

Environmental Impact Assessment Report (EIAR)

Volume 6 of 6: Appendices

(Appendix 18.2) Glint and Glare Assessment

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Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to model potential glint and glare impacts of the proposed solar arrays at five infrastructure sites of the Uisce Éireann Water Supply Project mentioned in the report in accordance with the scope of services set out in the contract between Jacobs and the Client.

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Executive summary

Uisce Éireann (UE) is exploring ways to maximise the environmental and economic benefits of their proposed Water Supply Project Eastern and Midlands (the Proposed Project). This includes generating renewable electricity using the available land at the main infrastructure sites. To support this initiative, the Proposed Project includes the installation of onsite solar photovoltaic (PV) arrays at five infrastructure sites. These are:

1. Water Treatment Plant (WTP)
2. Break Pressure Tank (BPT)
3. Booster Pumping Station (BPS)
4. Termination Point Reservoir (TPR)
5. Flow Control Valve (FCV)

PV arrays have not been proposed at the sixth infrastructure site, the Raw Water Intake & Pumping Station as this was not considered compatible with the architectural design of the site.

Jacobs is supporting the project through the Strategic Infrastructure Development (SID) process. To support this, a glint and glare assessment of the proposed solar arrays has been conducted. This assessment aims to model the potential glint and glare effects from the proposed solar arrays, evaluating their impact on local receptors near to each site, including properties, air traffic control towers, road users, rail lines and flight paths.

Jacobs has used the GlareGauge software package to conduct this assessment, which uses an interactive aerial map interface to plot solar arrays and the locations of ground-based receptors, including discrete observation (point) receptors, route receptors, and flight path receptors. Observation point (OP) receptors simulate an observer at a single, discrete location, defined by latitude, longitude, ground elevation and height above ground. These can be marked to represent an air traffic control tower (ATCT) for aviation purposes. Route receptors are multi-line representations that simulate observers travelling along continuous paths such as roads and railways. The 2-mile (approximately 3.2km) flight path receptor (FP) simulates an aircraft following a straight-line approach path toward a runway.

The Federal Aviation Authority (FAA) considers “glare with low after image potential” (green glare) to be acceptable for pilots approaching a landing area, however “glare with potential for after image” (yellow glare) is considered unacceptable. No glare on an ATCT can be allowed.

This assessment modelled the potential glint and glare effects from the proposed solar arrays on local receptors, including properties, road users and flight paths. The glare detected predominantly occurs during the early morning (06:00-08:00) and evening (18:00-20:00).

Across the five infrastructure sites, a total of 90-point receptors were assessed. Green glare was identified at 32-point receptors. The impact of this is considered low and no mitigation steps are proposed. No yellow glare was detected at any point receptors.

30 route receptors were modelled across the five sites. Green glare was detected at 22 of these. The impact is considered low with no proposed mitigation steps. Yellow glare was identified at 5 route receptors located at the BPT, BPS, TPR and FCV sites. Without any obstructions between the arrays and the route receptors this yellow glare would have an impact on road users. The resulting effect would be glare with a potential to cause an after-image. Further analysis indicated that proposed hedgerows included within current landscaping designs and site buildings from the Proposed Project are sufficient to remove instances of yellow glare at the BPS, BPT, TPR and FCV. The impact of the arrays on route receptors is therefore considered low with no further mitigation actions.

Six flight path receptors were modelled as part of this analysis at Weston and Casement Aerodromes. No glare was detected at Weston Airport’s ATCT or its flight paths from the FCV or TPR arrays. A short duration of glare

was detected at three of the four flight path approaches at Casement Aerodrome. The glare is classified as green which is permissible under FAA guidance. Given this and the short annual duration of the glare, the impact is considered low and no mitigation is proposed.

The following recommendations are proposed as part of our glint and glare study:

- Ensure vegetation planted on all sites is maintained at the heights specified in the landscaping drawings.
- Early stakeholder engagement should take place with Casement Aerodrome to inform them of the green glare predicted along the flight paths by the proposed TPR array, its duration and the time it occurs in order to foster positive stakeholder relations.

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Acronyms and abbreviations

Acronym	Definition
ATCT	Air Traffic Control Tower
BPT	Break Pressure Tank
BPS	Booster Pumping Station
EIA	Environmental Impact Assessment
FAA	(US) Federal Aviation Authority
FCV	Flow Control Valve
FP	Flight Path
HGV	Heavy Goods Vehicle
HSE	Health, Safety & Environmental
IAA	Irish Aviation Authority
ID	Identification
kWp	Kilowatt peak
MWp	Megawatt peak
OP	Observation Point
PS	Pumping Station
PV	Photovoltaic
RWI	Raw Water Intake
SID	Strategic Infrastructure Development
SGHAT	Solar Glare Hazard Assessment Tool
TPR	Termination Point Reservoir
UE	Uisce Éireann
WSP	Water Supply Project
WTP	Water Treatment Plant

1. Introduction

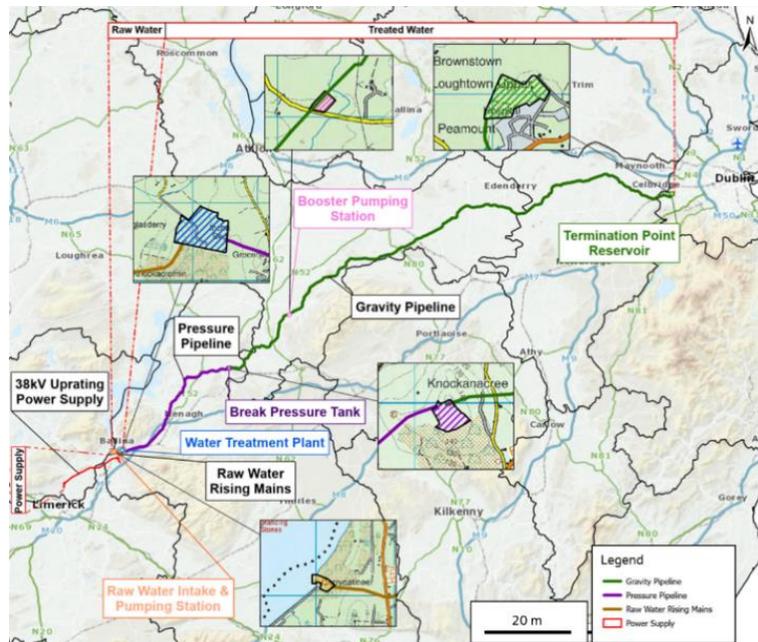
1.1 Project Background

The Water Supply Project Eastern and Midlands (the Proposed Project) by Uisce Éireann (UE) in the Eastern and Midlands Region of Ireland is designed to provide a new source of drinking water that will cater to the needs of over 40% of the country's population, extending up to 2050 and beyond. The current water sources in these regions are inadequate to support the anticipated economic and housing growth. The population in this region is projected to increase from 1.7 million to 2.1 million, necessitating a 40% increase in water supply by 2050. Hence, a new water source is essential to facilitate future regional growth, address supply shortages, and enhance the reliability of the existing system in a sustainable way.

The Proposed Project involves a pipeline of about 172 km, traversing through Tipperary, Offaly, Kildare, and Dublin. The plan includes the extraction of a new water source from the Parteen Basin, with a water treatment facility near the extraction point, and a pipeline leading to a terminal reservoir at Peamount, County Dublin. By 2050, the project aims to provide a peak capacity of 300 million litres per day (Mld) of treated water. The normal average output will be 154 Mld.

UE is exploring ways to maximise the environmental and economic benefits of the Proposed Project. One option being proposed is to use available land at the projects larger infrastructure sites to generate renewable electricity. A feasibility assessment has been conducted proposing onsite solar photovoltaic (PV) arrays be installed at five infrastructure sites, these are listed below and displayed in Figure 1-1 [1][2].

Figure 1-1 Map of the proposed scheme and the main sites in the Water Supply Project - East & Midlands Region



¹ Jacobs U.K. Limited, "Solar Scoping Study- Water Supply Project (Eastern & Midlands Region)," Jacobs U.K. Limited, Manchester, 2025.

² The Planning Application Boundary shown on images in this report reflects the boundary at the time of the assessment, and may differ from the final Planning Application Boundary.

These are the:

1. Water Treatment Plant (WTP)
2. Break Pressure Tank (BPT)
3. Booster Pumping Station (BPS)
4. Termination Point Reservoir (TPR)
5. Flow Control Valve (FCV)

PV arrays have not been proposed at the sixth infrastructure site, the Raw Water Intake & Pumping Station as this was not considered compatible with the architectural design of the site.

Jacobs is the lead consultant supporting the project through the Strategic Infrastructure Development (SID) application process. To support this process and facilitate the addition of PV, a glint and glare assessment has been conducted. This report outlines the results of this assessment, providing the methodology used to model the effects of glint and glare across all proposed sites. Detailing the potential impact on local receptors and providing mitigation steps to ensure impacts are reduced to a practicable minimum where required.

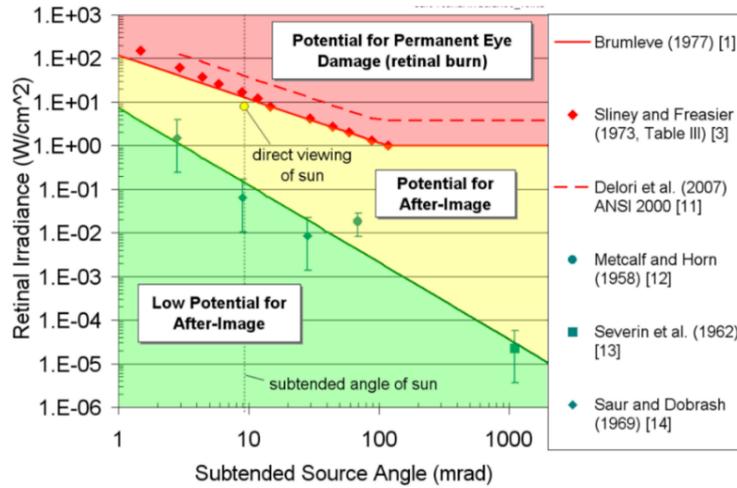
1.2 Glint and Glare from Solar Panels

Solar panels are known to cause glint and glare, which are defined as a significant contrast between a light source and background illuminance. The key difference between glint and glare is the duration of the visual impact; glare occurs over a continuous period, while glint is a brief flash of light. Glint and glare (referred to collectively as glare in this report) can be hazardous for some activities such as aviation and road travel. In addition to causing discomfort to the viewer, more significant instances of glare can be a source of distraction and can leave after-images which can compromise vision.

Glare from solar panels is typically comparable to that experienced from the reflection of sunlight off water surfaces such as lakes, or off windows of nearby buildings. Glare only occurs when there is very little or no obstruction of the sun by cloud and requires direct line-of-sight between the solar panels and the receptor to be experienced. The visual or ocular impact caused by glare is a function of the intensity of the glare source upon the retina (retinal irradiance) and the portion of a viewer's field of vision that the glare occupies (subtended source angle). This relationship is shown in Figure 1-2 ^[3], with the risk of looking directly at the sun plotted as a comparison. The effects of glare are categorised using a red, yellow, and green notation, these are described in further detail in the methodology, in Section 3 below.

³ S. C. A. Y. J. B. E. Ho C K, Solar Glare Hazard Analysis Tool (SGHAT) Technical Reference Manual, Sandia National Laboratories and US Department of Energy, 2015.

Figure 1-2 Ocular impact highlighting after - image potential



1.3 Guidance and Requirements

1.3.1 Glare Assessment Guidance

At the time of writing this assessment there is no mandated guidance or policy in relation to the assessment of glare effects on aviation, road & rail users or buildings in the Republic of Ireland. In response to this regulatory gap, Sustainable Energy Authority of Ireland (SEAI) produced planning and development recommendations which includes an approach to glare assessments^[4]. While this is specifically tailored for utility-scale PV installations, the approach detailed is still relevant to the scale of the solar assets for the Proposed Project. These recommendations do not constitute formal regulatory guidance, but they outline assessment methodologies derived from international best practices. As a result, this assessment ensures that industry best practice is followed in the evaluation of the impact of glare on receptors and in determining appropriate mitigation steps. This applies to the methodology and assumptions within this study.

1.3.2 Irish Aviation Authority Requirements

While there are currently no rules or regulations guiding the assessment of glare from the Irish Aviation Authority (IAA). In their guidance, the IAA recommended that proponents of solar PV systems within or near aerodromes follow the guidelines issued by the US Federal Aviation Administration (FAA) when making their assessments.

The FAA recommends that any proposed solar farms that are below the direct approach paths to an airport and within a distance of approximately 5 nautical miles (approximately 5.75 miles or 10km) from a runway end should be referred for a specific assessment by the relevant authorities and requires the use of the Solar Glare Hazard Assessment Tool (SGHAT, currently marketed as GlareGauge).

The FAA considers “glare with low after image potential” (displayed as green on the graphs) to be acceptable for pilots approaching a landing area, however “glare with potential for after image” (displayed as yellow on the graphs) is considered unacceptable. No glare on an air traffic control tower can be allowed. For the sake of clarity, the FAA’s consideration of acceptability regards highly sensitive aviation activities only and does not consider impact of glare on other receptors such as nearby residents or road users.

⁴ Walsh, S. (2016) *Planning and Development Guidance Recommendations for Utility Scale Solar Photovoltaic Schemes in Ireland, Future Analytics Consulting*. Available at: https://www.seai.ie/sites/default/files/publications/2016_RDD_96_Planning_Development_Guidance_UTILITY_Solar_PV_IrL_-_FAC.pdf (Accessed: 10 July 2025).

2. Site Overview

As previously indicated five sites have been proposed for the addition of PV. The following provides detail on the sites and the PV arrays selected for each location:

- The permanent Water Treatment Plant (WTP) site which is approximately 31ha and is located at Incha Beg, Birdhill, County Tipperary, 2 km east of the proposed raw water intake and pumping station (RWI&PS) site. The site is immediately north of dense woodland, but consists of open fields. It will contain a combination of ground and rooftop-mounted arrays, ranging from 10kWp – 1MWp.
- The permanent Break Pressure (BPT) site is located in Knockanacree, County Tipperary, approximately 37 km from the proposed WTP site, and covers a total area of approximately 7ha. The site layout accommodates an existing telecoms mast northeast of the site, which requires access for inspection and maintenance. It will contain a combination of ground and rooftop-mounted arrays, ranging from 25kWp – 150kWp.
- The permanent Booster Pumping Station (BPS) site covers a total area of approximately 2.6ha and is located in Coagh Upper, County Offaly. It is located along the Gravity Pipeline between the BPT and the TPR. It will house a single 20kWp ground-mounted array.
- The permanent Termination Point Reservoir (TPR) site will be located adjacent to an existing reservoir in Peamount, County Dublin. The 8.3ha⁵ site will act as the terminus for the Treated Water Pipeline and will be integrated into the existing water infrastructure that supplies the Greater Dublin Area. The TPR will house a single 300kWp ground-mounted array.
- The Flow Control Valve (FCV) site will be located near Baltracey, County Kildare, around 5 km west of the TPR along the Gravity Pipeline. The 0.5ha site will house a single 20kWp ground-mounted array.

Table 2-1 provides more detail on the sites and PV arrays at each location. Each PV layout is outlined in Section 4. Layout drawings and images of the geographic location of all sites can be found within Appendices A.1, B.1, C.1, D.1, and E.1.

Table 2-1 PV Array Overview

Site	Number of PV Arrays	Total AC Rated Capacity (kWp)	Latitude, Longitude of Site (deg)
Water Treatment Plant (WTP)	13	4,200	52.78609, -8.41686
Break Pressure Tank (BPT)	3	200	52.96058, -8.04214
Booster Pumping Station (BPS)	1	20	53.11462, -7.77059
Termination Point Reservoir (TPR)	1	300	53.32073, -6.48352
Flow Control Valve (FCV)	1	20	53.31036, -6.5533

⁵ This calculation does not include the existing site that is in Uisce Éireann ownership as it is not additional land required for the Proposed Project.

3. Methodology and Model Input Parameters

3.1 Software and Methodology

To analyse the impact of glare this study used the software package GlareGauge, which was developed by Sandia National Laboratories. As stated in Section 1.3.2, the selection of this software was due to the recommendation for use by the US Federal Aviation Administration (FAA) in assessing glare from solar PV installations located near airports in the US. While the guidance only recommends use for assessing the impact of glare on aviation receptors, the software tool can also be used to assess glare for all route and point receptors. To ensure consistency across this study GlareGauge is used to model all glare.

The GlareGauge tool uses an interactive aerial map interface to plot solar arrays and the location of ground-based receptors, including discrete observation (point) receptors, route receptors, and flight path receptors. Observation point receptors (OP) simulate an observer at a single, discrete location, defined by latitude, longitude, elevation and height above ground. These can be marked to represent an air traffic control tower (ATCT) for aviation purposes. Route receptors are multi-line representations that simulate observers travelling along continuous paths such as roads and railways. The 2-mile (approximately 3.2km) flight path receptor (FP) simulates an aircraft following a straight-line approach path towards a runway.

The Federal Aviation Authority (FAA) considers “glare with low after image potential” (green glare) to be acceptable for pilots approaching a landing area. However, “glare with potential for after image” (yellow glare) is considered unacceptable. No glare on an ATCT can be allowed. Table 3-1 provides detail on the glare intensity designation and how this study determines the significance of glare on each receptor.

Table 3-1 Glare intensity designation

Coding Used	Intensity Key	Impact Significance	Mitigation Requirement
Green Glare	Glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time	Low	No mitigation recommended
Yellow Glare	Glare with potential to cause an after-image	Moderate	Mitigation recommended
Red Glare	Glare with potential to cause permanent retinal damage	High	Mitigation required

Our method to conduct this glare assessment has been developed using a mix of inputs from stakeholders and using data identified through desktop studies. The key method steps are as follows:

- Using GIS tools to conduct a desktop inspection of potential route and point receptors proximate to all sites.
- Analyse and select the appropriate receptors for each site, ensuring a line of sight to an array. The line of sight was identified with the support of GIS software.
- Where there was a dense grouping of point receptors an appropriate aggregation of receptors was selected.
- Key input values were collated; where data was not specifically available, best practice assumptions were used. These are provided in more detail in Section 3.2, 3.3, and 4.
- The array layouts, receptor selection and modelling parameters were all input in the GlareGauge software, and the model was run to assess the impact of glare across all receptors.

- The results were assessed to identify the magnitude and impact of glare on each receptor.
- The initial simulations for this assessment used a conservative approach, assuming a direct line of sight between all arrays and receptors (no terrain or obstructions). This demonstrates the highest potential impact of glare on a receptor, assuming that the landscape/ obstructions could change at a future point, such as a hedgerow being removed.
- In instances where yellow glare was detected at receptors, a more detailed review of the terrain was conducted. Obstructions were identified and included within the model.
- Furthermore, a sensitivity analysis was conducted. Obstructions were modelled at different heights to determine the minimum height required to mitigate instances of yellow glare.
- Where yellow glare remained mitigation steps were identified with relevant specialist teams and modelled in GlareGauge. This process was iterated until the glare was reduced to a low impact on receptors (green glare).

3.2 Model Parameters and Assumptions

The modelling parameters used across all sites are outlined in Table 3-2.

Table 3-2 PV system and receptor parameters used for the study

Parameter	Value	Comment
PV System Preferences		
Time zone (UTC)	+0	Ireland time zone to capture correct angles of the sun
Peak DNI (W/m ²)	992	Calculated peak DNI
Time interval (mins)	1	Assessment carried out for every minute of the year. Actual timing of visual impact may not be exact to a one minute granularity due to limitations of the software.
Mounting type	Fixed	
Reflectivity calculations	Varies with incident angle	Increases with increasing incident angle
Reflection diffusion	Correlated to module surface type	Calculates the spread of the reflected beam according to the module surface: texture of the glass and application of anti-reflective coating (ARC)
Solar module surface	Lightly textured with ARC	Assumption based on typical product selection
Tilt (°)	15, 20	From horizontal. Exact tilts for each array at the different infrastructure sites are detailed further in Section 3.3
Orientation (°)	Various	From true north. Exact orientations for each array at the different infrastructure sites are detailed in Section 3.3
Height of module above ground (m)	To centre of the panel	As detailed in Section 3.3

Receptor Parameters		
View angle (°) – cars, trucks / heavy goods vehicles (HGVs), trains	50	Assumption based on typical viewing angle of vehicles
Receptor height – ground floor (m)	1.65	Assumption for ground floor receptors based on a typical building
Receptor height – first floor (m)	4.65	Assumption for first floor receptors based on a typical building
Weston Aerodrome ATCT height (m)	13.65	Estimation from desktop study. The ATCT has been assumed to be the height of a five-storey building
Receptor height – car (m)	1.5	Assumption for light vehicle road users based on a typical vehicle
Receptor height – trucks & HGVs (m)	2.5	Assumption for large vehicles based on a typical vehicle
Receptor height – train (m)	3	Assumption for trains based on a typical vehicle

In addition to these model parameters the following software limitations were also relevant to the assessment:

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses may not account for all physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions. These are manually identified and modelled where deemed necessary.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
- 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.

3.3 Tilt, Height and Orientation

Due to the relative complexity of the layout of PV across the Proposed Project, incorporating a mix of both roof and ground mounted arrays, the following section outlines the parameters that are unique to individual arrays. These include the tilt angle and orientation of the array. The height above ground indicates whether the array is ground or roof mounted. The specific value listed in the table is the distance between the ground and the centre point of the array, accounting for mounting structures. This is detailed for all five infrastructure sites in the tables below.

Table 3-3 WTP tilt, height and orientation

PV name	Tilt degree	Height above ground (m)	Orientation degree
Chemical dosing manifold building	15	6.95	191
Control building	15	10.55	190
Field array	20	1.19	180
Lamellar clarifiers building	15	13.75	281
Large field array	20	1.19	180
Sludge dewatering building 1 – east	15	12.45	101
Sludge dewatering building 1 - west	15	12.45	282
Sludge dewatering building 2 - east	15	12.45	101
Sludge dewatering building 2 - west	15	12.45	282
Sludge storage building 1	15	6.95	267
Sludge storage building 2	15	6.95	87
UV dosing	15	10.15	102
Water treatment module 1	15	10.15	191
Water treatment module 2	15	10.15	191
Water treatment module 3	15	10.15	191

Table 3-4 BPT tilt, height and orientation

PV name	Tilt degree	Height above ground (m)	Orientation degree
Array on tank	20	1.19	180
Control building roof mounted array	15	5.35	180
Array to the south of site	15	1.19	180

Table 3-5 BPS tilt, height and orientation

PV name	Tilt degree	Height above ground (m)	Orientation degree
PV array 1	20	1.19	180

Table 3-6 TPR tilt, height and orientation

PV name	Tilt degree	Height above ground (m)	Orientation degree
PV array 1	20	10.19	180

Table 3-7 FCV tilt, height and orientation

PV name	Tilt degree	Height above ground (m)	Orientation degree
PVarray 1	20	1.19	180

4. Identification of Receptors

4.1 Water Treatment Plant Analysis Elements

4.1.1 Discrete Observation (Point) Receptors

17 discrete observation receptors, or point receptors were assessed at the WTP. The point receptors were modelled at an observer height of 1.65m for ground floor buildings and 4.65m for first floor buildings as per Table 3-2.

Table 4-1 details the 17-point receptors assessed in this study, and Figure 4-1 shows the point receptor locations relative to the proposed PV array.

Table 4-1 WTP point receptors

ID	Description	Receptor Height (m)	Location (latitude, longitude)
OP1	Property on R494, Ballina, County Tipperary, V94	4.65	52.78373, -8.43189
OP2	Property on L6030, Birdhill, County Tipperary, V94	4.65	52.78448, -8.40046
OP3	Property on L6030, Birdhill, County Tipperary, V94	4.65	52.78779, -8.4019
OP4	Property on L6030, Birdhill, County Tipperary, V94	4.65	52.78265, -8.40208
OP5	Property on L6030, Birdhill, County Tipperary, V94	4.65	52.78181, -8.4023
OP6	Property on L6030, Birdhill, County Tipperary, V94	4.65	52.78092, -8.40255
OP7	Property on L6030, Birdhill, County Tipperary, V94	4.65	52.78932, -8.40458
OP8	Property on L6030, Birdhill, County Tipperary, V94	4.65	52.79105, -8.4048
OP9	Property on L6030, Ballina, County Tipperary, V94	4.65	52.79188, -8.40628
OP10	Property on R494, Ballina, County Tipperary, V94	4.65	52.78731, -8.42967
OP11	Farm house and barn on L94942, Ballina, County Tipperary, V94	4.65	52.77983, -8.42869
OP12	Property on L94942, Ballina, County Tipperary, V94	4.65	52.77939, -8.42996
OP13	Property on R494, Ballina, County Tipperary, V94	4.65	52.78078, -8.43132

ID	Description	Receptor Height (m)	Location (latitude, longitude)
OP14	Property on R494, Ballina, County Tipperary, V94	4.65	52.78158, -8.43132
OP15	The Platinum Touch, Shannonside Business Park, Birdhill, County Tipperary, V94	4.65	52.77461, -8.42997
OP16	Property on Unnamed road, Birdhill, County Tipperary, V94	4.65	52.77556, -8.43136
OP17	Shannonside Business Park, Birdhill, County Tipperary, V94	4.65	52.77548, -8.42984

Figure 4-1 WTP point receptor locations (proposed PV array area shown in yellow)

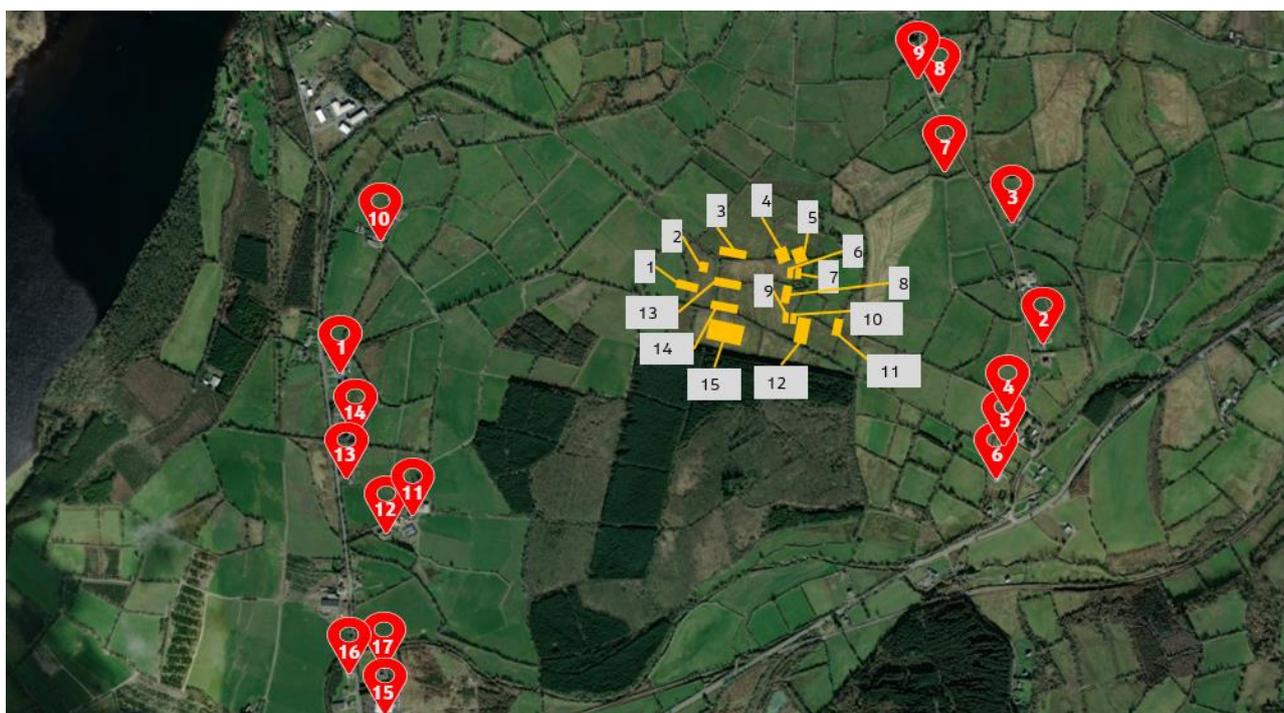


Table 4-2 Corresponding numbers for PV arrays as shown in Figure 4-1

Number	Solar Array
1	Chemical dosing manifold building
2	Lamellar clarifiers building
3	Water treatment module 3
4	Sludge storage building 1
5	Sludge storage building 2
6	Sludge dewatering building 2 - east

Number	Solar Array
7	Sludge dewatering building 2 - west
8	UV dosing building
9	Sludge dewatering building 1 - east
10	Sludge dewatering building 1 – west
11	Control building
12	Field array
13	Water treatment module 2
14	Water treatment module 1
15	Large field array

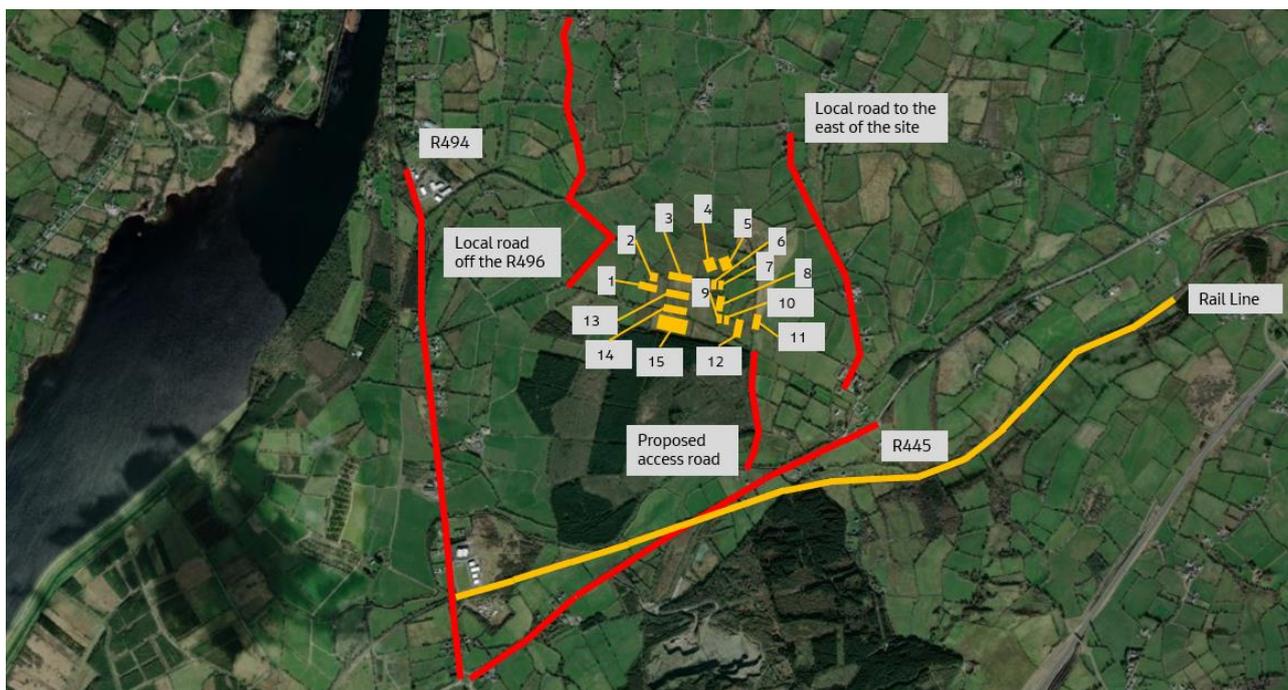
4.1.2 Route Receptors

Six ground-based route receptors were assessed in the study for the WTP. These are listed in Table 4-3 and shown in Figure 4-2. These were modelled at a height of 1.5m, reflecting the driving height of passenger vehicles, and 2.5m reflecting the driving height of larger vehicles and delivery trucks. There is a rail line running to the south of the site, which has been modelled at a height of 3m.

Table 4-3 WTP route receptors

Description	Type	Receptor Height (m)
Local road to the east of the site	Road	1.5 / 2.5
Proposed Access Road	Road	1.5 / 2.5
Local road off R496	Road	1.5 / 2.5
R445	Road	1.5 / 2.5
R494	Road	1.5 / 2.5
Rail Line	Railway	3

Figure 4-2 WTP route receptor locations (proposed PV arrays shown in yellow)



4.1.3 Flight Path Receptors

No nearby flight paths were identified within 10km of the WTP.

4.2 Break Pressure Tank Analysis Elements

4.2.1 Discrete Observation (Point) Receptors

11 discrete point receptors were assessed at the BPT. Details of the point receptors are given in Table 4-4 and the location of these receptors can be seen in Figure 4-3. Table 4-5 shows the numerical ID for each of the PV arrays in the figure.

Table 4-4 BPT point receptors

ID	Description	Receptor Height (m)	Location (latitude, longitude)
OP1	Property on L5020, CloghJordan, County Tipperary, E53	4.65	52.9575, -8.03421
OP2	Property on Modreeny Road, CloghJordan, County Tipperary, E53	1.65	52.95421, -8.03602
OP3	Property on L1064, CloghJordan, County Tipperary, E53	4.65	52.95978, -8.05634
OP4	Property on L5020, CloghJordan, County Tipperary, E53	4.65	52.96083, -8.03458
OP5	Property on Modreeny Road, CloghJordan, County Tipperary, E53	4.65	52.95323, -8.04123

Water Supply Project Eastern and Midlands - Glint & Glare Assessment

ID	Description	Receptor Height (m)	Location (Latitude, Longitude)
OP6	A stone ruin on Modreeny Road, CloghJordan, County Tipperary, E53	4.65	52.95416, -8.03782
OP7	Property on Modreeny Road, CloghJordan, County Tipperary, E53	4.65	52.95423, -8.04461
OP8	Property on Modreeny Road, CloghJordan, County Tipperary, E53	4.65	52.95376, -8.04905
OP9	Farmhouse and buildings on Modreeny Road, CloghJordan, County Tipperary, E53	4.65	52.954, -8.04658
OP10	Property on L1064, CloghJordan, County Tipperary, E53	4.65	52.96102, -8.05252
OP11	Farmhouse and buildings on L1064, Mertonhall, County Tipperary, E53	4.65	52.9572, -8.05827

Figure 4-3 BPT point receptor locations (proposed PV array area shown in yellow)

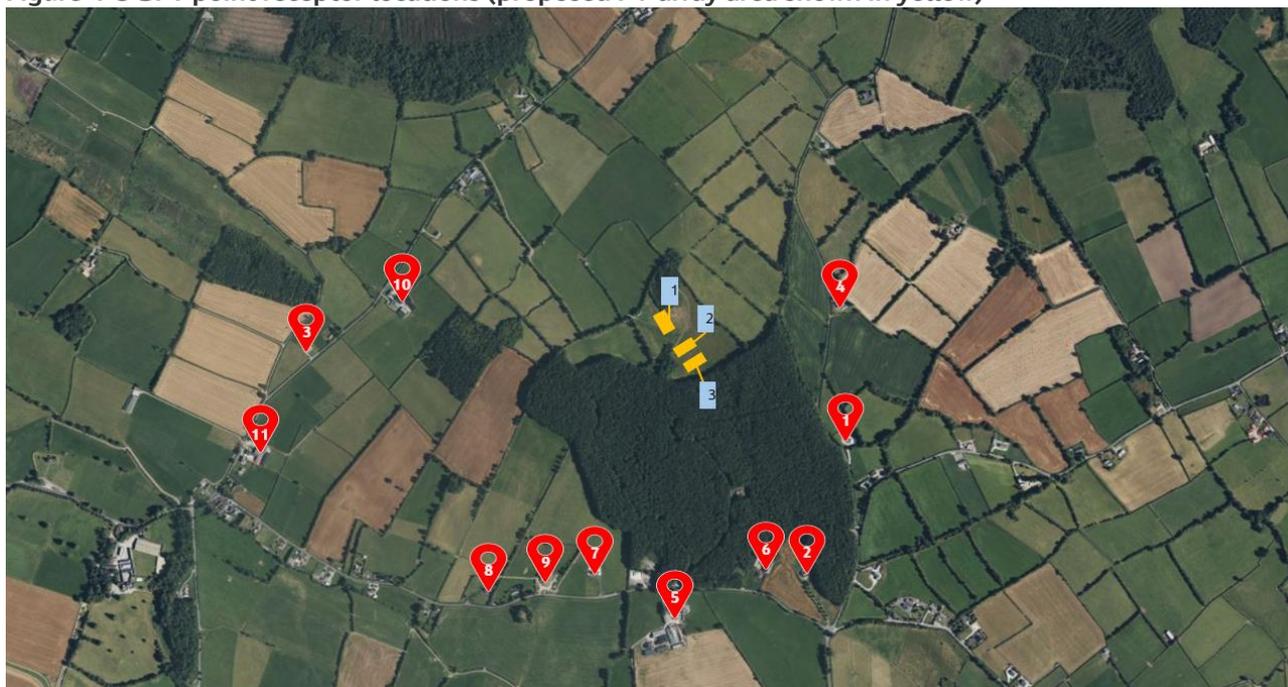


Table 4-5 Corresponding numbers for PV arrays as shown in Figure 4-3

Number	Solar Array
1	Array on tank
2	Control building rooftop array
3	Array to the south of site

4.2.2 Route Receptors

Five ground-based route receptors were assessed in the study for the BPT, which are listed in Table 4-6 and shown in Figure 4-4. No rail receptors were identified near the BPT site.

Table 4-6 BPT route receptors

Description	Type	Receptor Height (m)
Proposed Access Road	Road	1.5 / 2.5
East Road off R491	Road	1.5 / 2.5
Old Birr Road	Road	1.5 / 2.5
R491	Road	1.5 / 2.5
South Road off R491	Road	1.5 / 2.5

Figure 4-4 BPT route receptor location (proposed PV array area shown in yellow)



4.2.3 Flight Path Receptors

No nearby flight paths were noted for the BPT.

4.2.4 Obstructions

Obstructions between the PV arrays and receptors have been modelled following an initial identification of yellow glare at the site, as detailed in Section 3 and discussed in more detail in Section 5. The forest to the south of the site and a hedgerow running parallel to the proposed access road have been modelled as obstructions. Figure 4-5 and Figure 4-6 show the obstructions in pink relative to receptors. The forest has been modelled as a 5m high obstruction and the hedgerow adjacent to the proposed access road as a 2.5m obstruction.

Figure 4-5 BPT point receptor location (proposed PV array area shown in yellow; the pink line indicates the obstructions modelled in GlareGauge)

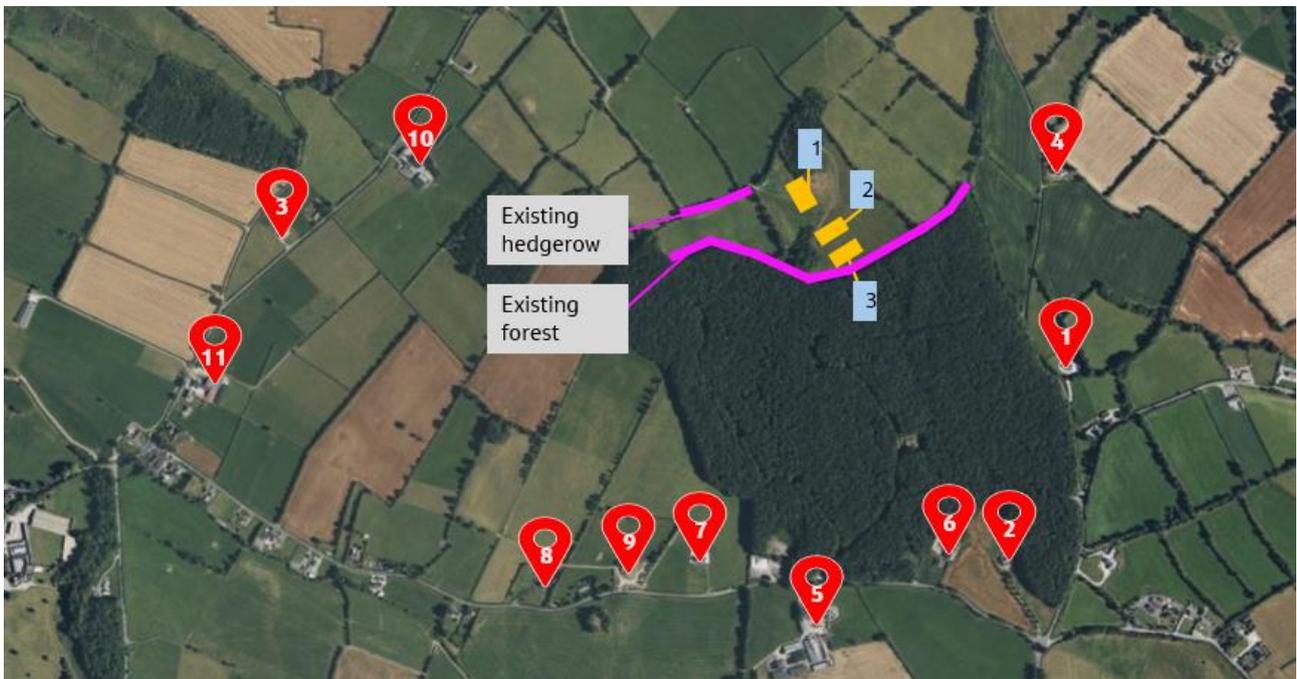
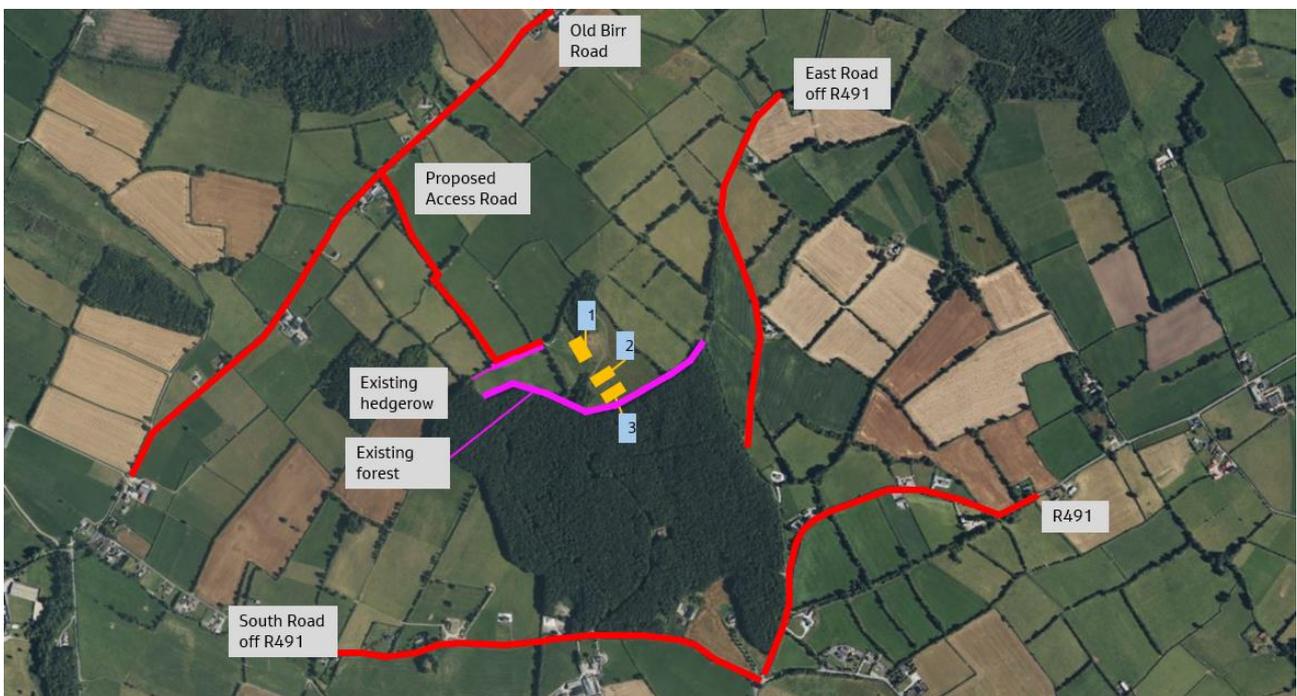


Figure 4-6 BPT route receptor location (proposed PV array area shown in yellow; the pink line indicates the obstructions modelled in GlareGauge)



4.3 Booster Pumping Station

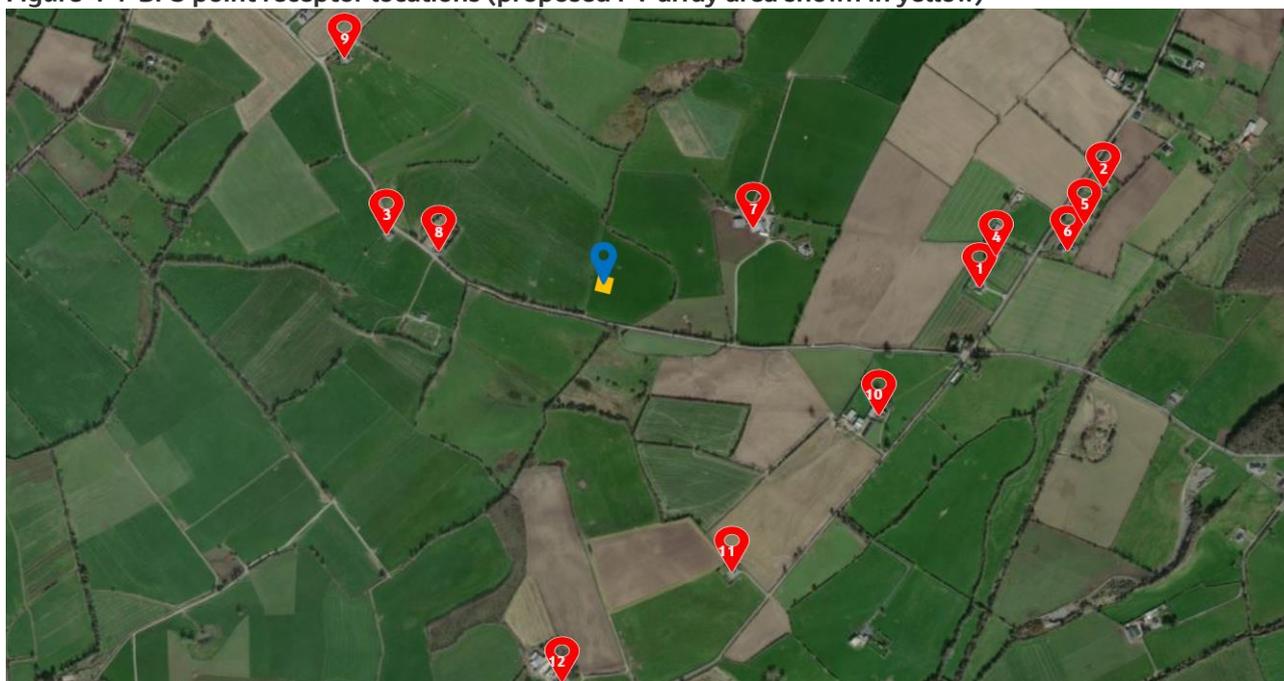
4.3.1 Discrete Observation (Point) Receptors

12 discrete point receptors were assessed at the BPS. Details of the point receptors are given in Table 4-7 and the location of these receptors can be seen Figure 4-7.

Table 4-7 BPS point receptors

ID	Description	Receptor Height (m)	Location (latitude, longitude)
OP1	Property on Unnamed Road, County Offaly, R42	4.65	53.11451, -7.75685
OP2	Property on Unnamed Road, County Offaly, R42	4.65	53.11672, -7.75253
OP3	Property on L3003, County Offaly	4.65	53.11569, -7.77757
OP4	Property on Unnamed Road, County Offaly, R42	4.65	53.11519, -7.75643
OP5	Property on Unnamed Road, County Offaly, R42	4.65	53.1159, -7.75348
OP6	Property on Unnamed Road, County Offaly, R42	4.65	53.11536, -7.75403
OP7	Property on L3003, County Offaly, R42	1.65	53.11594, -7.76491
OP8	Property on L3003, County Offaly	4.65	53.11527, -7.77595
OP9	Property on Unnamed Road, County Offaly, R42	4.65	53.11939, -7.77914
OP10	Property on Unnamed Road, Birr, County Offaly, R42	1.65	53.11191, -7.76042
OP11	Property on Unnamed Road, Birr, County Offaly, R42	1.65	53.10853, -7.76563
OP12	Property on Unnamed Road, Birr, County Offaly, R42	4.65	53.10622, -7.77155

Figure 4-7 BPS point receptor locations (proposed PV array area shown in yellow)



4.3.2 Route Receptors

Four ground-based route receptors were assessed for the BPS, which are listed in Table 4-8. BPS route receptors are displayed in Figure 4-8. No rail receptors were identified near the BPS site.

Table 4-8 BPS route receptors

Description	Type	Receptor Height (m)
Access Road to Nearby Barn	Road	1.5 / 2.5
L3003	Road	1.5 / 2.5
Pass	Road	1.5 / 2.5
Proposed Access Road	Road	1.5 / 2.5

Figure 4-8 BPS route receptor locations (proposed PV arrays shown in yellow)



4.3.3 Flight Path Receptors

No nearby flight paths were noted for the BPT.

4.3.4 Obstructions

Obstructions between the PV and receptors was modelled following an initial identification of yellow glare at the site. The Booster Pumping Station Building located west of the array was modelled as an obstruction. Figure 4-9 and Figure 4-10 show the obstruction in pink relative to receptors. The building was modelled as a 5.5m high obstruction.

Figure 4-9 BPS point receptor location (proposed PV array area shown in yellow; the pink box indicates the obstruction modelled in GlareGauge)

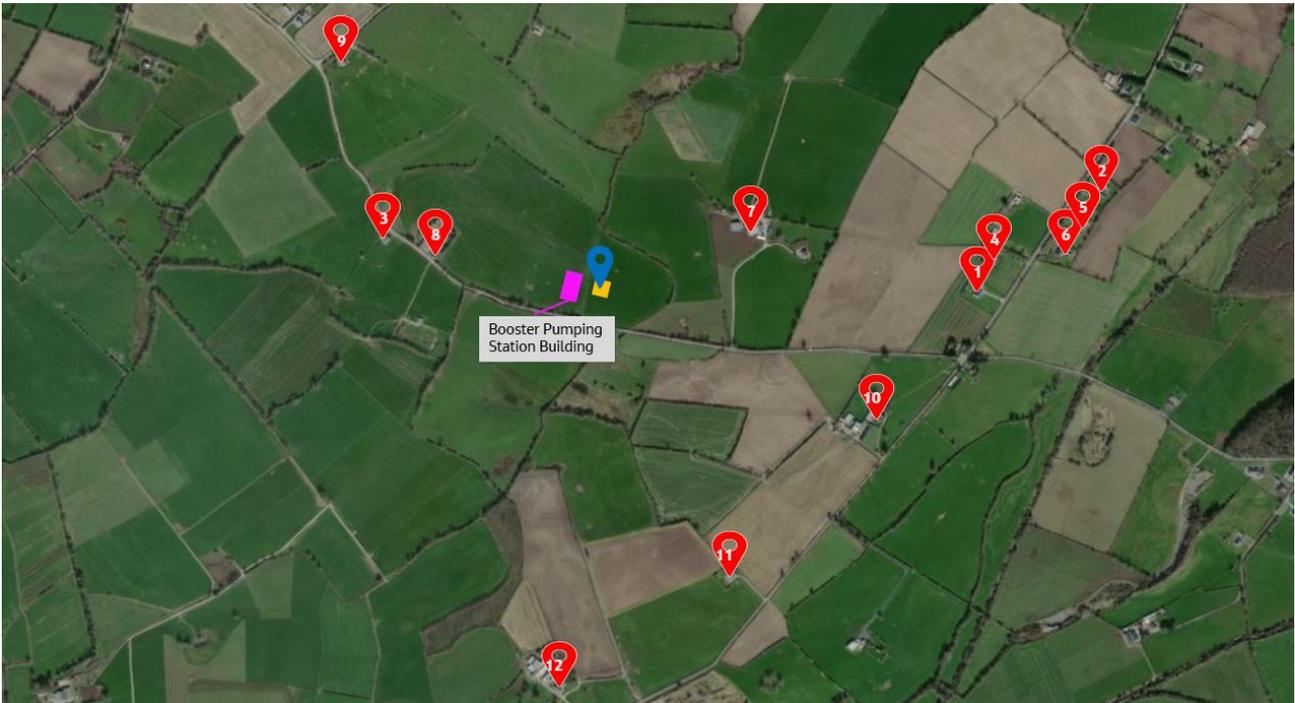


Figure 4-10 BPS route receptor location (proposed PV array area shown in yellow; the pink box indicates the obstruction modelled in GlareGauge)



4.4 Termination Point Reservoir Analysis Elements

4.4.1 Discrete Observation (Point) Receptors

30 discrete point receptors were modelled at the TPR. Point receptors were modelled at an observer height of 1.65m for ground floor buildings, 4.65m for first floor buildings. For the air traffic control tower (ATCT) at Weston Airport we have assumed the tower is a five-storey building at a height of 13.65m. There is no ATCT at Casement Aerodrome. Table 4-9 details the 30 point receptors assessed in this study, and Figure 4-11 and Figure 4-12 show the point receptor locations relative to the proposed PV array.

