 - northbound

No glare found

Lot 2b - SW and Route: M12 - southbound

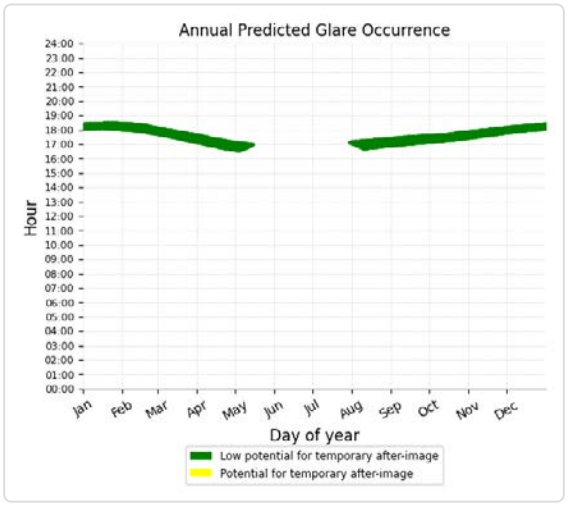
No glare found

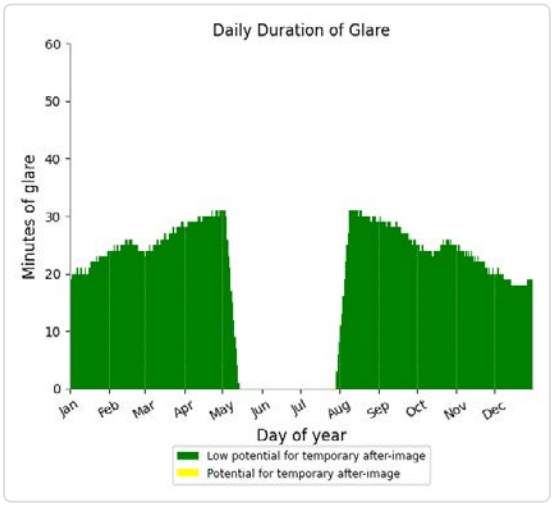
Lot 2b - SW and Route: Runway

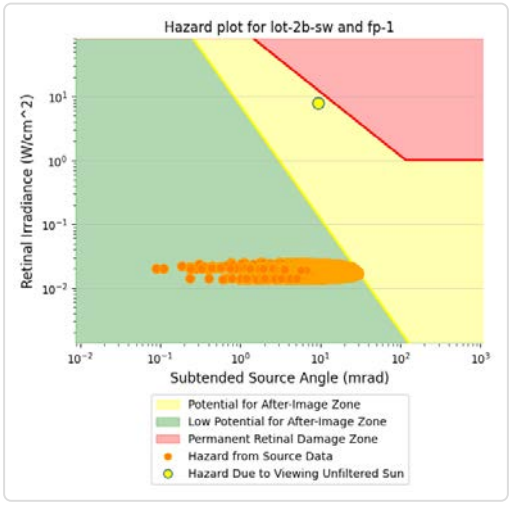
No glare found

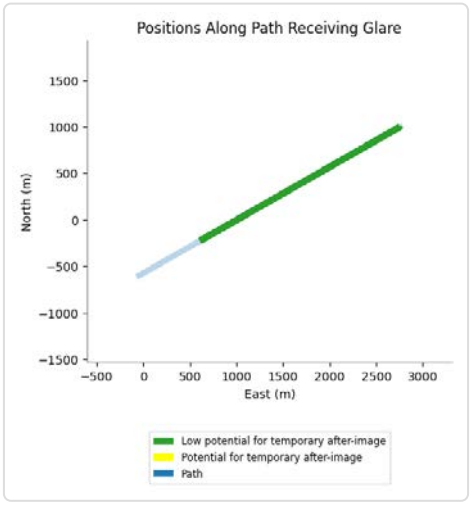
Lot 2b - SW and FP: FP 1

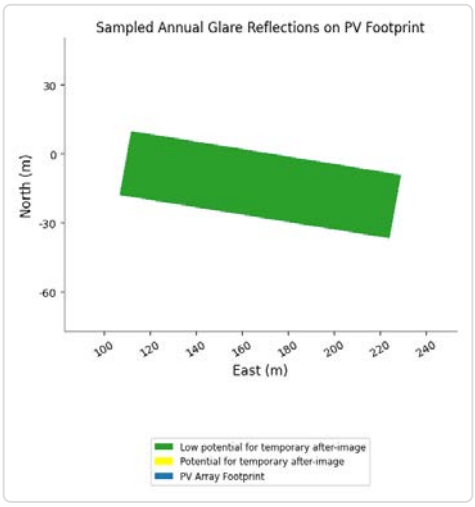
Yellow glare: none
Green glare: 7,018 min.

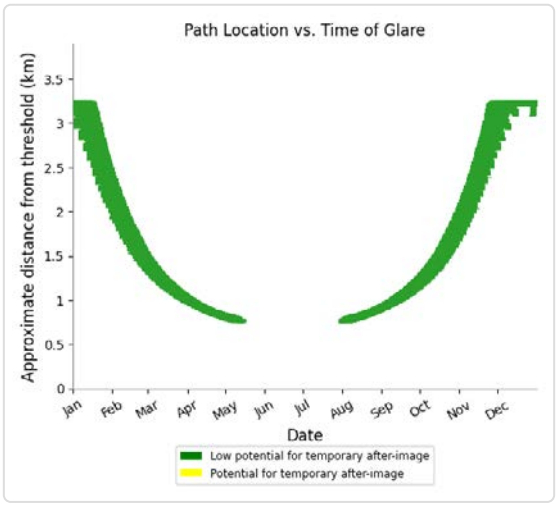












Lot 2b - SW and FP: FP 2

No glare found

Lot 2b - SW and OP 1

No glare found

Lot 2b - SW and OP 2

No glare found

Lot 2b - SW and OP 3

No glare found

PV: Lot 2b - W low potential for temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	6,698	111.6	0	0.0
FP 2	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

Lot 2b - W and Route: Airport Entry

No glare found

Lot 2b - W and Route: Elizabeth Drive

No glare found

Lot 2b - W and Route: Luddenham Road

No glare found

Lot 2b - W and Route: M-12

No glare found

Lot 2b - W and Route: M12 - northbound

No glare found

Lot 2b - W and Route: M12 - southbound

No glare found

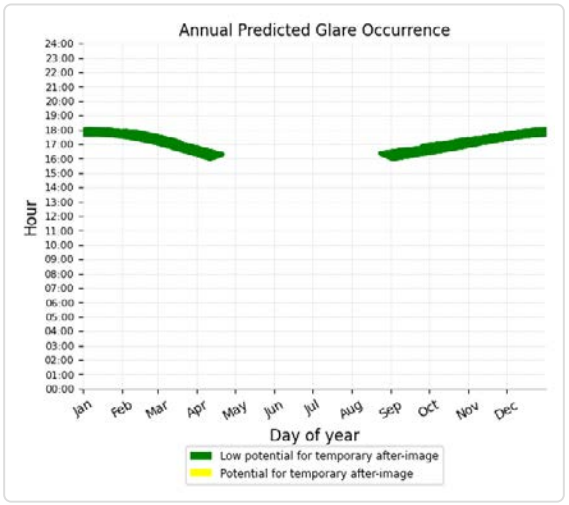
Lot 2b - W and Route: Runway

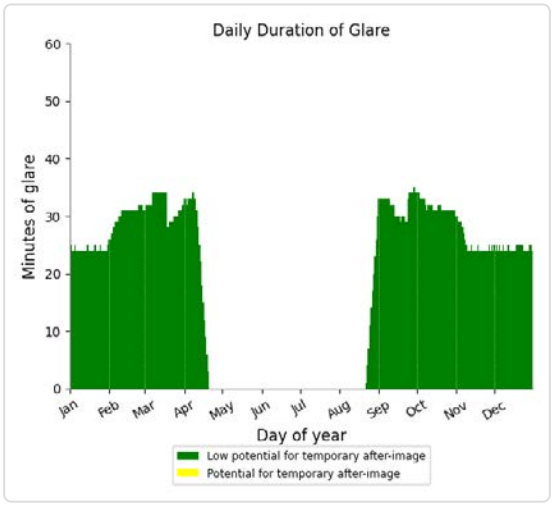
No glare found

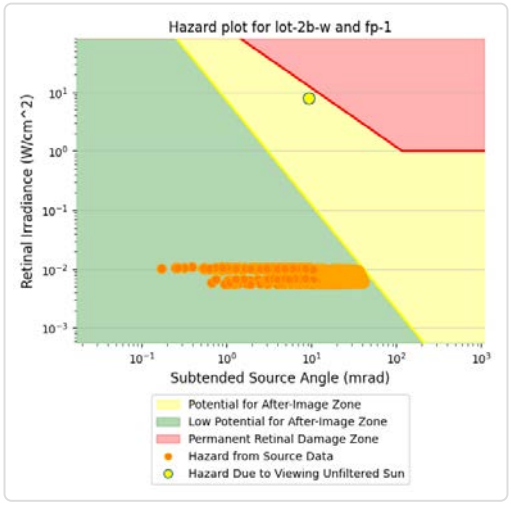
Lot 2b - W and FP: FP 1

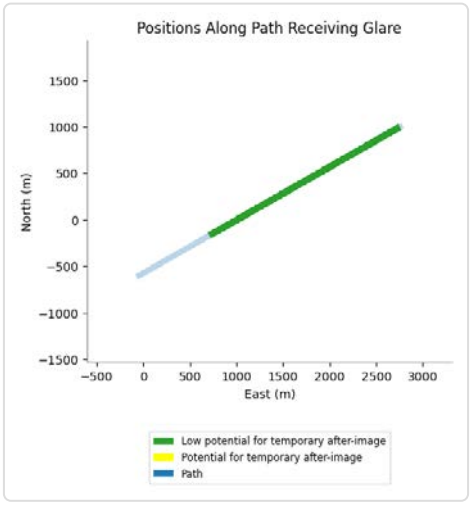
Yellow glare: none

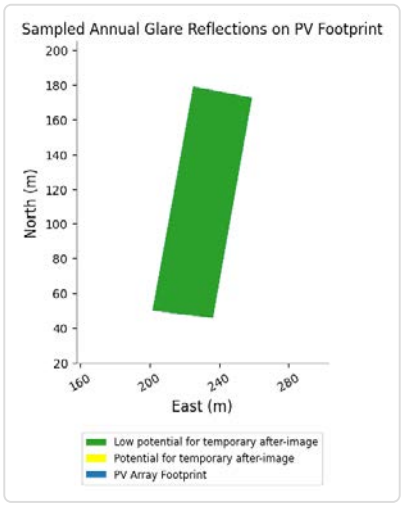
Green glare: 6,698 min.

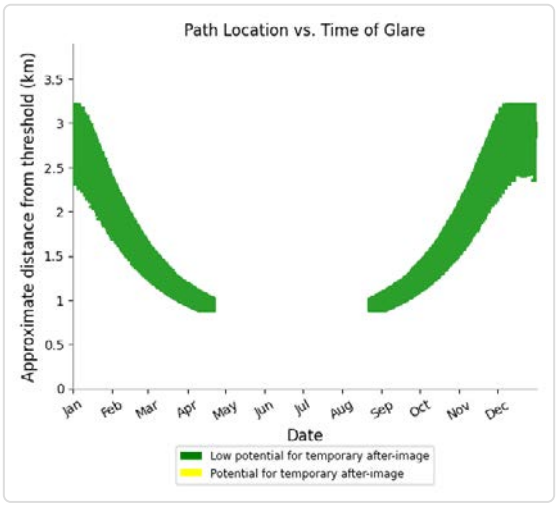












Lot 2b - W and FP: FP 2

No glare found

Lot 2b - W and OP 1

No glare found

Lot 2b - W and OP 2

No glare found

Lot 2b - W and OP 3

No glare found

PV: Lot 4a - E potential temporary after-image

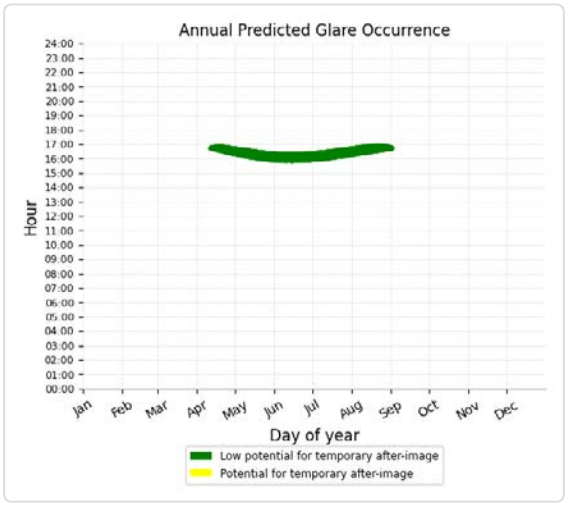
Receptor results ordered by category of glare

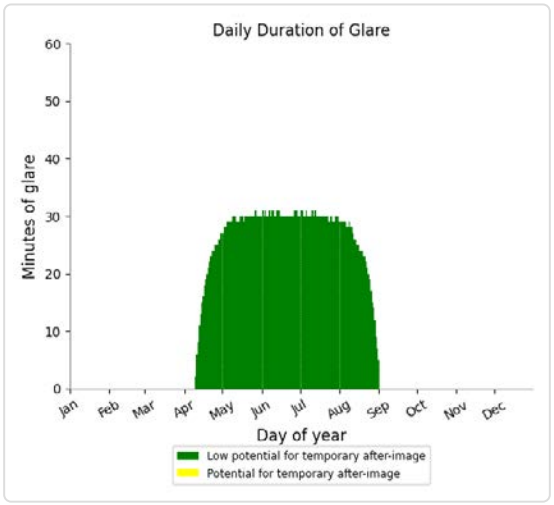
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	3,875	64.6	0	0.0
M-12	2,163	36.0	0	0.0
M12 - northbound	1,234	20.6	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	8,037	133.9	1,663	27.7
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

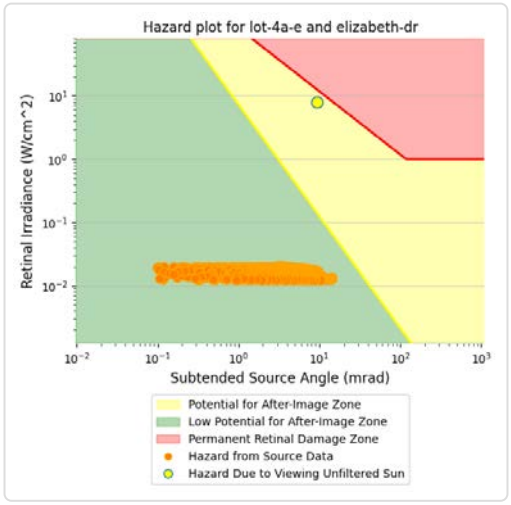
Lot 4a - E and Route: Elizabeth Drive

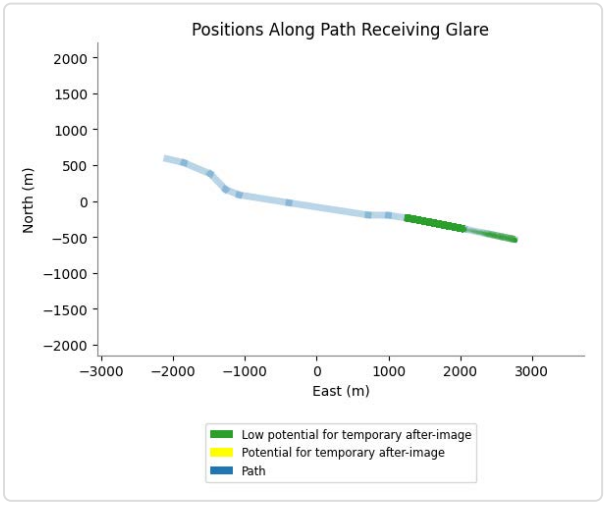
Yellow glare: none

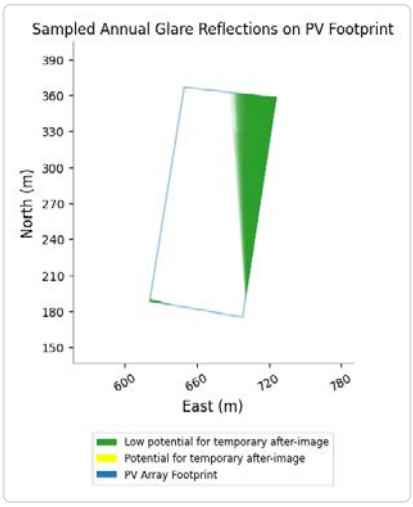
Green glare: 3,875 min.







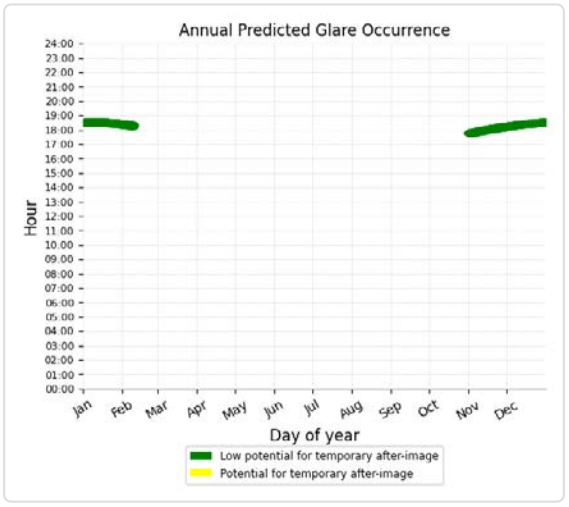


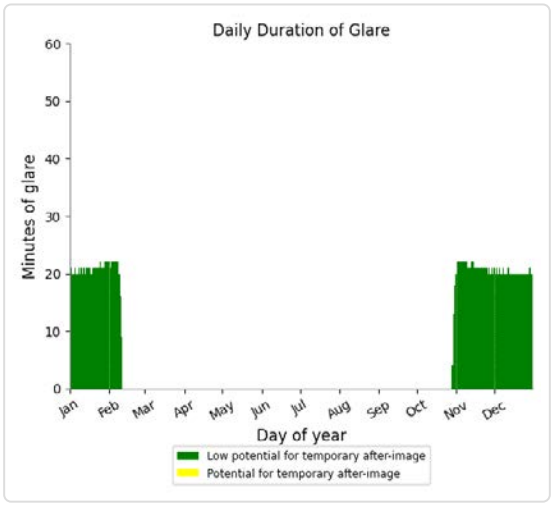


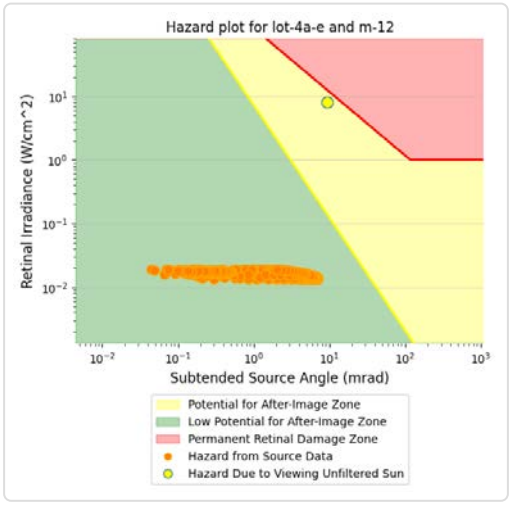
Lot 4a - E and Route: M-12

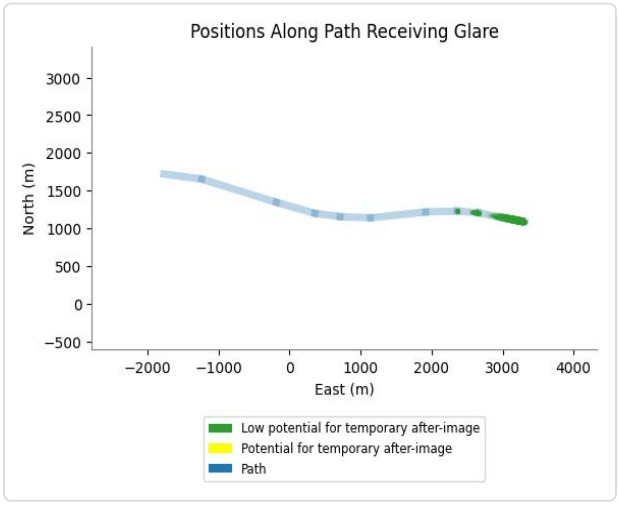
Yellow glare: none

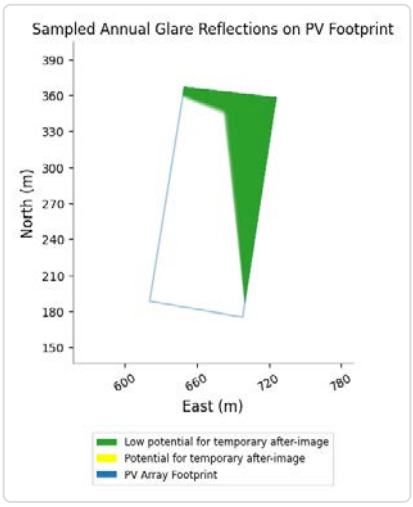
Green glare: 2,163 min.







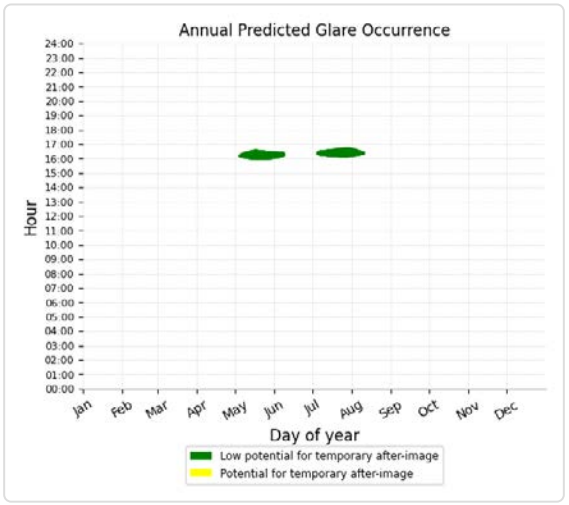


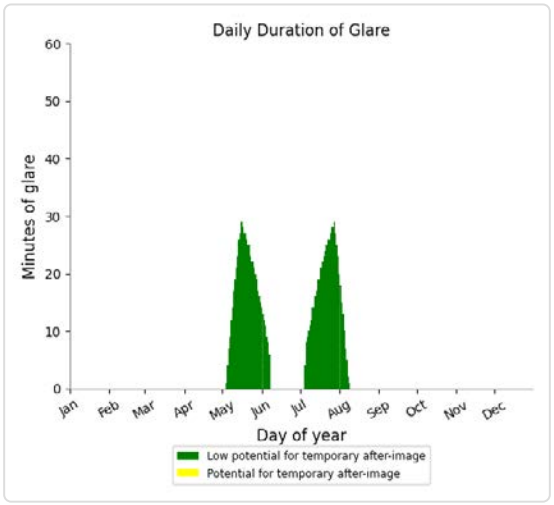


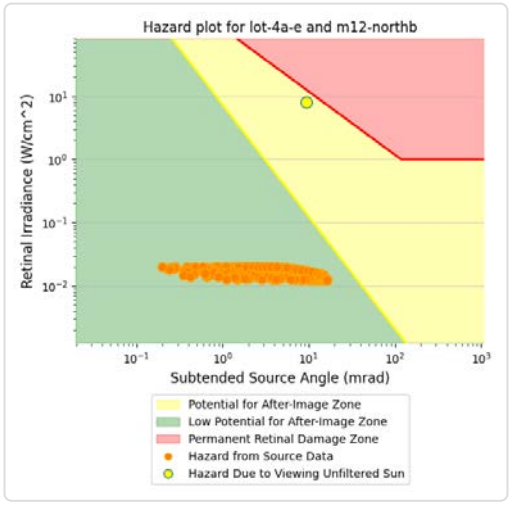
Lot 4a - E and Route: M12 - northbound

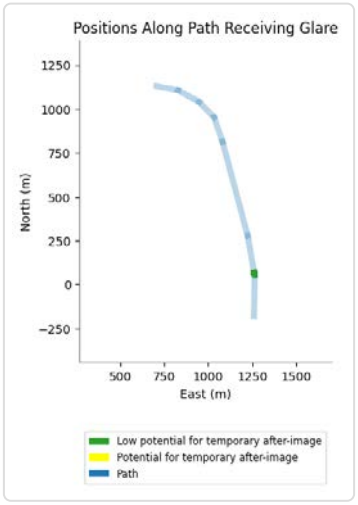
Yellow glare: none

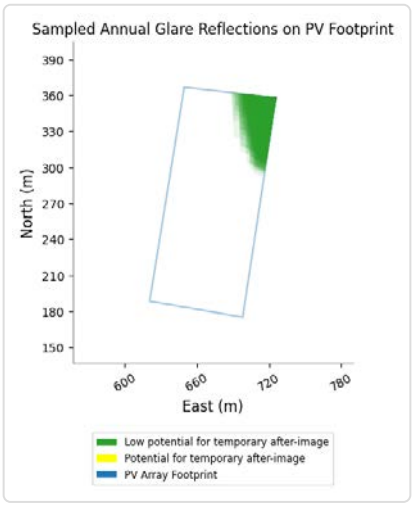
Green glare: 1,234 min.











Lot 4a - E and Route: Airport Entry

No glare found

Lot 4a - E and Route: Luddenham Road

No glare found

Lot 4a - E and Route: M12 - southbound

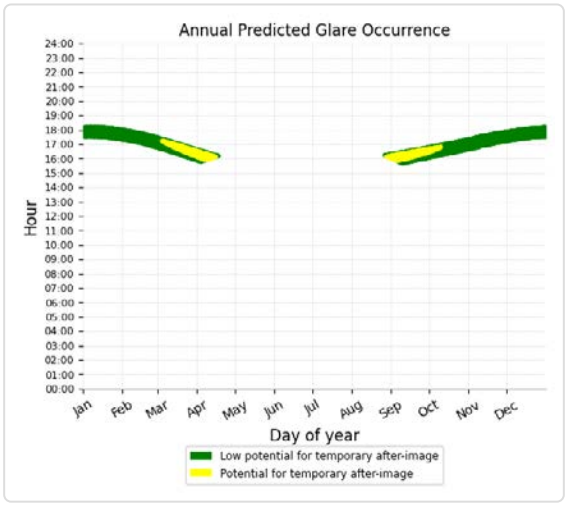
No glare found

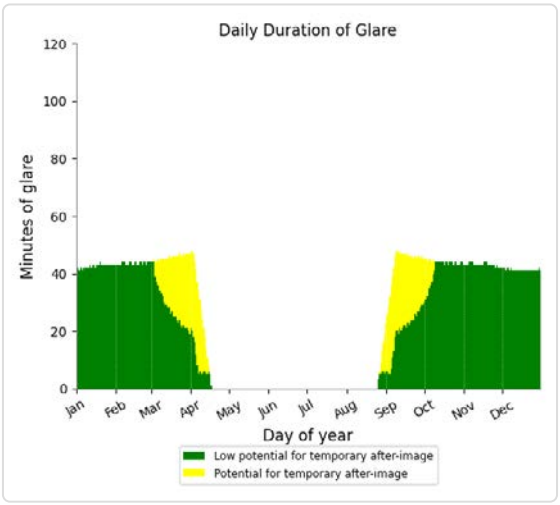
Lot 4a - E and Route: Runway

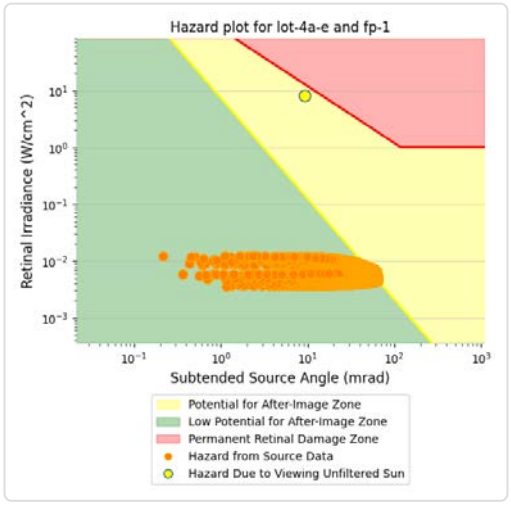
No glare found

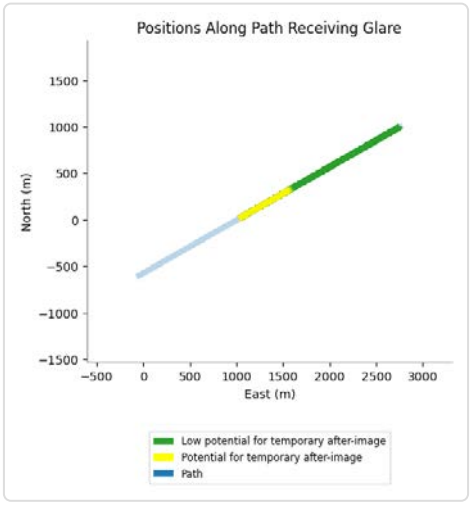
Lot 4a - E and FP: FP 1

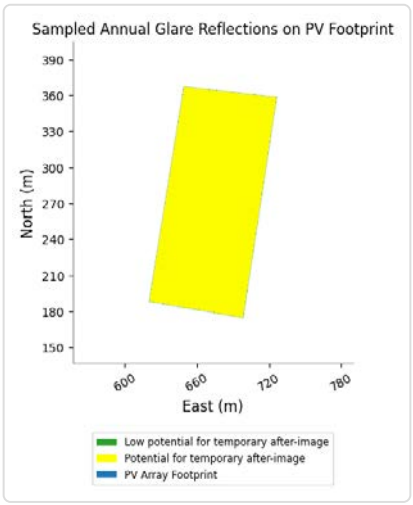
Yellow glare: 1,663 min.
Green glare: 8,037 min.

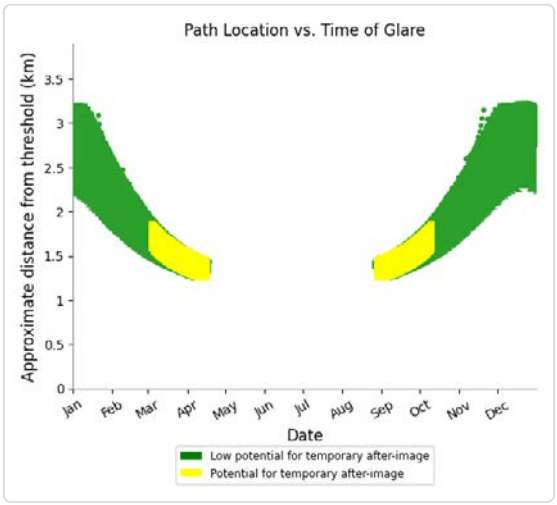












Lot 4a - E and FP: FP 2

No glare found

Lot 4a - E and OP 1

No glare found

Lot 4a - E and OP 2

No glare found

Lot 4a - E and OP 3

No glare found

PV: Lot 4a - W potential temporary after-image

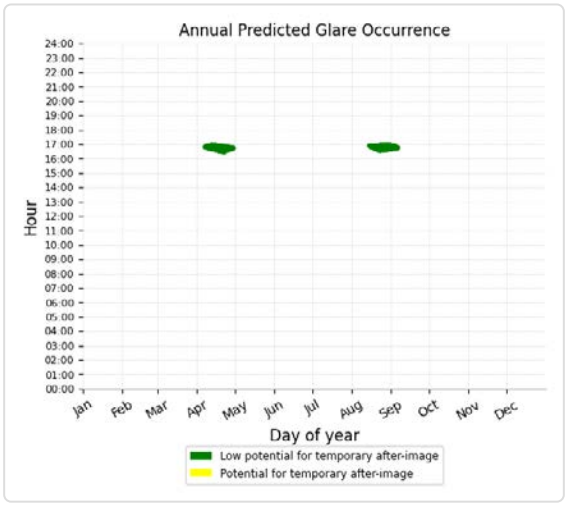
Receptor results ordered by category of glare

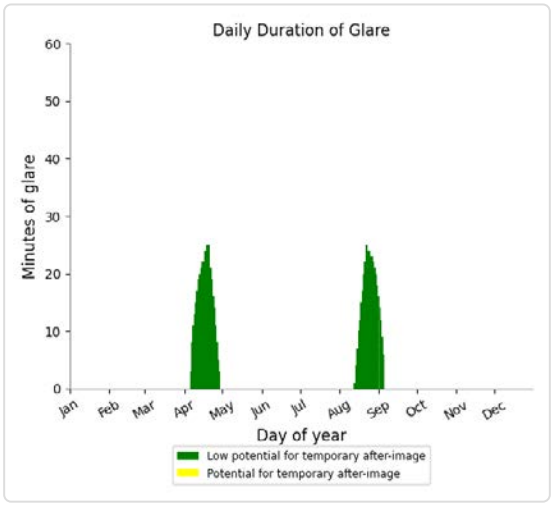
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	781	13.0	0	0.0
M-12	554	9.2	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	7,556	125.9	439	7.3
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

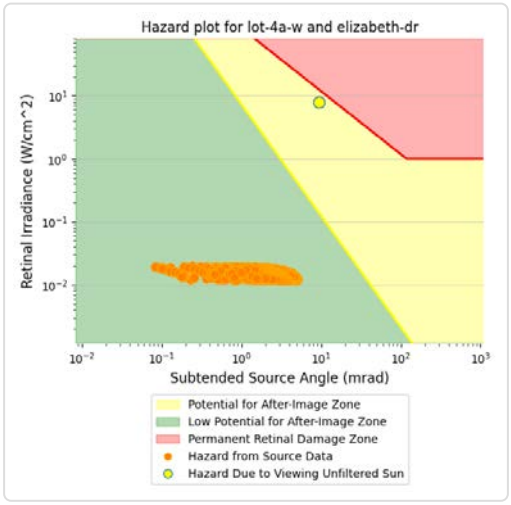
Lot 4a - W and Route: Elizabeth Drive

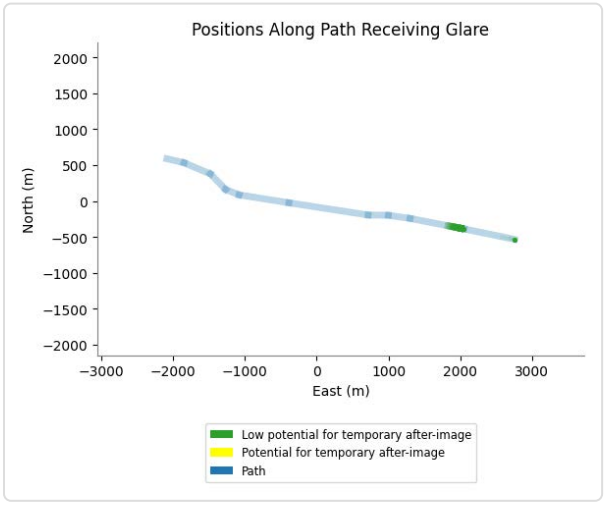
Yellow glare: none

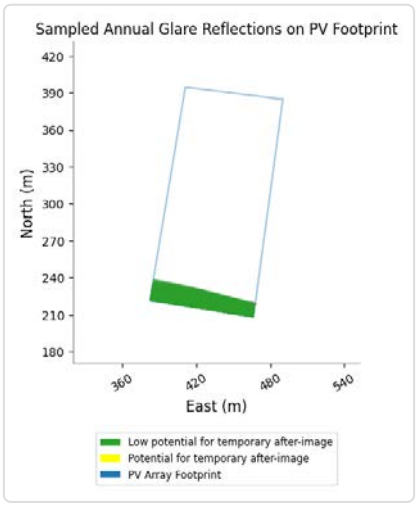
Green glare: 781 min.







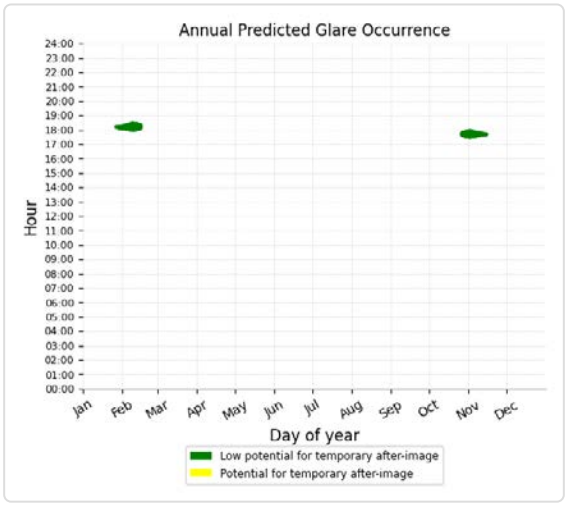


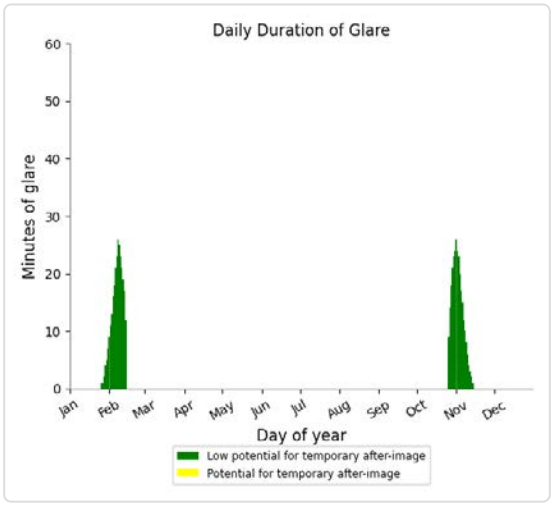


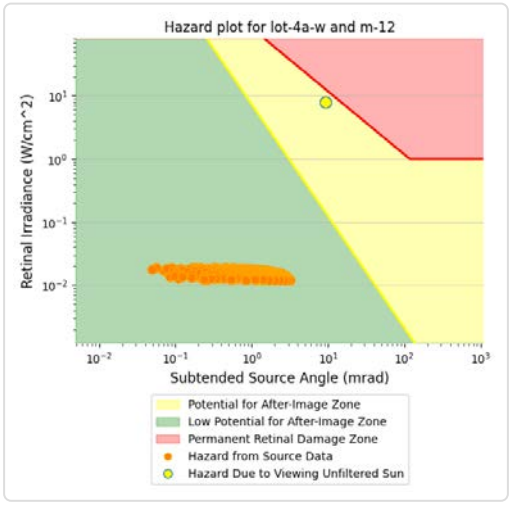
Lot 4a - W and Route: M-12

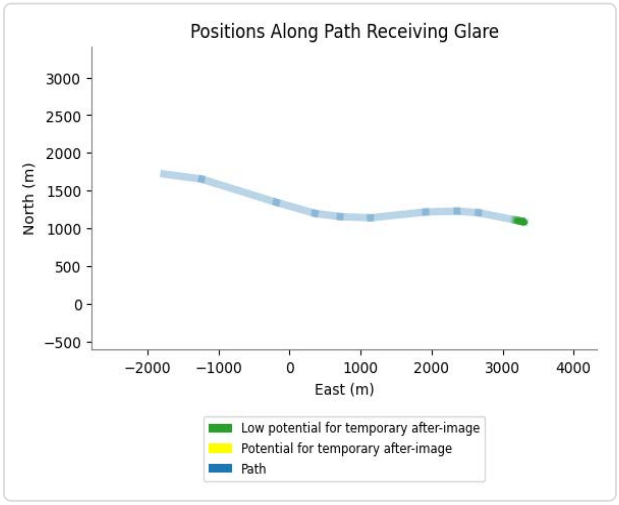
Yellow glare: none

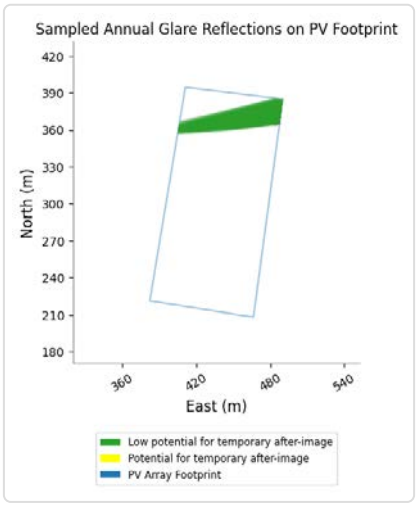
Green glare: 554 min.











Lot 4a - W and Route: Airport Entry

No glare found

Lot 4a - W and Route: Luddenham Road

No glare found

Lot 4a - W and Route: M12 - northbound

No glare found

Lot 4a - W and Route: M12 - southbound

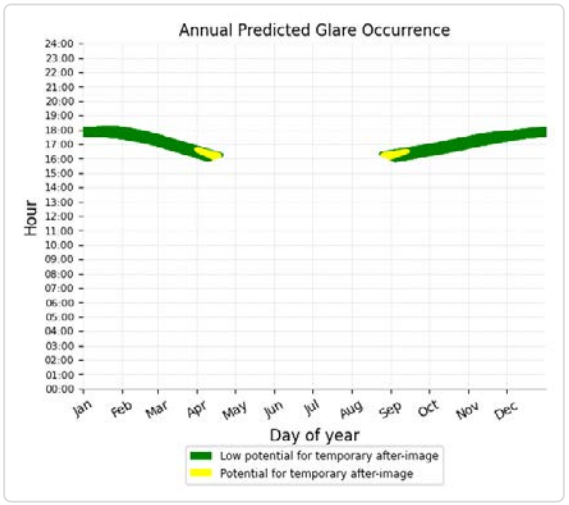
No glare found

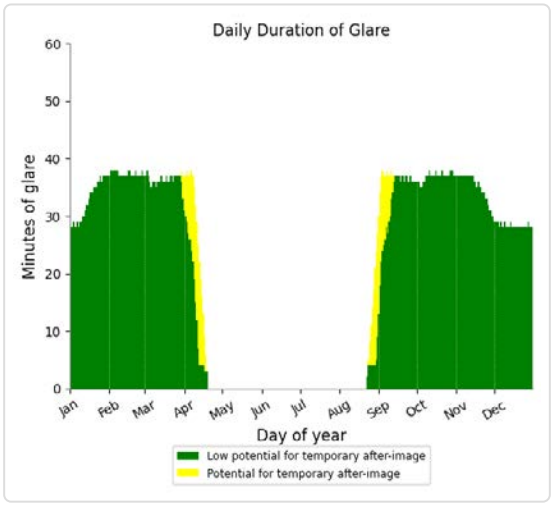
Lot 4a - W and Route: Runway

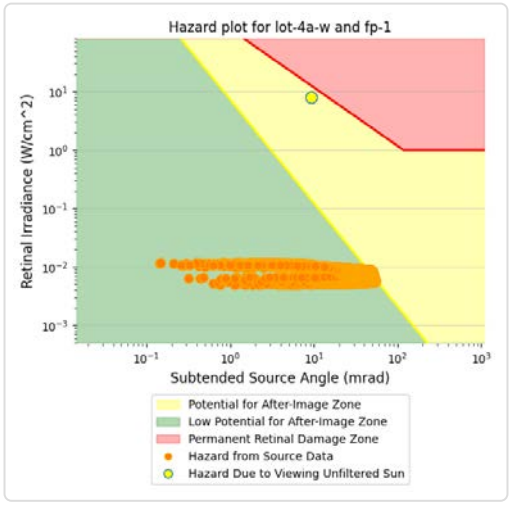
No glare found

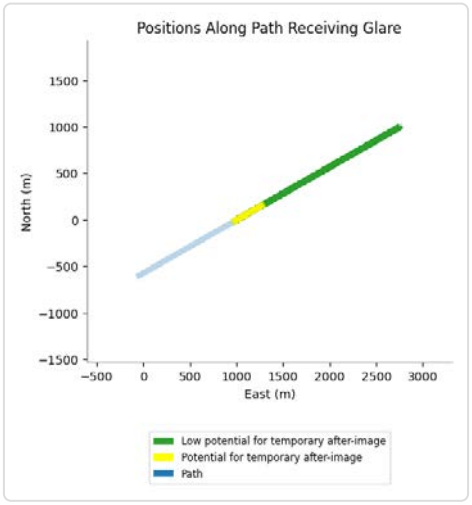
Lot 4a - W and FP: FP 1

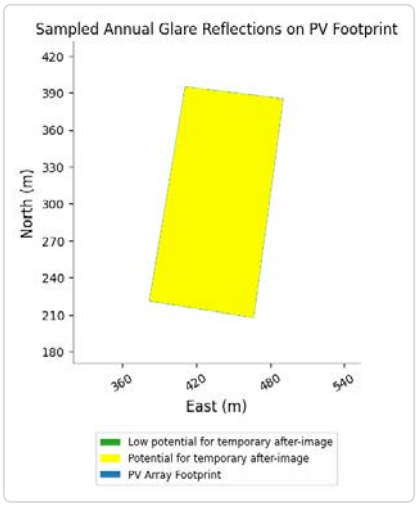
Yellow glare: 439 min.
Green glare: 7,556 min.

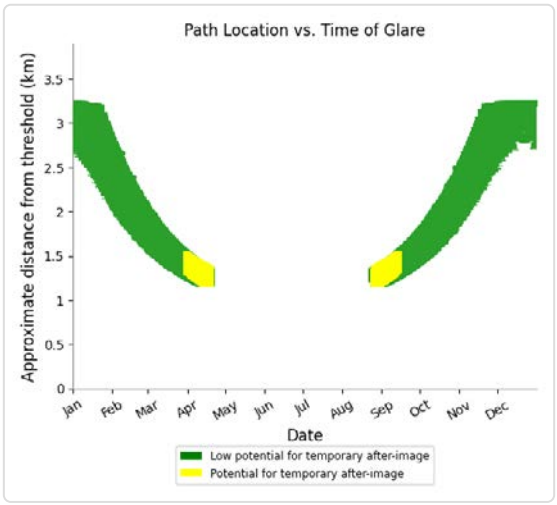












Lot 4a - W and FP: FP 2

No glare found

Lot 4a - W and OP 1

No glare found

Lot 4a - W and OP 2

No glare found

Lot 4a - W and OP 3

No glare found

PV: Lot 4b - E potential temporary after-image

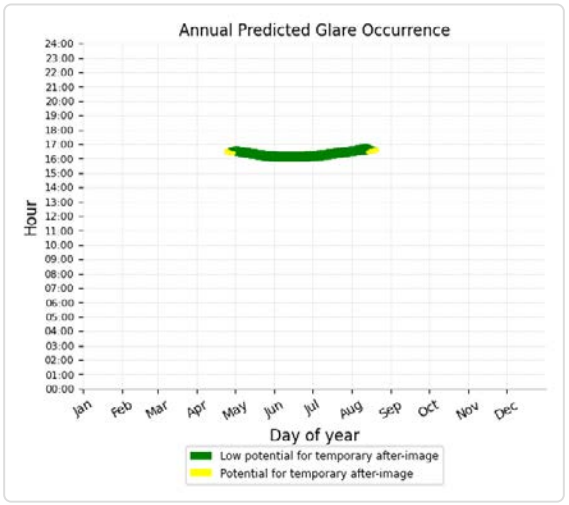
Receptor results ordered by category of glare

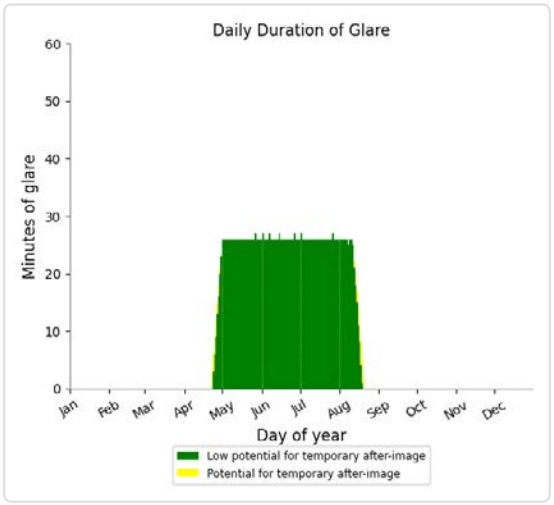
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
M12 - northbound	2,877	48.0	38	0.6
Elizabeth Drive	2,524	42.1	0	0.0
M-12	2,845	47.4	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	7,695	128.2	16	0.3
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

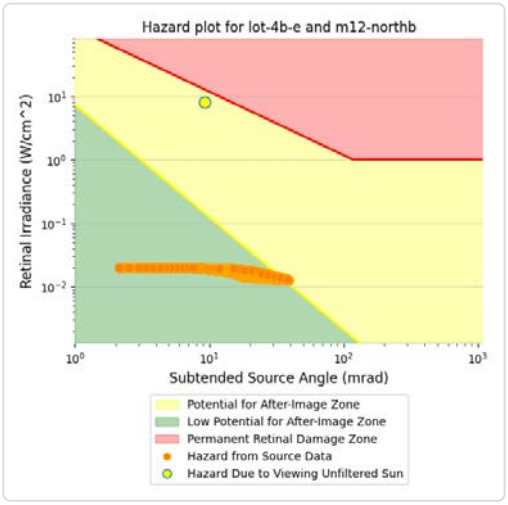
Lot 4b - E and Route: M12 - northbound

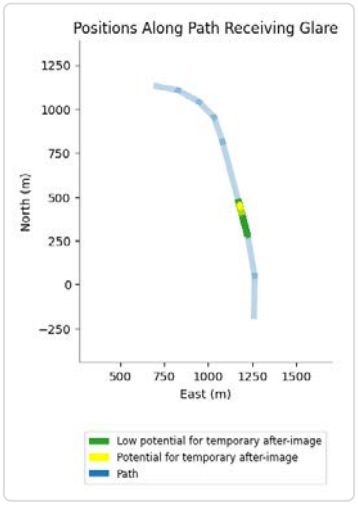
Yellow glare: 38 min.

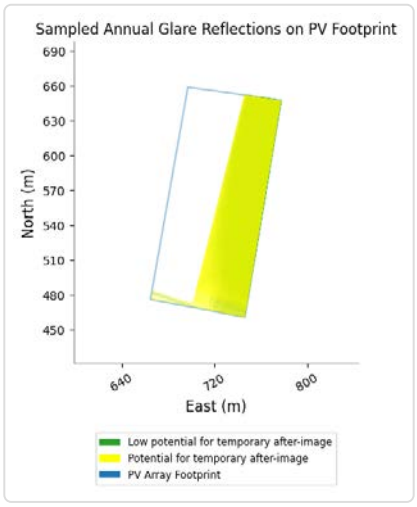
Green glare: 2,877 min.







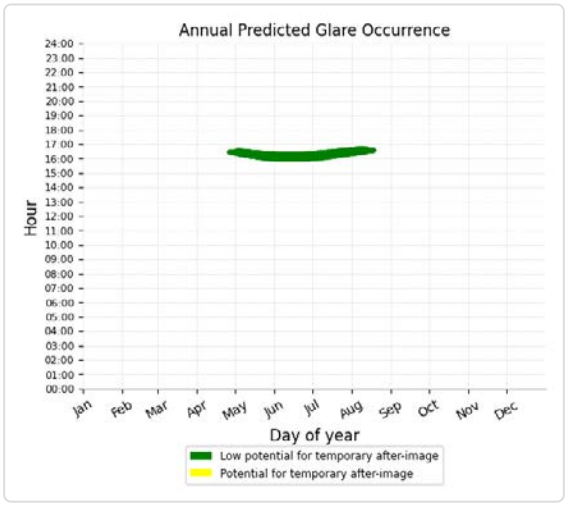


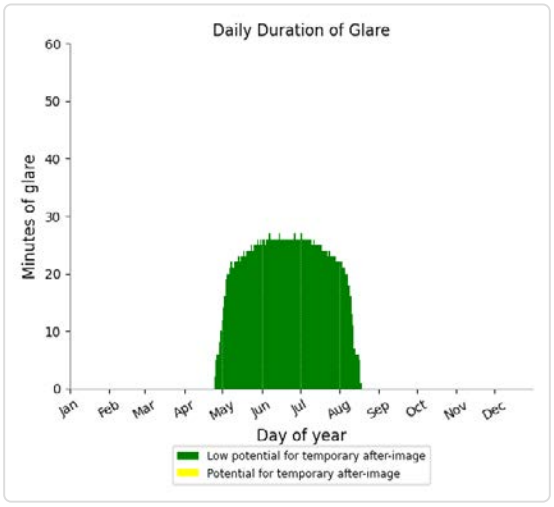


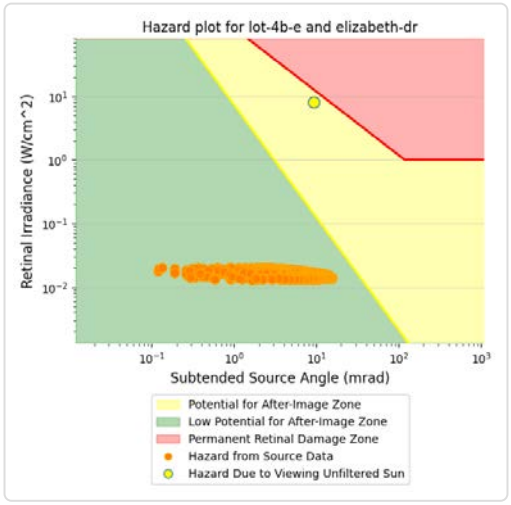
Lot 4b - E and Route: Elizabeth Drive

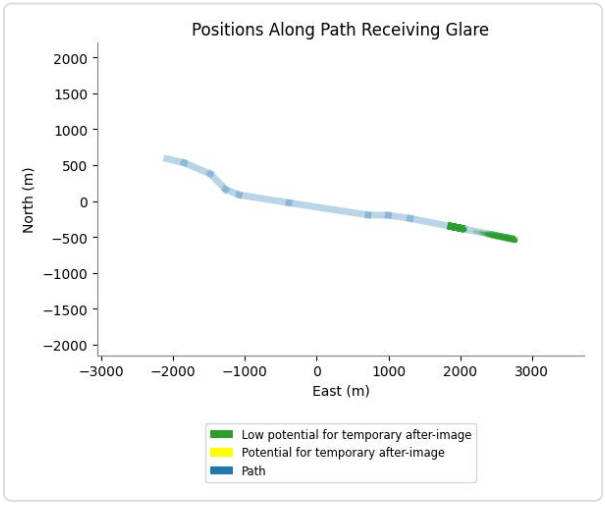
Yellow glare: none

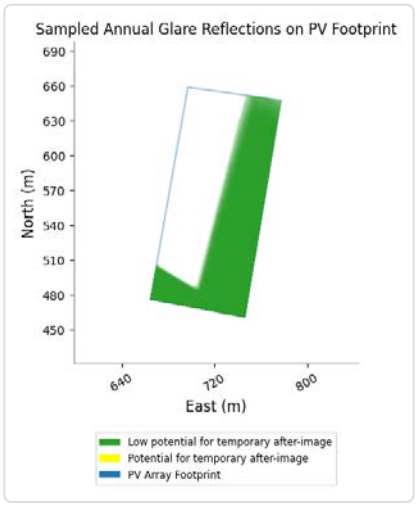
Green glare: 2,524 min.