Table 4-9 TPR point receptors

ID	Description	Receptor Height (m)	Location (latitude, longitude)
OP1	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.31935, -6.48163
OP2	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.31847, -6.48221
OP3	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.31877, -6.4794
OP4	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.31849, -6.48096
OP5	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.31782, -6.4835
OP6	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.31768, -6.47795
OP7	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.31847, -6.47665
OP8	Property on Peamount Lane, Newcastle DED 1986, South Dublin, D24	4.65	53.31957, -6.47633
OP9	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.31674, -6.47925
OP10	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.31833, -6.48034
OP11	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.31915, -6.47907
OP12	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.31629, -6.48175
OP13	Education Centre, Peamount Road, Newcastle DED 1986, South Dublin, D22	4.65	53.31537, -6.48005

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ID	Description	Receptor Height (m)	Location (latitude, longitude)
OP14	Peamount Hospital, Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D24	4.65	53.3165, -6.47668
OP15	Newcastle Golf Centre, Peamount Lane, Newcastle DED 1986, South Dublin, D24	4.65	53.3209, -6.47287
OP16	Peamount Wellness Centre, Peamount Road, Newcastle DED 1986, South Dublin, D22	4.65	53.31454, -6.48192
OP17	Self-Storage Container Units, Peamount Road, Newcastle DED 1986, South Dublin, D22	4.65	53.3196, -6.46767
OP18	Property on Relickeen Lane, Newcastle DED 1986, South Dublin, W23	4.65	53.32057, -6.49674
19-ATCT	Air Traffic Control Tower- (Weston Airport) M4, Lucan-St. Helens DED 1986, Lucan, County Dublin, W23	13.65	53.35561, -6.48954
OP20	Property on Relickeen Lane, Newcastle DED 1986, South Dublin, W23	4.65	53.31963, -6.49735
OP21	Property on Relickeen Lane, Newcastle DED 1986, South Dublin, W23	4.65	53.31884, -6.49939
OP22	Property on Loughtown Road, Newcastle DED 1986, South Dublin, D22	4.65	53.31761, -6.50001
OP23	Property on Loughtown Road, Newcastle DED 1986, South Dublin, D22	4.65	53.31695, -6.49789
OP24	Property on Loughtown Road, Newcastle DED 1986, South Dublin, D22	4.65	53.31719, -6.49497
OP25	Property on Loughtown Road, Newcastle DED 1986, South Dublin, D22	4.65	53.31727, -6.49315
OP26	Property on Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D22	4.65	53.31256, -6.48955
OP27	Property on Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D22	4.65	53.31362, -6.48696
OP28	Property on Relickeen Lane, Newcastle DED 1986, South Dublin, W23	4.65	53.31941, -6.4975
OP29	Property on Peamount Road, Newcastle DED 1986, Newcastle, County Dublin, D22	4.65	53.31945, -6.46272

ID	Description	Receptor Height (m)	Location (latitude, longitude)
OP30	Caravan Park Unnamed Road, Newcastle DED 1986, South Dublin, K78	4.65	53.32322, -6.46451

Figure 4-11 TPR point receptor locations (proposed PV array area shown in yellow)

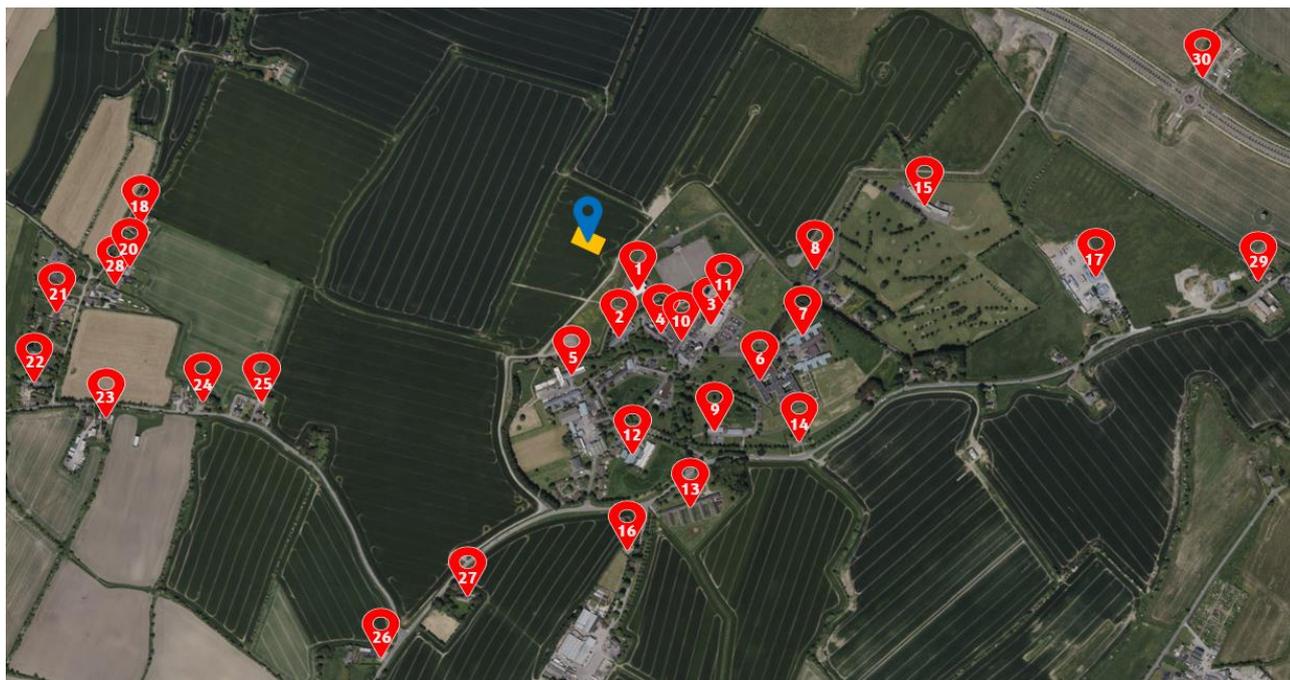
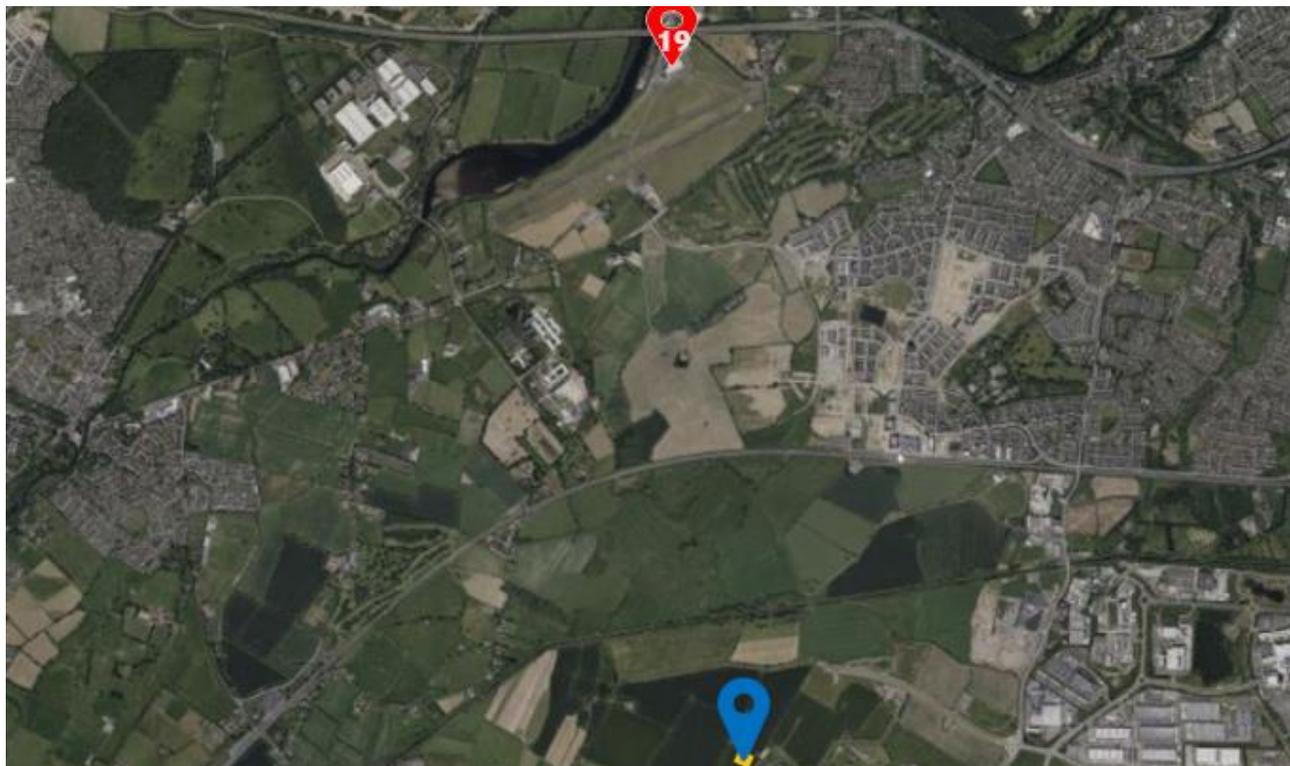


Figure 4-12 Air traffic control tower point receptor at Weston Airport (proposed solar PV array area shown in yellow)



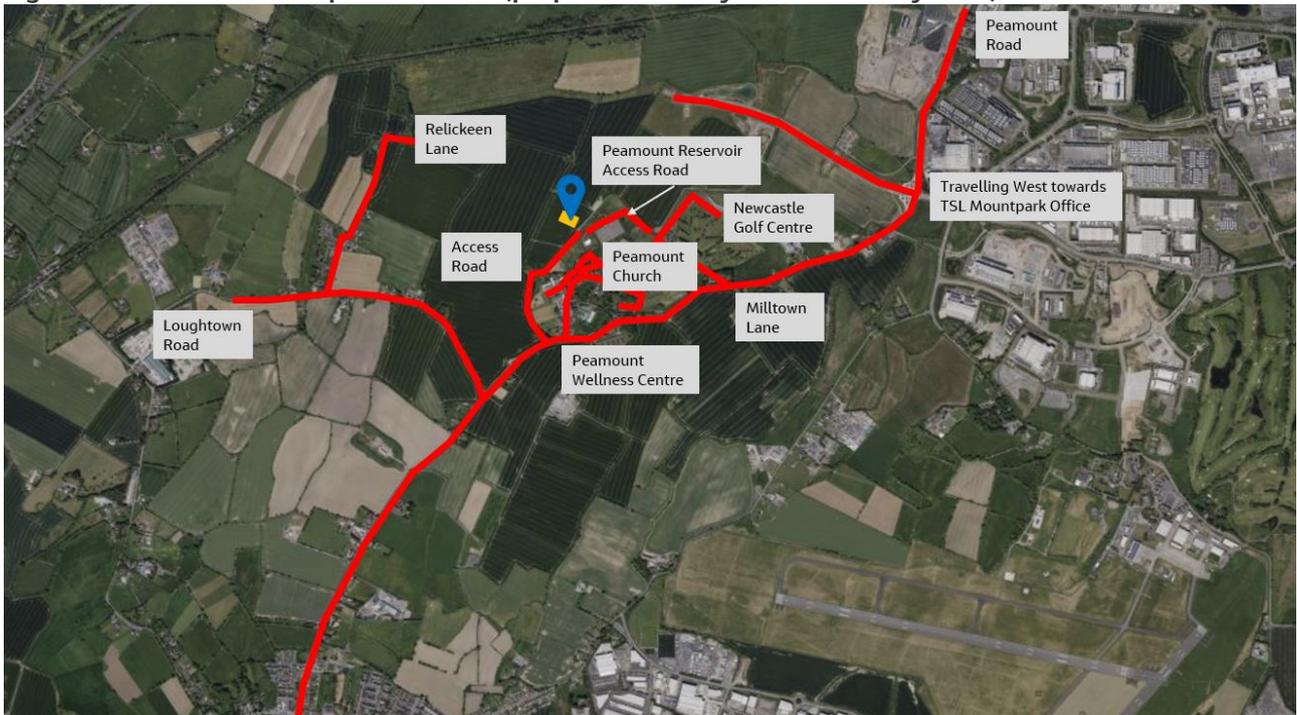
4.4.2 Route Receptors

Ten ground-based route receptors were assessed in this study, which are listed in Table 4-10 and shown in Figure 4-13. No rail receptors were identified near the TPR site.

Table 4-10 TPR route receptors

Description	Type	Receptor Height (m)
Access Road	Road	1.5 / 2.5
Loughtown Road	Road	1.5 / 2.5
Milltown Lane	Road	1.5 / 2.5
Newcastle Golf Centre	Road	1.5 / 2.5
Peamount Church	Road	1.5 / 2.5
Peamount Road	Road	1.5 / 2.5
Peamount Wellness Centre	Road	1.5 / 2.5
Relickeen Lane	Road	1.5 / 2.5
Travelling West towards TSL	Road	1.5 / 2.5
Mountpark Office	Road	1.5 / 2.5
Peamount Reservoir Access Road	Road	1.5 / 2.5

Figure 4-13 TPR route receptor locations (proposed PV array area shown in yellow)



4.4.3 Flight Path Receptors

Six 2-mile flight path receptors, were modelled, representing all the approaches to the runways at Weston Airport and Casement Aerodrome located approximately 4km (2.5 miles) north and 2km (1.2 miles) southeast of the proposed PV array respectively. These flight path receptors are shown in Figure 4-14 and Figure 4-15.

Figure 4-14 TPR 2-mile flight paths assessed at Weston Airport (proposed PV array area shown in yellow)

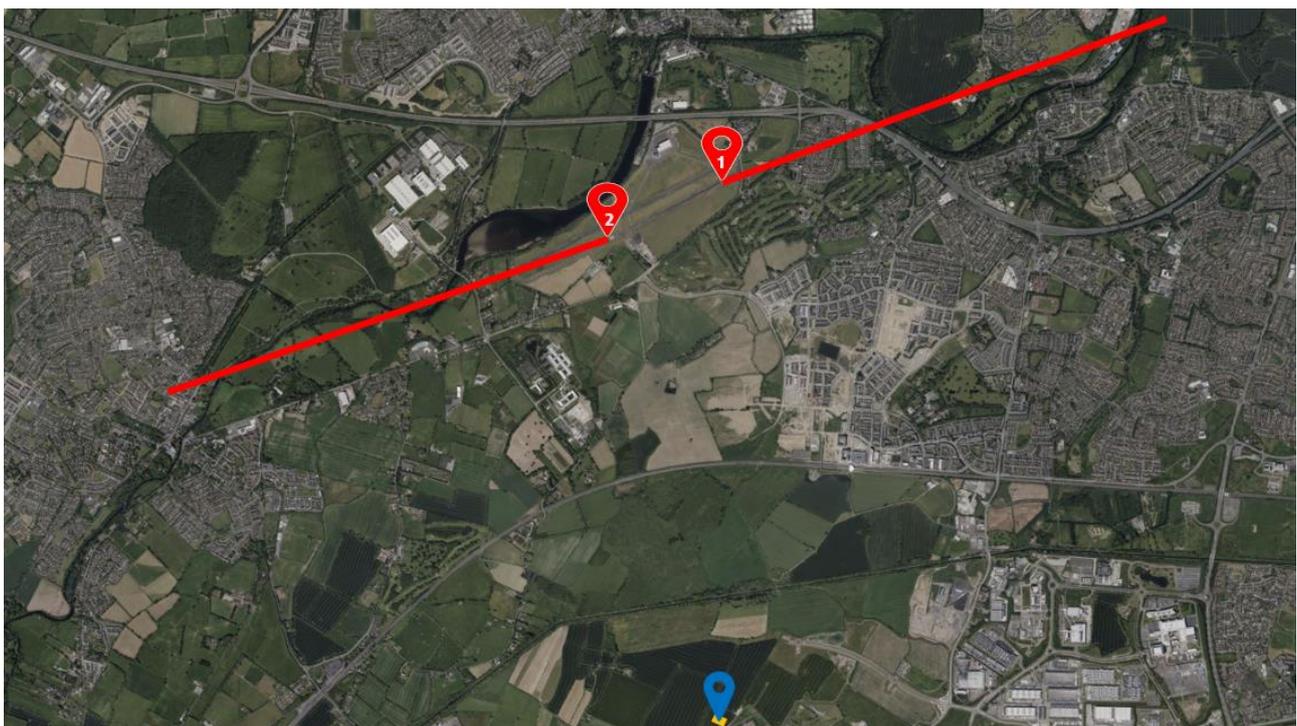
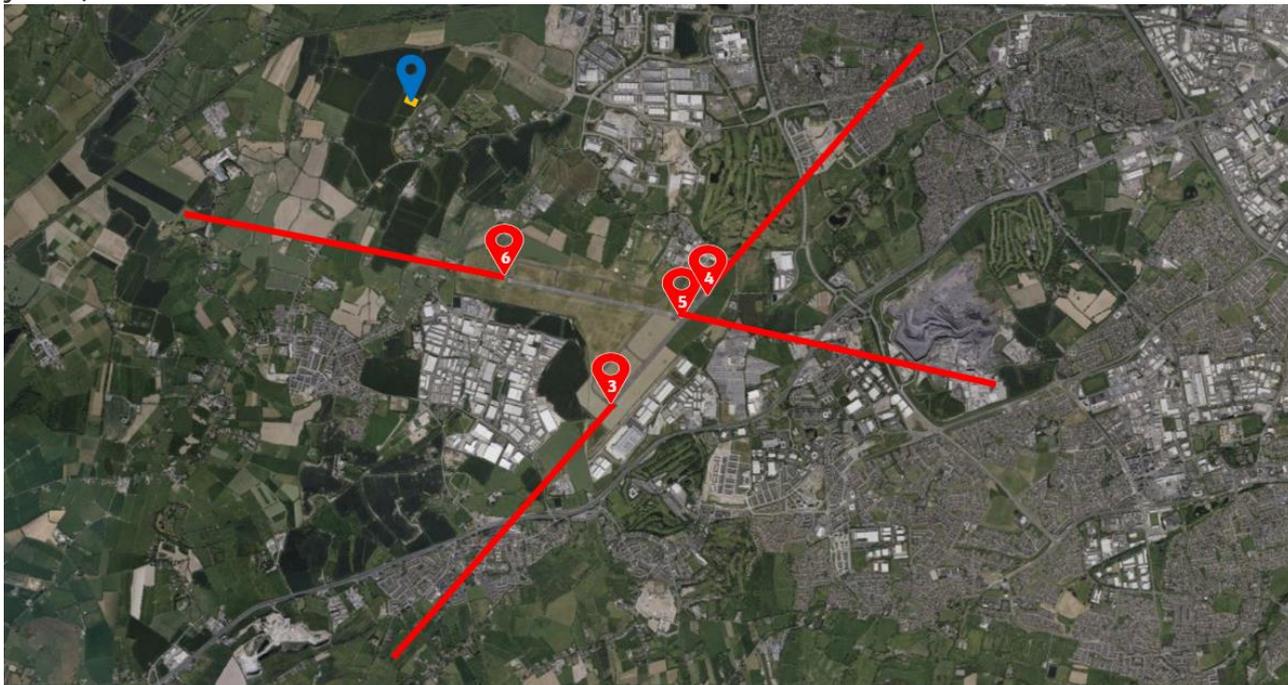


Figure 4-15 TPR 2-mile flight paths assessed at Casement Aerodrome (proposed PV array area shown in yellow)



4.4.4 Obstructions

Obstructions between the PV and receptors were modelled following an initial identification of yellow glare at the site. A new hedgerow has been proposed running alongside the Peamount reservoir access road to mitigate this, modelled at a height of 2.5m. The existing treeline between the array and the Peamount hospital buildings was also modelled to examine its effects on reducing glare experienced by one of the point receptors on the east of the hospital boundary. This was modelled at a height of 5m. Figure 4-16 and Figure 4-17 show the obstructions in pink relative to receptors.

Figure 4-16 TPR point receptor location (proposed PV array area shown in yellow; the pink line indicates the obstruction modelled in GlareGauge)



Figure 4-17 TPR route receptor location (proposed PV array area shown in yellow; the pink line indicates the obstruction modelled in GlareGauge)



4.5 Flow Control Valve Analysis Elements

4.5.1 Discrete Observation (Point) Receptors

20 discrete point receptors were assessed at the FCV, these are listed in Table 4-11. Figure 4-18 and Figure 4-19 show the point receptor locations relative to the proposed PV array.

Table 4-11 FCV point receptors

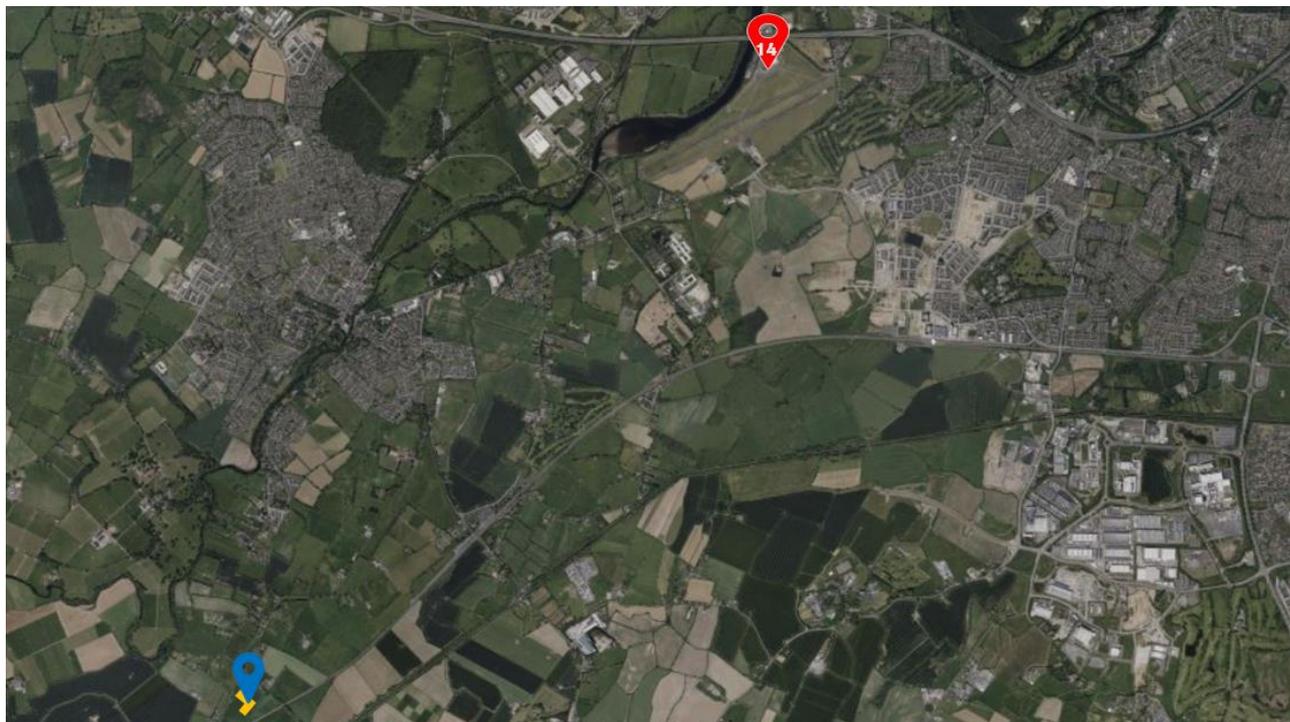
ID	Description	Receptor Height (m)	Location (latitude, longitude)
OP1	Property on Temple Mills Road, 13 th Lock, County Kildare, W23	4.65	53.30916, -6.55543
OP2	Property on Temple Mills Road, 13 th Lock, County Kildare, W23	4.65	53.30846, -6.55609
OP3	Property on Temple Mills Road, 13 th Lock, County Kildare, W23 (south-west of the proposed PV array)	4.65	53.30796, -6.55647
OP4	Property on L2008, 13 th Lock, County Kildare, W23	4.65	53.30671, -6.55868
OP5	Property on Unnamed Road, County Kildare, W23	4.65	53.31042, -6.55831
OP6	Property on Unnamed Road, County Kildare, W23	4.65	53.31243, -6.55853
OP7	Property on Lyons Road, County Kildare, W23	4.65	53.31172, -6.55165
OP8	Property on Lyons Road, County Kildare, W23	4.65	53.31134, -6.55094
OP9	Property on Lyons Road, County Kildare, W23	4.65	53.31101, -6.55028
OP10	Property on Unnamed Road, County Kildare, W23	4.65	53.31276, -6.55558
OP11	Property on Unnamed Road, County Kildare, W23	4.65	53.31321, -6.55718
OP12	Property on Lyons Road, County Kildare, W23	4.65	53.31077, -6.54992
OP13	The Farm, Lyons Road, County Kildare, W23	4.65	53.31137, -6.54909
14-ATCT	Air Traffic Control Tower- (Weston Airport) M4, Lucan-St. Helens DED 1986, Lucan, County Dublin, W23	13.65	53.35561, -6.48953
OP15	The Mill Restaurant and Terrace, Grand Canal Greenway, 13 th Lock, County Kildare, W23	4.65	53.30139, -6.55496
OP16	Cliff at Lyons (Hotel), Lyons Road, Newcastle DED 1986, South Dublin, W23	4.65	53.3065, -6.54223
OP17	Lyons Demesne Estate, Lyons House, The Village at Lyons, 13 th Lock, County Kildare, W23	4.65	53.30124, -6.54513

ID	Description	Receptor Height (m)	Location (latitude, longitude)
OP18	Barn on Lyons Road, County Kildare, W23	4.65	53.3078, -6.54586
OP19	Property on L2008, 13 th Lock, County Kildare, W23	4.65	53.30552, -6.55828
OP20	Property on L2008, 13 th Lock, County Kildare, W23	4.65	53.30515, -6.55852

Figure 4-18 FCV point receptor locations (proposed solar PV array area shown in yellow)



Figure 4-19 FCV air traffic control tower point receptor at Weston Airport (proposed solar PV array area shown in yellow)



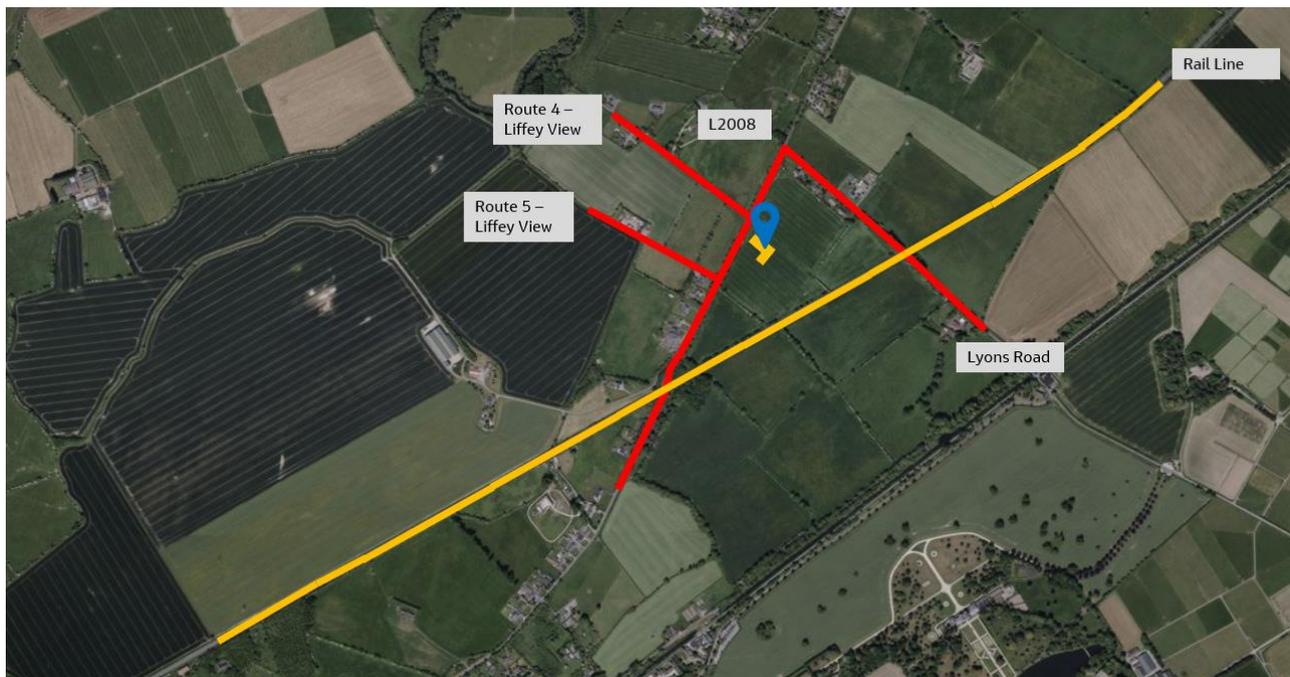
4.5.2 Route Receptors

Five ground-based route receptors were assessed in this study, which are listed in Table 4-12 and shown in Figure 4-20. A rail line runs to the southeast of the FCV, this has been modelled at a height of 3m.

Table 4-12 FCV route receptors

Description	Type	Receptor Height (m)
L2008	Road	1.5 / 2.5
Lyons Road	Road	1.5 / 2.5
Route 4- Liffey View	Road	1.5 / 2.5
Route 5- Liffey View	Road	1.5 / 2.5
Rail Line	Railway	3

Figure 4-20 FCV route receptors (proposed PV array area shown in yellow)



4.5.3 Flight Path Receptors

Six 2-mile flight path receptors have been modelled, representing all the approaches to the runways at Weston Airport and Casement Aerodrome, located approximately 6.5km (4 miles) northeast and 7.5km (4.6 miles) southeast of the proposed PV array respectively. These two flight path receptors are shown in Figure 4-21 and Figure 4-22.

Figure 4-21 FCV 2-mile flight paths assessed at Weston Airport (the proposed solar PV array is shown in yellow)

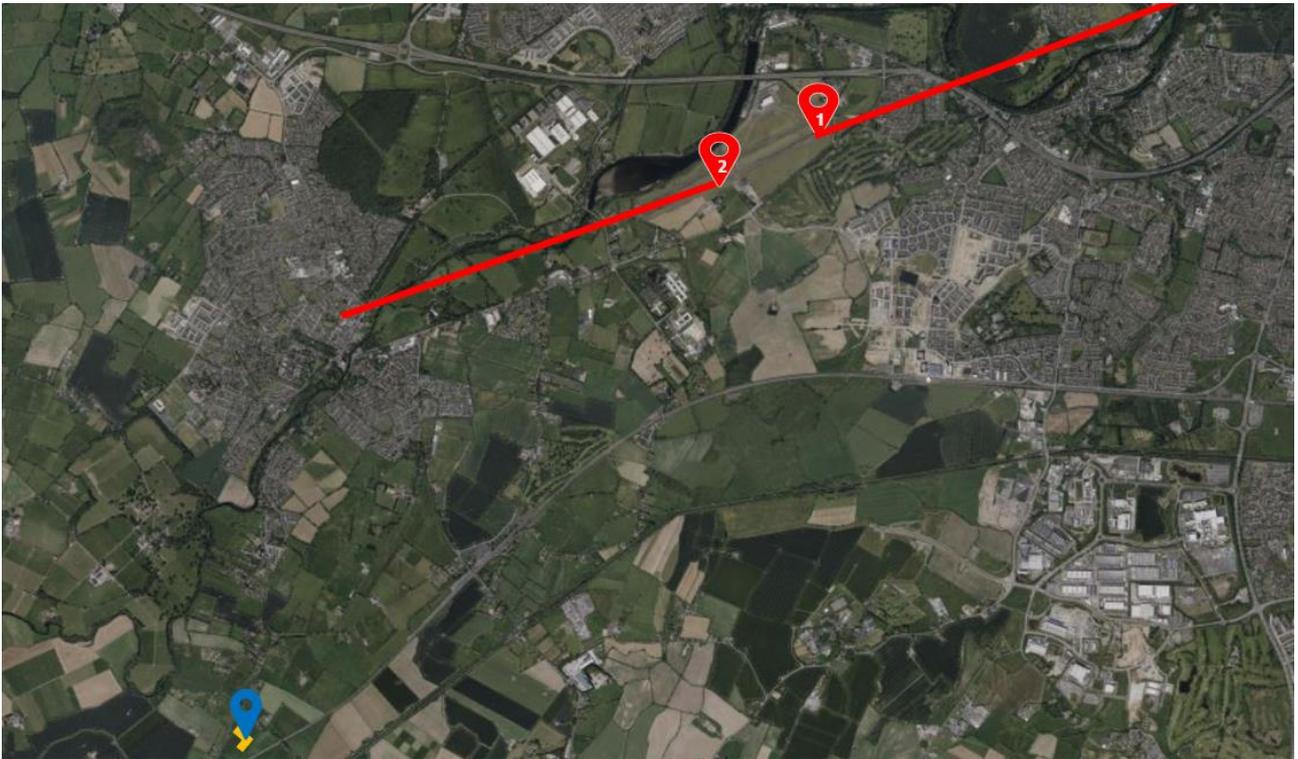


Figure 4-22 FCV 2-mile flight paths assessed at Casement Aerodrome (the proposed solar PV array is shown in yellow)



4.5.4 Obstructions

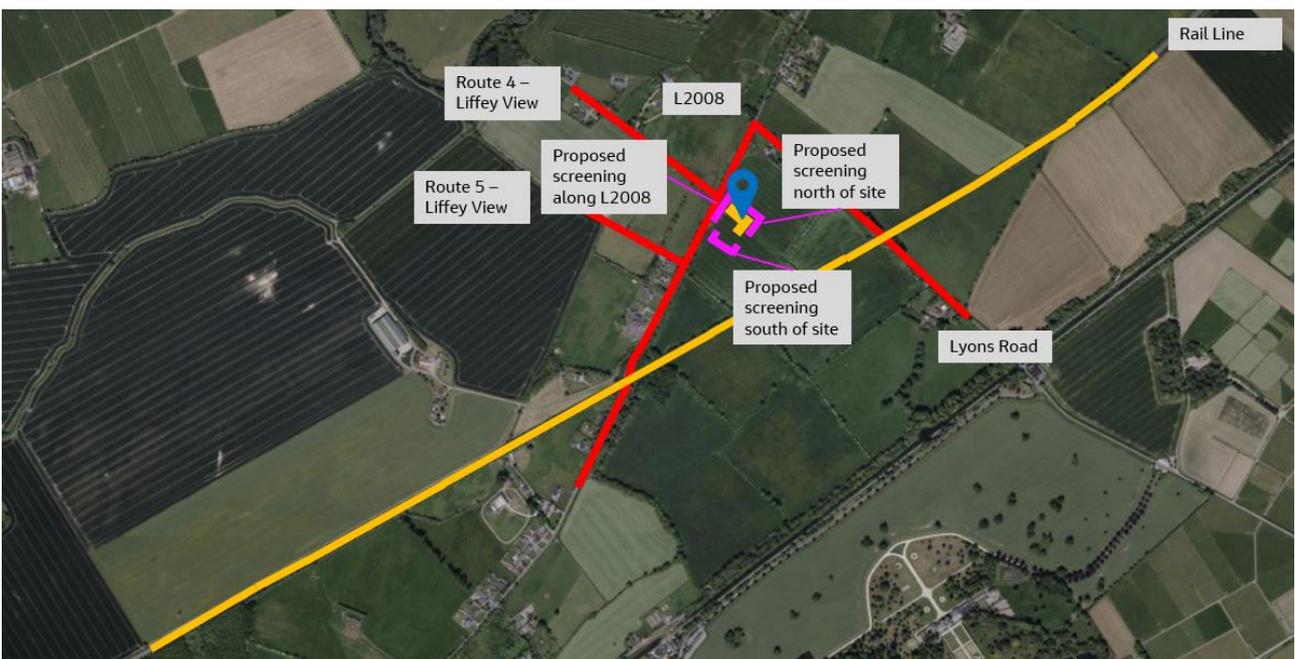
Obstructions between the PV and receptors were modelled following an initial identification of yellow glare at the site. The tree-lined hedgerow located to the west of the array, adjacent to the L2008, was included as an obstruction in the model.

Figure 4-23 and Figure 4-24 show the obstructions in pink, relative to receptors. Additionally, proposed hedgerows to the north and south of the array were also modelled as obstructions. All hedgerows have been modelled as a 3.5m high obstruction. To mitigate instances of yellow glare, the screening proposed along L2008 and the site's southern boundary has been extended up to the site entrance. Further details are provided in Section 6.2.

Figure 4-23 FCV point receptor location (proposed PV array area shown in yellow; the pink line indicates the obstruction modelled in GlareGauge)



Figure 4-24 FCV route receptor location (proposed PV array area shown in yellow; the pink line indicates the obstruction modelled in GlareGauge)



5. Results

The following section outlines the results of the analysis conducted in GlareGauge, detailing the significance of the impact of glare at each receptor. The results have been presented through GIS figures showing the magnitude of glare experienced, visually differentiating such receptors from those that experience no glare. The tables set out the duration of glare on an annual basis. Where yellow glare has been identified additional graphs have been provided detailing the time of day/year in which glare occurs. Due to the number of receptors analysed for each array and the quantity of data only those receptors experiencing glare are reported in Section 5. If a receptor is not specified it is because no glare was identified, and it experiences 0 mins of glare of any intensity. The full results for all receptors are presented in Appendix A - Appendix E.

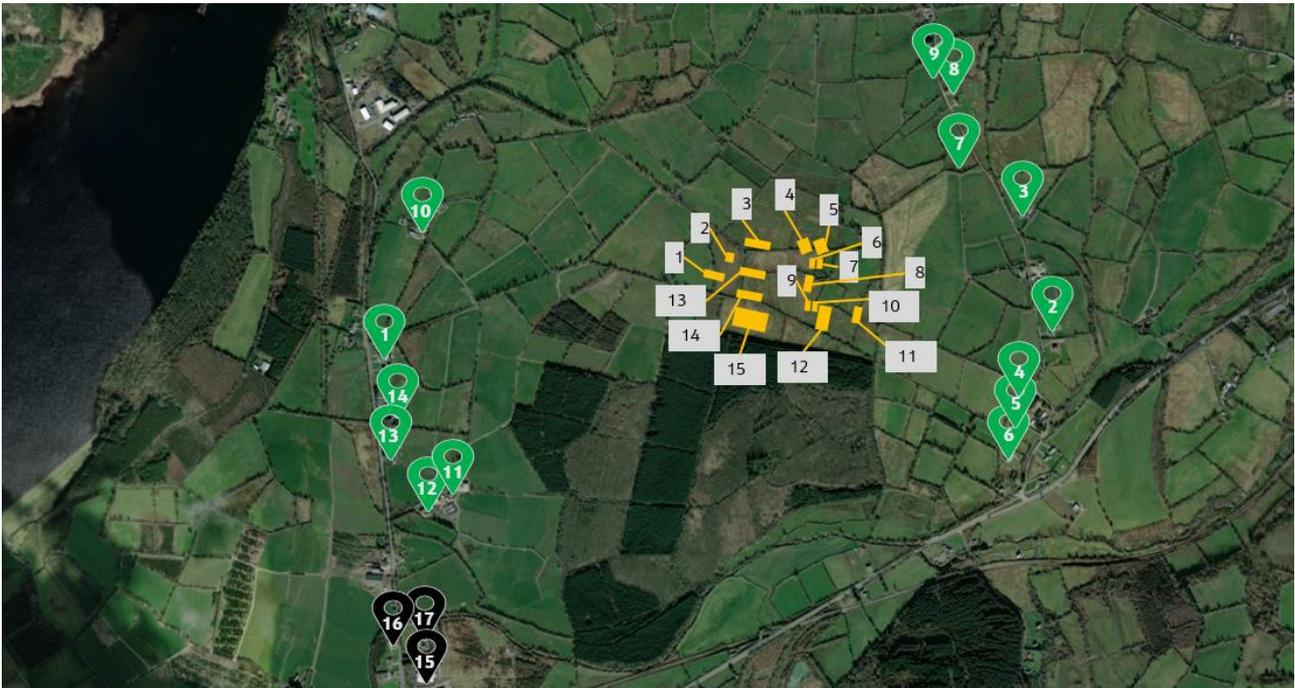
For clarity, the tables and figures in this section outline the magnitude of glare prior to the modelling of any obstructions. This provides a clear representation of the potential impact of the arrays. In all instances where glare resulted in a significant impact to the receptors, mitigations have been modelled to reduce the significance of the impact within an acceptable threshold. The full results for all receptors are presented in Appendix A - O, which includes the results for obstruction modelling. Where obstructions have been modelled, their impact and associated mitigation requirements are discussed within the relevant subsections of the results. This approach aligns with the methodology outlined in Section 3.

5.1 Point Receptor Results

5.1.1 Water Treatment Plant (WTP)

The analysis shows that potential glare is predicted at most of the point receptors east and west of the site at discrete points in the year. This glare is not continuous. Further information is contained in Appendix A. The receptors further southwest experience no glare. The receptors potentially experiencing glare are shown in Figure 5-1. Our results are conservative. Beyond what is outlined in Section 4 as obstructions, our models assume there is no additional terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given the flora surrounding the arrays, , and the topography, the duration of glare experienced at each receptor will likely be lower than that reported. Glare estimated at all point receptors are in the 'green' glare zones, resulting in a low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. No yellow or red glare was detected at the point receptors proximate to the WTP. The impact of glare detected at the site is therefore considered low requiring no further mitigation.

Figure 5-1 WTP point receptors with predicted glare (black indicates no glare is predicted)



5.1.1.1 Chemical Dosing Manifold Building

Table 5-1 Point receptor glare for the chemical dosing manifold building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	1570	0
OP4	1230	0
OP5	1988	0
OP6	756	0
OP14	640	0

5.1.1.2 Control Building

Table 5-2 Point receptor glare for the control building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	566	0
OP2	75	0
OP4	2008	0
OP5	40	0

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP11	404	0
OP12	392	0
OP14	627	0

5.1.1.3 Field Array

Table 5-3 Point receptor glare for the field array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP2	1117	0
OP4	2182	0
OP5	742	0
OP11	1096	0
OP12	1014	0
OP13	1059	0
OP14	846	0

5.1.1.4 Lamellar Clarifiers Building

Table 5-4 Point receptor glare for the lamellar clarifiers building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP10	2653	0

5.1.1.5 Large Field Array

Table 5-5 Point receptor glare for the large field array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	730	0
OP2	981	0
OP4	2041	0
OP5	2560	0
OP6	1353	0

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP11	816	0
OP12	721	0
OP13	2323	0
OP14	2373	0

5.1.1.6 Sludge Dewatering Building 1 - East

Table 5-6 Point receptor glare for the sludge dewatering building 1 - east array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP2	874	0
OP3	953	0
OP7	1096	0
OP8	1745	0
OP9	390	0

5.1.1.7 Sludge Dewatering Building 2 - East

Table 5-7 Point receptor glare for the sludge dewatering building 2 – east array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP3	1420	0
OP7	1155	0
OP8	1193	0
OP9	1238	0

5.1.1.8 Sludge Dewatering Building 2 - West

Table 5-8 Point receptor glare for the sludge dewatering building 2 – west array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP10	1270	0

5.1.1.9 Sludge Storage Building 1

Table 5-9 Point receptor glare for the sludge storage building 1 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP10	688	0

5.1.1.10 Sludge Storage Building 2

Table 5-10 Point receptor glare for the sludge storage building 2 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP3	3388	0
OP7	2030	0
OP8	1478	0
OP9	1597	0

5.1.1.11 UV Dosing Building

Table 5-11 Point receptor glare for the UV dosing building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP3	1388	0
OP7	1374	0
OP8	1566	0
OP9	1371	0

5.1.1.12 Water Treatment Module 1

Table 5-12 Point receptor glare for the water treatment module 1 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	1318	0
OP4	1274	0
OP5	1947	0
OP6	869	0
OP13	1526	0

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP14	2360	0

5.1.1.13 Water Treatment Module 2

Table 5-13 Point receptor glare for the water treatment module 2 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	1278	0
OP2	508	0
OP4	1668	0
OP5	726	0
OP10	177	0
OP13	381	0
OP14	1438	0

5.1.1.14 Water Treatment Module 3

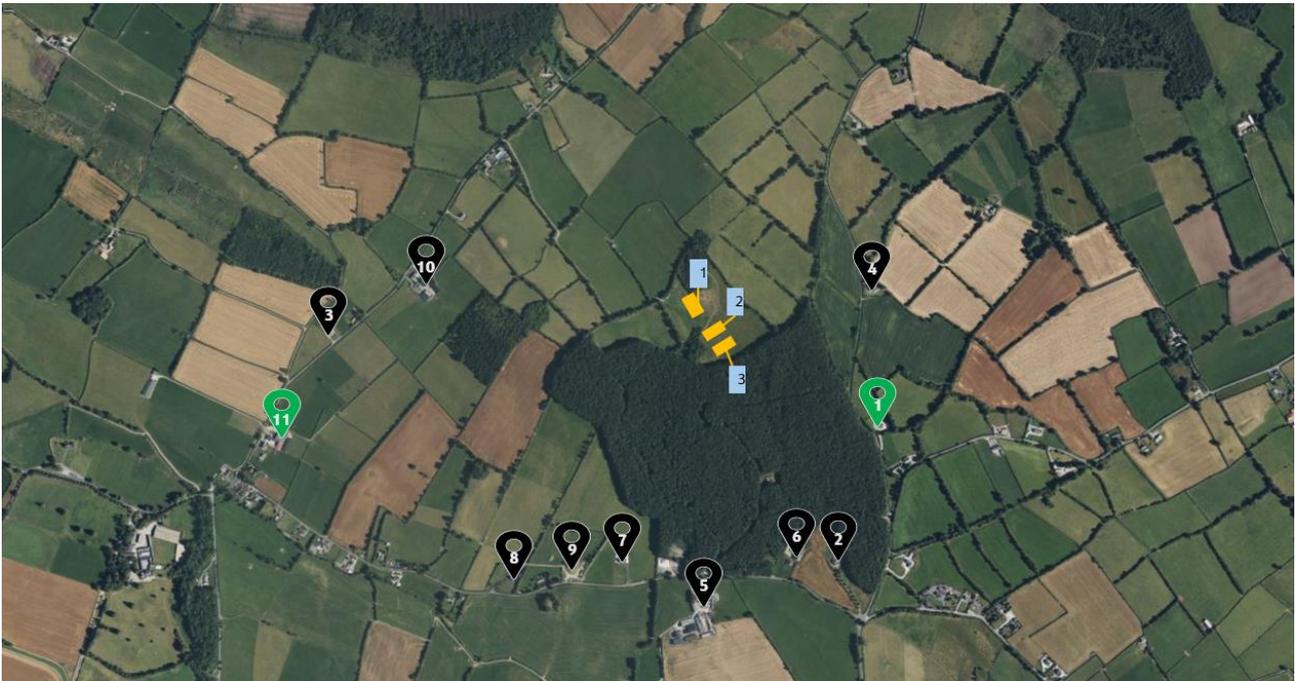
Table 5-14 Point receptor glare for the water treatment module 3 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	734	0
OP2	321	0
OP4	1230	0
OP14	307	0

5.1.2 Break Pressure Tank (BPT)

The analysis shows that potential glare is predicted at only a small selection of the point receptors east and west of the site at discrete points in the year. This glare is not continuous. Further details are provided in Appendix B. The majority of receptors experience no glare especially those directly south of the site. The receptors potentially experiencing glare are shown in Figure 5-2. Our results are conservative. Beyond what is outlined in Section 4 as obstructions, our models assume there is no additional terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given the flora surrounding the arrays, and the topography, the duration of glare experienced at each receptor will likely be lower than that reported. Glare estimated at all point receptors are in the 'green' glare zones, resulting in a low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. No yellow or red glare was detected at the point receptors proximate to the BPT. The impact of glare detected at the site is therefore considered low requiring no further mitigation.

Figure 5-2 BPT point receptors with predicted glare (black indicates no glare is predicted)



5.1.2.1 PV Array 1 – Array on Tank

Table 5-15 Point receptor glare for PV array 1 – array on tank

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP11	1060	0

5.1.2.2 PV Array 2 – Control Building Rooftop Array

Table 5-16 Point receptor glare for PV array 2 – control building rooftop array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	1076	0
OP11	370	0

5.1.2.3 PV Array 3 – Array to South of Site

Table 5-17 Point receptor glare for PV array 3 – array to south of site

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	1491	0
OP11	227	0

5.1.3 Booster Pumping Station (BPS)

The analysis shows that potential glare is predicted at only a small selection of the point receptors directly east of the site at discrete points in the year. This glare is not continuous. Further information is provided in Appendix C. The majority of receptors experience no glare. The receptors potentially experiencing glare are shown in Figure 5-3. Our results are conservative. Beyond what is outlined in Section 4 as obstructions, our models assume there is no additional terrain, landscape, or other obstructions between the proposed PV array and the

receptors. Given the flora surrounding the arrays, the duration of glare experienced at each receptor will likely be lower than that reported. Glare estimated at all point receptors are in the 'green' glare zones, resulting in a low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. No yellow or red glare was detected at the point receptors proximate to the BPS. The impact of glare detected at the site is therefore considered low requiring no further mitigation.

Figure 5-3 BPS point receptors with predicted glare (black indicates no glare is predicted)

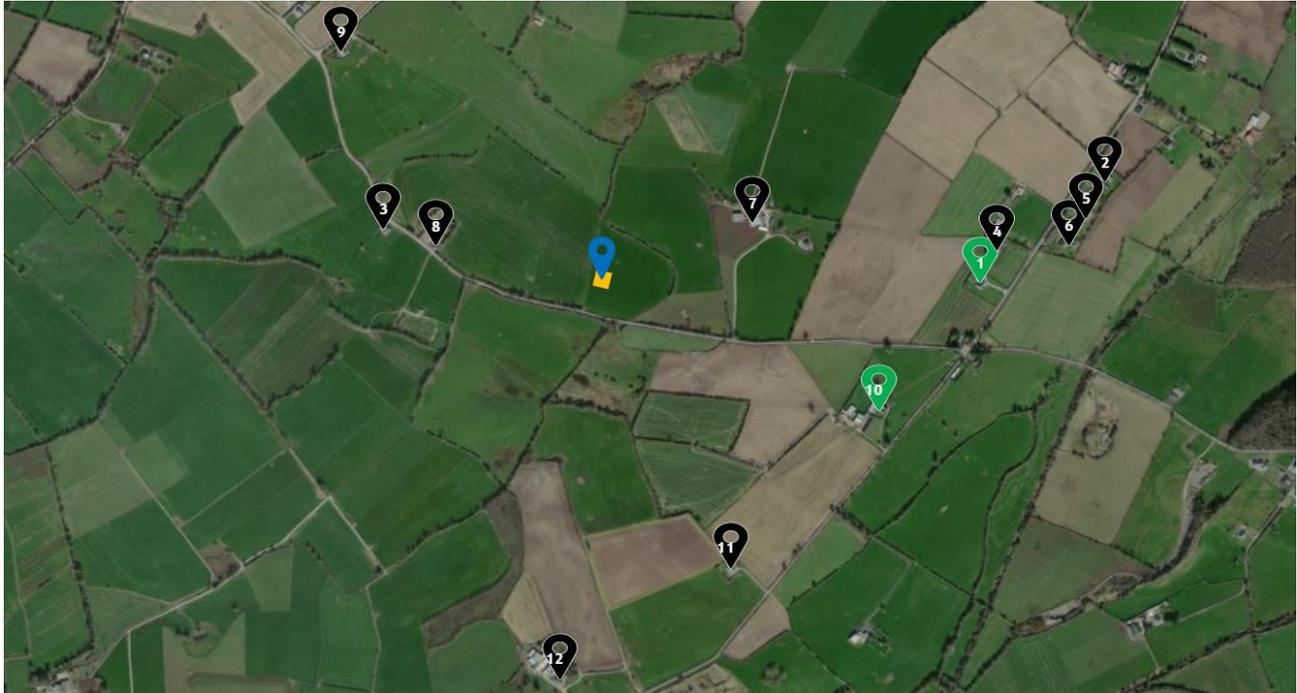


Table 5-18 Point receptor glare for the BPS PV array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	313	0
OP10	942	0

5.1.4 Termination Point Reservoir (TPR)

The analysis shows that potential glare is predicted at a number of point receptors east and west of the site at discrete points in the year. This glare is not continuous. Further information is contained in Appendix D. The receptors further south experience no glare. The receptors potentially experiencing glare are displayed in Figure 5-4. Our results are conservative. Beyond what is outlined in Section 4 as obstructions, our models assume there is no additional terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given the flora surrounding the arrays, the duration of glare experienced at each receptor will likely be lower than that reported. Glare estimated at all point receptors are in the 'green' glare zones, resulting in a low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. No yellow or red glare was detected at the point receptors proximate to the TPR. The impact of glare detected at the site is therefore considered low requiring no further mitigation.