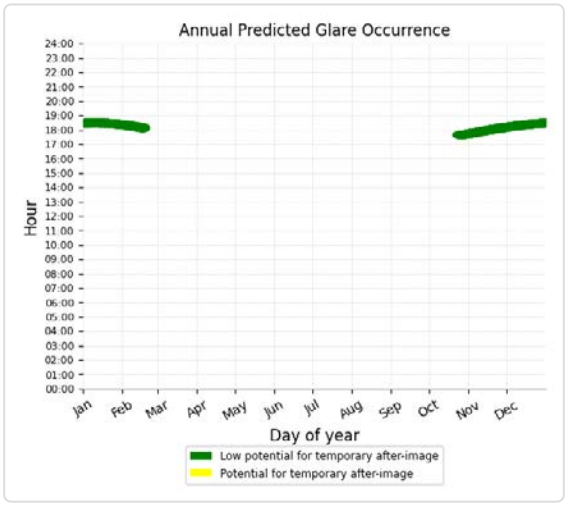


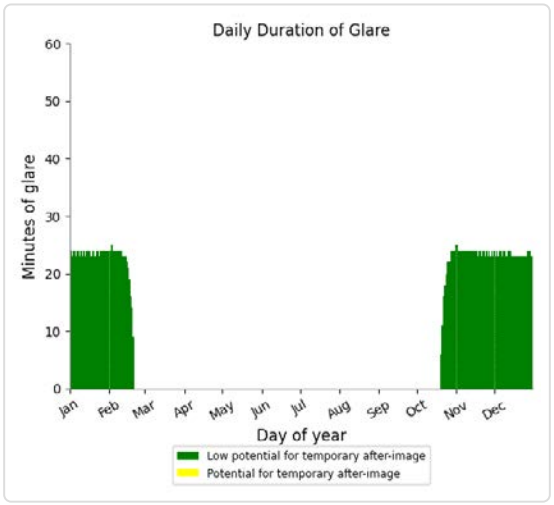


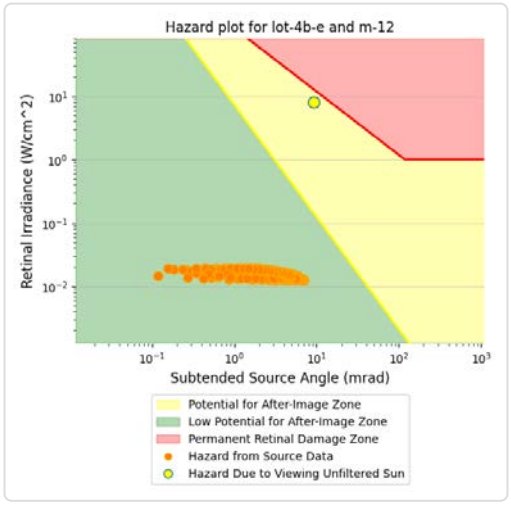
Lot 4b - E and Route: M-12

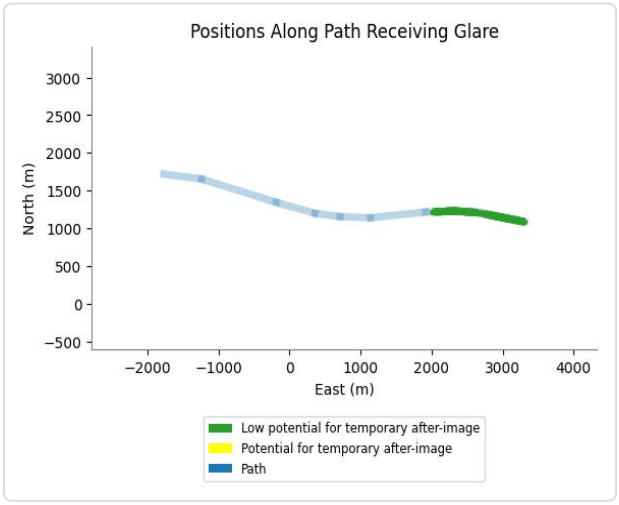
Yellow glare: none

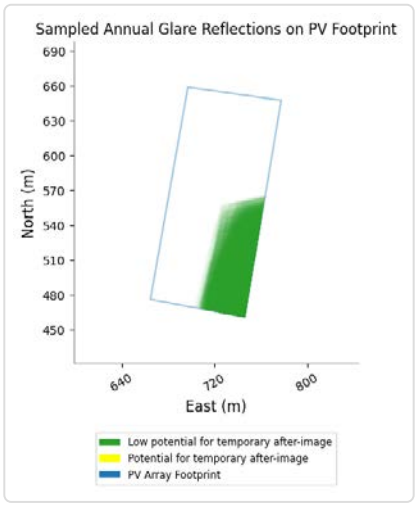
Green glare: 2,845 min.











Lot 4b - E and Route: Airport Entry

No glare found

Lot 4b - E and Route: Luddenham Road

No glare found

Lot 4b - E and Route: M12 - southbound

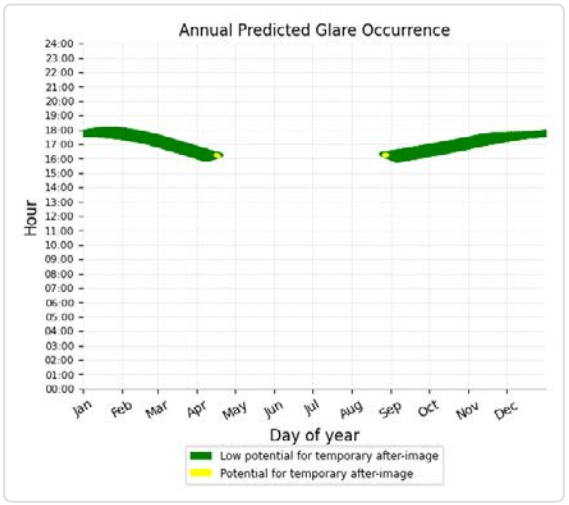
No glare found

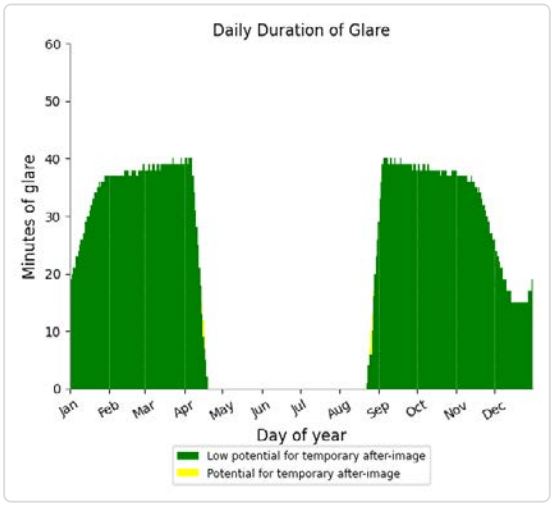
Lot 4b - E and Route: Runway

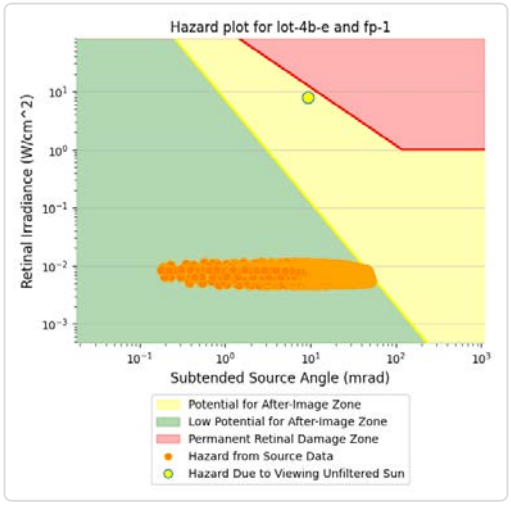
No glare found

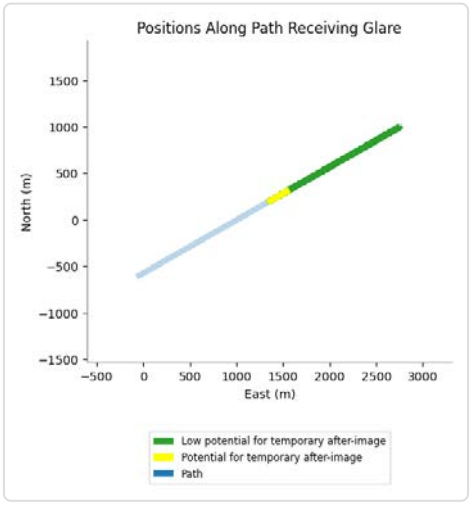
Lot 4b - E and FP: FP 1

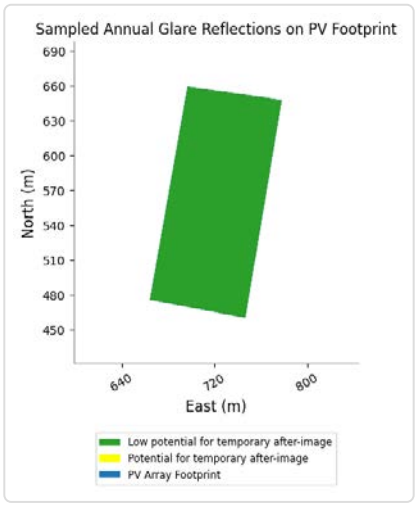
Yellow glare: 16 min.
Green glare: 7,695 min.

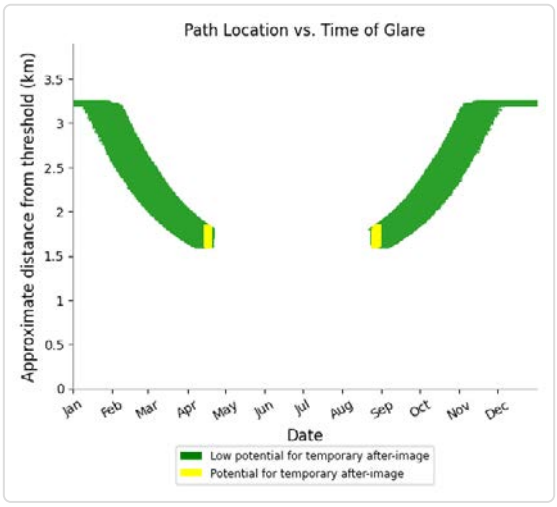












Lot 4b - E and FP: FP 2

No glare found

Lot 4b - E and OP 1

No glare found

Lot 4b - E and OP 2

No glare found

Lot 4b - E and OP 3

No glare found

PV: Lot 4b - W low potential for temporary after-image

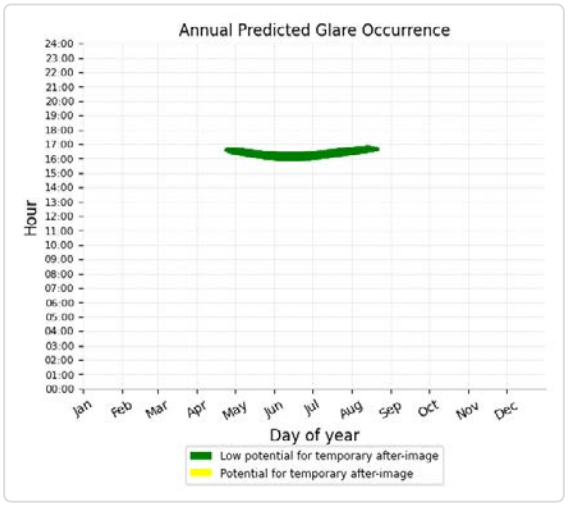
Receptor results ordered by category of glare

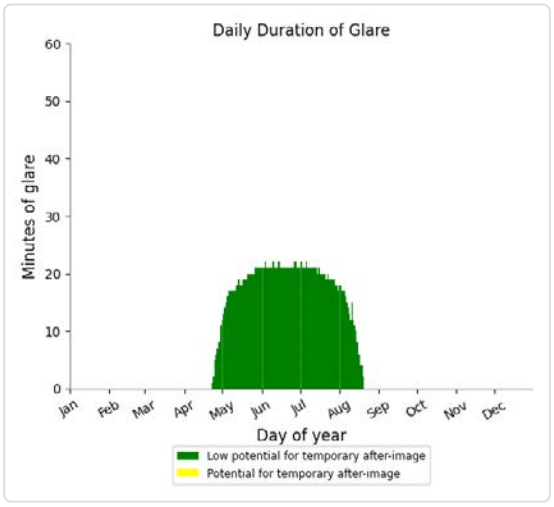
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	2,107	35.1	0	0.0
M12 - northbound	1,744	29.1	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	5,593	93.2	0	0.0
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

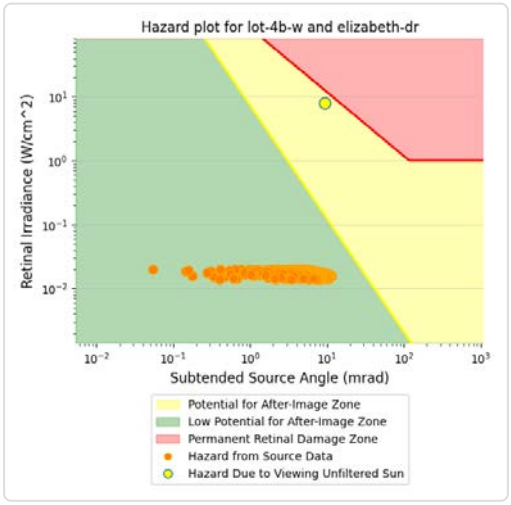
Lot 4b - W and Route: Elizabeth Drive

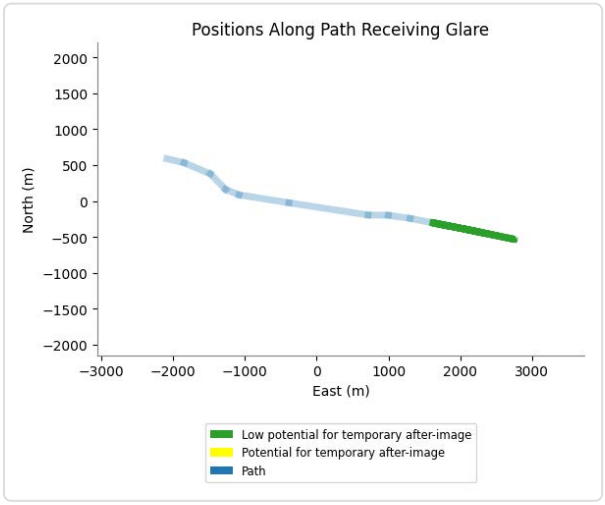
Yellow glare: none

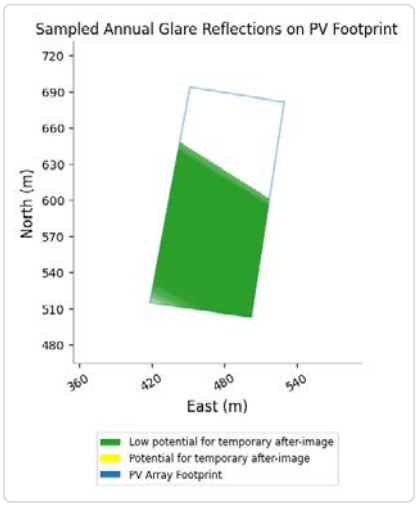
Green glare: 2,107 min.







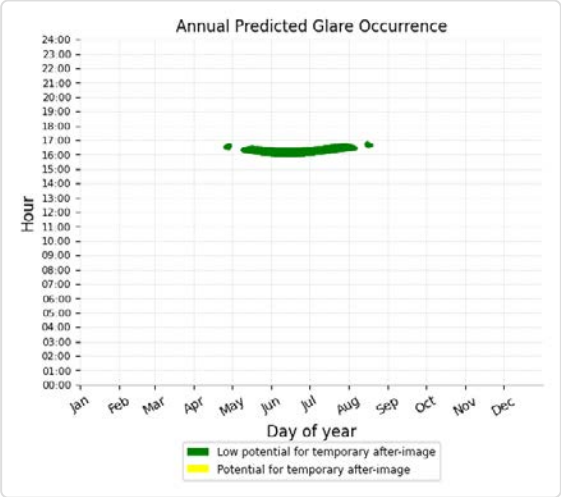


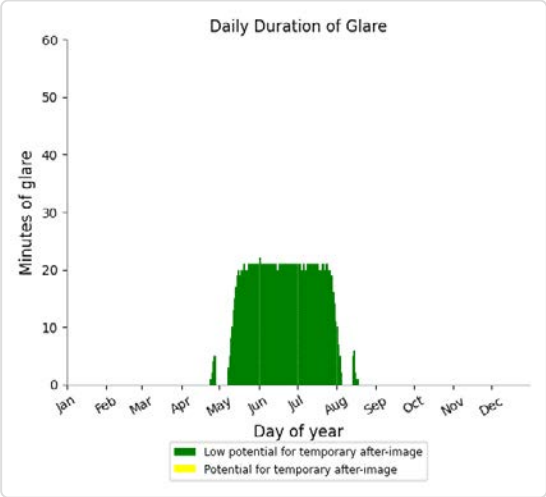


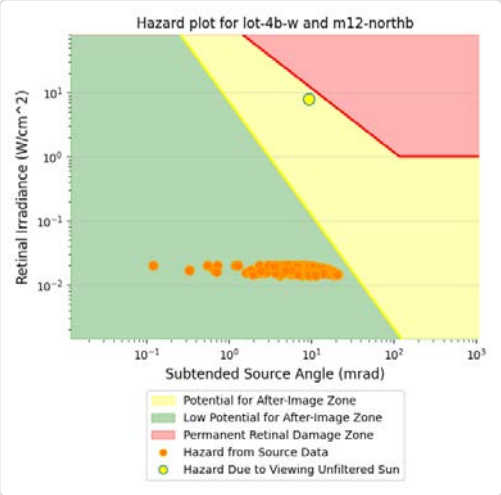
Lot 4b - W and Route: M12 - northbound

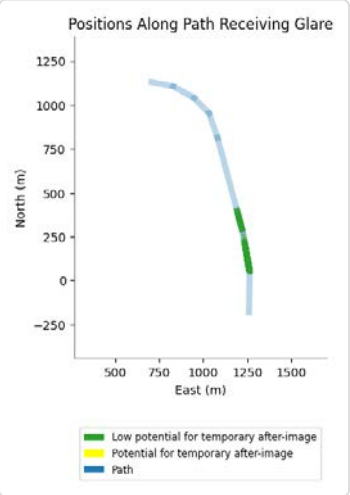
Yellow glare: none

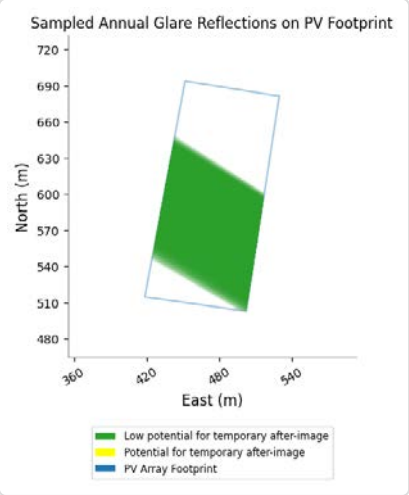
Green glare: 1,744 min.











Lot 4b - W and Route: Airport Entry

No glare found

Lot 4b - W and Route: Luddenham Road

No glare found

Lot 4b - W and Route: M-12

No glare found

Lot 4b - W and Route: M12 - southbound

No glare found

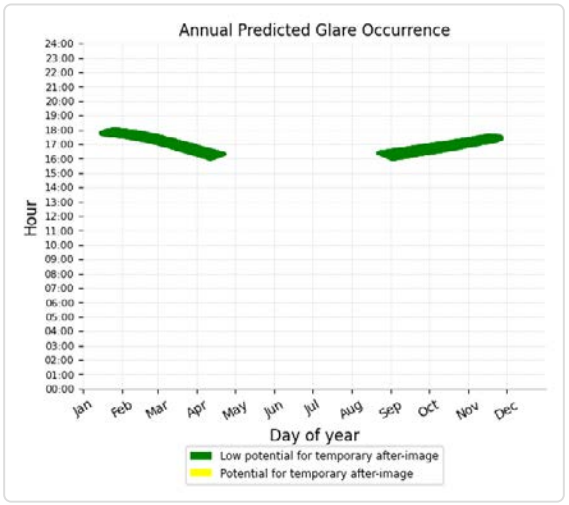
Lot 4b - W and Route: Runway

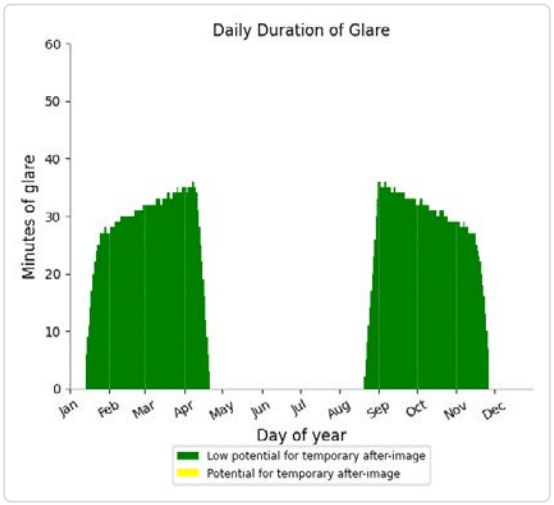
No glare found

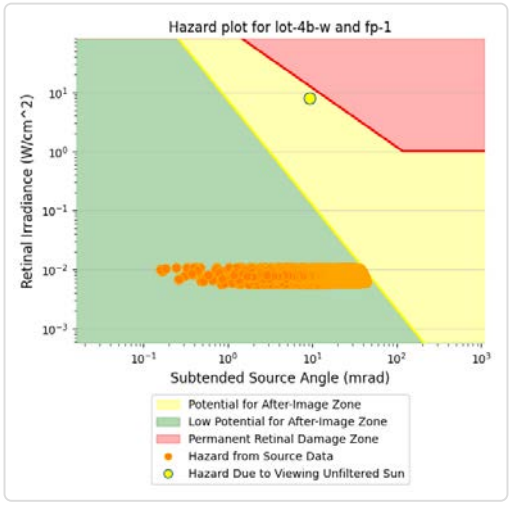
Lot 4b - W and FP: FP 1

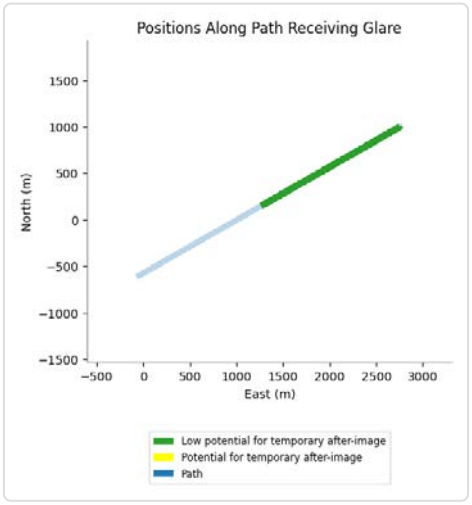
Yellow glare: none

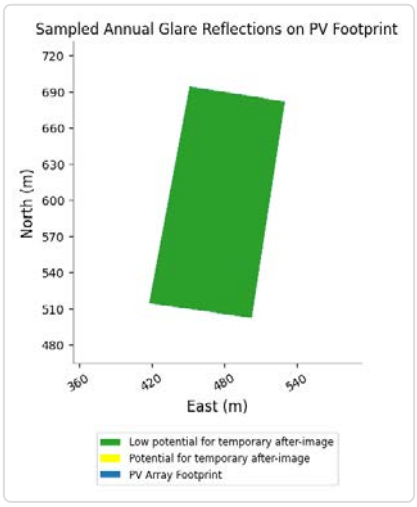
Green glare: 5,593 min.

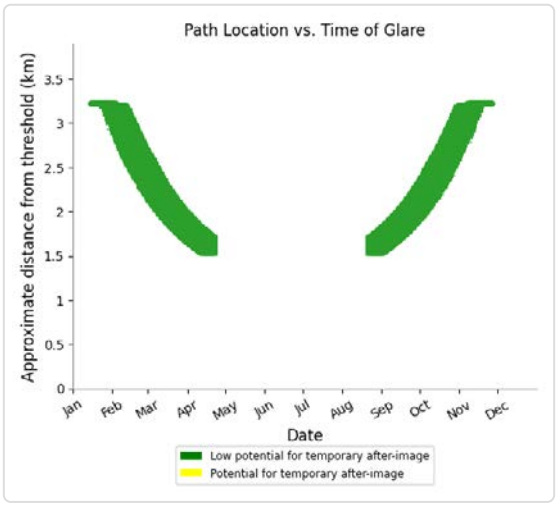












Lot 4b - W and FP: FP 2

No glare found

Lot 4b - W and OP 1

No glare found

Lot 4b - W and OP 2

No glare found

Lot 4b - W and OP 3

No glare found

PV: Lot 5b low potential for temporary after-image

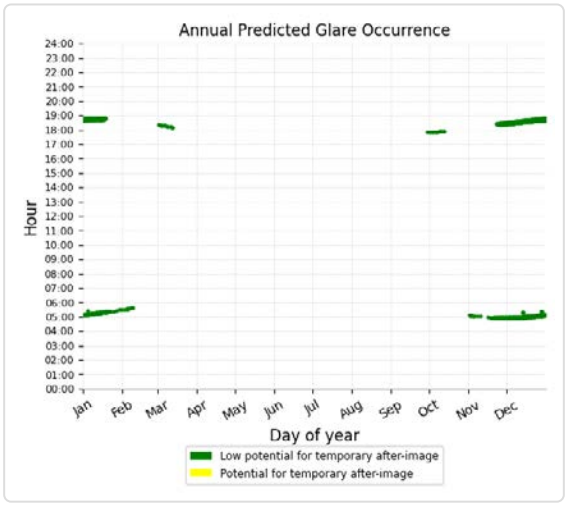
Receptor results ordered by category of glare

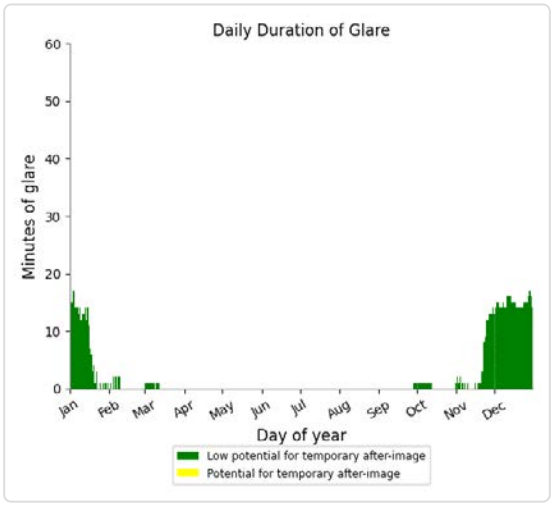
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
M-12	852	14.2	0	0.0
M12 - northbound	176	2.9	0	0.0
M12 - southbound	34	0.6	0	0.0
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	4,557	76.0	0	0.0
FP 2	0	0.0	0	0.0
OP 3	326	5.4	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0

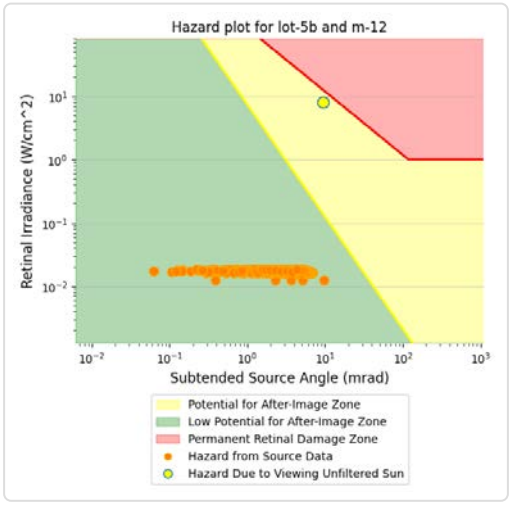
Lot 5b and Route: M-12

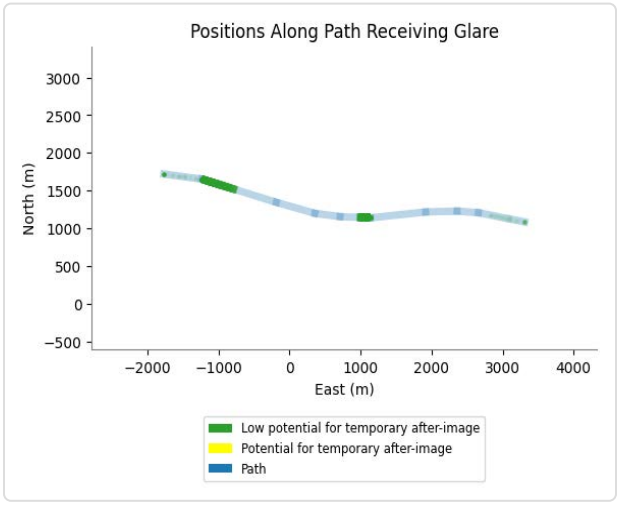
Yellow glare: none

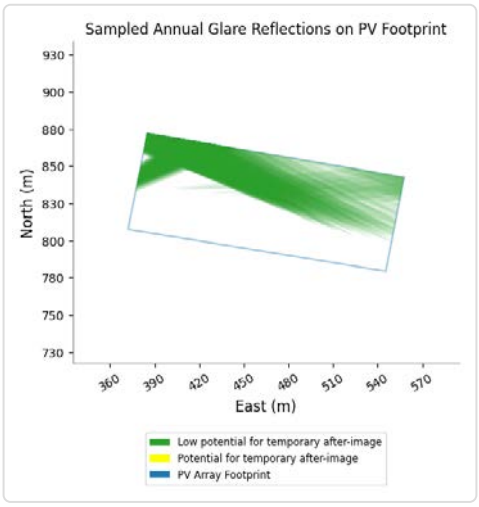
Green glare: 852 min.







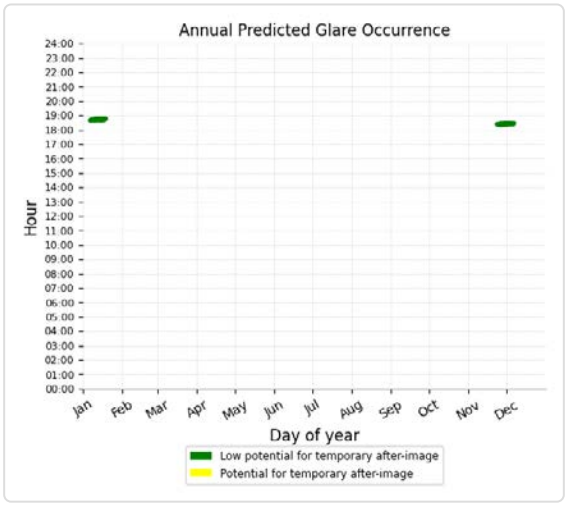


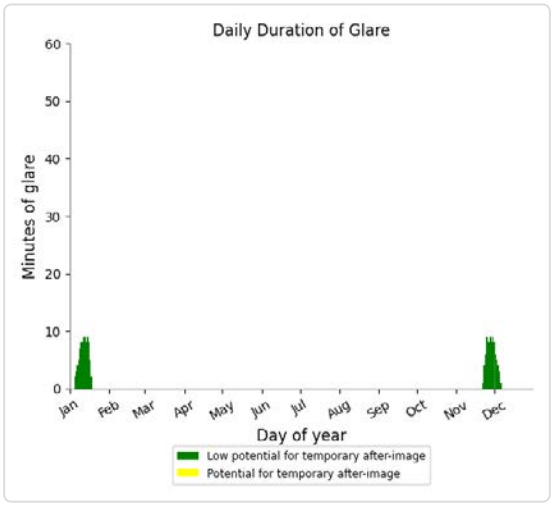


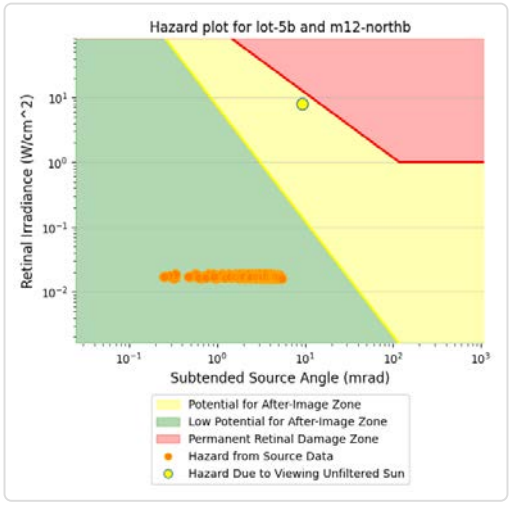
Lot 5b and Route: M12 - northbound

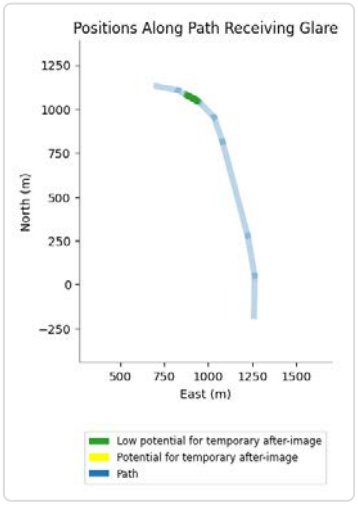
Yellow glare: none

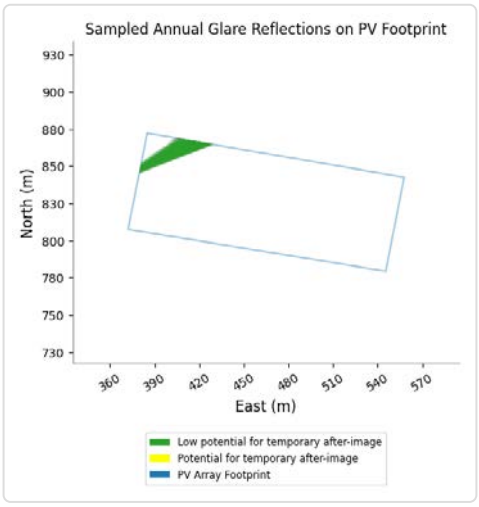
Green glare: 176 min.







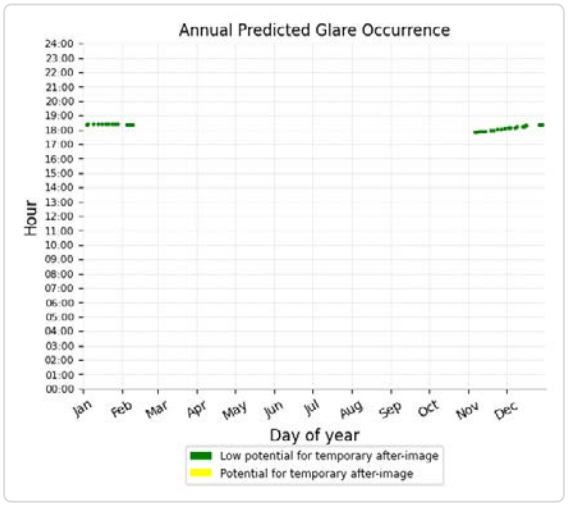


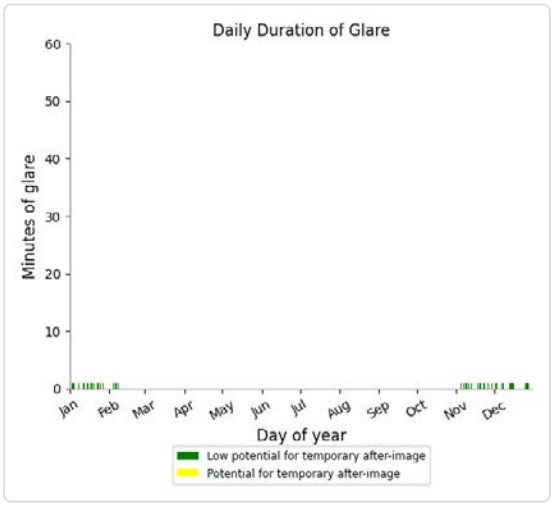


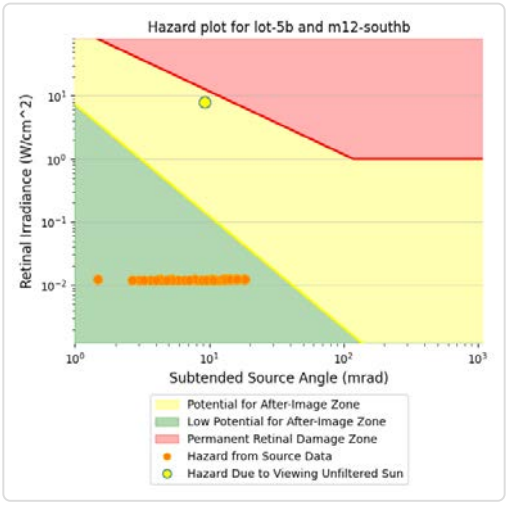
Lot 5b and Route: M12 - southbound

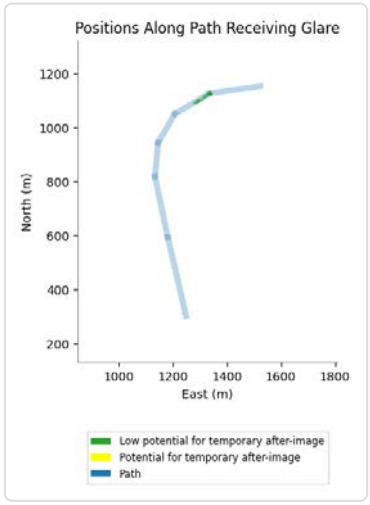
Yellow glare: none

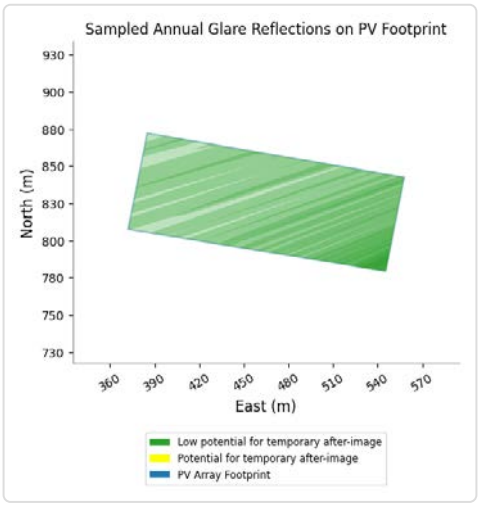
Green glare: 34 min.











Lot 5b and Route: Airport Entry

No glare found

Lot 5b and Route: Elizabeth Drive

No glare found

Lot 5b and Route: Luddenham Road

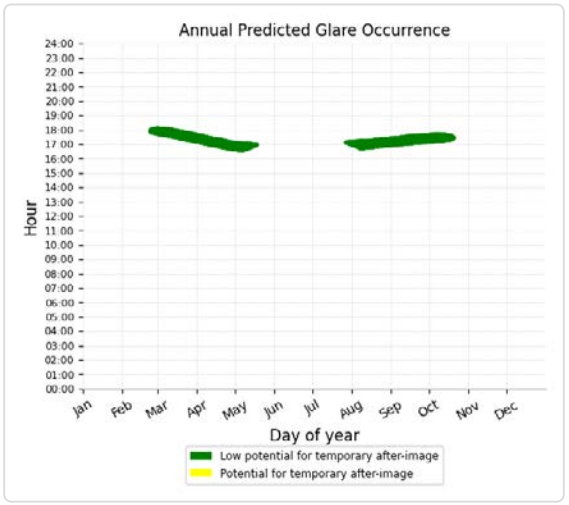
No glare found

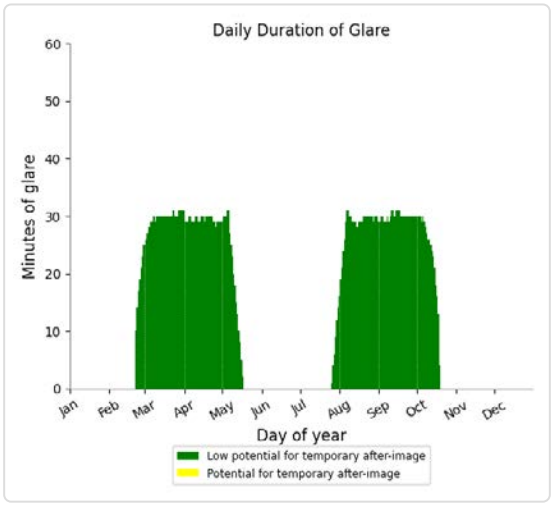
Lot 5b and Route: Runway

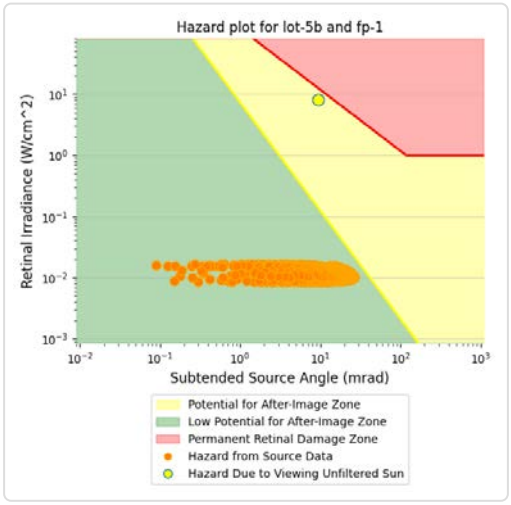
No glare found

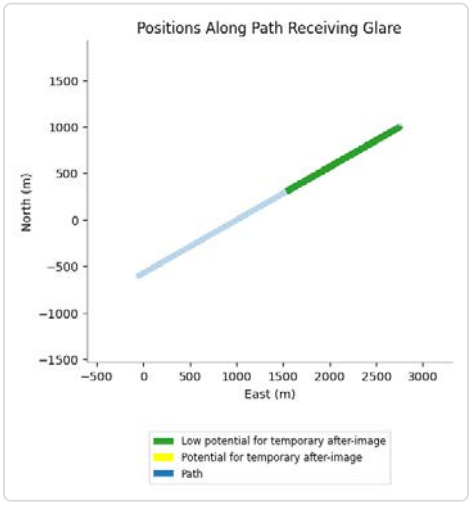
Lot 5b and FP: FP 1

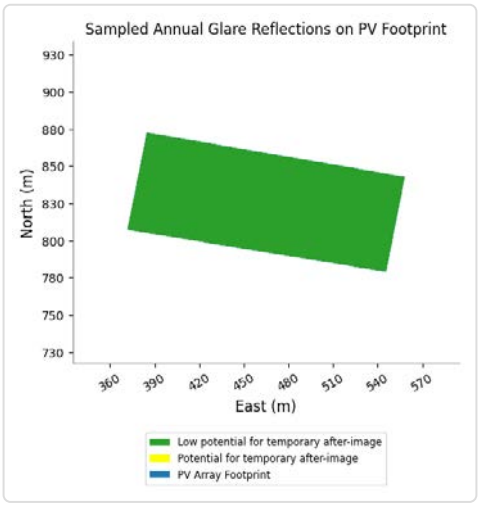
Yellow glare: none
Green glare: 4,557 min.

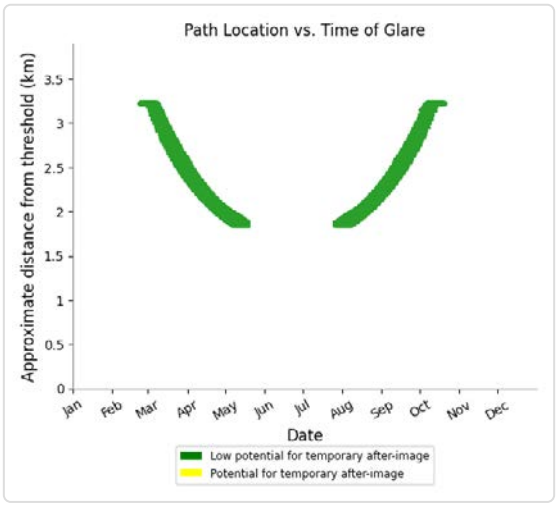












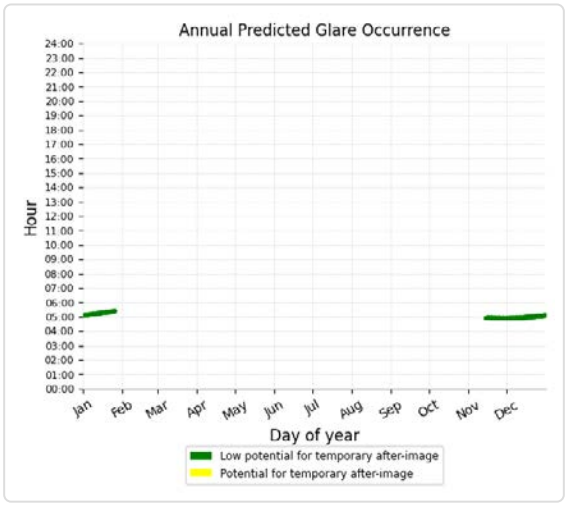
Lot 5b and FP: FP 2

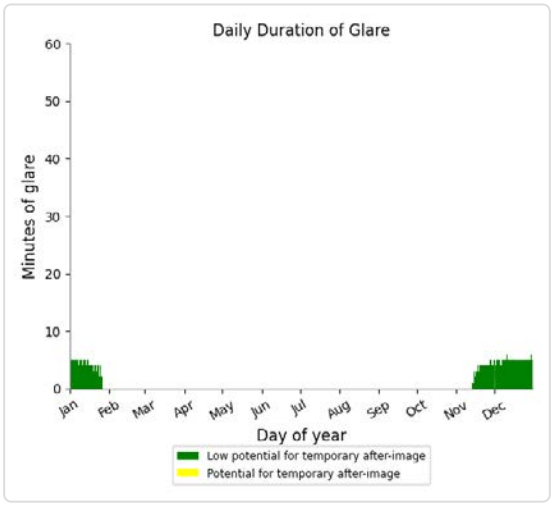
No glare found

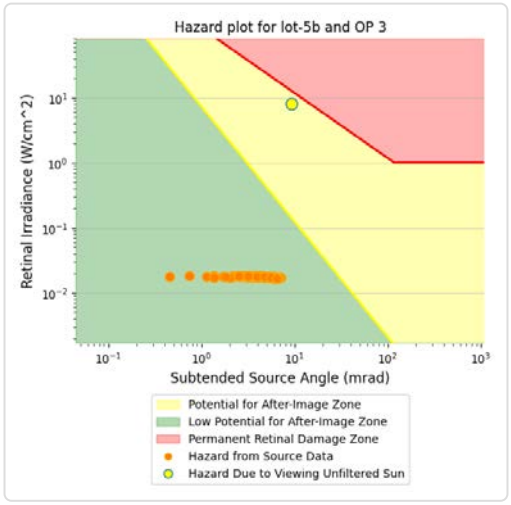
Lot 5b and OP 3

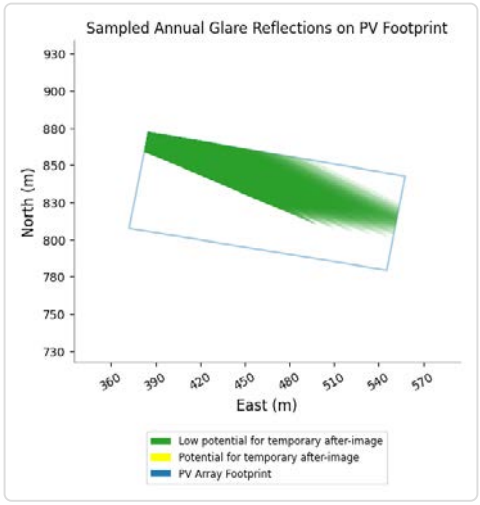
Yellow glare: none

Green glare: 326 min.









Lot 5b and OP 1

No glare found

Lot 5b and OP 2

No glare found

PV: Lot 5b - E low potential for temporary after-image

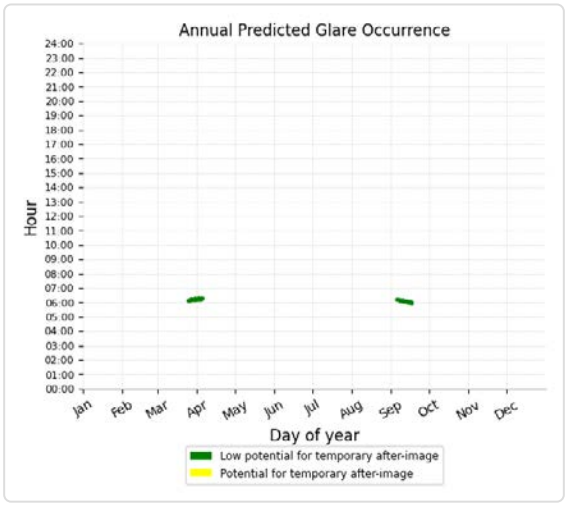
Receptor results ordered by category of glare

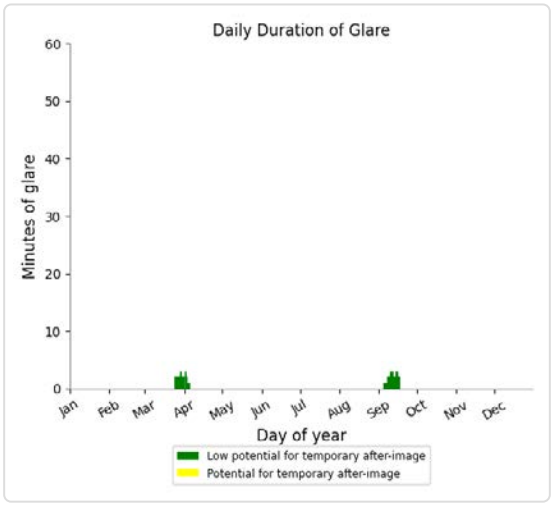
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	53	0.9	0	0.0
Luddenham Road	182	3.0	0	0.0
M-12	2,803	46.7	0	0.0
M12 - southbound	1,524	25.4	0	0.0
Airport Entry	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	5,181	86.3	0	0.0
FP 2	0	0.0	0	0.0
OP 3	356	5.9	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0

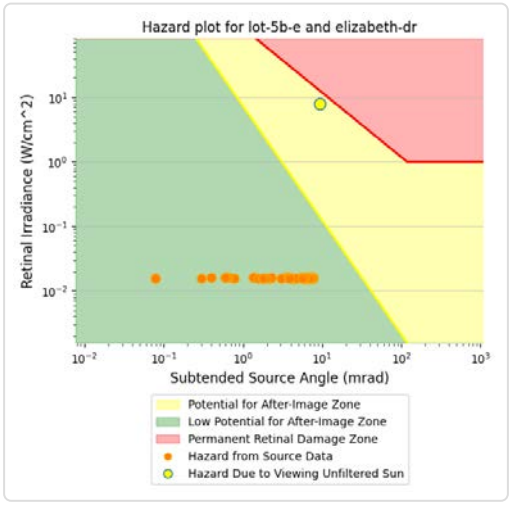
Lot 5b - E and Route: Elizabeth Drive

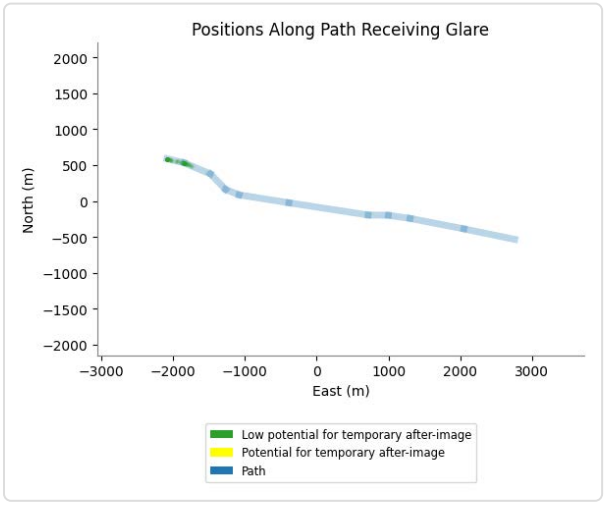
Yellow glare: none

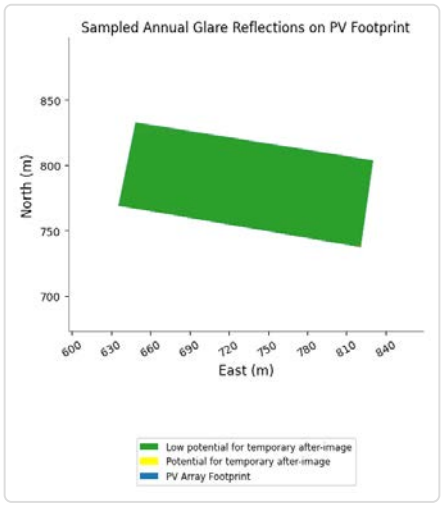
Green glare: 53 min.