No glare was detected at Weston Airport's air traffic control tower (19-ATCT).

Our analysis prior to modelling any obstructions detected the presence of green glare at observation point 7 (OP7), a Peamount Hospital building. Given the sensitive nature of operations at hospitals and the potential impact to occupants at this building, further analysis was conducted examining the impact of existing vegetation in obstructing the glare. The treeline between the PV array and OP7 was modelled as a 5m high

obstruction in GlareGauge shown in Figure 4-17. This further analysis indicated that the existing treeline is sufficient to remove the occurrence of green glare at OP7.

Figure 5-4 TPR point receptors with predicted glare (black indicates no glare predicted)

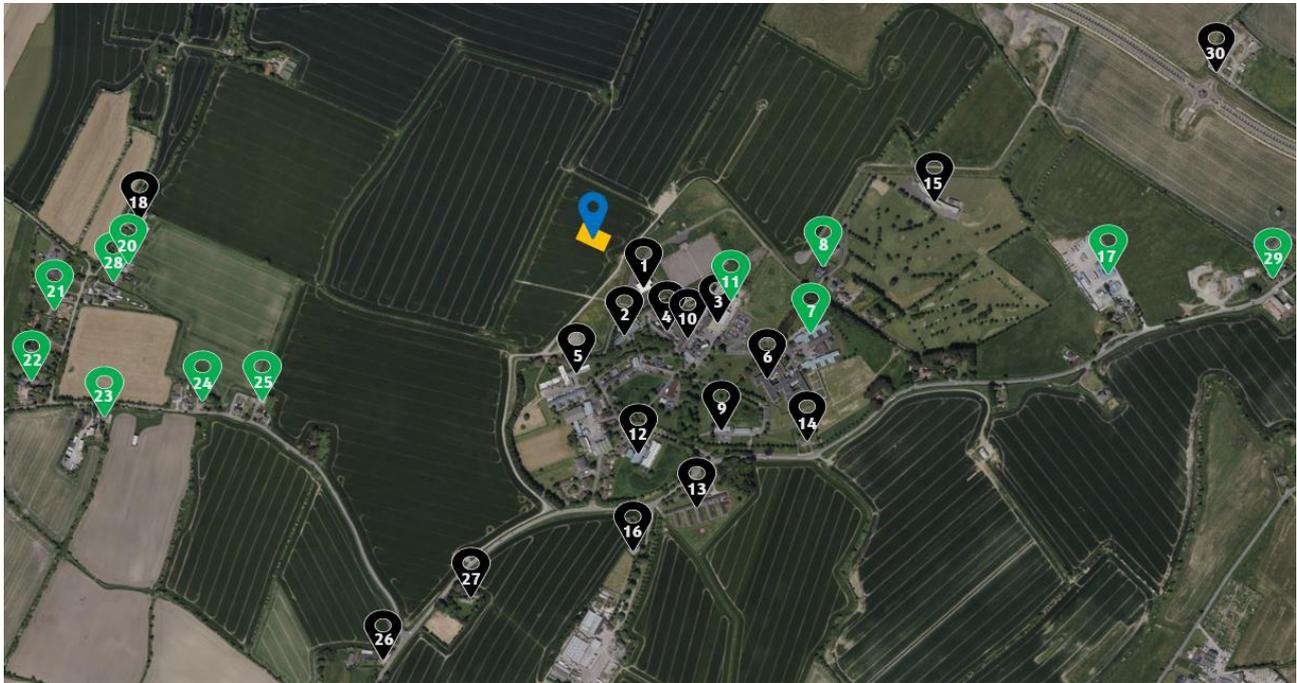


Table 5-19 Point receptor glare for the TPR PV array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP7	1163	0
OP8	1121	0
OP11	1244	0
OP17	298	0
OP20	169	0
OP21	456	0
OP22	873	0
OP23	1667	0
OP24	1496	0
OP25	1049	0
OP28	222	0
OP29	268	0

5.1.5 Flow Control Valve (FCV)

The analysis shows that potential glare is predicted at a couple of point receptors east and west of the site at discrete points in the year. This glare is not continuous. Further detail is provided in 0. The receptors further north and south experience no glare. The receptors potentially experiencing glare are shown in Figure 5-5. Our results are conservative. Beyond what is outlined in Section 4 as obstructions, our models assume there is no additional terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given

the flora surrounding the arrays, the duration of glare experienced at each receptor will likely be lower than that reported. Glare estimated at all point receptors are in the 'green' glare zones, resulting in a low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. No yellow or red glare was detected at the point receptors proximate to the FCV. The impact of glare detected at the site is therefore considered low requiring no further mitigation.

No glare was detected at Weston Airport's air traffic control tower (14-ATCT).

Figure 5-5 FCV point receptors with predicted glare (black indicates no glare predicted)



Table 5-20 Point receptor glare for the FCV PV array

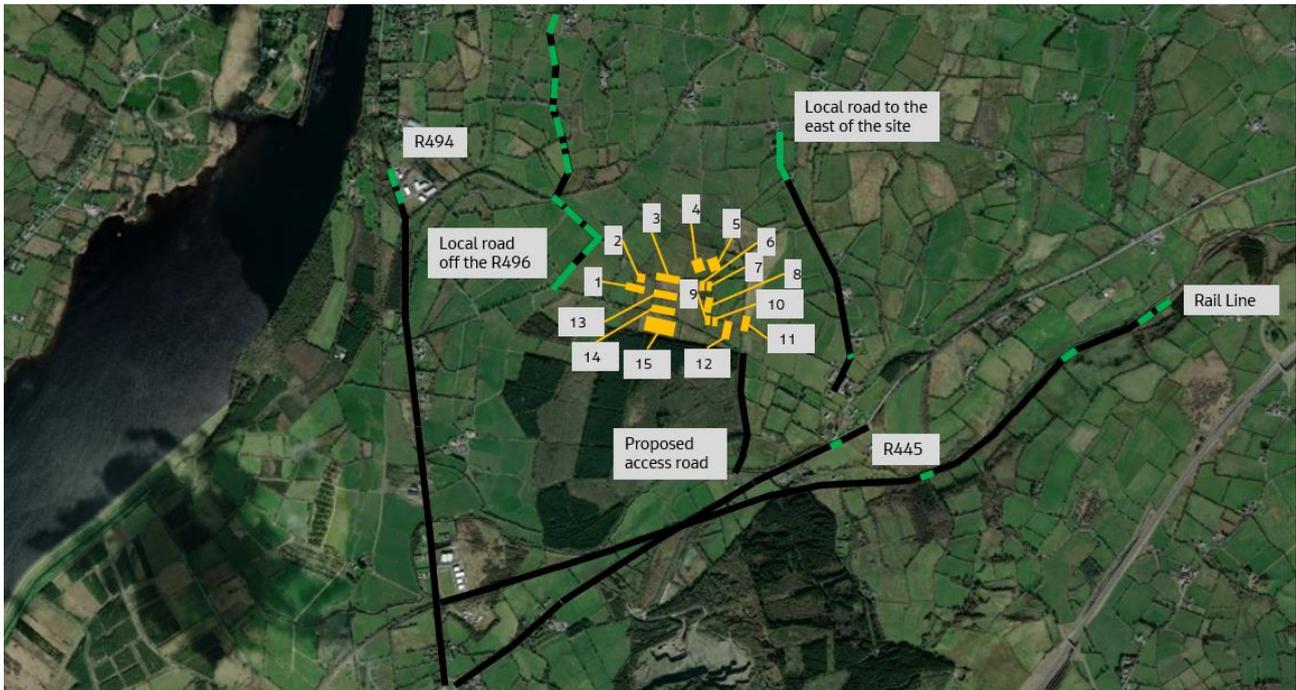
ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP5	224	0
OP18	418	0

5.2 Route Receptor Results

5.2.1 Water Treatment Plant (WTP)

The analysis shows that potential glare is predicted at various places across the route receptors predominantly to the east and northwest of the site. Most routes experience no glare at all along much of their length. Details of the annual duration of glare predicted on each route and the locations at which it occurs are provided in Figure 5-6 and the tables below. As with the point receptors, our results are conservative. Beyond what is outlined in Section 4 as obstructions, our models assume there is no additional terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given the flora surrounding the arrays, and the topography, the duration of glare experienced at each receptor will likely be lower than that reported. Glare estimated at all route receptors is in the 'green' glare zones, resulting in a low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. No yellow or red glare was detected at the route receptors proximate to the WTP. The impact of glare detected at the site is therefore considered low requiring no further mitigation.

Figure 5-6 WTP route receptors with predicted glare (black indicates no glare is predicted)



5.2.1.1 Chemical Dosing Manifold Building

Table 5-21 Route receptor glare from the chemical dosing manifold building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road off the R496	182	0
R445	435	0
Rail Line	1,878	0

5.2.1.2 Control Building

Table 5-22 Route receptor glare from the control building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Line	289	0

5.2.1.3 Field Array

Table 5-23 Route receptor glare from the field array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Line	871	0

5.2.1.4 Lamellar Clarifiers Building

Table 5-24 Route receptor glare from the lamellar clarifiers building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road off the R496	11731	0
R494	1535	0

5.2.1.5 Large Field Array

Table 5-25 Route receptor glare from the large field array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
R445	624	0
Rail Line	3301	0

5.2.1.6 Sludge Dewatering Building 1 - East

Table 5-26 Route receptor glare from the sludge dewatering building 1 - east array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	1136	0
Rail Line	2353	0

5.2.1.7 Sludge Dewatering Building 1 - West

Table 5-27 Route receptor glare from the sludge dewatering building 1 - west array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road off the R496	3353	0
R494	880	0

5.2.1.8 Sludge Dewatering Building 2 - East

Table 5-28 Route receptor glare from the sludge dewatering building 2 - east array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	2037	0

Rail Line	1557	0
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5.2.1.9 Sludge Dewatering Building 2 - West

Table 5-29 Route receptor glare from the sludge dewatering building 2 - west array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road off the R496	4696	0
R494	214	0

5.2.1.10 Sludge Storage Building 1

Table 5-30 Route receptor glare from the sludge storage building 1 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road off the R496	5801	0
R494	23	0

5.2.1.11 Sludge Storage Building 2

Table 5-31 Route receptor glare from the sludge storage building 2 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	3114	0
Rail Line	425	0

5.2.1.12 UV Dosing Building

Table 5-32 Route receptor glare from the UV dosing building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	2020	0
Rail Line	2246	0

5.2.1.13 Water Treatment Module 1

Table 5-33 Route receptor glare from the water treatment module 1 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
R445	506	0
Rail Line	1811	0

5.2.1.14 Water Treatment Module 2

Table 5-34 Route receptor glare from the water treatment module 2 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road off the R496	309	0
Rail Line	624	0

5.2.1.15 Water Treatment Module 3

Table 5-35 Route receptor glare from the water treatment module 3 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	475	0
Local road off the R496	739	0
Rail Line	61	0

5.2.2 Break Pressure Tank (BPT)

The analysis shows that potential glare is predicted at various places across the route receptors predominantly to the southeast and west of the site. Most routes experience no glare at all along much of their length. Details of the annual duration of glare predicted on each route and the locations at which it occurs are provided in Figure 5-7 and the tables below. Our results are conservative. Beyond what is outlined in Section 4 as obstructions, our models assume there is no additional terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given the flora surrounding the arrays, and the topography, the duration of glare experienced at each receptor will likely be lower than that reported. The results indicated yellow glare along the proposed access road into the site. Without mitigative actions this would have an impact on drivers on the road. A hazard plot of this glare can be seen in Figure 5-8. All other glare detected is categorised as green glare with a low impact and therefore no mitigation is required.

An analysis of the screening effect of vegetation planting on the yellow glare was undertaken. The existing treeline to the south of the site and the hedgerow, proposed by the landscaping team, along the proposed access road were modelled as obstructions to glare, as described in Section 4.2.4. The GlareGauge analysis suggests if the current vegetation is maintained at or above 2.5m for the hedgerow along the proposed access

road, and 5m for the treeline to the south of the site, instances of yellow glare are no longer detected. It should be noted that the access road falls within the site boundary and is not for public use. Measures for dealing with the yellow glare therefore ultimately fall under site Health, Safety and Environmental (HSE) policy of the site owners and/or operators.

With the screening vegetation considered, glare estimated at all route receptors are in the 'green' glare zones, resulting in a low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. No yellow or red glare was detected at the route receptors proximate to the BPT. The impact of glare detected at the site is therefore considered low requiring no further mitigation. As with the point receptors, our results are conservative and assume in our modelling there is only specified terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given the flora surrounding the arrays, the duration of glare experienced at each receptor will likely be lower.

Figure 5-7 BPT route receptors with predicted glare (black indicates no predicted glare)

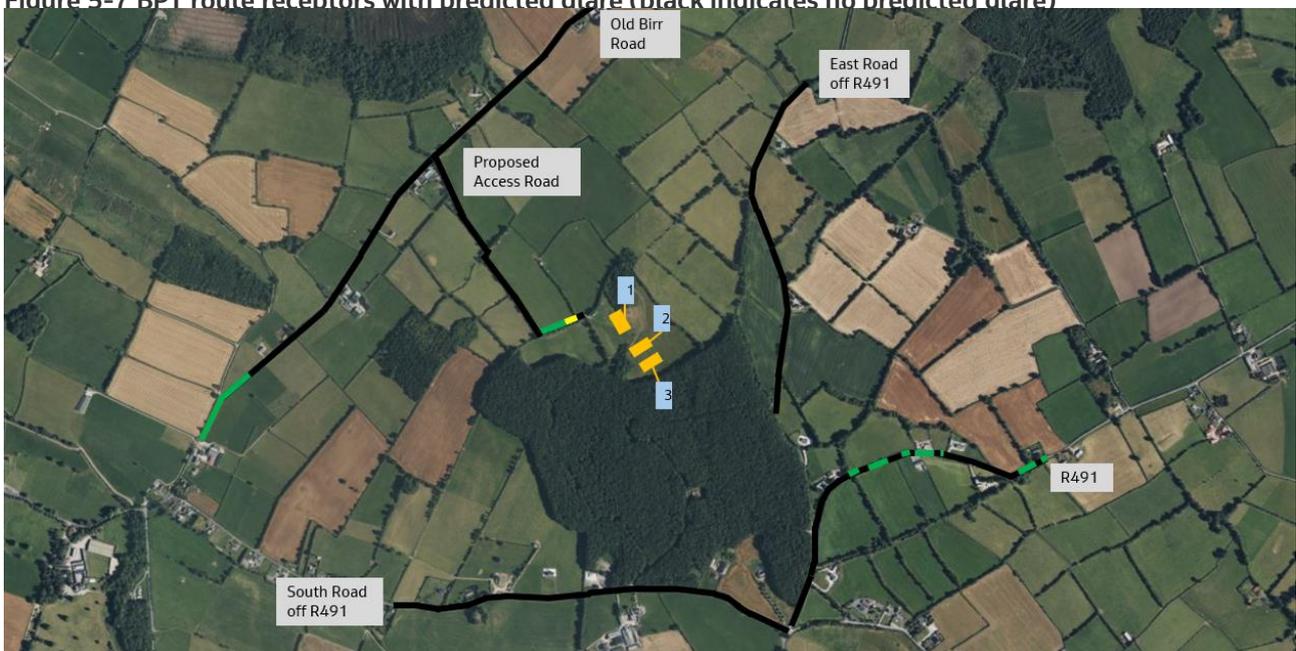
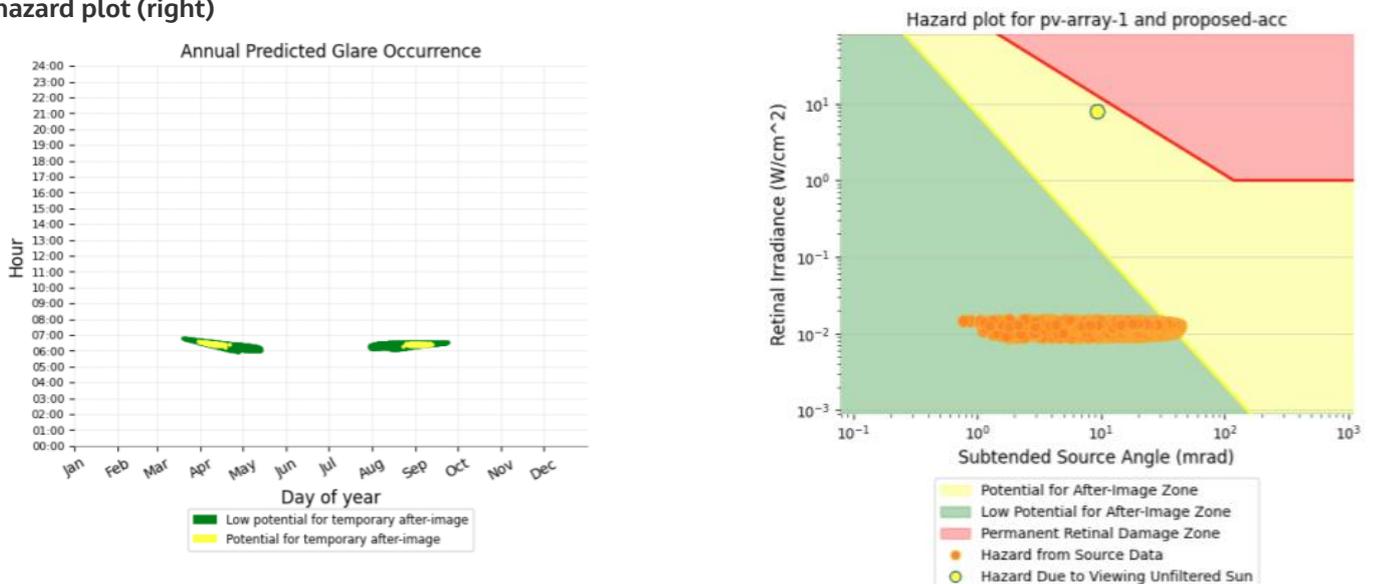


Figure 5-8 Time of day/year of glare occurrence at the proposed access road (left) and associated hazard plot (right)



5.2.2.1 PV Array 1 – Array on Tank

Table 5-36 Route receptor glare at PV array 1 – array on tank

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Old Birr Road	1269	0
Proposed access road	1518	244
R491	3403	0

5.2.2.2 PV Array 2 – Control Building Rooftop Array

Table 5-37 Route receptor glare at PV array 2 – control building rooftop array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Old Birr Road	276	0
R491	3544	0

5.2.2.3 PV Array 3 – Array to South of Site

Table 5-38 Route receptor glare at PV array 3 – array to south of site

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Old Birr Road	113	0
R491	3993	0

5.2.3 Booster Pumping Station (BPS)

The analysis for the BPS shows that potential glare is predicted at some sections along the L3003 to the south of the site. Most routes experience no glare at all along much of their length. Details of the annual duration of glare predicted on each route and the locations at which it occurs are provided in Figure 5-9 and the tables below. As with the point receptors, our results are conservative. Beyond what is outlined in Section 4 as obstructions, our models assume there is no additional terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given the flora surrounding the arrays, the duration of glare experienced at each receptor will likely be lower than that reported. The results indicated the presence of yellow glare along the L3003 to the west of the array. Without mitigative actions this would have an impact on drivers on the road. A hazard plot of this glare can be seen in Figure 5-10. All other glare detected is categorised as green glare with low impact.

An analysis of the screening effect of the Booster Pumping Station (BPS) building, located west of the site and assessed at a height of 5.5m, was undertaken. The GlareGauge analysis suggests instances of yellow glare are no longer detected when this obstruction is accounted for.

With the BPS building considered, glare estimated at all route receptors are in the 'green' glare zones, resulting in a low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. No yellow or red glare was detected at the route receptors proximate to the BPS. The impact of glare detected at the site is therefore considered low requiring no further mitigation.

Figure 5-9 BPS route receptors with predicted glare (black indicates no glare is predicted)

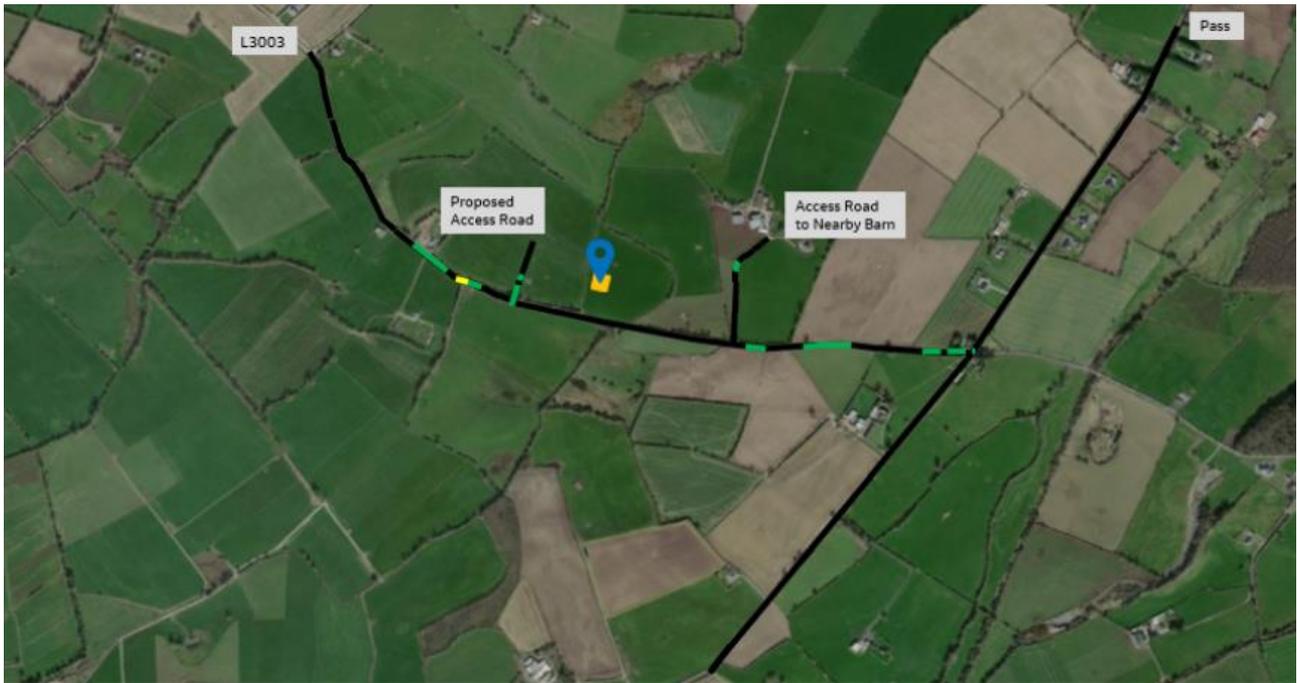


Figure 5-10 Time of day/year of glare occurrence at the L3003 (left) and associated hazard plot (right)

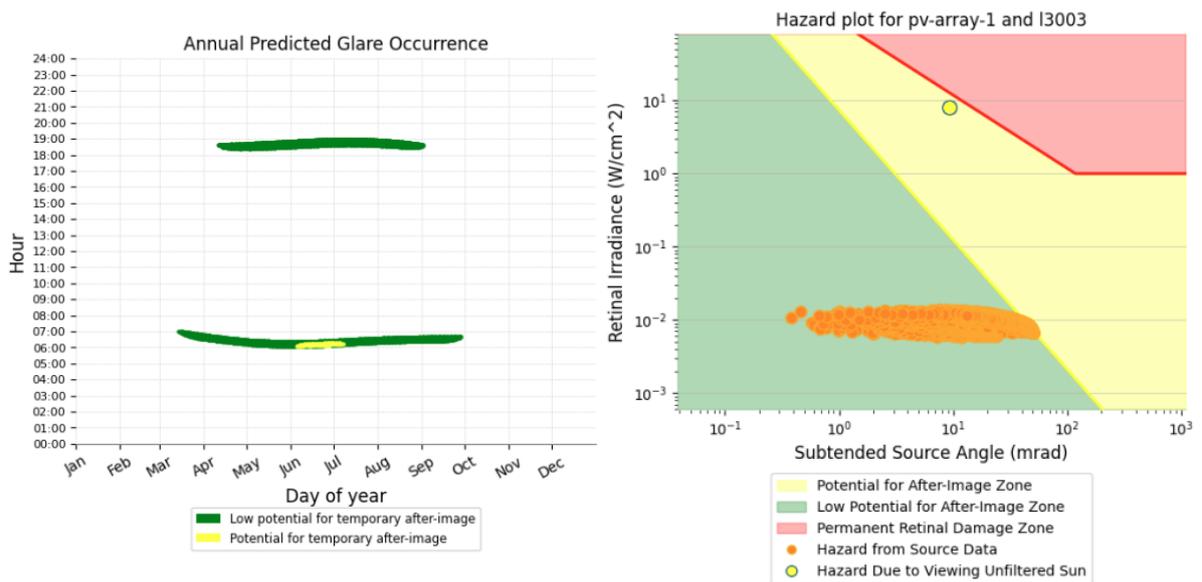


Table 5-39 Route receptor glare from the BPS PV array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Access road to nearby barn	71	0
L3003	5184	104
Proposed Access Road	1116	0
Pass	16	0

5.2.4 Termination Point Reservoir (TPR)

The analysis for the TPR shows that potential glare is predicted at various places along the routes to the east and west of the site. Most routes south of the site including the roads around Peamount hospital experience no glare at all. Details of the annual duration of glare predicted on each route and the locations at which it occurs are provided in Figure 5-11 and the tables below. As with the point receptors, our results are conservative. Beyond what is outlined in Section 4 as obstructions, our models assume there is no additional terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given the flora surrounding the arrays, the duration of glare experienced at each receptor will likely be lower than that reported. The results indicated the presence of yellow glare along the private access road around the existing Peamount reservoir within the Proposed Project site. Without mitigative actions this would have an impact on drivers on the road. A hazard plot of this glare can be seen in Figure 5-12. All other glare detected is categorised as green glare with low impact.

An analysis of the screening effect of a new proposed hedgerow adjacent to the road was modelled as an obstruction to the yellow glare. The GlareGauge analysis suggests if the new vegetation is put in place at or above 2.5m, instances of yellow glare are no longer detected. It should be noted that the access road falls within the site boundary and is not for public use. Measures for dealing with the yellow glare therefore ultimately fall under site Health, Safety and Environmental (HSE) policy of the site owners and/or operators.

After providing vegetation screening at the height suggested, glare estimated at all route receptors are in the 'green' glare zones, resulting in a low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. No yellow or red glare was detected at the route receptors proximate to the TPR. The impact of glare detected at the site is therefore considered low requiring no further mitigation. As with the point receptors, our results are conservative and assume there is only specified terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given the flora surrounding the arrays, the duration of glare experienced at each receptor will likely be lower.

Figure 5-11 TPR route receptors with predicted glare (black indicates no glare is predicted)

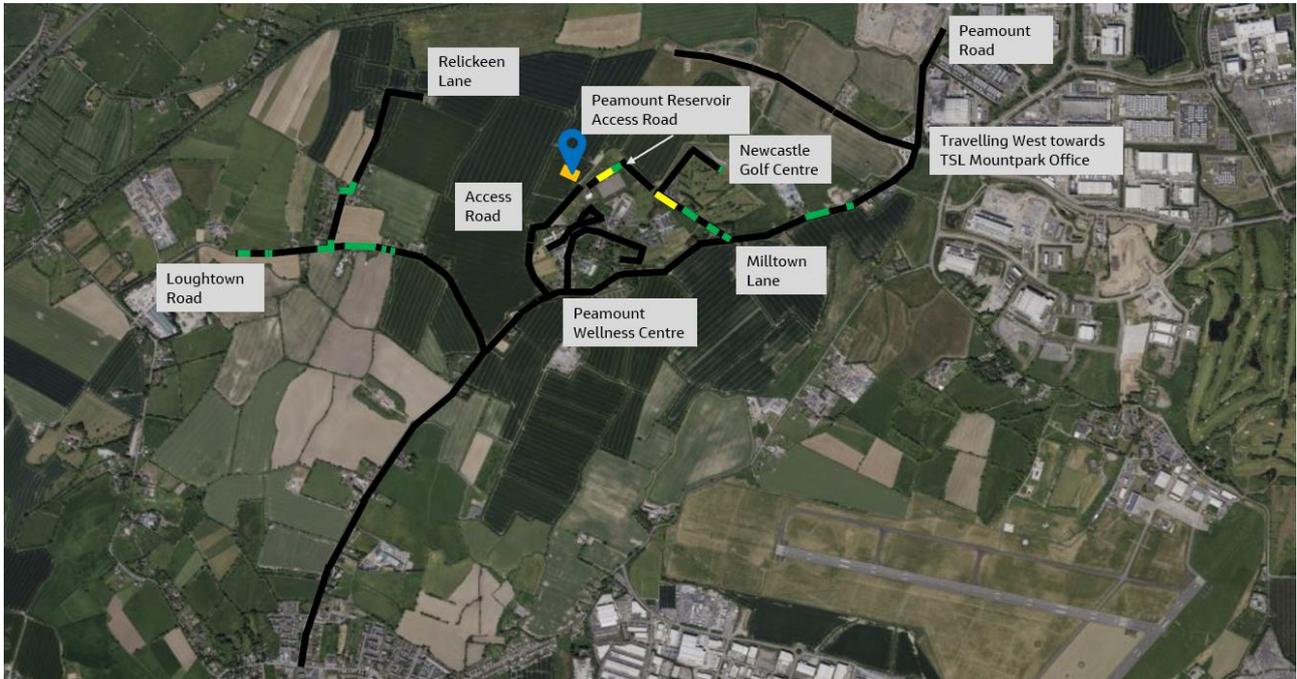


Figure 5-12 Time of day/year of glare occurrence at the site Peamount reservoir access road (left) and associated hazard plot (right)

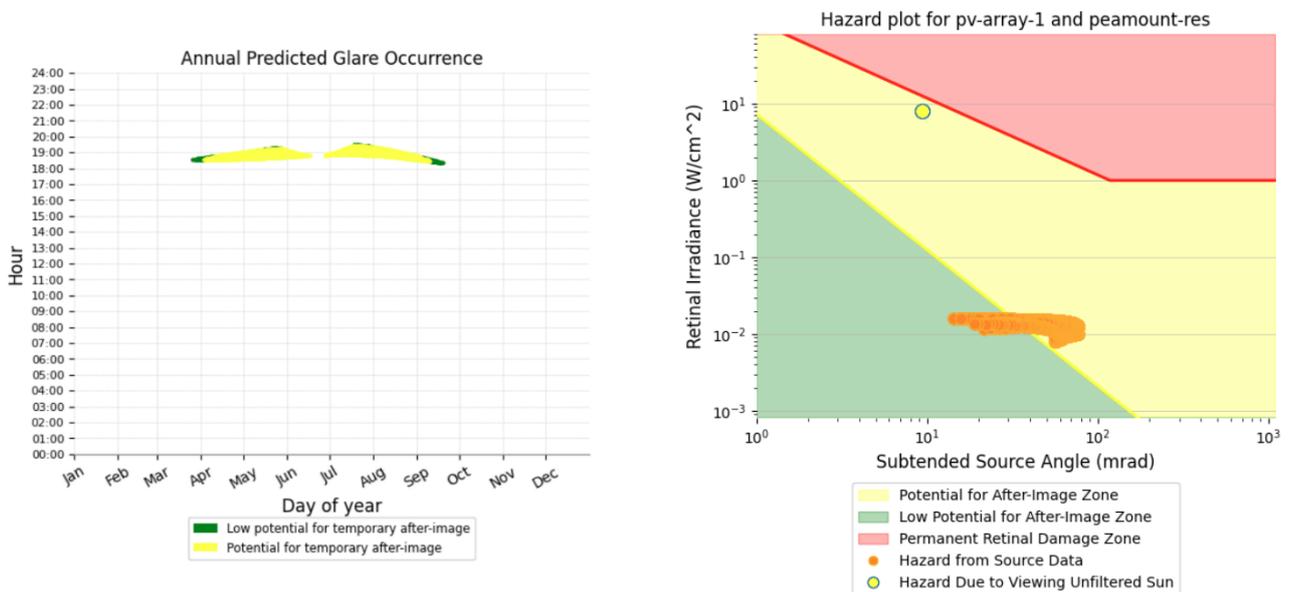


Figure 5-13 Time of day/year of glare occurrence at Milltown Lane (left) and associated hazard plot (right)

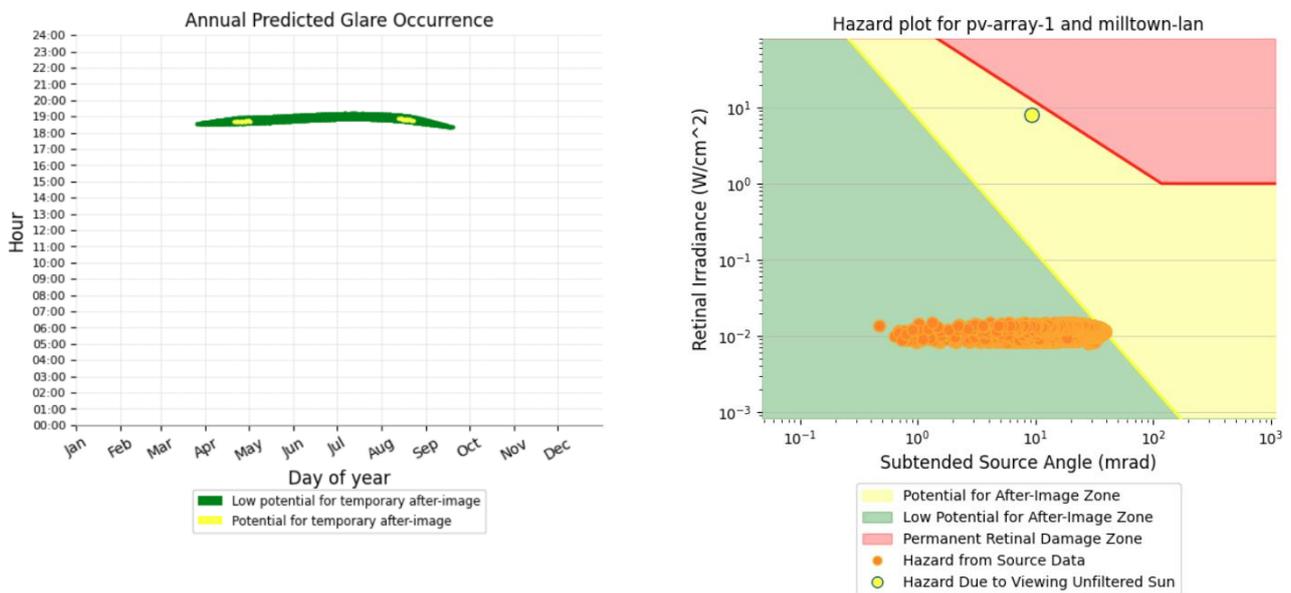


Table 5-40 Route receptor glare at TPR site

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Loughtown Road	2323	0
Milltown Lane	2995	28
Newcastle Golf Centre	60	0
Peamount Road	2994	0
Relickeen Lane	725	0
Peamount Reservoir Access Road	257	3017

5.2.5 Flow Control Valve (FCV)

The analysis for the FCV shows that potential glare is predicted along the routes east and west of the site. Most routes experience no glare at all along much of their length. Details of the annual duration of glare predicted on each route and the locations at which it occurs are provided in Figure 5-13 and the table below. The results are conservative as they do not take account of terrain or other screening. As with the point receptors, our results are conservative. Beyond what is outlined in Section 4 as obstructions, our models assume there is no additional terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given the flora surrounding the arrays, and the topography, the duration of glare experienced at each receptor will likely be lower than that reported. The results indicated the presence of yellow glare along the L2008 to the west of the Proposed Project site. Without mitigation this would have an impact on drivers on the road. A hazard plot of this glare can be seen in Figure 5-14. All other glare detected is categorised as green glare with low impact.

An analysis was conducted on the screening effect of the proposed hedgerows adjacent to the L2008, to the north, and to the south of the site as obstructions to the yellow glare detected. The GlareGauge analysis suggests if the vegetation is maintained at or above 3.5m in height, and the proposed planting along L2008

and the southern boundary of the site is extended up to the site entrance, instances of yellow glare are no longer detected. This information has been fed back to the landscaping team and is included within their designs.

With the changes to vegetation included, glare estimated at all route receptors are in the 'green' glare zones, resulting in a low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. No yellow or red glare was detected at the route receptors proximate to the FCV. The impact of glare detected at the site is therefore considered low requiring no further mitigation. As with the point receptors, our results are conservative and assume in our modelling there is only specified terrain, landscape, or other obstructions between the proposed PV array and the receptors. Given the flora surrounding the arrays, the duration of glare experienced at each receptor will likely be lower.

Figure 5-14 FCV route receptors with predicted glare (black indicates no glare is predicted)

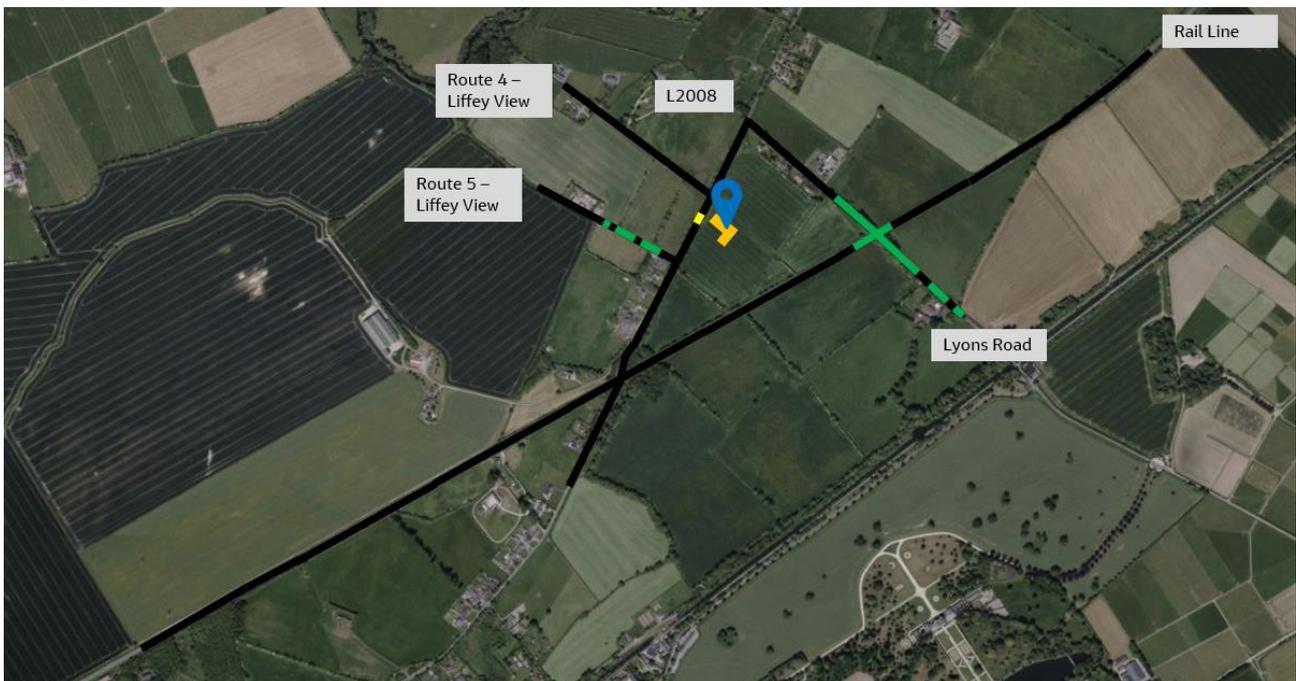


Figure 5-15 Time of day/year of glare occurrence at the L2008 (left) and associated hazard plot (right)

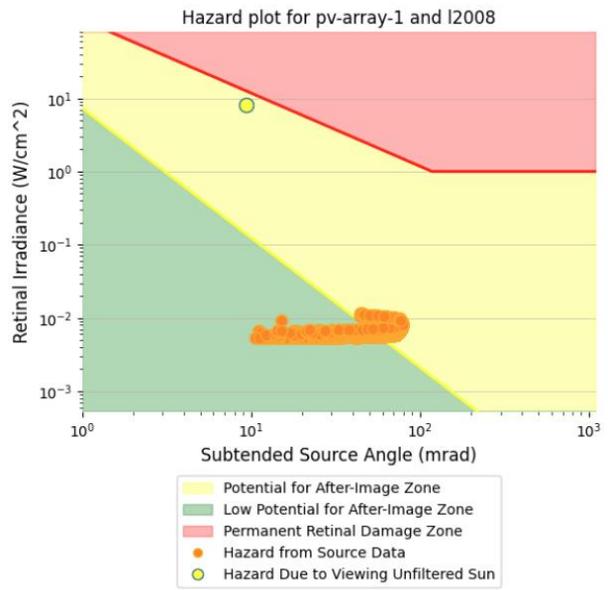
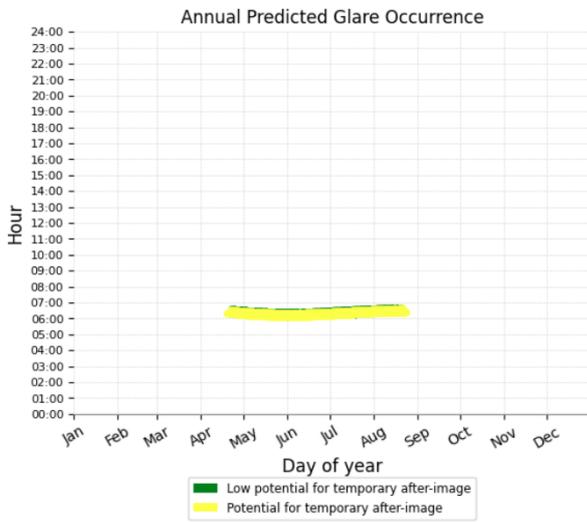


Table 5-41 Route receptors glare at the FCV site

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
L2008	361	3189
Lyons Road	2529	0
Route 5- Liffey View	3386	0

5.3 Flight Path Receptor Results

5.3.1 Termination Point Reservoir (TPR)

The analysis shows that a short duration of glare occurs along the flight path for three of the four approaches to the runways at Casement Aerodrome. Details of the annual duration of glare and where along the flight paths the glare occurs are shown in Table 5-42 and Figure 5-15 respectively. The glare is categorised as green glare with a low potential for after image which is permissible for flight paths under FAA guidance. As the annual duration of the glare is low and it occurs primarily at the highest point of approach on each flight path the impact is considered low and no remedial action is proposed. Additionally, the results are conservative and do not model any obstructions between the array and the flight path receptors. Given the distance between the array and the aerodrome and the fact that glare is predicted at points in the approach path, it is likely the surrounding flora and buildings will reduce the duration of, or remove entirely the instances of glare. No glare was detected along the flight paths at Weston Aerodrome nor it's ATCT. Whilst the glare is of low impact and is permissible under FAA guidelines it is recommended to engage with Casement Aerodrome and inform them of the proposed development and the impact of the glare in order to foster positive stakeholder relations.

Figure 5-16 TPR flight path receptors with predicted glare at Casement Aerodrome (black indicates no glare is predicted)

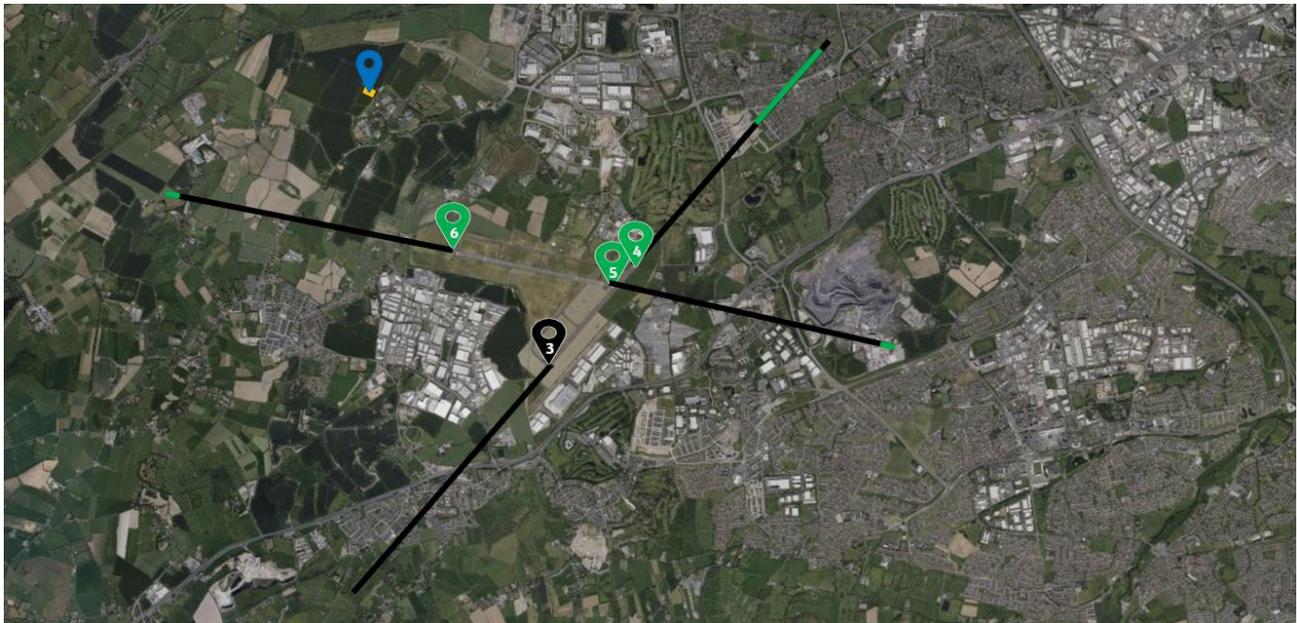


Table 5-42 Flight path receptors glare for the TPR

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
FP 4	678	0

FP 5	275	0
FP 6	764	0

5.3.2 Flow Control Valve (FCV)

Our analysis shows that a short duration of glare from the FCV occurs along the flight path for two of the four approaches to the runways at Casement Aerodrome. Details of the annual duration of glare and where along the flight paths the glare occurs are shown in Table 5-43 and Figure 5-16 respectively. The glare is categorised as green glare with a low potential for after image which is permissible for flight paths under FAA guidance. Whilst the glare does occur at lower points in the aircraft approach route, the annual duration of the glare is relatively low. Additionally, the results are conservative and do not model any obstructions between the array and the flight path receptors. Given the distance between the array and the aerodrome and the fact that glare is predicted at points in the approach path, it is likely the surrounding flora and buildings will reduce the duration of, or remove entirely the instances of glare. The overall impact is therefore considered low and no mitigation measures are proposed. No glare was detected along the flight paths at Weston Aerodrome nor it's ATCT. Again, it is recommended to engage with Casement Aerodrome and inform them of the proposed development and the impact of the glare in order to foster positive stakeholder relations.

Figure 5-17 FCV flight path receptors with predicted glare at Casement Aerodrome (black indicates no glare is predicted)

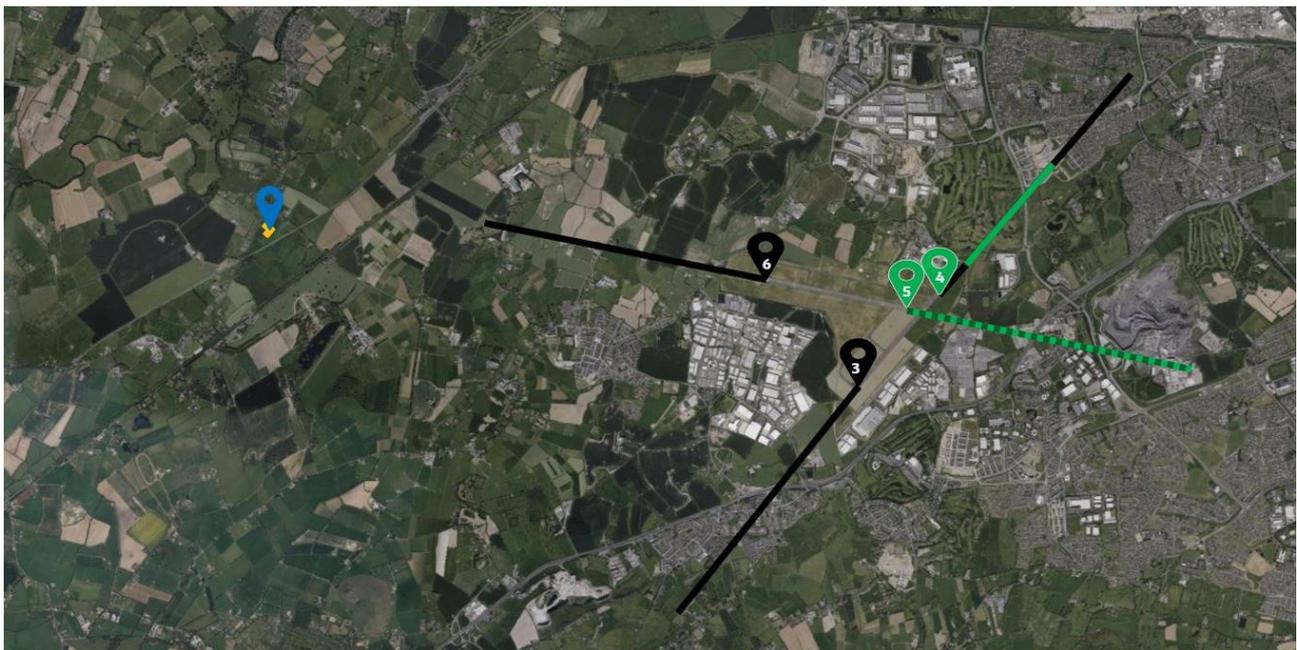


Table 5-43 Flight path receptor glare for the FCV

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
FP 4	310	0
FP 5	553	0

6. Conclusions & Recommendations

6.1 Conclusions

This assessment modelled the potential effects of glare from the proposed solar arrays on local receptors, such as properties, air traffic control towers, road users, rail lines and flight paths. The glare detected predominantly occurs during the early morning (06:00-08:00) and evening (18:00-20:00). As previously stated, our results are conservative. Beyond what is outlined in Section 4 as obstructions, our models assume there is no additional terrain, landscape, or other obstructions between the proposed PV array and receptors. Given the flora surrounding the arrays, the duration of glare experienced at each receptor will likely be lower than the findings of our study.

Iterations of our analysis do show instances of yellow glare, these are summarised further in Section 6.1.2. Through further assessment our models show that existing vegetation screenings, planned hedgerow plantings from the Proposed Projects landscape team and site buildings reduce the significance of the impact of yellow glare to within an acceptable threshold. Subsequently all instances of glare are considered of low significance requiring no further mitigations.

6.1.1 Observation Point Receptors

Across the five infrastructure sites assessed, a total of 90-point receptors were analysed. The potential for green glare was identified at 32-point receptors. No glare was detected at Weston Airport's air traffic control tower (19-ATCT). At the TPR no glare is detected at any of the buildings linked to the Peamount Hospital. The impact of glare is considered low for point receptors and no remedial actions are proposed. No yellow glare was detected at any point receptor. These results are summarised in Table 6-1.

Table 6-1 Point Receptor Results

Glare Classification	No. of Receptors	Impact	Mitigation Measures?	Residual Impact
Green	32	Low	None	N/A
Yellow	0	N/A	None	N/A

6.1.2 Route Receptors

30 route receptors were modelled across the five sites. The potential for green glare was detected at 22 of these. The potential for yellow glare was identified at 5 route receptors located at the Break Pressure Tank (BPT), Booster Pumping Station (BPS), Termination Point Reservoir (TPR) and Flow Control Valve (FCV) sites. Without any obstructions between the arrays and the route receptors this yellow glare would have an impact on road users. The resulting effect would be glare with a potential to cause an after-image. Further analysis indicated that proposed hedgerows included within current landscaping designs and site buildings from the Proposed Project are sufficient to remove instances of yellow glare at the BPS, BPT, TPR and FCV. The impact of the arrays on route receptors is therefore considered low with no further mitigation actions. These findings are summarised in Table 6-2.

Table 6-2 Route Receptor Results

Glare Classification	No. of Receptors	Impact	Mitigation Measures?	Residual Impact
Green	22	Low	None	N/A
Yellow	5	Moderate significance	Plant hedgerows as per the site landscaping drawings. Plant new hedgerows on the TPR site access road. Extend the proposed hedgerows running along the L2008 at the FCV.	Low

6.1.3 Flight Path Receptors

Six flight path receptors were modelled as part of this analysis at Weston and Casement Aerodromes. No glare was detected at Weston Airport’s ATCT or its flight paths from the FCV or TPR arrays. A short duration of glare was detected at three of the four flight path approaches at Casement Aerodrome. The glare is classified as green which is permissible under FAA guidance. Given this and the short annual duration of the glare, the impact is considered low and no mitigation is proposed. It is suggested however, to engage with Casement Aerodrome to inform them of the proposed development and the impact of the predicted glare.

Table 6-3 Flight path receptor results

Glare Classification	No. of Receptors	Impact	Mitigation Measures?	Residual Impact
Green	3	Low	None	N/A
Yellow	0	N/A	None	N/A

6.2 Recommendations

Yellow glare with a potential to leave retinal after images was identified at route receptors for the BPT, BPS, TPR, and FCV should there be no obstruction between the arrays and those routes. The steps to mitigate the impact are incorporated into existing landscape designs.

Furthermore, the potential for green glare at the Casement Aerodrome was identified but is considered to have a low impact as per FAA guidance.

The following recommendations are therefore proposed:

- Ensure vegetation planted on all sites is maintained at the minimum heights specified in the landscaping drawings and detailed in this report.
- Early stakeholder engagement should take place with Casement Aerodrome to inform them of the green glare predicted along the flight paths by the proposed TPR array, it’s duration and the time it occurs in order to foster positive stakeholder relations.

A.2 Point Receptor Results

Figure A- 3 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at each point receptor, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all point receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones. No yellow or red glare was detected at the WTP.

A.2.1 Point Receptor Results Tables

A.2.1.1 Chemical Dosing Manifold Building

Table A- 1 Point receptor glare for the chemical dosing manifold building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	1570	0
OP2	0	0
OP3	0	0
OP4	1230	0
OP5	1988	0
OP6	756	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	0	0
OP11	0	0
OP12	0	0
OP13	0	0
OP14	640	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.2 Control Building

Table A- 2 Point receptor glare for the control building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	566	0
OP2	75	0
OP3	0	0
OP4	2008	0
OP5	40	0

OP6	0	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	0	0
OP11	404	0
OP12	392	0
OP13	0	0
OP14	627	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.3 Field Array

Table A- 3 Point receptor glare for the field array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	1117	0
OP3	0	0
OP4	2182	0
OP5	742	0
OP6	0	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	0	0
OP11	1096	0
OP12	1014	0
OP13	1059	0
OP14	846	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.4 Lamellar Clarifiers Building

Table A- 4 Point receptor glare for the lamellar clarifiers building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	0	0
OP3	0	0
OP4	0	0
OP5	0	0
OP6	0	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	2653	0
OP11	0	0
OP12	0	0
OP13	0	0
OP14	0	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.5 Large Field Array

Table A- 5 Point receptor glare the large field array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	730	0
OP2	981	0
OP3	0	0
OP4	2041	0
OP5	2560	0
OP6	1353	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	0	0
OP11	816	0
OP12	721	0

OP13	2323	0
OP14	2373	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.6 Sludge Dewatering Building 1 – East

Table A- 6 Point receptor glare the sludge dewatering building 1 – east array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	874	0
OP3	953	0
OP4	0	0
OP5	0	0
OP6	0	0
OP7	1096	0
OP8	1745	0
OP9	390	0
OP10	0	0
OP11	0	0
OP12	0	0
OP13	0	0
OP14	0	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.7 Sludge Dewatering Building 2 - East

Table A- 7 Point receptor glare for the sludge dewatering building 2 - east array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	0	0
OP3	1420	0
OP4	0	0
OP5	0	0

OP6	0	0
OP7	1155	0
OP8	1193	0
OP9	1238	0
OP10	0	0
OP11	0	0
OP12	0	0
OP13	0	0
OP14	0	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.8 Sludge Dewatering Building 2 - West

Table A- 8 Point receptor glare for the sludge dewatering building 2 - west array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	0	0
OP3	0	0
OP4	0	0
OP5	0	0
OP6	0	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	1270	0
OP11	0	0
OP12	0	0
OP13	0	0
OP14	0	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.9 Sludge Storage Building 1

Table A- 9 Point receptor glare for the sludge storage building 1 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	0	0
OP3	0	0
OP4	0	0
OP5	0	0
OP6	0	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	688	0
OP11	0	0
OP12	0	0
OP13	0	0
OP14	0	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.10 Sludge Storage Building 2

Table A- 10 Point receptor glare for the sludge storage building 2 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	0	0
OP3	3388	0
OP4	0	0
OP5	0	0
OP6	0	0
OP7	2030	0
OP8	1478	0
OP9	1597	0
OP10	0	0
OP11	0	0
OP12	0	0

OP13	0	0
OP14	0	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.11 UV Dosing Building

Table A- 11 Point receptor glare for the UV dosing building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	0	0
OP3	1388	0
OP4	0	0
OP5	0	0
OP6	0	0
OP7	1374	0
OP8	1566	0
OP9	1371	0
OP10	0	0
OP11	0	0
OP12	0	0
OP13	0	0
OP14	0	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.12 Water Treatment Module 1

Table A- 12 Point receptor glare for the water treatment module 1 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	1318	0
OP2	0	0
OP3	0	0
OP4	1274	0
OP5	1947	0

OP6	869	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	0	0
OP11	0	0
OP12	0	0
OP13	1526	0
OP14	2360	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.13 Water Treatment Module 2

Table A- 13 Point receptor glare for the water treatment module 2 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	1278	0
OP2	508	0
OP3	0	0
OP4	1668	0
OP5	726	0
OP6	0	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	177	0
OP11	0	0
OP12	0	0
OP13	381	0
OP14	1438	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.1.14 Water Treatment Module 3

Table A- 14 Point receptor glare for the water treatment module 3 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	734	0
OP2	321	0
OP3	0	0
OP4	1230	0
OP5	0	0
OP6	0	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	0	0
OP11	0	0
OP12	0	0
OP13	0	0
OP14	307	0
OP15	0	0
OP16	0	0
OP17	0	0

A.2.2 Glare Graphs

A.2.2.1 Chemical Manifold Building

Figure A- 3 Time of day/year of glare occurrence at OP1 (left) and associated hazard plot (right)

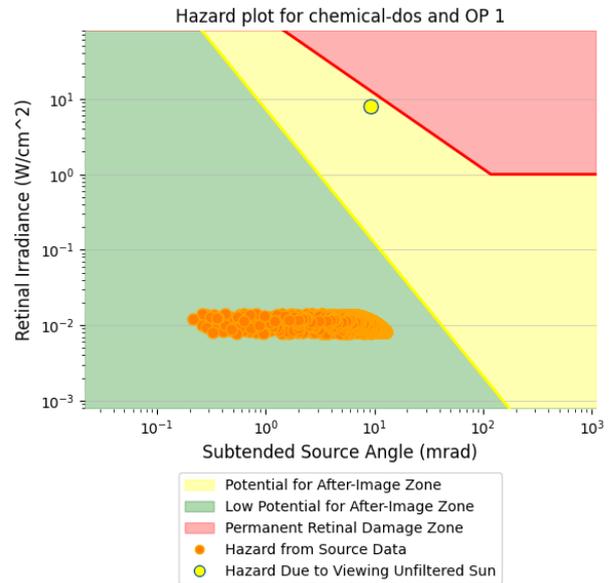
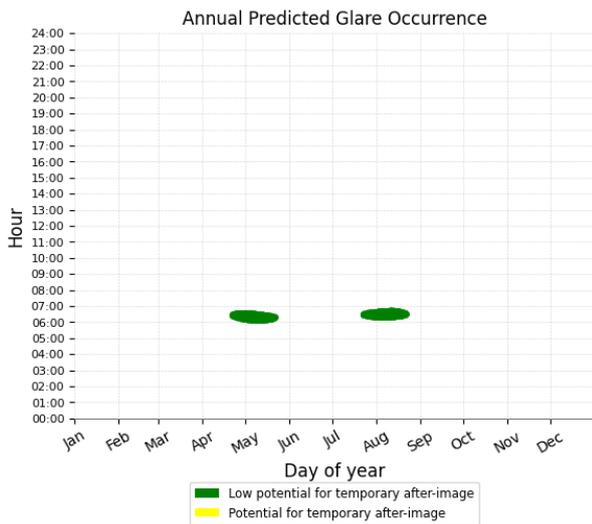


Figure A- 4 Time of day/year of glare occurrence at OP4 (left) and associated hazard plot (right)

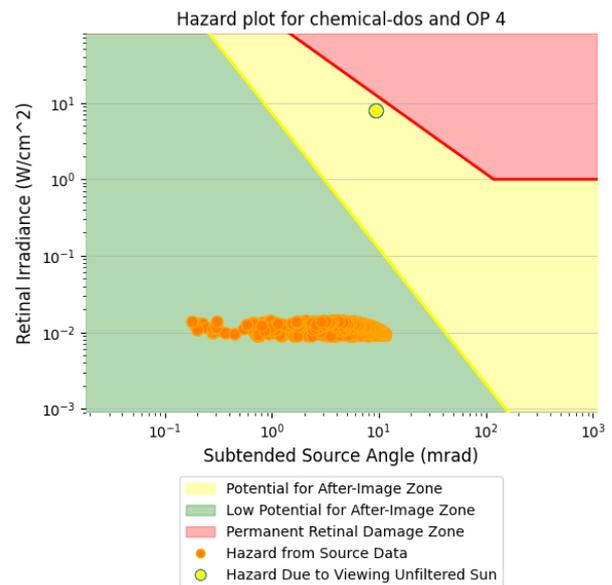
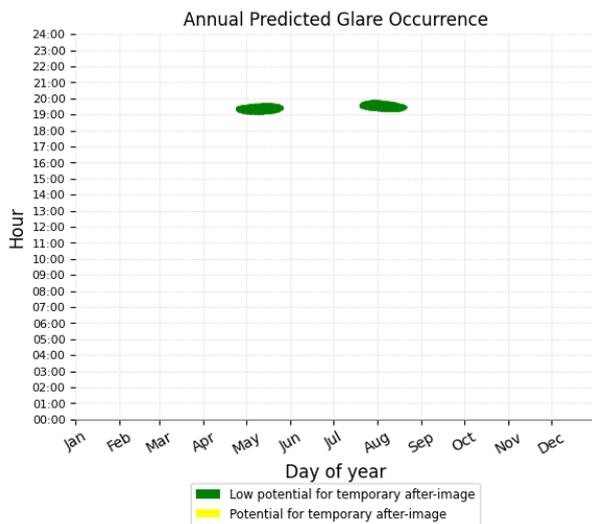


Figure A- 5 Time of day/year of glare occurrence at OP5 (left) and associated hazard plot (right)

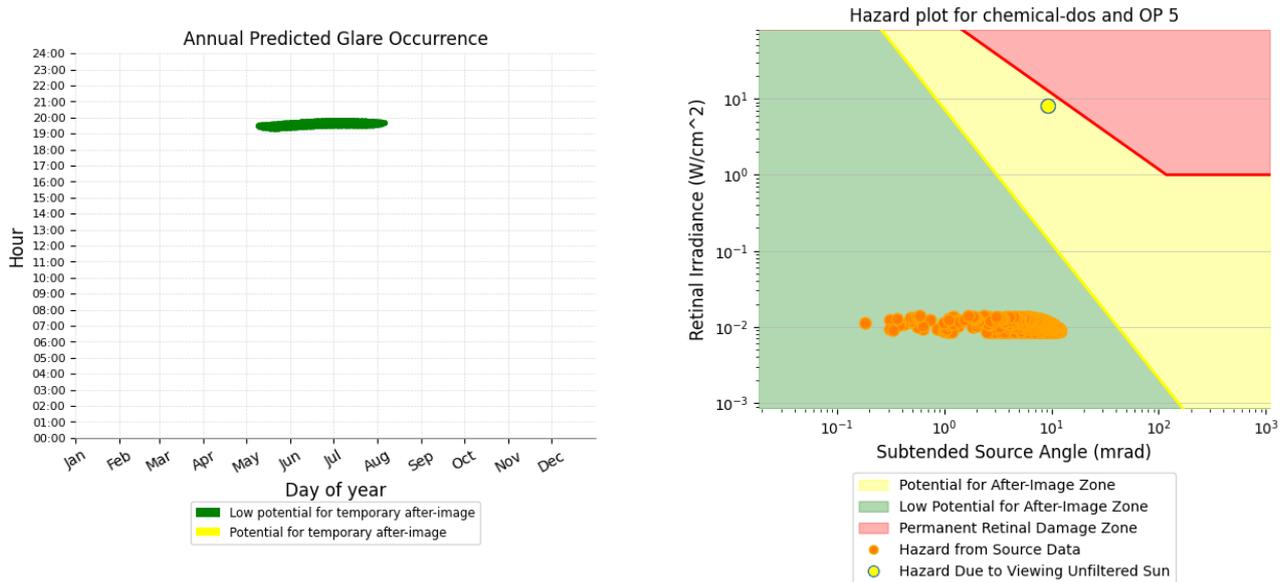


Figure A- 6 Time of day/year of glare occurrence at OP6 (left) and associated hazard plot (right)

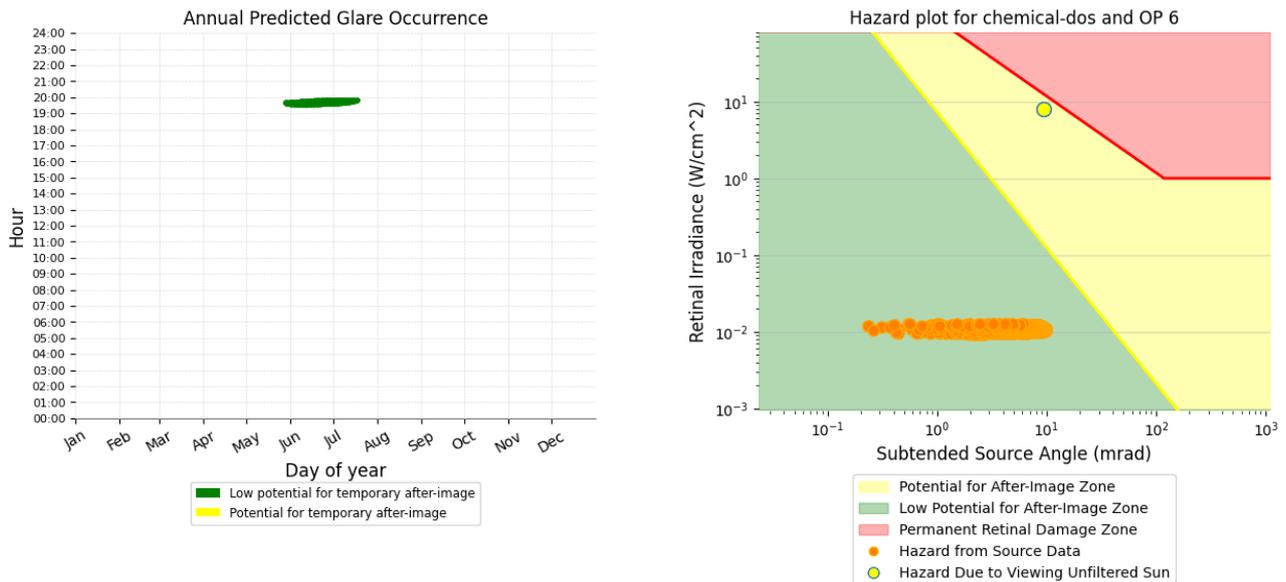
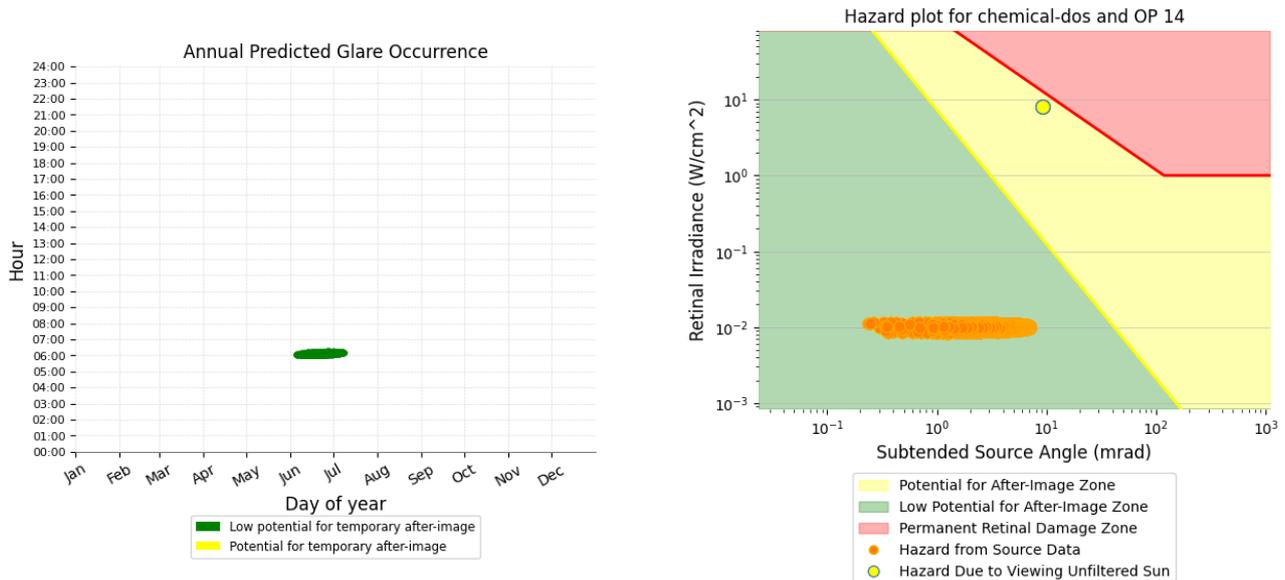


Figure A- 7 Time of day/year of glare occurrence at OP14 (left) and associated hazard plot (right)



A.2.2.2 Control Building

Figure A- 8 Time of day/year of glare occurrence at OP1 (left) and associated hazard plot (right)

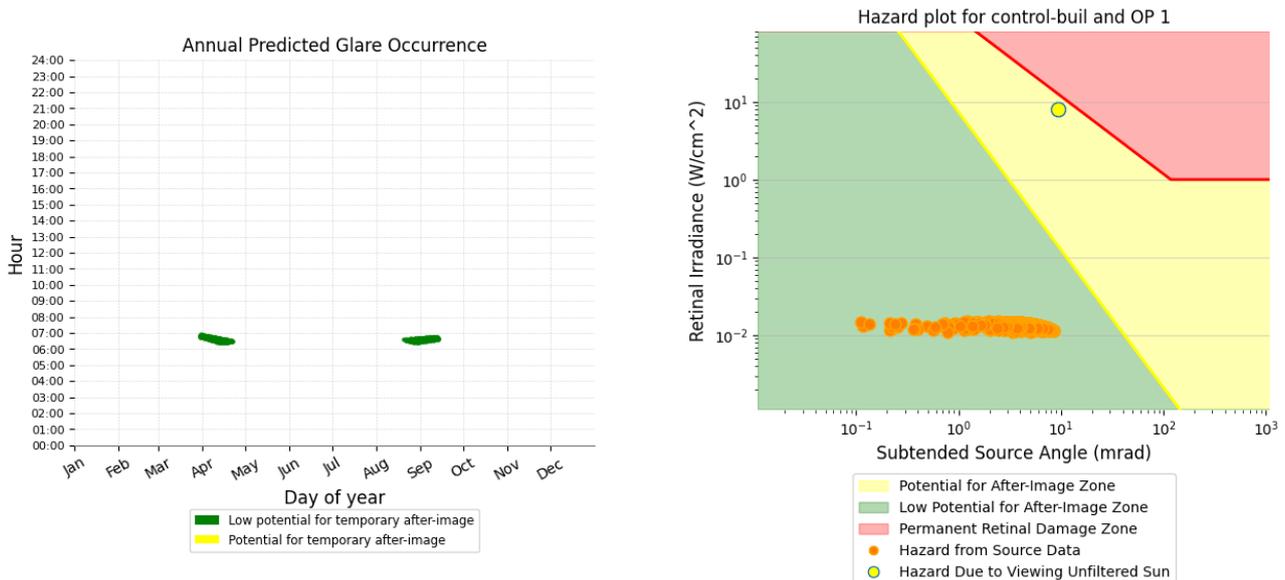


Figure A- 9 Time of day/year of glare occurrence at OP2 (left) and associated hazard plot (right)

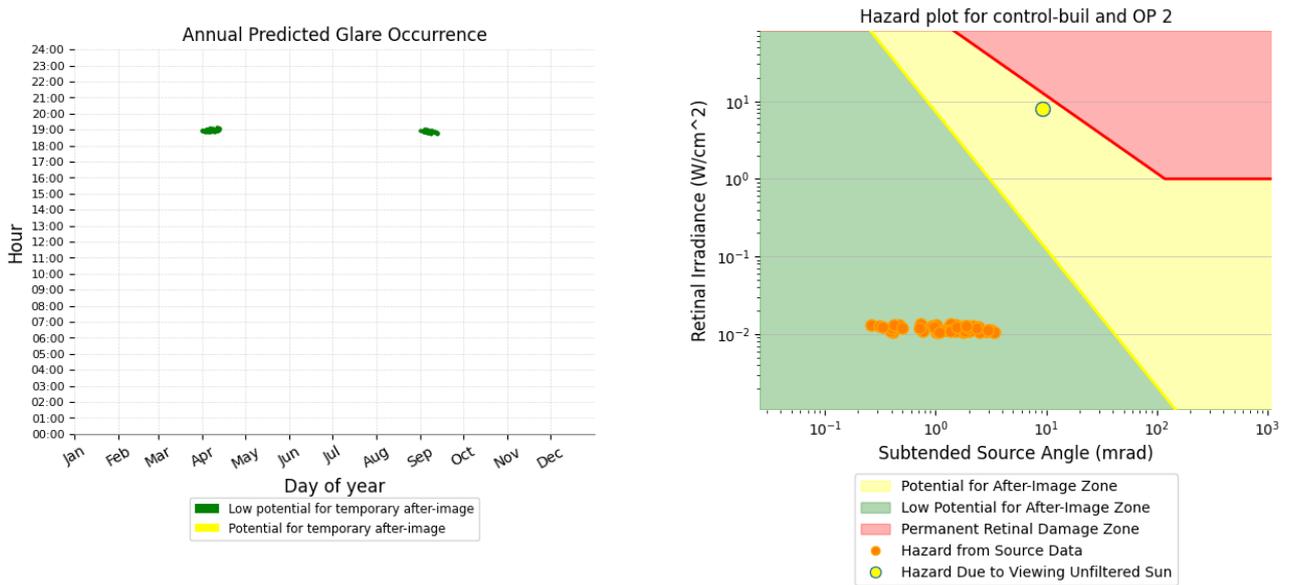


Figure A- 10 Time of day/year of glare occurrence at OP4 (left) and associated hazard plot (right)

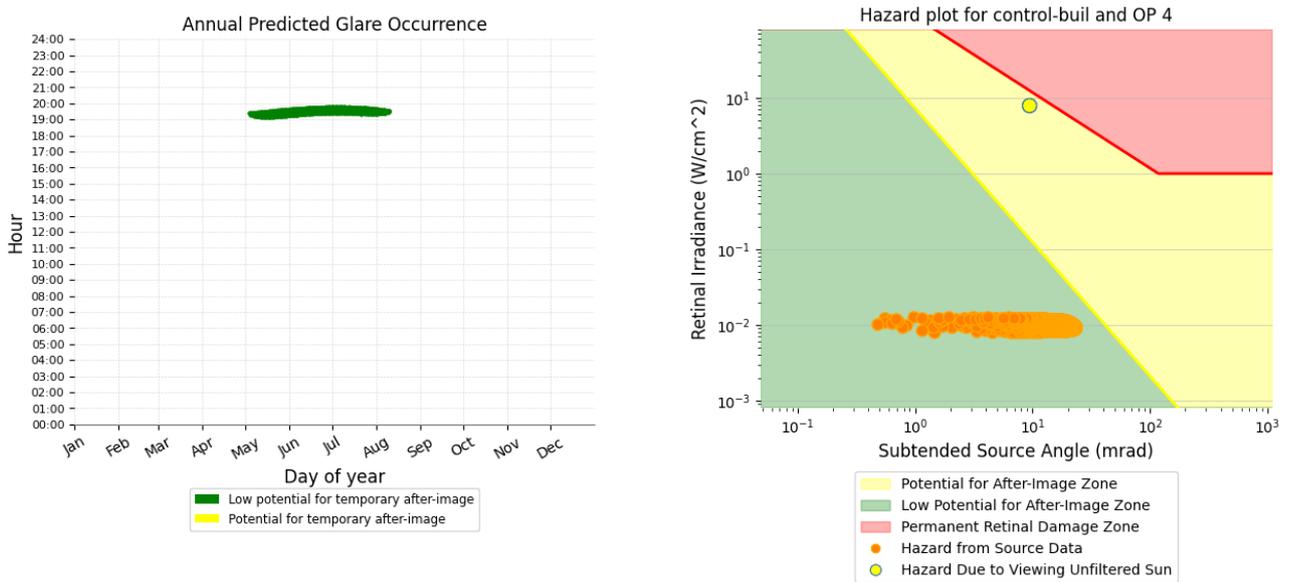


Figure A- 11 Time of day/year of glare occurrence at OP5 (left) and associated hazard plot (right)

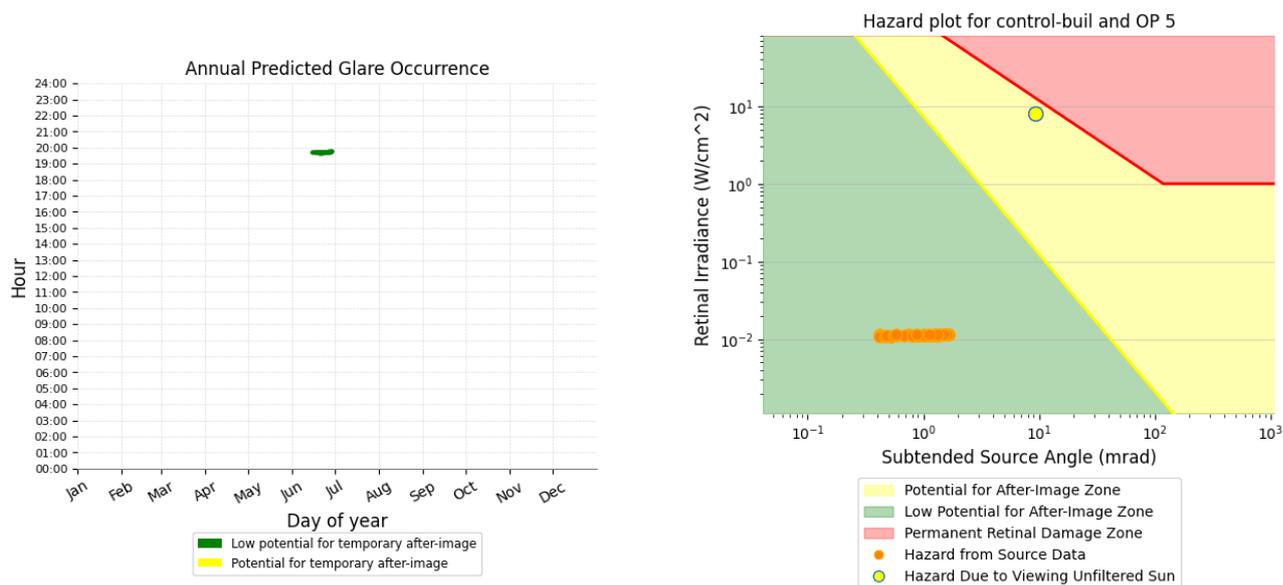


Figure A- 12 Time of day/year of glare occurrence at OP11 (left) and associated hazard plot (right)

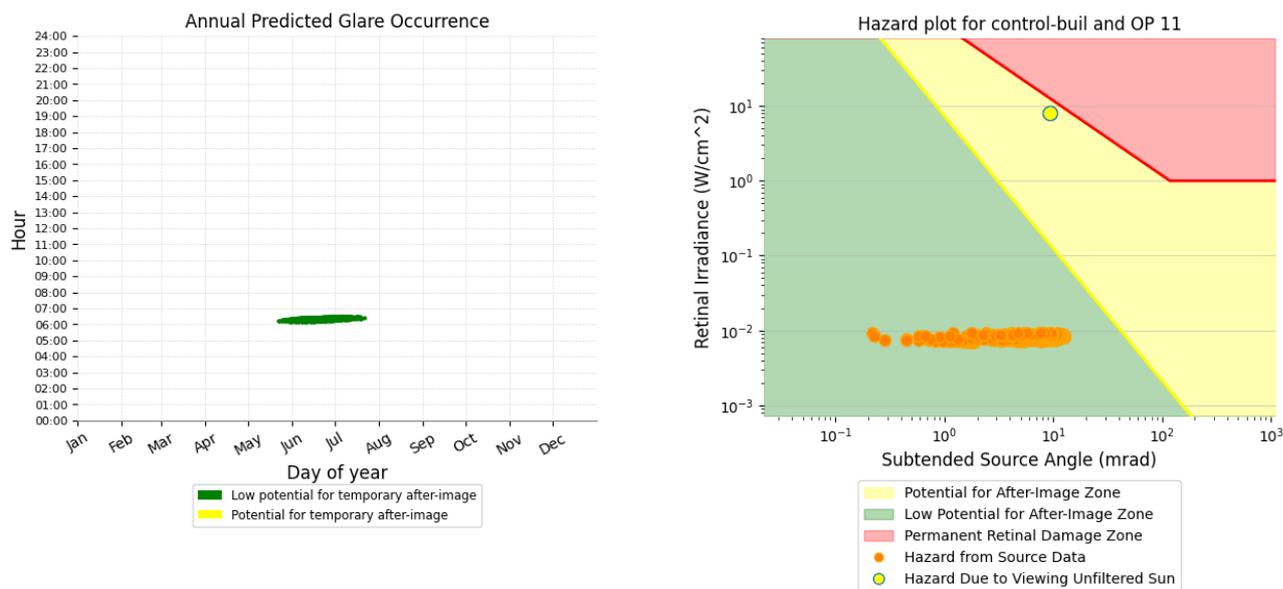


Figure A- 13 Time of day/year of glare occurrence at OP12 (left) and associated hazard plot (right)

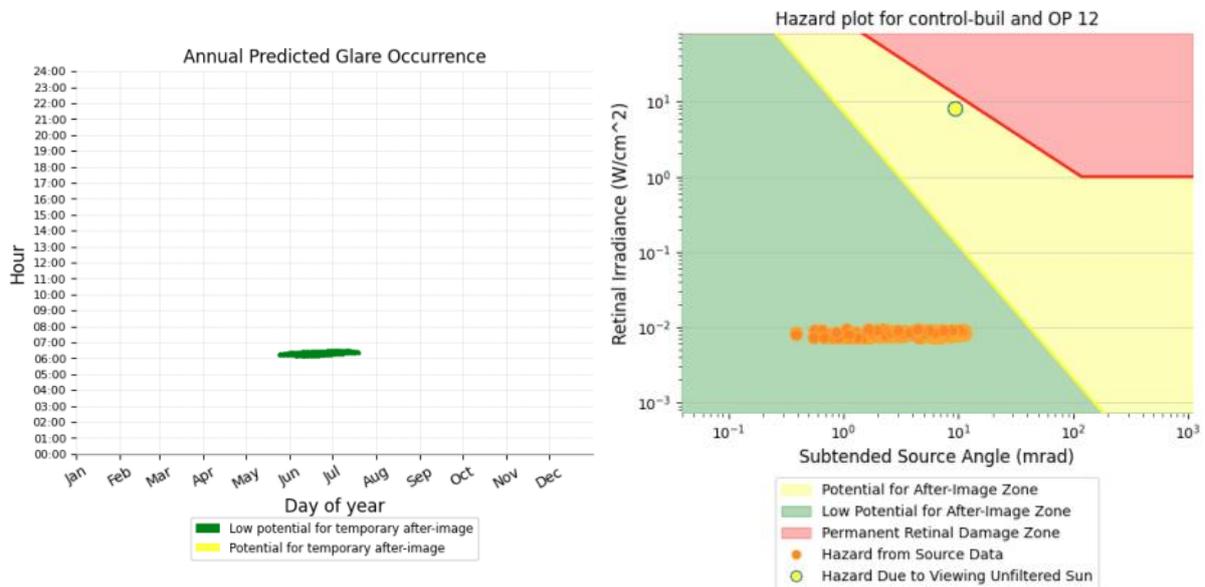
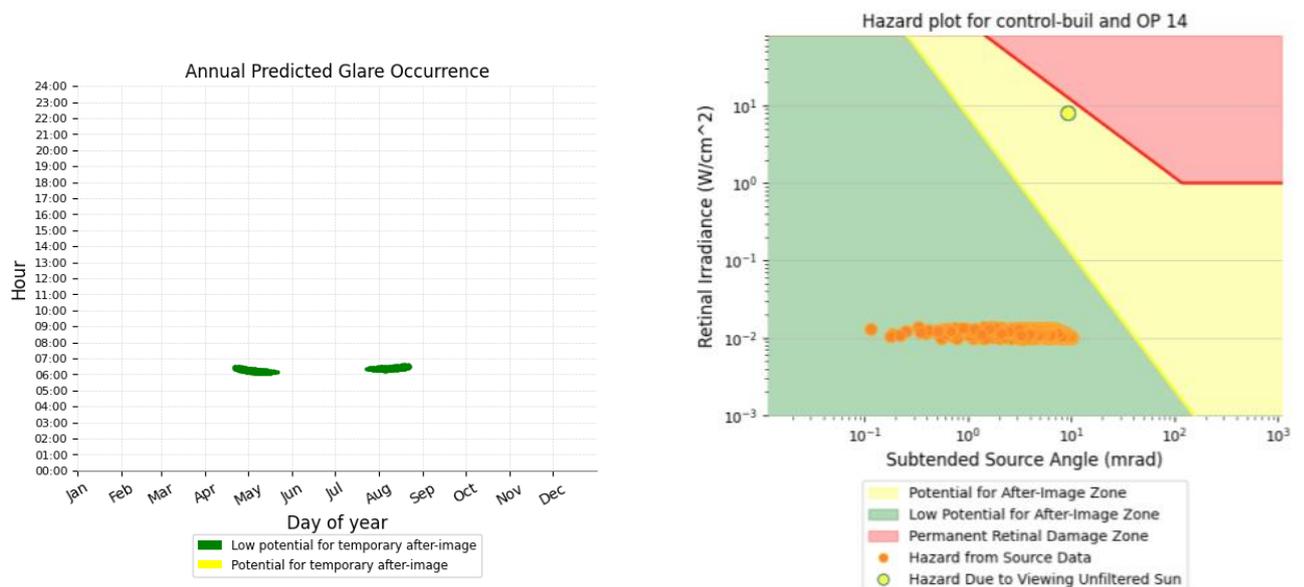


Figure A- 14 Time of day/year of glare occurrence at OP14 (left) and associated hazard plot (right)



A.2.2.3 Field Array

Figure A- 15 Time of day/year of glare occurrence at OP2 (left) and associated hazard plot (right)

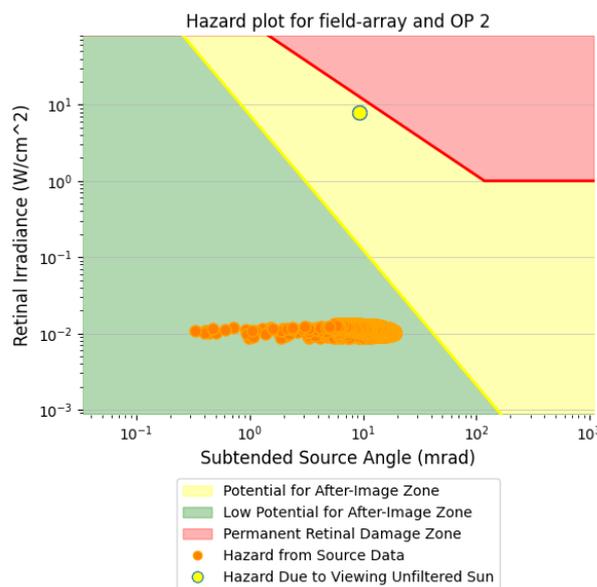
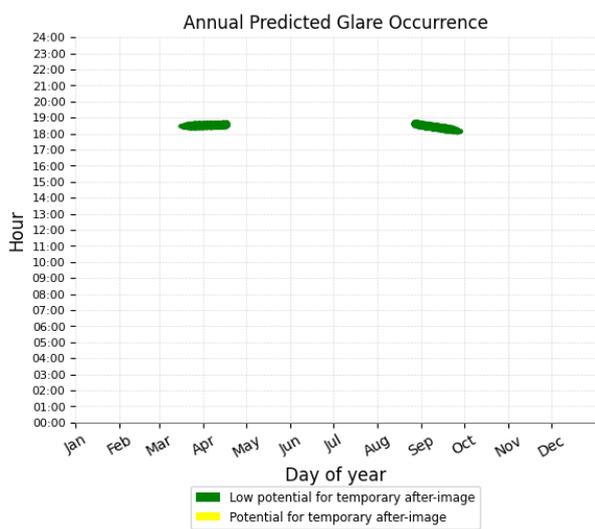


Figure A- 16 Time of day/year of glare occurrence at OP4 (left) and associated hazard plot (right)

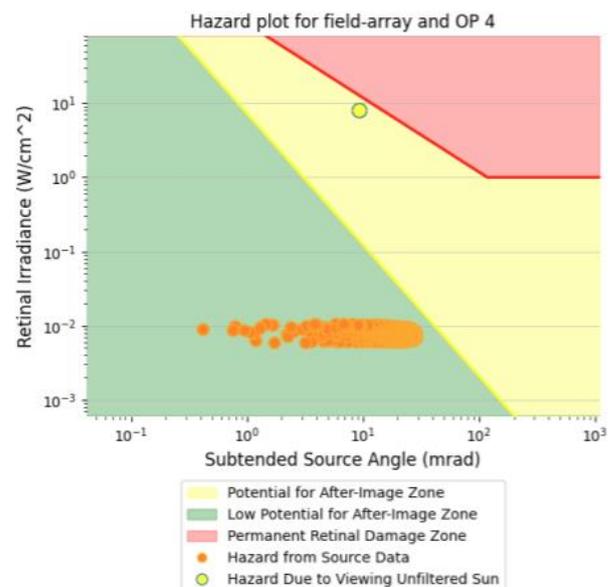
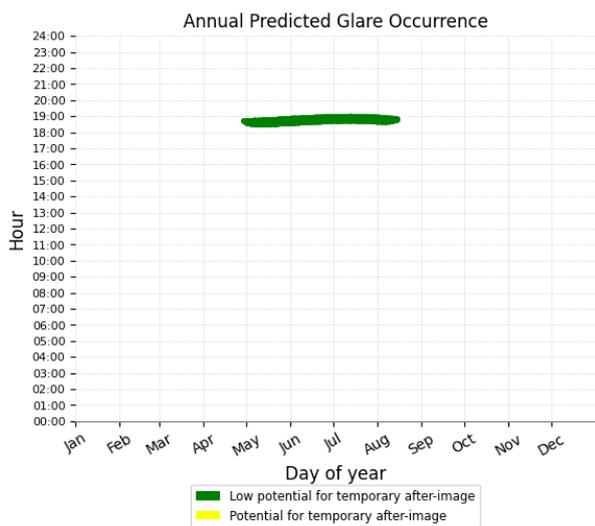


Figure A- 17 Time of day/year of glare occurrence at OP5 (left) and associated hazard plot (right)

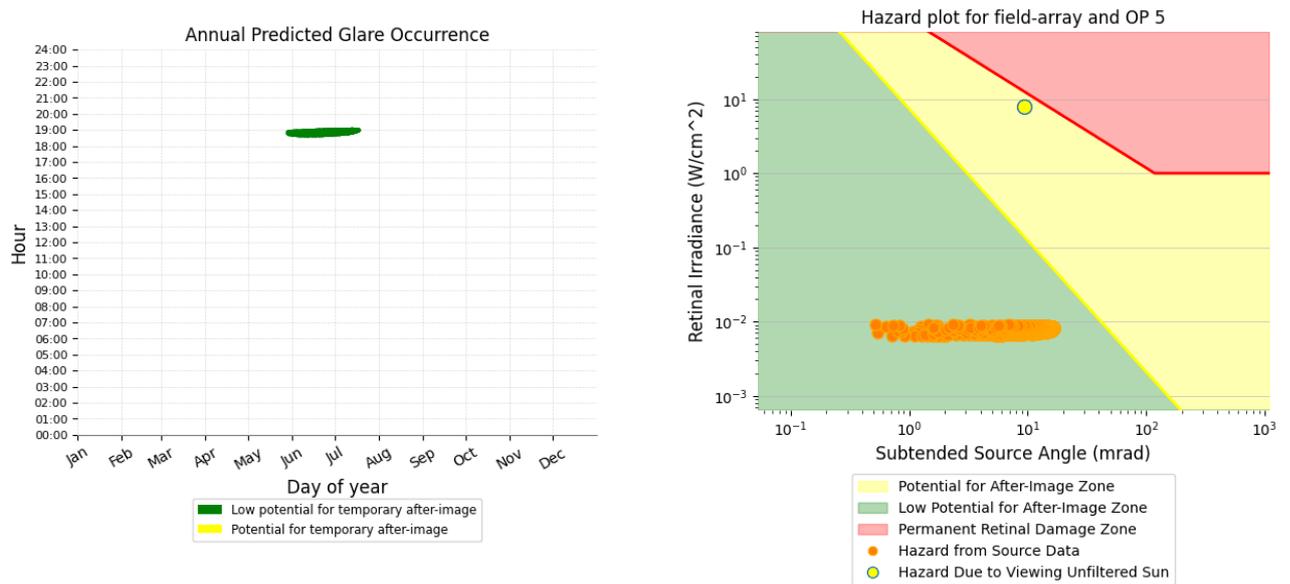


Figure A- 18 Time of day/year of glare occurrence at OP11 (left) and associated hazard plot (right)

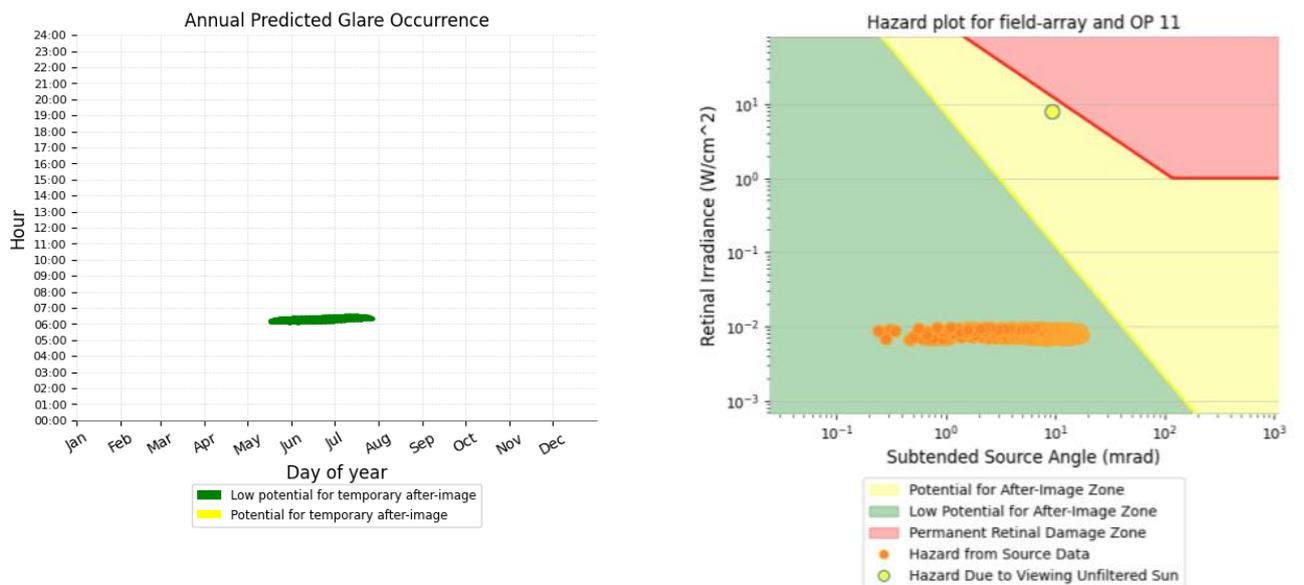


Figure A- 19 Time of day/year of glare occurrence at OP12 (left) and associated hazard plot (right)

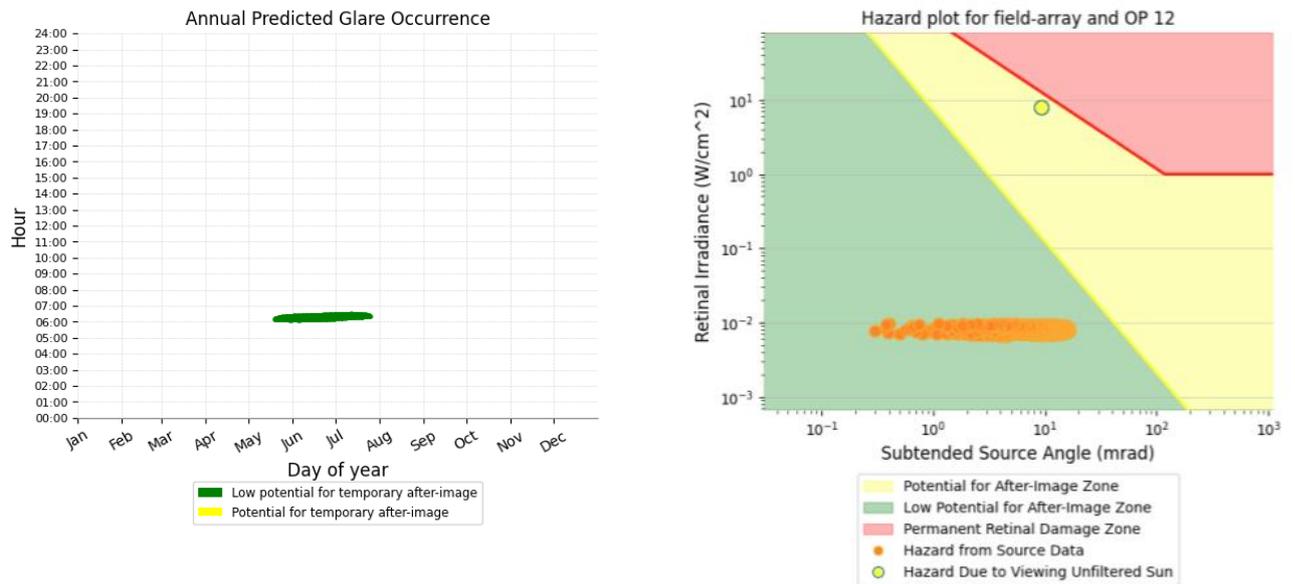


Figure A- 20 Time of day/year of glare occurrence at OP13 (left) and associated hazard plot (right)

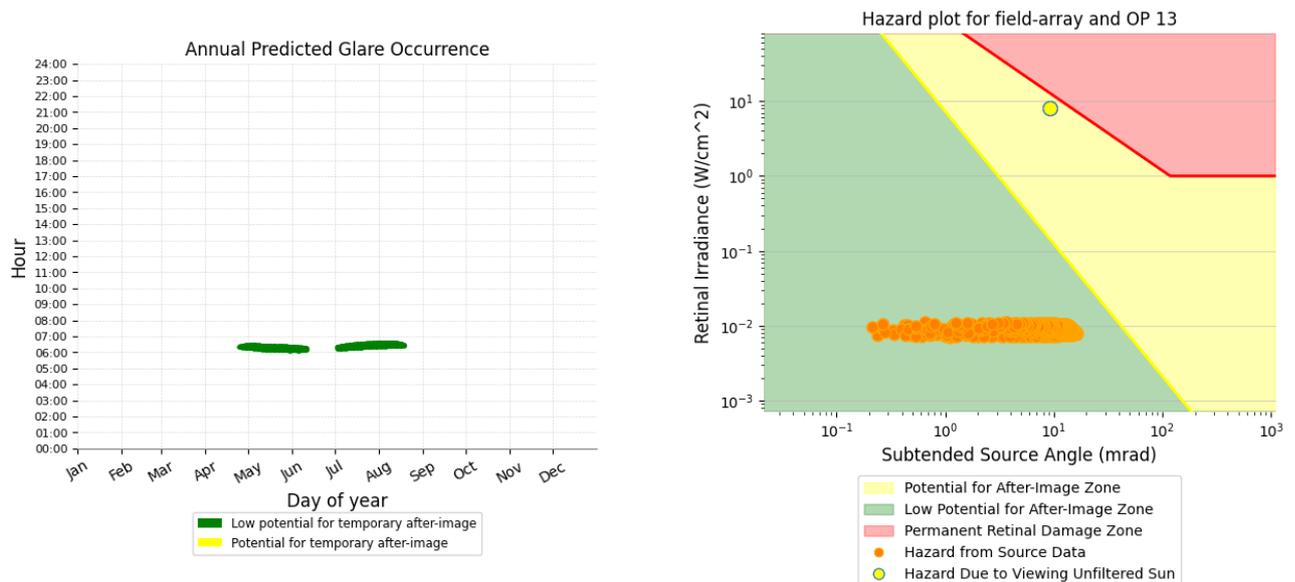
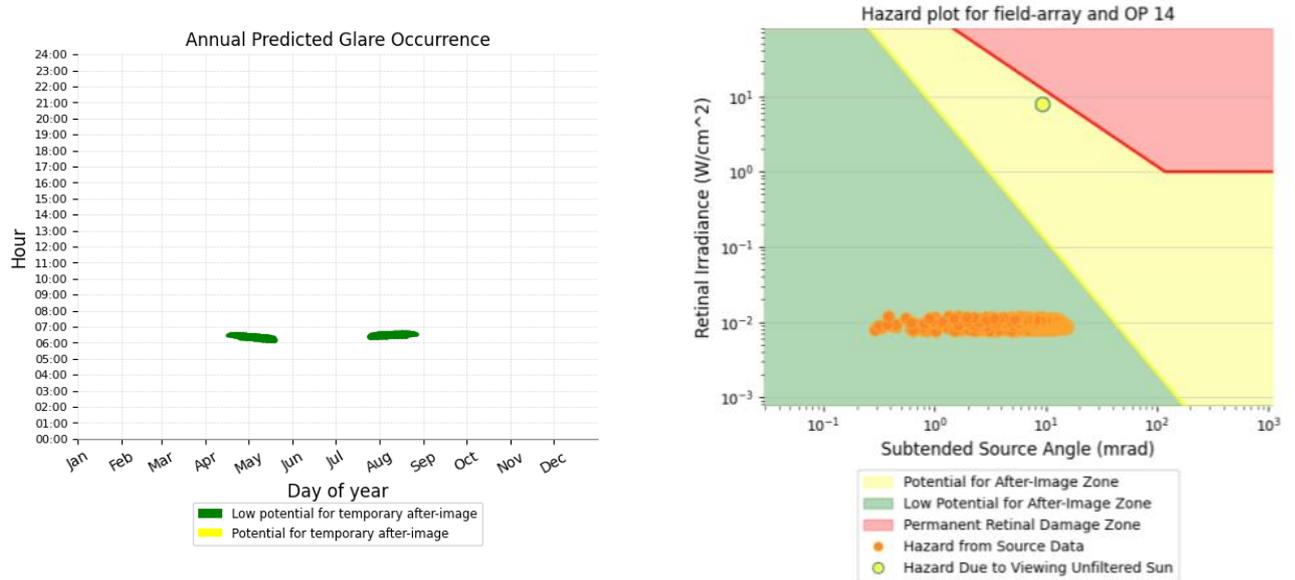
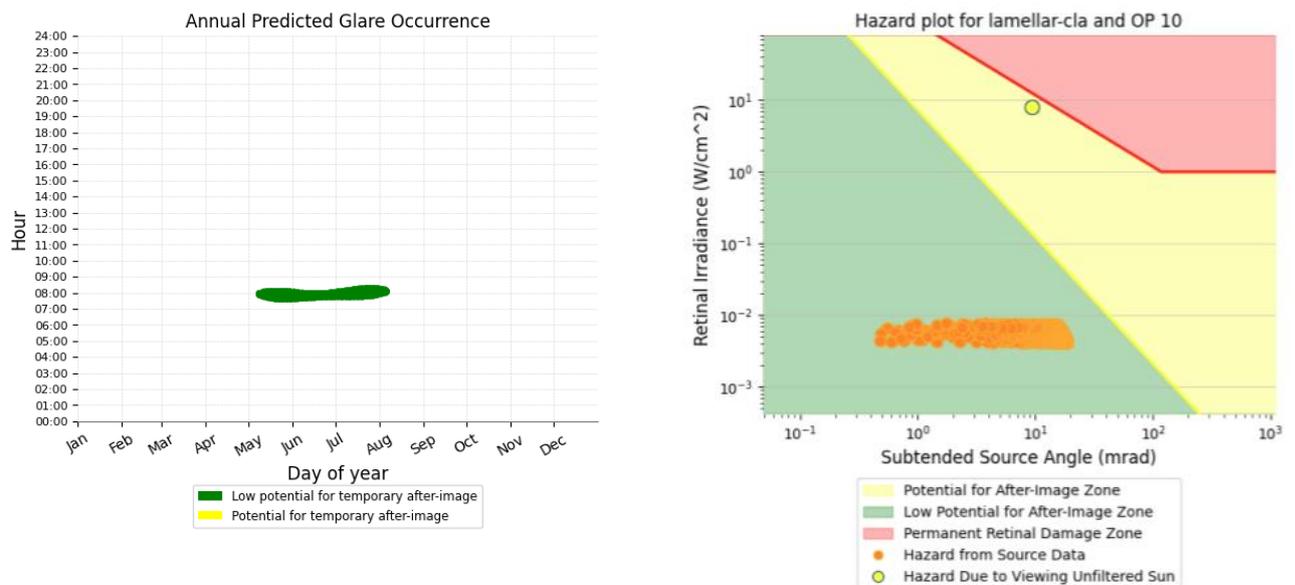