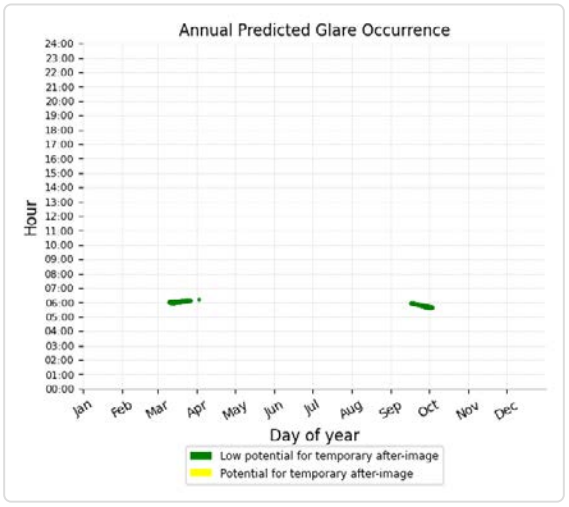


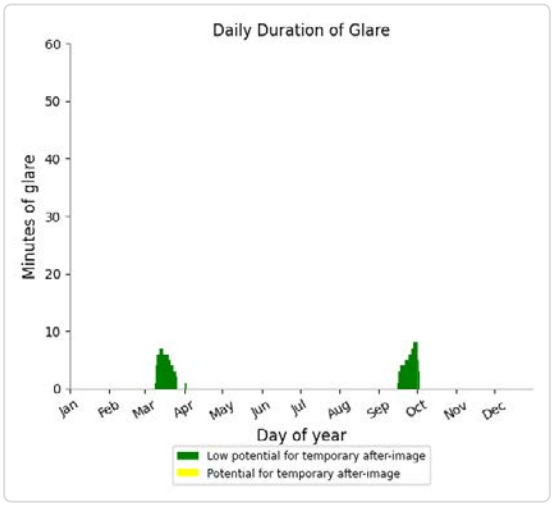


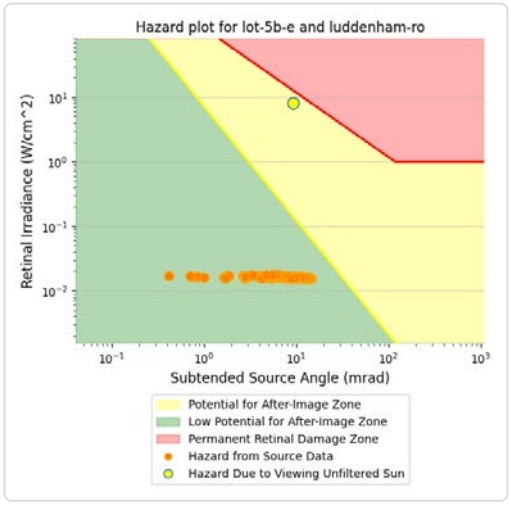
Lot 5b - E and Route: Luddenham Road

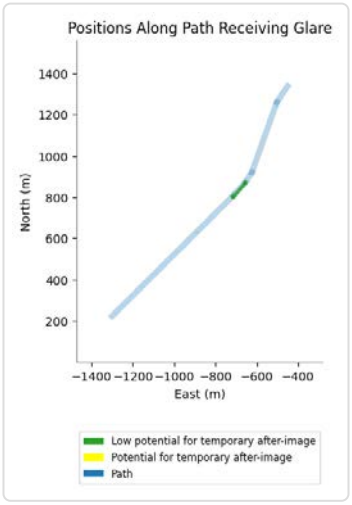
Yellow glare: none

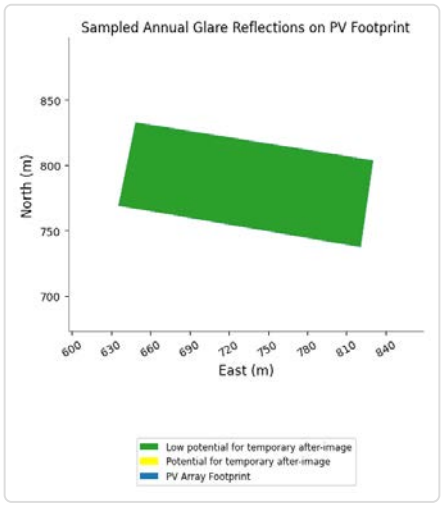
Green glare: 182 min.







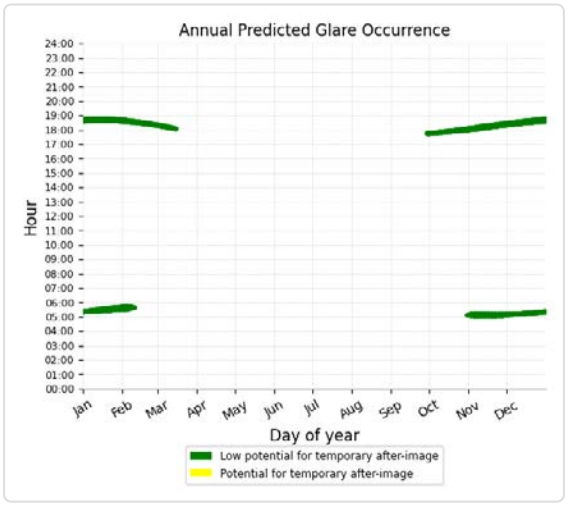


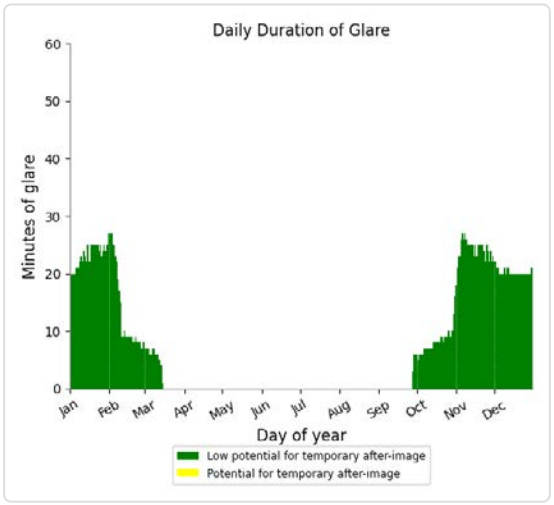


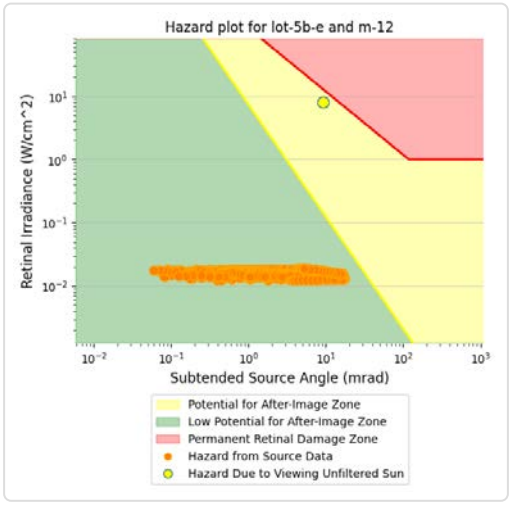
Lot 5b - E and Route: M-12

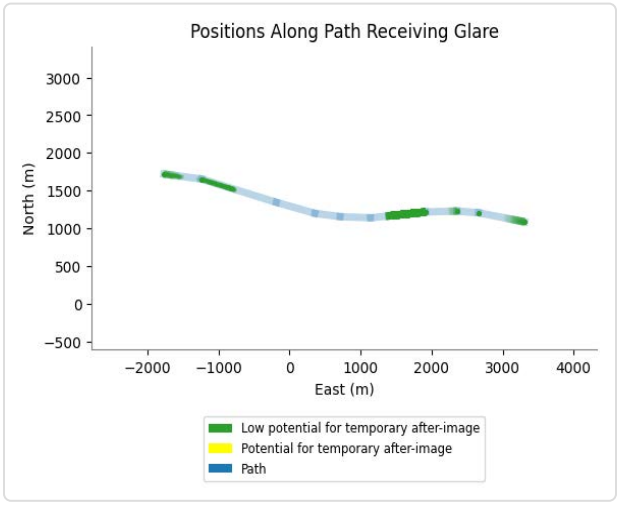
Yellow glare: none

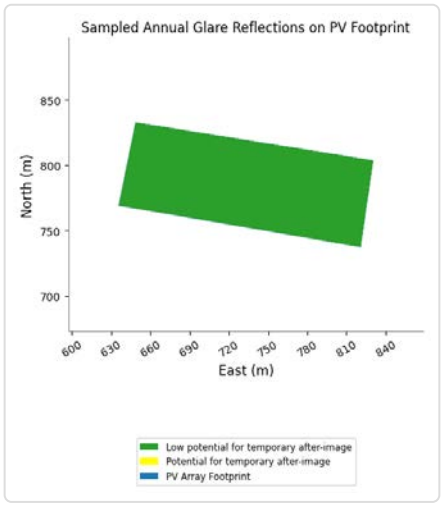
Green glare: 2,803 min.







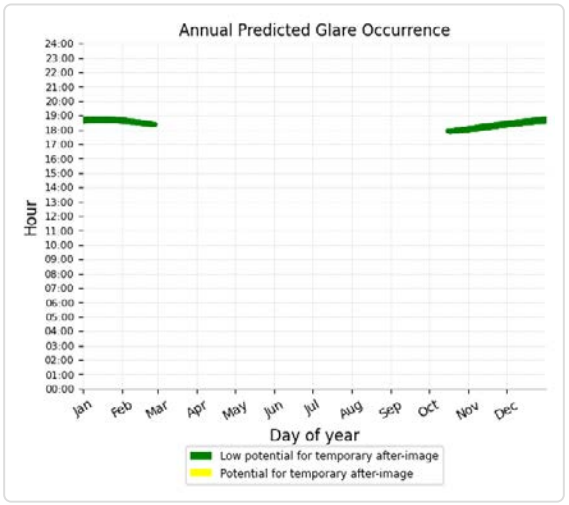


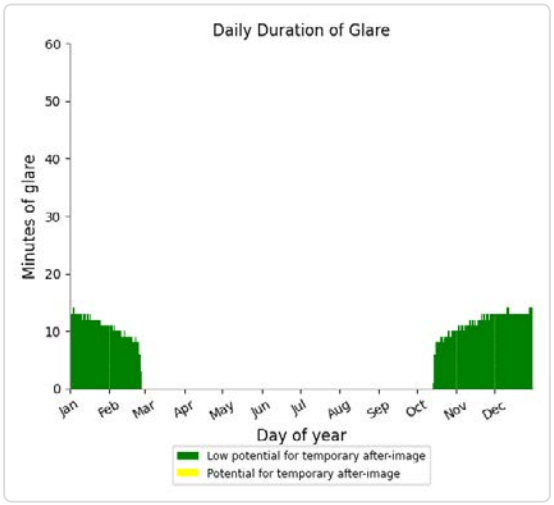


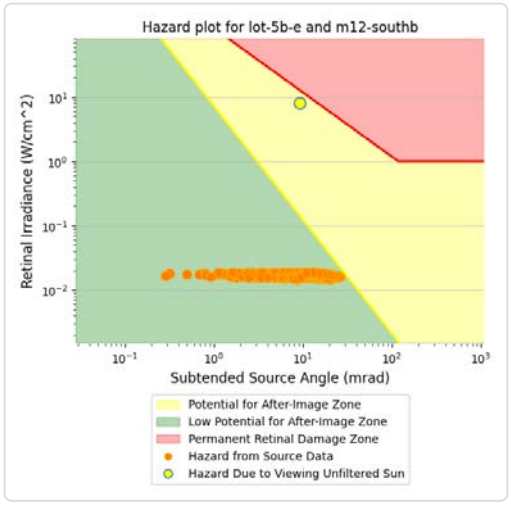
Lot 5b - E and Route: M12 - southbound

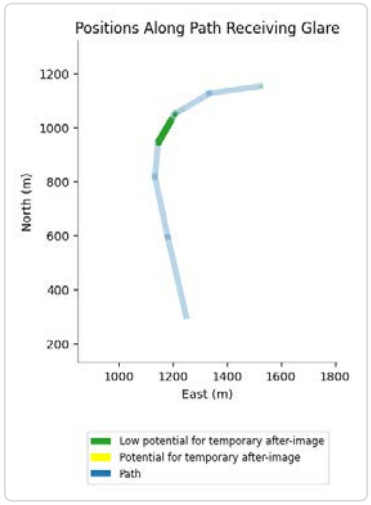
Yellow glare: none

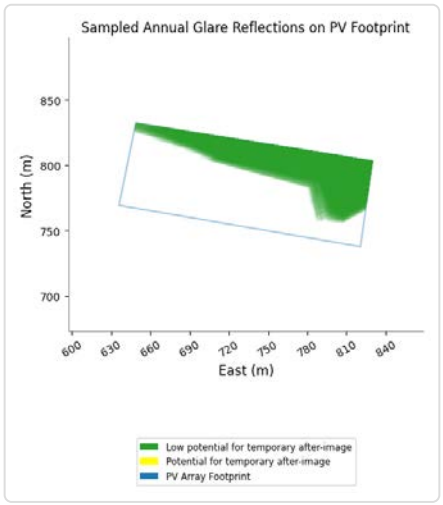
Green glare: 1,524 min.











Lot 5b - E and Route: Airport Entry

No glare found

Lot 5b - E and Route: M12 - northbound

No glare found

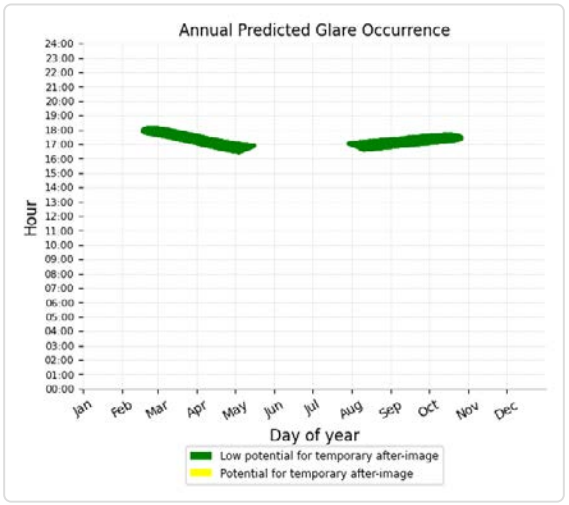
Lot 5b - E and Route: Runway

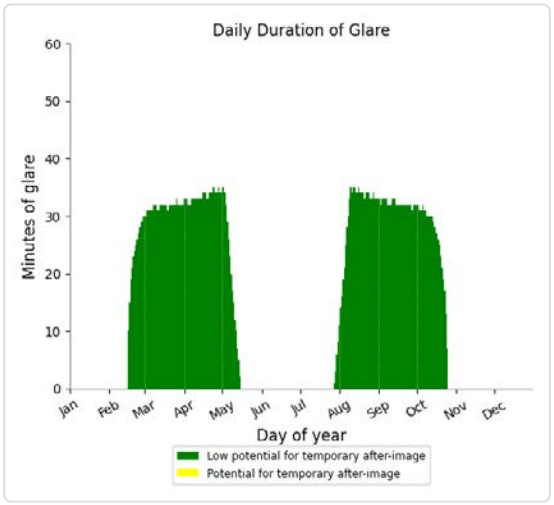
No glare found

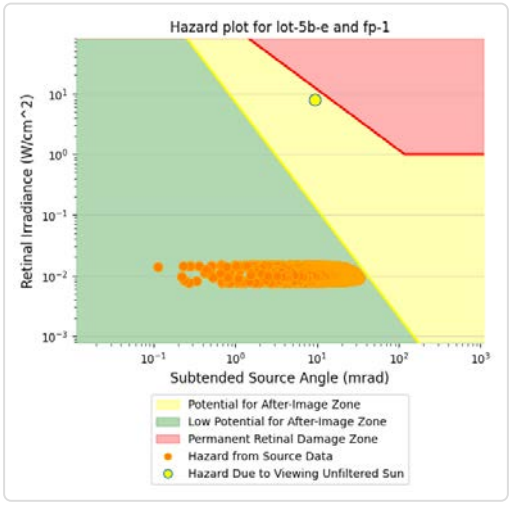
Lot 5b - E and FP: FP 1

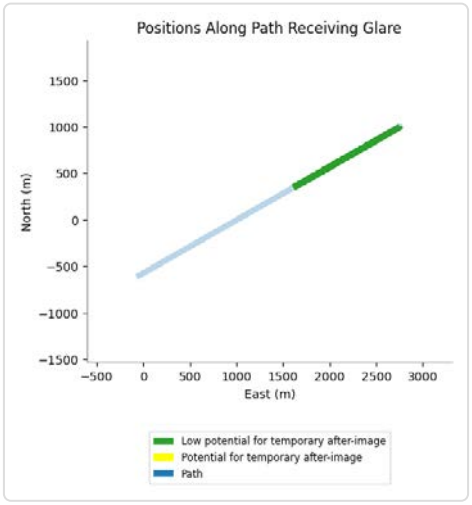
Yellow glare: none

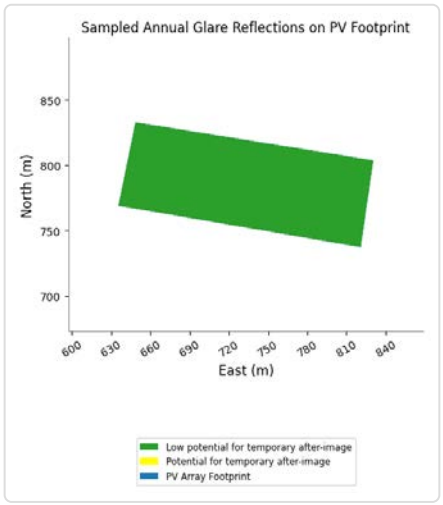
Green glare: 5,181 min.

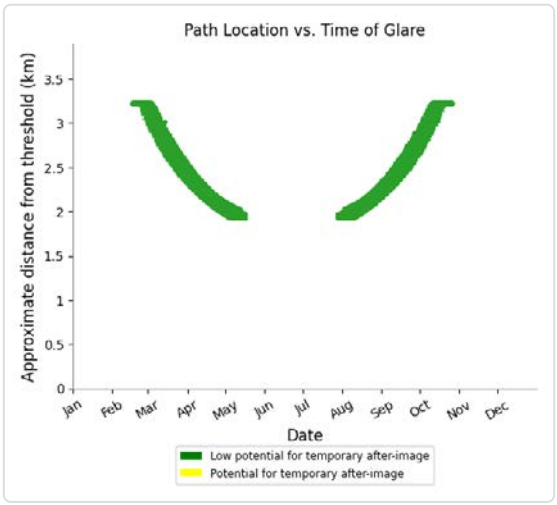












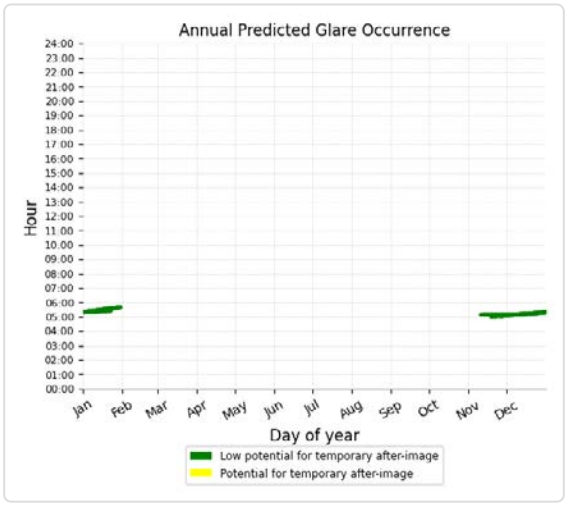
Lot 5b - E and FP: FP 2

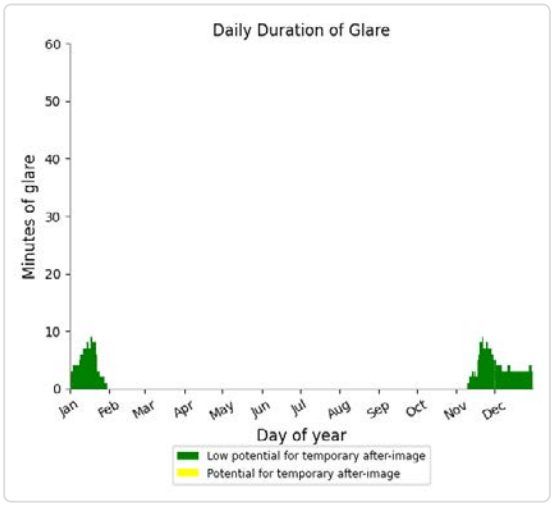
No glare found

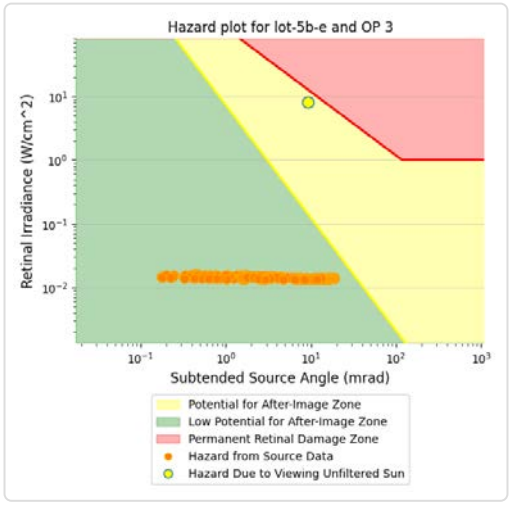
Lot 5b - E and OP 3

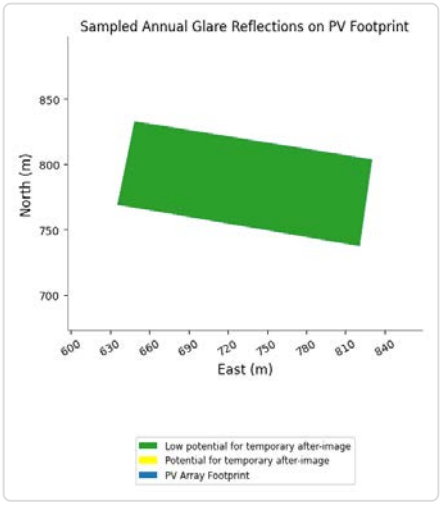
Yellow glare: none

Green glare: 356 min.









Lot 5b - E and OP 1

No glare found

Lot 5b - E and OP 2

No glare found

PV: Lot5b - N low potential for temporary after-image

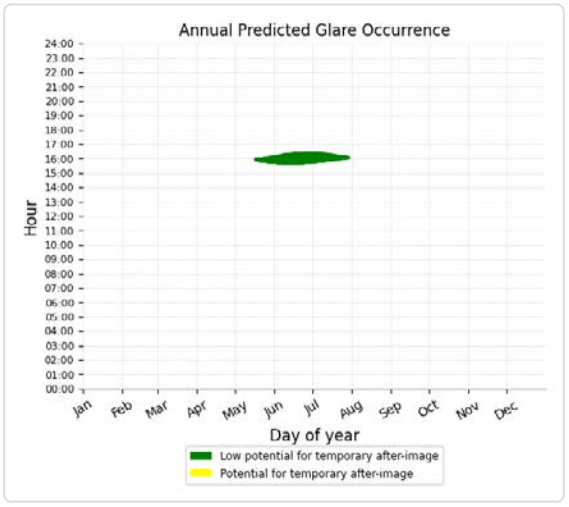
Receptor results ordered by category of glare

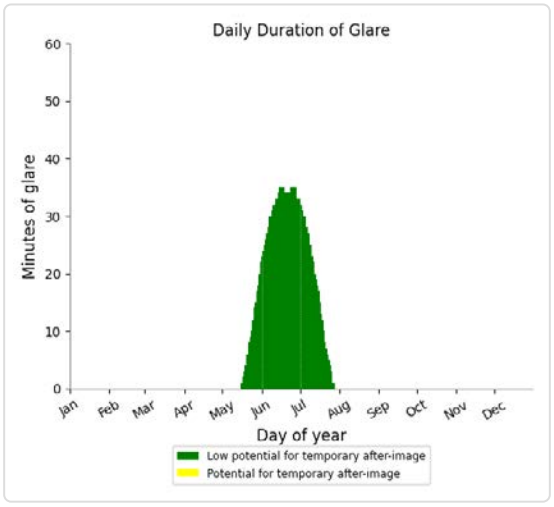
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	1,619	27.0	0	0.0
M-12	568	9.5	0	0.0
M12 - northbound	1,801	30.0	0	0.0
M12 - southbound	407	6.8	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	2,508	41.8	0	0.0
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

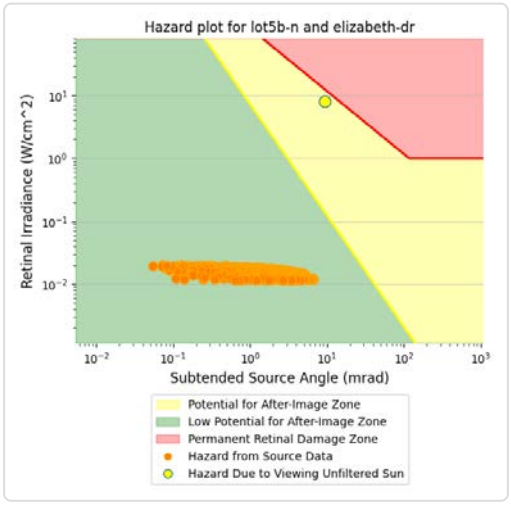
Lot5b - N and Route: Elizabeth Drive

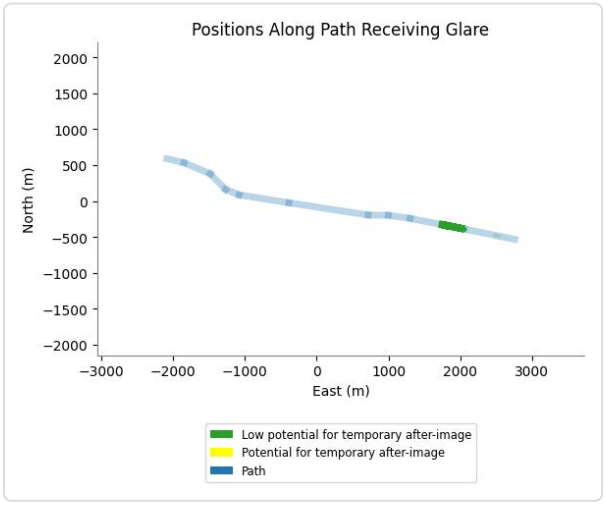
Yellow glare: none

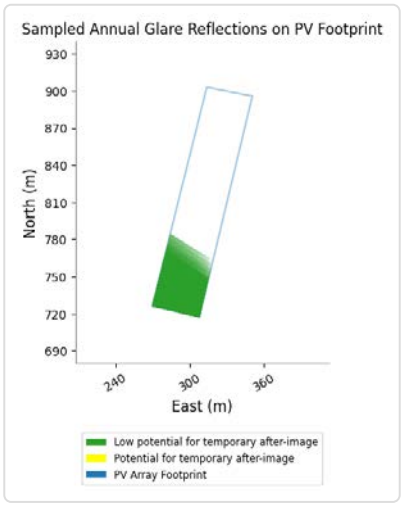
Green glare: 1,619 min.







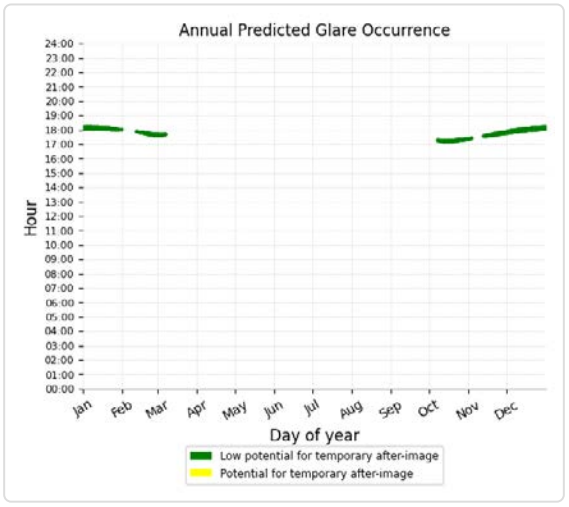


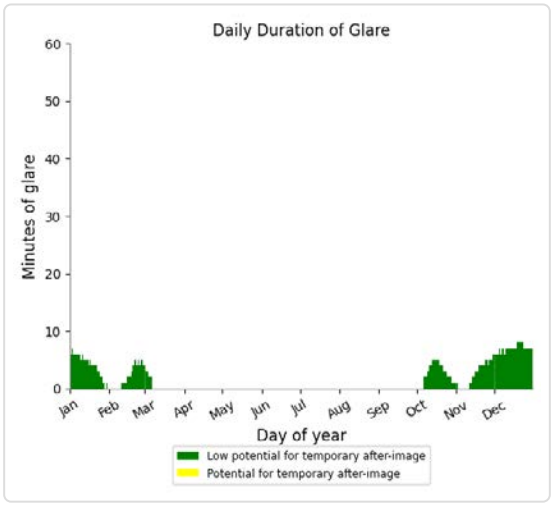


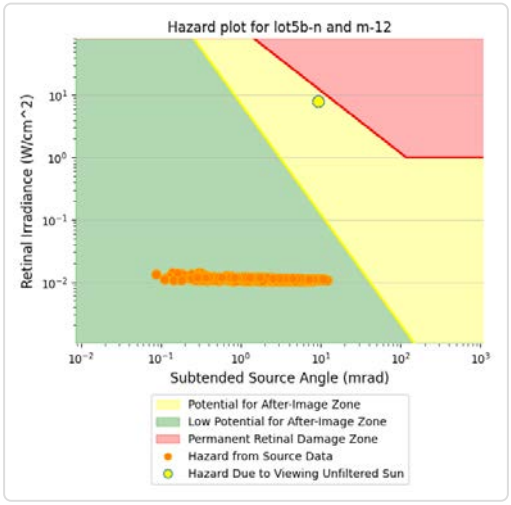
Lot5b - N and Route: M-12

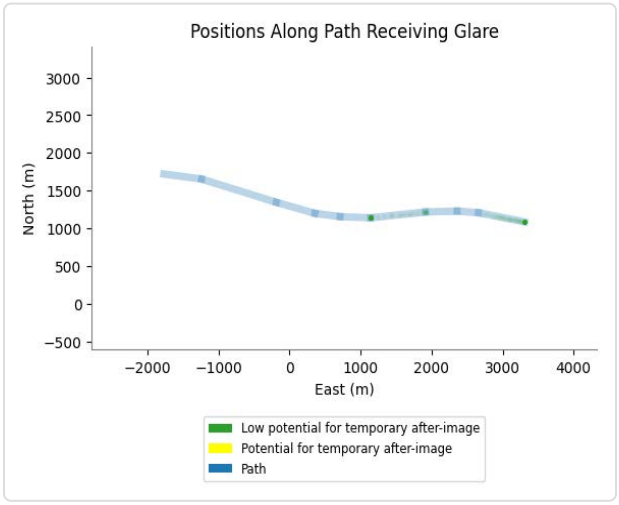
Yellow glare: none

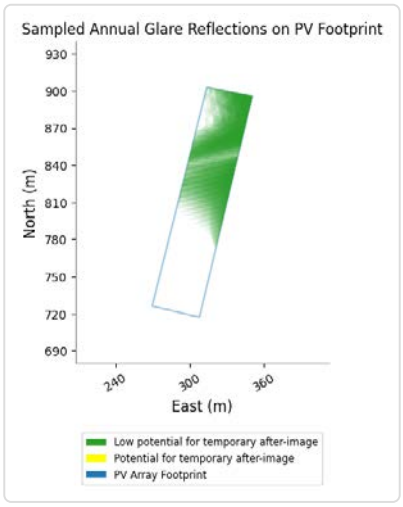
Green glare: 568 min.







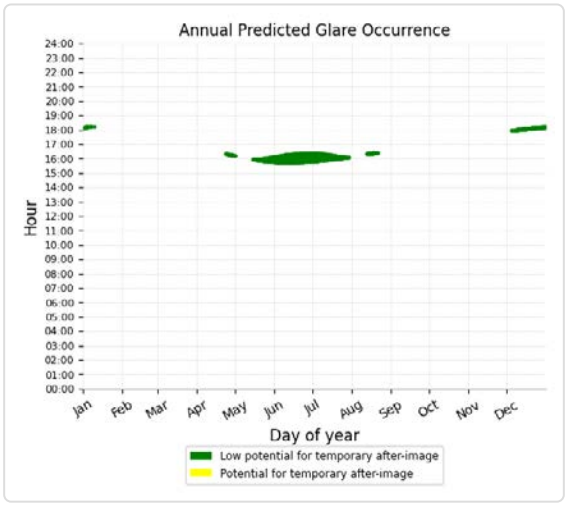


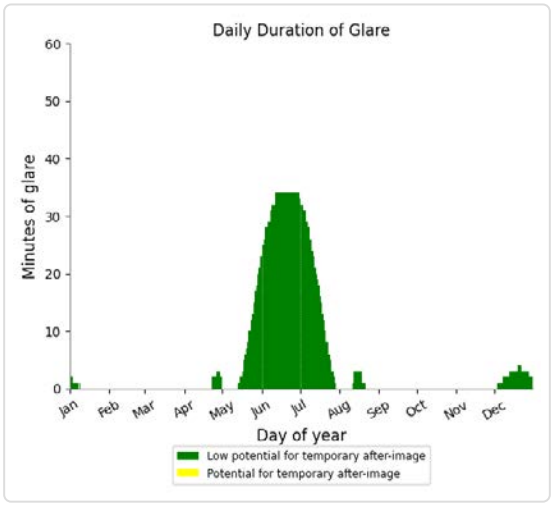


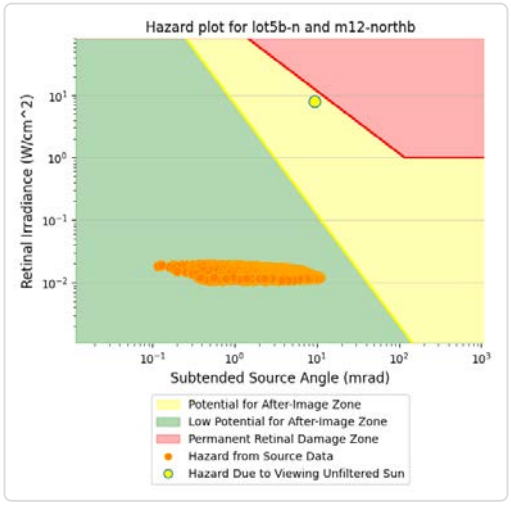
Lot5b - N and Route: M12 - northbound

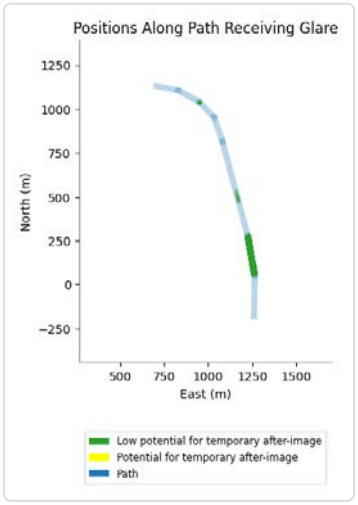
Yellow glare: none

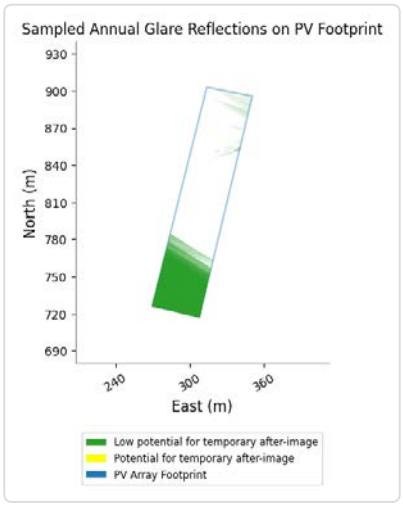
Green glare: 1,801 min.







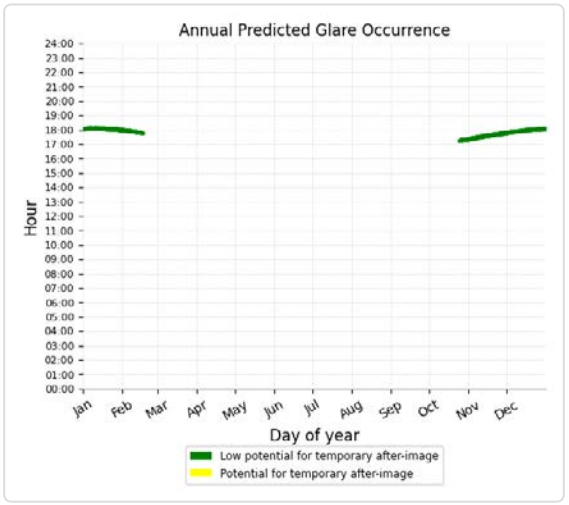


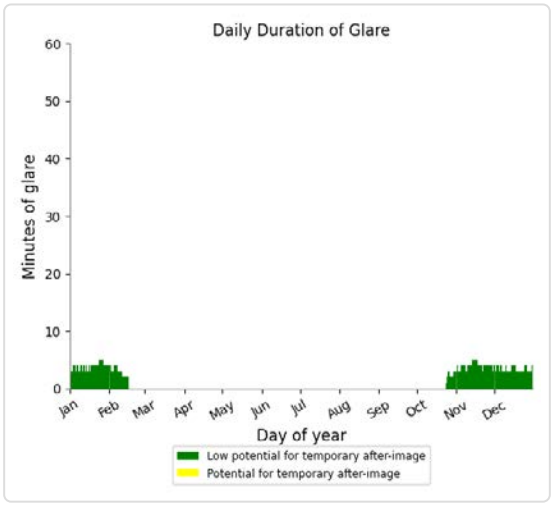


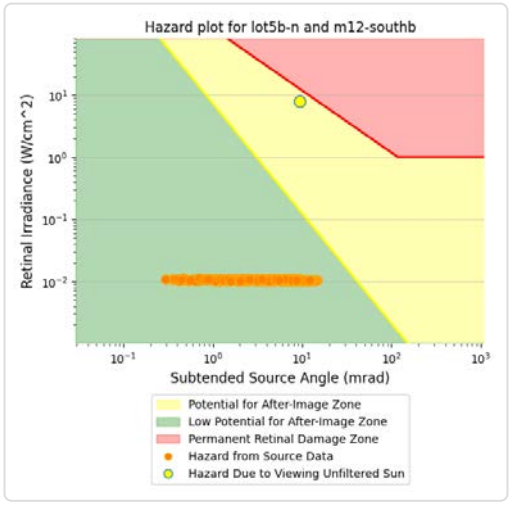
Lot5b - N and Route: M12 - southbound

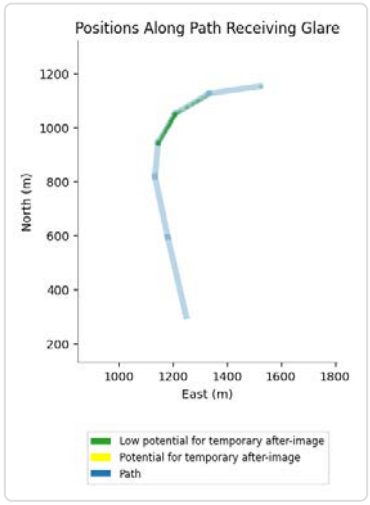
Yellow glare: none

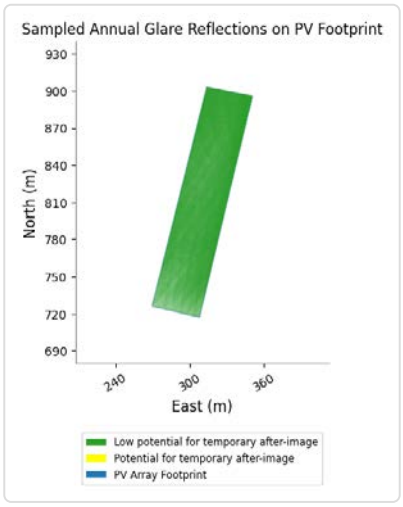
Green glare: 407 min.











Lot5b - N and Route: Airport Entry

No glare found

Lot5b - N and Route: Luddenham Road

No glare found

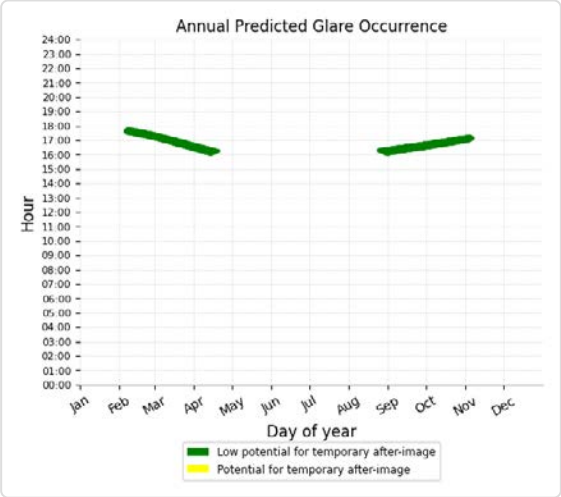
Lot5b - N and Route: Runway

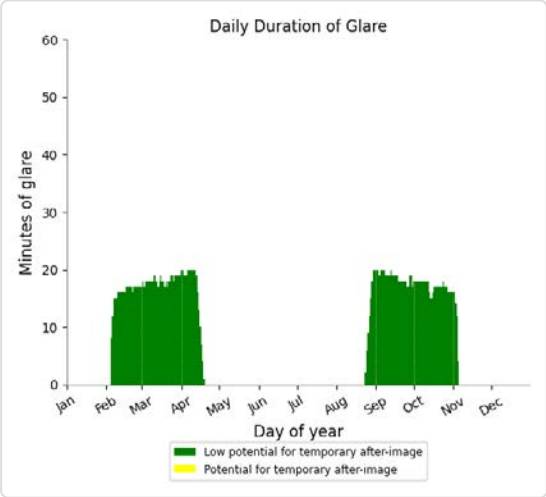
No glare found

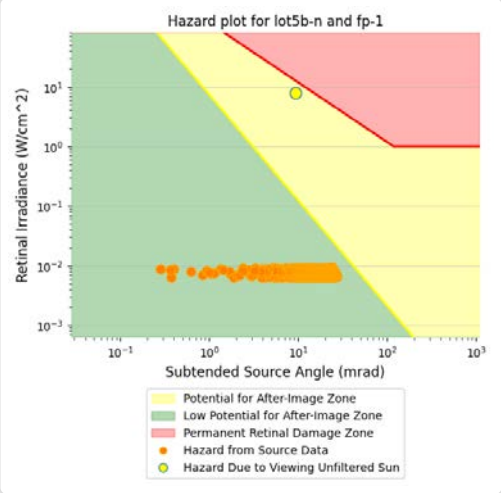
Lot5b - N and FP: FP 1

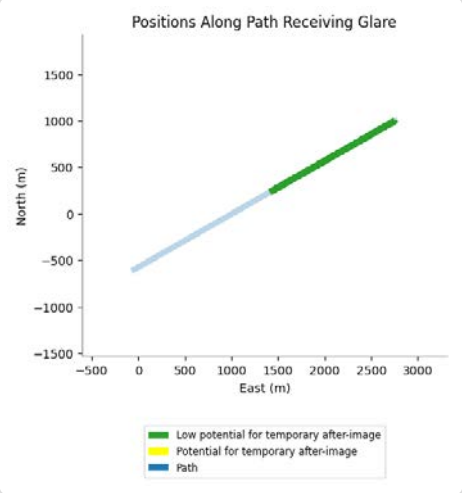
Yellow glare: none

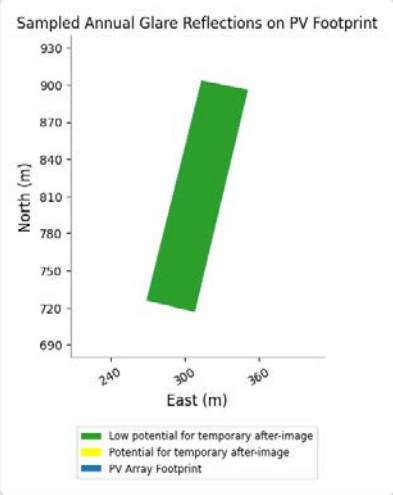
Green glare: 2,508 min.

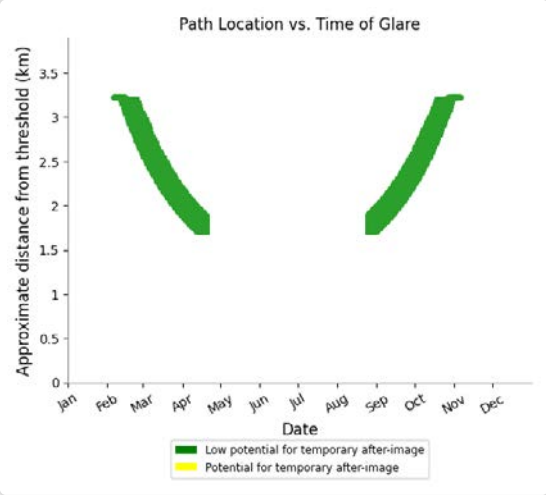












Lot5b - N and FP: FP 2

No glare found

Lot5b - N and OP 1

No glare found

Lot5b - N and OP 2

No glare found

Lot5b - N and OP 3

No glare found

PV: Lot 5b - NW low potential for temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	3,134	52.2	0	0.0
FP 2	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

Lot 5b - NW and Route: Airport Entry

No glare found

Lot 5b - NW and Route: Elizabeth Drive

No glare found

Lot 5b - NW and Route: Luddenham Road

No glare found

Lot 5b - NW and Route: M-12

No glare found

Lot 5b - NW and Route: M12 - northbound

No glare found

Lot 5b - NW and Route: M12 - southbound

No glare found

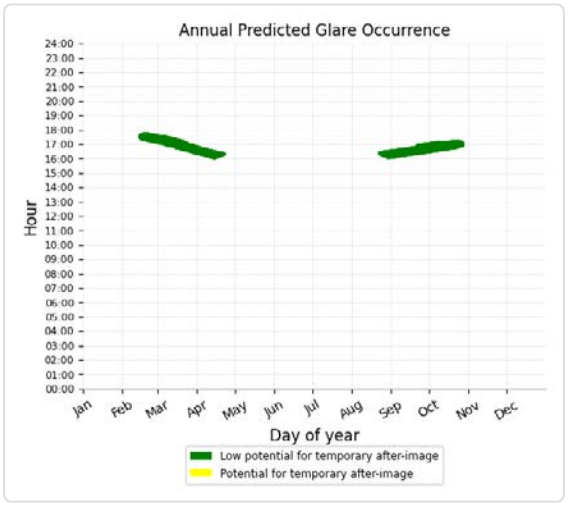
Lot 5b - NW and Route: Runway

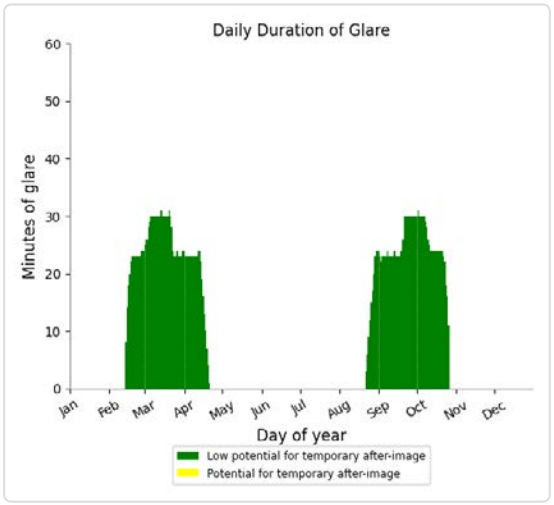
No glare found

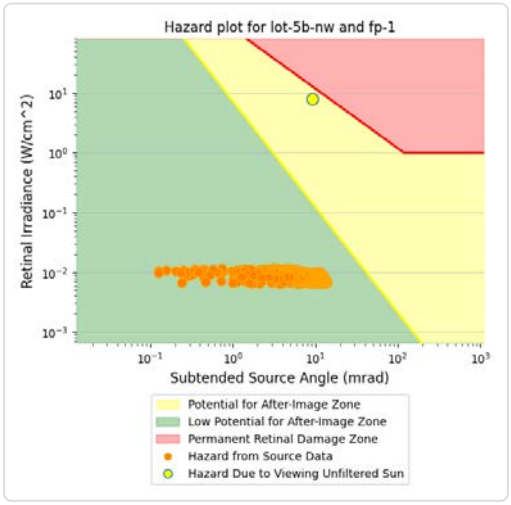
Lot 5b - NW and FP: FP 1

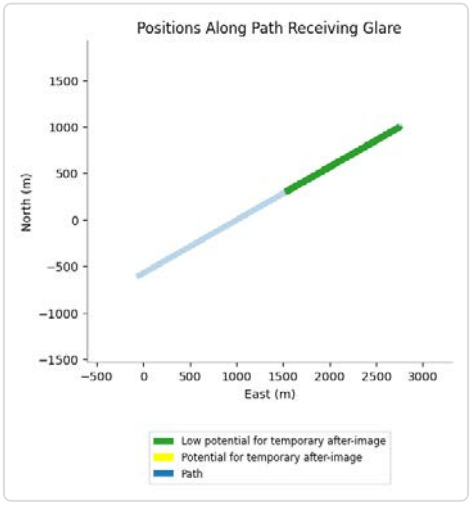
Yellow glare: none

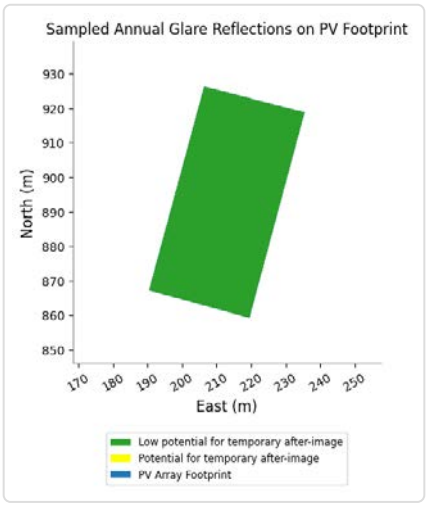
Green glare: 3,134 min.

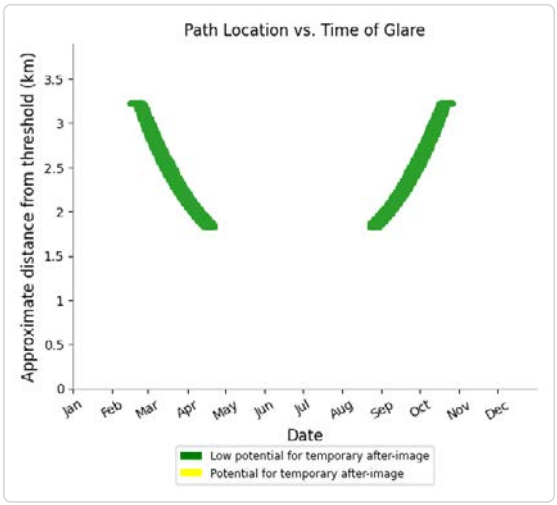












Lot 5b - NW and FP: FP 2

No glare found

Lot 5b - NW and OP 1

No glare found

Lot 5b - NW and OP 2

No glare found

Lot 5b - NW and OP 3

No glare found

PV: Lot 5b - SE potential temporary after-image

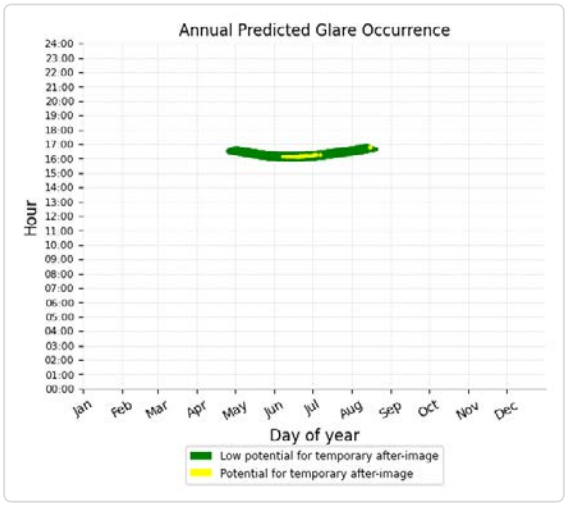
Receptor results ordered by category of glare

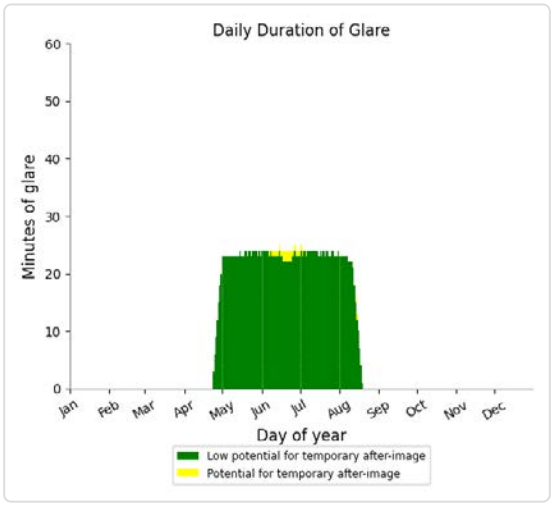
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
M12 - northbound	2,568	42.8	36	0.6
Elizabeth Drive	1,317	21.9	0	0.0
M-12	1,919	32.0	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	6,242	104.0	0	0.0
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

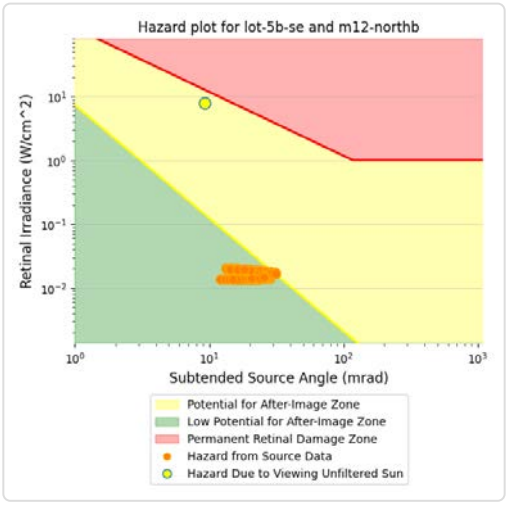
Lot 5b - SE and Route: M12 - northbound

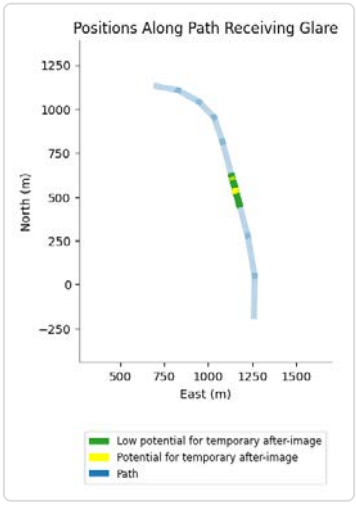
Yellow glare: 36 min.