Figure A- 21 Time of day/year of glare occurrence at OP14 (left) and associated hazard plot (right)



A.2.2.4 Lamellar Clarifiers Building

Figure A- 22 Time of day/year of glare occurrence at OP10 (left) and associated hazard plot (right)



A.2.2.5 Large Field Array

Figure A- 23 Time of day/year of glare occurrence at OP1 (left) and associated hazard plot (right)

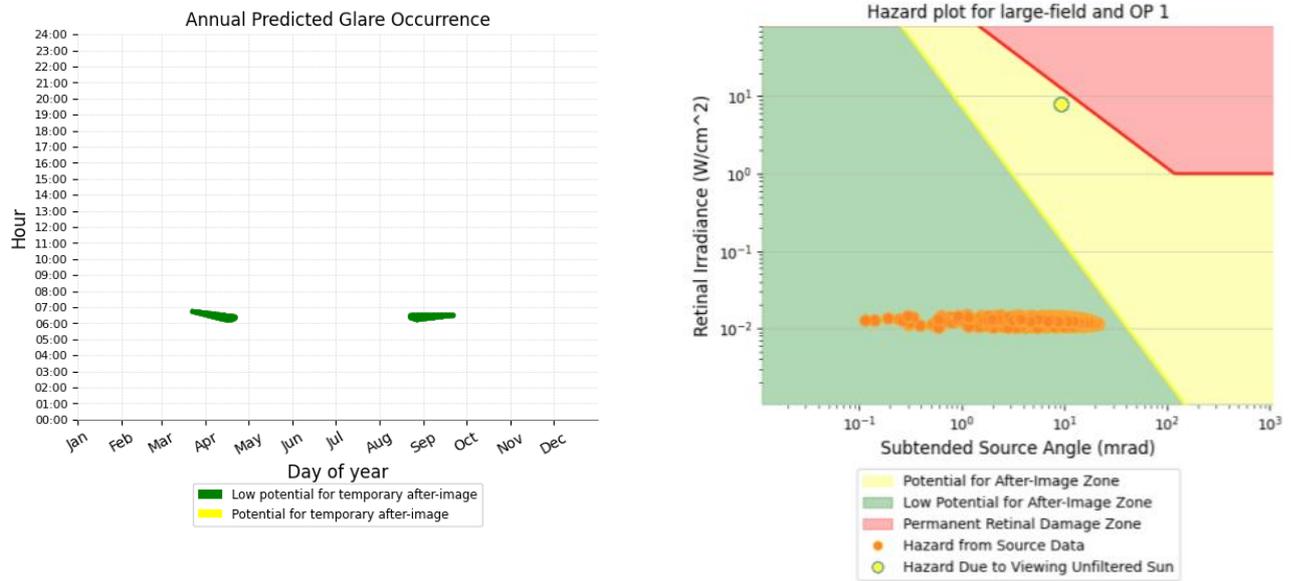


Figure A- 24 Time of day/year of glare occurrence at OP2 (left) and associated hazard plot (right)

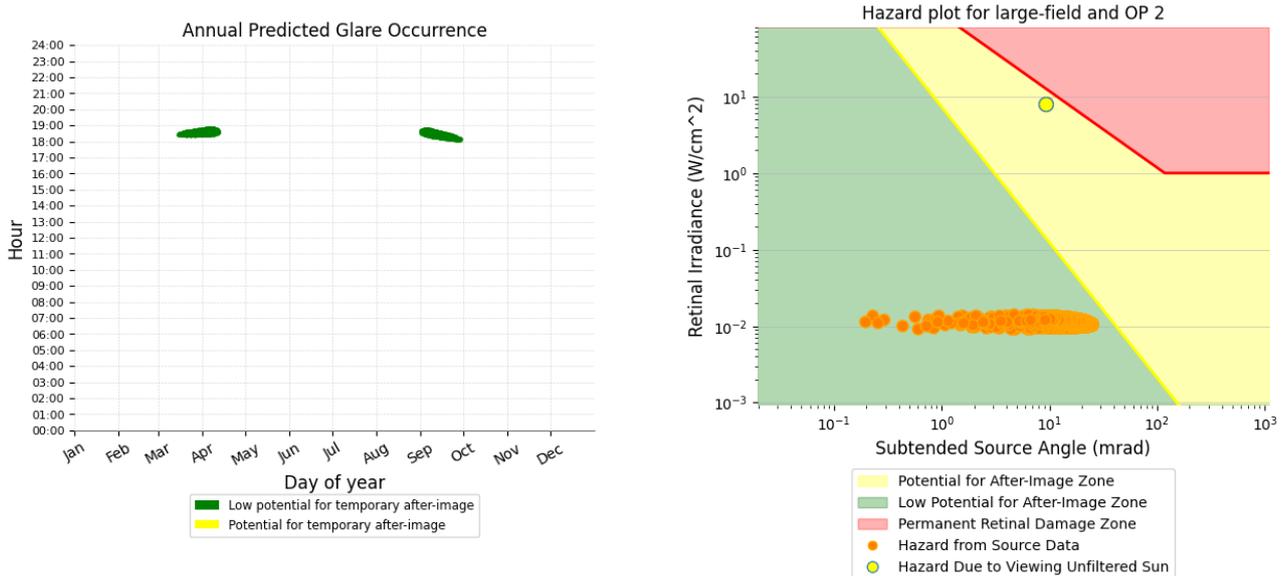


Figure A- 25 Time of day/year of glare occurrence at OP4 (left) and associated hazard plot (right)

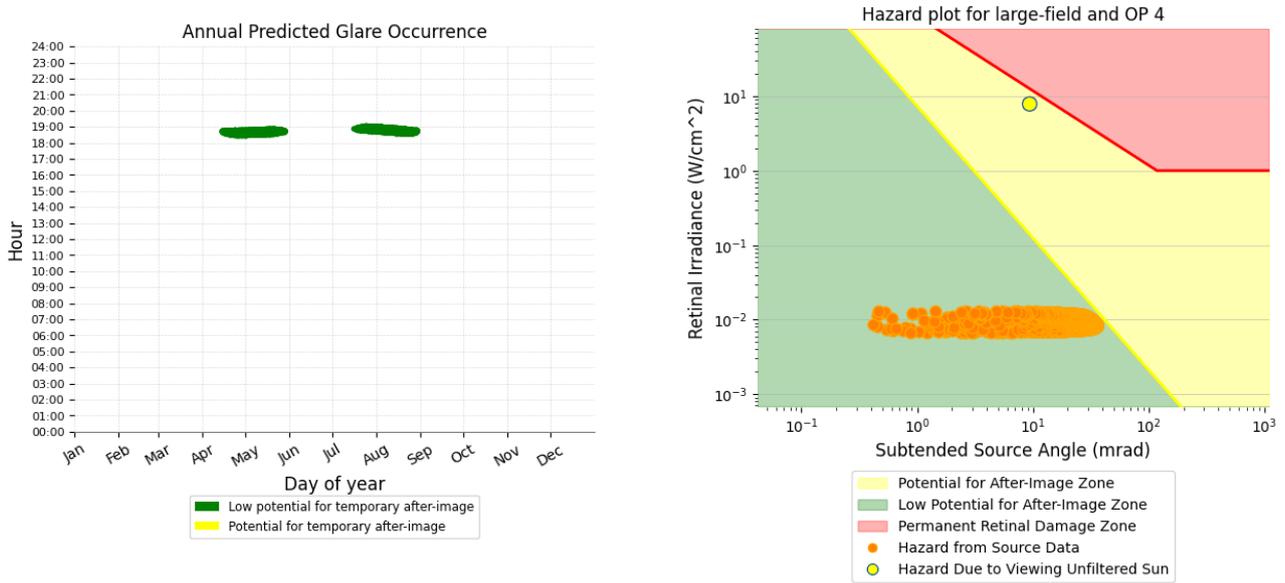


Figure A- 26 Time of day/year of glare occurrence at OP5 (left) and associated hazard plot (right)

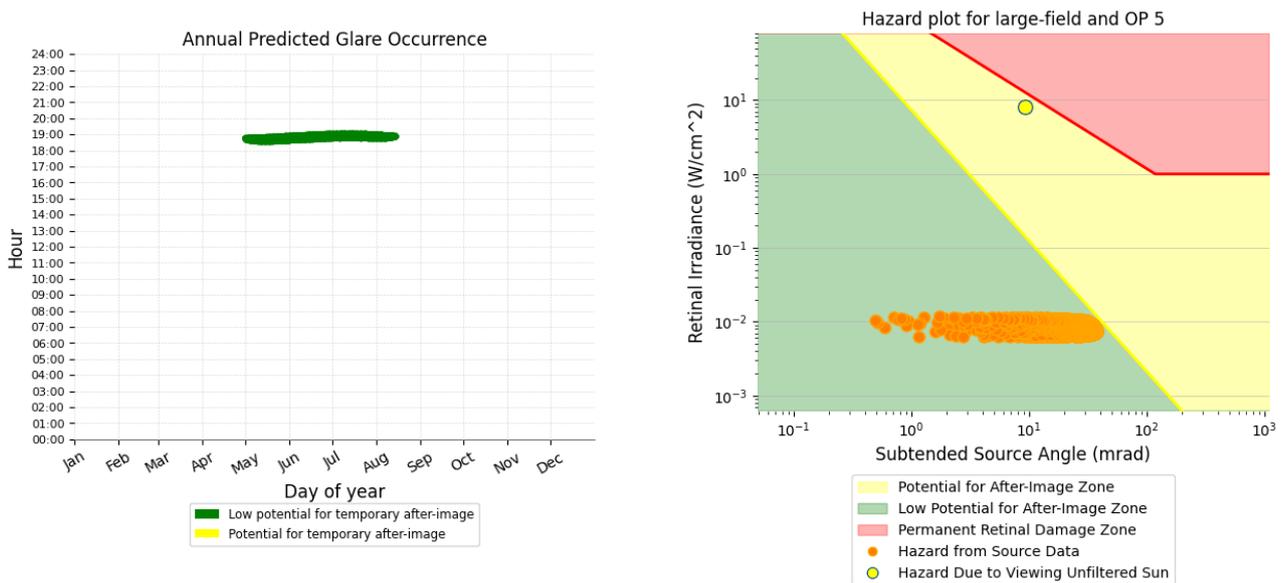


Figure A- 27 Time of day/year of glare occurrence at OP6 (left) and associated hazard plot (right)

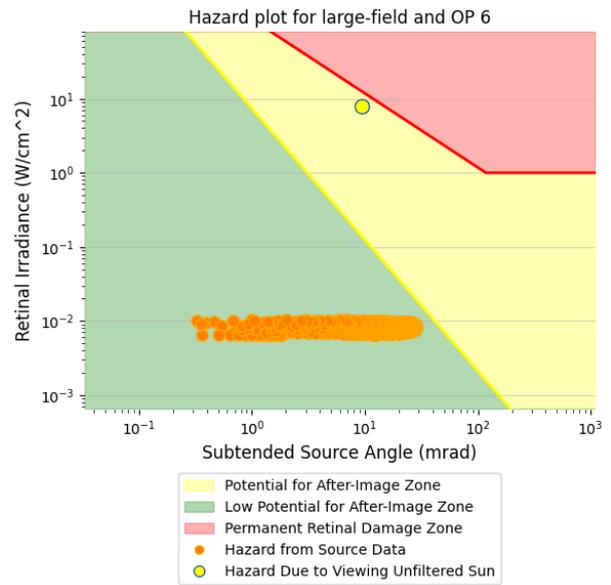
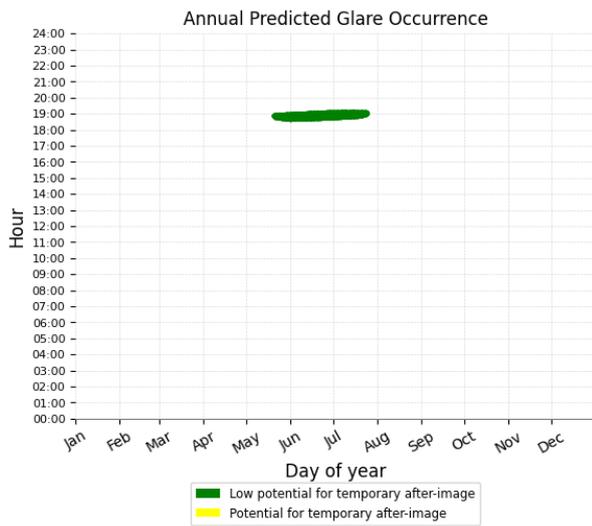


Figure A- 28 Time of day/year of glare occurrence at OP11 (left) and associated hazard plot (right)

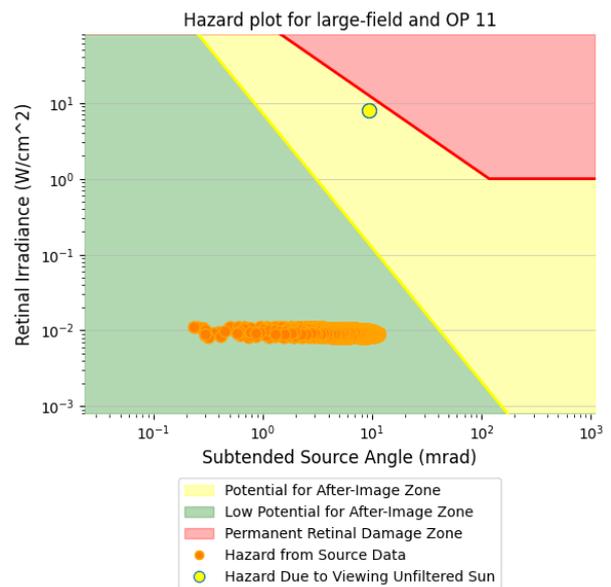
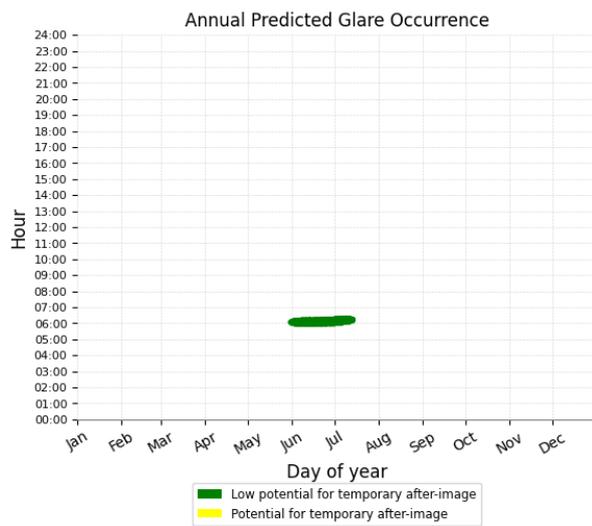


Figure A- 29 Time of day/year of glare occurrence at OP12 (left) and associated hazard plot (right)

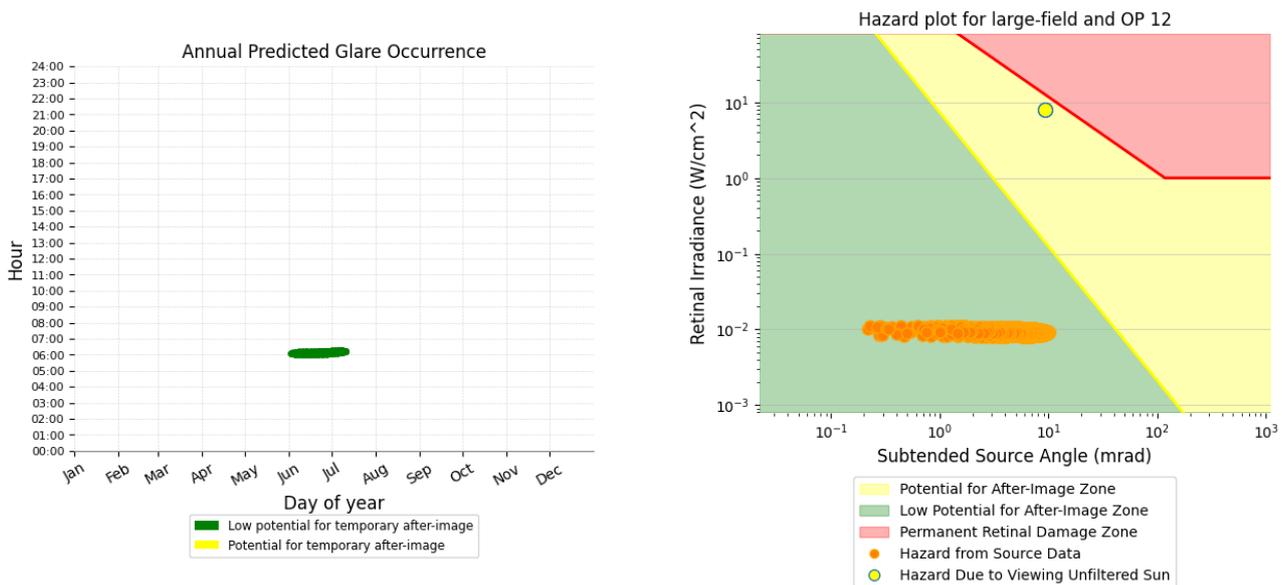


Figure A- 30 Time of day/year of glare occurrence at OP13 (left) and associated hazard plot (right)

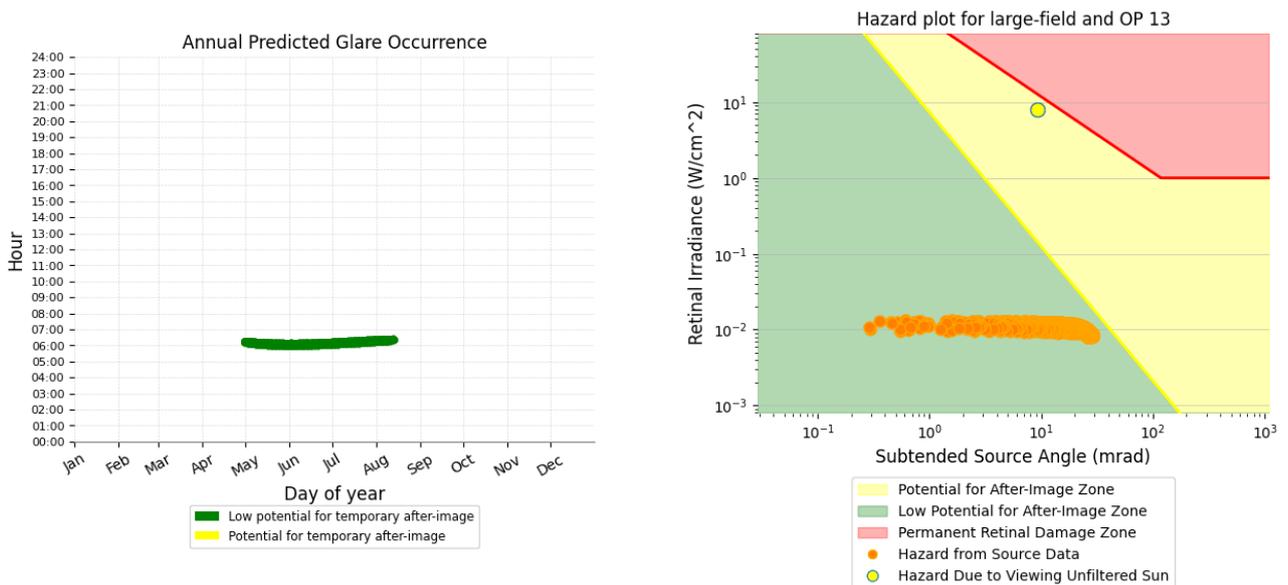
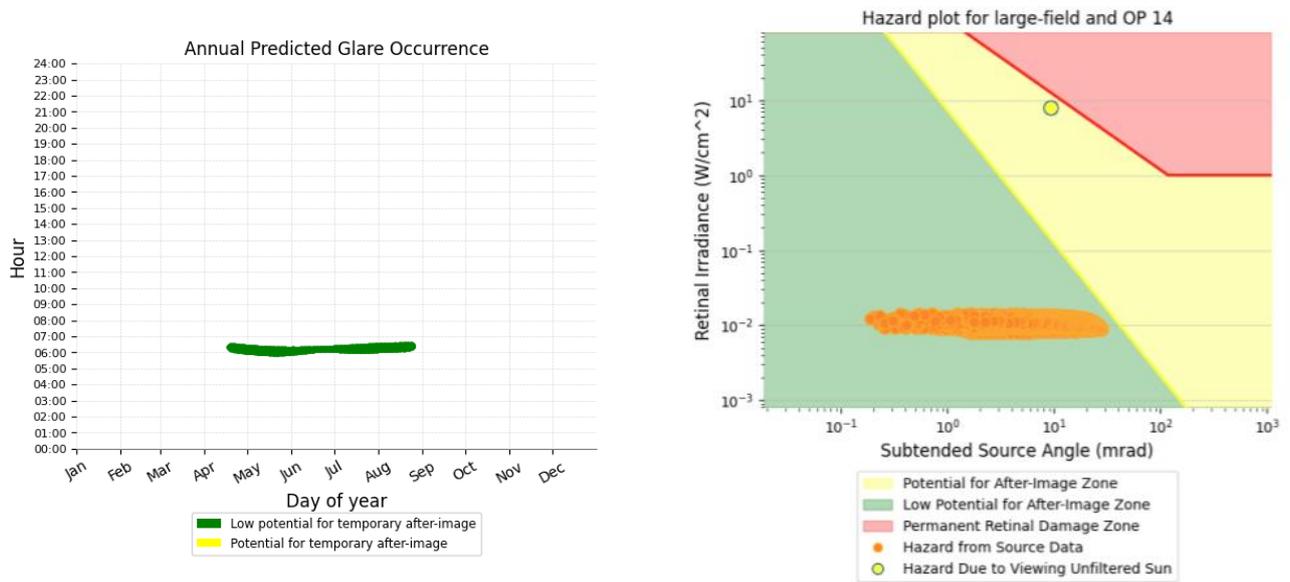


Figure A- 31 Time of day/year of glare occurrence at OP14 (left) and associated hazard plot (right)



A.2.2.6 Sludge Dewatering Building 1 – East

Figure A- 32 Time of day/year of glare occurrence at OP2 (left) and associated hazard plot (right)

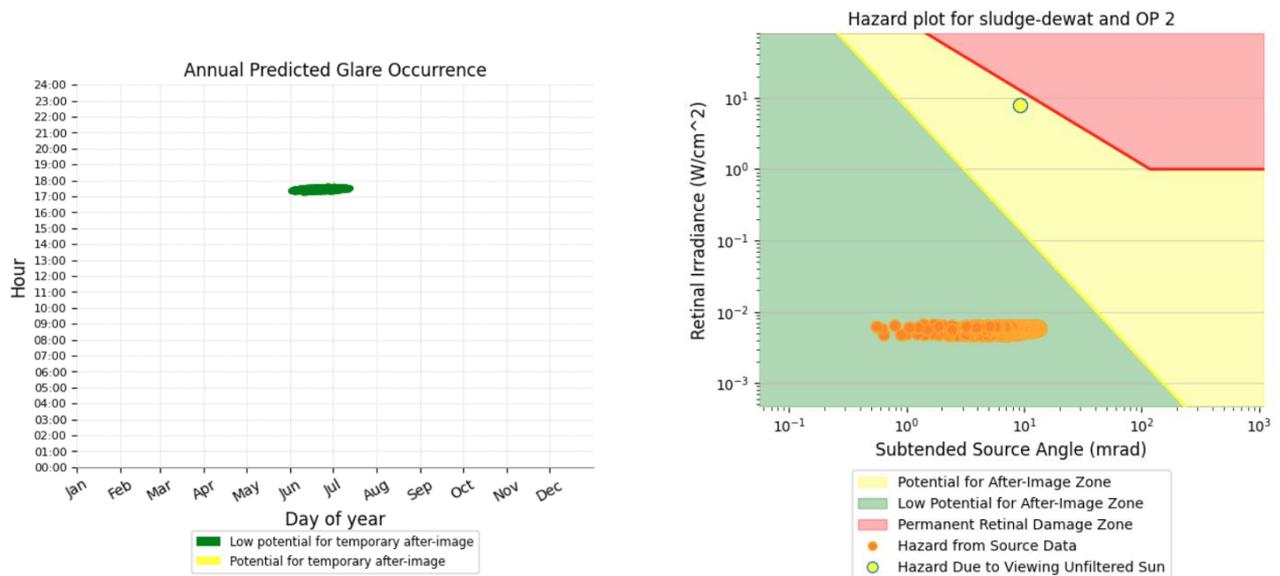


Figure A- 33 Time of day/year of glare occurrence at OP3 (left) and associated hazard plot (right)

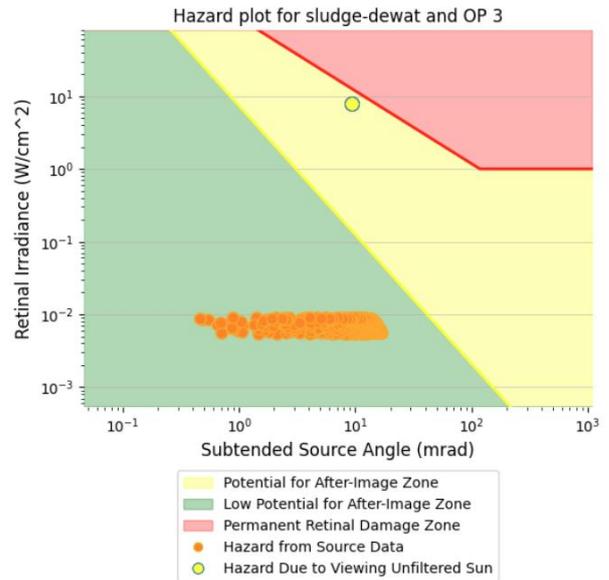
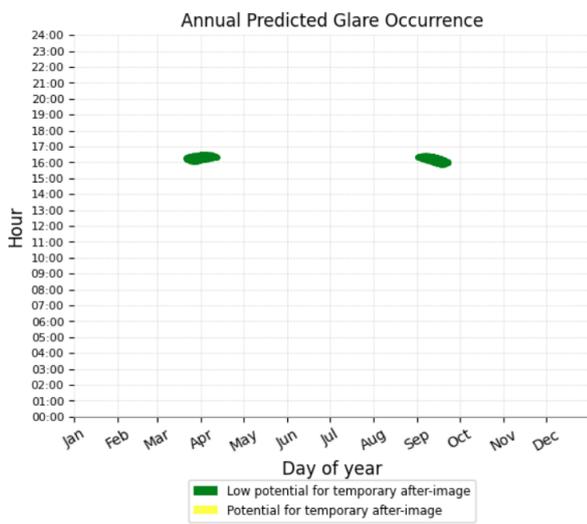


Figure A- 34 Time of day/year of glare occurrence at OP7 (left) and associated hazard plot (right)

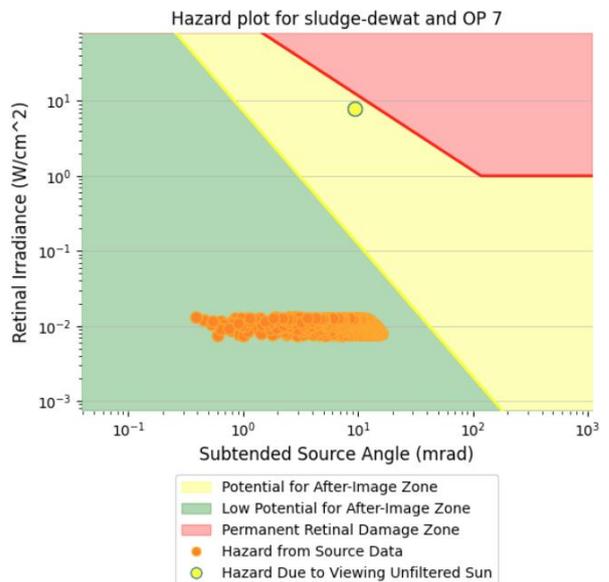
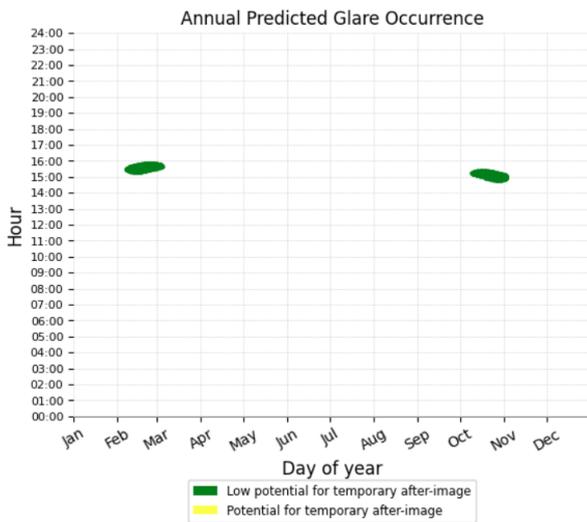


Figure A- 35 Time of day/year of glare occurrence at OP8 (left) and associated hazard plot (right)

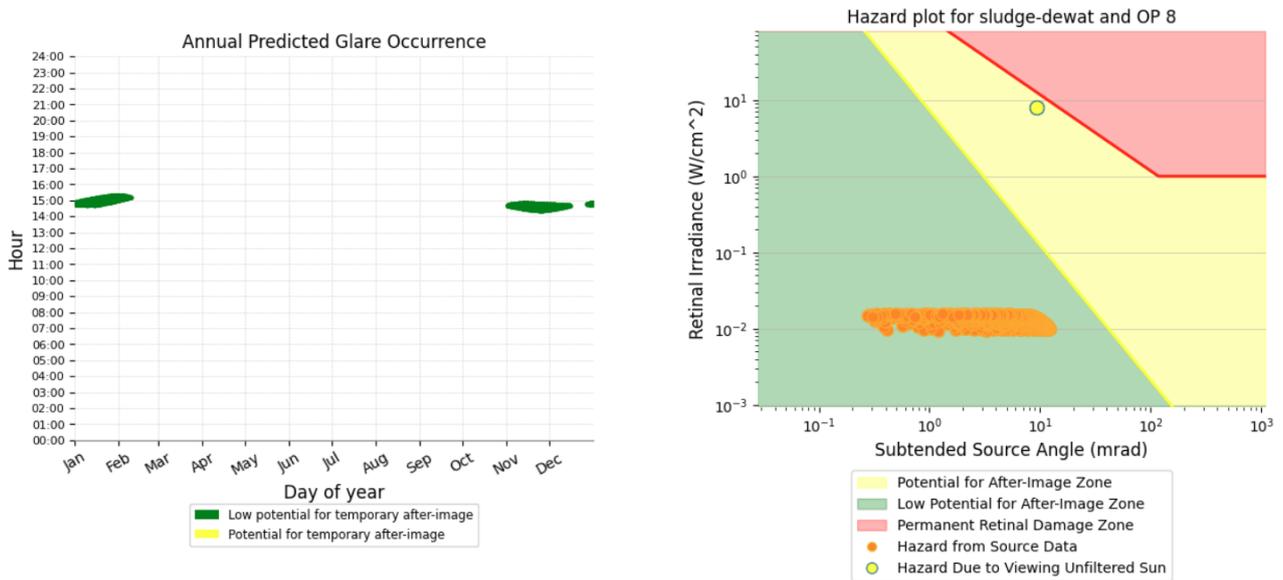
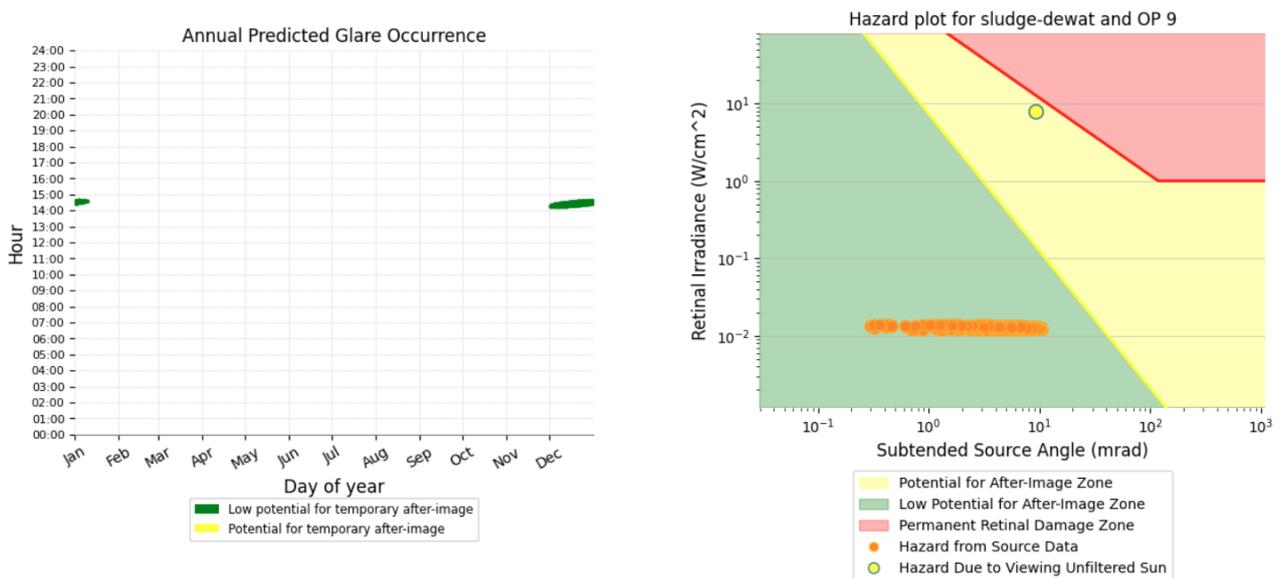


Figure A- 36 Time of day/year of glare occurrence at OP9 (left) and associated hazard plot (right)



A.2.2.7 Sludge Dewatering Building 2 – East

Figure A- 37 Time of day/year of glare occurrence at OP3 (left) and associated hazard plot (right)

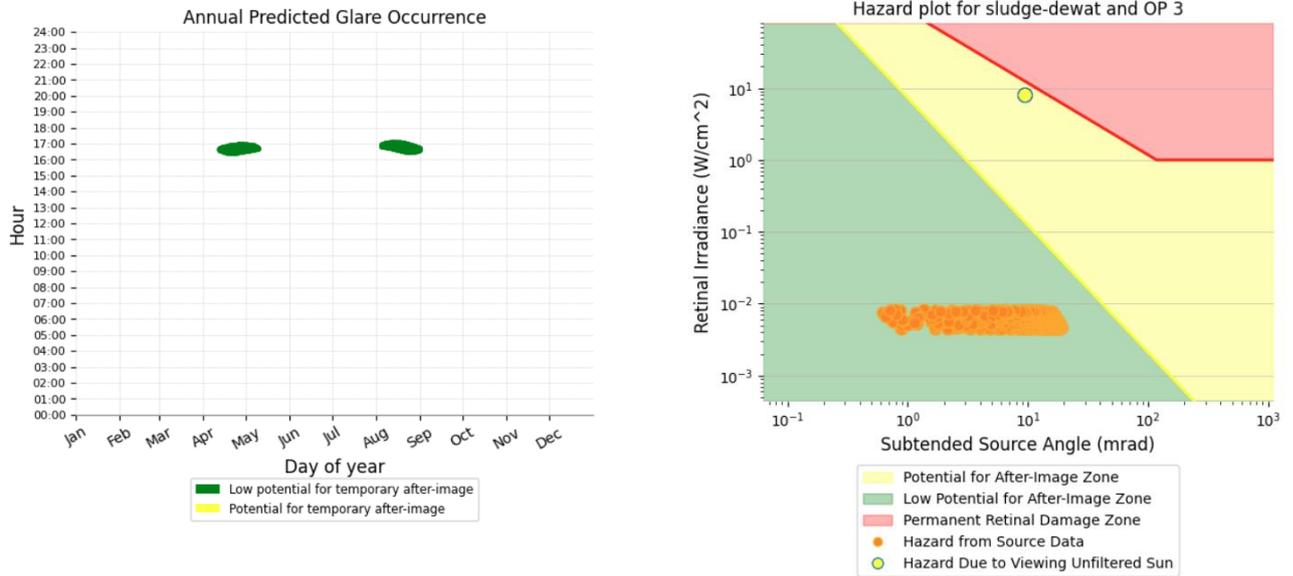


Figure A- 38 Time of day/year of glare occurrence at OP7 (left) and associated hazard plot (right)

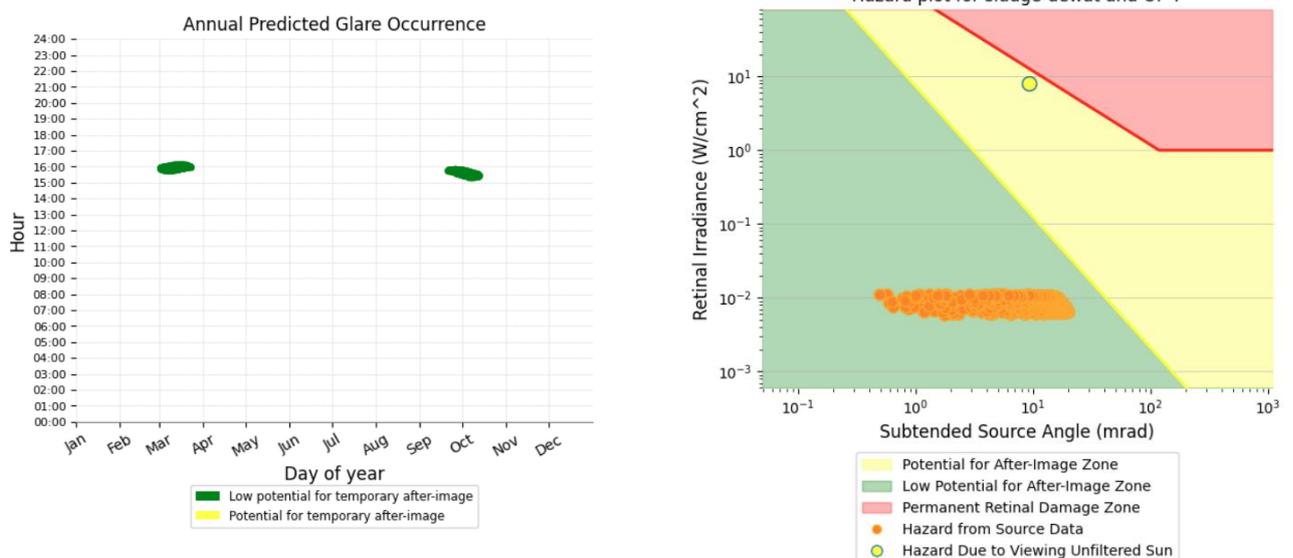


Figure A- 39 Time of day/year of glare occurrence at OP8 (left) and associated hazard plot (right)

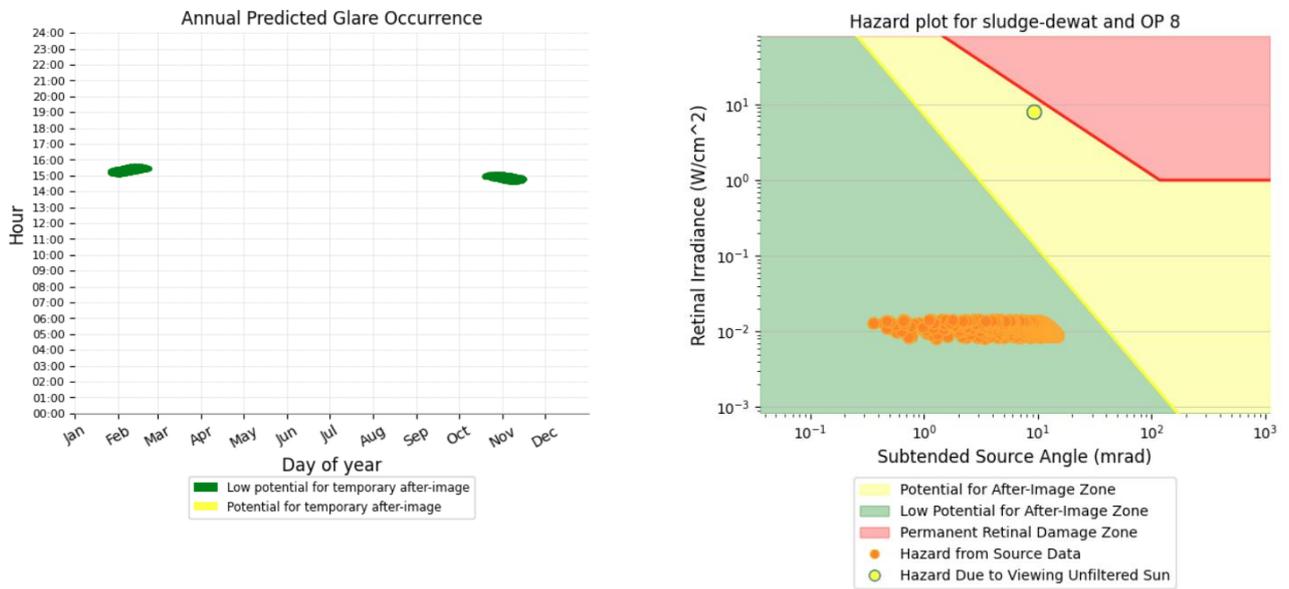
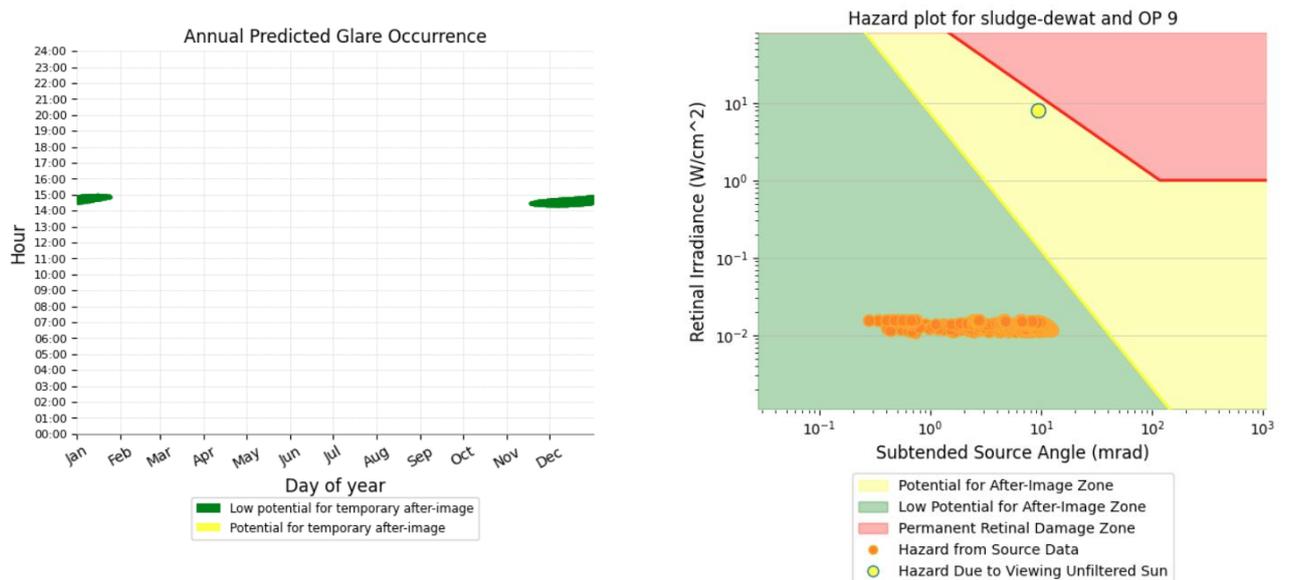
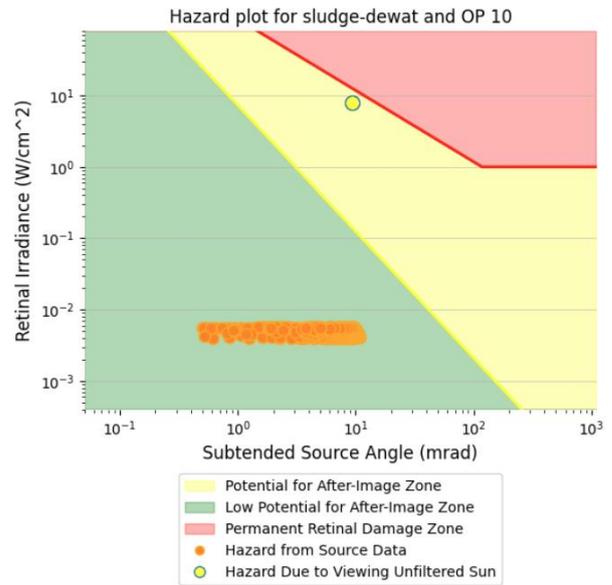
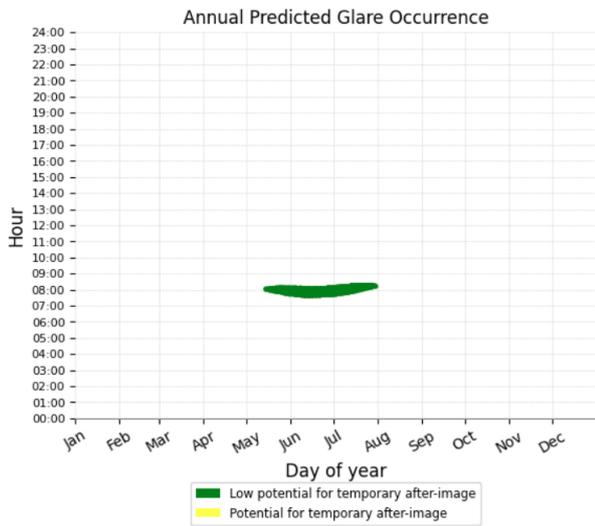


Figure A- 40 Time of day/year of glare occurrence at OP9 (left) and associated hazard plot (right)



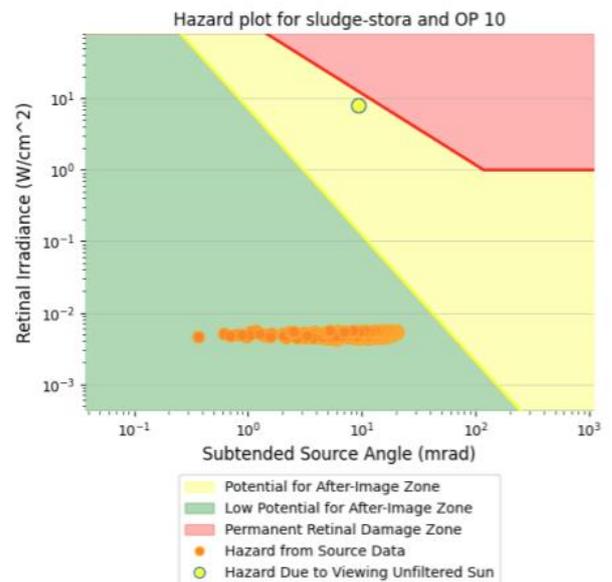
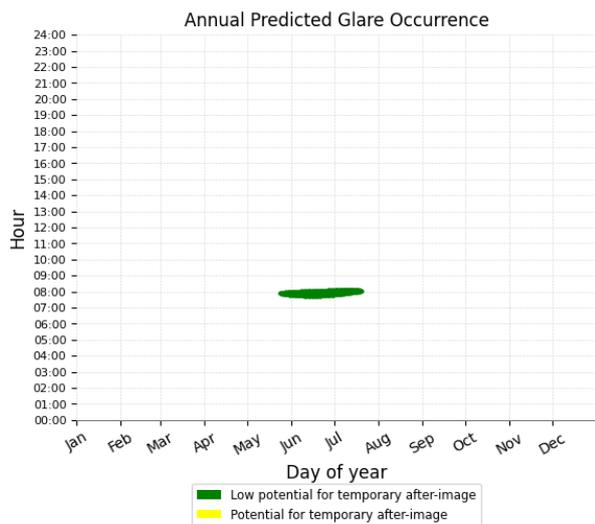
A.2.2.8 Sludge Dewatering Building 2 – West

Figure A- 41 Time of day/year of glare occurrence at OP10 (left) and associated hazard plot (right)



A.2.2.9 Sludge Storage Building 1

Figure A- 42 Time of day/year of glare occurrence at OP10 (left) and associated hazard plot (right)



A.2.2.10 Sludge Storage Building 2

Figure A- 43 Time of day/year of glare occurrence at OP3 (left) and associated hazard plot (right)