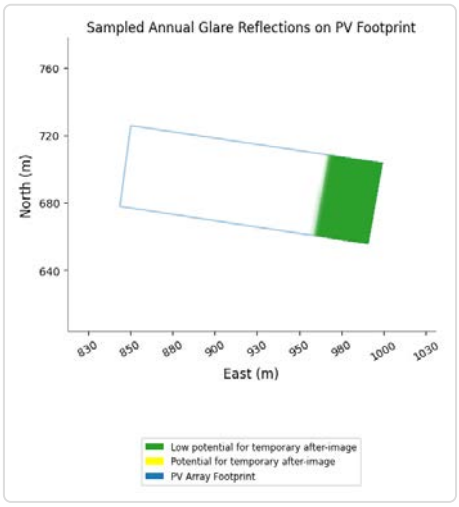
Green glare: 2,568 min.







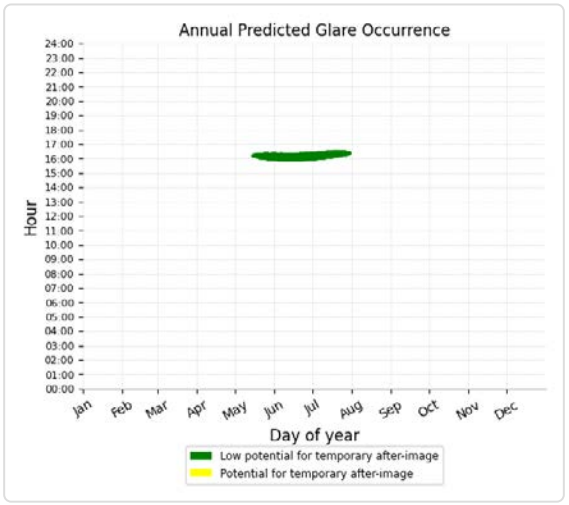


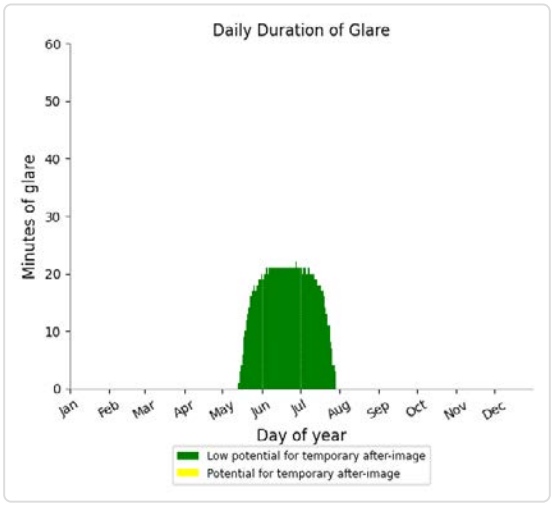


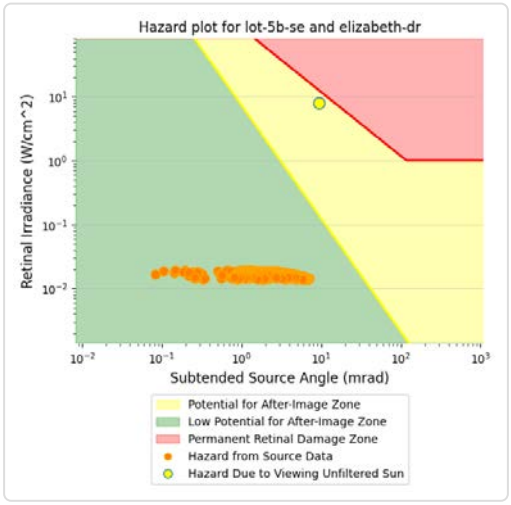
Lot 5b - SE and Route: Elizabeth Drive

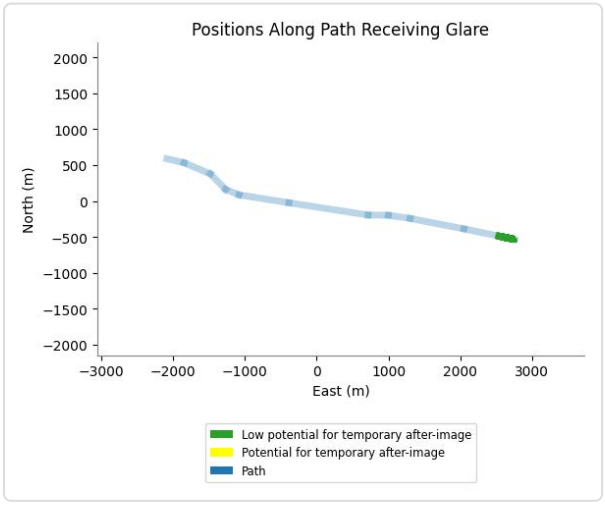
Yellow glare: none

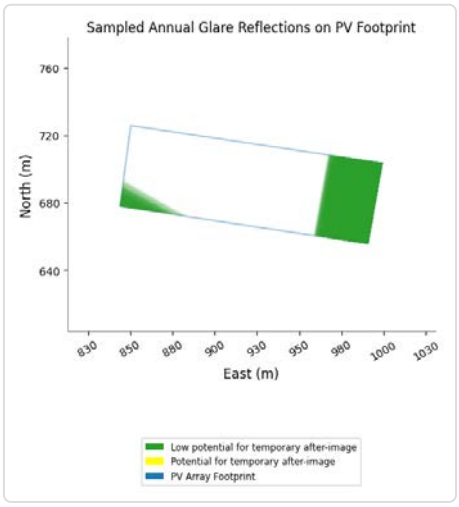
Green glare: 1,317 min.







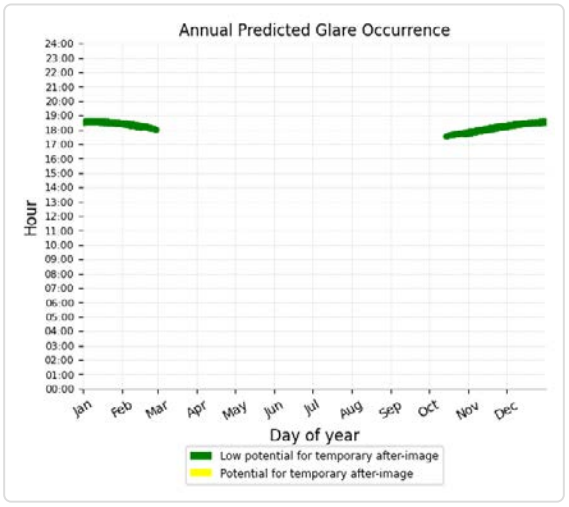


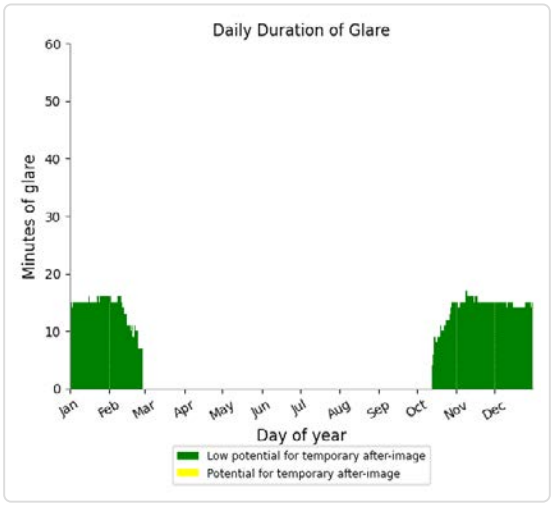


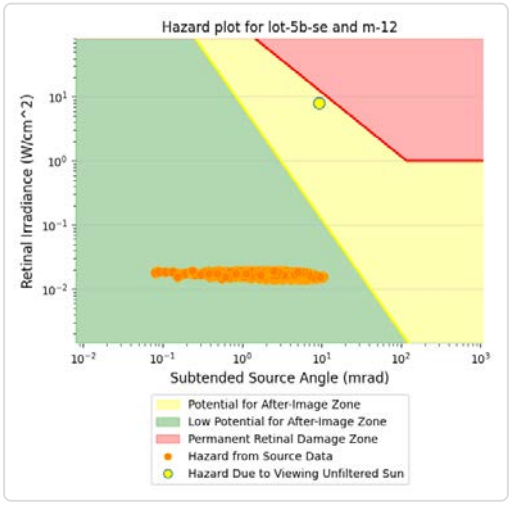
Lot 5b - SE and Route: M-12

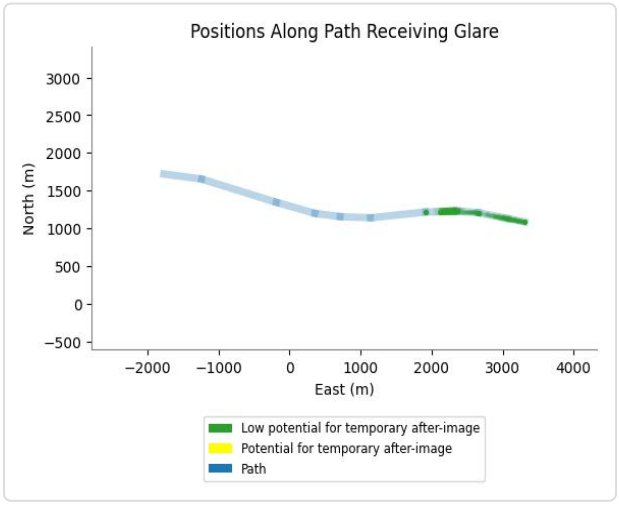
Yellow glare: none

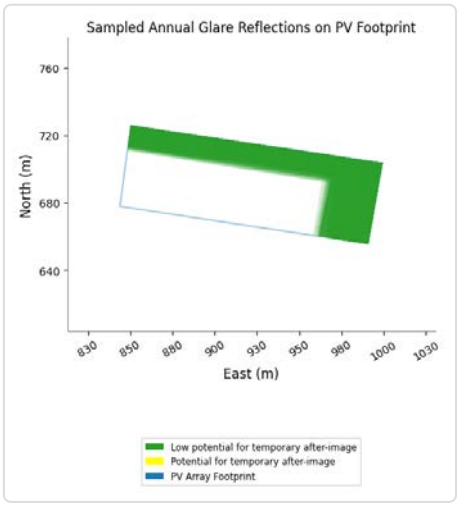
Green glare: 1,919 min.











Lot 5b - SE and Route: Airport Entry

No glare found

Lot 5b - SE and Route: Luddenham Road

No glare found

Lot 5b - SE and Route: M12 - southbound

No glare found

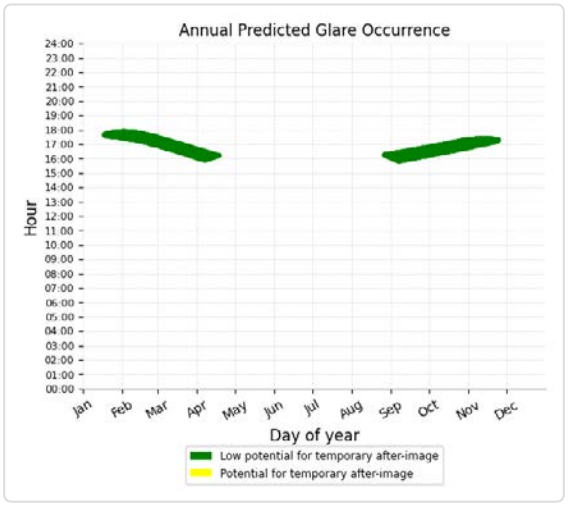
Lot 5b - SE and Route: Runway

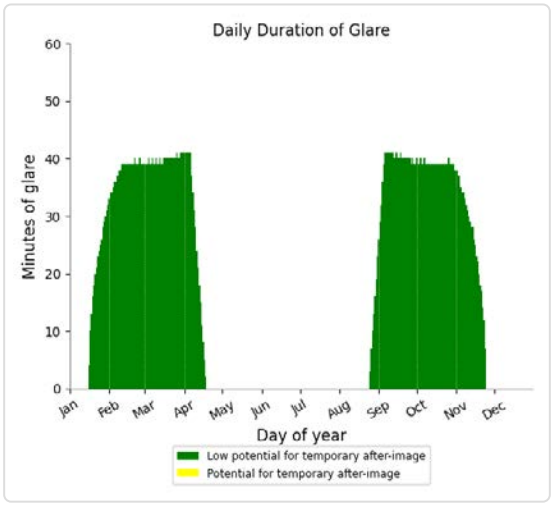
No glare found

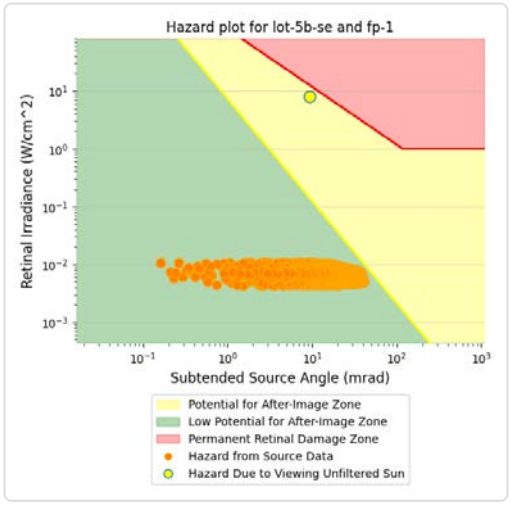
Lot 5b - SE and FP: FP 1

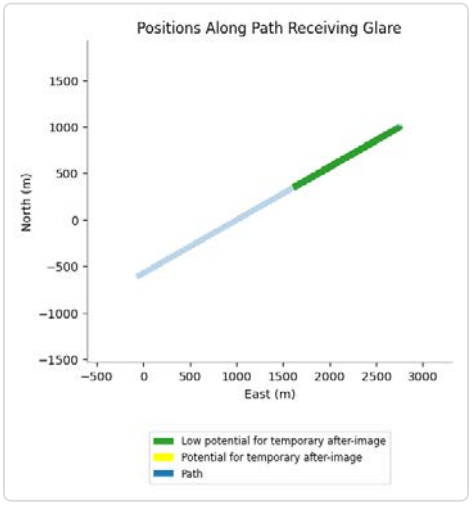
Yellow glare: none

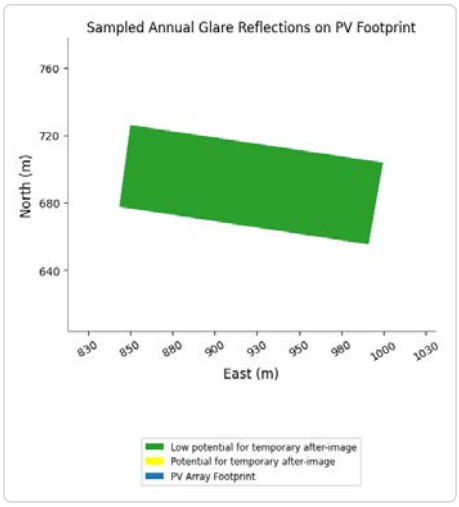
Green glare: 6,242 min.

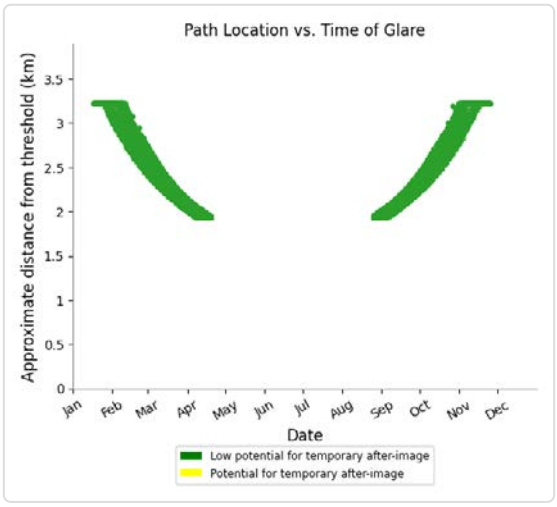












Lot 5b - SE and FP: FP 2

No glare found

Lot 5b - SE and OP 1

No glare found

Lot 5b - SE and OP 2

No glare found

Lot 5b - SE and OP 3

No glare found

PV: Lot 5c potential temporary after-image

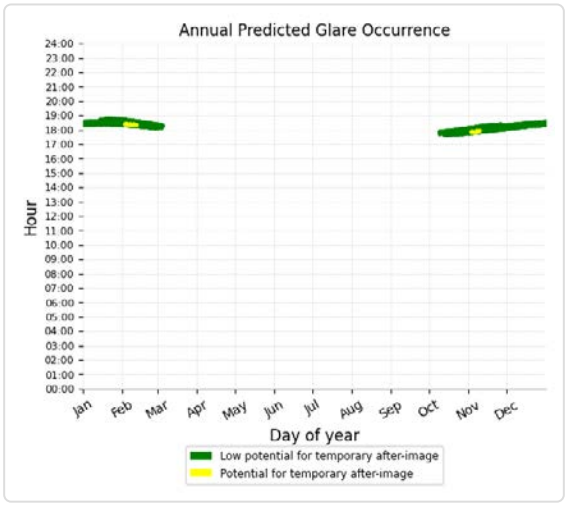
Receptor results ordered by category of glare

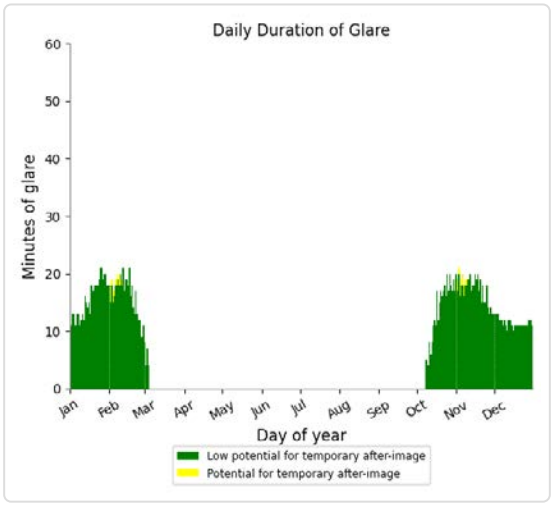
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
M12 - southbound	2,154	35.9	25	0.4
M-12	1,550	25.8	0	0.0
M12 - northbound	796	13.3	0	0.0
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	4,102	68.4	0	0.0
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

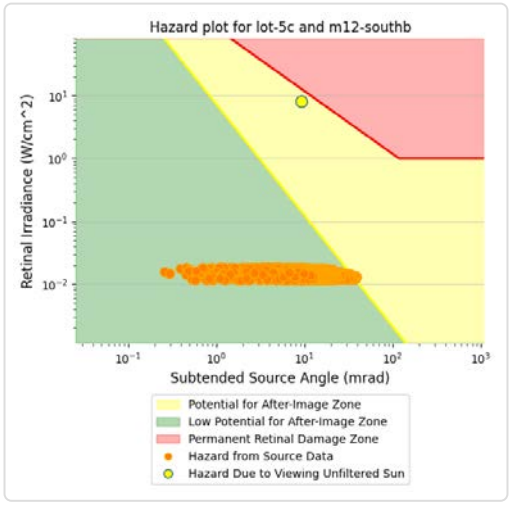
Lot 5c and Route: M12 - southbound

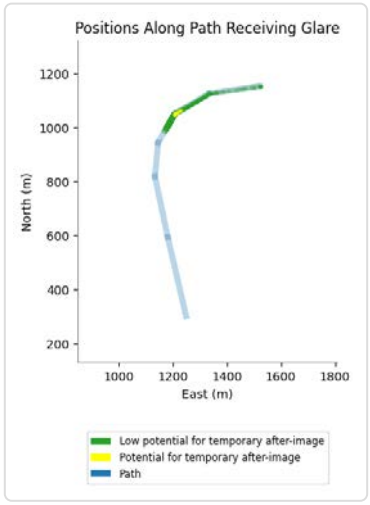
Yellow glare: 25 min.

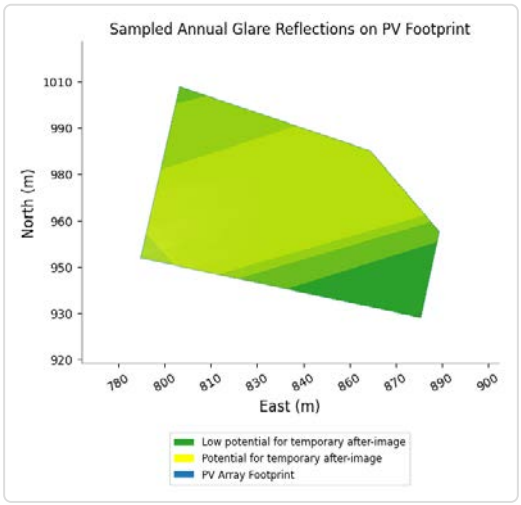
Green glare: 2,154 min.







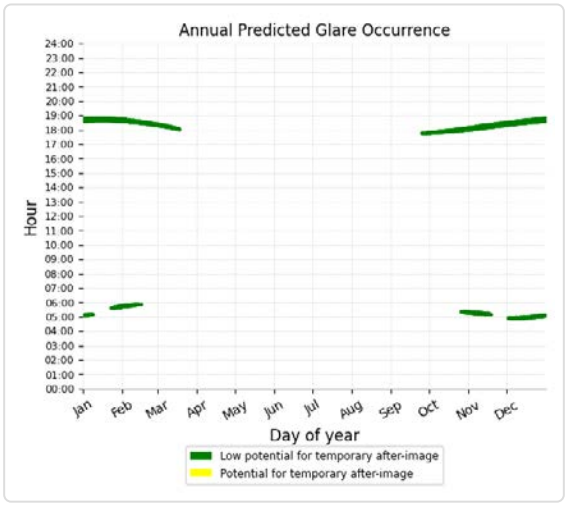


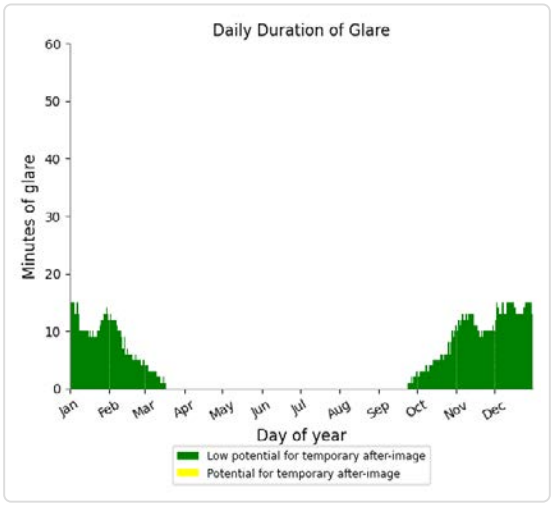


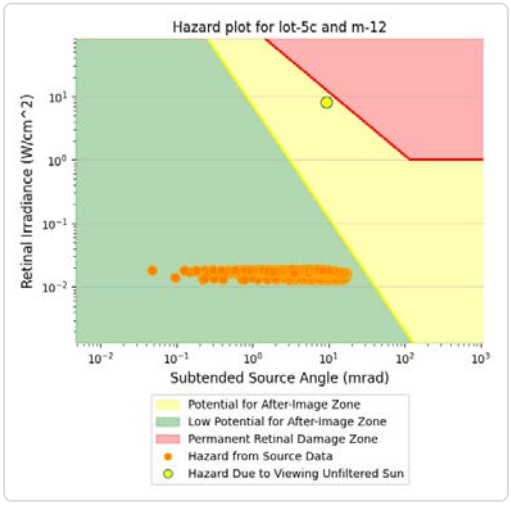
Lot 5c and Route: M-12

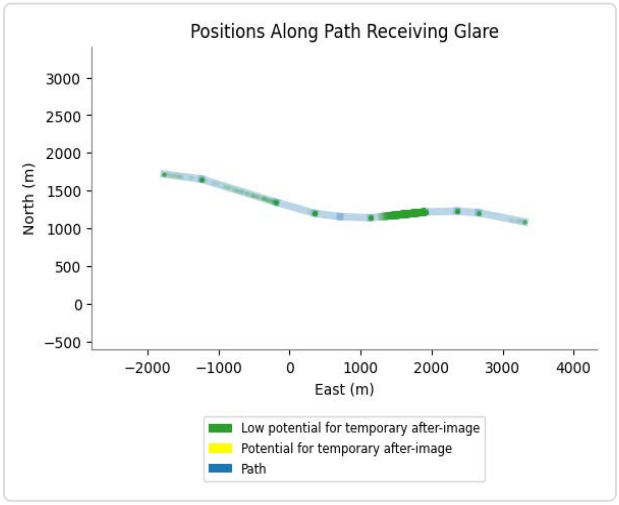
Yellow glare: none

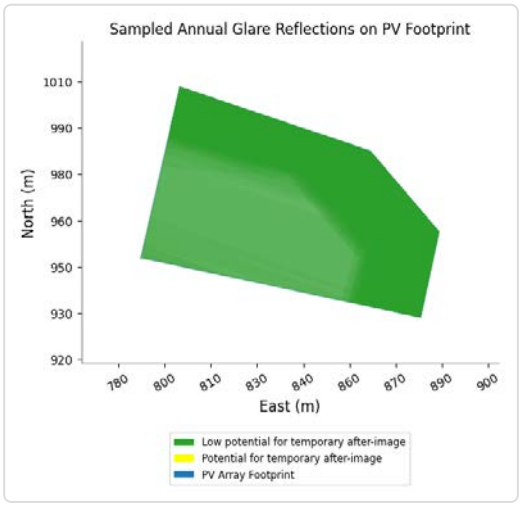
Green glare: 1,550 min.







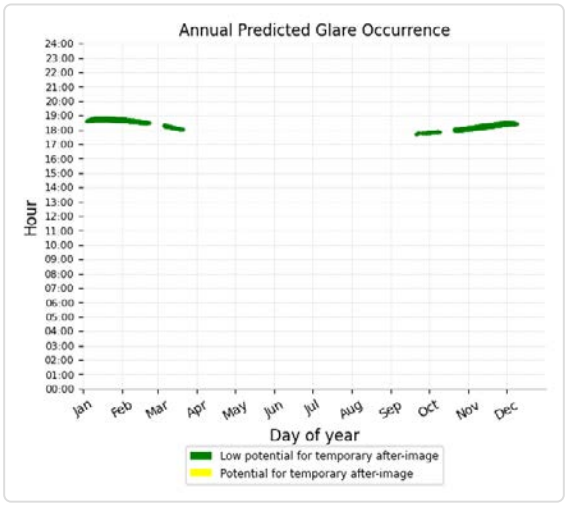


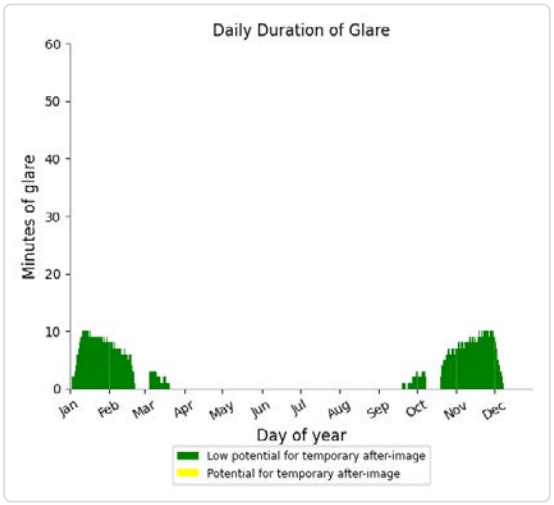


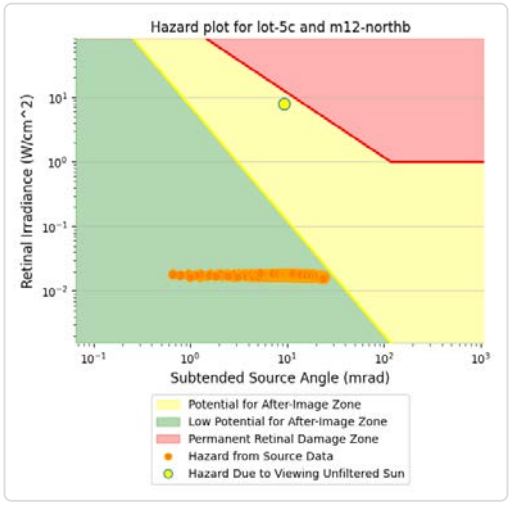
Lot 5c and Route: M12 - northbound

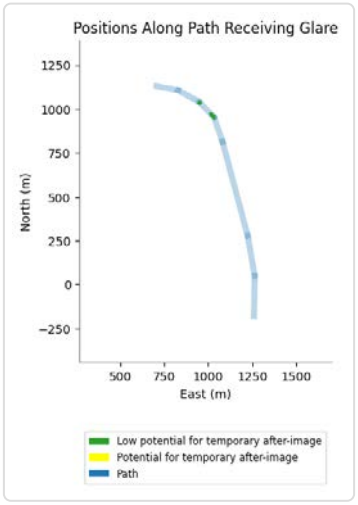
Yellow glare: none

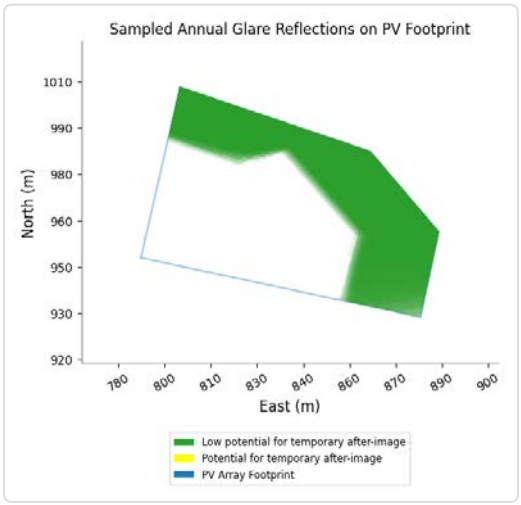
Green glare: 796 min.











Lot 5c and Route: Airport Entry

No glare found

Lot 5c and Route: Elizabeth Drive

No glare found

Lot 5c and Route: Luddenham Road

No glare found

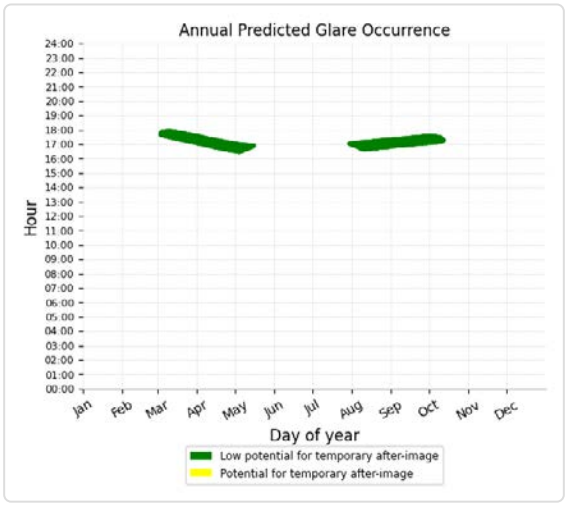
Lot 5c and Route: Runway

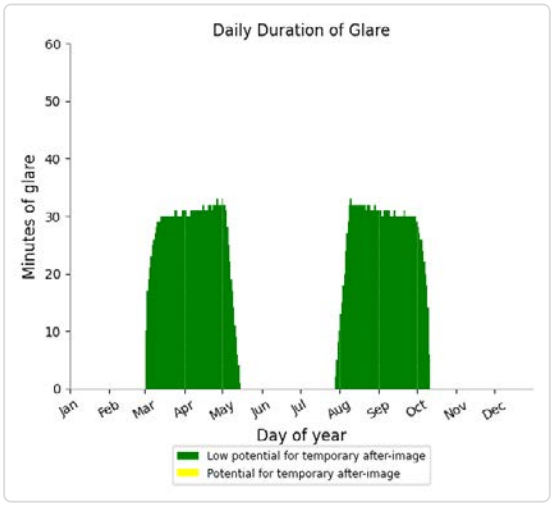
No glare found

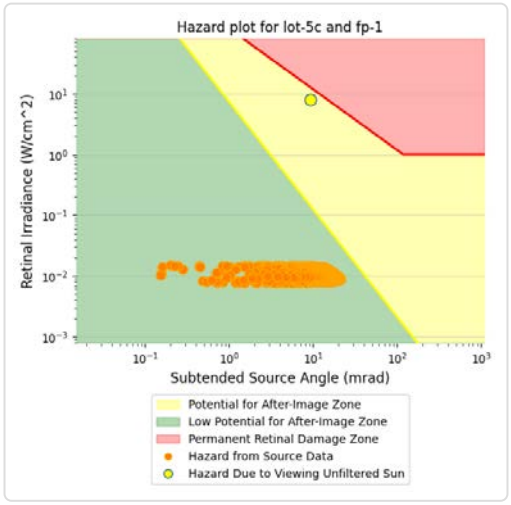
Lot 5c and FP: FP 1

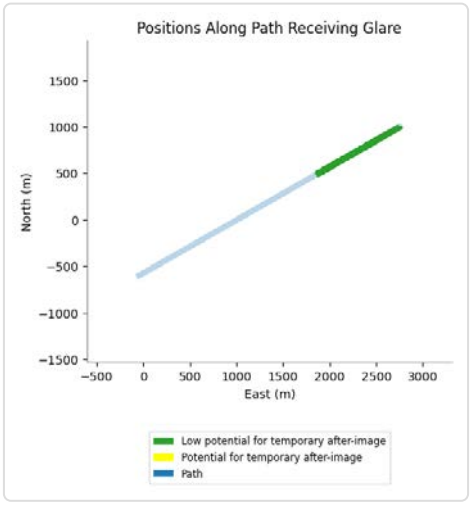
Yellow glare: none

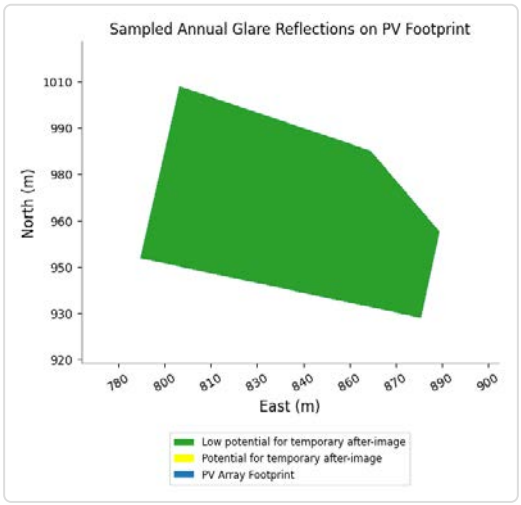
Green glare: 4,102 min.

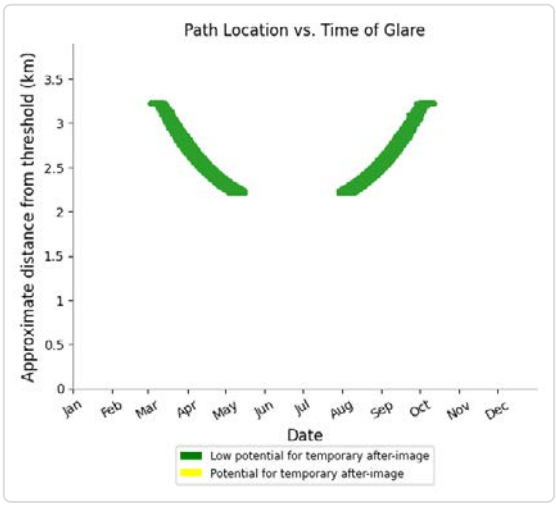












Lot 5c and FP: FP 2

No glare found

Lot 5c and OP 1

No glare found

Lot 5c and OP 2

No glare found

Lot 5c and OP 3

No glare found

PV: Lot 6a - E potential temporary after-image

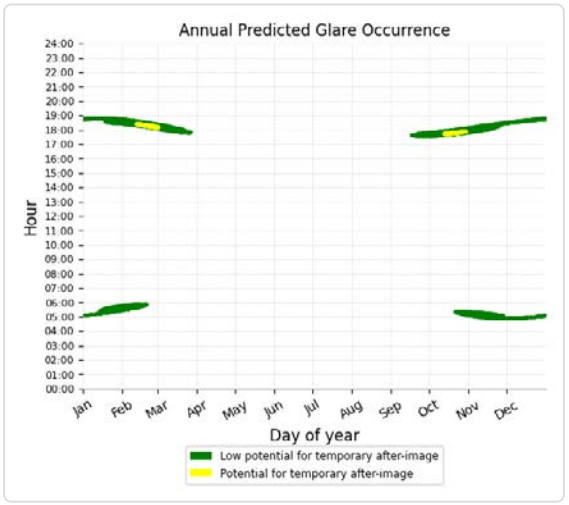
Receptor results ordered by category of glare

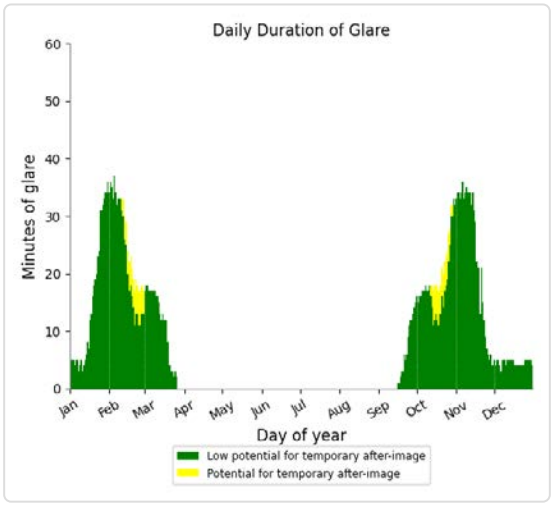
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
M-12	2,923	48.7	167	2.8
M12 - northbound	188	3.1	0	0.0
M12 - southbound	948	15.8	0	0.0
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	3,486	58.1	0	0.0
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

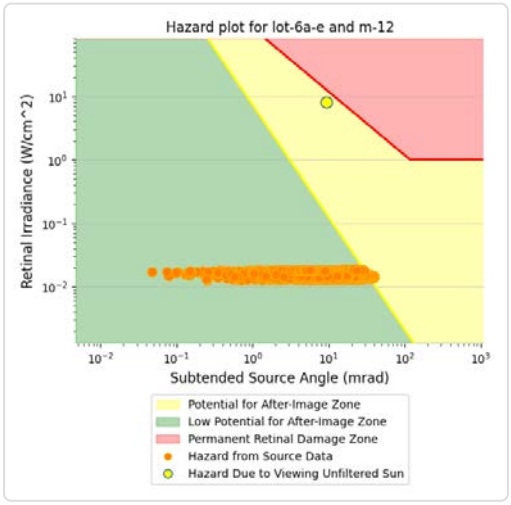
Lot 6a - E and Route: M-12

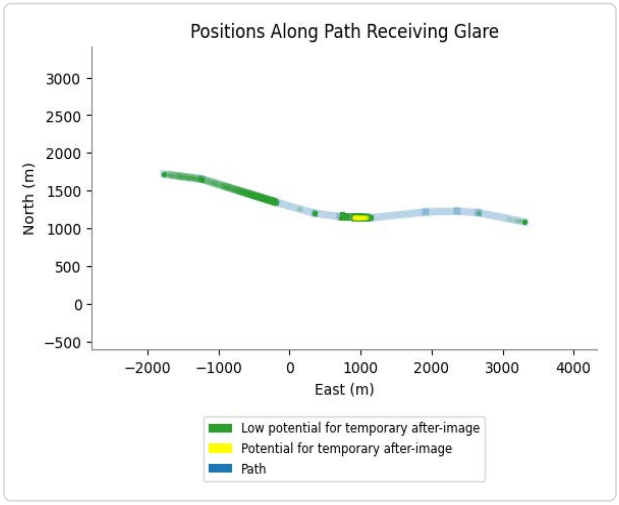
Yellow glare: 167 min.

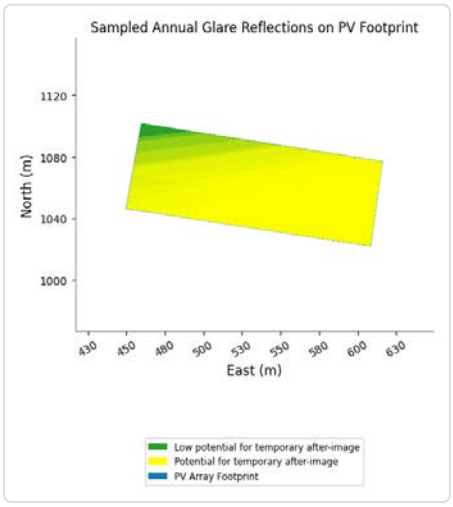
Green glare: 2,923 min.







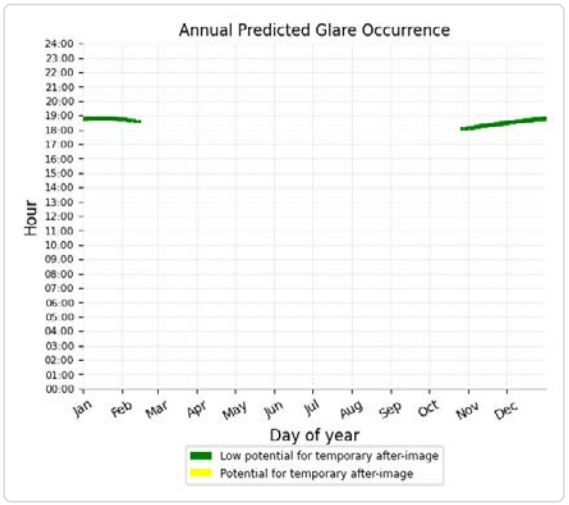


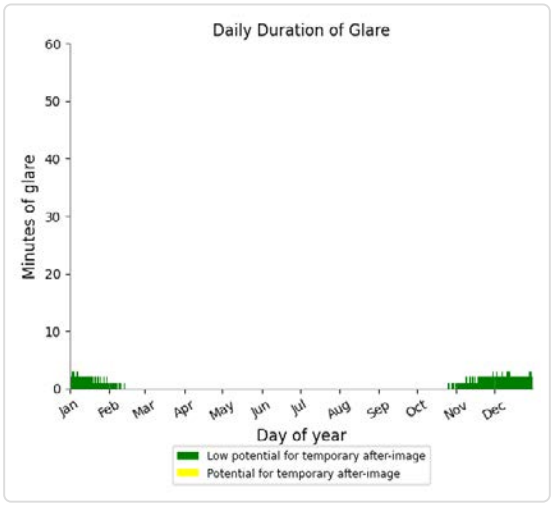


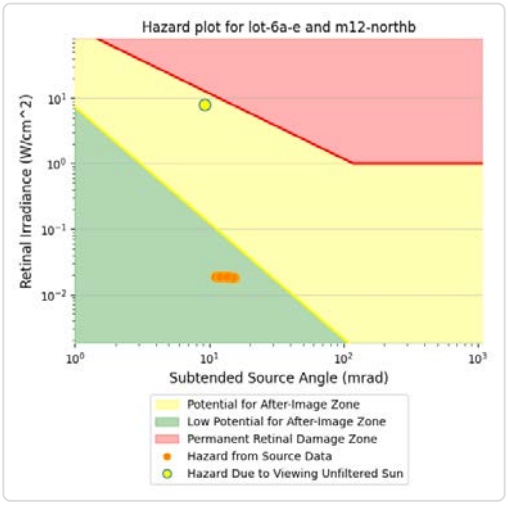
Lot 6a - E and Route: M12 - northbound

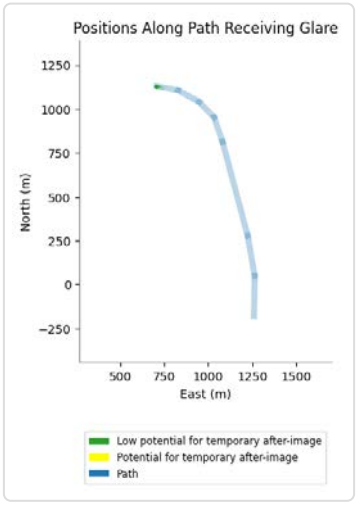
Yellow glare: none

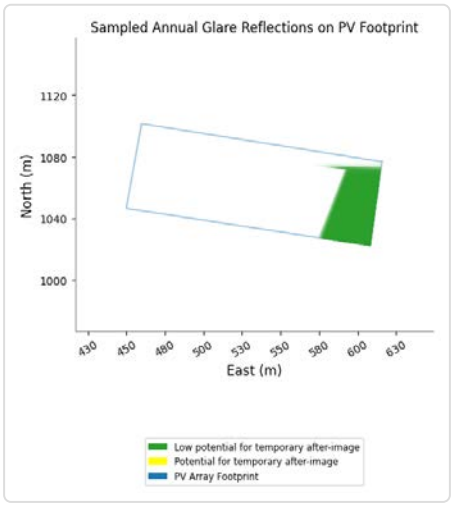
Green glare: 188 min.







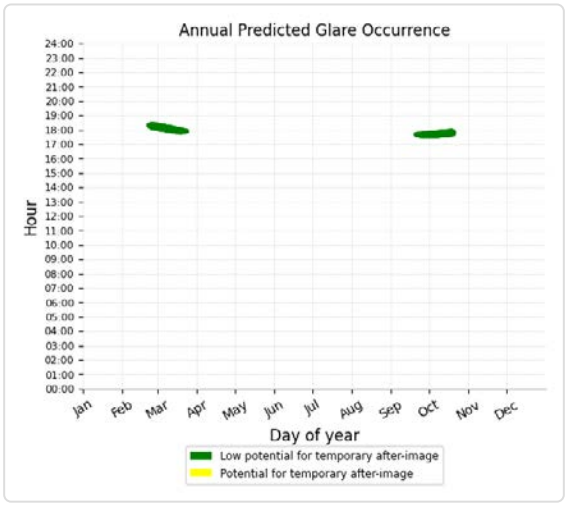


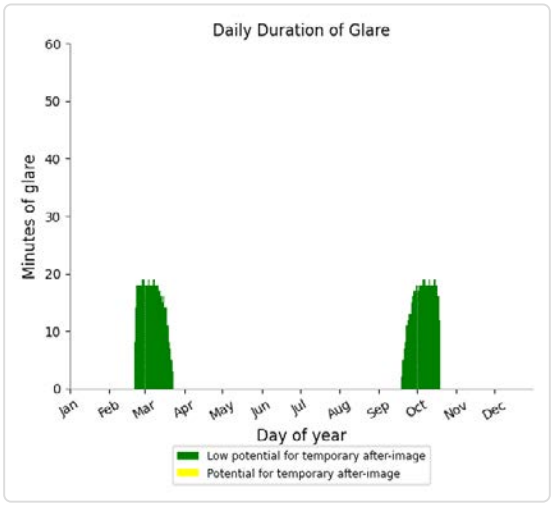


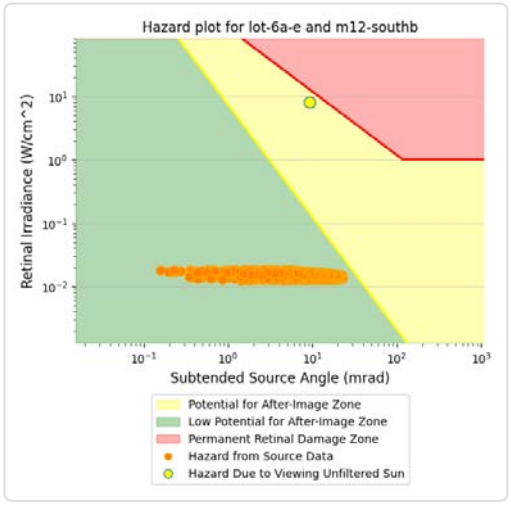
Lot 6a - E and Route: M12 - southbound

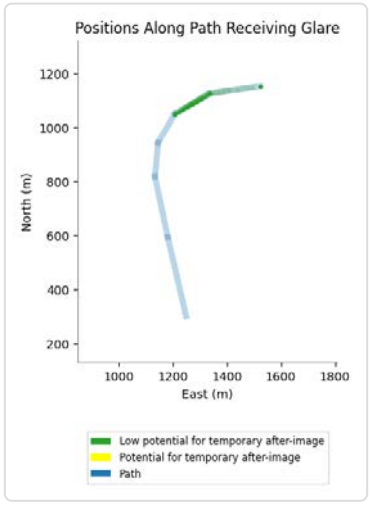
Yellow glare: none

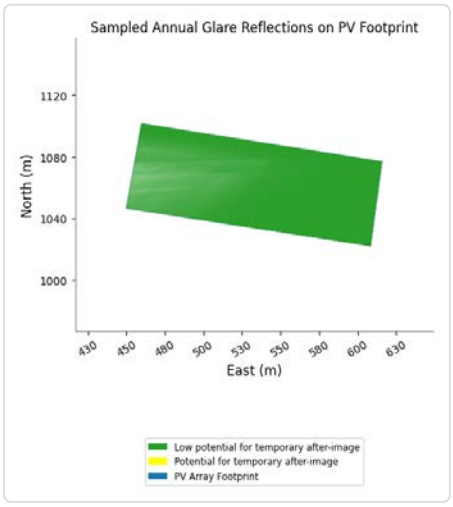
Green glare: 948 min.











Lot 6a - E and Route: Airport Entry

No glare found

Lot 6a - E and Route: Elizabeth Drive

No glare found

Lot 6a - E and Route: Luddenham Road

No glare found

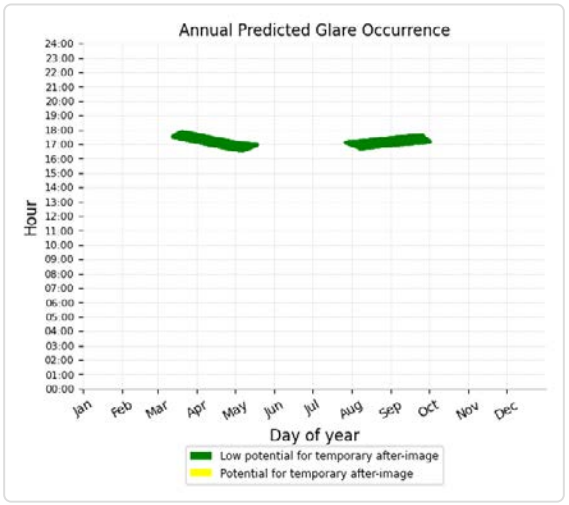
Lot 6a - E and Route: Runway

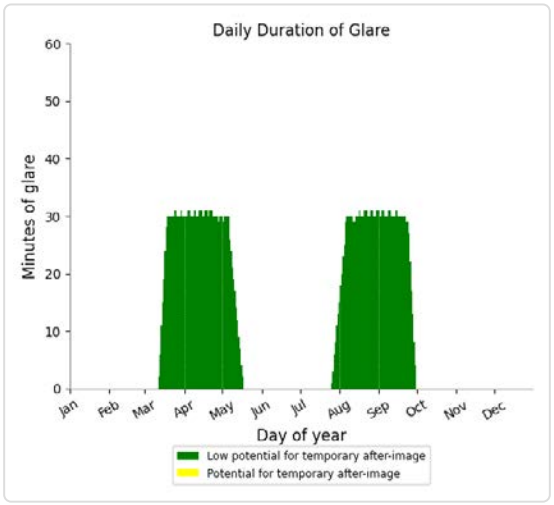
No glare found

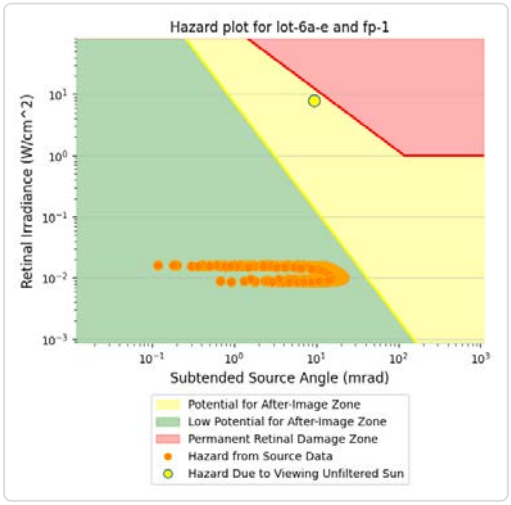
Lot 6a - E and FP: FP 1

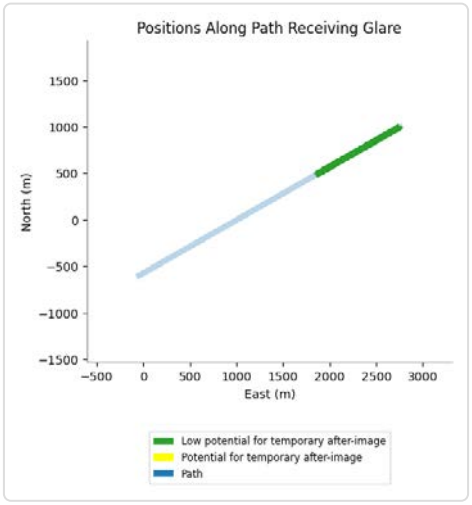
Yellow glare: none

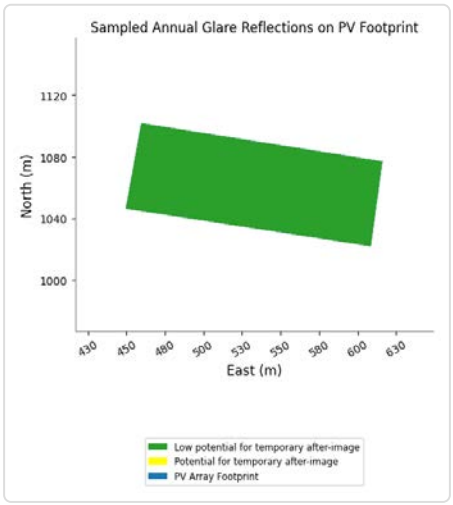
Green glare: 3,486 min.