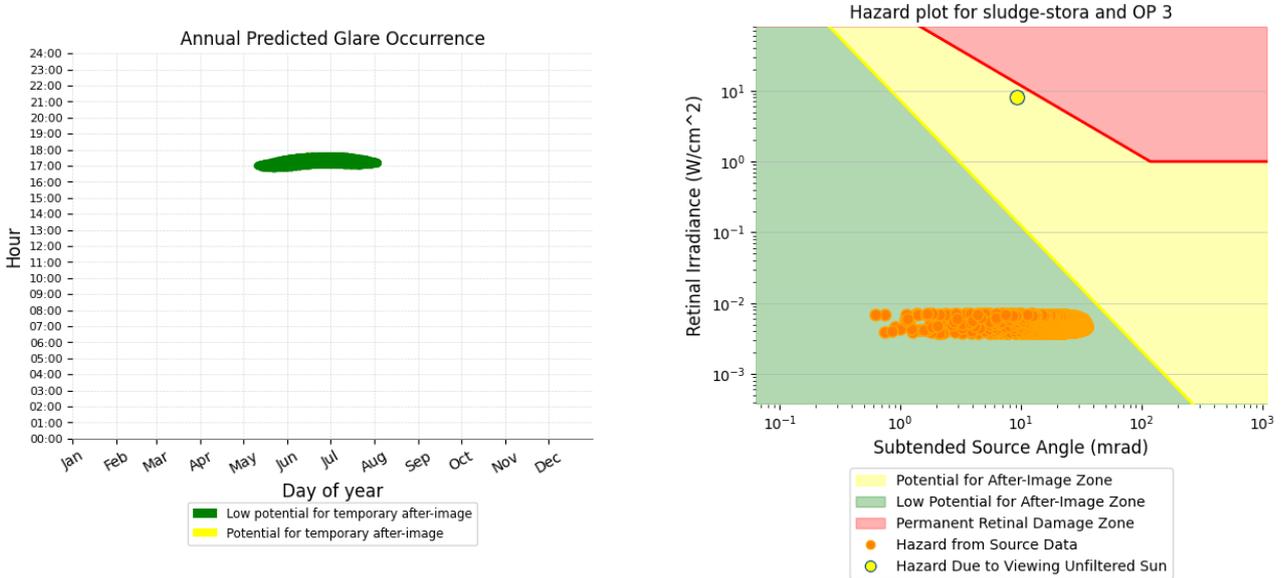


Figure A- 44 Time of day/year of glare occurrence at OP7 (left) and associated hazard plot (right)

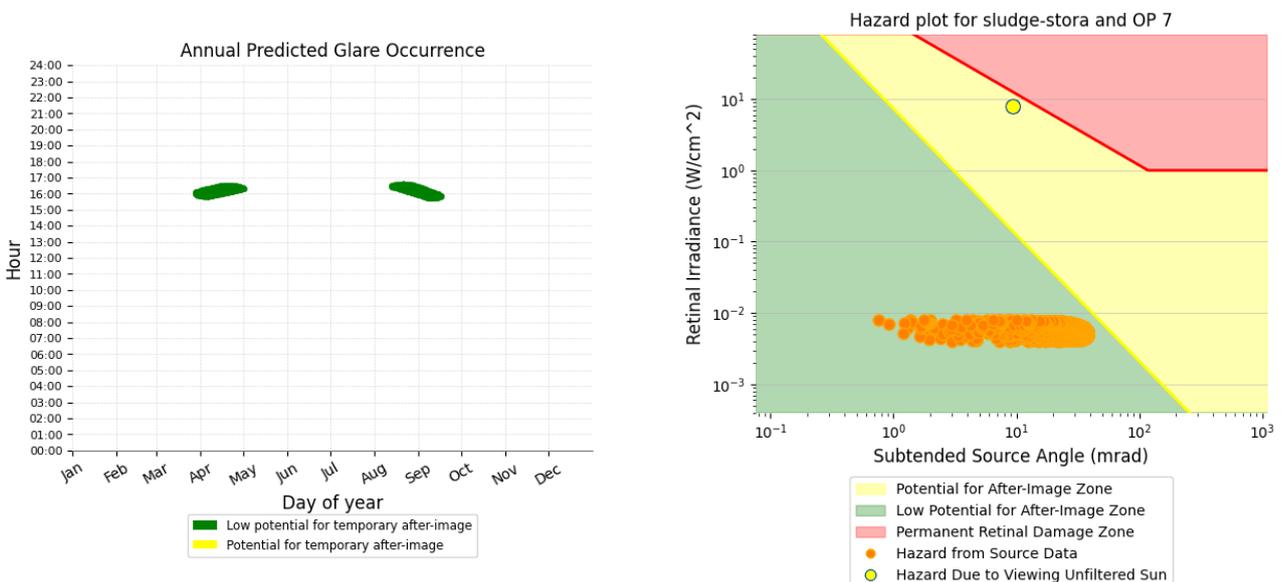


Figure A- 45 Time of day/year of glare occurrence at OP8 (left) and associated hazard plot (right)

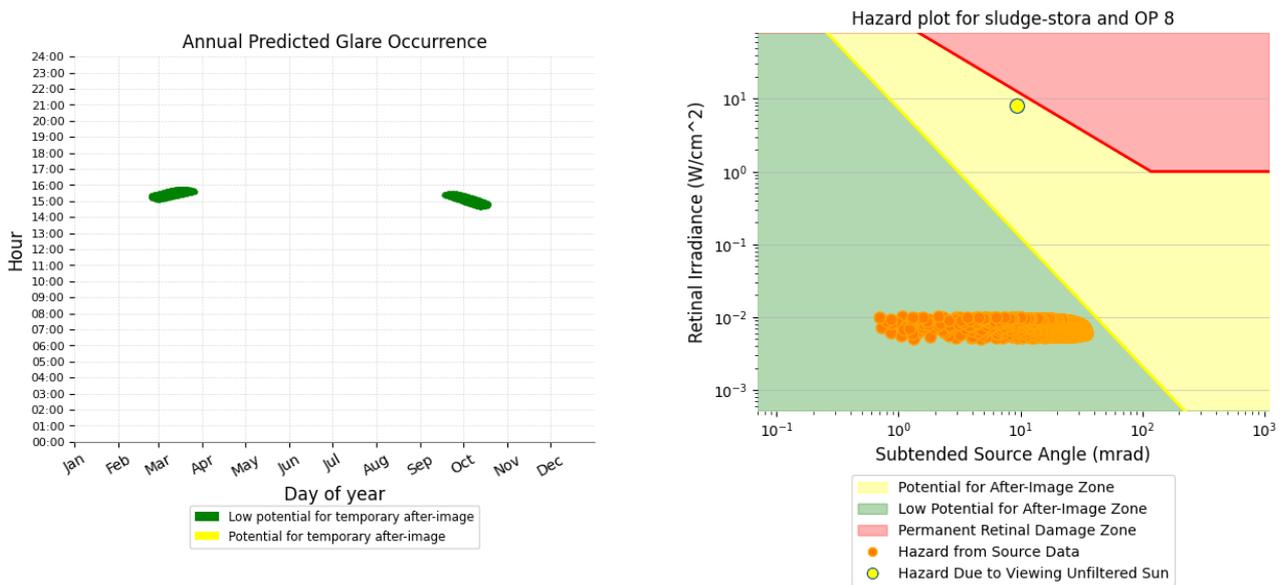
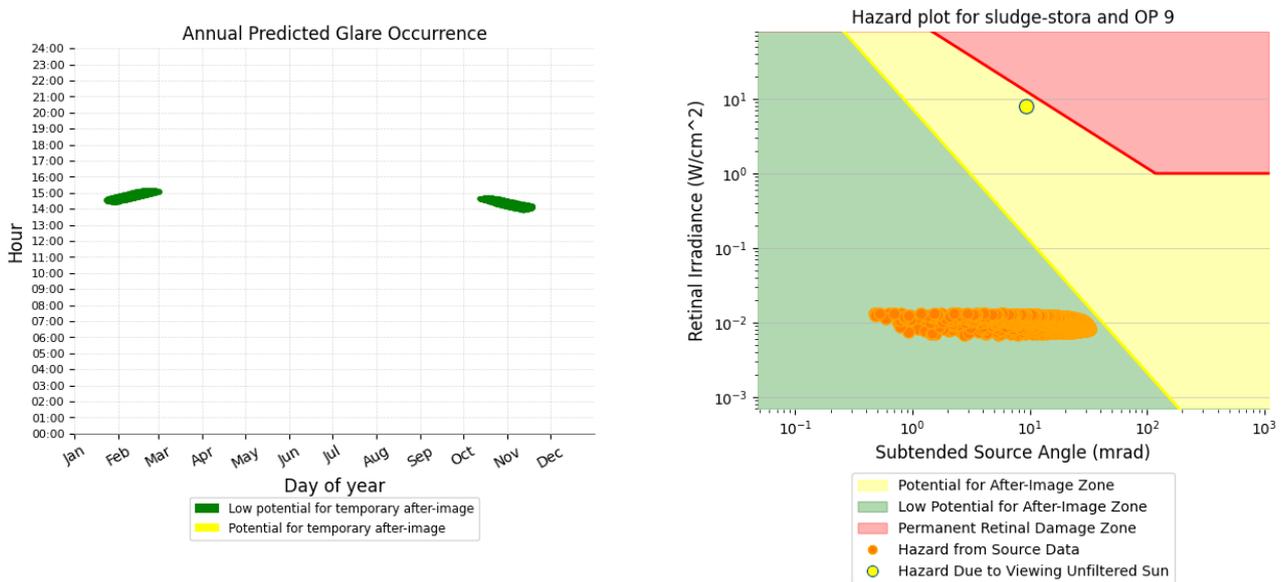


Figure A- 46 Time of day/year of glare occurrence at OP9 (left) and associated hazard plot (right)



A.2.2.11 UV Dosing

Figure A- 47 Time of day/year of glare occurrence at OP3 (left) and associated hazard plot (right)

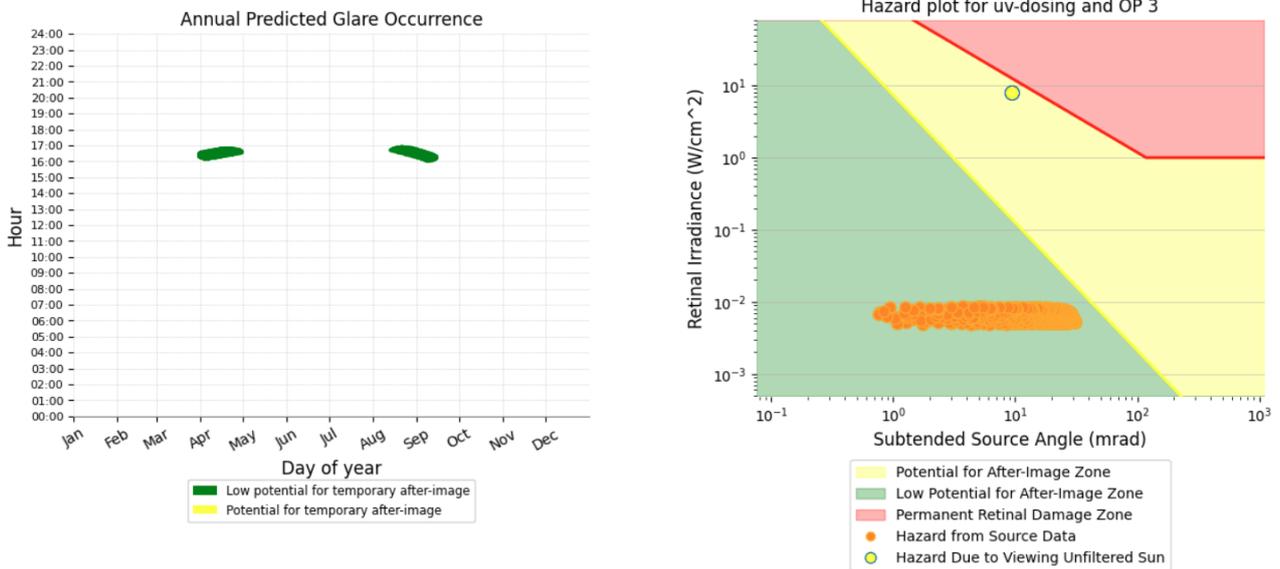


Figure A- 48 Time of day/year of glare occurrence at OP7 (left) and associated hazard plot (right)

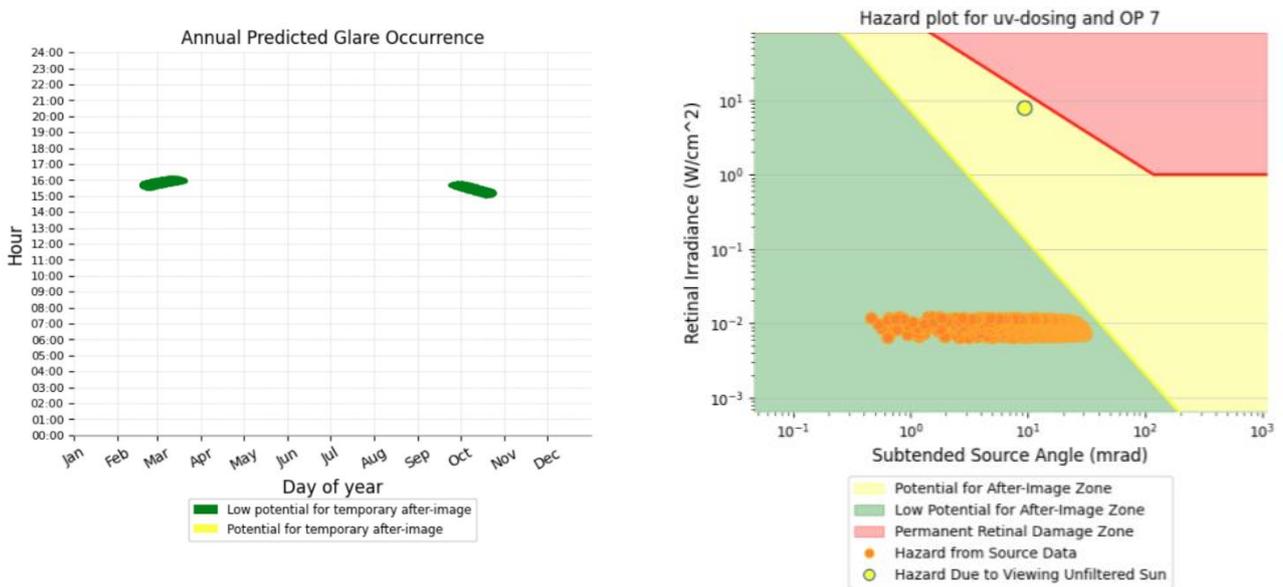


Figure A- 49 Time of day/year of glare occurrence at OP8 (left) and associated hazard plot (right)

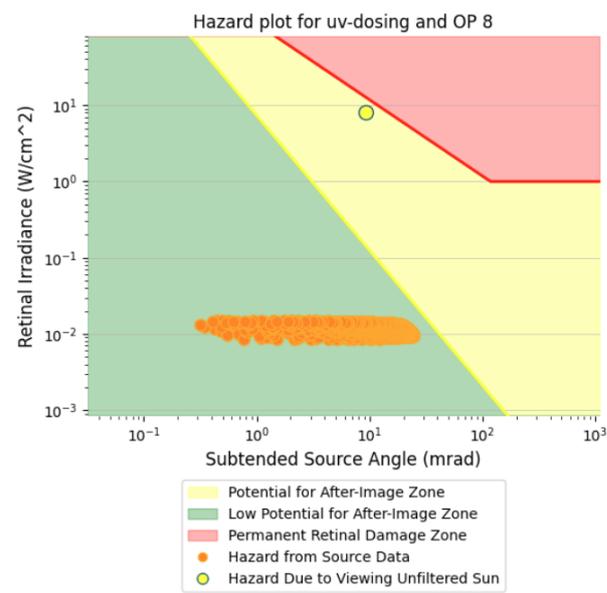
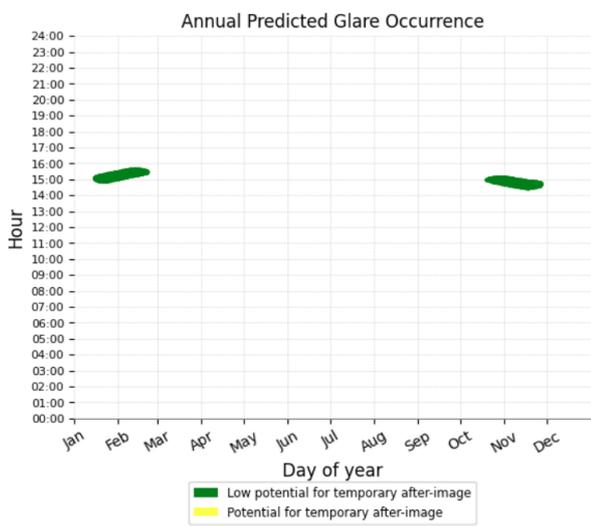
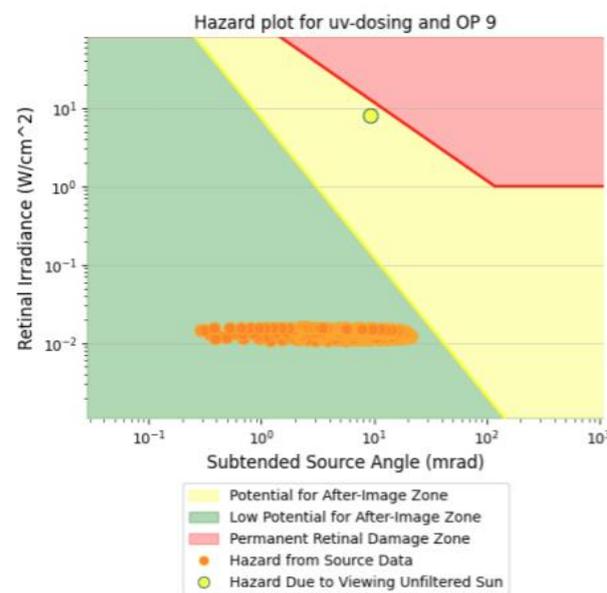
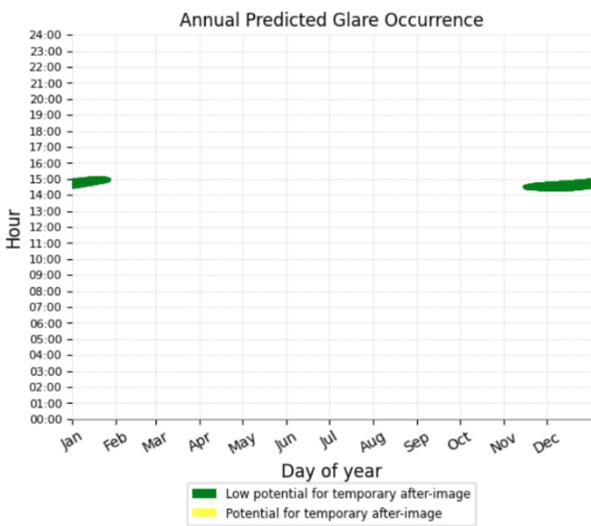


Figure A- 50 Time of day/year of glare occurrence at OP9 (left) and associated hazard plot (right)



A.2.2.12 Water Treatment Module 1

Figure A- 51 Time of day/year of glare occurrence at OP1 (left) and associated hazard plot (right)

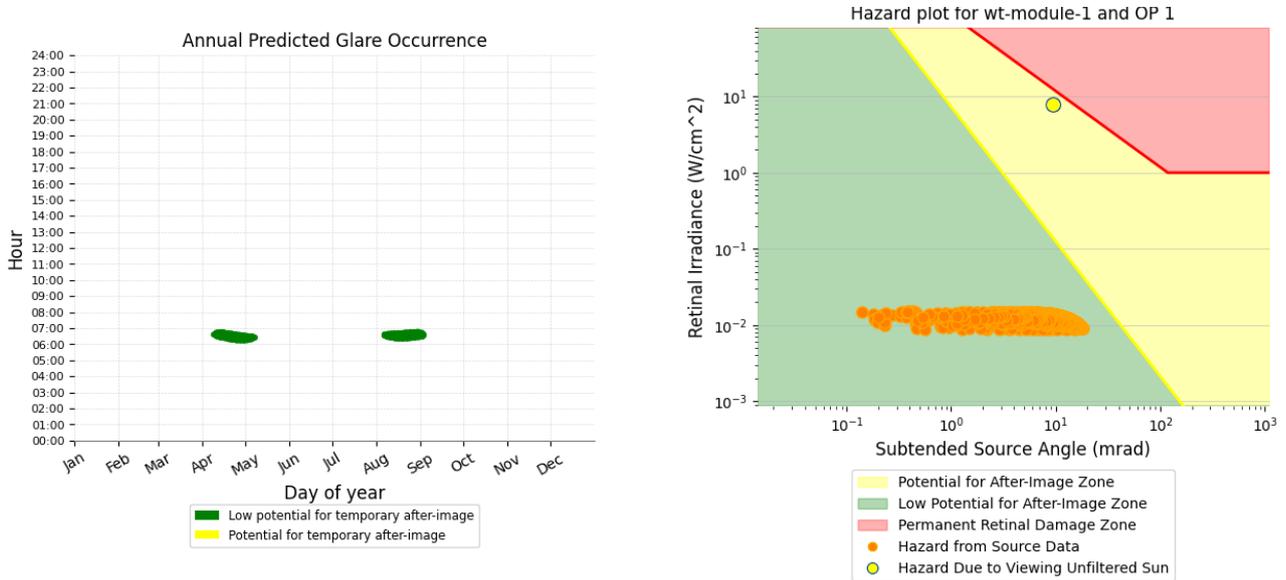


Figure A- 52 Time of day/year of glare occurrence at OP4 (left) and associated hazard plot (right)

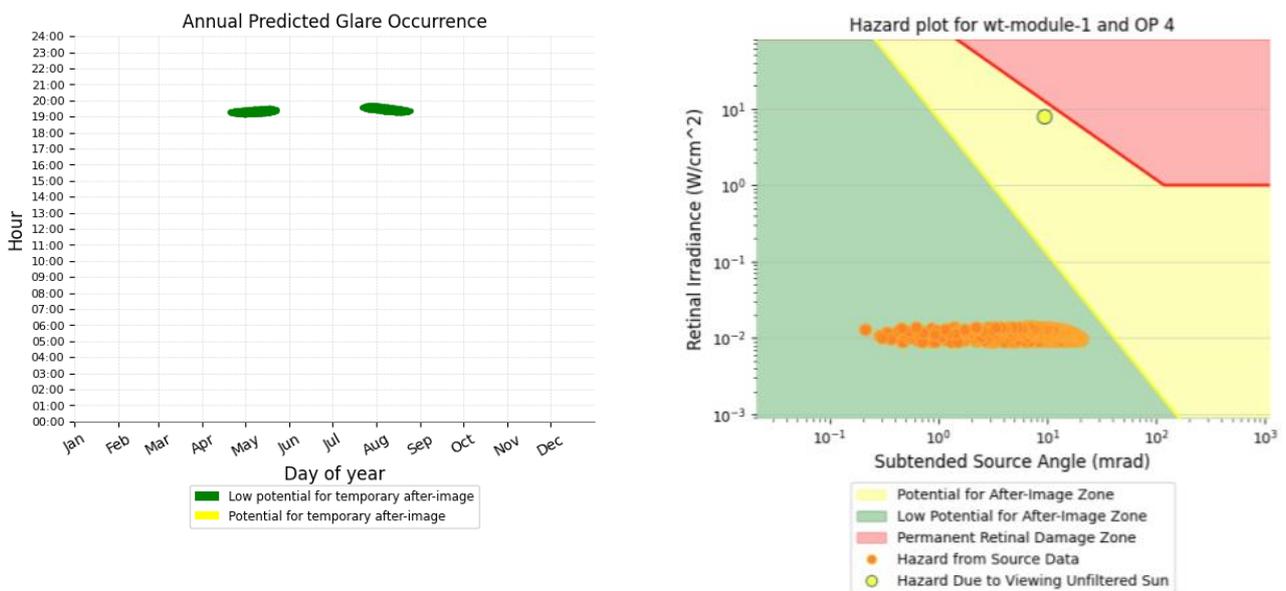


Figure A- 53 Time of day/year of glare occurrence at OP5 (left) and associated hazard plot (right)

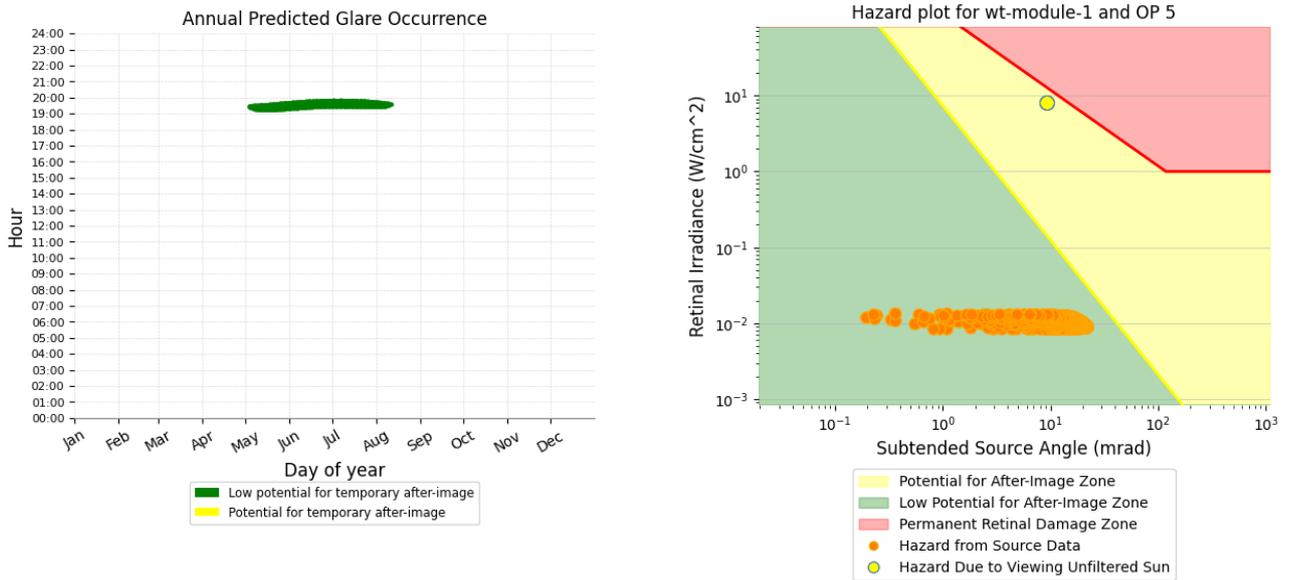


Figure A- 54 Time of day/year of glare occurrence at OP6 (left) and associated hazard plot (right)

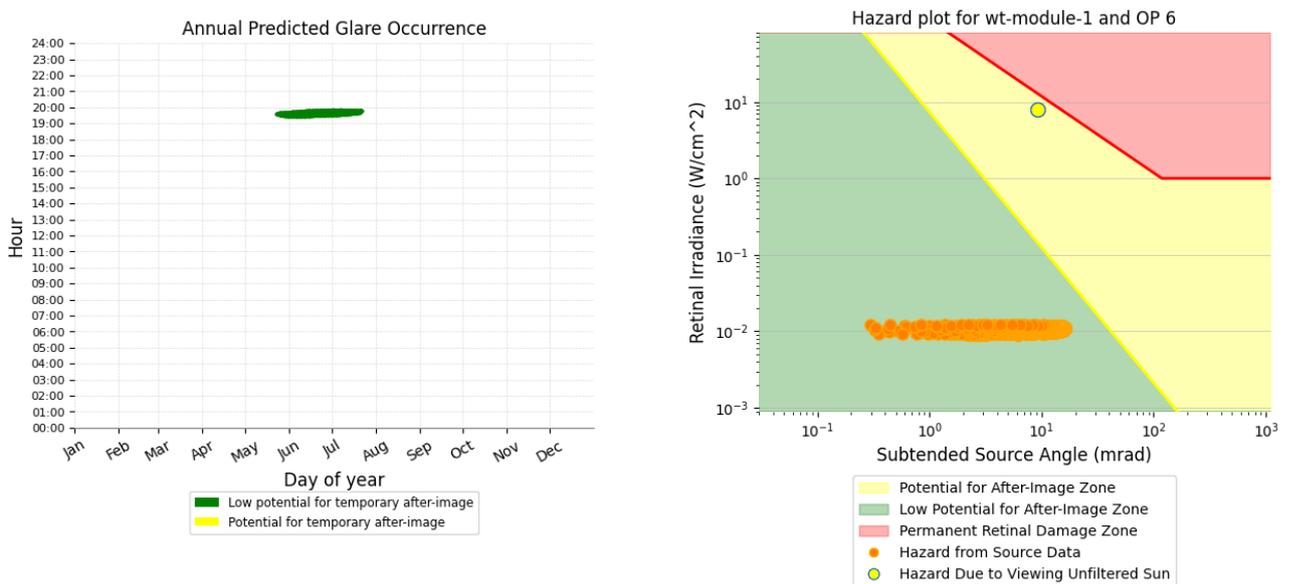


Figure A- 55 Time of day/year of glare occurrence at OP13 (left) and associated hazard plot (right)

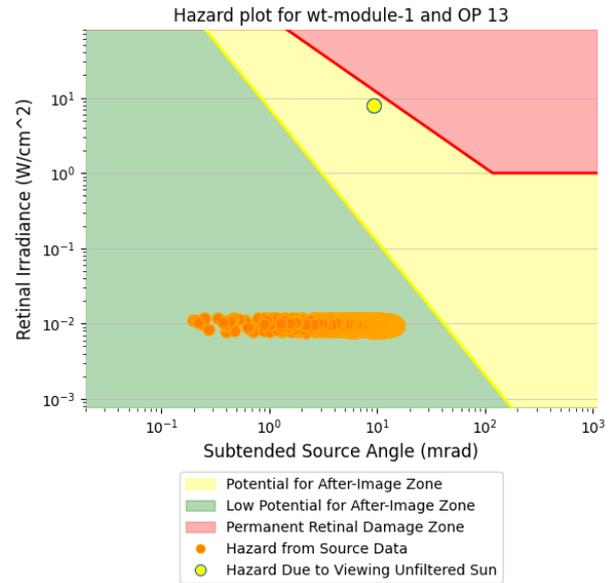
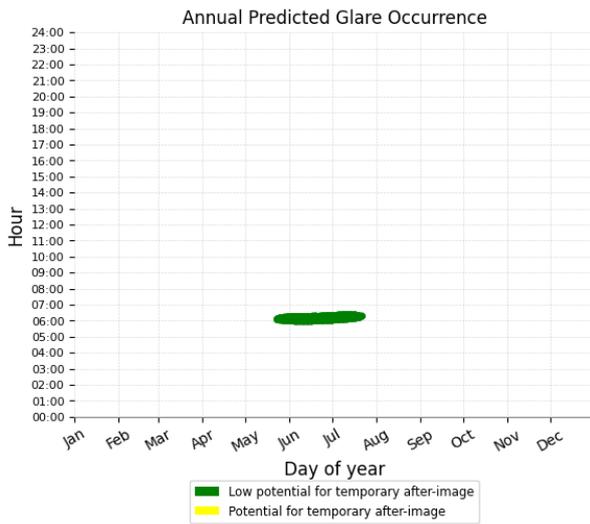
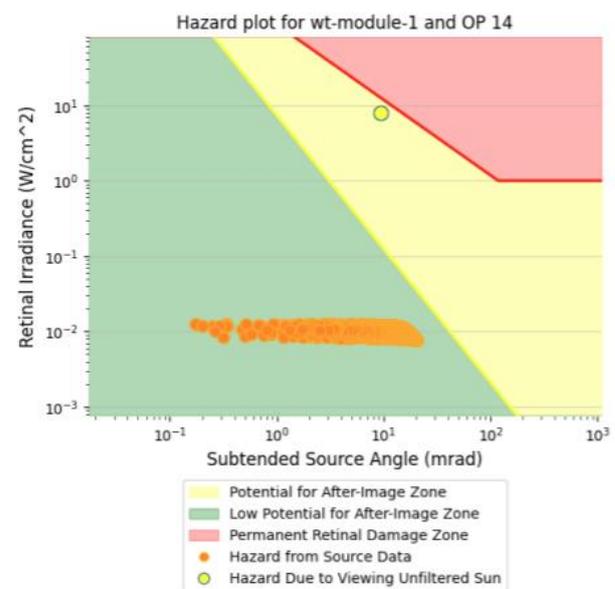
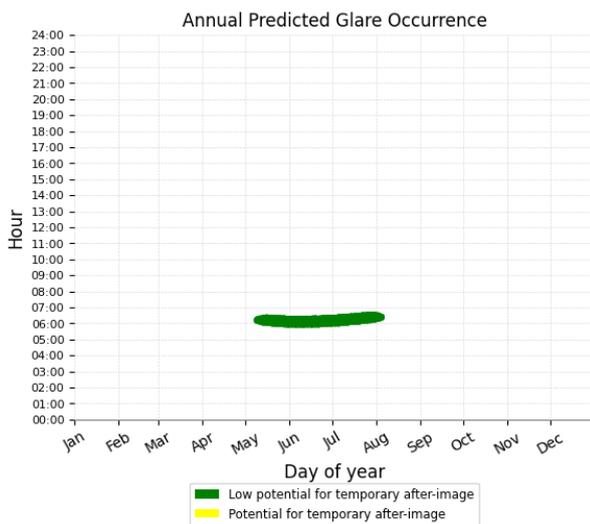


Figure A- 56 Time of day/year of glare occurrence at OP14 (left) and associated hazard plot (right)



A.2.2.13 Water Treatment Module 2

Figure A- 57 Time of day/year of glare occurrence at OP1 (left) and associated hazard plot (right)

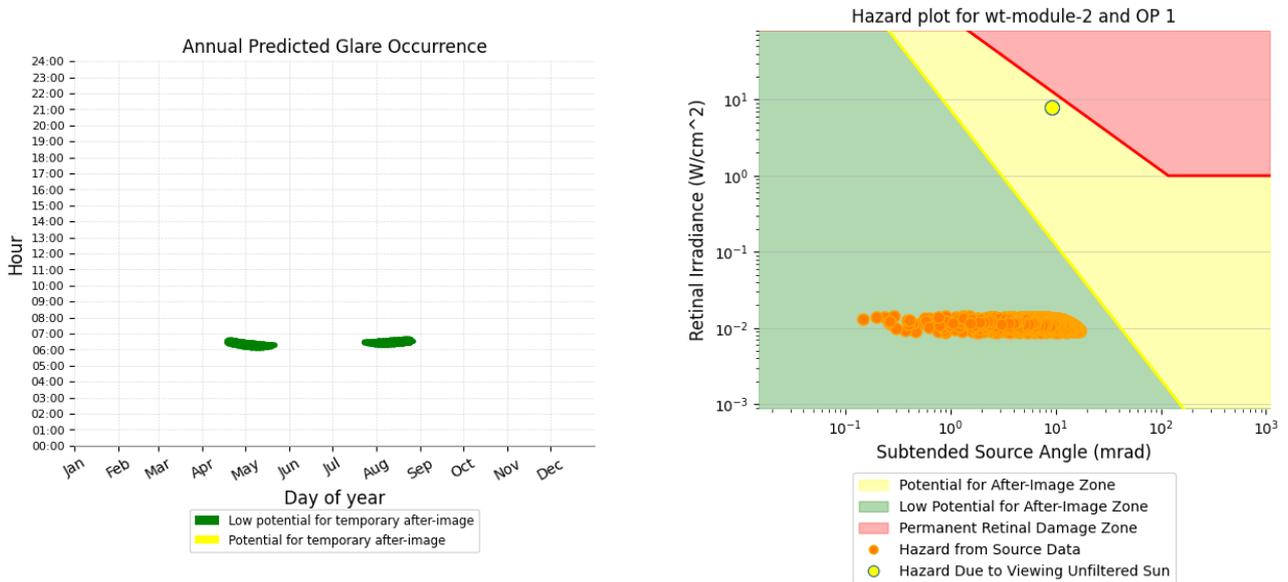


Figure A- 58 Time of day/year of glare occurrence at OP2 (left) and associated hazard plot (right)

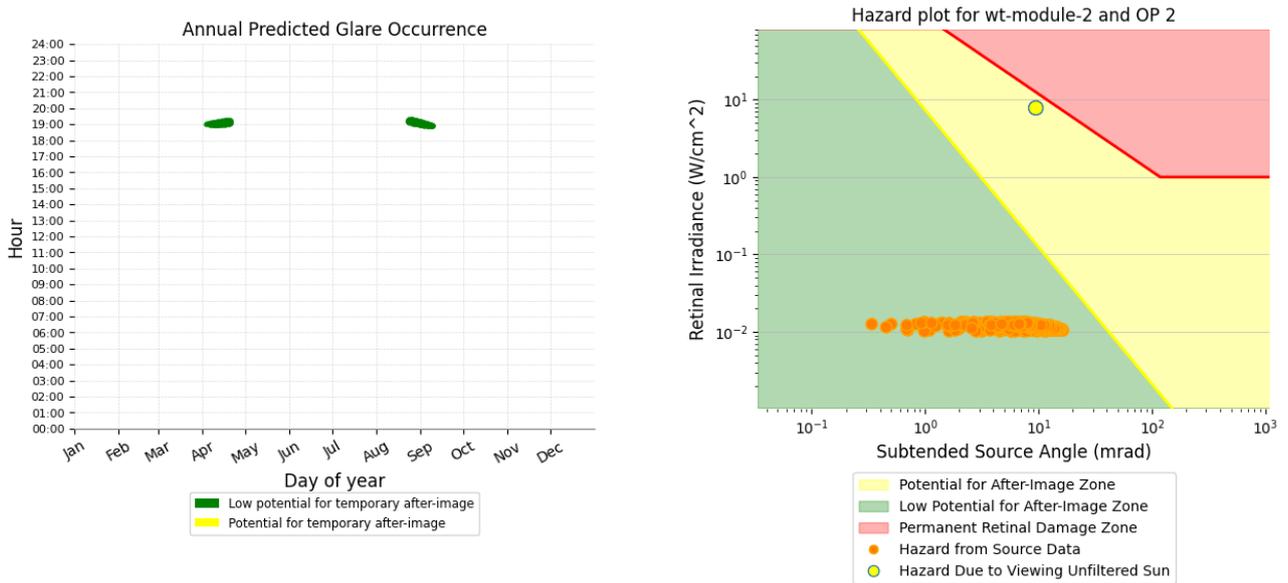


Figure A- 59 Time of day/year of glare occurrence at OP4 (left) and associated hazard plot (right)

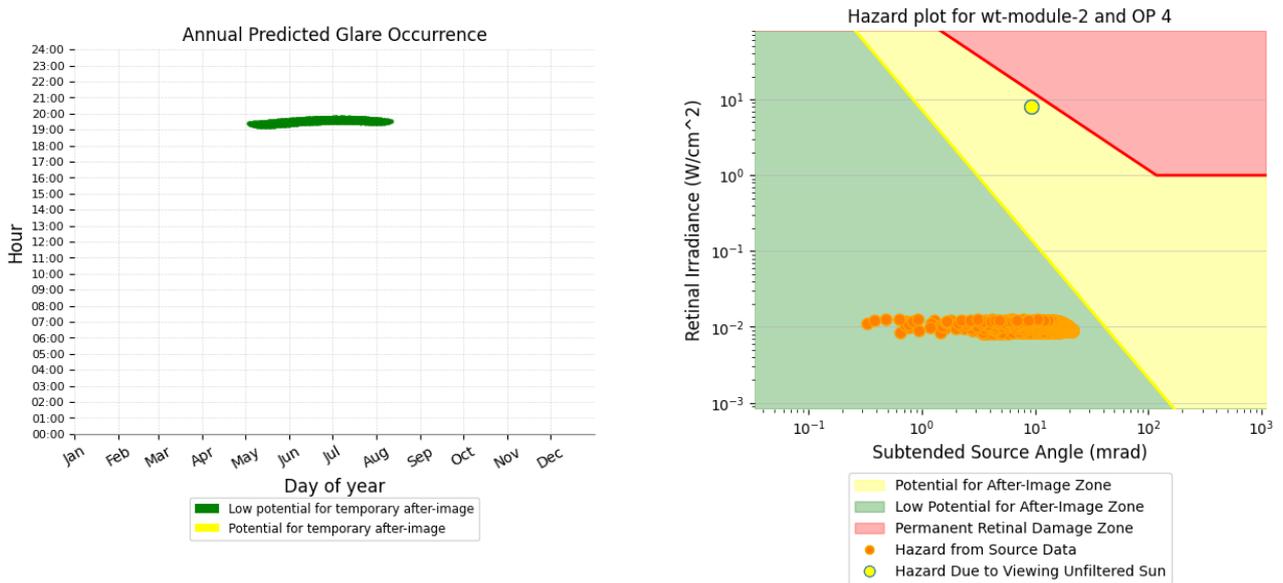


Figure A- 60 Time of day/year of glare occurrence at OP5 (left) and associated hazard plot (right)

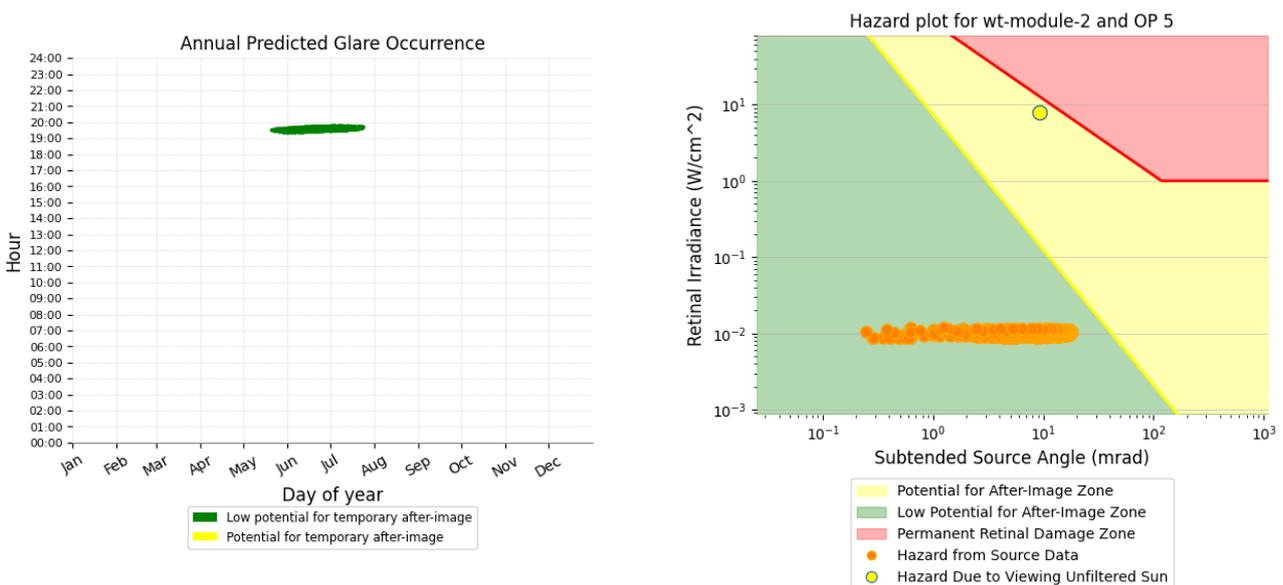


Figure A- 61 Time of day/year of glare occurrence at OP10 (left) and associated hazard plot (right)

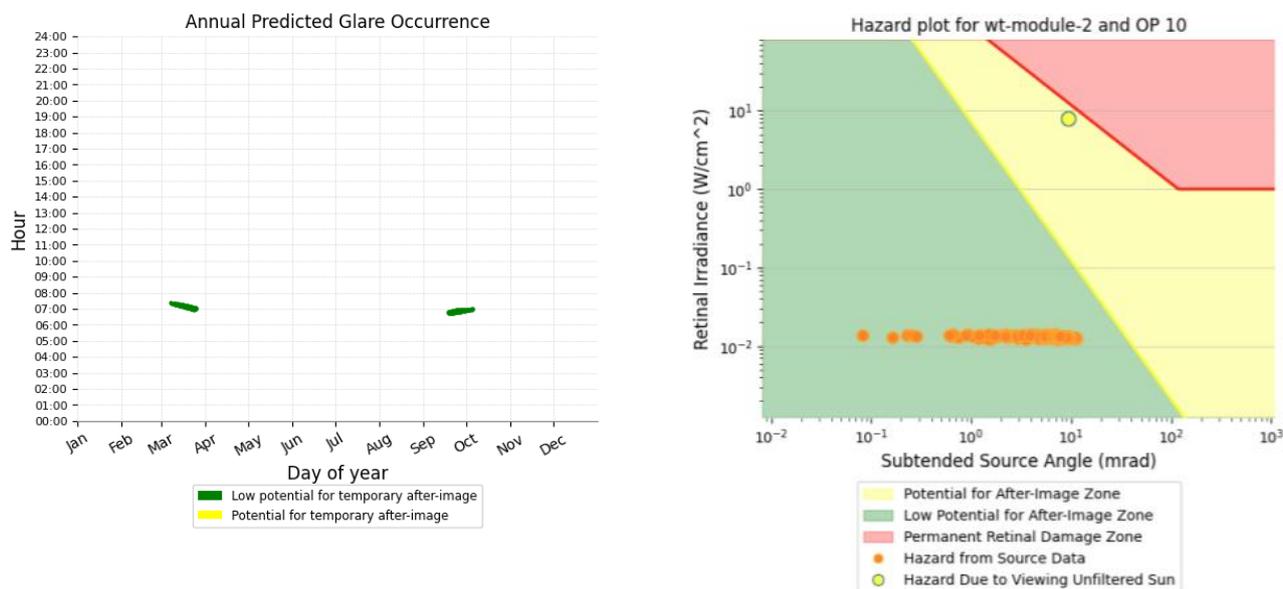


Figure A- 62 Time of day/year of glare occurrence at OP13 (left) and associated hazard plot (right)

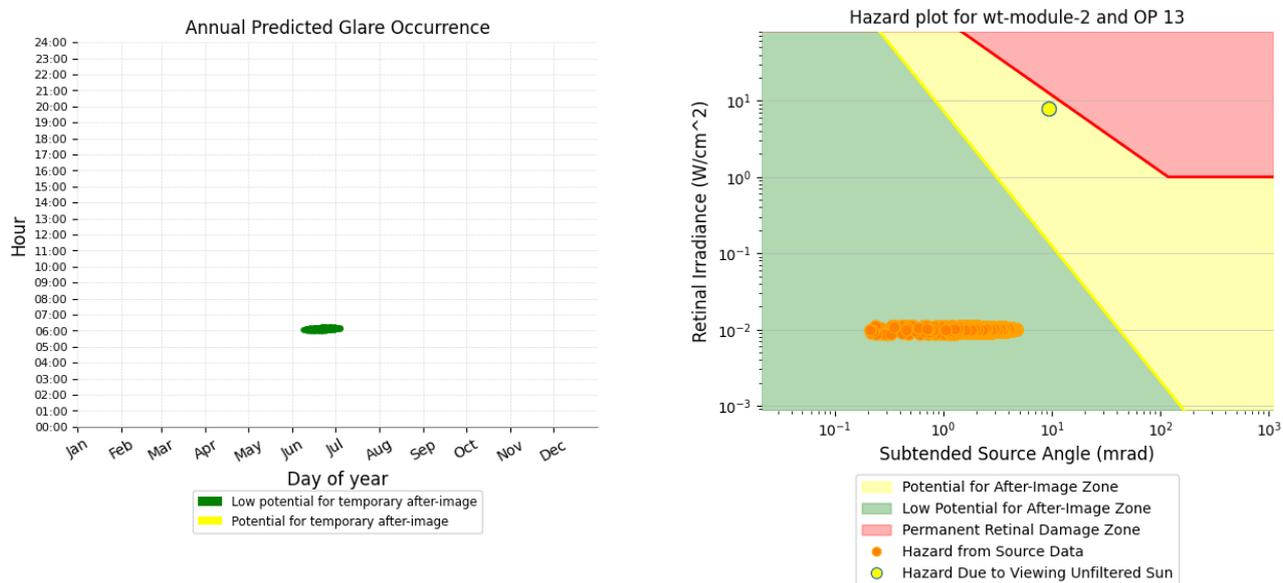
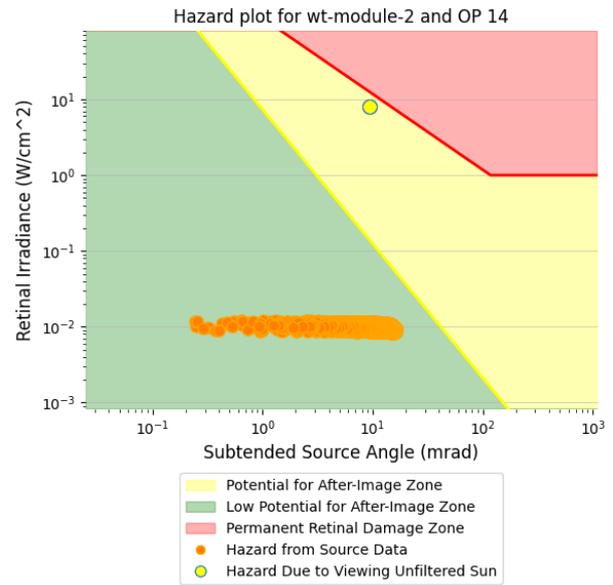
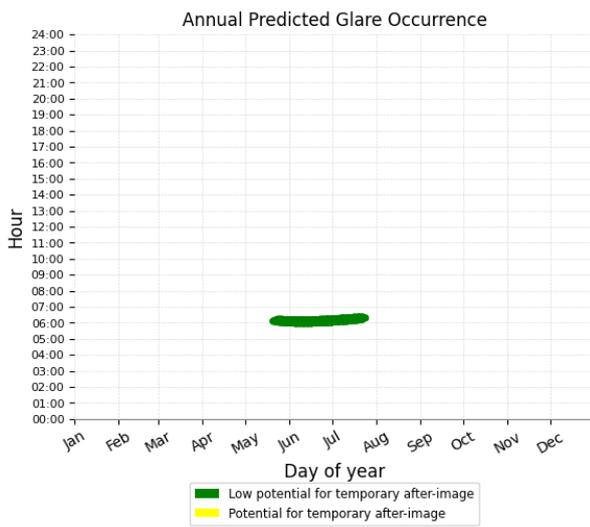


Figure A- 63 Time of day/year of glare occurrence at OP14 (left) and associated hazard plot (right)



A.2.2.14 Water Treatment Module 3

Figure A- 64 Time of day/year of glare occurrence at OP1 (left) and associated hazard plot (right)

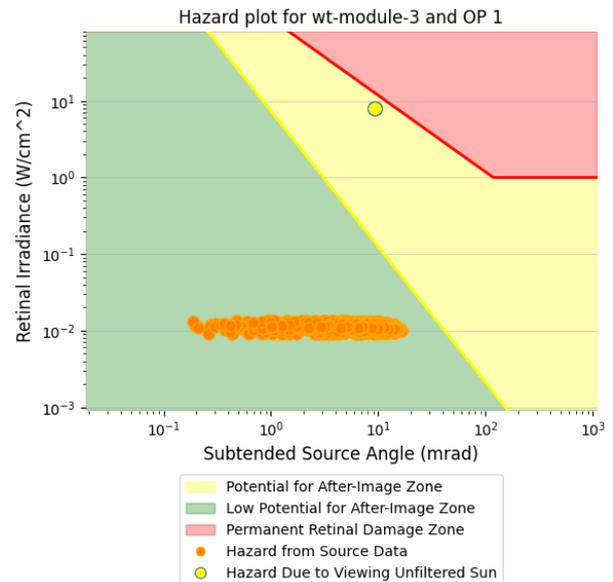
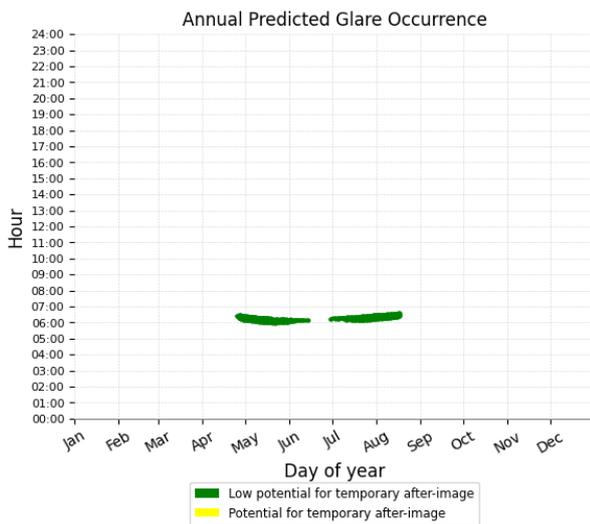


Figure A- 65 Time of day/year of glare occurrence at OP2 (left) and associated hazard plot (right)

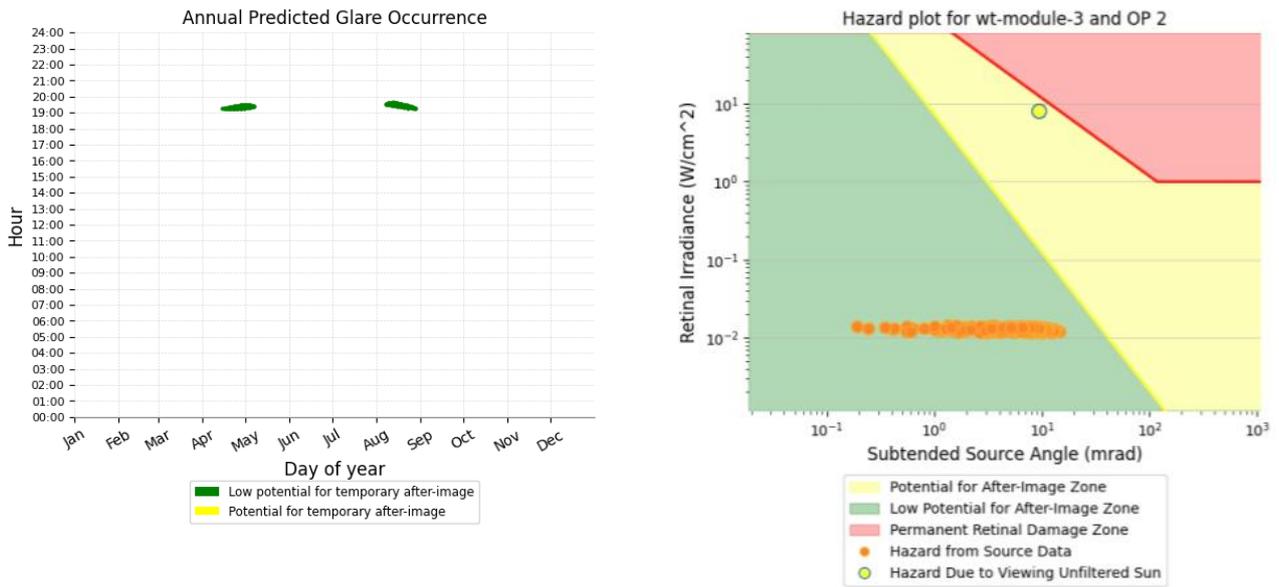


Figure A- 66 Time of day/year of glare occurrence at OP4 (left) and associated hazard plot (right)

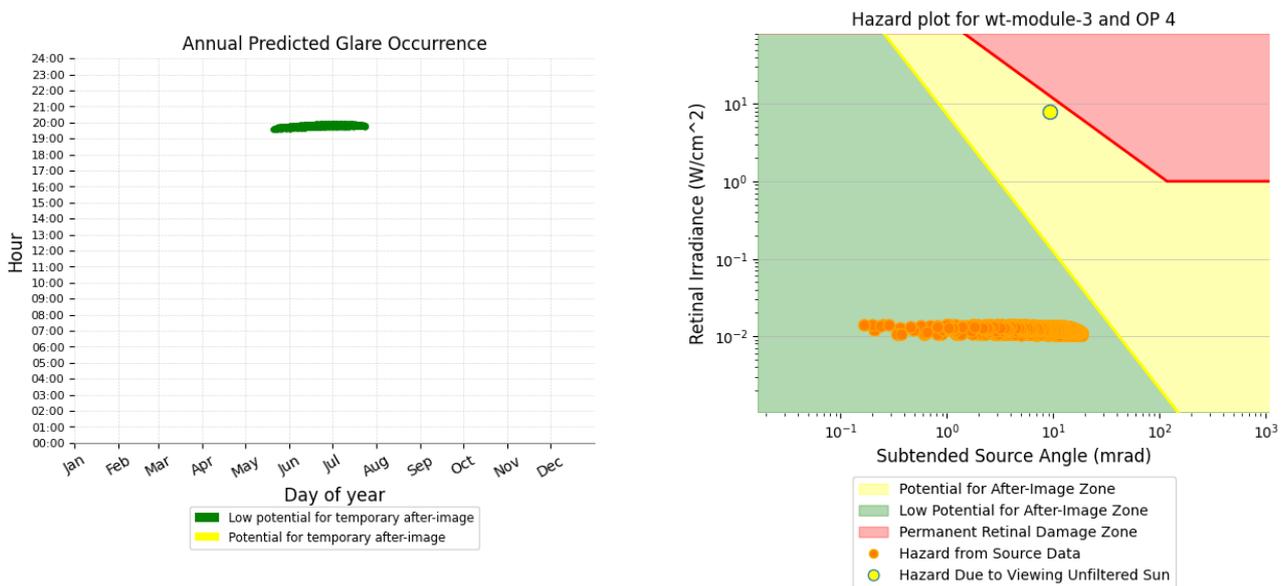
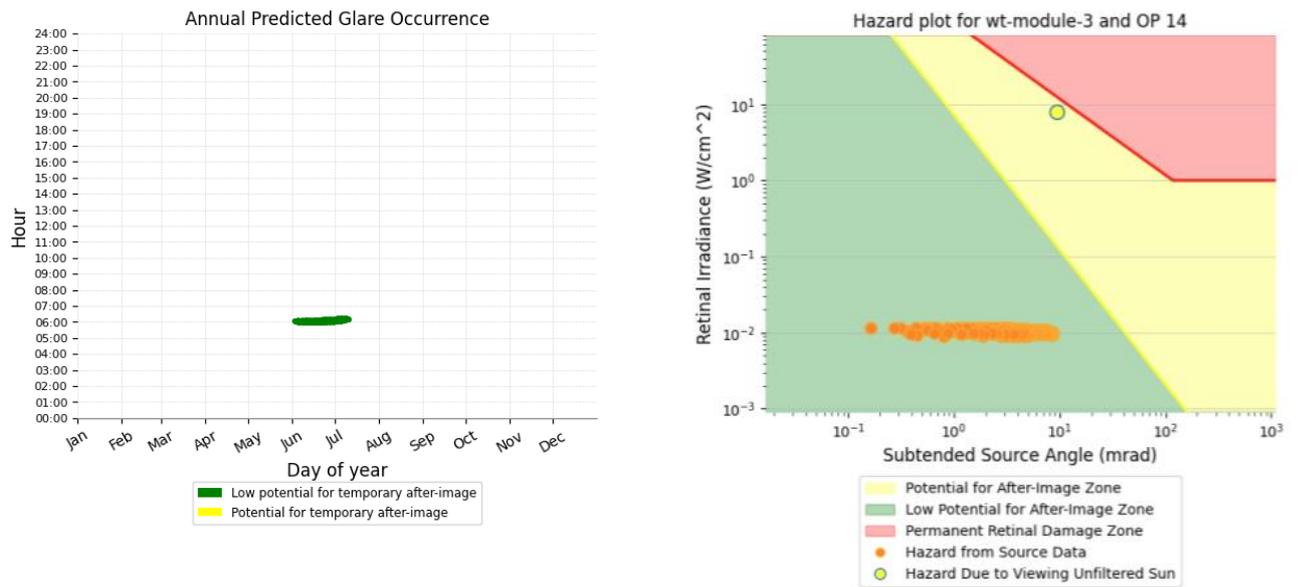


Figure A- 67 Time of day/year of glare occurrence at OP14 (left) and associated hazard plot (right)



A.3 Route Receptor Results

Figure A- 68 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at each route receptor, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all route receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones. No yellow or red glare was detected at the WTP. Route receptors were modelled at three different heights: 2.5m for heavy goods vehicles (HGVs), 1.5m for normal road vehicles, and 3m for rail routes, to ensure the results of the assessment were thorough and representative.

A.3.1 Route Receptor Modelled at 2.5m Height

A.3.1.1 Route Receptors Results Tables

A.3.1.1.1 Chemical Dosing Manifold Building

Table A- 15 Route receptor glare at the chemical dosing manifold building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	182	0
Proposed Access Road	0	0
R445	435	0
R494	0	0

A.3.1.1.2 Lamellar Clarifiers Building

Table A- 16 Route receptor glare at the lamellar clarifiers building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	11731	0
Proposed Access Road	0	0

R445	0	0
R494	1535	0

A.3.1.1.3 Large Field Array

Table A- 17 Route receptor glare at the large field array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	0	0
Proposed Access Road	0	0
R445	624	0
R494	0	0

A.3.1.1.4 Sludge Dewatering Building 1 - East

Table A- 18 Route receptor glare at the sludge dewatering building 1 – east array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	1136	0
Local road off the R496	0	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.1.1.5 Sludge Dewatering Building 1 - West

Table A- 19 Route receptor glare at the sludge dewatering building 1 - west array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
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Local road to the east of the site	0	0
Local road off the R496	3353	0
Proposed Access Road	0	0
R445	0	0
R494	880	0

A.3.1.1.6 Sludge Dewatering Building 2 - East

Table A- 20 Route receptor glare at the sludge dewatering building 2 - east array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	2037	0
Local road off the R496	0	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.1.1.7 Sludge Dewatering Building 2 - West

Table A- 21 Route receptor glare at the sludge dewatering building 2 - west array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	4696	0
Proposed Access Road	0	0

R445	0	0
R494	214	0

A.3.1.1.8 Sludge Storage Building 1

Table A- 22 Route receptor glare at the sludge storage building 1 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	5801	0
Proposed Access Road	0	0
R445	0	0
R494	23	0

A.3.1.1.9 Sludge Storage Building 2

Table A- 23 Route receptor glare at the sludge storage building 2 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	3114	0
Local road off the R496	0	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.1.1.10 UV Dosing Building

Table A- 24 Route receptor glare at the UV dosing building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	2020	0
Local road off the R496	0	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.1.1.11 Water Treatment Module 1

Table A- 25 Route receptor glare at the water treatment module 1 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	0	0
Proposed Access Road	0	0
R445	506	0
R494	0	0

A.3.1.1.12 Water Treatment Module 2

Table A- 26 Route receptor glare at the water treatment module 2 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0

Local road off the R496	309	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.1.1.13 Water Treatment Module 3

Table A- 27 Route receptor glare at the water treatment module 3 array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	475	0
Local road off the R496	739	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.1.2 Glare Graphs

A.3.1.3 Chemical Dosing Manifold Building

Figure A- 68 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)

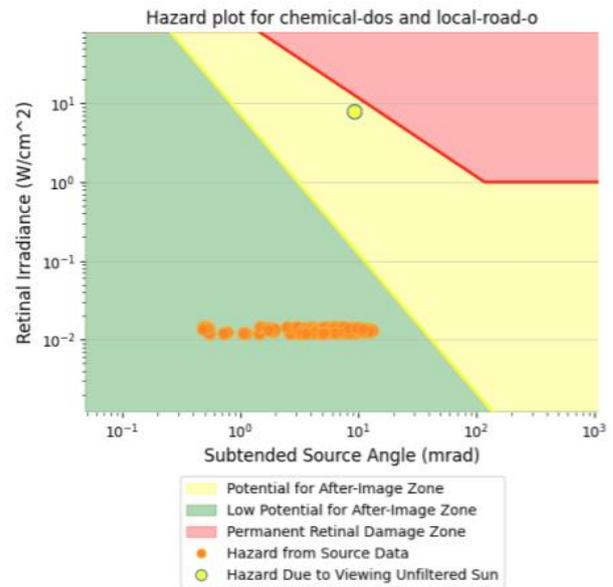
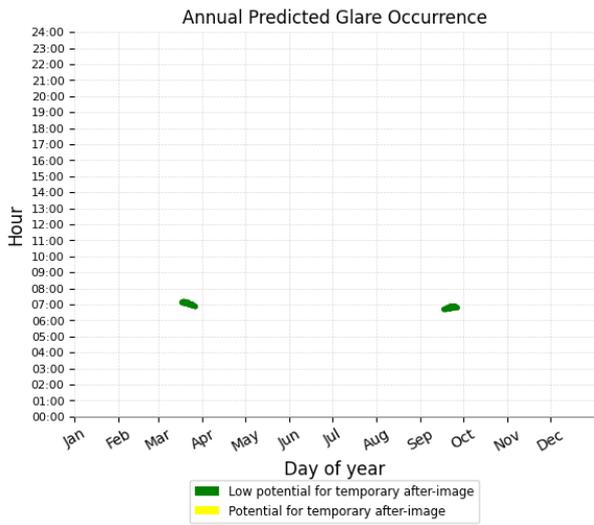
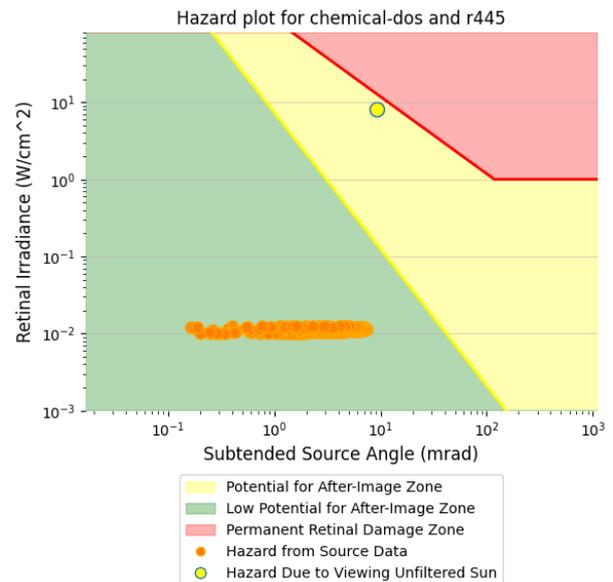
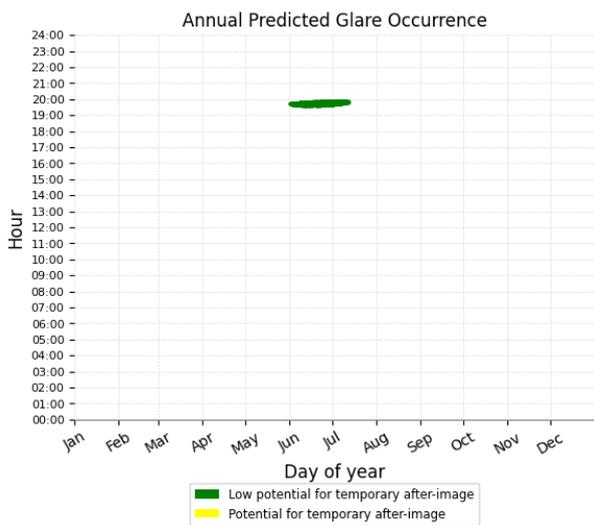


Figure A- 69 Time of day/year of glare occurrence at the R445 (left) and associated hazard plot (right)



A.3.1.3.1 Lamellar Clarifiers Building

Figure A- 70 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)

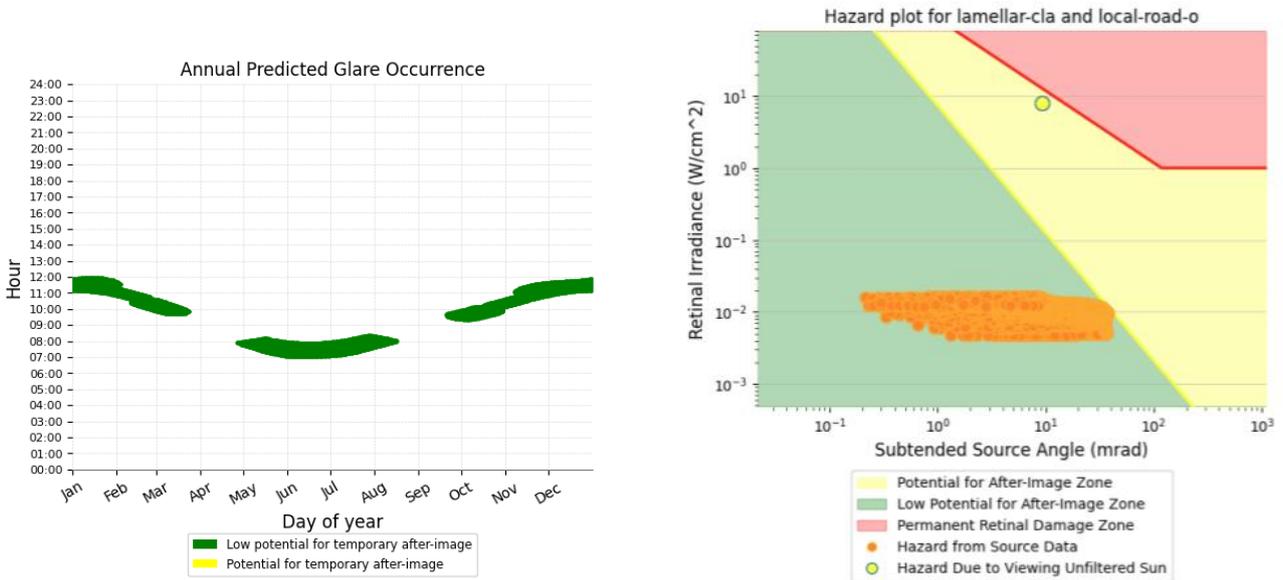
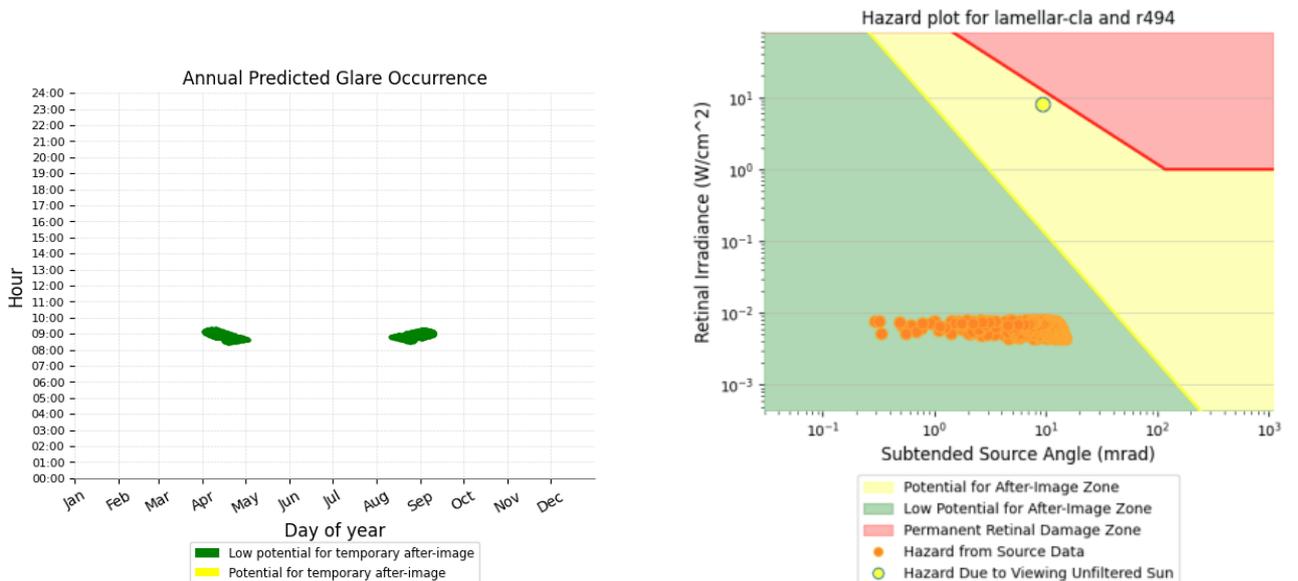
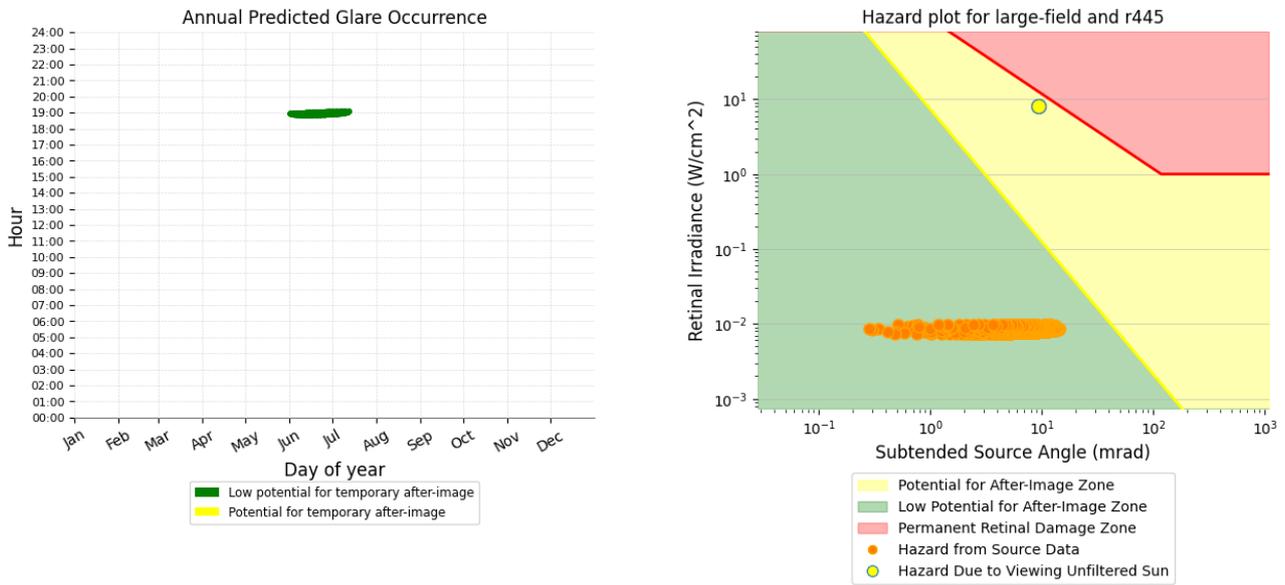


Figure A- 71 Time of day/year of glare occurrence at the R494 (left) and associated hazard plot (right)



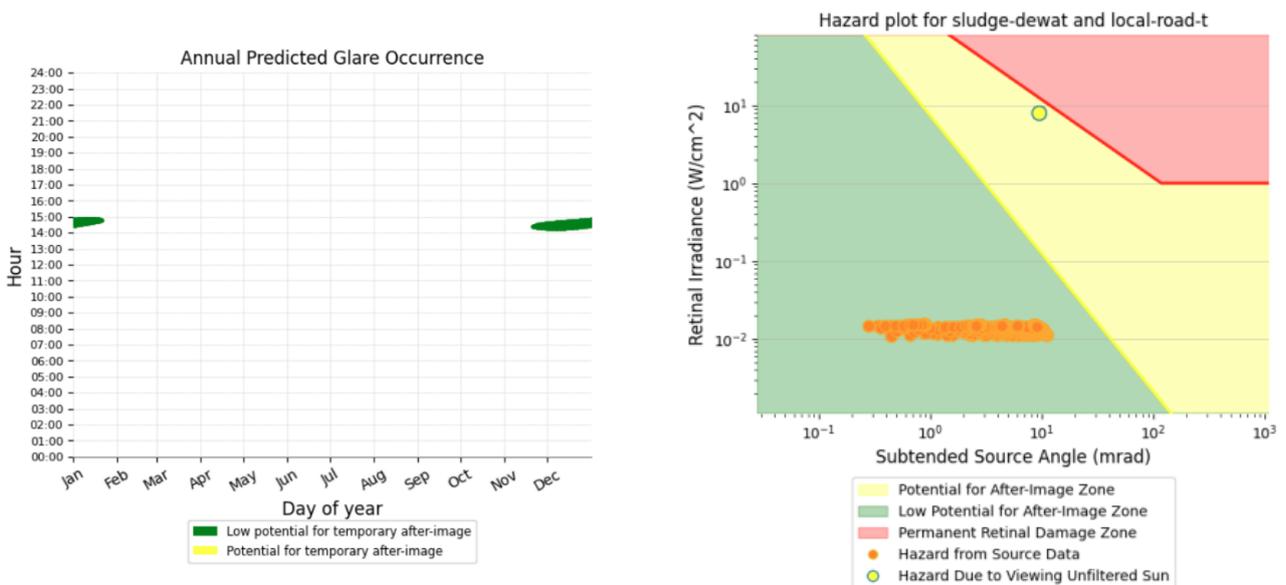
A.3.1.3.2 Large Field Array

Figure A- 72 Time of day/year of glare occurrence at the R445 (left) and associated hazard plot (right)



A.3.1.3.3 Sludge Dewatering Building 1 -East

Figure A- 73 Time of day/year of glare occurrence at the local road to the east of the site (left) and associated hazard plot (right)



A.3.1.3.4 Sludge Dewatering Building 1 -West

Figure A- 74 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)

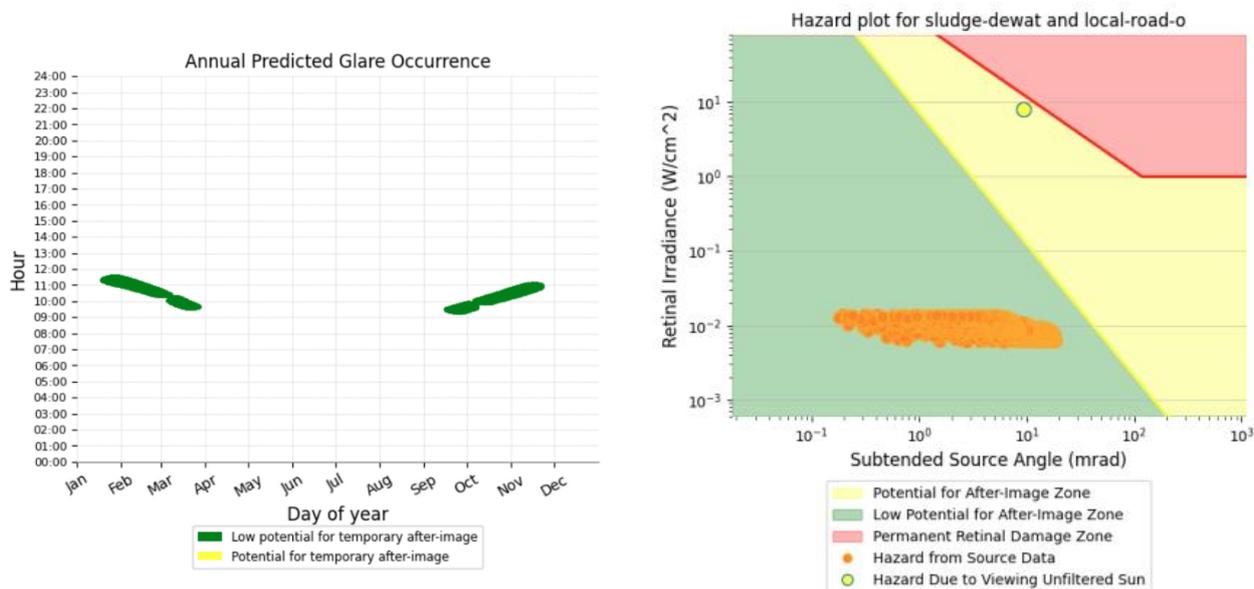
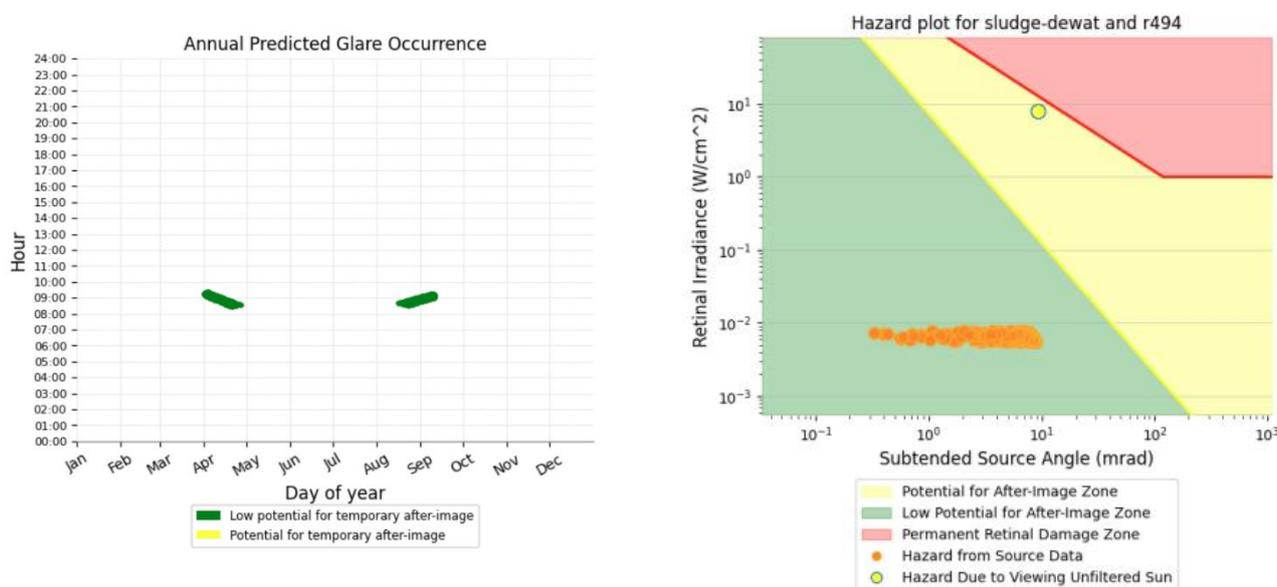
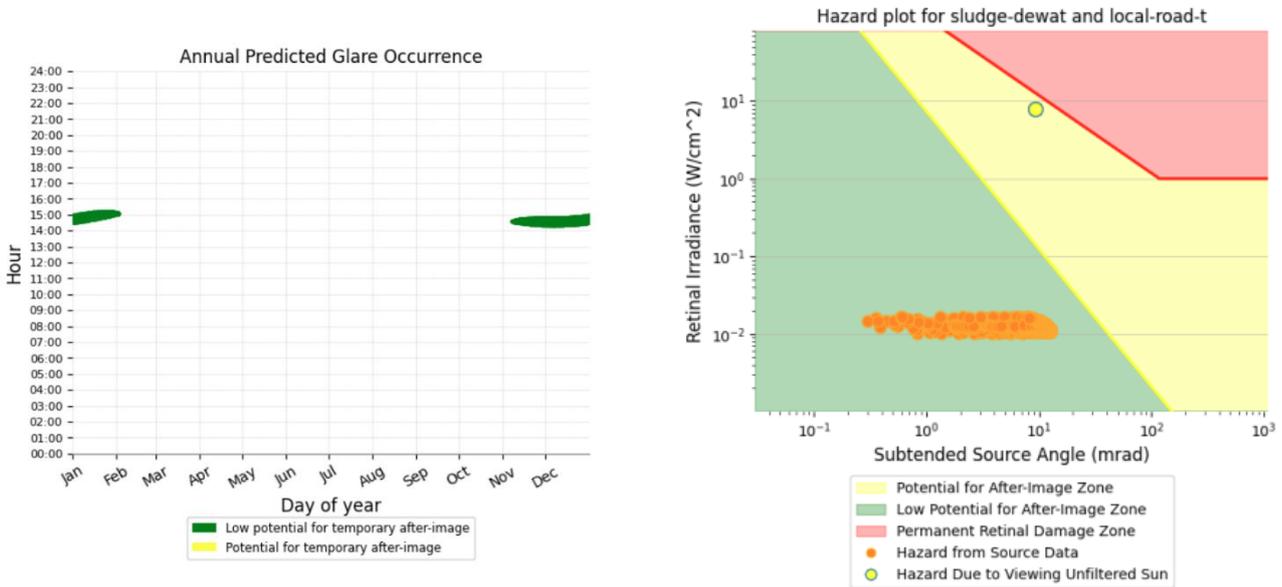


Figure A- 75 Time of day/year of glare occurrence at the R494 (left) and associated hazard plot (right)



A.3.1.3.5 Sludge Dewatering Building 2 – East

Figure A- 76 Time of day/year of glare occurrence at the local road to the east of the site (left) and associated hazard plot (right)



A.3.1.3.6 Sludge Dewatering Building 2 - West

Figure A- 77 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)

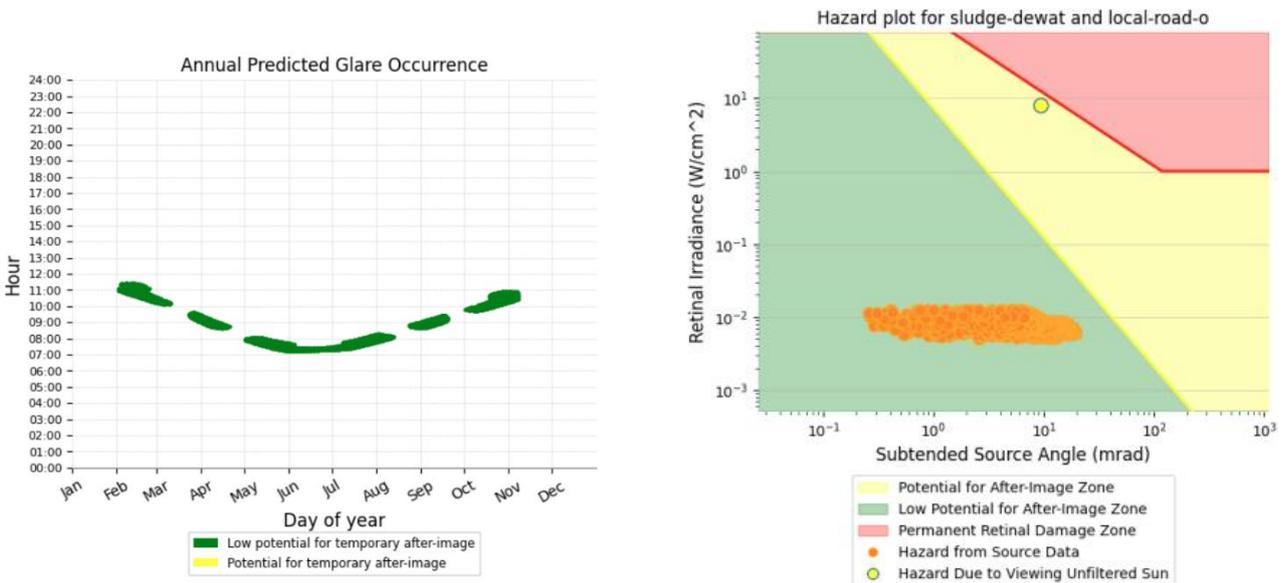
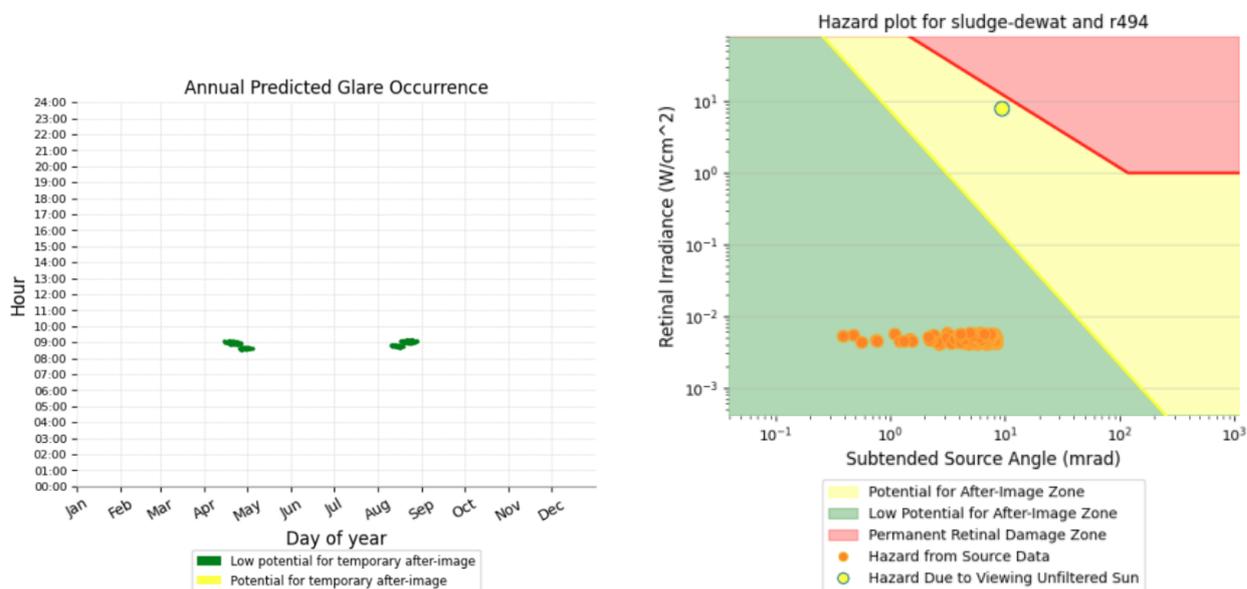


Figure A- 78 Time of day/year of glare occurrence at the R494 (left) and associated hazard plot (right)



A.3.1.3.7 Sludge Storage Building 1

Figure A- 79 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)

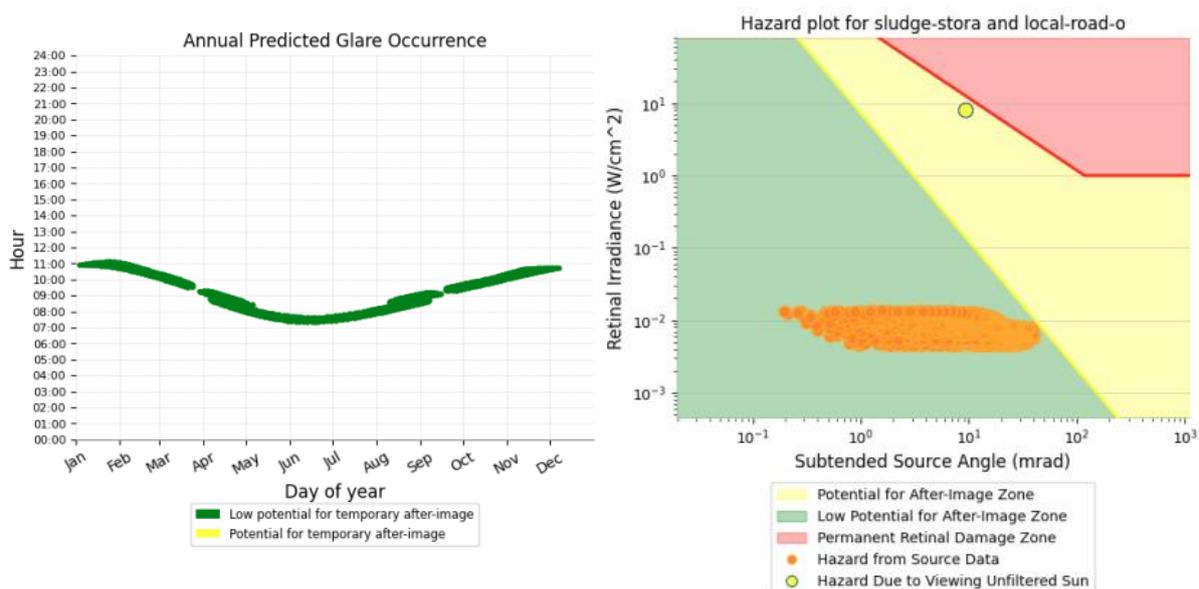
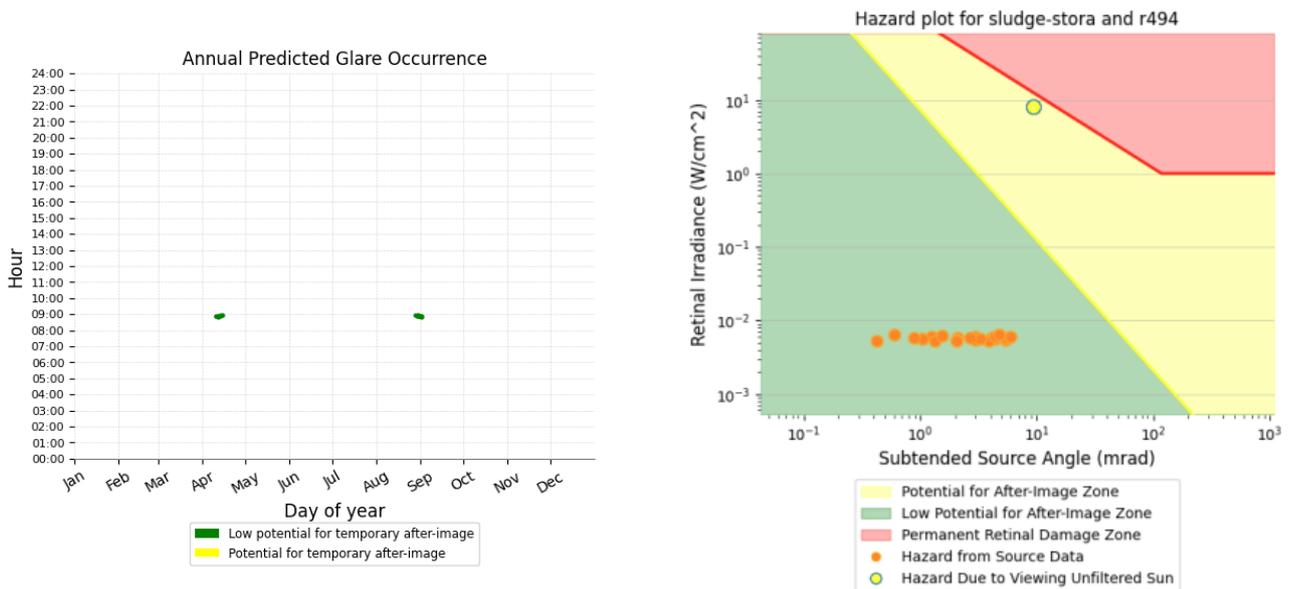
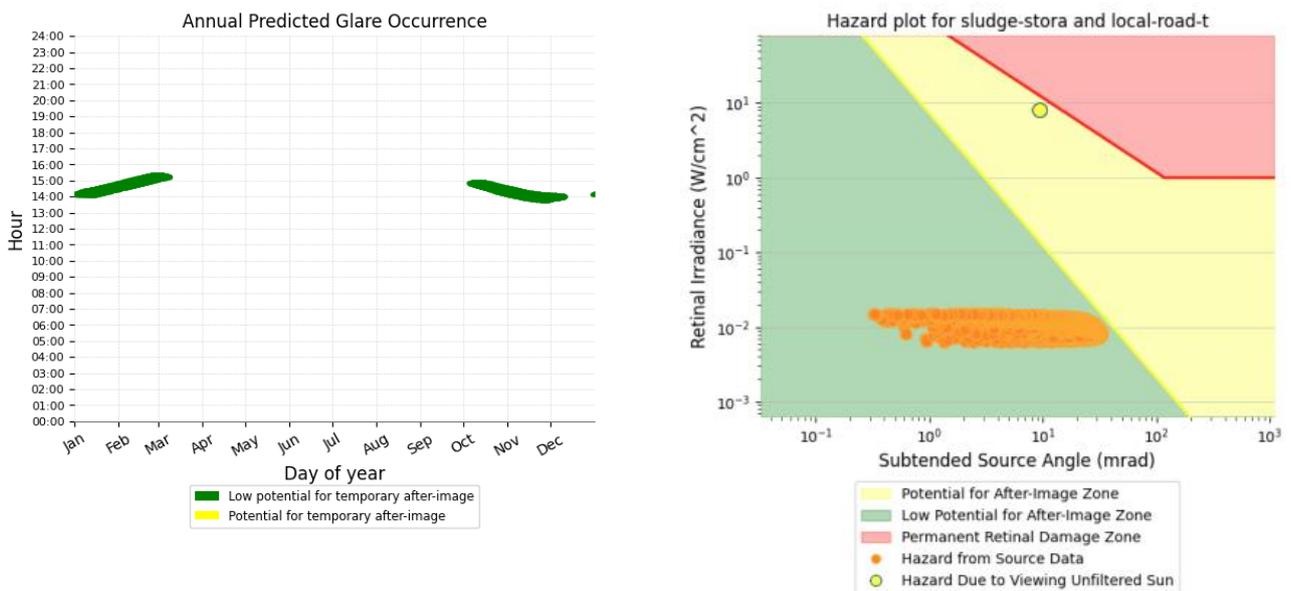


Figure A- 80 Time of day/year of glare occurrence at the R494 (left) and associated hazard plot (right)



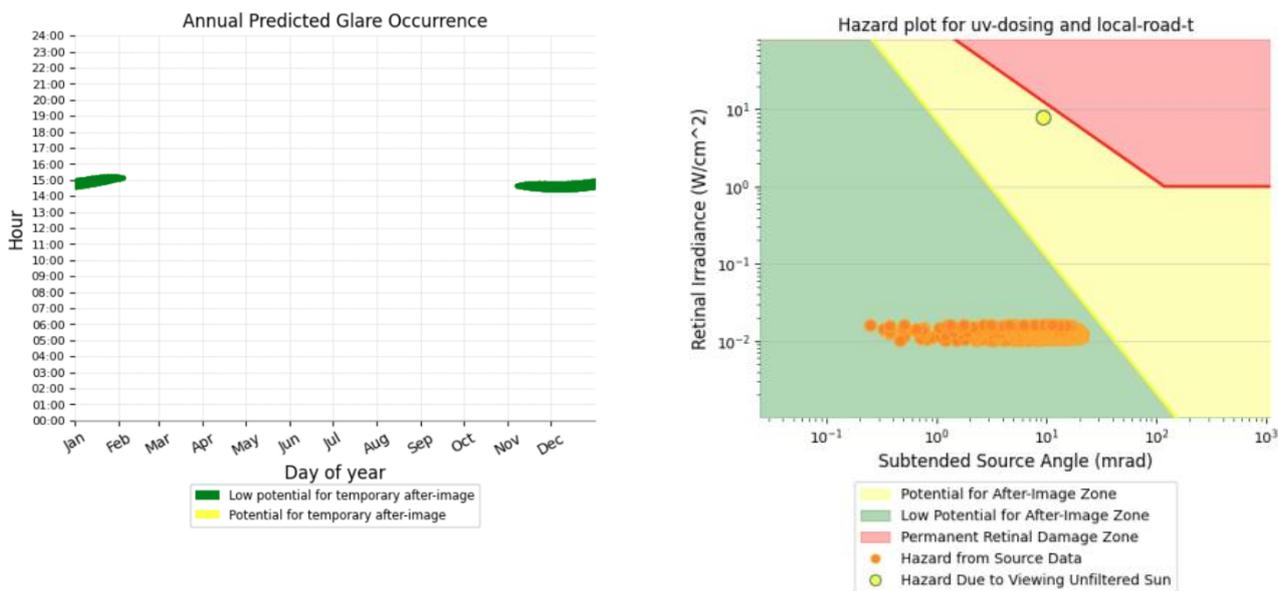
A.3.1.3.8 Sludge Storage Building 2

Figure A- 81 Time of day/year of glare occurrence at the local road to the east of the site (left) and associated hazard plot (right)



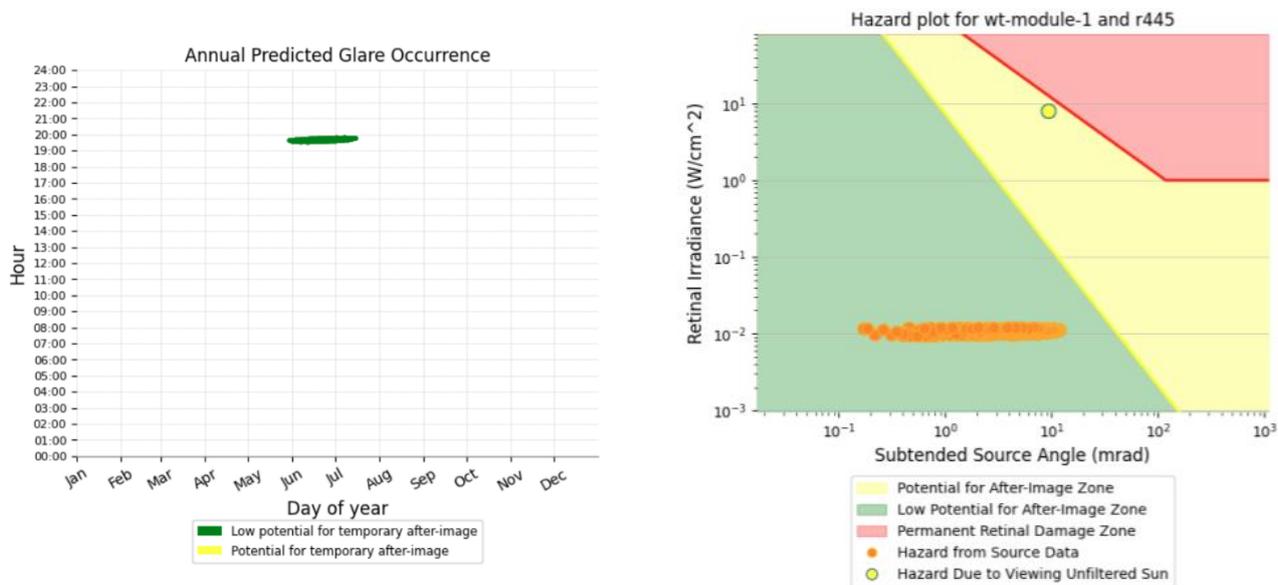
A.3.1.3.9 UV Dosing

Figure A- 82 Time of day/year of glare occurrence at the local road to the east of the site (left) and associated hazard plot (right)



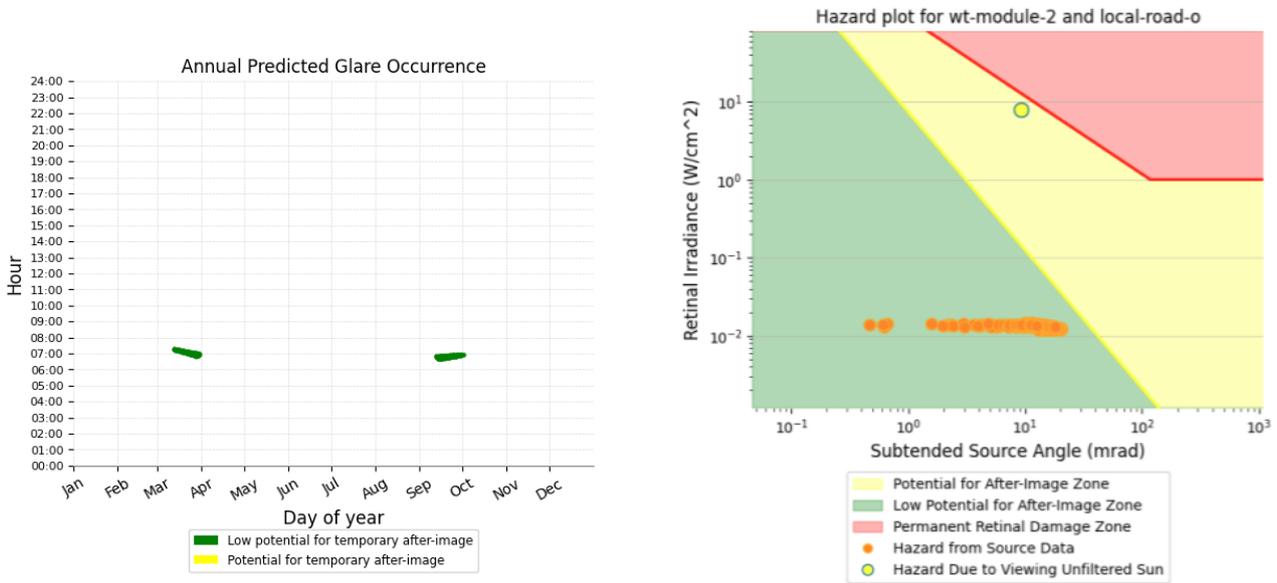
A.3.1.3.10 Water Treatment Module 1

Figure A- 83 Time of day/year of glare occurrence at the R445 (left) and associated hazard plot (right)



A.3.1.3.11 Water Treatment Module 2

Figure A- 84 Time of day/year of glare occurrence at the local road off the R494 (left) and associated hazard plot (right)



A.3.1.3.12 Water Treatment Module 3

Figure A- 85 Time of day/year of glare occurrence at the local road to the east of the site (left) and associated hazard plot (right)