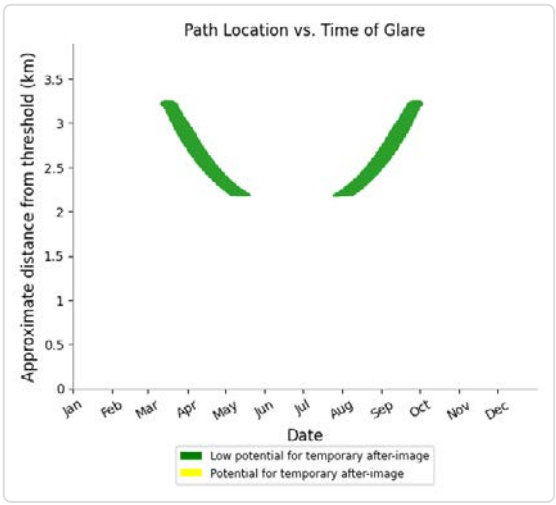












Lot 6a - E and FP: FP 2

No glare found

Lot 6a - E and OP 1

No glare found

Lot 6a - E and OP 2

No glare found

Lot 6a - E and OP 3

No glare found

PV: Lot 6a - W potential temporary after-image

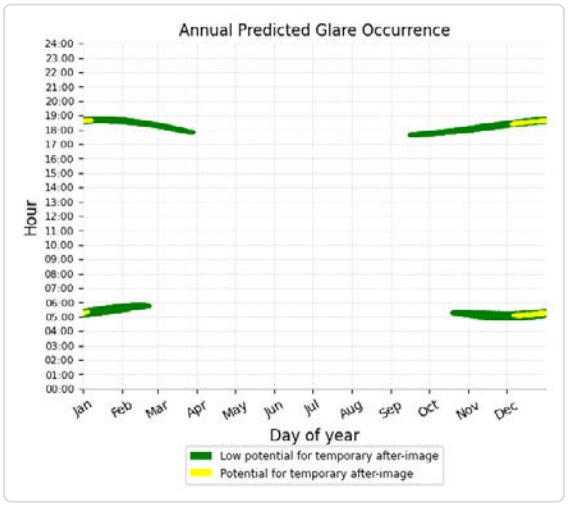
Receptor results ordered by category of glare

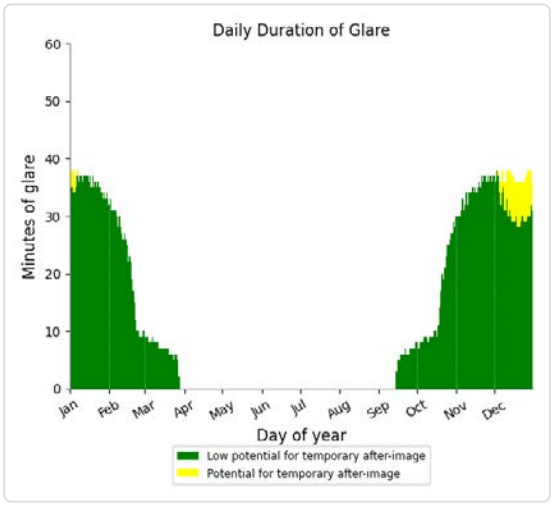
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
M-12	4,462	74.4	195	3.2
M12 - northbound	225	3.8	0	0.0
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	2,990	49.8	0	0.0
FP 2	0	0.0	0	0.0
OP 3	787	13.1	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0

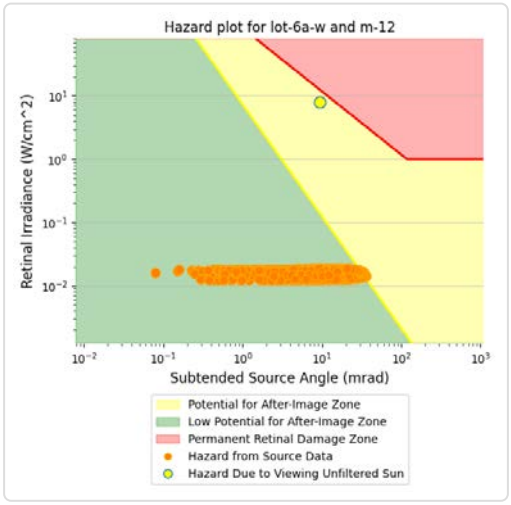
Lot 6a - W and Route: M-12

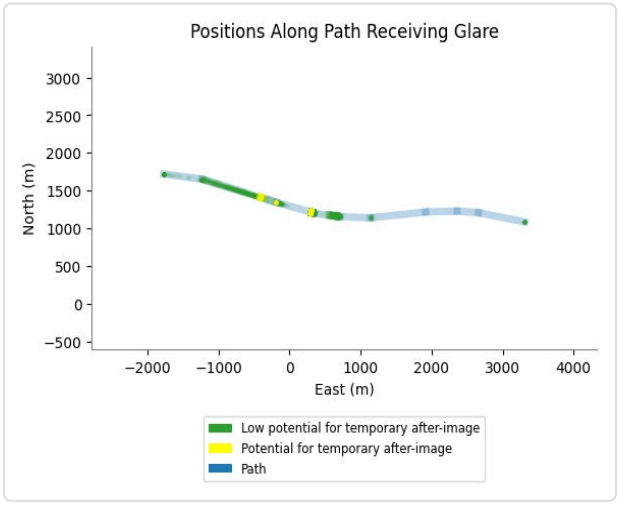
Yellow glare: 195 min.

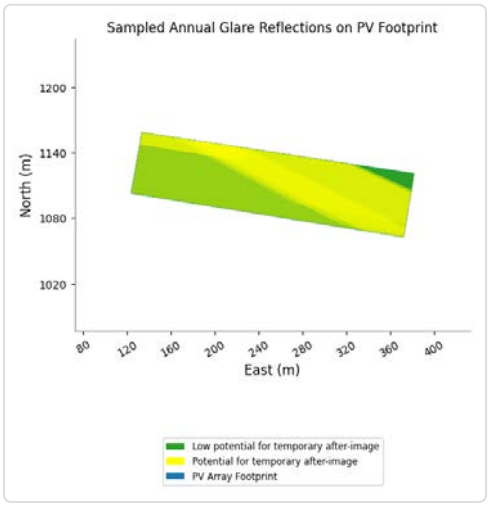
Green glare: 4,462 min.







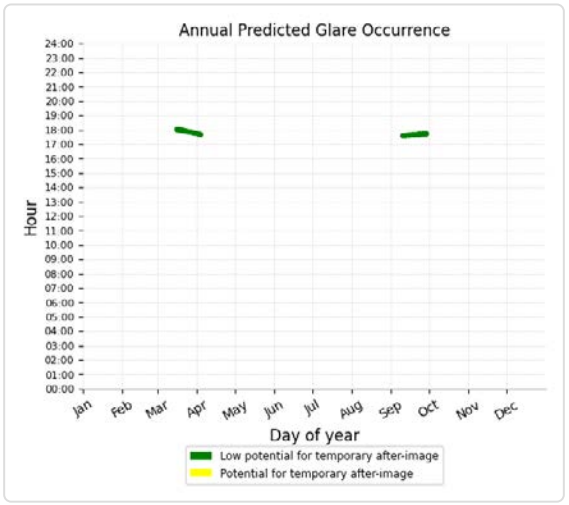


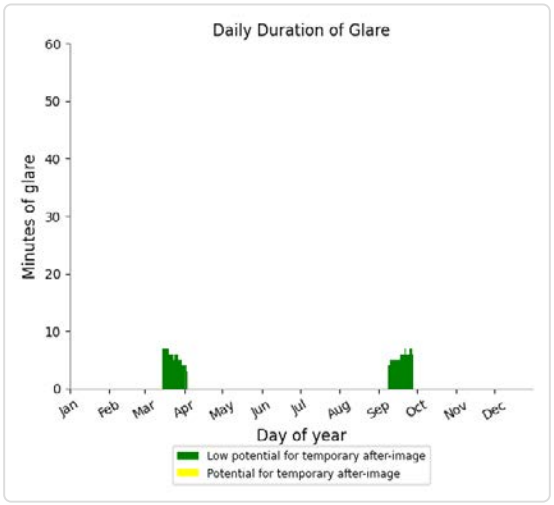


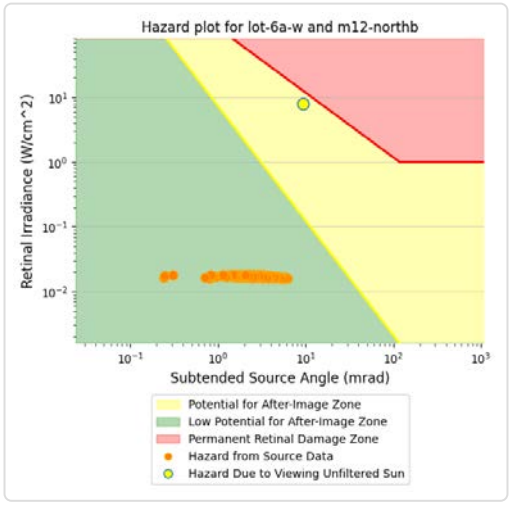
Lot 6a - W and Route: M12 - northbound

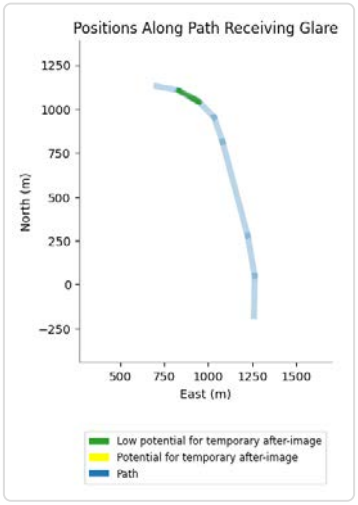
Yellow glare: none

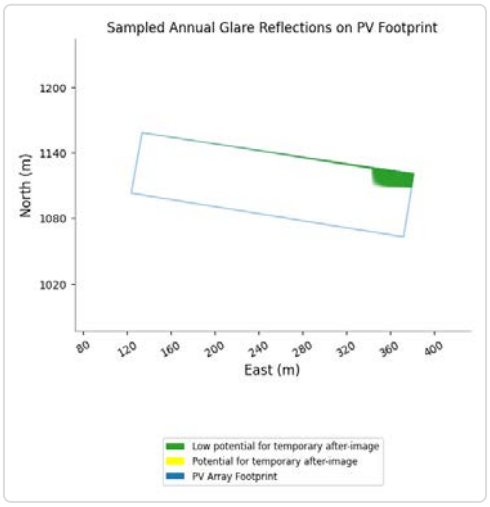
Green glare: 225 min.











Lot 6a - W and Route: Airport Entry

No glare found

Lot 6a - W and Route: Elizabeth Drive

No glare found

Lot 6a - W and Route: Luddenham Road

No glare found

Lot 6a - W and Route: M12 - southbound

No glare found

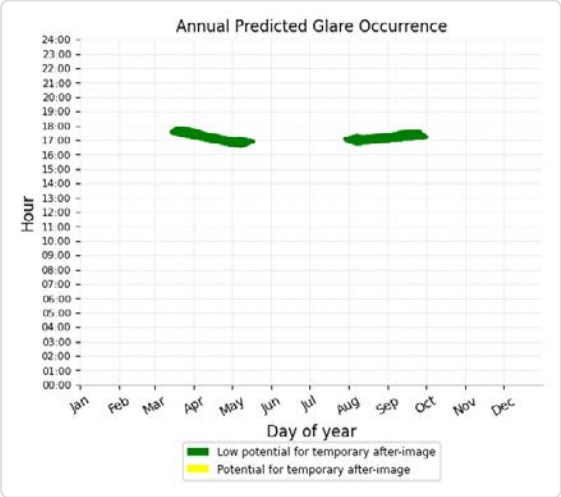
Lot 6a - W and Route: Runway

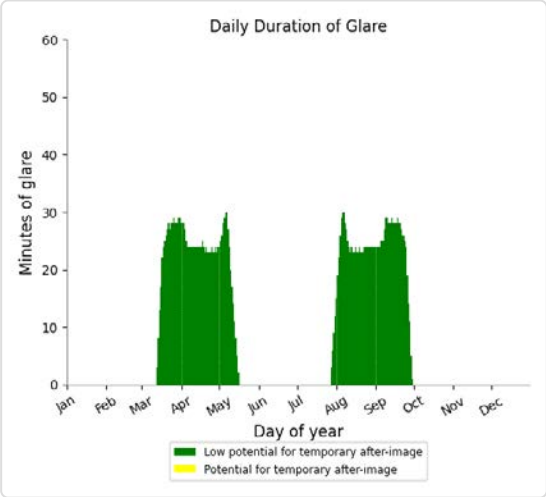
No glare found

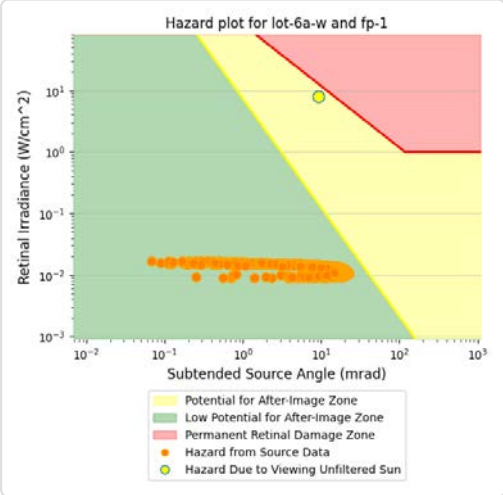
Lot 6a - W and FP: FP 1

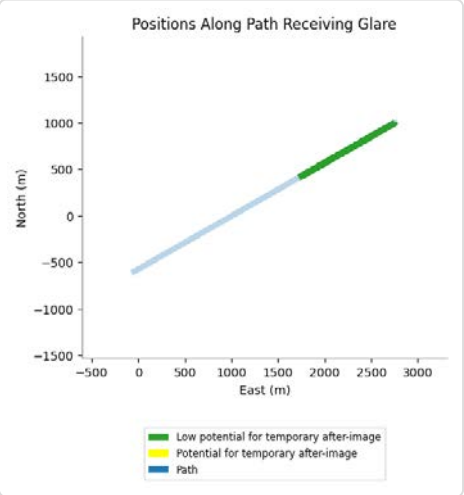
Yellow glare: none

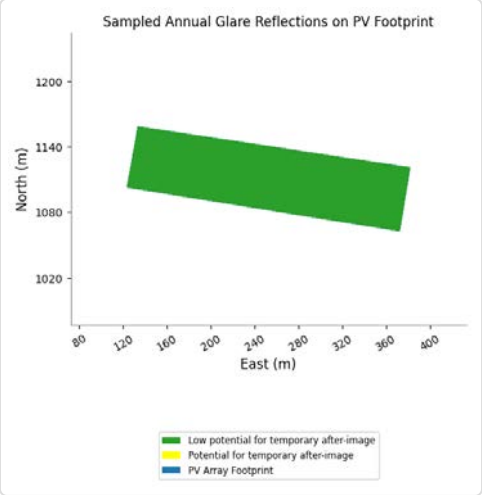
Green glare: 2,990 min.

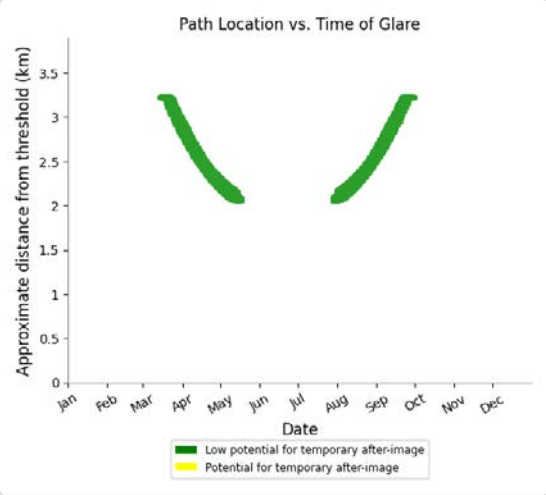












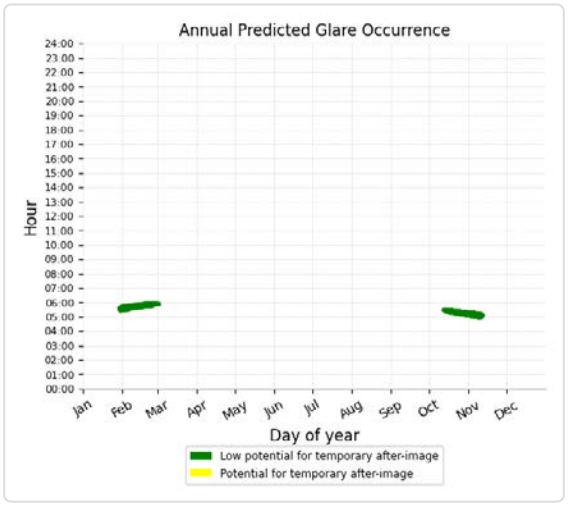
Lot 6a - W and FP: FP 2

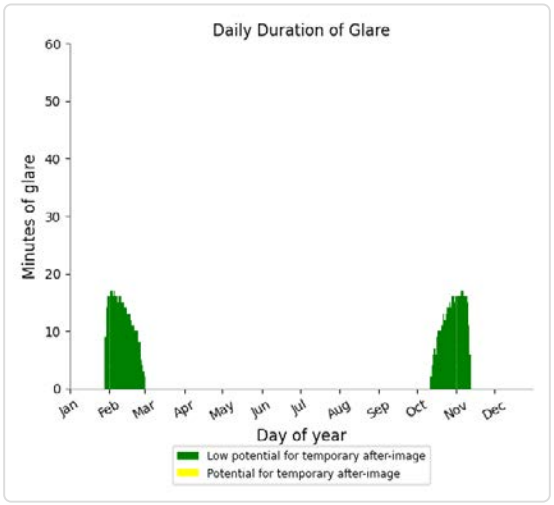
No glare found

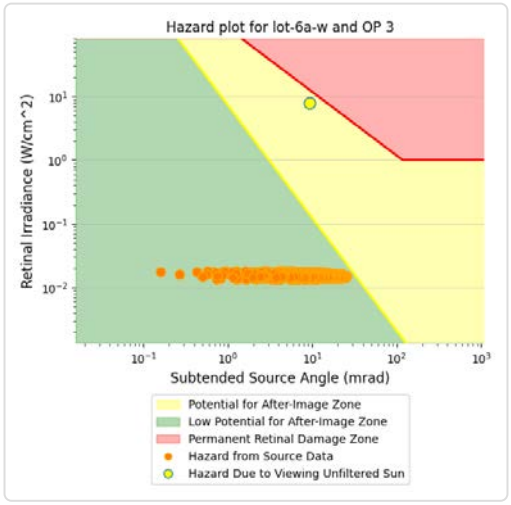
Lot 6a - W and OP 3

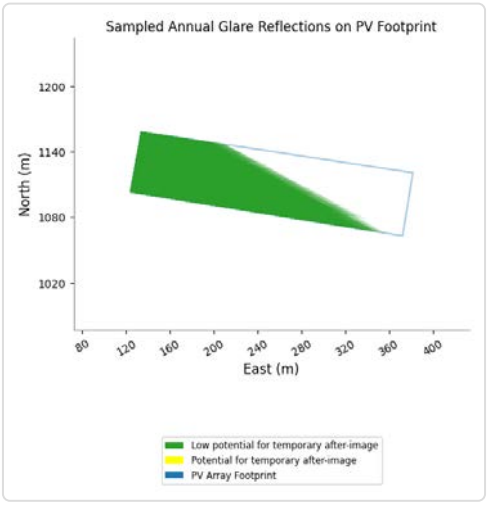
Yellow glare: none

Green glare: 787 min.









Lot 6a - W and OP 1

No glare found

Lot 6a - W and OP 2

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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FORGESOLAR GLARE ANALYSIS

Project: **Burrah Park SSDA**
Site configuration: **Burrah Park - Solar - West**

Created 08 Apr, 2025
Updated 09 Apr, 2025
Time-step 1 minute
Timezone offset UTC10
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 1 MW to 5 MW
Site ID 146191.24576

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
	°	°	min	hr	min	hr	kWh
Lot 1a - NE	5.0	100.0	5,514	91.9	0	0.0	-
Lot 1a - SE	5.0	100.0	9,054	150.9	0	0.0	-
Lot 1a - SW	5.0	10.0	3,037	50.6	0	0.0	-
Lot 1a - W	5.0	10.0	4,330	72.2	0	0.0	-
Lot 1b	5.0	100.0	3,060	51.0	0	0.0	-
Lot 1b - E	5.0	100.0	4,338	72.3	0	0.0	-
Lot 3a	5.0	100.0	4,206	70.1	0	0.0	-
Lot 3a-E	5.0	10.0	3,332	55.5	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
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	4,996	83.3	0	0.0
Luddenham Road	33	0.6	0	0.0
M-12	273	4.5	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	40	0.7	0	0.0
Runway	0	0.0	0	0.0
FP 1	31,529	525.5	0	0.0
FP 2	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

Component Data

PV Arrays

Name: Lot 1a - NE
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.865628	150.729501	61.68	12.00	73.68
2	-33.867605	150.729126	67.70	12.00	79.70
3	-33.867552	150.728568	66.66	12.00	78.66
4	-33.865565	150.728986	63.11	12.00	75.11

Name: Lot 1a - SE
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.867899	150.729051	68.22	12.00	80.22
2	-33.869770	150.728697	74.38	12.00	86.38
3	-33.869681	150.728139	72.86	12.00	84.86
4	-33.867819	150.728546	67.93	12.00	79.93

Name: Lot 1a - SW
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 10.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.868551	150.722303	58.45	12.00	70.45
2	-33.868327	150.722374	57.87	12.00	69.87
3	-33.868384	150.722757	59.87	12.00	71.87
4	-33.868464	150.722813	59.55	12.00	71.55
5	-33.868645	150.722775	59.19	12.00	71.19

Name: Lot 1a - W
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 10.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.869196	150.724169	62.16	12.00	74.16
2	-33.869016	150.724212	62.04	12.00	74.04
3	-33.869334	150.726677	70.18	12.00	82.18
4	-33.869537	150.726634	69.53	12.00	81.53

Name: Lot 1b
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.868368	150.724545	61.67	12.00	73.67
2	-33.866413	150.724940	56.91	12.00	68.91
3	-33.866351	150.724441	55.79	12.00	67.79
4	-33.868297	150.724009	60.89	12.00	72.89

Name: Lot 1b - E
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.868539	150.726082	65.71	12.00	77.71
2	-33.865626	150.726741	57.86	12.00	69.86
3	-33.865728	150.727321	59.45	12.00	71.45
4	-33.868622	150.726653	67.56	12.00	79.56

Name: Lot 3a
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 100.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.864854	150.728274	58.46	12.00	70.46
2	-33.863032	150.728617	54.22	12.00	66.22
3	-33.863090	150.729169	54.48	12.00	66.48
4	-33.864943	150.728815	59.59	12.00	71.59

Name: Lot 3a-E
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 10.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.864972	150.730392	58.64	12.00	70.64
2	-33.864711	150.730435	58.60	12.00	70.60
3	-33.864609	150.729684	57.20	12.00	69.20
4	-33.864869	150.729635	58.77	12.00	70.77

Route Receptors

Name: Airport Entry
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.881880	150.735957	62.58	1.20	63.78
2	-33.880063	150.739970	65.47	1.20	66.67
3	-33.878567	150.741708	56.29	1.20	57.49
4	-33.877035	150.742716	54.98	1.20	56.18
5	-33.872278	150.743918	55.14	1.20	56.34

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

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.864571	150.707868	72.48	1.20	73.68
2	-33.865070	150.710443	66.52	1.20	67.72
3	-33.866459	150.714391	62.40	1.20	63.60
4	-33.868419	150.716708	58.93	1.20	60.13
5	-33.869096	150.718725	59.68	1.20	60.88
6	-33.870094	150.726236	67.67	1.20	68.87
7	-33.871626	150.738166	65.31	1.20	66.51
8	-33.871662	150.741213	60.57	1.20	61.77
9	-33.872054	150.744475	53.65	1.20	54.85
10	-33.873372	150.752586	46.36	1.20	47.56
11	-33.874690	150.760225	62.47	1.20	63.67

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

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.857810	150.725537	60.51	1.20	61.71
2	-33.858505	150.724979	61.76	1.20	62.96
3	-33.861570	150.723670	59.47	1.20	60.67
4	-33.862015	150.723327	59.16	1.20	60.36
5	-33.862603	150.722683	59.77	1.20	60.97
6	-33.867859	150.716353	58.97	1.20	60.17

Name: M-12
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.854366	150.711274	79.98	1.20	81.18
2	-33.854972	150.717025	85.15	1.20	86.35
3	-33.857752	150.728397	55.11	1.20	56.31
4	-33.859071	150.734277	54.55	1.20	55.75
5	-33.859463	150.738096	54.04	1.20	55.24
6	-33.859605	150.742731	66.03	1.20	67.23
7	-33.858910	150.751121	47.65	1.20	48.85
8	-33.858803	150.755906	43.40	1.20	44.60
9	-33.858999	150.759146	42.13	1.20	43.33
10	-33.860104	150.766206	37.84	1.20	39.04

Name: M12 - northbound
Path type: One-way (toward increasing index)
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.871498	150.744026	55.36	1.20	56.56
2	-33.869431	150.744068	59.02	1.20	60.22
3	-33.867364	150.743639	68.47	1.20	69.67
4	-33.862536	150.742094	61.17	1.20	62.37
5	-33.861288	150.741579	61.93	1.20	63.13
6	-33.860487	150.740657	61.96	1.20	63.16
7	-33.859899	150.739369	56.53	1.20	57.73
8	-33.859685	150.738039	54.13	1.20	55.33

Name: M12 - southbound
Path type: One-way (toward increasing index)
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.859471	150.746879	66.89	1.20	68.09
2	-33.859720	150.744841	70.10	1.20	71.30
3	-33.860398	150.743468	68.68	1.20	69.88
4	-33.861360	150.742802	63.79	1.20	64.99
5	-33.862482	150.742674	62.75	1.20	63.95
6	-33.864513	150.743189	68.79	1.20	69.99
7	-33.867150	150.743918	68.68	1.20	69.88

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

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.890589	150.698321	102.34	10.00	112.34
2	-33.875697	150.729006	77.95	10.00	87.95

Flight Path Receptors

Name: FP 1
Description:
Threshold height: 15 m
Direction: 240.1°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-33.875293	150.729945	79.04	15.24	94.28
Two-mile	-33.860881	150.760169	45.77	217.19	262.97

Name: FP 2
Description:
Threshold height: 15 m
Direction: 60.1°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-33.891395	150.696738	88.58	15.24	103.82
Two-mile	-33.905829	150.666524	64.83	207.67	272.50

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-33.886006	150.719408	79.12	10.00
OP 2	2	-33.865614	150.719816	59.66	1.60
OP 3	3	-33.858389	150.725975	63.56	1.60

Obstruction Components

Name: Obstruction 1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.868298	150.722341	57.76
2	-33.868793	150.722164	58.66
3	-33.868980	150.723322	59.77
4	-33.868859	150.723365	59.75

Name: Obstruction 10
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.868118	150.738068	73.21
2	-33.866710	150.738347	65.98

Name: Obstruction 11
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.865686	150.738487	63.98
2	-33.864047	150.738819	65.10

Name: Obstruction 12
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.863664	150.739270	64.49
2	-33.862505	150.739463	60.39
3	-33.862247	150.737232	60.57

Name: Obstruction 13
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.861873	150.740311	58.71
2	-33.861695	150.738905	58.52
3	-33.860474	150.739077	57.72

Name: Obstruction 14
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.859957	150.735408	57.73
2	-33.860216	150.737156	57.51
3	-33.861276	150.736963	60.94

Name: Obstruction 15
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.859726	150.734700	57.00
2	-33.859369	150.731760	51.17
3	-33.860563	150.731535	52.76

Name: Obstruction 16
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.863040	150.729228	54.38
2	-33.862888	150.727940	53.02
3	-33.864795	150.727543	57.06

Name: Obstruction 17
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.864670	150.730494	58.60
2	-33.864563	150.729614	57.04
3	-33.864955	150.729539	59.23

Name: Obstruction 18
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.865677	150.727372	59.57
2	-33.865472	150.725859	55.68
3	-33.866995	150.725473	59.52

Name: Obstruction 19
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.863619	150.734592	67.48
2	-33.865240	150.734281	64.94

Name: Obstruction 2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.866377	150.724977	56.96
2	-33.866306	150.724435	55.67
3	-33.866658	150.723941	56.20
4	-33.868265	150.723560	59.06
5	-33.868399	150.724558	61.77

Name: Obstruction 3
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.868996	150.724183	61.93
2	-33.869370	150.724102	62.55
3	-33.869709	150.726661	68.07
4	-33.869330	150.726731	70.23

Name: Obstruction 4
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.868934	150.728914	71.25
2	-33.869940	150.728721	75.25
3	-33.869744	150.727562	70.61
4	-33.868515	150.727873	69.60

Name: Obstruction 5
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.867954	150.730244	64.56
2	-33.870101	150.729890	73.06
3	-33.870225	150.730985	70.78

Name: Obstruction 6
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.870288	150.731671	72.18
2	-33.870457	150.732937	68.12

Name: Obstruction 7
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.867506	150.730310	64.74
2	-33.865760	150.730600	59.94
3	-33.865849	150.731490	60.96

Name: Obstruction 8
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.869908	150.734249	64.10
2	-33.870710	150.734099	67.13

Name: Obstruction 9
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.870683	150.737875	70.35
2	-33.870568	150.736770	68.96
3	-33.868813	150.737178	68.90

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
	°	°	min	hr	min	hr	kWh
Lot 1a - NE	5.0	100.0	5,514	91.9	0	0.0	-
Lot 1a - SE	5.0	100.0	9,054	150.9	0	0.0	-
Lot 1a - SW	5.0	10.0	3,037	50.6	0	0.0	-
Lot 1a - W	5.0	10.0	4,330	72.2	0	0.0	-
Lot 1b	5.0	100.0	3,060	51.0	0	0.0	-
Lot 1b - E	5.0	100.0	4,338	72.3	0	0.0	-
Lot 3a	5.0	100.0	4,206	70.1	0	0.0	-
Lot 3a-E	5.0	10.0	3,332	55.5	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
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	4,996	83.3	0	0.0
Luddenham Road	33	0.6	0	0.0
M-12	273	4.5	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	40	0.7	0	0.0
Runway	0	0.0	0	0.0
FP 1	31,529	525.5	0	0.0
FP 2	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

PV: Lot 1a - NE low potential for temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	5,514	91.9	0	0.0
FP 2	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

Lot 1a - NE and Route: Airport Entry

No glare found

Lot 1a - NE and Route: Elizabeth Drive

No glare found

Lot 1a - NE and Route: Luddenham Road

No glare found

Lot 1a - NE and Route: M-12

No glare found

Lot 1a - NE and Route: M12 - northbound

No glare found

Lot 1a - NE and Route: M12 - southbound

No glare found

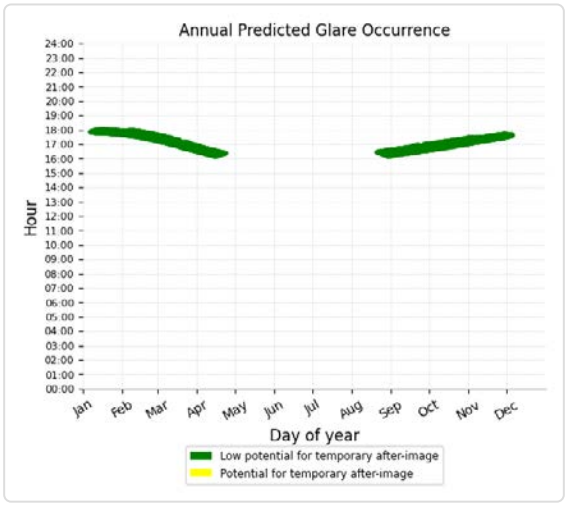
Lot 1a - NE and Route: Runway

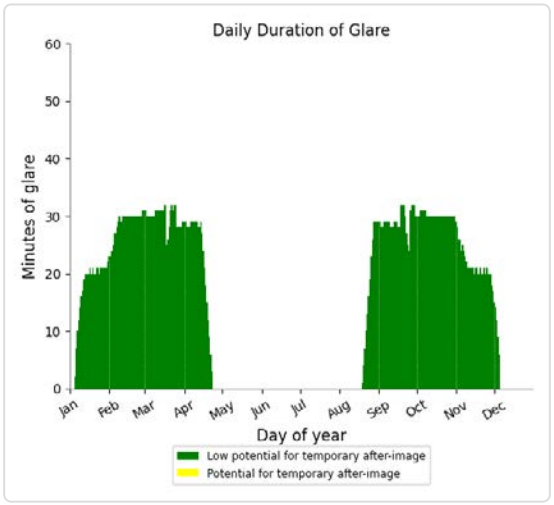
No glare found

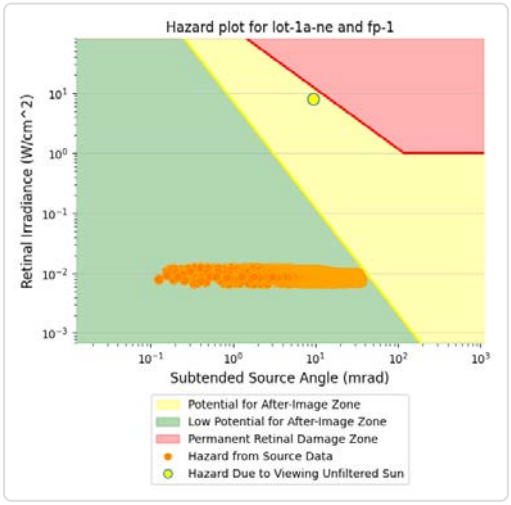
Lot 1a - NE and FP: FP 1

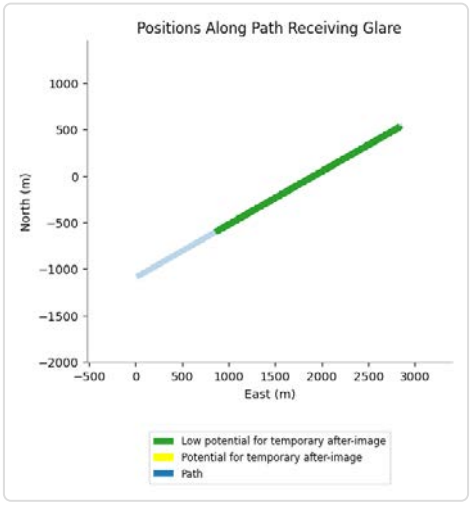
Yellow glare: none

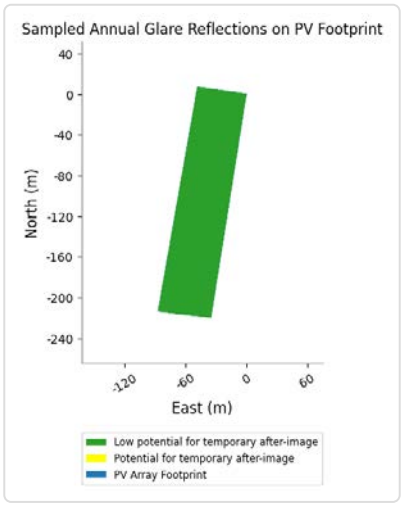
Green glare: 5,514 min.

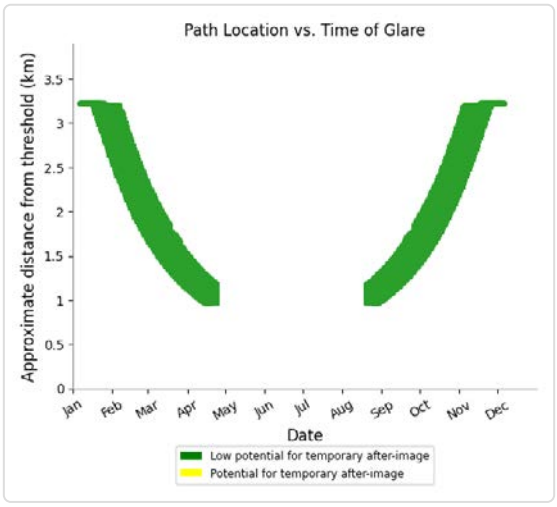












Lot 1a - NE and FP: FP 2

No glare found

Lot 1a - NE and OP 1

No glare found

Lot 1a - NE and OP 2

No glare found

Lot 1a - NE and OP 3

No glare found

PV: Lot 1a - SE low potential for temporary after-image

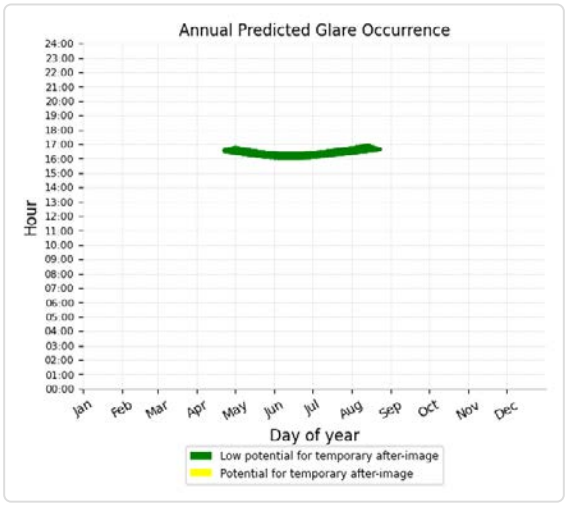
Receptor results ordered by category of glare

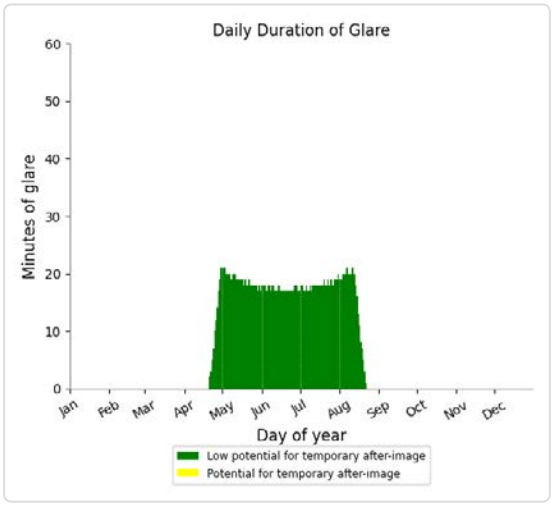
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	2,124	35.4	0	0.0
M-12	273	4.5	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	6,657	111.0	0	0.0
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

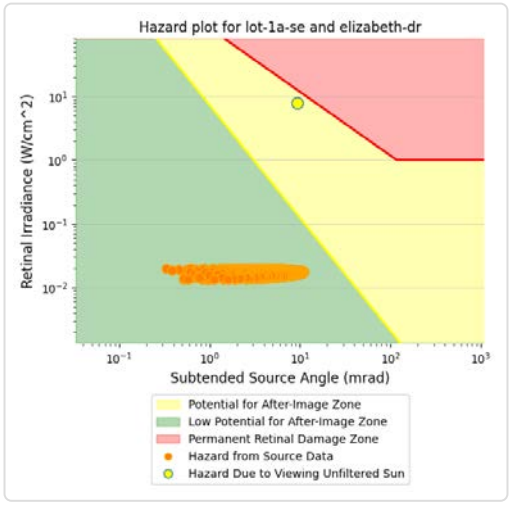
Lot 1a - SE and Route: Elizabeth Drive

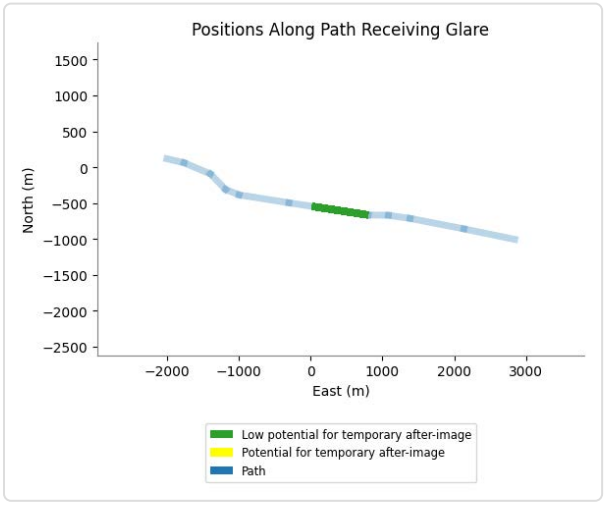
Yellow glare: none

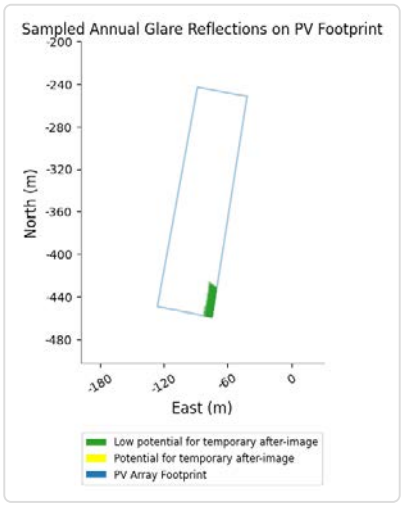
Green glare: 2,124 min.







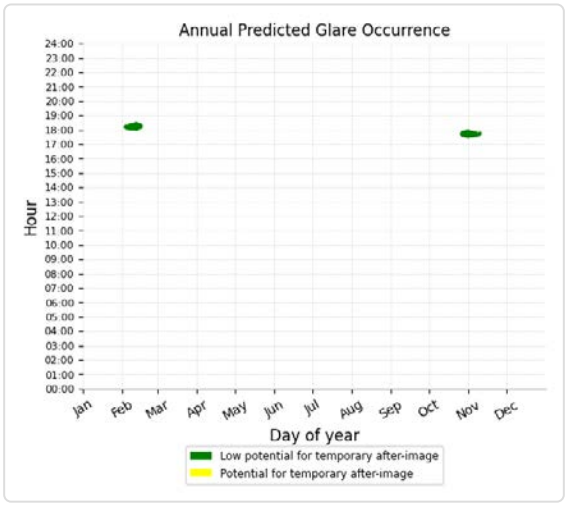


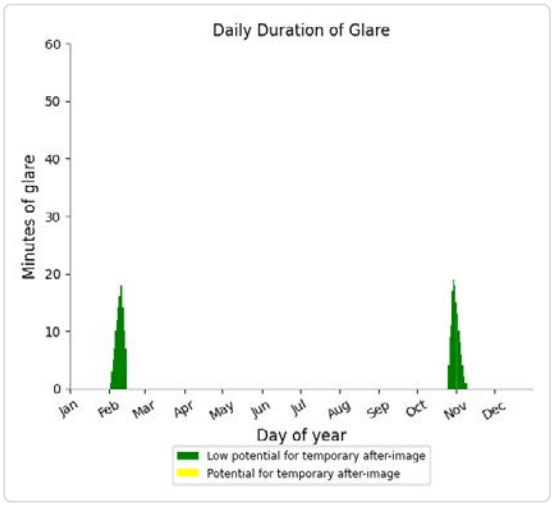


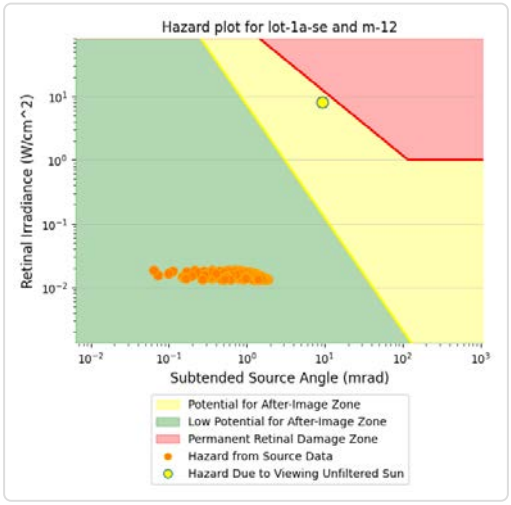
Lot 1a - SE and Route: M-12

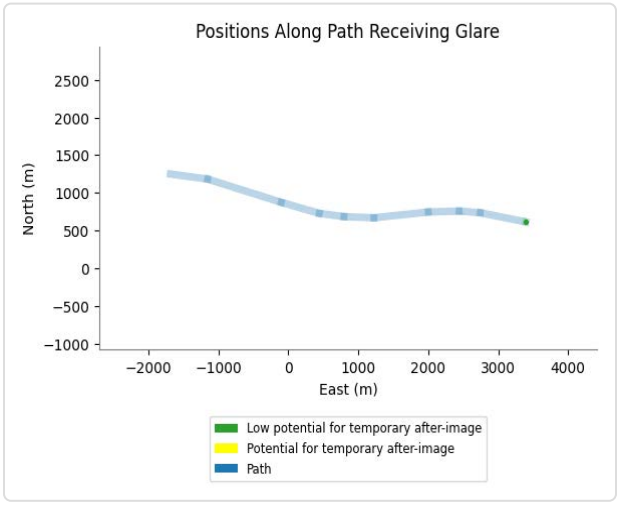
Yellow glare: none

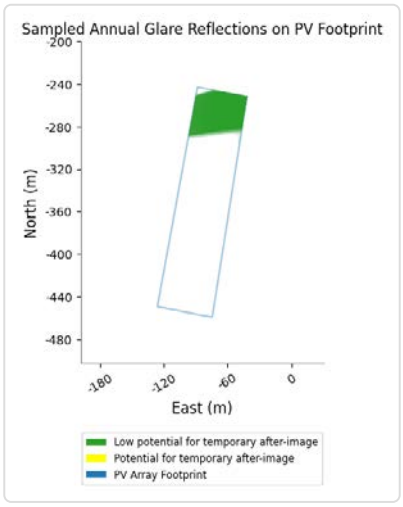
Green glare: 273 min.











Lot 1a - SE and Route: Airport Entry

No glare found

Lot 1a - SE and Route: Luddenham Road

No glare found

Lot 1a - SE and Route: M12 - northbound

No glare found

Lot 1a - SE and Route: M12 - southbound

No glare found

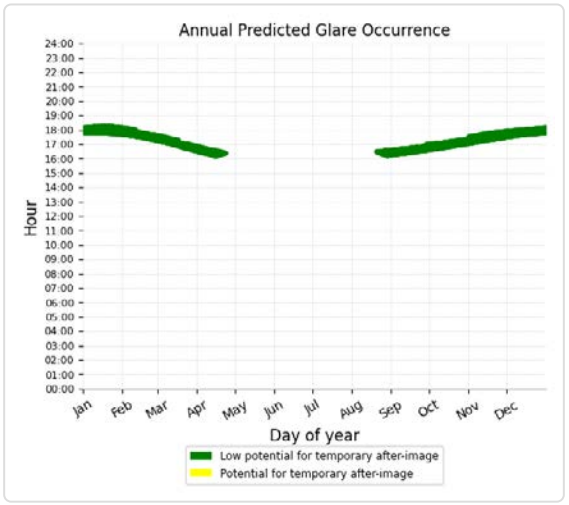
Lot 1a - SE and Route: Runway

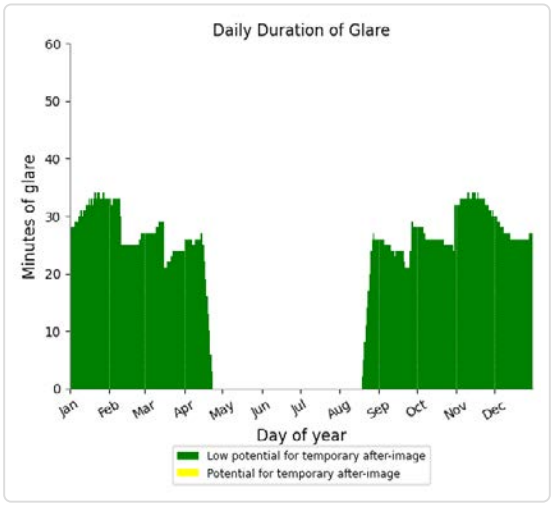
No glare found

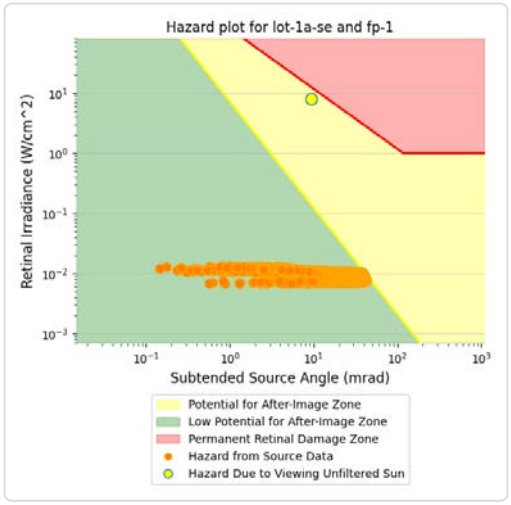
Lot 1a - SE and FP: FP 1

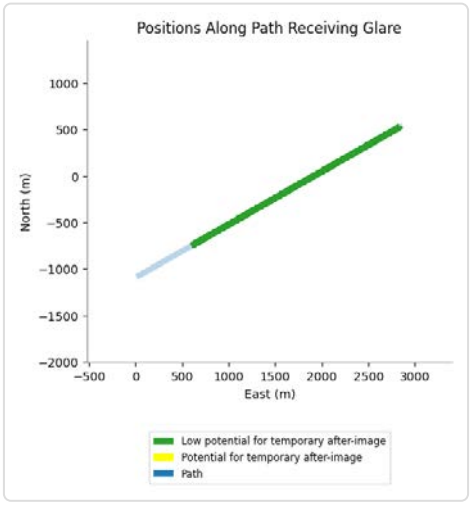
Yellow glare: none

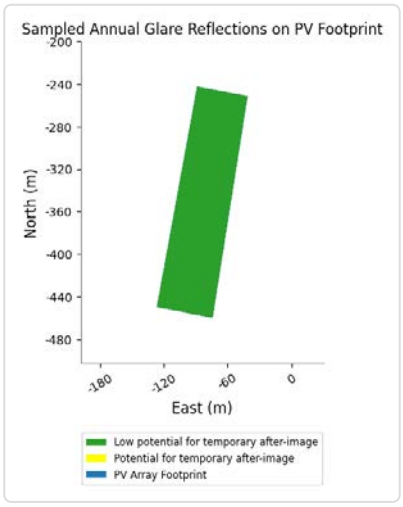
Green glare: 6,657 min.

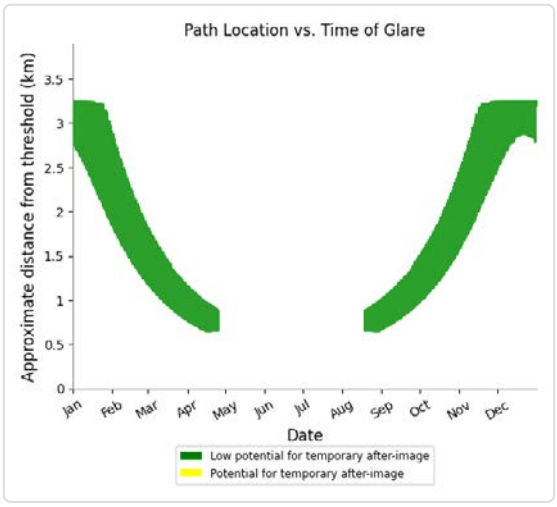












Lot 1a - SE and FP: FP 2

No glare found

Lot 1a - SE and OP 1

No glare found

Lot 1a - SE and OP 2

No glare found

Lot 1a - SE and OP 3

No glare found

PV: Lot 1a - SW low potential for temporary after-image

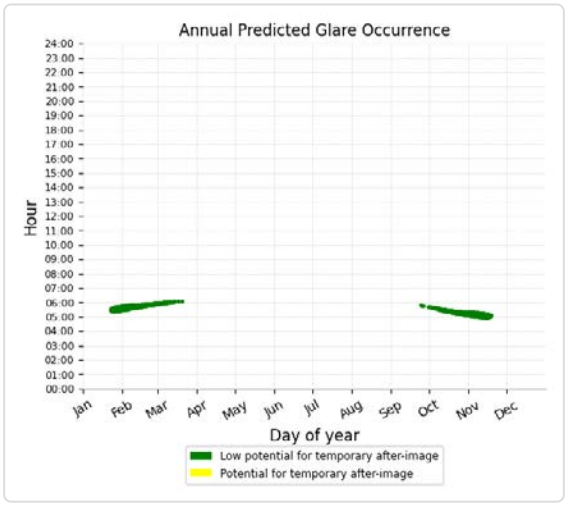
Receptor results ordered by category of glare

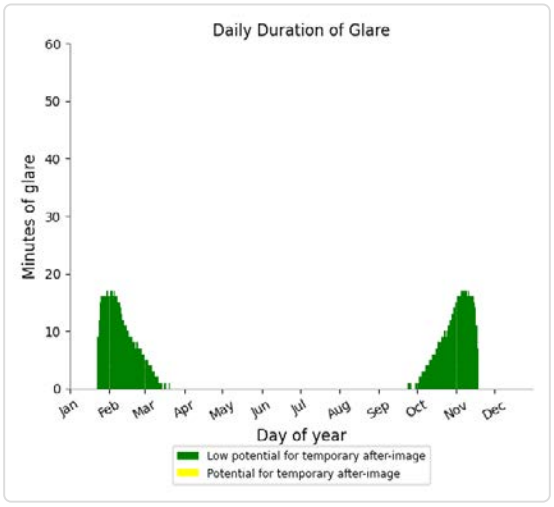
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	991	16.5	0	0.0
Luddenham Road	33	0.6	0	0.0
Airport Entry	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	2,013	33.5	0	0.0
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

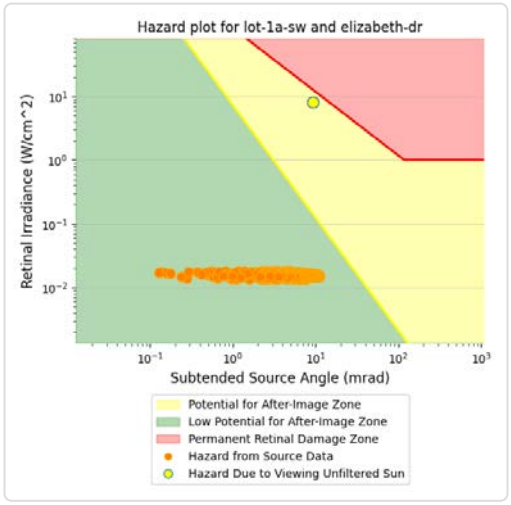
Lot 1a - SW and Route: Elizabeth Drive

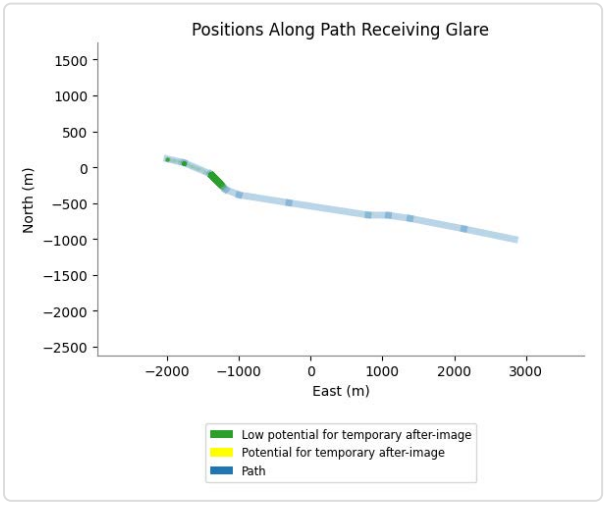
Yellow glare: none

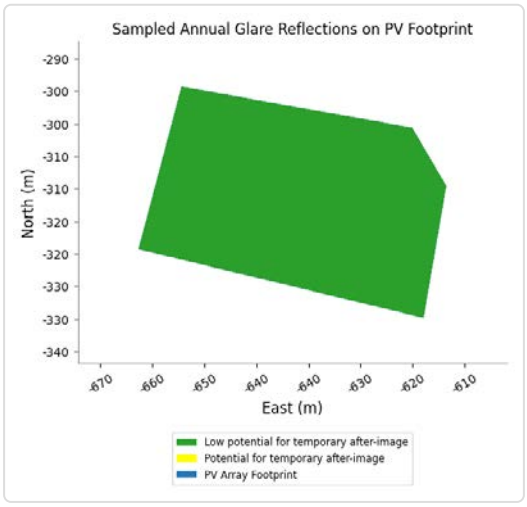
Green glare: 991 min.





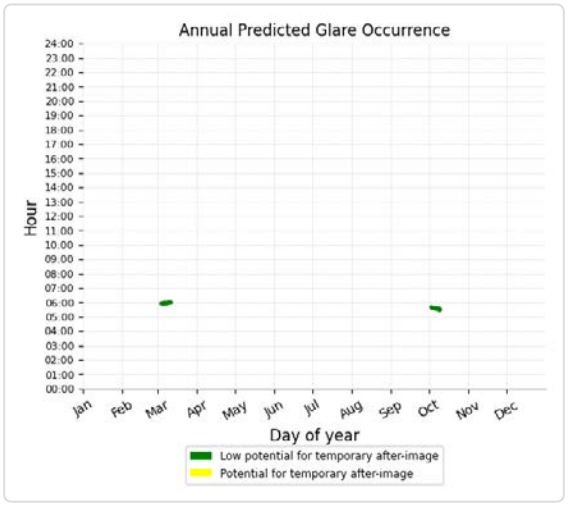


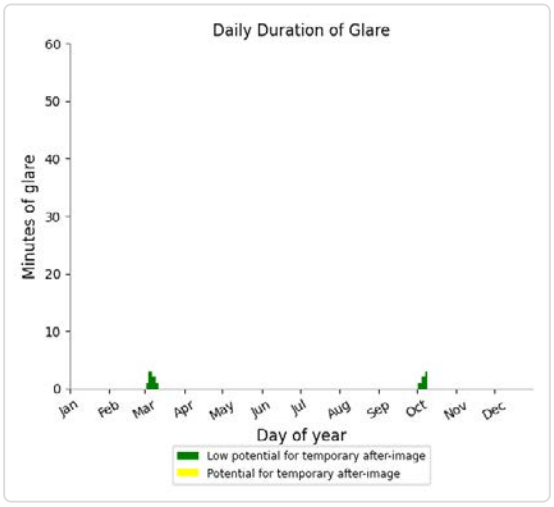


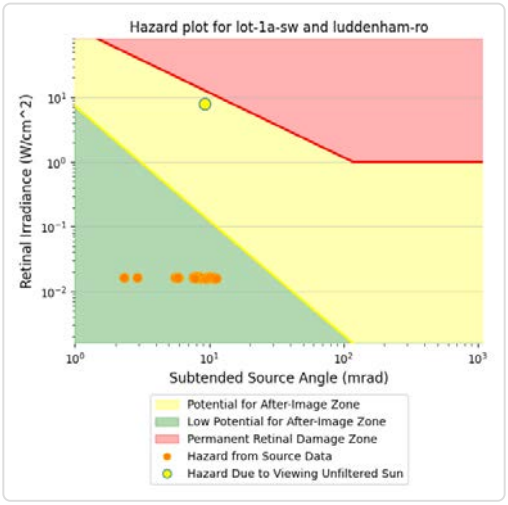


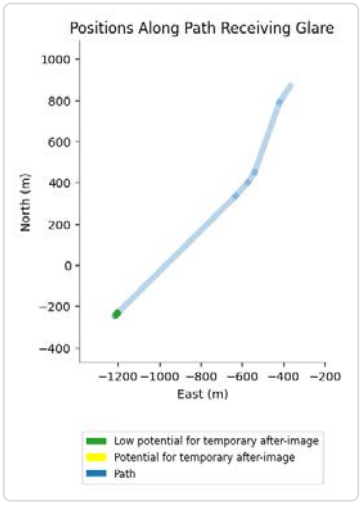
Lot 1a - SW and Route: Luddenham Road

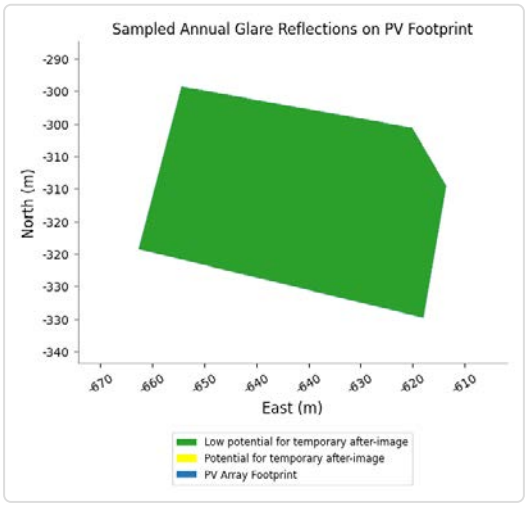
Yellow glare: none
Green glare: 33 min.











Lot 1a - SW and Route: Airport Entry

No glare found

Lot 1a - SW and Route: M-12

No glare found

Lot 1a - SW and Route: M12 - northbound

No glare found

Lot 1a - SW and Route: M12 - southbound

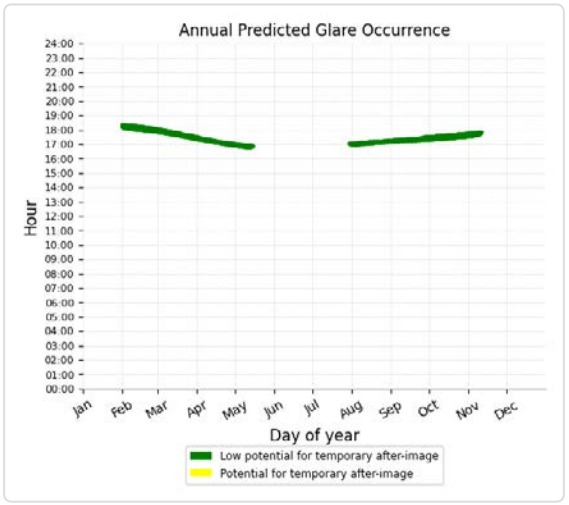
No glare found

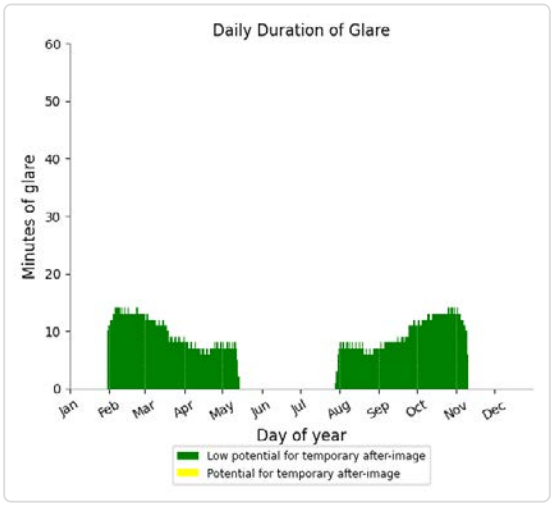
Lot 1a - SW and Route: Runway

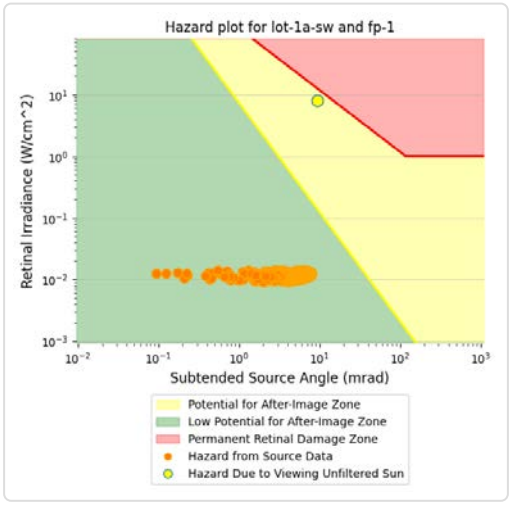
No glare found

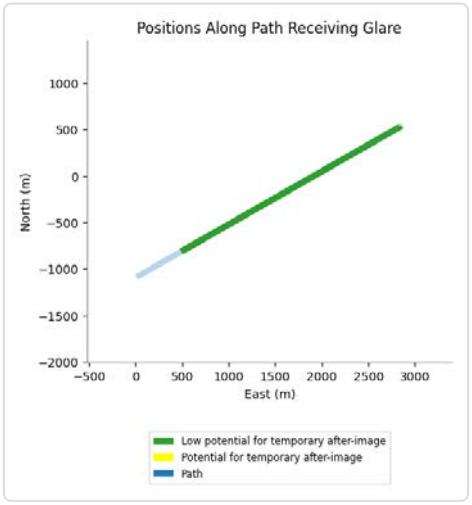
Lot 1a - SW and FP: FP 1

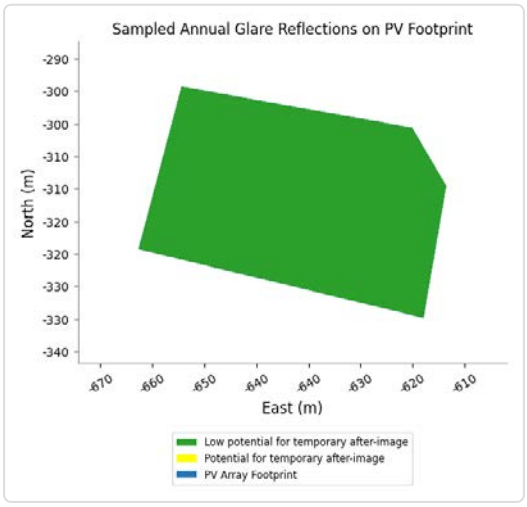
Yellow glare: none
Green glare: 2,013 min.

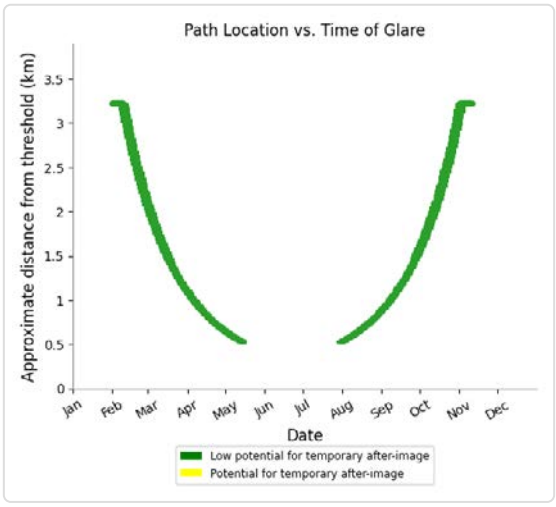












Lot 1a - SW and FP: FP 2

No glare found

Lot 1a - SW and OP 1

No glare found

Lot 1a - SW and OP 2

No glare found

Lot 1a - SW and OP 3

No glare found

PV: Lot 1a - W low potential for temporary after-image

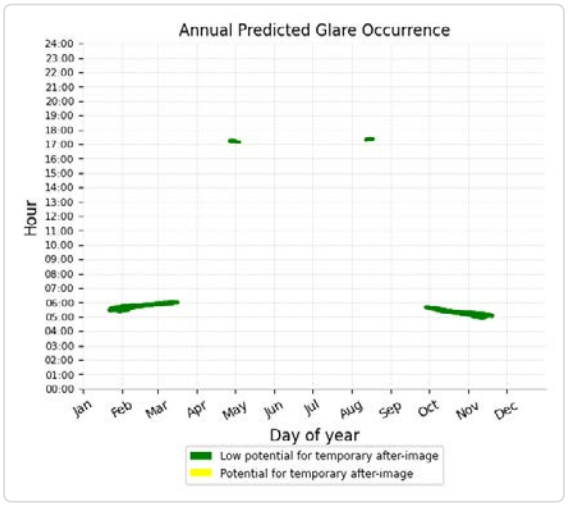
Receptor results ordered by category of glare

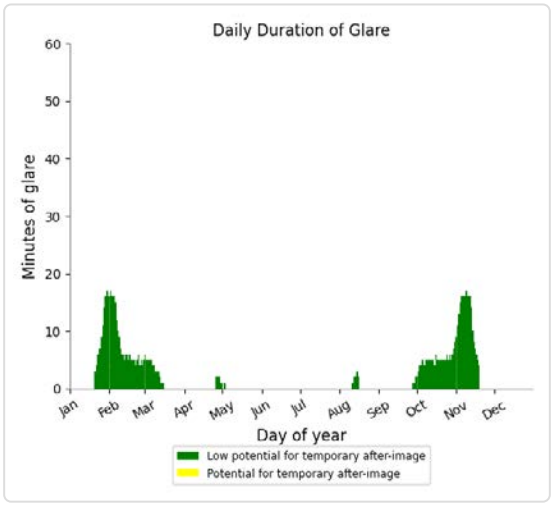
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	806	13.4	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	3,524	58.7	0	0.0
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

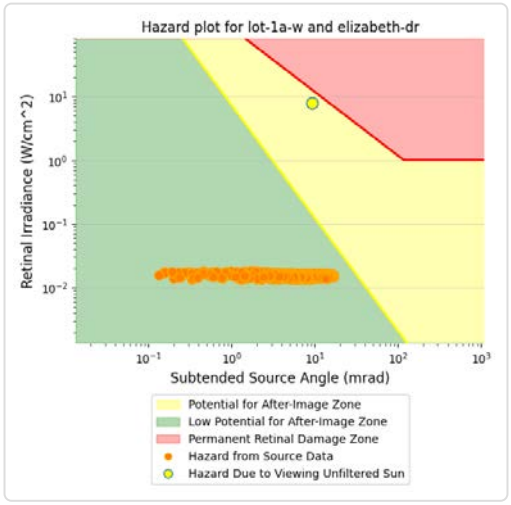
Lot 1a - W and Route: Elizabeth Drive

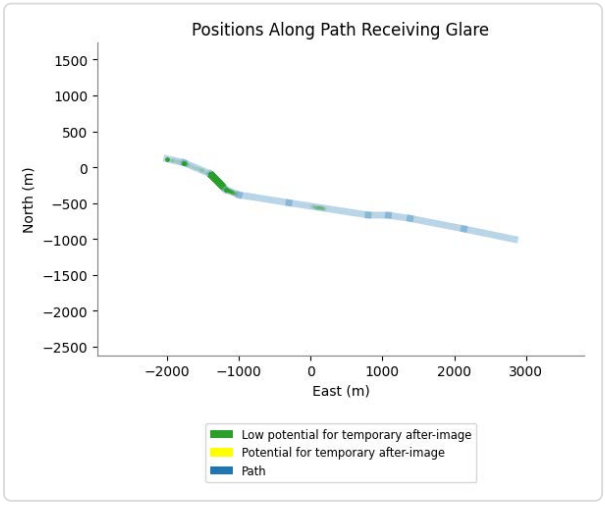
Yellow glare: none

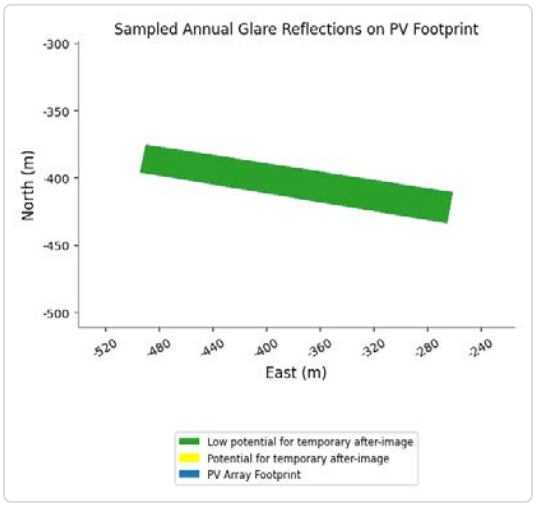
Green glare: 806 min.











Lot 1a - W and Route: Airport Entry

No glare found

Lot 1a - W and Route: Luddenham Road

No glare found

Lot 1a - W and Route: M-12

No glare found

Lot 1a - W and Route: M12 - northbound

No glare found

Lot 1a - W and Route: M12 - southbound

No glare found

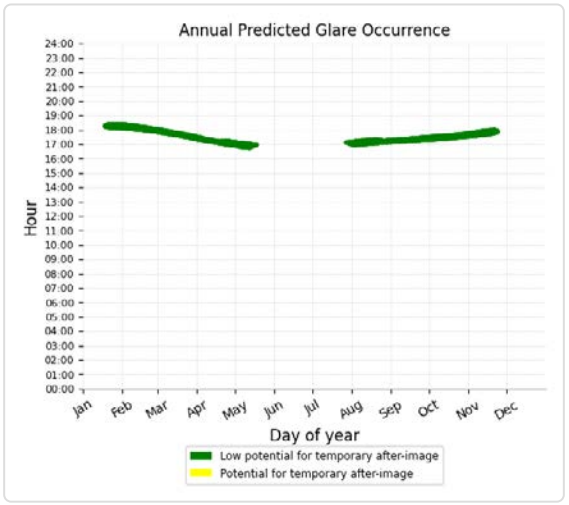
Lot 1a - W and Route: Runway

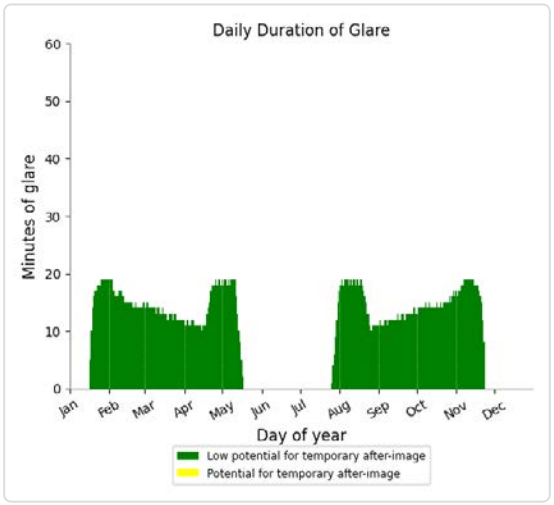
No glare found

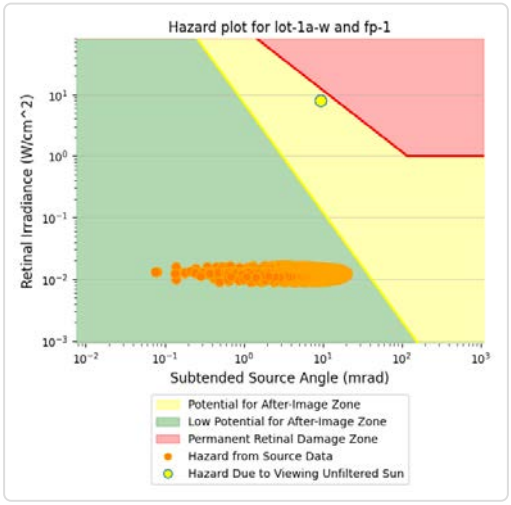
Lot 1a - W and FP: FP 1

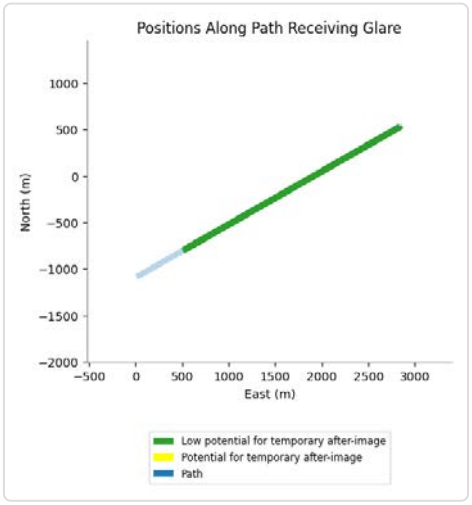
Yellow glare: none

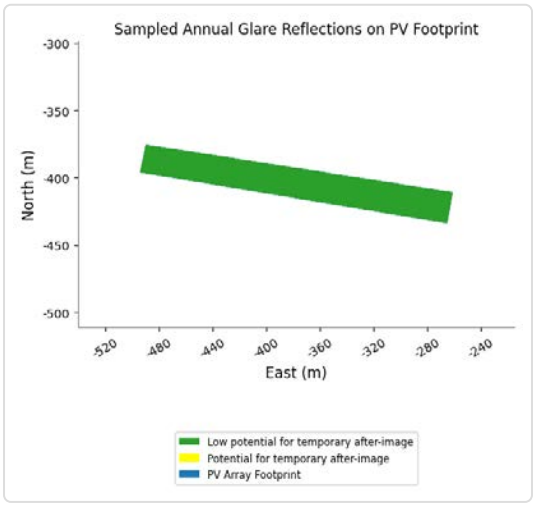
Green glare: 3,524 min.

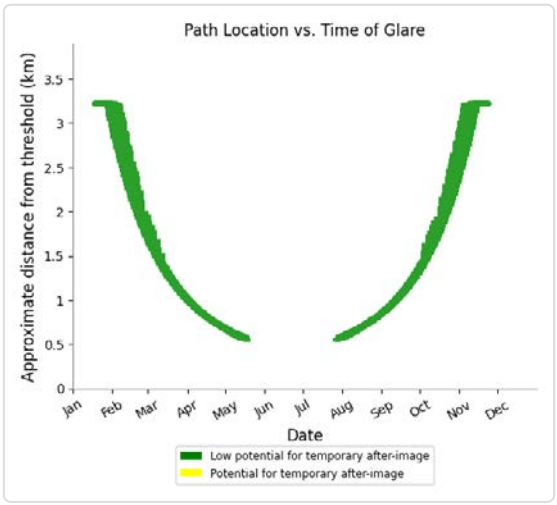












Lot 1a - W and FP: FP 2

No glare found

Lot 1a - W and OP 1

No glare found

Lot 1a - W and OP 2

No glare found

Lot 1a - W and OP 3

No glare found

PV: Lot 1b low potential for temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	3,060	51.0	0	0.0
FP 2	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

Lot 1b and Route: Airport Entry

No glare found

Lot 1b and Route: Elizabeth Drive

No glare found

Lot 1b and Route: Luddenham Road

No glare found

Lot 1b and Route: M-12

No glare found

Lot 1b and Route: M12 - northbound

No glare found

Lot 1b and Route: M12 - southbound

No glare found

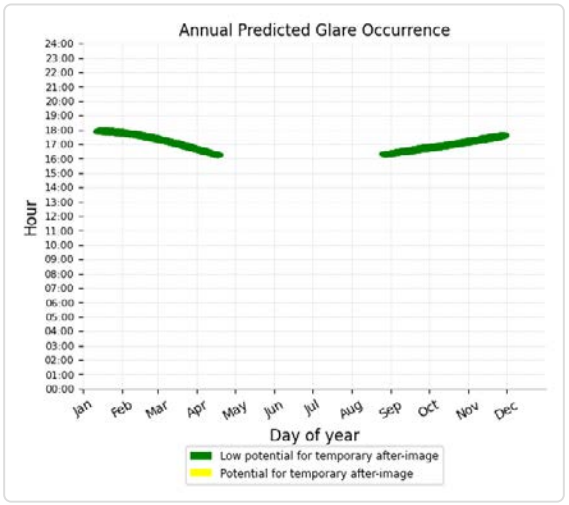
Lot 1b and Route: Runway

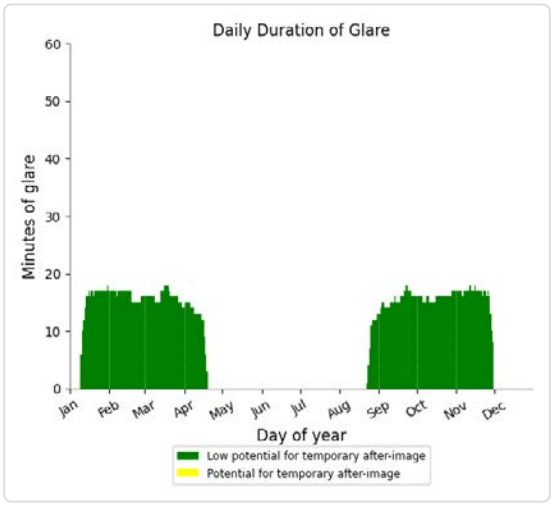
No glare found

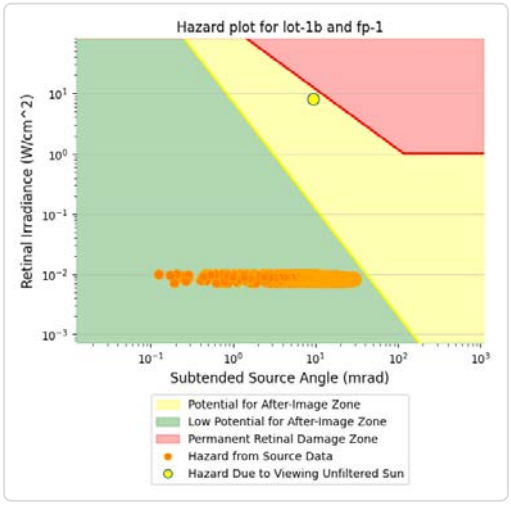
Lot 1b and FP: FP 1

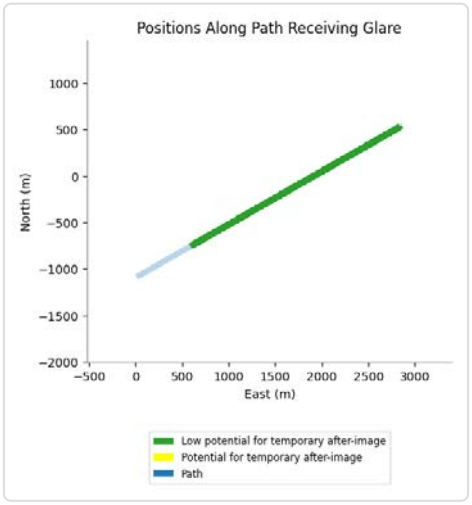
Yellow glare: none

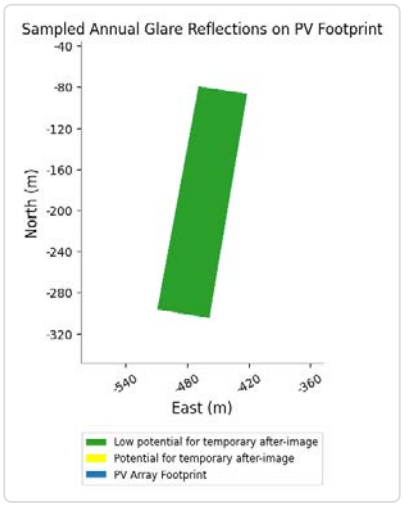
Green glare: 3,060 min.

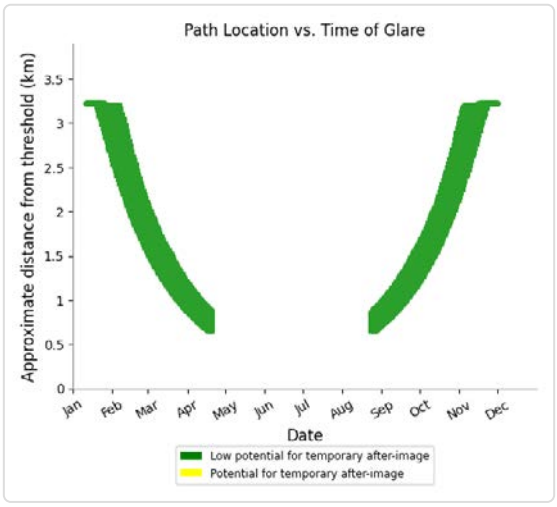












Lot 1b and FP: FP 2

No glare found

Lot 1b and OP 1

No glare found

Lot 1b and OP 2

No glare found

Lot 1b and OP 3

No glare found

PV: Lot 1b - E low potential for temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Airport Entry	0	0.0	0	0.0
Elizabeth Drive	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	4,338	72.3	0	0.0
FP 2	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

Lot 1b - E and Route: Airport Entry

No glare found

Lot 1b - E and Route: Elizabeth Drive

No glare found

Lot 1b - E and Route: Luddenham Road

No glare found

Lot 1b - E and Route: M-12

No glare found

Lot 1b - E and Route: M12 - northbound

No glare found

Lot 1b - E and Route: M12 - southbound

No glare found

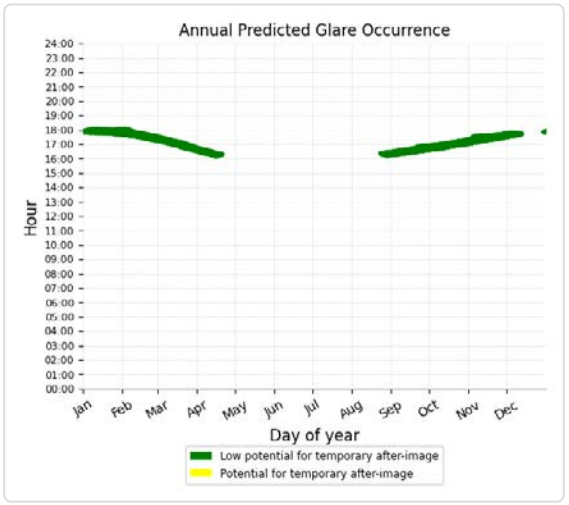
Lot 1b - E and Route: Runway

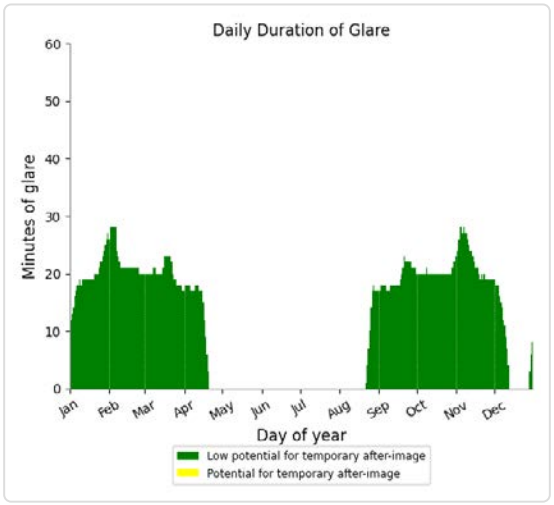
No glare found

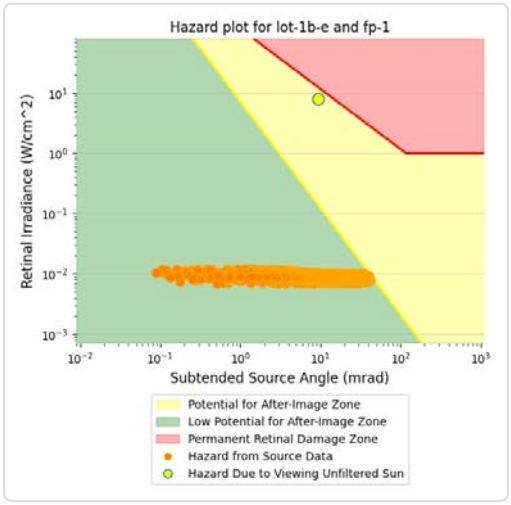
Lot 1b - E and FP: FP 1

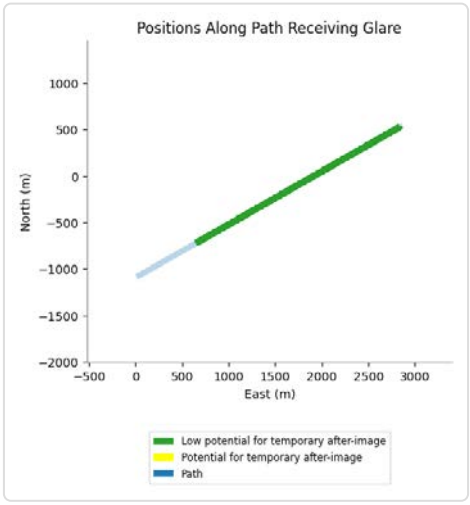
Yellow glare: none

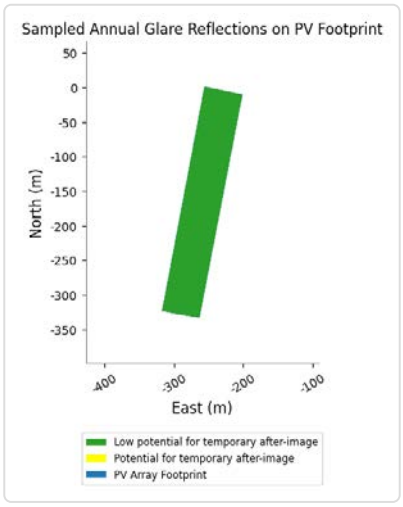
Green glare: 4,338 min.

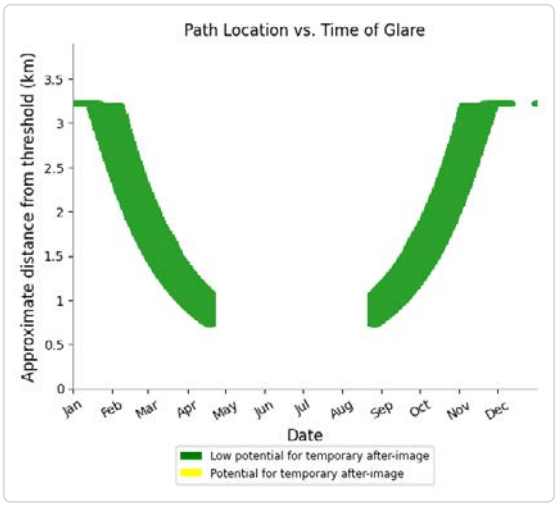












Lot 1b - E and FP: FP 2

No glare found

Lot 1b - E and OP 1

No glare found

Lot 1b - E and OP 2

No glare found

Lot 1b - E and OP 3

No glare found

PV: Lot 3a low potential for temporary after-image

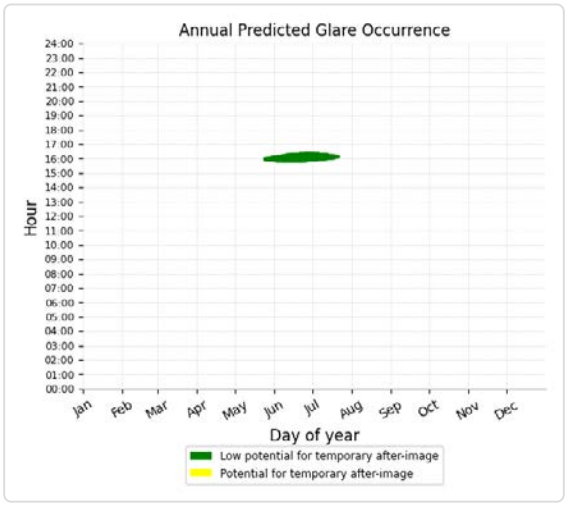
Receptor results ordered by category of glare

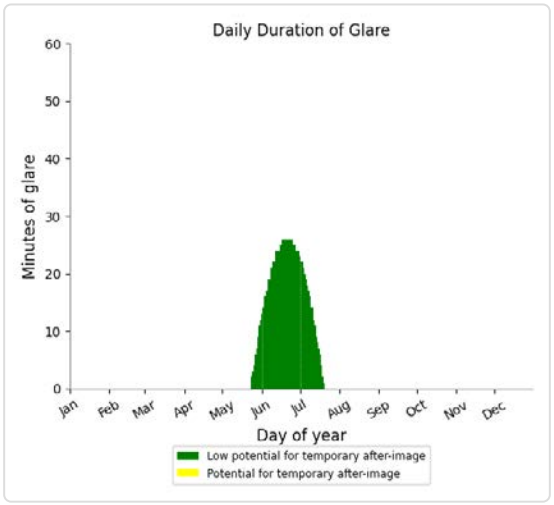
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	997	16.6	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
M12 - southbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	3,209	53.5	0	0.0
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

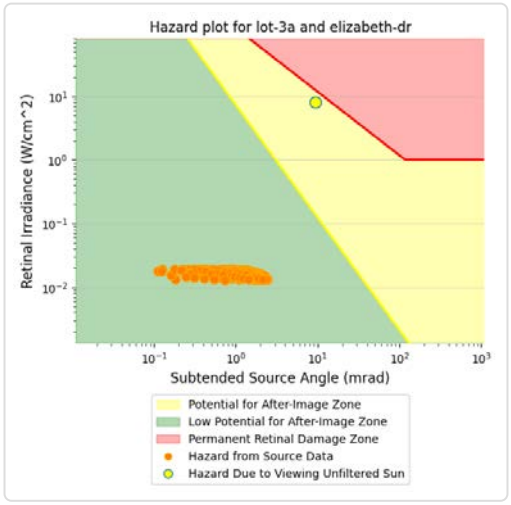
Lot 3a and Route: Elizabeth Drive

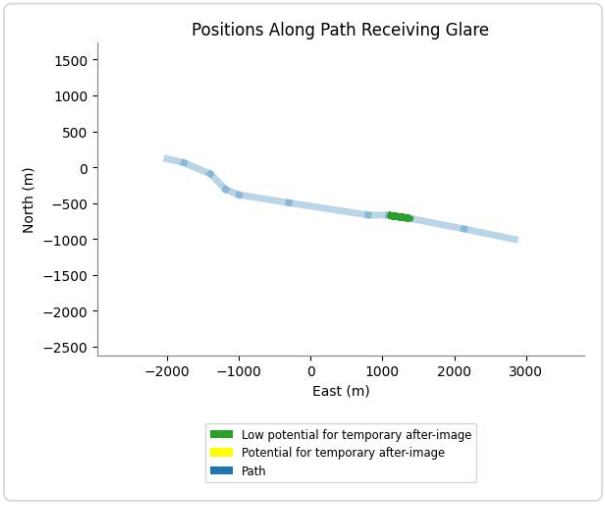
Yellow glare: none

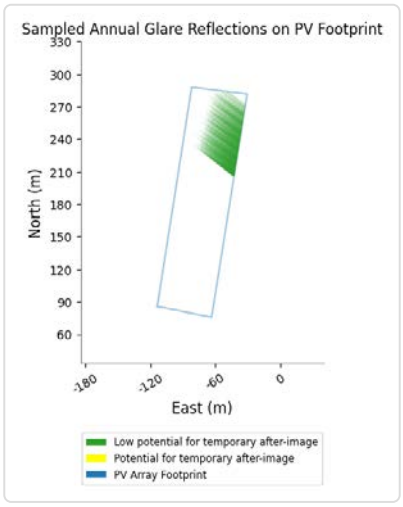
Green glare: 997 min.











Lot 3a and Route: Airport Entry

No glare found

Lot 3a and Route: Luddenham Road

No glare found

Lot 3a and Route: M-12

No glare found

Lot 3a and Route: M12 - northbound

No glare found

Lot 3a and Route: M12 - southbound

No glare found

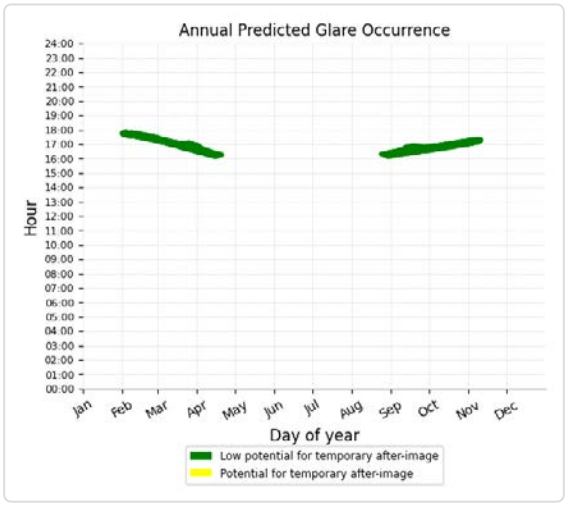
Lot 3a and Route: Runway

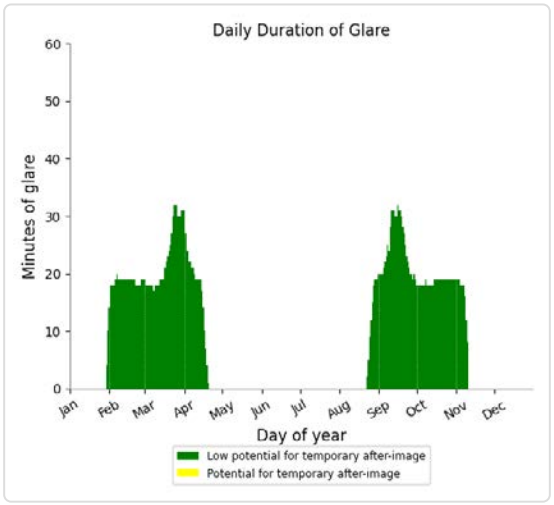
No glare found

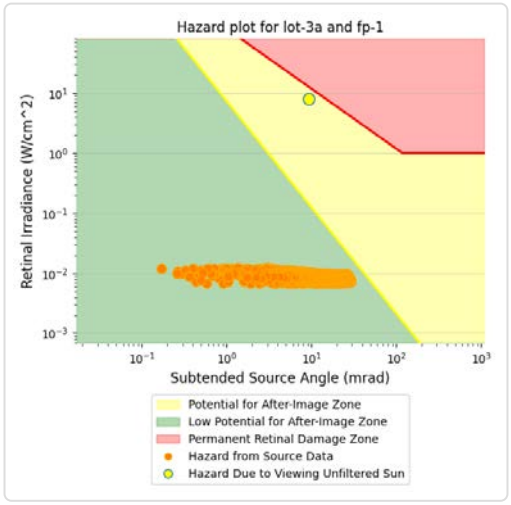
Lot 3a and FP: FP 1

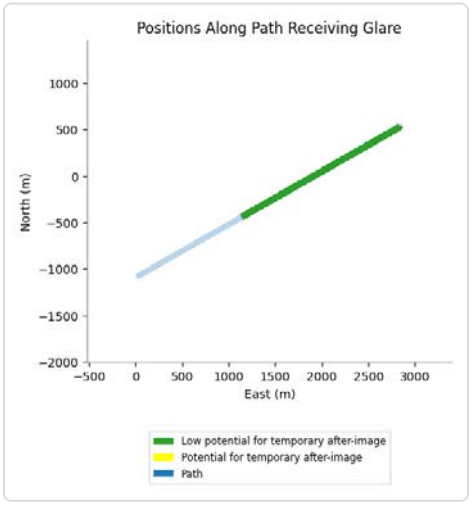
Yellow glare: none

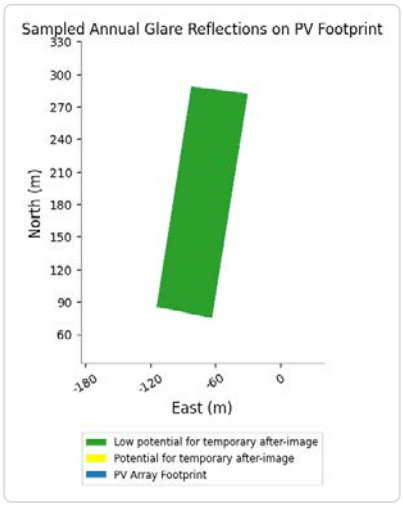
Green glare: 3,209 min.

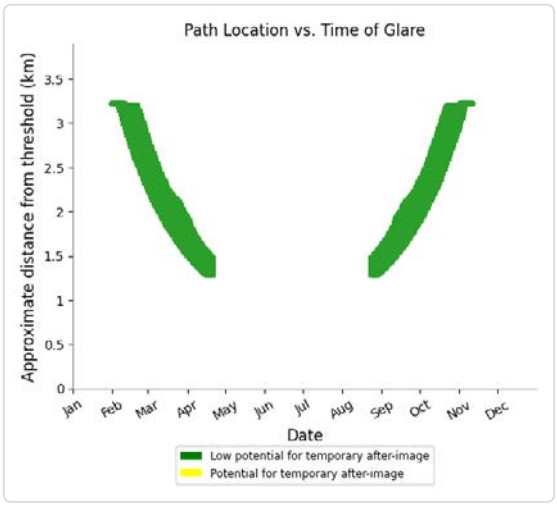












Lot 3a and FP: FP 2

No glare found

Lot 3a and OP 1

No glare found

Lot 3a and OP 2

No glare found

Lot 3a and OP 3

No glare found

PV: Lot 3a-E low potential for temporary after-image

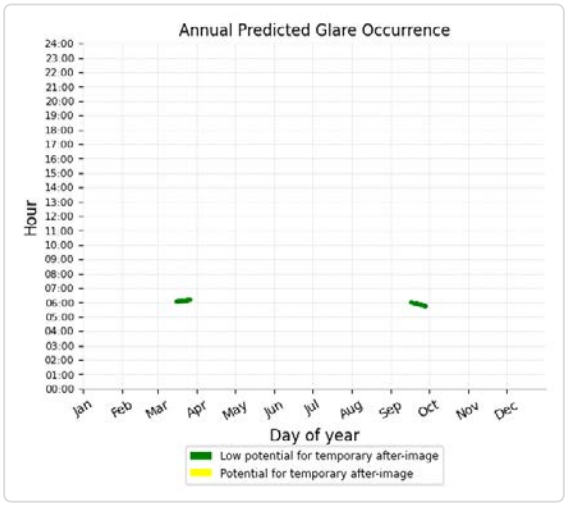
Receptor results ordered by category of glare

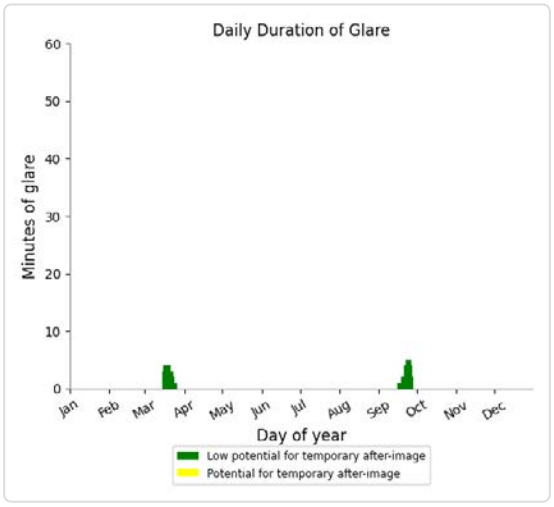
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	78	1.3	0	0.0
M12 - southbound	40	0.7	0	0.0
Airport Entry	0	0.0	0	0.0
Luddenham Road	0	0.0	0	0.0
M-12	0	0.0	0	0.0
M12 - northbound	0	0.0	0	0.0
Runway	0	0.0	0	0.0
FP 1	3,214	53.6	0	0.0
FP 2	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0

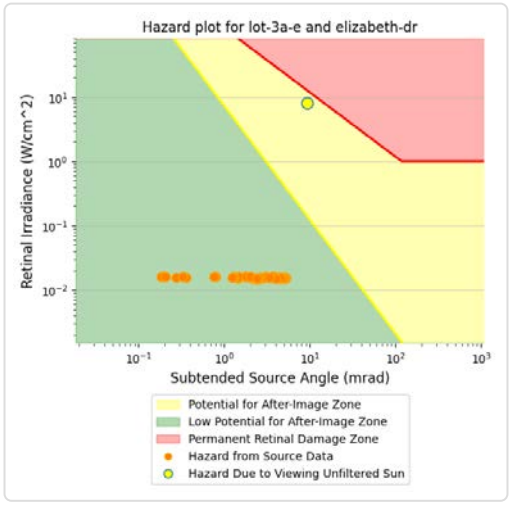
Lot 3a-E and Route: Elizabeth Drive

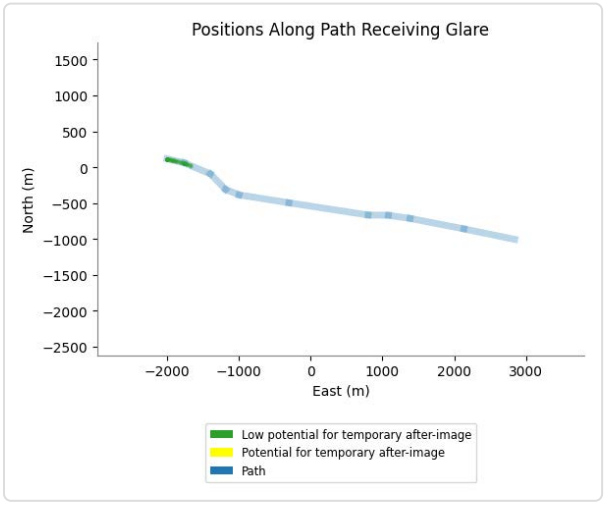
Yellow glare: none

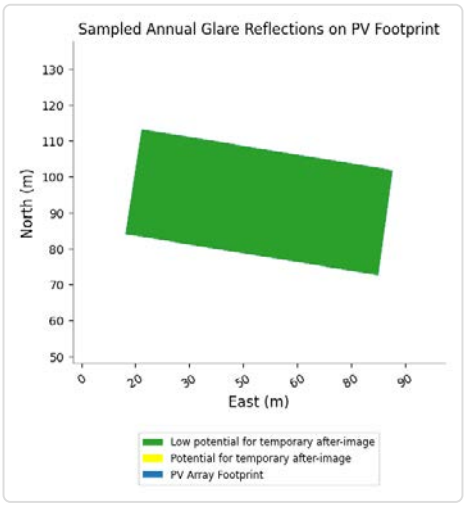
Green glare: 78 min.







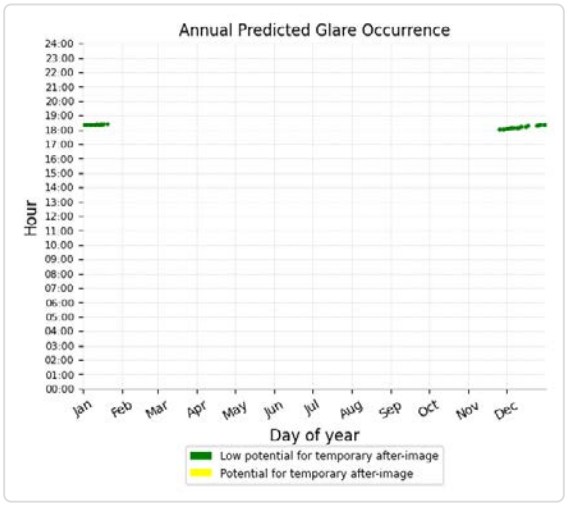


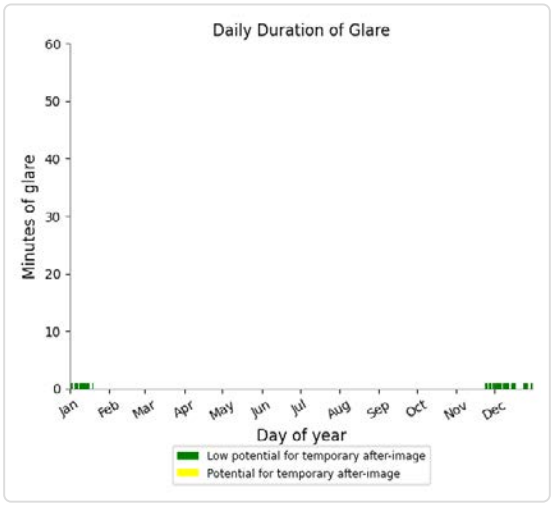


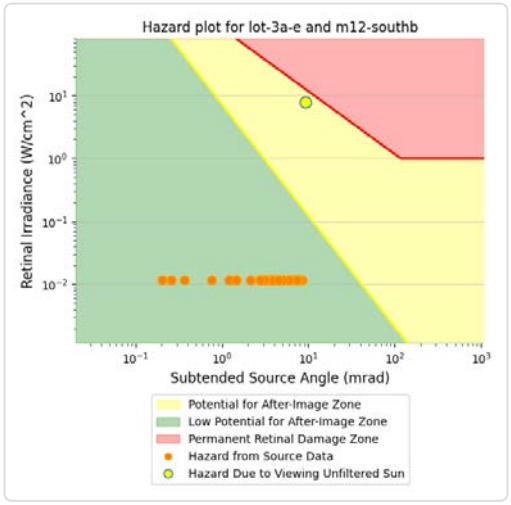
Lot 3a-E and Route: M12 - southbound

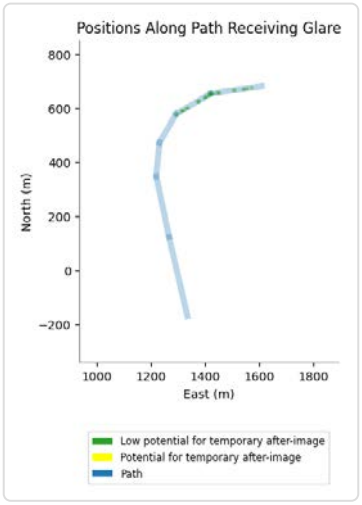
Yellow glare: none

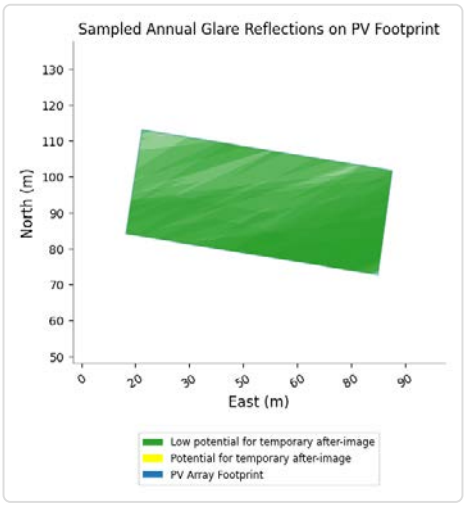
Green glare: 40 min.











Lot 3a-E and Route: Airport Entry

No glare found

Lot 3a-E and Route: Luddenham Road

No glare found

Lot 3a-E and Route: M-12

No glare found

Lot 3a-E and Route: M12 - northbound

No glare found

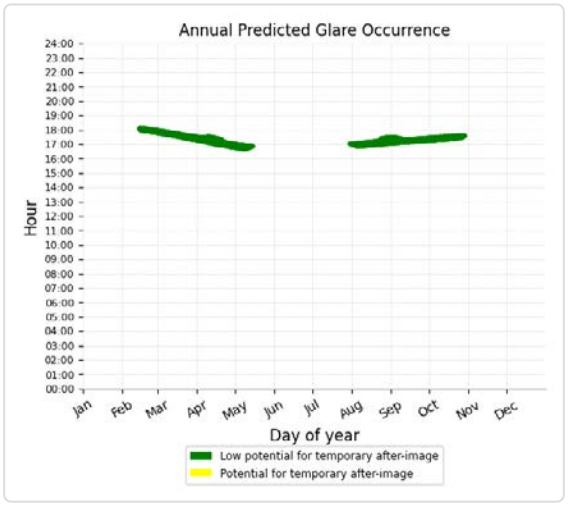
Lot 3a-E and Route: Runway

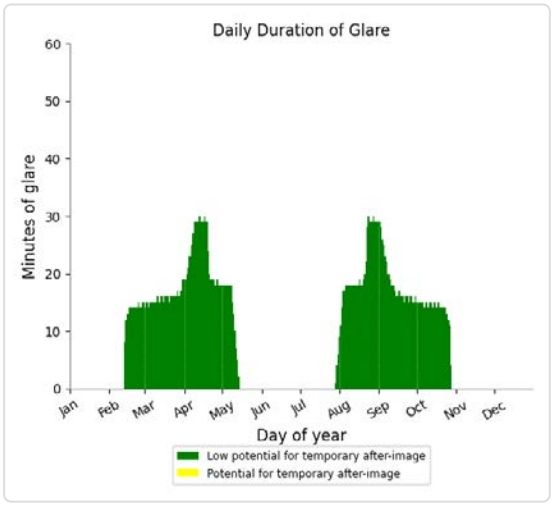
No glare found

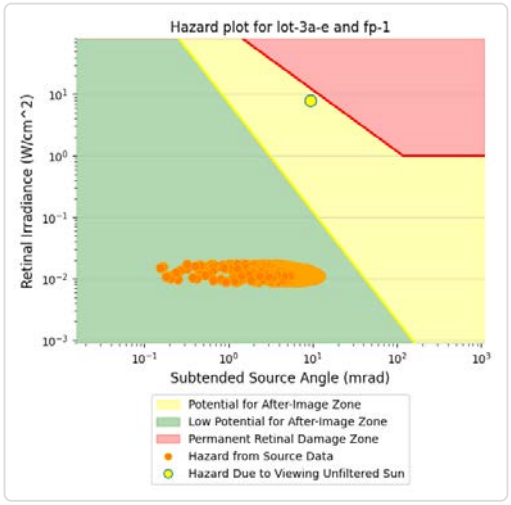
Lot 3a-E and FP: FP 1

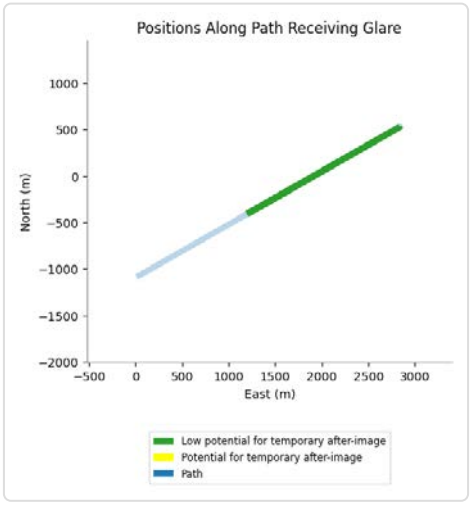
Yellow glare: none

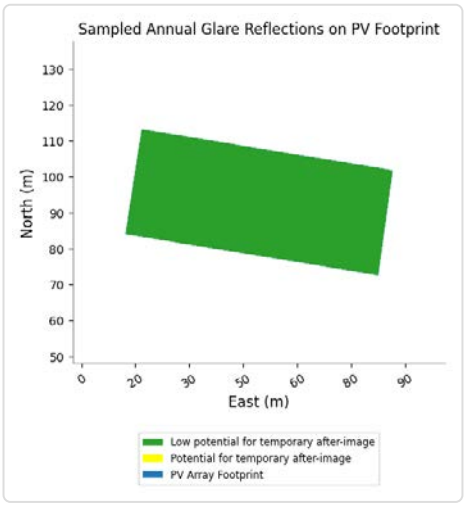
Green glare: 3,214 min.

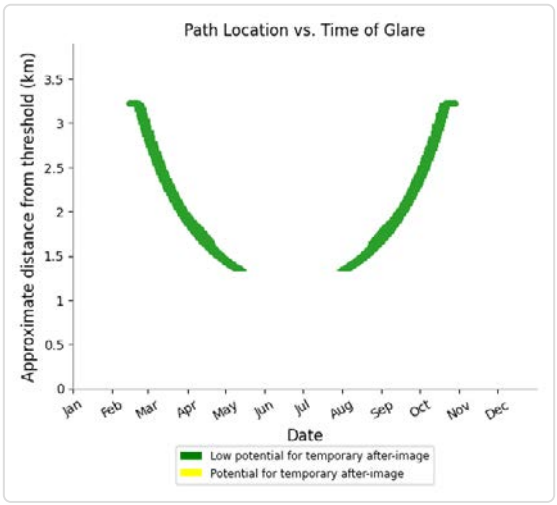












Lot 3a-E and FP: FP 2

No glare found

Lot 3a-E and OP 1

No glare found

Lot 3a-E and OP 2

No glare found

Lot 3a-E and OP 3

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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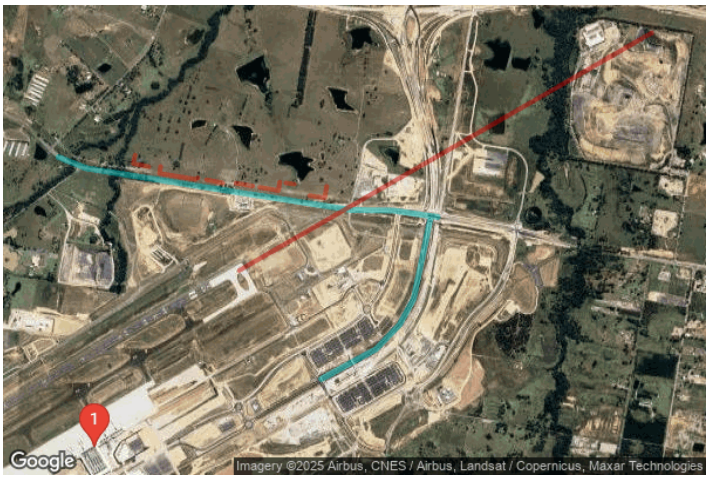
FORGESOLAR GLARE ANALYSIS

Project: **Burrah Park SSDA**
Site configuration: **Burrah Park - Surfaces south**

Created 10 Apr, 2025
Updated 10 Apr, 2025
Time-step 1 minute
Timezone offset UTC10
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Site ID 146451.24576

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

Vertical Surface	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Lot 1a - SE	2,203	36.7	9,396	156.6
Lot 1a - SW	835	13.9	2,768	46.1
Lot 1a - W	1,832	30.5	13,016	216.9
Lot 2b	2,351	39.2	11,980	199.7
Lot 2b-Central	2,431	40.5	1,761	29.4
Lot 2b - E	2,158	36.0	12,297	204.9
Lot 2b - SW	1,920	32.0	7,854	130.9

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
Airport Entry	127	2.1	0	0.0
Elizabeth Drive	13,428	223.8	59,072	984.5
FP 1	175	2.9	0	0.0
OP 1	0	0.0	0	0.0

Component Data

Vertical Surfaces

Name: Lot 1a - SE
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.869987	150.728735	75.40
2	-33.869791	150.727549	70.48

Name: Lot 1a - SW
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.869000	150.723321	59.76
2	-33.868808	150.722181	58.65
3	-33.868292	150.722316	57.70

Name: Lot 1a - W
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.869677	150.726913	69.34
2	-33.869761	150.726730	68.13
3	-33.869405	150.724102	62.55
4	-33.868991	150.724177	61.90

Name: Lot 2b
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.869934	150.732912	68.60
2	-33.870446	150.732810	68.60
3	-33.870250	150.731448	72.22

Name: Lot 2b-Central
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.870058	150.733978	64.80
2	-33.869986	150.733372	66.15

Name: Lot 2b - E
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.870195	150.736352	67.17
2	-33.870881	150.736202	70.62
3	-33.870756	150.735102	68.23

Name: Lot 2b - SW
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.870168	150.730924	70.37
2	-33.870004	150.729700	73.91

Route Receptors

Name: Airport Entry
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.881880	150.735957	62.58	1.20	63.78
2	-33.880063	150.739970	65.47	1.20	66.67
3	-33.878567	150.741708	56.29	1.20	57.49
4	-33.877035	150.742716	54.98	1.20	56.18
5	-33.872278	150.743918	55.14	1.20	56.34

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

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.868419	150.716708	58.93	1.20	60.13
2	-33.869096	150.718725	59.68	1.20	60.88
3	-33.870094	150.726236	67.67	1.20	68.87
4	-33.871626	150.738166	65.31	1.20	66.51
5	-33.871662	150.741213	60.57	1.20	61.77
6	-33.872054	150.744475	53.65	1.20	54.85

Flight Path Receptors

Name: FP 1
Description:
Threshold height: 15 m
Direction: 240.1°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-33.875293	150.729945	79.04	15.24	94.28
Two-mile	-33.860881	150.760169	45.77	217.19	262.97

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-33.886006	150.719408	79.12	10.00

Glare Analysis Results

Summary of Results Glare with potential for temporary after-image predicted

Vertical Surface	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Lot 1a - SE	2,203	36.7	9,396	156.6
Lot 1a - SW	835	13.9	2,768	46.1
Lot 1a - W	1,832	30.5	13,016	216.9
Lot 2b	2,351	39.2	11,980	199.7
Lot 2b-Central	2,431	40.5	1,761	29.4
Lot 2b - E	2,158	36.0	12,297	204.9
Lot 2b - SW	1,920	32.0	7,854	130.9

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
Airport Entry	127	2.1	0	0.0
Elizabeth Drive	13,428	223.8	59,072	984.5
FP 1	175	2.9	0	0.0
OP 1	0	0.0	0	0.0

VS: Lot 1a - SE

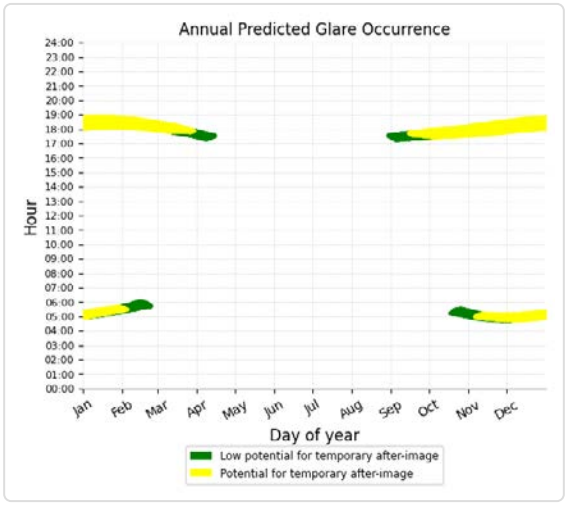
VS Face: 1-2 potential temporary after-image

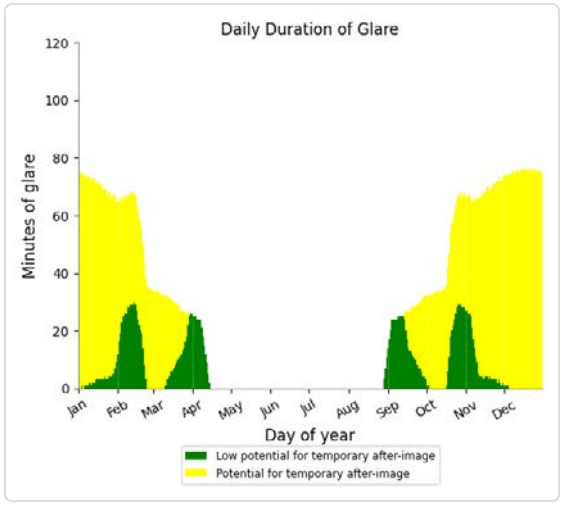
Receptor results ordered by category of glare

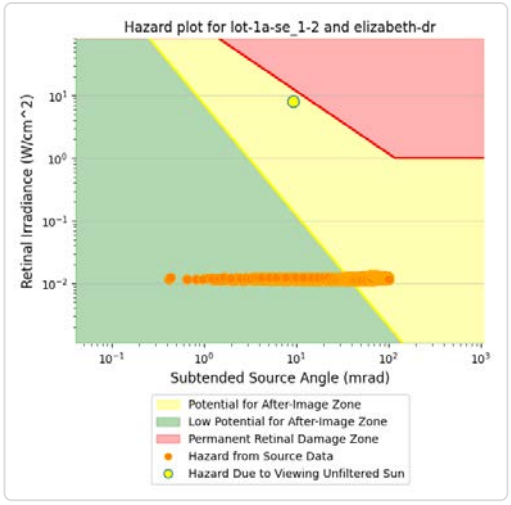
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	2,203	36.7	9,396	156.6
Airport Entry	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
9,396 minutes of yellow glare
2,203 minutes of green glare







Airport Entry

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

OP 1

Receptor type: Observation Point
No glare found

VS: Lot 1a - SW

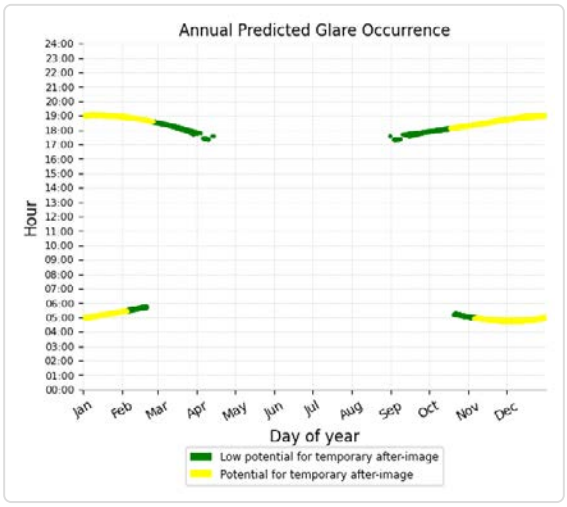
VS Face: 1-2 potential temporary after-image

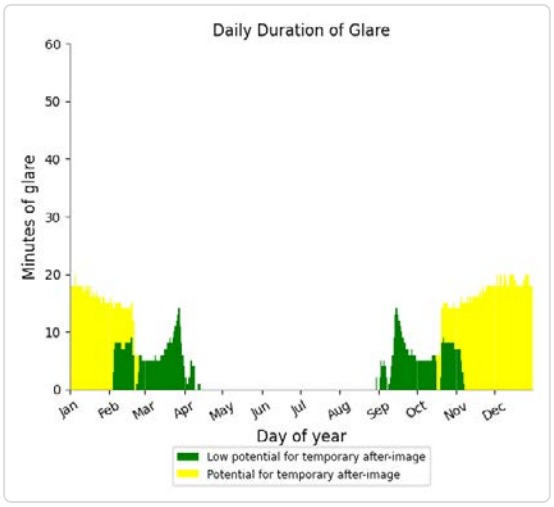
Receptor results ordered by category of glare

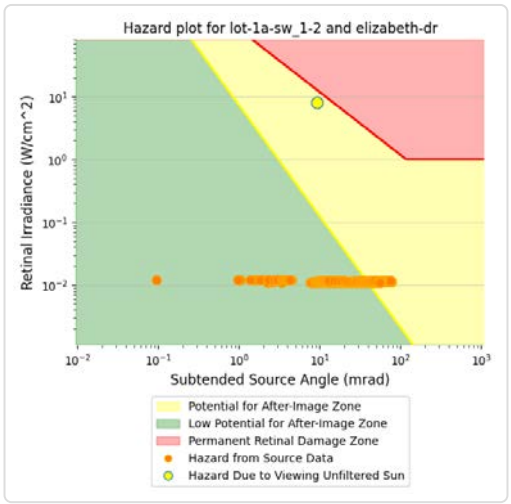
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	813	13.6	1,836	30.6
Airport Entry	0	0.0	0	0.0
FP 1	22	0.4	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
1,836 minutes of yellow glare
813 minutes of green glare







Airport Entry

Receptor type: Route

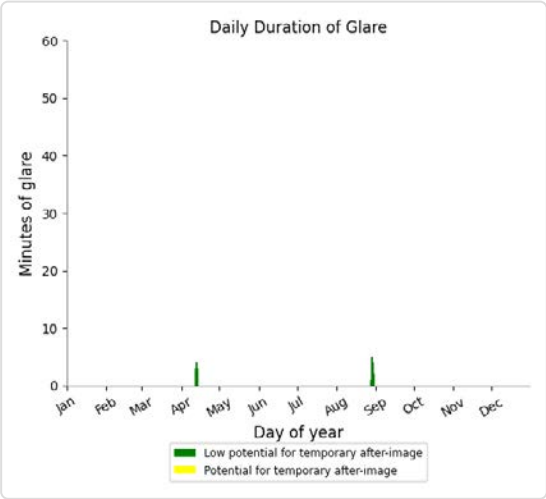
No glare found

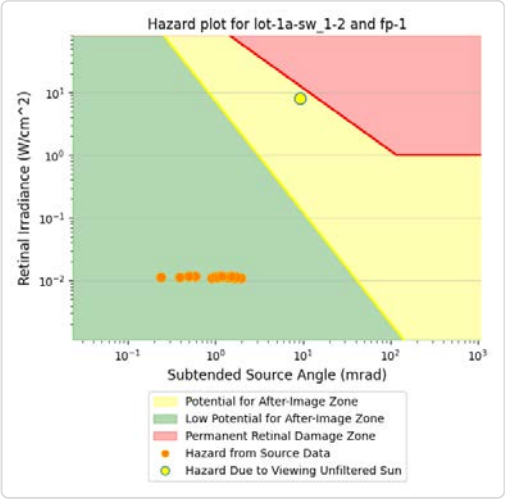
FP 1

Receptor type: 2-mile Flight Path

0 minutes of yellow glare

22 minutes of green glare





OP 1

Receptor type: Observation Point

No glare found

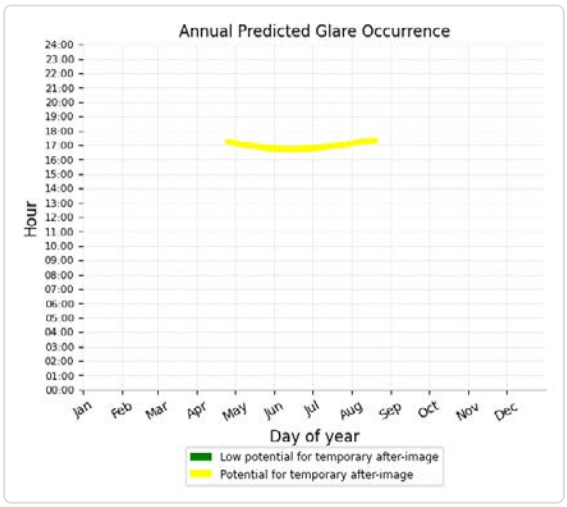
VS Face: 2-3 potential temporary after-image

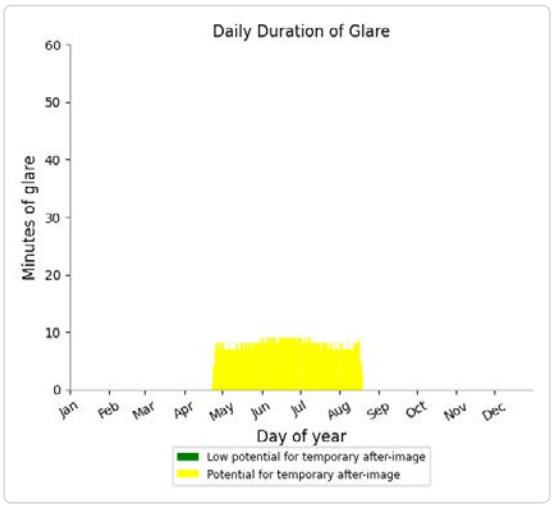
Receptor results ordered by category of glare

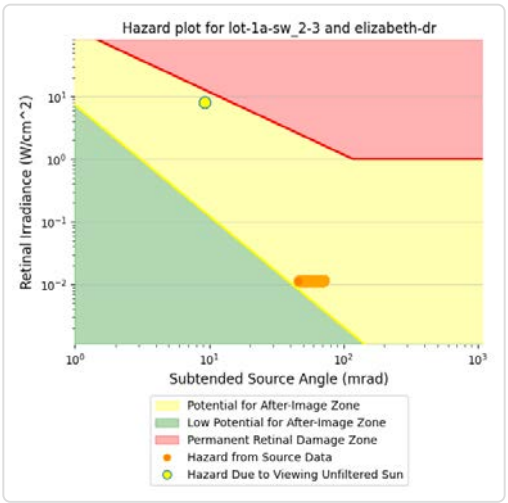
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	0	0.0	932	15.5
Airport Entry	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
932 minutes of yellow glare
0 minutes of green glare







Airport Entry

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

OP 1

Receptor type: Observation Point
No glare found

VS: Lot 1a - W

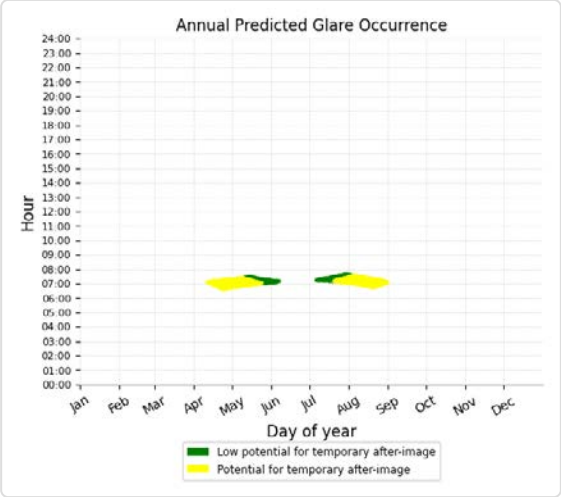
VS Face: 1-2 potential temporary after-image

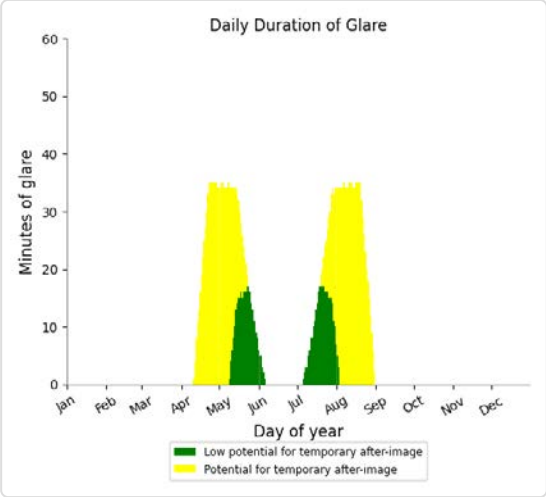
Receptor results ordered by category of glare

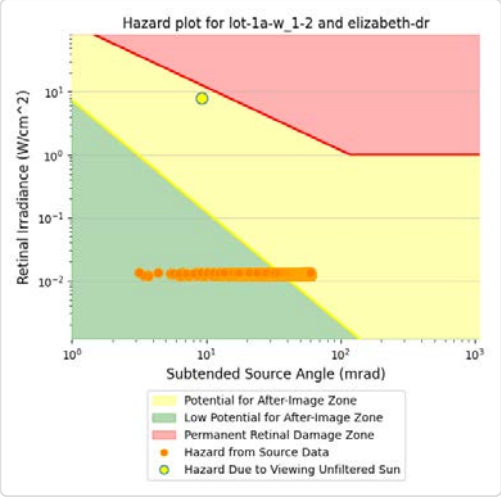
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	614	10.2	2,037	34.0
Airport Entry	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
2,037 minutes of yellow glare
614 minutes of green glare







Airport Entry

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

OP 1

Receptor type: Observation Point
No glare found

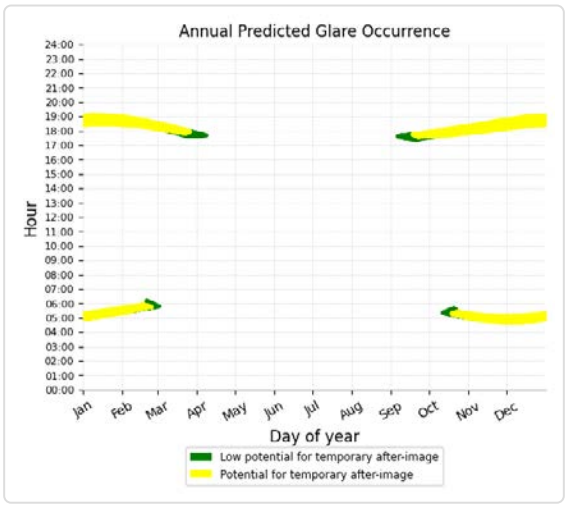
VS Face: 2-3 potential temporary after-image

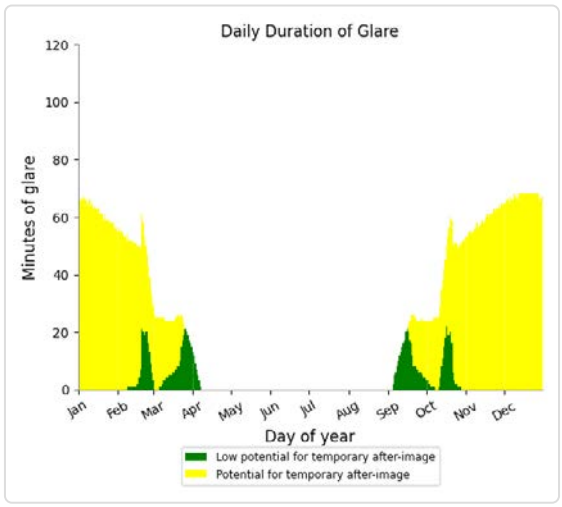
Receptor results ordered by category of glare

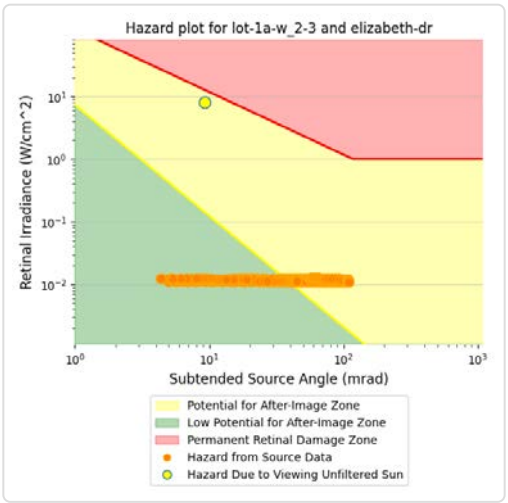
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	917	15.3	8,789	146.5
Airport Entry	0	0.0	0	0.0
FP 1	153	2.5	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
8,789 minutes of yellow glare
917 minutes of green glare





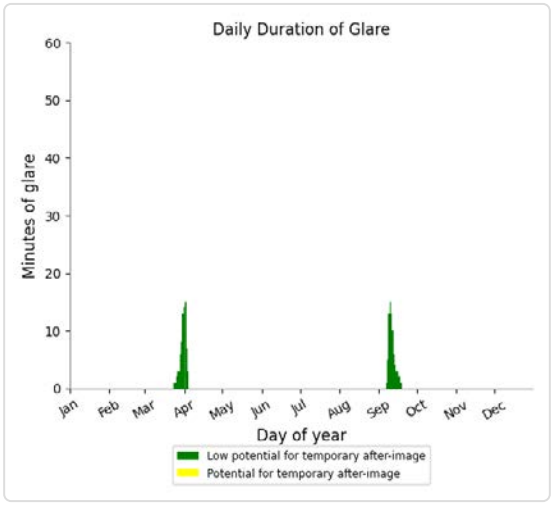


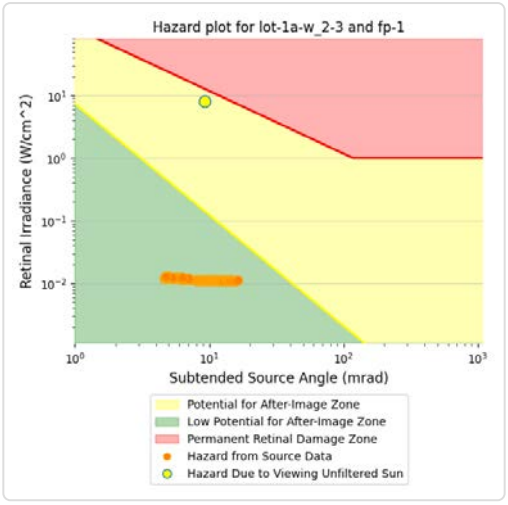
Airport Entry

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
0 minutes of yellow glare
153 minutes of green glare





OP 1

Receptor type: Observation Point
No glare found

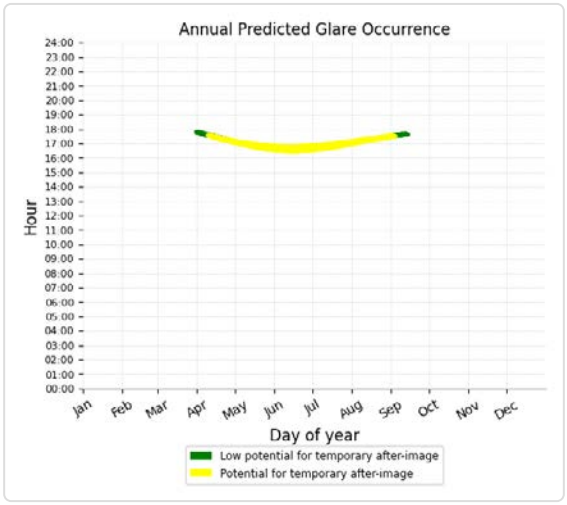
VS Face: 3-4 potential temporary after-image

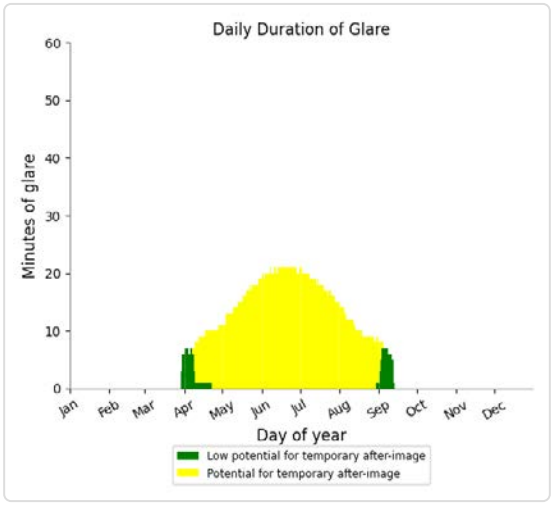
Receptor results ordered by category of glare

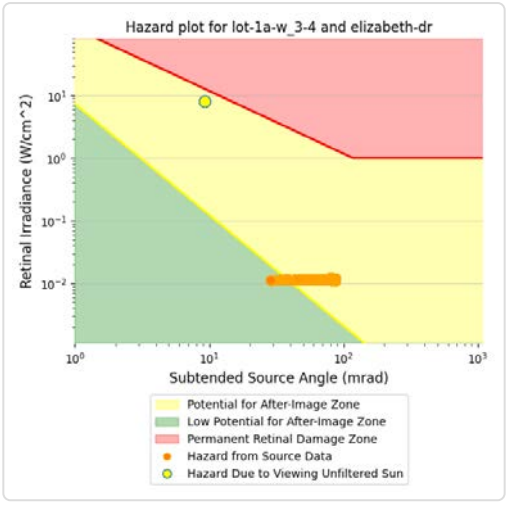
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	148	2.5	2,190	36.5
Airport Entry	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
2,190 minutes of yellow glare
148 minutes of green glare







Airport Entry

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

OP 1

Receptor type: Observation Point
No glare found

VS: Lot 2b

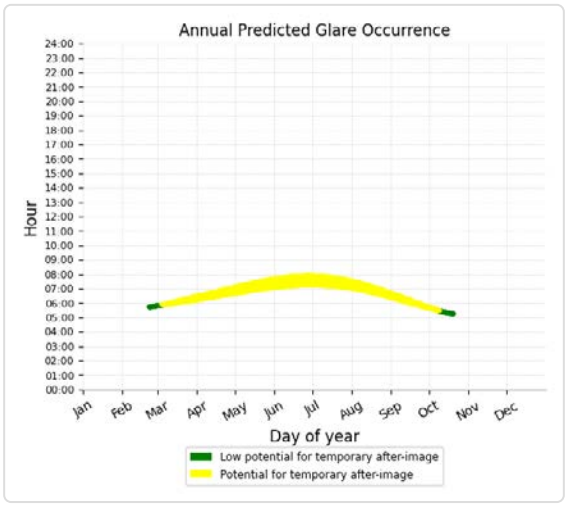
VS Face: 1-2 potential temporary after-image

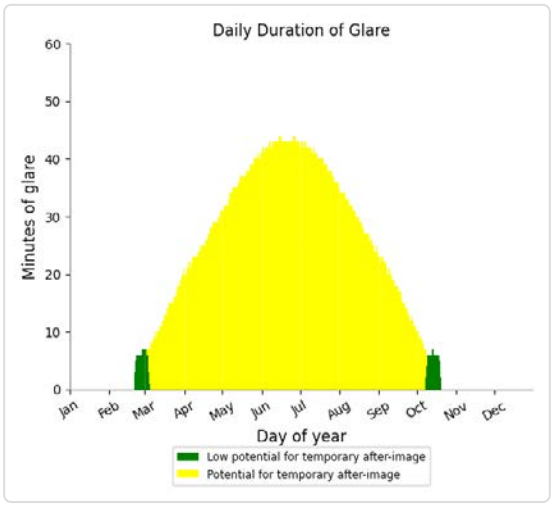
Receptor results ordered by category of glare

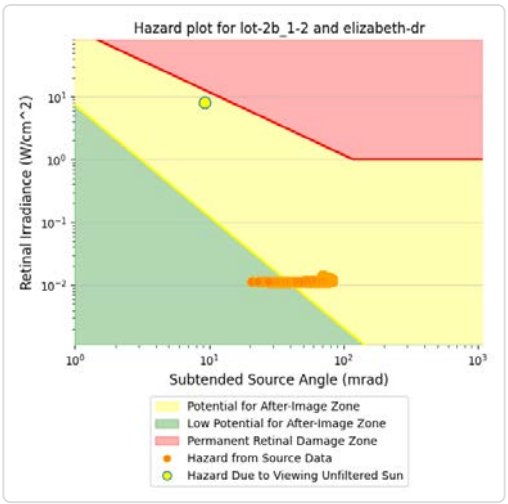
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	139	2.3	6,276	104.6
Airport Entry	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
6,276 minutes of yellow glare
139 minutes of green glare







Airport Entry

Receptor type: Route

No glare found

FP 1

Receptor type: 2-mile Flight Path

No glare found

OP 1

Receptor type: Observation Point

No glare found

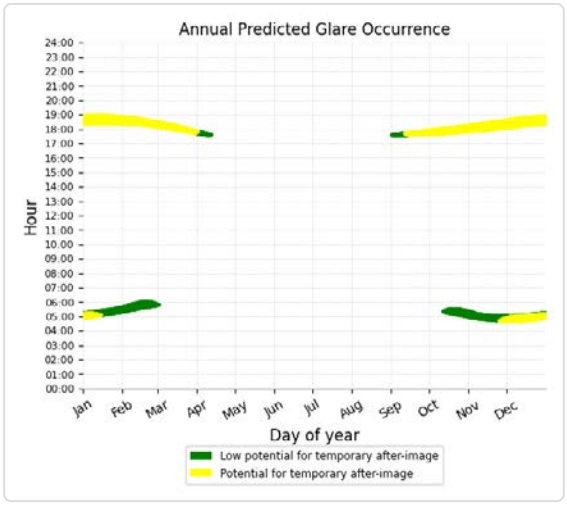
VS Face: 2-3 potential temporary after-image

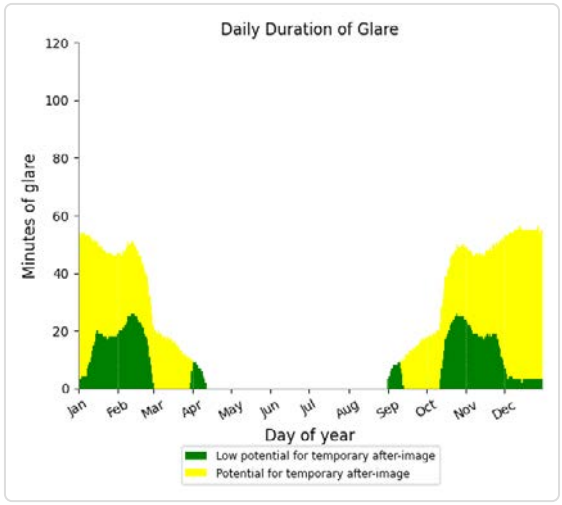
Receptor results ordered by category of glare

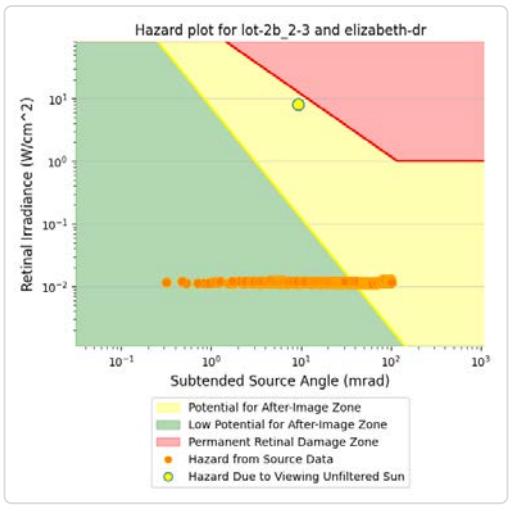
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	2,212	36.9	5,704	95.1
Airport Entry	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
5,704 minutes of yellow glare
2,212 minutes of green glare







Airport Entry

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

OP 1

Receptor type: Observation Point
No glare found

VS: Lot 2b-Central

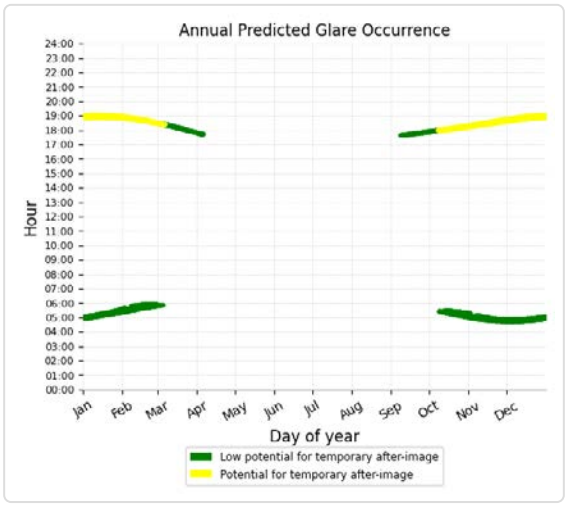
VS Face: 1-2 potential temporary after-image

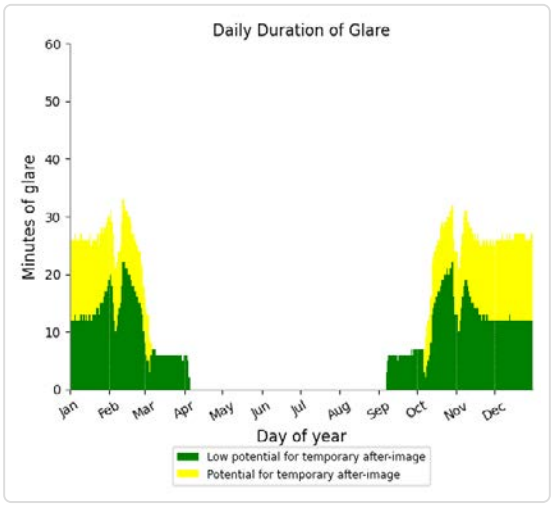
Receptor results ordered by category of glare

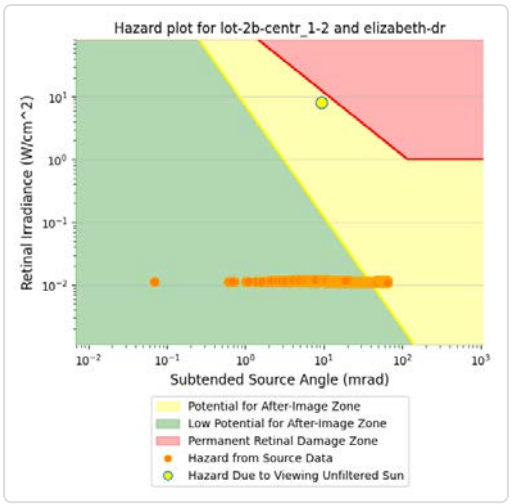
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	2,431	40.5	1,761	29.4
Airport Entry	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
1,761 minutes of yellow glare
2,431 minutes of green glare







Airport Entry

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

OP 1

Receptor type: Observation Point
No glare found

VS: Lot 2b - E

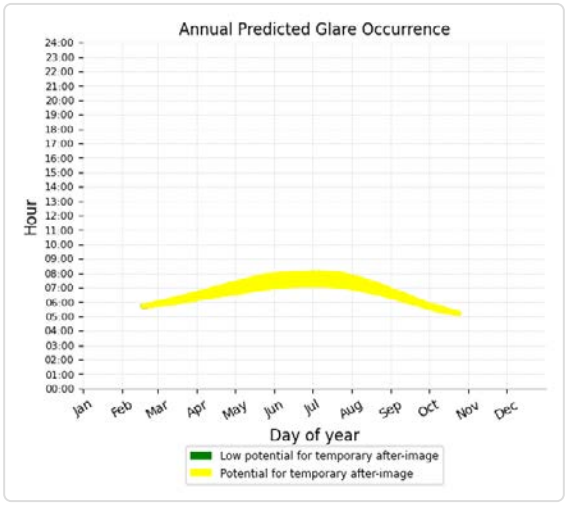
VS Face: 1-2 potential temporary after-image

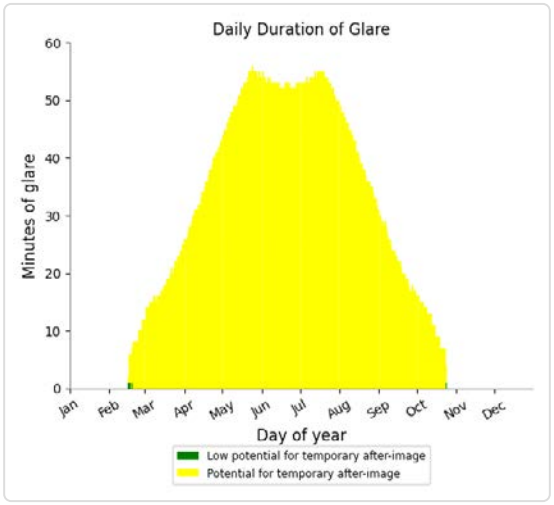
Receptor results ordered by category of glare

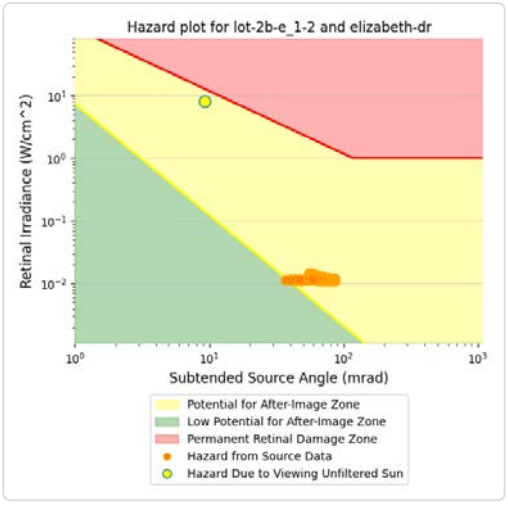
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	4	0.1	8,756	145.9
Airport Entry	127	2.1	0	0.0
FP 1	0	0.0	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
8,756 minutes of yellow glare
4 minutes of green glare

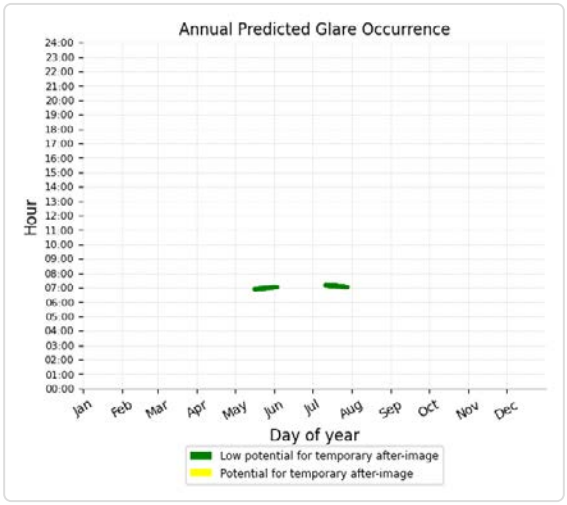


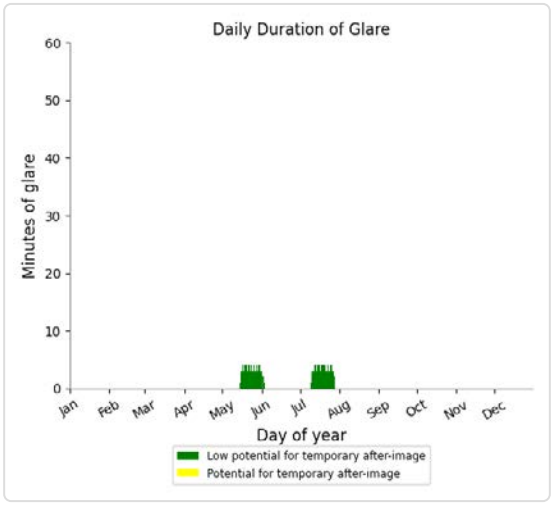


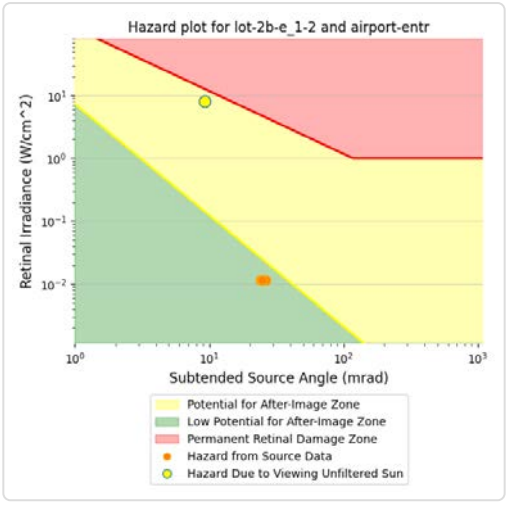


Airport Entry

Receptor type: Route
0 minutes of yellow glare
127 minutes of green glare







FP 1

Receptor type: 2-mile Flight Path
No glare found

OP 1

Receptor type: Observation Point
No glare found

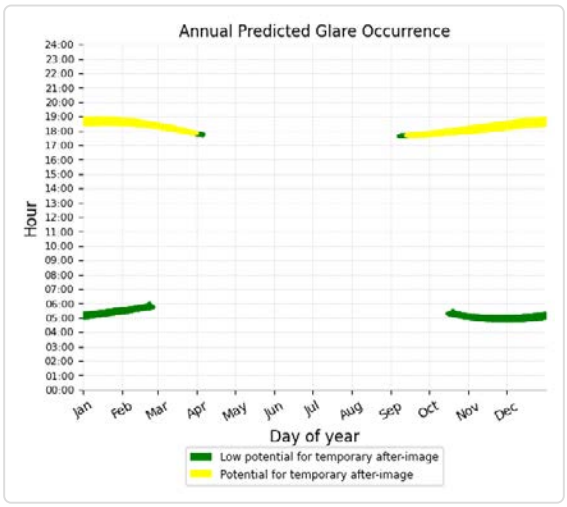
VS Face: 2-3 potential temporary after-image

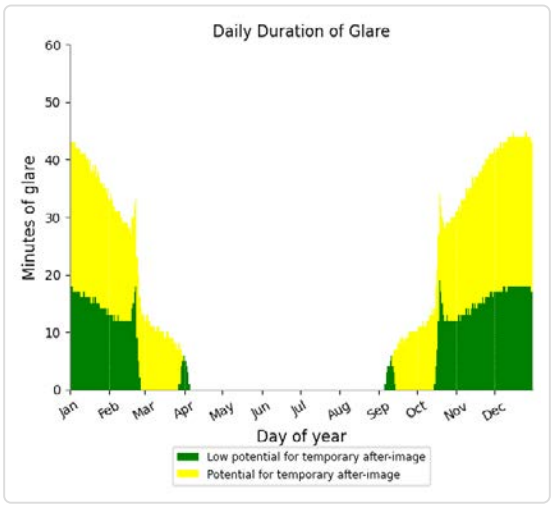
Receptor results ordered by category of glare

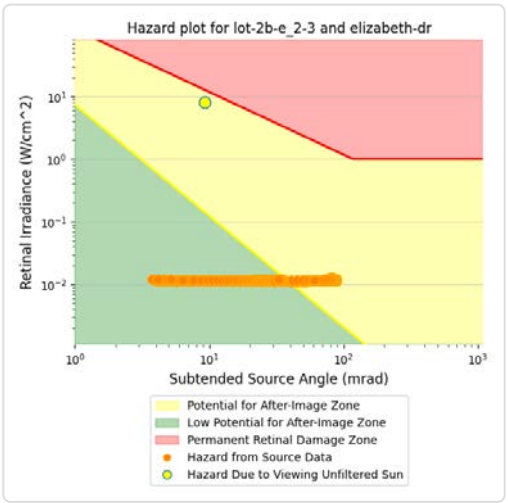
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	2,027	33.8	3,541	59.0
Airport Entry	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
3,541 minutes of yellow glare
2,027 minutes of green glare







Airport Entry

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

OP 1

Receptor type: Observation Point
No glare found

VS: Lot 2b - SW

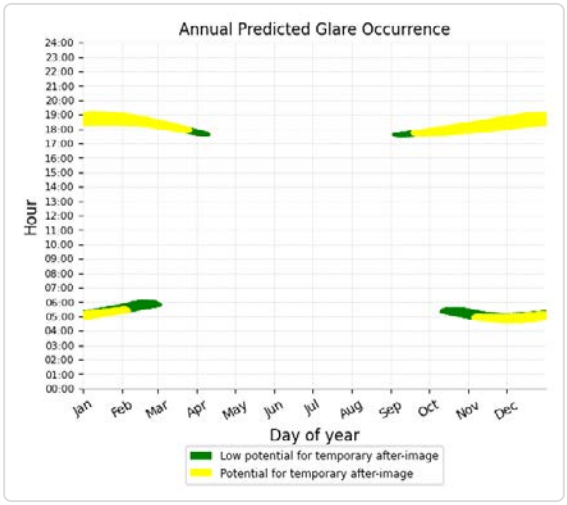
VS Face: 1-2 potential temporary after-image

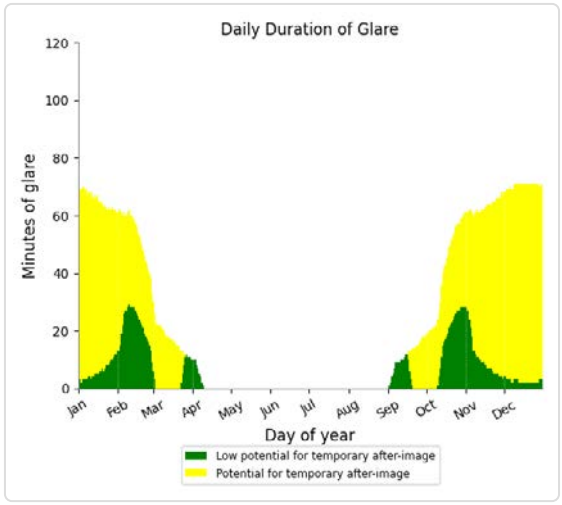
Receptor results ordered by category of glare

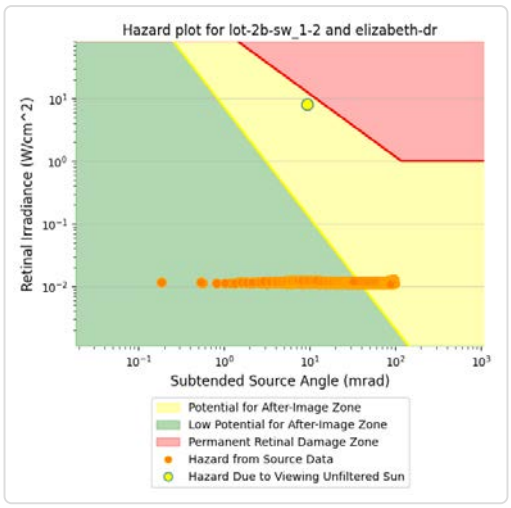
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	1,920	32.0	7,854	130.9
Airport Entry	0	0.0	0	0.0
FP 1	0	0.0	0	0.0
OP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
7,854 minutes of yellow glare
1,920 minutes of green glare







Airport Entry

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

OP 1

Receptor type: Observation Point
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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FORGESOLAR GLARE ANALYSIS

Project: **Burrah Park SSDA**
Site configuration: **Burrah Park - Surfaces east**

Created 09 Apr, 2025
Updated 10 Apr, 2025
Time-step 1 minute
Timezone offset UTC10
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Site ID 146444.24576

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

Vertical Surface	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Lot 2b - E	784	13.1	9,802	163.4
Lot 2b - SE	1,661	27.7	6,615	110.2
Lot 4a - E	1,666	27.8	2,474	41.2
Lot 4b - E	1,102	18.4	1,823	30.4
Lot 5b SE	1,004	16.7	13,714	228.6

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
Elizabeth Drive	4,723	78.7	17,402	290.0
M12 - East	0	0.0	0	0.0
M12 - West	1,414	23.6	17,026	283.8
FP 1	80	1.3	0	0.0

Component Data

Vertical Surfaces

Name: Lot 2b - E
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.870316	150.736320	67.96
2	-33.870877	150.736234	70.62
3	-33.870734	150.734860	67.43

Name: Lot 2b - SE
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.869067	150.738477	75.34
2	-33.870524	150.738172	70.94
3	-33.870640	150.737887	70.49
4	-33.870502	150.737040	70.06

Name: Lot 4a - E
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.866617	150.738302	66.20
2	-33.868341	150.737996	74.13

Name: Lot 4b - E
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.864009	150.738882	65.02
2	-33.865755	150.738512	63.96

Name: Lot 5b SE
Use smooth glass reflectivity profile? No
Custom reflectivity: 0.5
Slope error: 10.0 mrad
Lower edge height: 3 m
Upper edge height: 10 m
Surface glare contribution: evaluate single side

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	-33.863962	150.741619	62.48
2	-33.864495	150.741501	63.67
3	-33.864207	150.739388	66.24

Route Receptors

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

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.870094	150.726236	67.67	1.20	68.87
2	-33.871626	150.738166	65.31	1.20	66.51
3	-33.871662	150.741213	60.57	1.20	61.77
4	-33.872054	150.744475	53.65	1.20	54.85
5	-33.873372	150.752586	46.36	1.20	47.56

Name: M12 - East
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.858809	150.750870	48.56	1.20	49.76
2	-33.858666	150.747394	64.19	1.20	65.39
3	-33.858292	150.745505	64.03	1.20	65.23
4	-33.858381	150.743853	65.22	1.20	66.42
5	-33.858933	150.742973	65.35	1.20	66.55
6	-33.859842	150.742180	64.80	1.20	66.00
7	-33.861143	150.742008	63.09	1.20	64.29

Name: M12 - West
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-33.857337	150.726472	59.01	1.20	60.21
2	-33.858949	150.733456	52.36	0.00	52.36
3	-33.859814	150.738896	54.92	1.20	56.12
4	-33.860179	150.739883	58.53	1.20	59.73
5	-33.860936	150.740730	61.54	1.20	62.74
6	-33.862451	150.741492	61.24	1.20	62.44
7	-33.867306	150.743466	68.17	1.20	69.37
8	-33.870190	150.744014	55.79	1.20	56.99
9	-33.871651	150.743950	54.97	1.20	56.17

Flight Path Receptors

Name: FP 1
Description:
Threshold height: 15 m
Direction: 240.1°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-33.875293	150.729945	79.04	15.24	94.28
Two-mile	-33.860881	150.760169	45.77	217.19	262.97

Glare Analysis Results

Summary of Results

Glare with potential for temporary after-image predicted

Vertical Surface	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Lot 2b - E	784	13.1	9,802	163.4
Lot 2b - SE	1,661	27.7	6,615	110.2
Lot 4a - E	1,666	27.8	2,474	41.2
Lot 4b - E	1,102	18.4	1,823	30.4
Lot 5b SE	1,004	16.7	13,714	228.6

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
Elizabeth Drive	4,723	78.7	17,402	290.0
M12 - East	0	0.0	0	0.0
M12 - West	1,414	23.6	17,026	283.8
FP 1	80	1.3	0	0.0

VS: Lot 2b - E

VS Face: 1-2

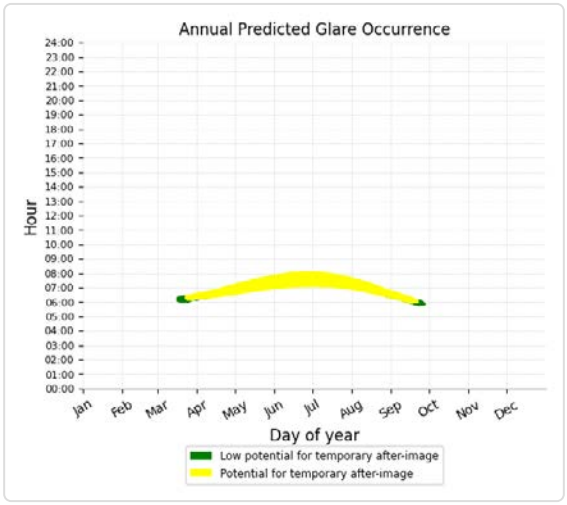
potential temporary after-image

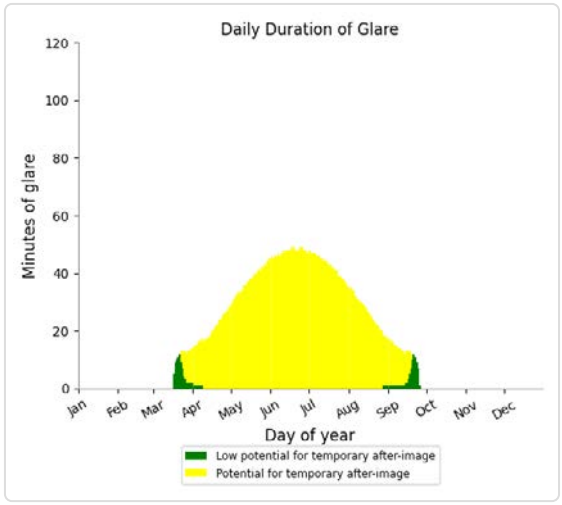
Receptor results ordered by category of glare

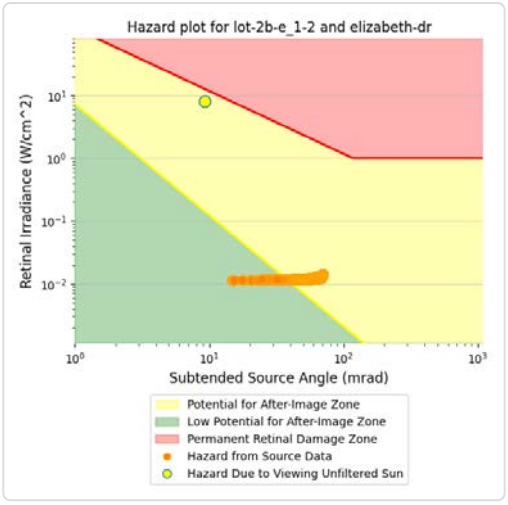
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	199	3.3	5,666	94.4
M12 - East	0	0.0	0	0.0
M12 - West	0	0.0	0	0.0
FP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
5,666 minutes of yellow glare
199 minutes of green glare







M12 - East

Receptor type: Route
No glare found

M12 - West

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

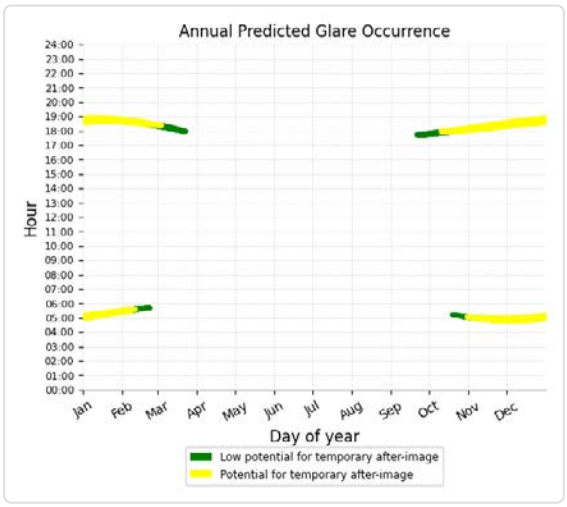
VS Face: 2-3 potential temporary after-image

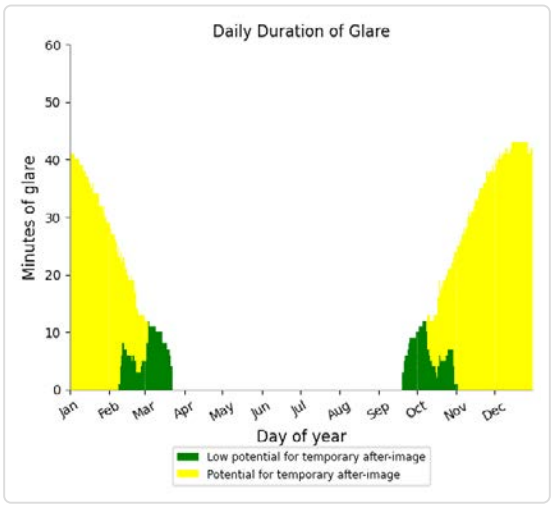
Receptor results ordered by category of glare

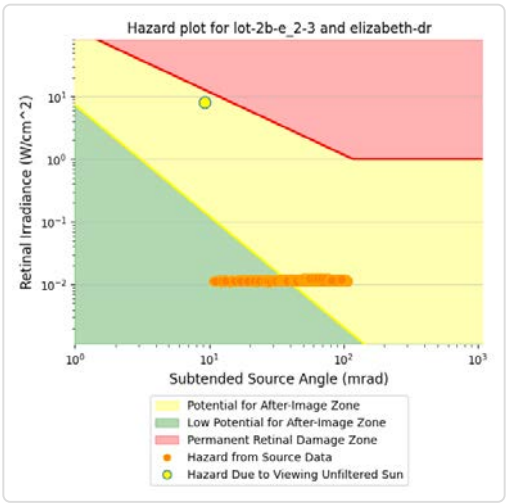
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	583	9.7	4,136	68.9
M12 - East	0	0.0	0	0.0
M12 - West	0	0.0	0	0.0
FP 1	2	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
4,136 minutes of yellow glare
583 minutes of green glare







M12 - East

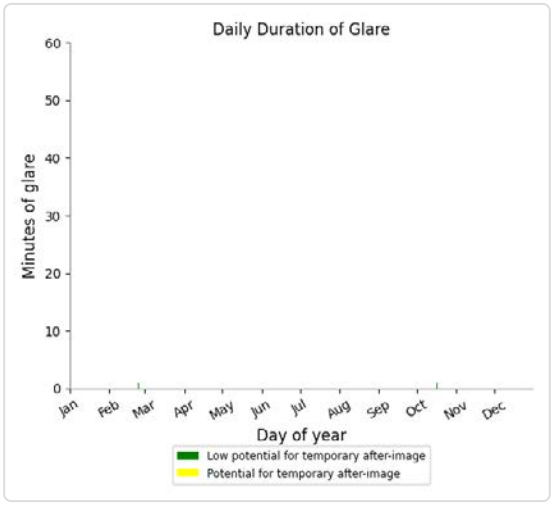
Receptor type: Route
No glare found

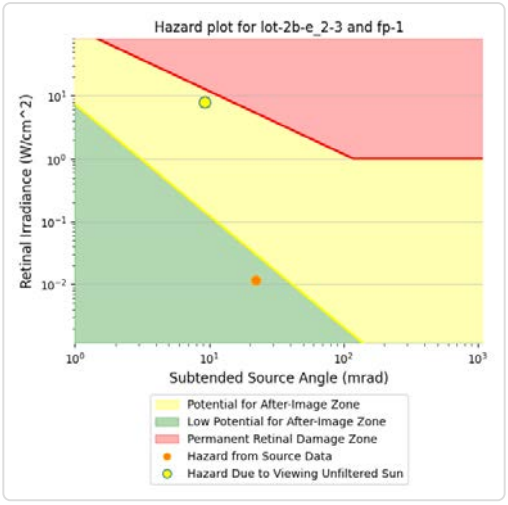
M12 - West

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
0 minutes of yellow glare
2 minutes of green glare





VS: Lot 2b - SE

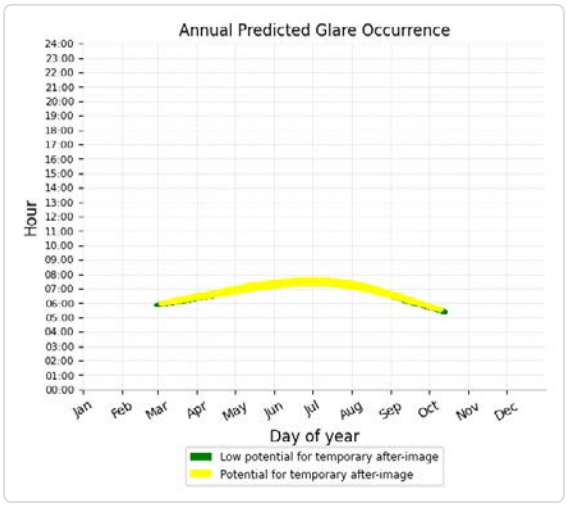
VS Face: 1-2 potential temporary after-image

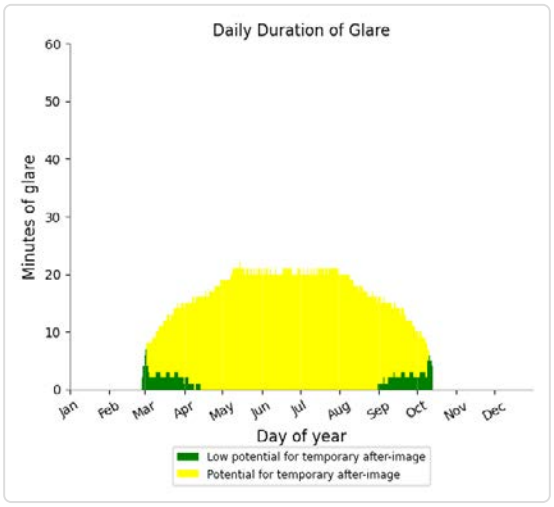
Receptor results ordered by category of glare

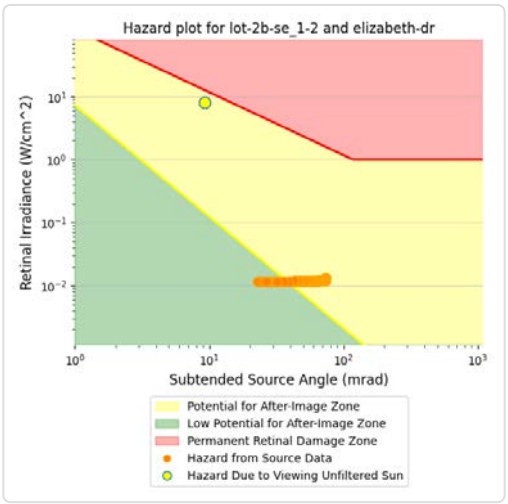
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	206	3.4	3,598	60.0
M12 - East	0	0.0	0	0.0
M12 - West	0	0.0	0	0.0
FP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
3,598 minutes of yellow glare
206 minutes of green glare







M12 - East

Receptor type: Route

No glare found

M12 - West

Receptor type: Route

No glare found

FP 1

Receptor type: 2-mile Flight Path

No glare found

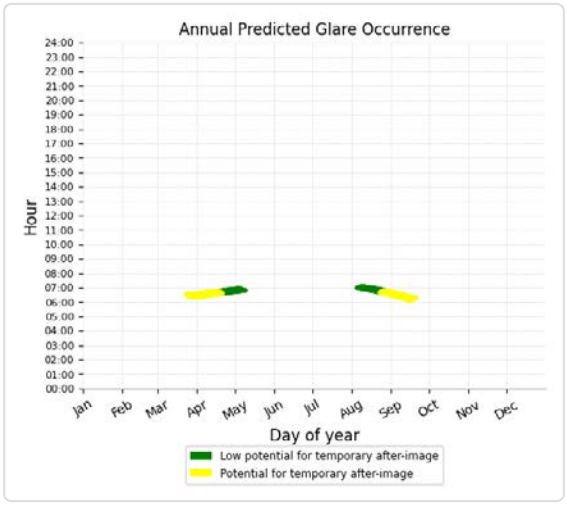
VS Face: 2-3 potential temporary after-image

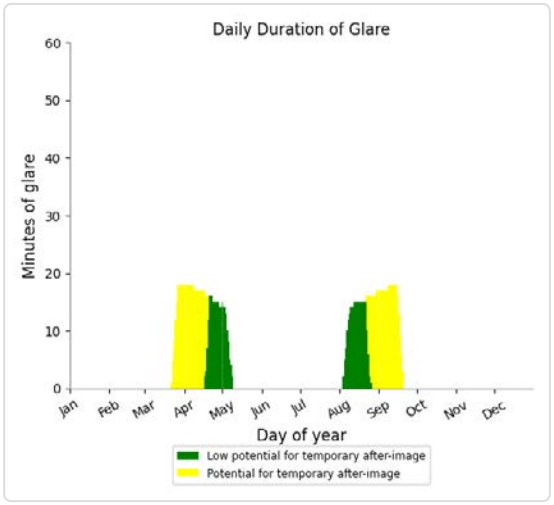
Receptor results ordered by category of glare

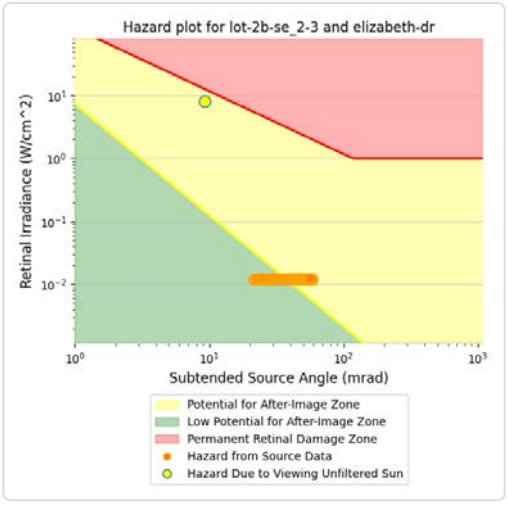
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	520	8.7	889	14.8
M12 - East	0	0.0	0	0.0
M12 - West	0	0.0	0	0.0
FP 1	77	1.3	0	0.0

Elizabeth Drive

Receptor type: Route
889 minutes of yellow glare
520 minutes of green glare







M12 - East

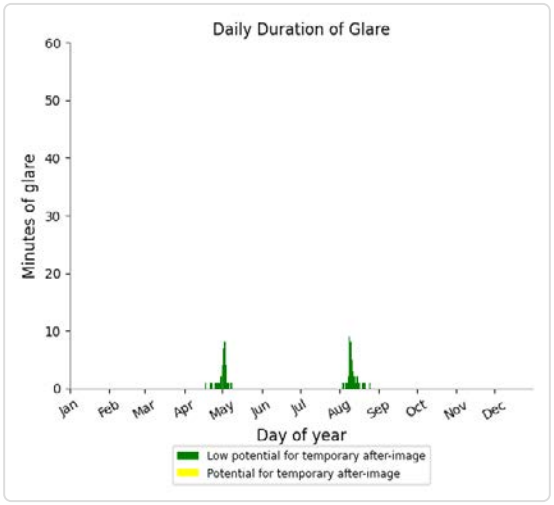
Receptor type: Route
No glare found

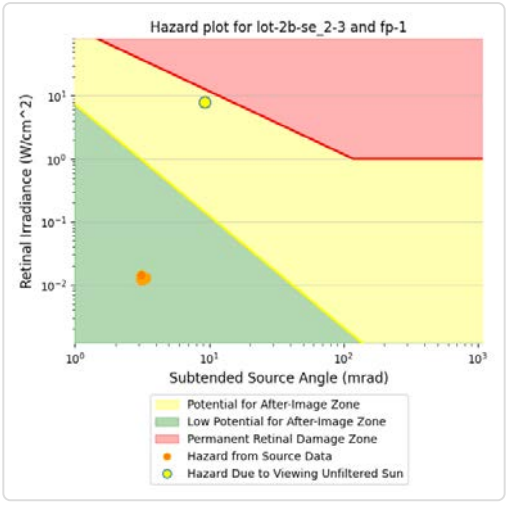
M12 - West

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
0 minutes of yellow glare
77 minutes of green glare





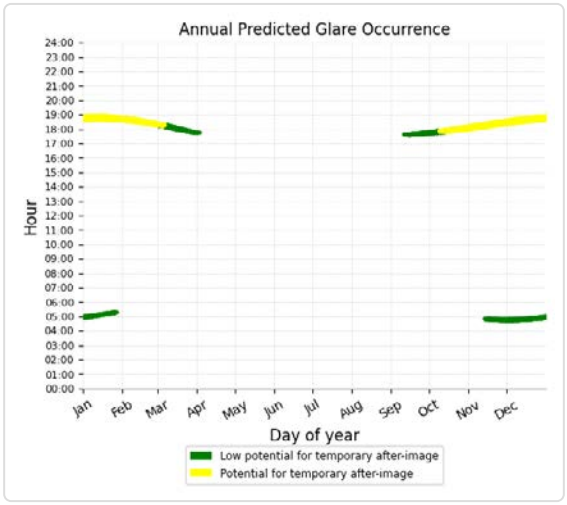
VS Face: 3-4 potential temporary after-image

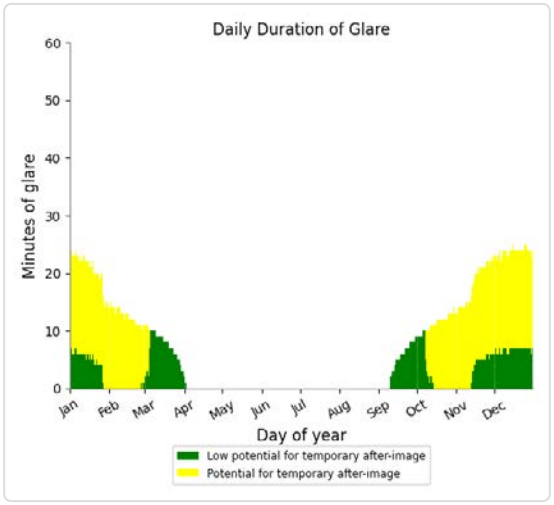
Receptor results ordered by category of glare

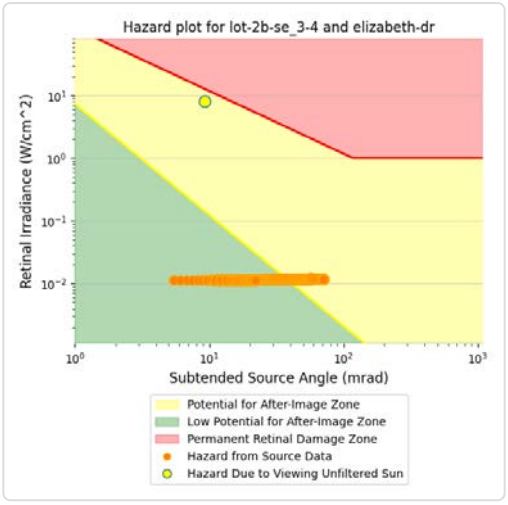
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	857	14.3	2,128	35.5
M12 - East	0	0.0	0	0.0
M12 - West	0	0.0	0	0.0
FP 1	1	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
2,128 minutes of yellow glare
857 minutes of green glare







M12 - East

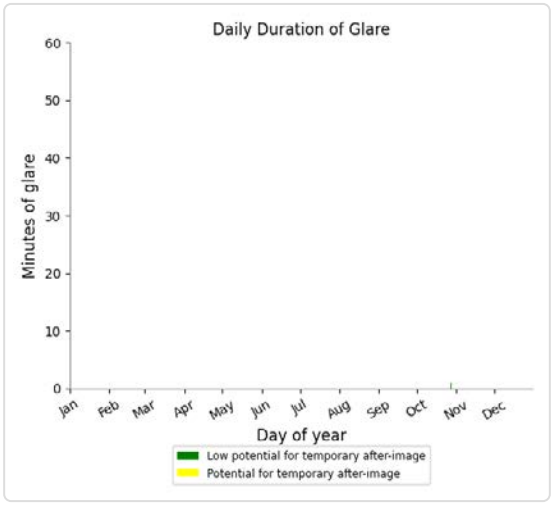
Receptor type: Route
No glare found

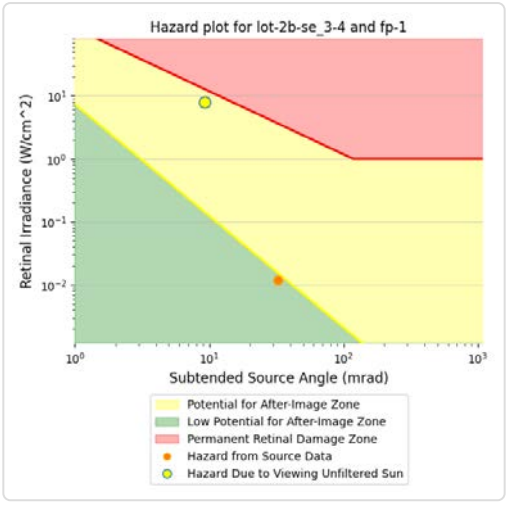
M12 - West

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
0 minutes of yellow glare
1 minutes of green glare





VS: Lot 4a - E

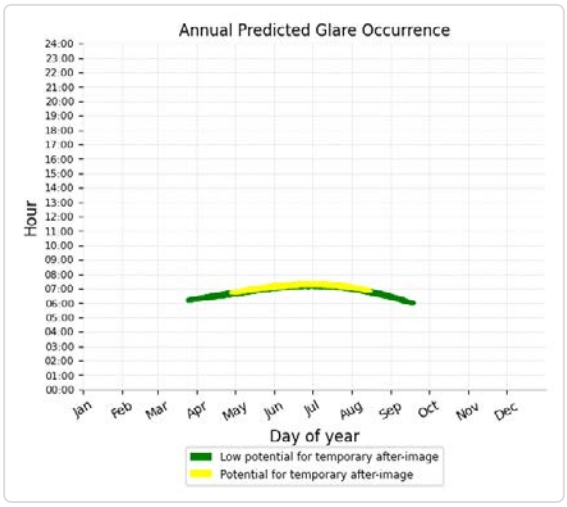
VS Face: 1-2 potential temporary after-image

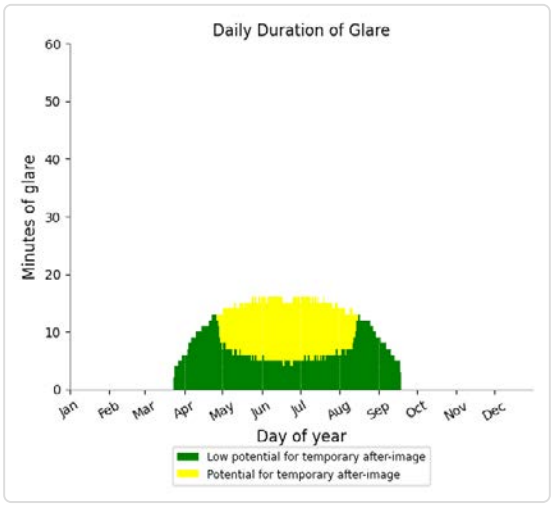
Receptor results ordered by category of glare

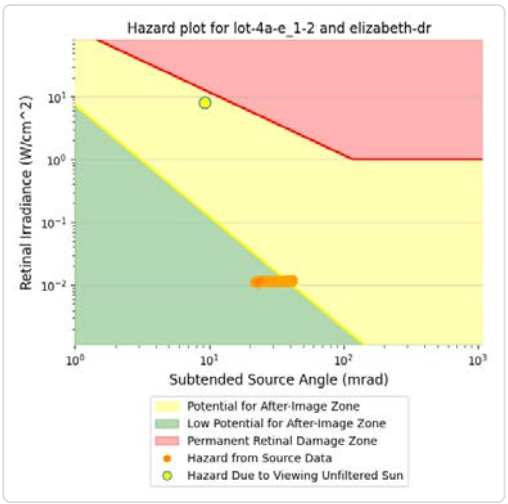
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Elizabeth Drive	1,262	21.0	985	16.4
M12 - West	404	6.7	1,489	24.8
M12 - East	0	0.0	0	0.0
FP 1	0	0.0	0	0.0

Elizabeth Drive

Receptor type: Route
985 minutes of yellow glare
1,262 minutes of green glare

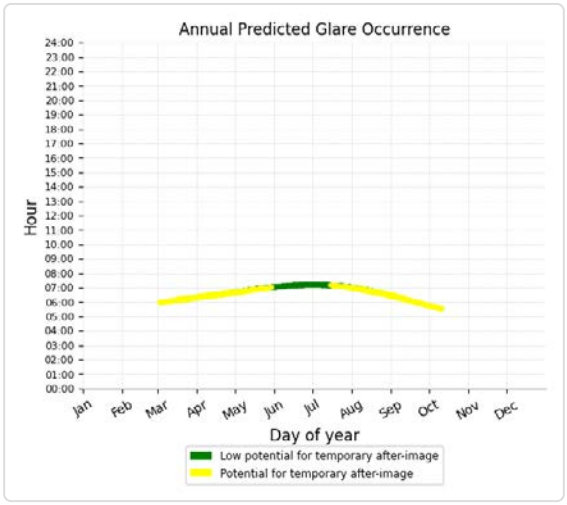


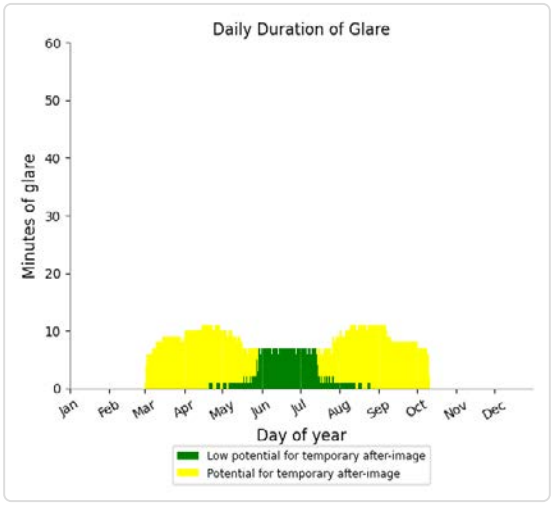


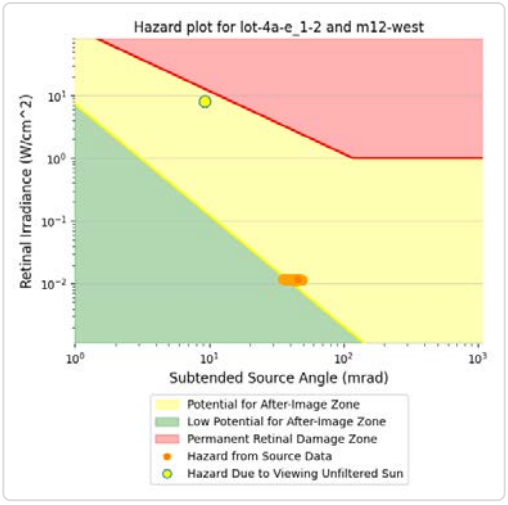


M12 - West

Receptor type: Route
1,489 minutes of yellow glare
404 minutes of green glare







M12 - East

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

VS: Lot 4b - E

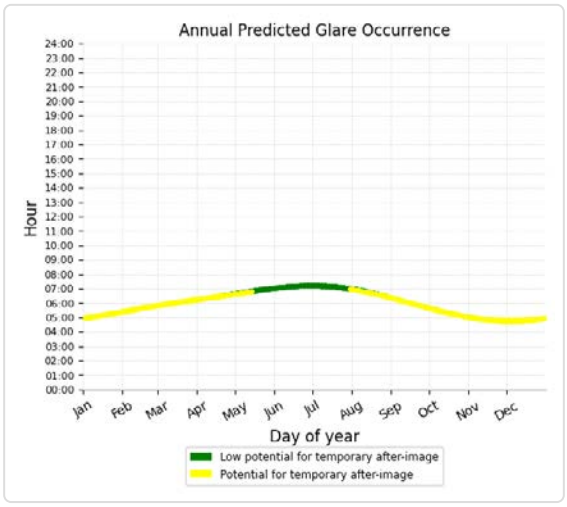
VS Face: 1-2 potential temporary after-image

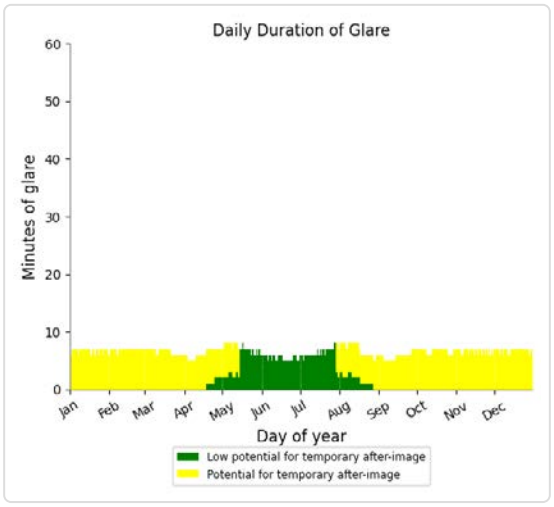
Receptor results ordered by category of glare

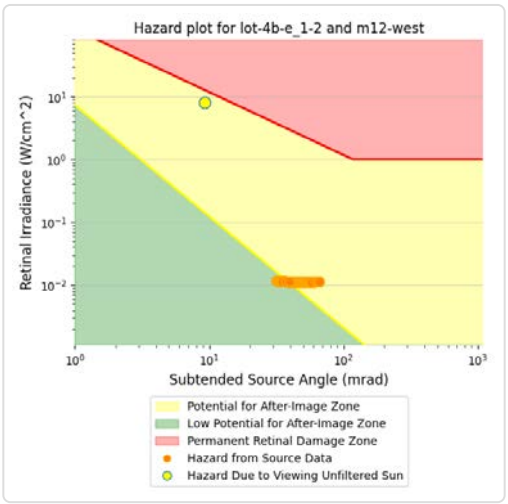
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
M12 - West	573	9.6	1,823	30.4
Elizabeth Drive	529	8.8	0	0.0
M12 - East	0	0.0	0	0.0
FP 1	0	0.0	0	0.0

M12 - West

Receptor type: Route
1,823 minutes of yellow glare
573 minutes of green glare

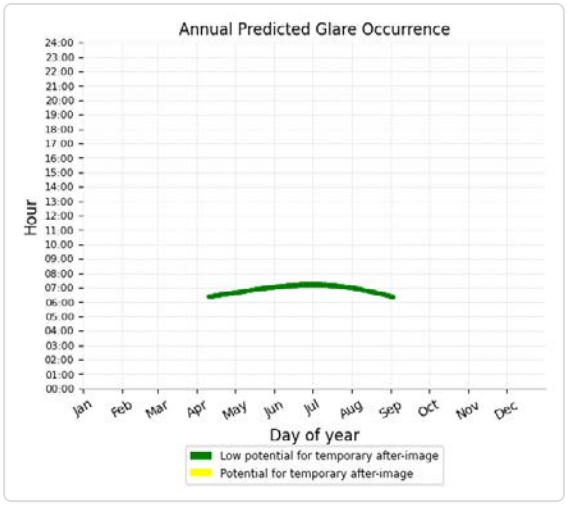


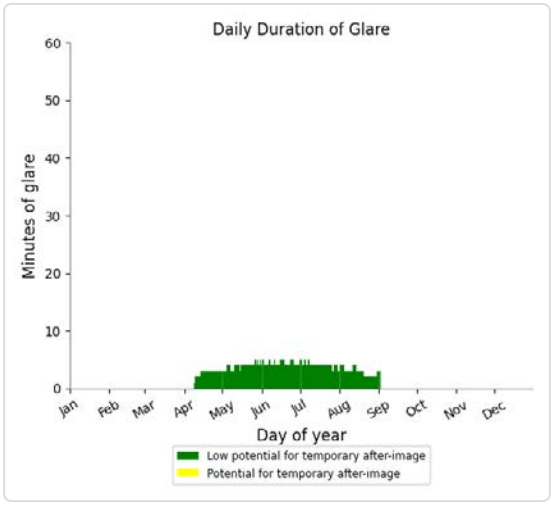


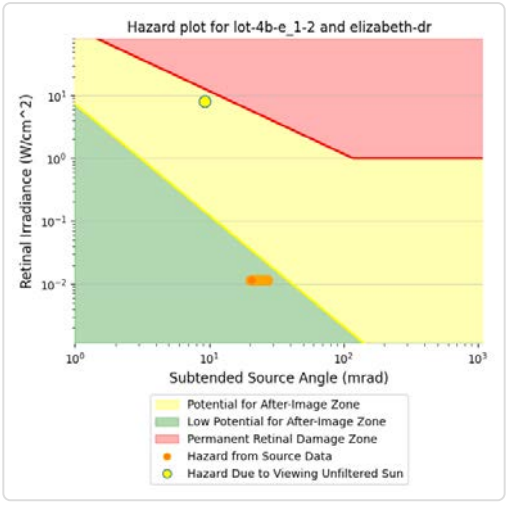


Elizabeth Drive

Receptor type: Route
0 minutes of yellow glare
529 minutes of green glare







M12 - East

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

VS: Lot 5b SE

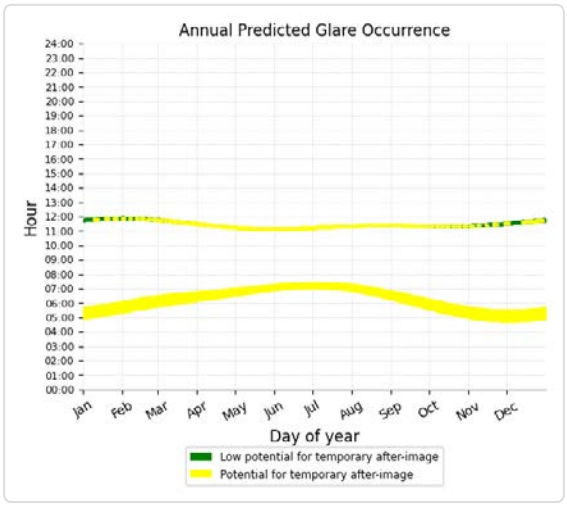
VS Face: 1-2 potential temporary after-image

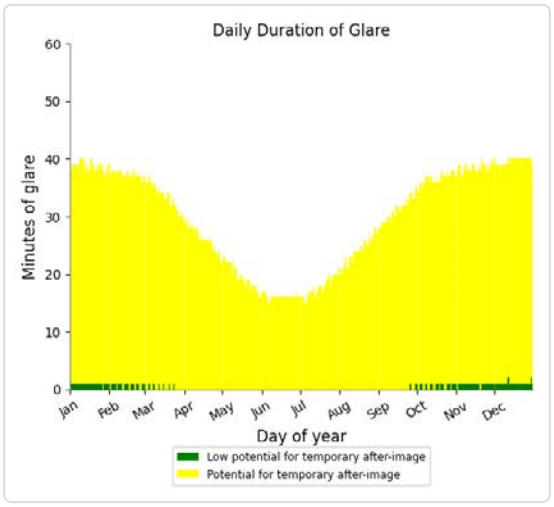
Receptor results ordered by category of glare

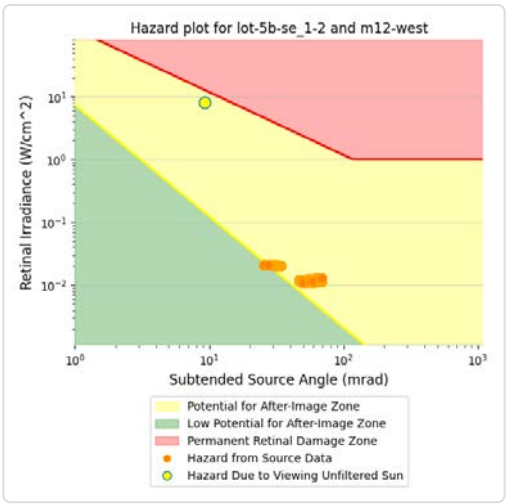
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
M12 - West	140	2.3	10,768	179.5
Elizabeth Drive	309	5.2	0	0.0
M12 - East	0	0.0	0	0.0
FP 1	0	0.0	0	0.0

M12 - West

Receptor type: Route
10,768 minutes of yellow glare
140 minutes of green glare

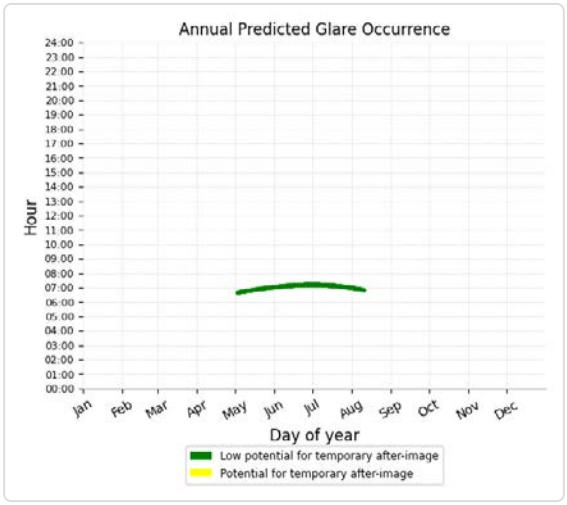


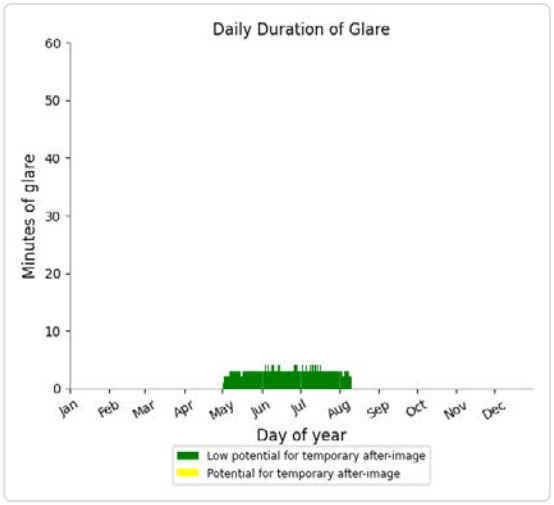


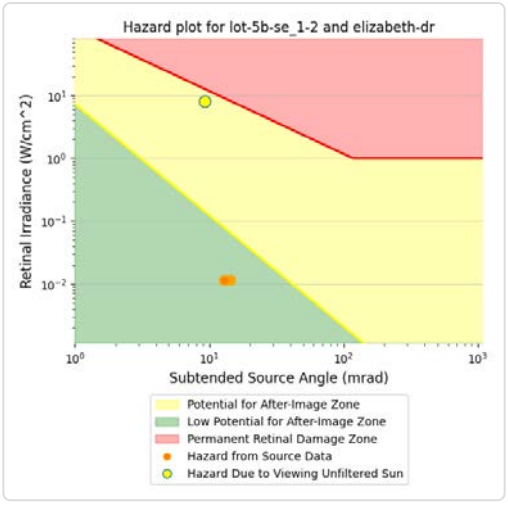


Elizabeth Drive

Receptor type: Route
0 minutes of yellow glare
309 minutes of green glare







M12 - East

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
No glare found

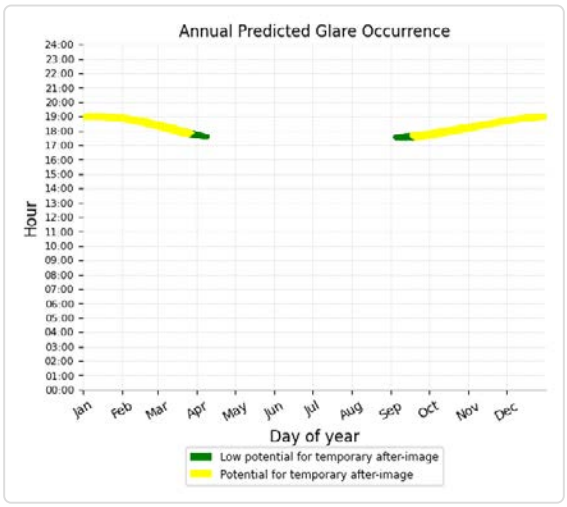
VS Face: 2-3 potential temporary after-image

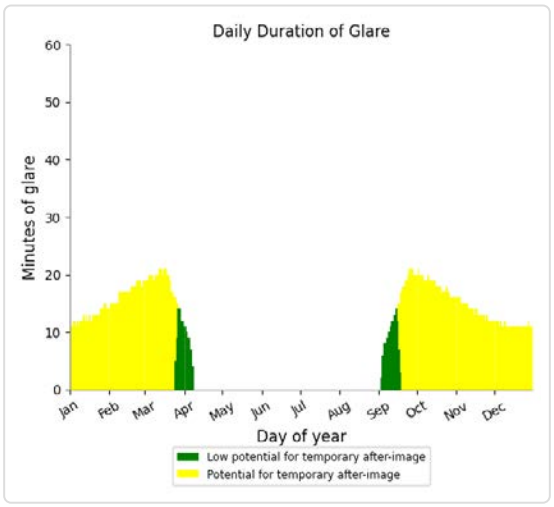
Receptor results ordered by category of glare

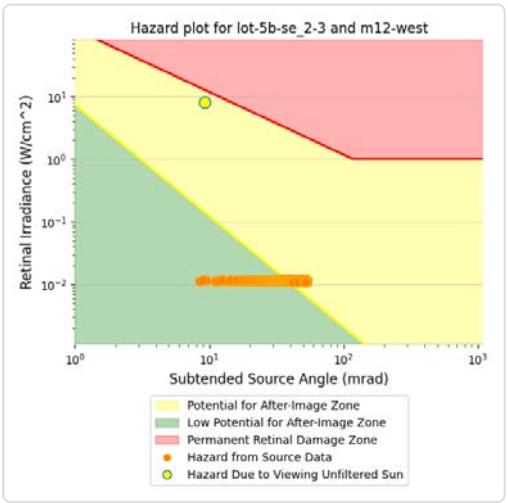
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
M12 - West	297	5.0	2,946	49.1
Elizabeth Drive	258	4.3	0	0.0
M12 - East	0	0.0	0	0.0
FP 1	0	0.0	0	0.0

M12 - West

Receptor type: Route
2,946 minutes of yellow glare
297 minutes of green glare

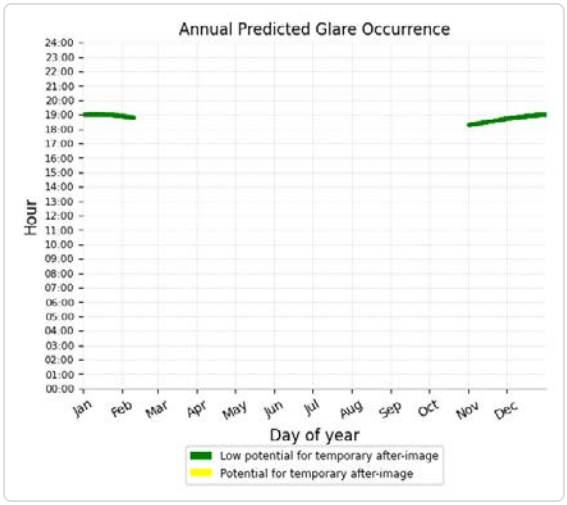


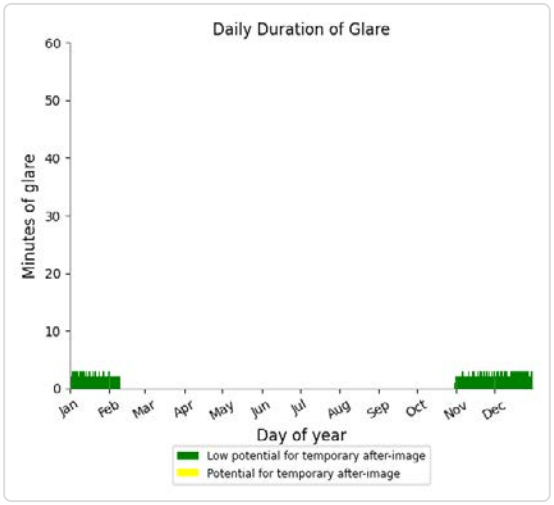


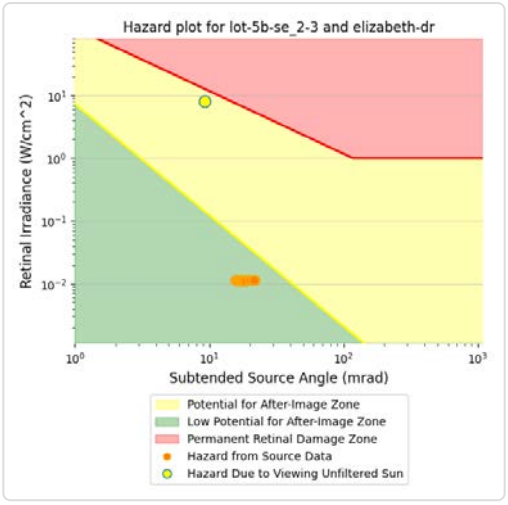


Elizabeth Drive

Receptor type: Route
0 minutes of yellow glare
258 minutes of green glare







M12 - East

Receptor type: Route
No glare found

FP 1

Receptor type: 2-mile Flight Path
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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