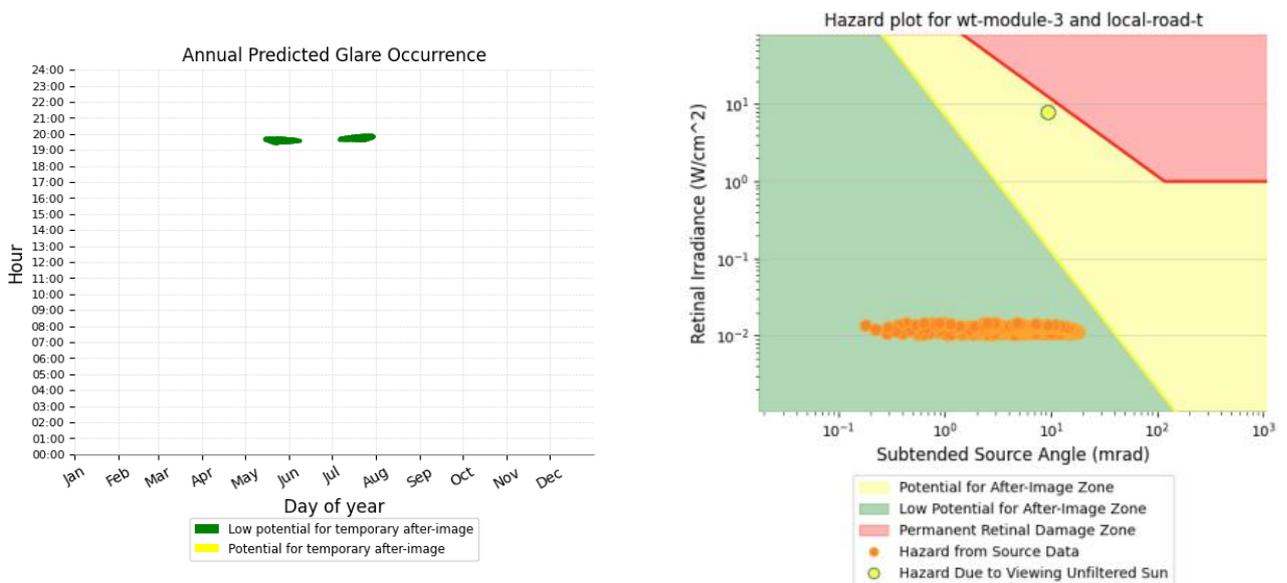
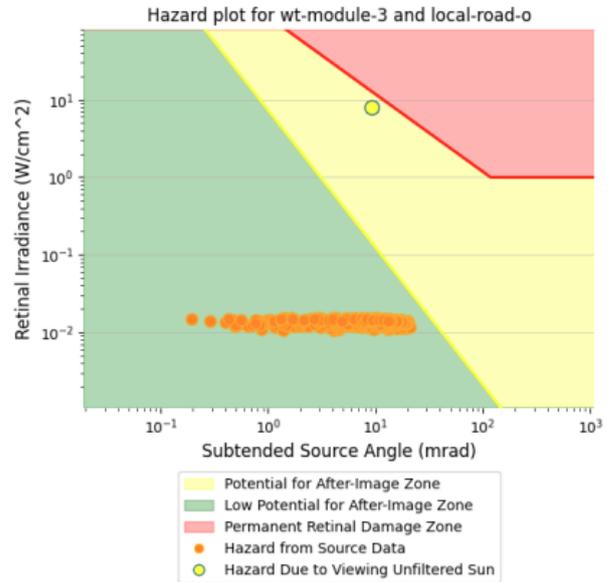
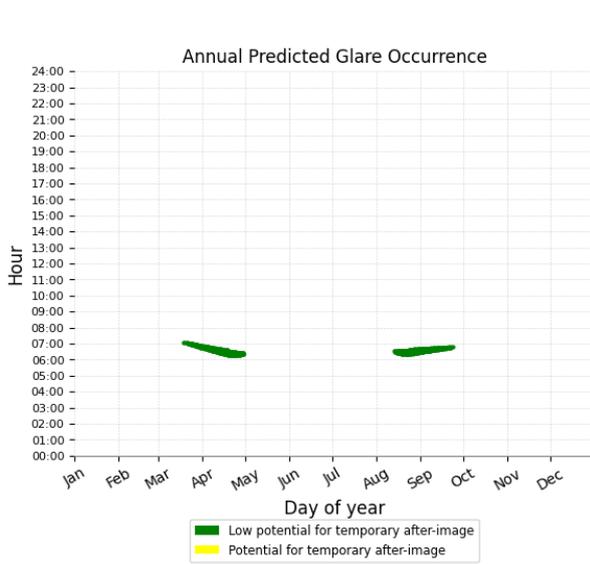


Figure A- 86 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)



A.3.2 Route Receptor Modelled at 1.5m Height

A.3.2.1 Route Receptors Results Tables

A.3.2.1.1 Chemical Dosing Manifold Building

Table A- 28 Route receptor glare at the chemical dosing manifold building array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	164	0
Proposed Access Road	0	0
R445	424	0
R494	0	0

A.3.2.1.2 Control Building

Table A- 29 Route receptor glare at the control building

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	15	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.2.1.3 Lamellar Clarifiers Building

Table A- 30 Route receptor glare at the lamellar clarifiers building

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	11973	0
Proposed Access Road	0	0

R445	0	0
R494	1552	0

A.3.2.1.4 Large Field Array

Table A- 31 Route receptor glare at the large field array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	0	0
Proposed Access Road	0	0
R445	613	0
R494	0	0

A.3.2.1.5 Sludge Dewatering Building 1 – East

Table A- 32 Route receptor glare at the sludge dewatering building 1- east

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	1149	0
Local road off the R496	0	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.2.1.6 Sludge Dewatering Building 1 – West

Table A- 33 Route receptor glare at the sludge dewatering building 1- west

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	3414	0

Proposed Access Road	0	0
R445	0	0
R494	902	0

A.3.2.1.7 Sludge Dewatering Building 2 – East

Table A- 34 Route receptor glare at the sludge dewatering building 2- east

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	2049	0
Local road off the R496	0	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.2.1.8 Sludge Dewatering Building 2 – West

Table A- 35 Route receptor glare at the sludge dewatering building 2- west

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	4830	0
Proposed Access Road	0	0
R445	0	0
R494	220	0

A.3.2.1.9 Sludge Storage Building 1

Table A- 36 Route receptor glare at the sludge storage building 1

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0

Local road off the R496	6935	0
Proposed Access Road	0	0
R445	0	0
R494	16	0

A.3.2.1.10 Sludge Storage Building 2

Table A- 37 Route receptor glare at the sludge storage building 2

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	3192	0
Local road off the R496	0	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.2.1.11 UV Dosing

Table A- 38 Route receptor glare at the uv dosing

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	2054	0
Local road off the R496	0	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.2.1.12 Water Treatment Module 1

Table A- 39 Route receptor glare at the water treatment module 1

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0

Local road off the R496	0	0
Proposed Access Road	0	0
R445	446	0
R494	0	0

A.3.2.1.13 Water Treatment Module 2

Table A- 40 Route receptor glare at the water treatment module 2

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	0	0
Local road off the R496	309	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.2.1.14 Water Treatment Module 3

Table A- 41 Route receptor glare at the water treatment module 3

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Local road to the east of the site	476	0
Local road off the R496	915	0
Proposed Access Road	0	0
R445	0	0
R494	0	0

A.3.2.2 Glare Graphs

A.3.2.2.1 Chemical Dosing Manifold Building

Figure A- 87 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)

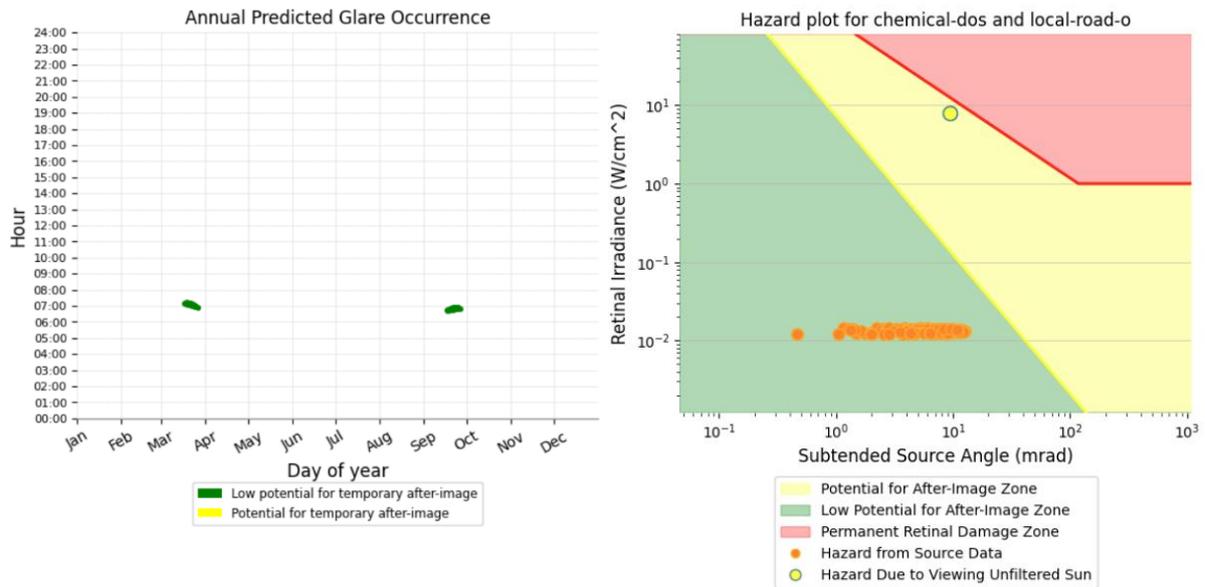
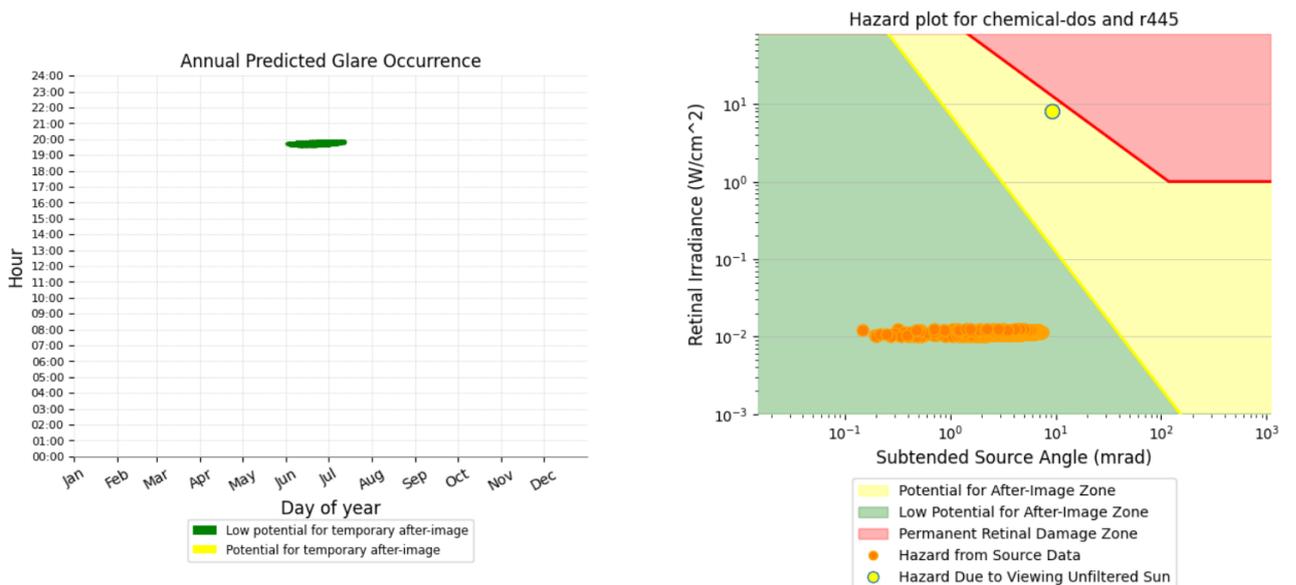
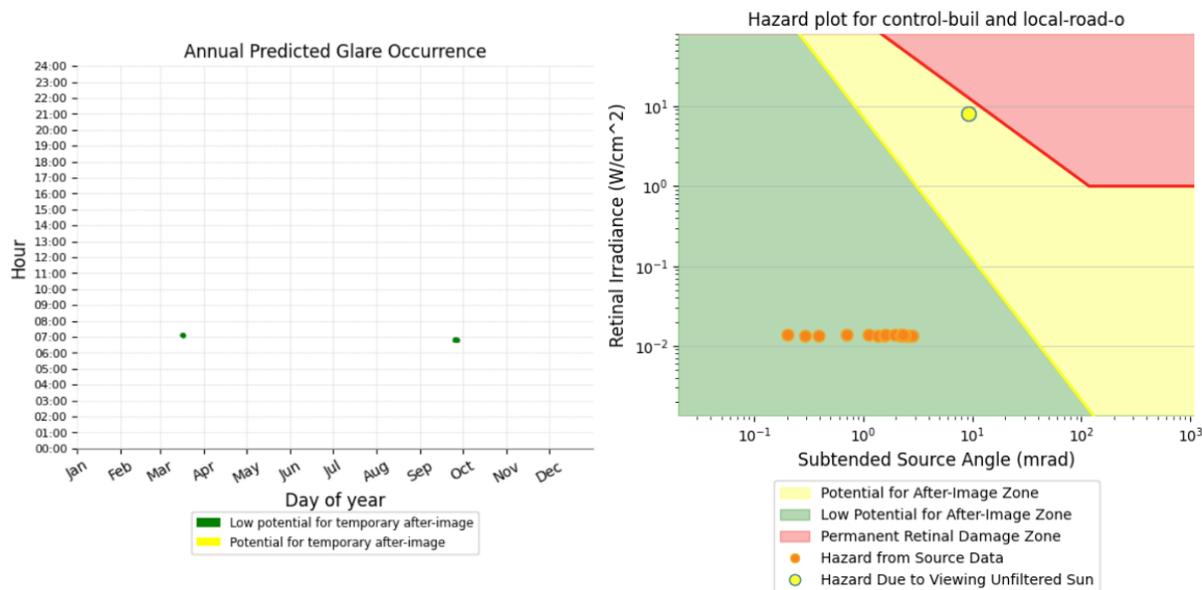


Figure A- 88 Time of day/year of glare occurrence at the R445 (left) and associated hazard plot (right)



A.3.2.2.2 Control Building

Figure A- 89 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)



A.3.2.2.3 Lamellar Clarifiers Building

Figure A- 90 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)

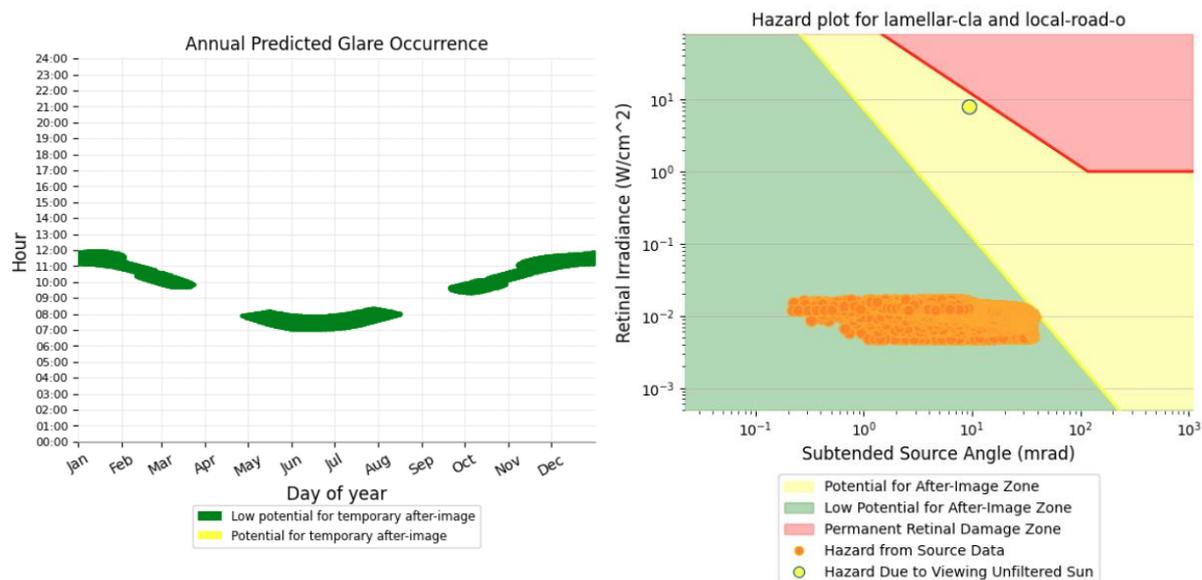
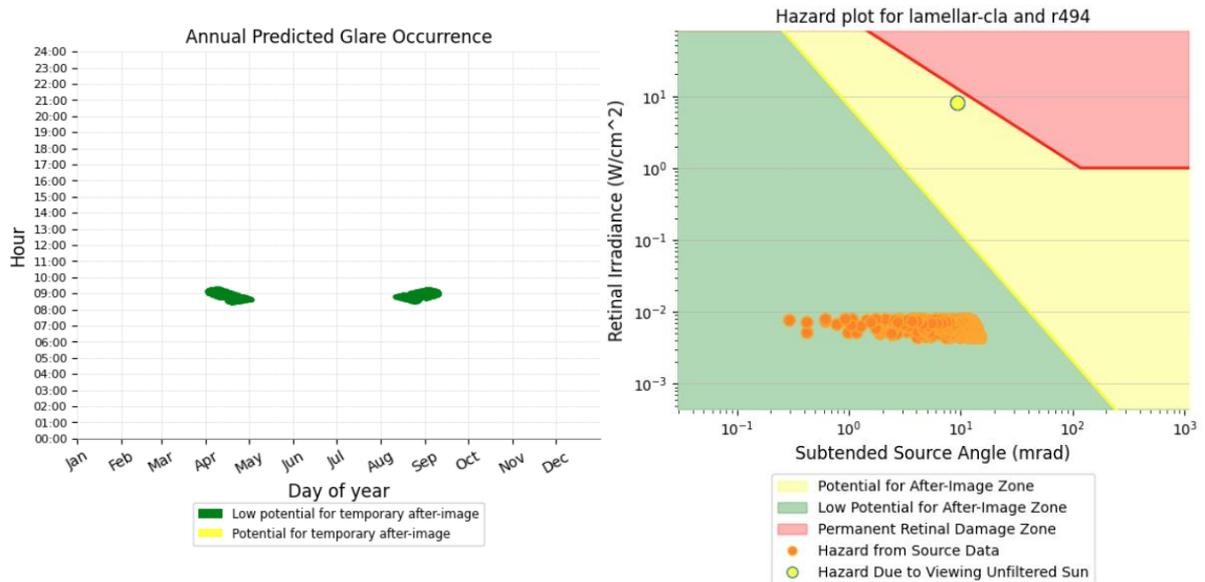
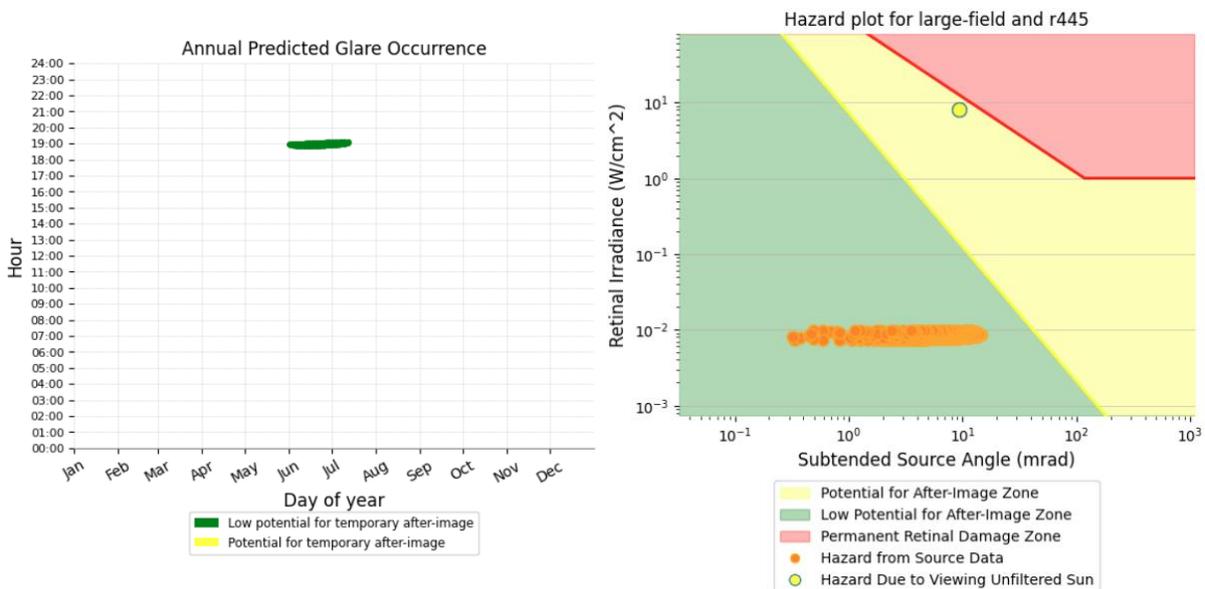


Figure A- 91 Time of day/year of glare occurrence at the R494 (left) and associated hazard plot (right)



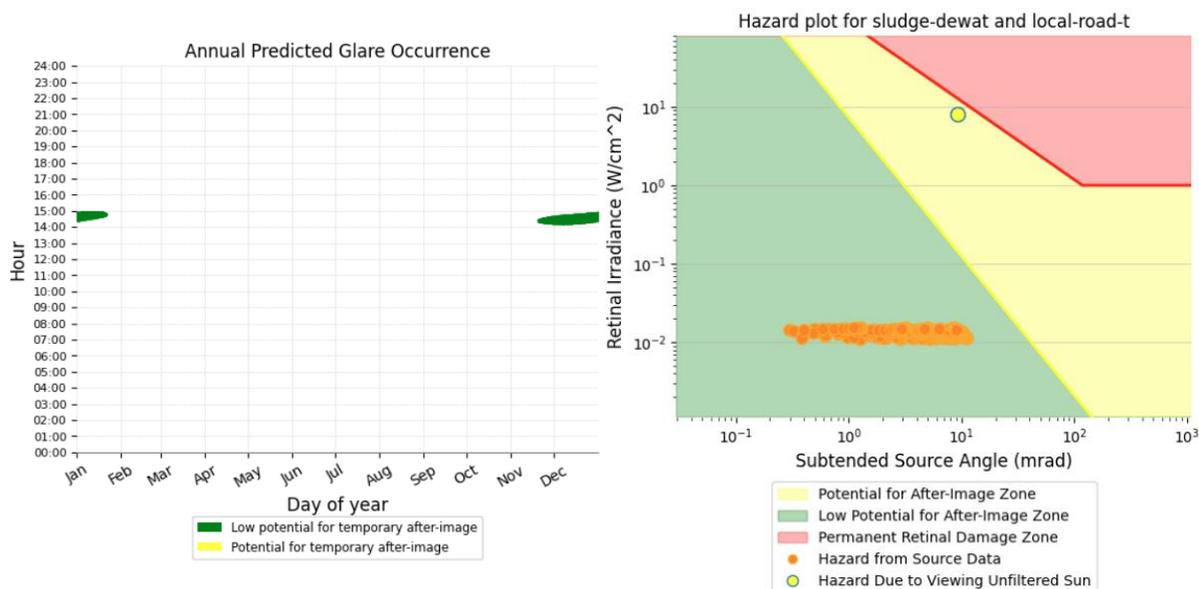
A.3.2.2.4 Large Field Array

Figure A- 92 Time of day/year of glare occurrence at the R445 (left) and associated hazard plot (right)



A.3.2.2.5 Sludge Dewatering Building 1 – East

Figure A- 93 Time of day/year of glare occurrence at the local road to the east of the site (left) and associated hazard plot (right)



A.3.2.2.6 Sludge Dewatering Building 1 – West

Figure A- 94 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)

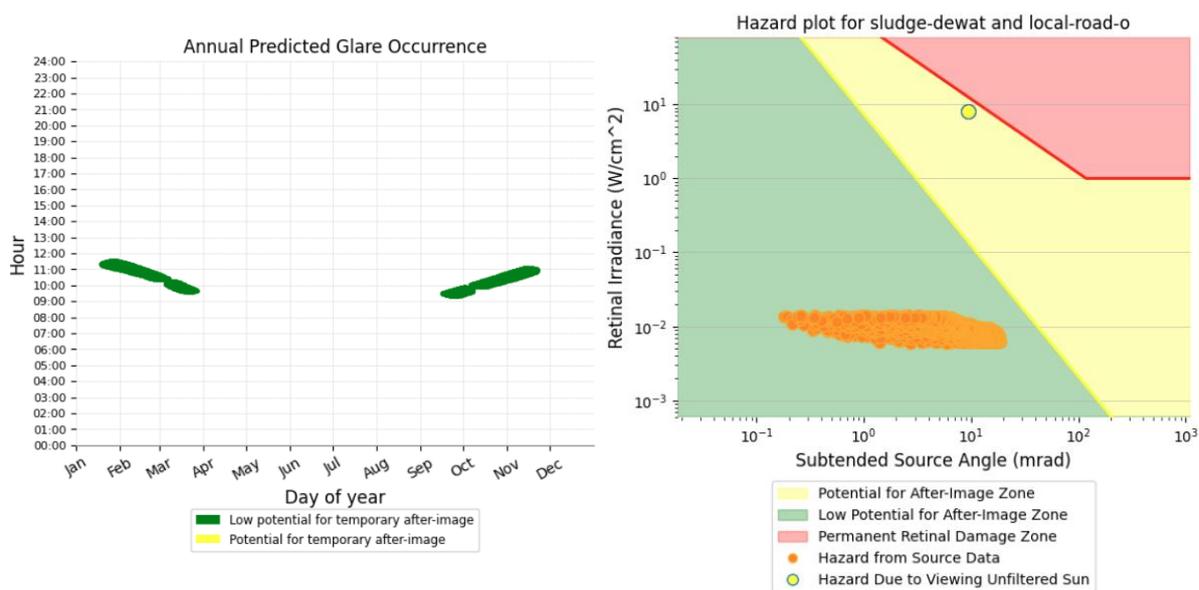
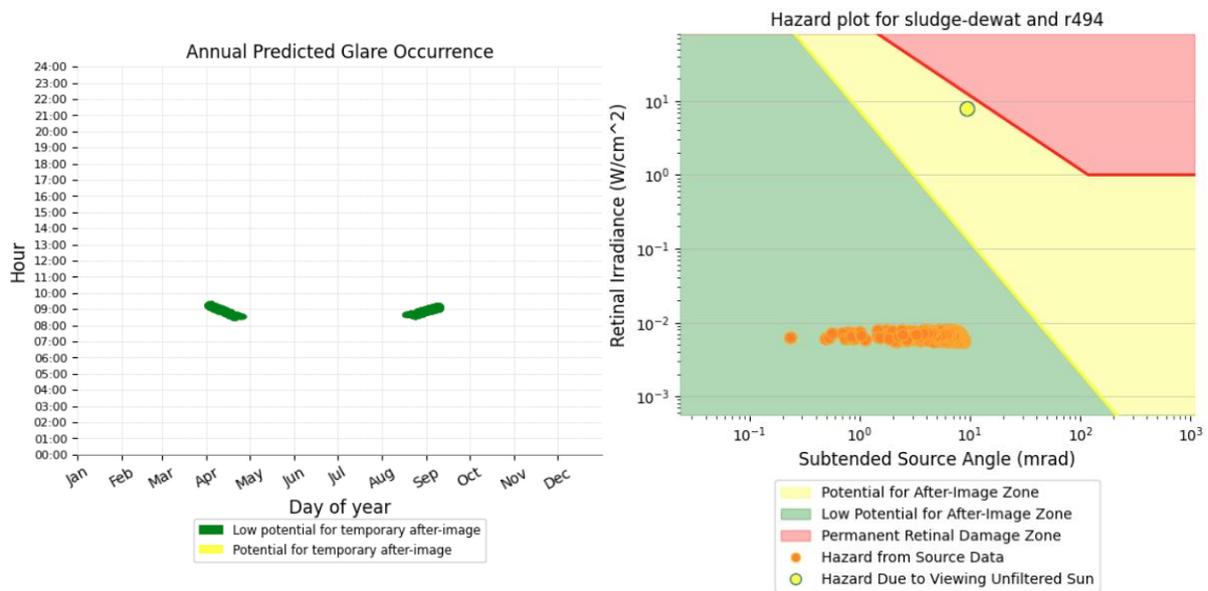
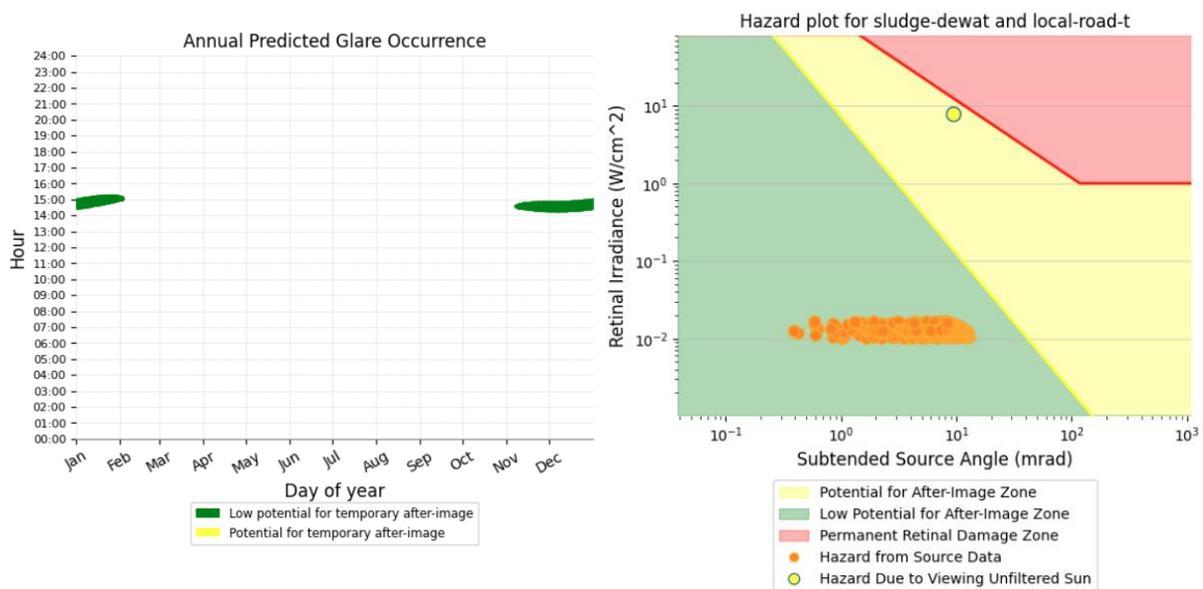


Figure A- 95 Time of day/year of glare occurrence at the R494 (left) and associated hazard plot (right)



A.3.2.2.7 Sludge Dewatering Building 2 - East

Figure A- 96 Time of day/year of glare occurrence at the local road to the east of the site (left) and associated hazard plot (right)



A.3.2.2.8 Sludge Dewatering Building 2 – West

Figure A- 97 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)

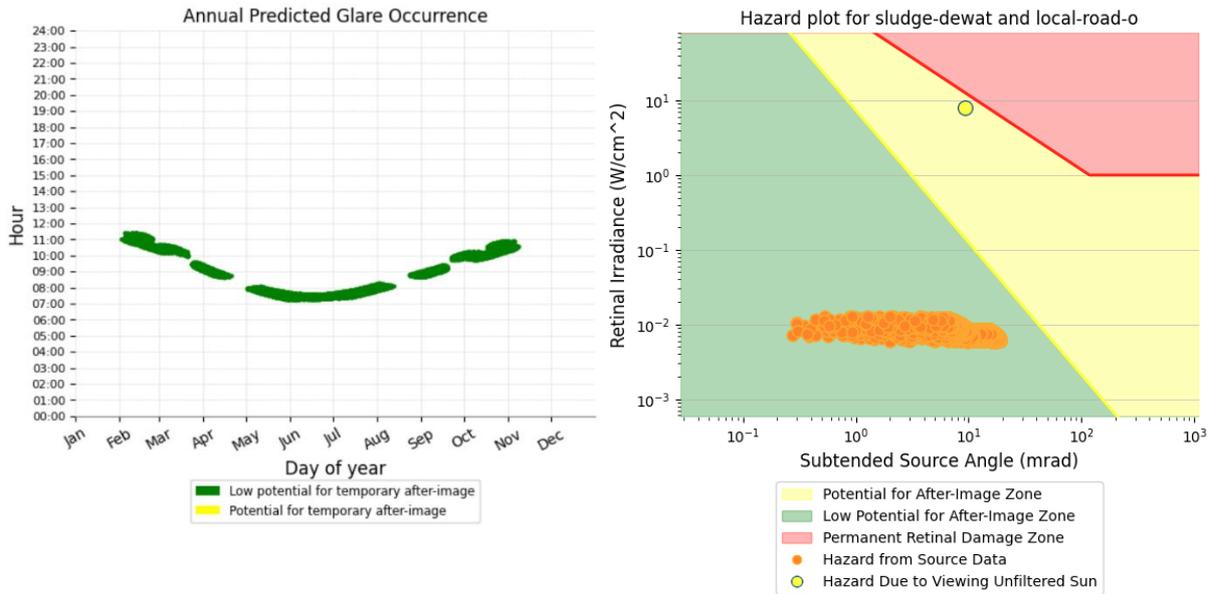
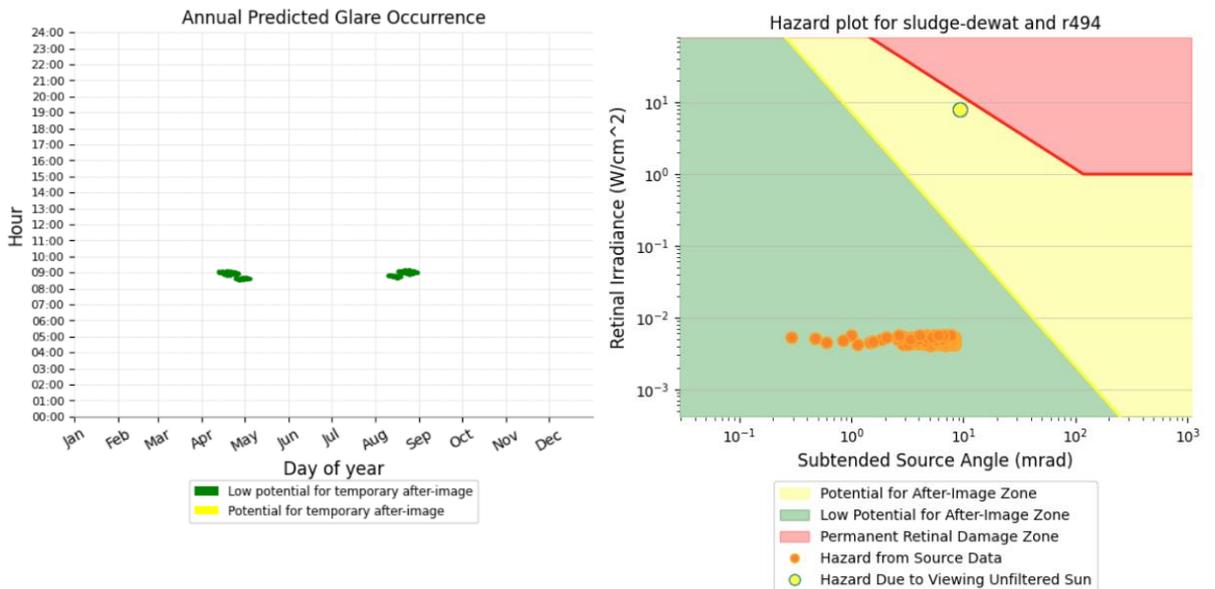


Figure A- 98 Time of day/year of glare occurrence at the R494 (left) and associated hazard plot (right)



A.3.2.2.9 Sludge Storage Building 1

Figure A- 99 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)

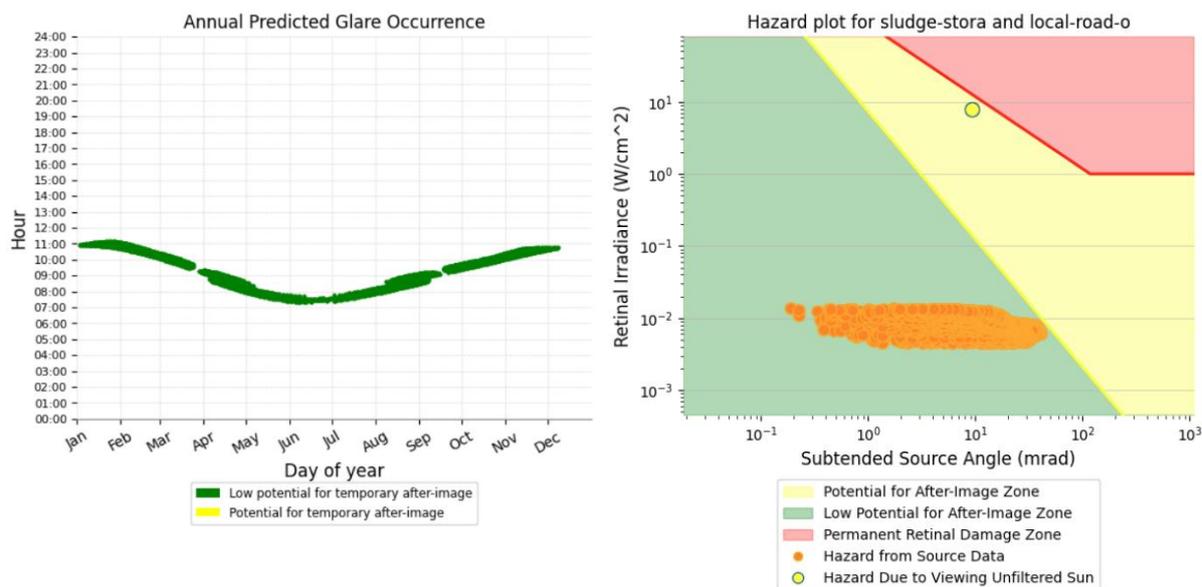
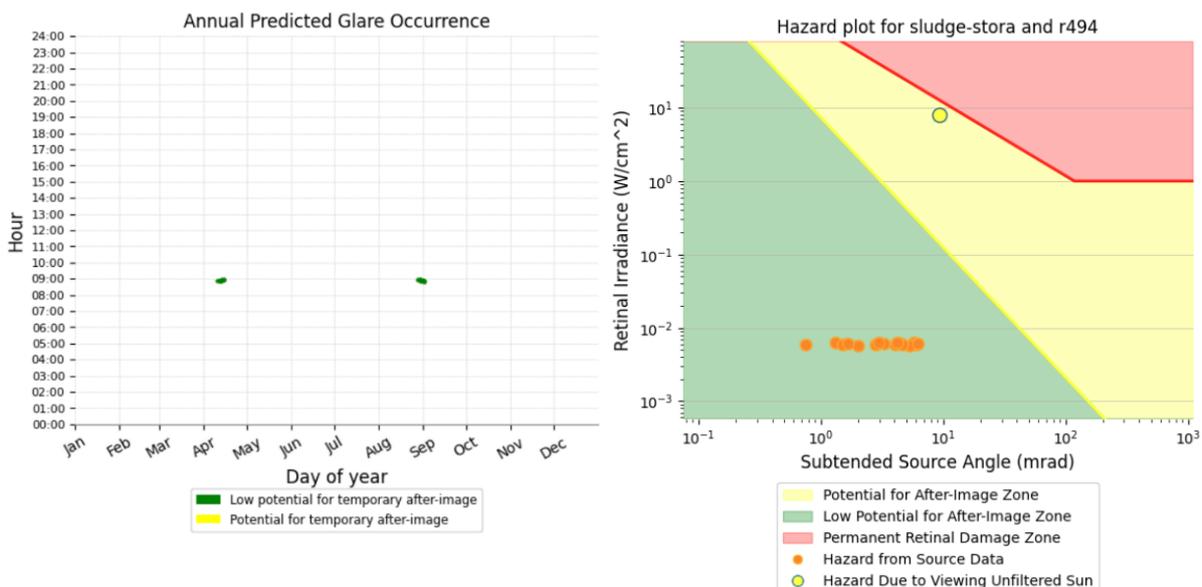
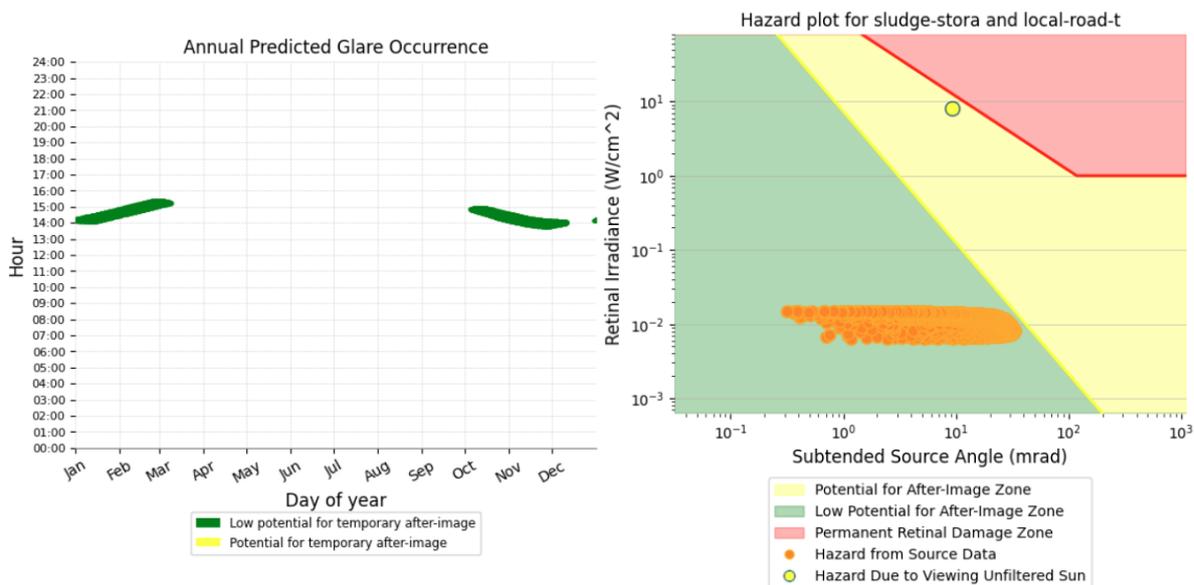


Figure A- 100 Time of day/year of glare occurrence at the R494 (left) and associated hazard plot (right)



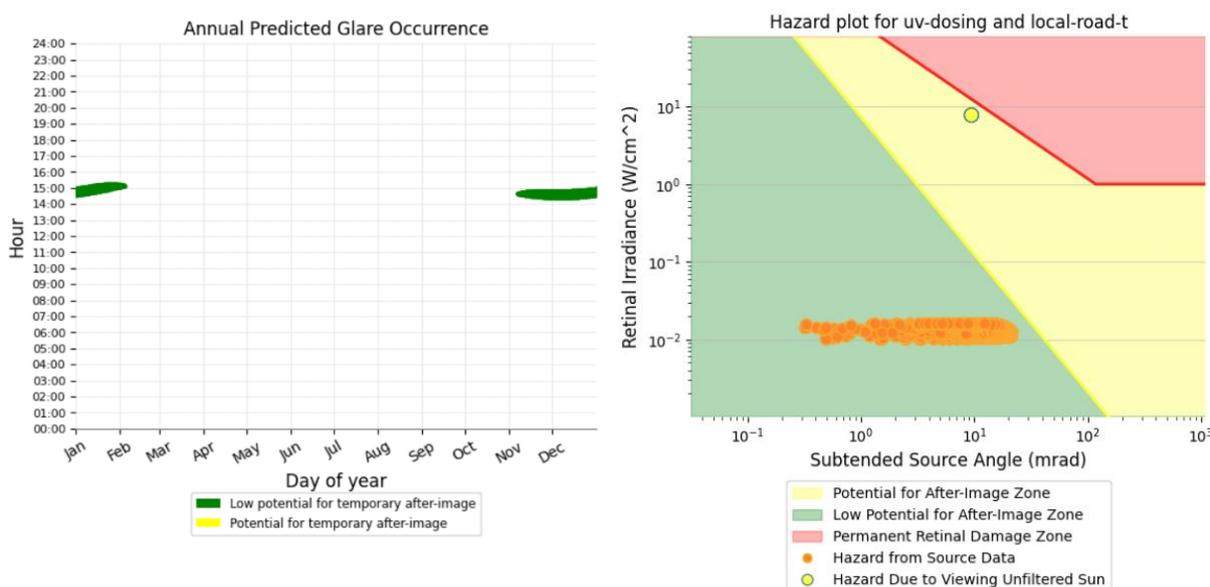
A.3.2.2.10 Sludge Storage Building 2

Figure A- 101 Time of day/year of glare occurrence at the local road to the east of the site (left) and associated hazard plot (right)



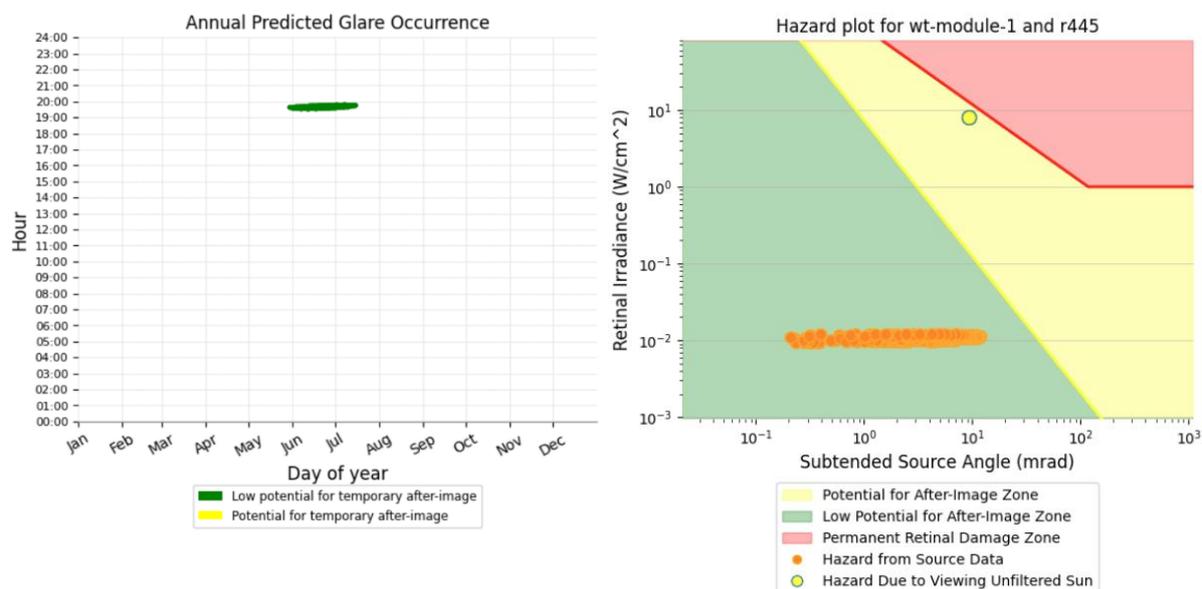
A.3.2.2.11 UV Dosing

Figure A- 102 Time of day/year of glare occurrence at the local road to the east of the site (left) and associated hazard plot (right)



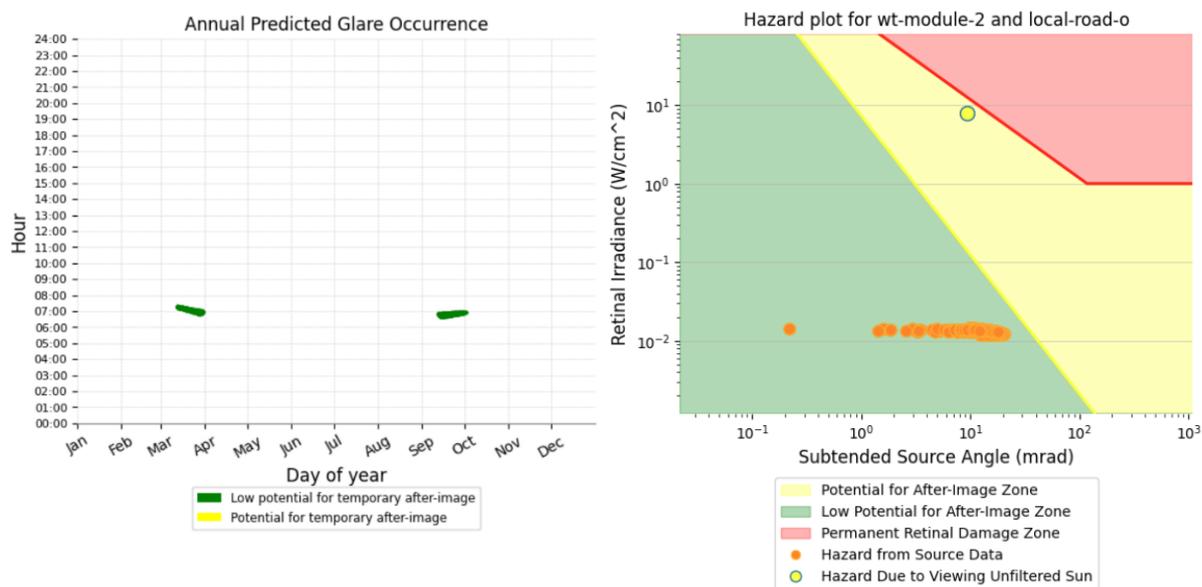
A.3.2.2.12 Water Treatment Module 1

Figure A- 103 Time of day/year of glare occurrence at the R445 (left) and associated hazard plot (right)



A.3.2.2.13 Water Treatment Module 2

Figure A- 104 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)



A.3.2.2.14 Water Treatment Module 3

Figure A- 106 Time of day/year of glare occurrence at the local road to the east of the site (left) and associated hazard plot (right)

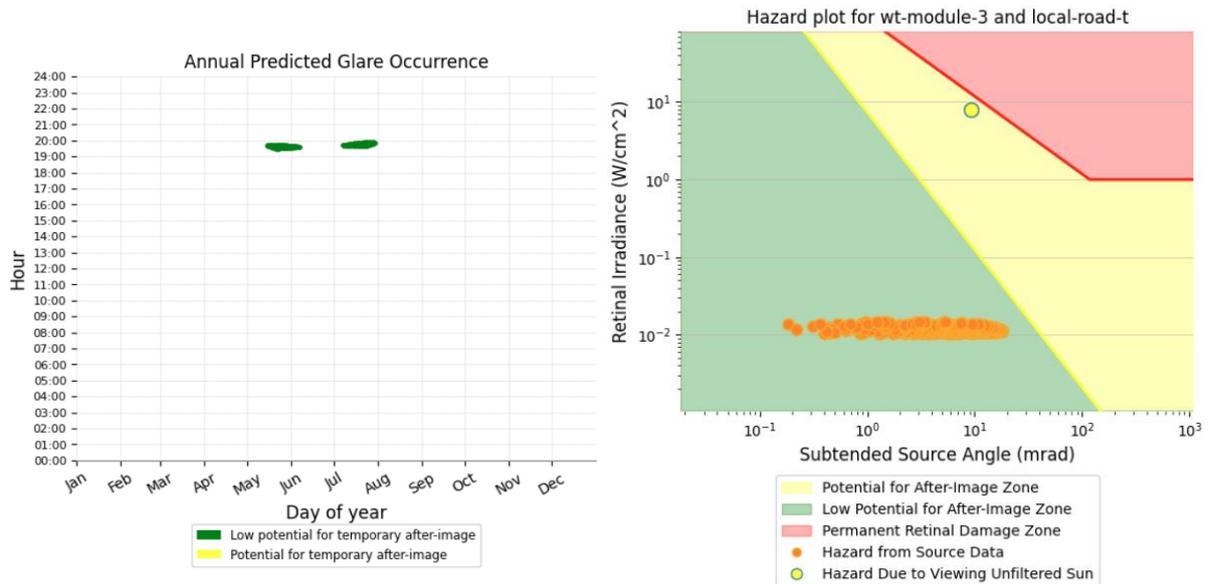
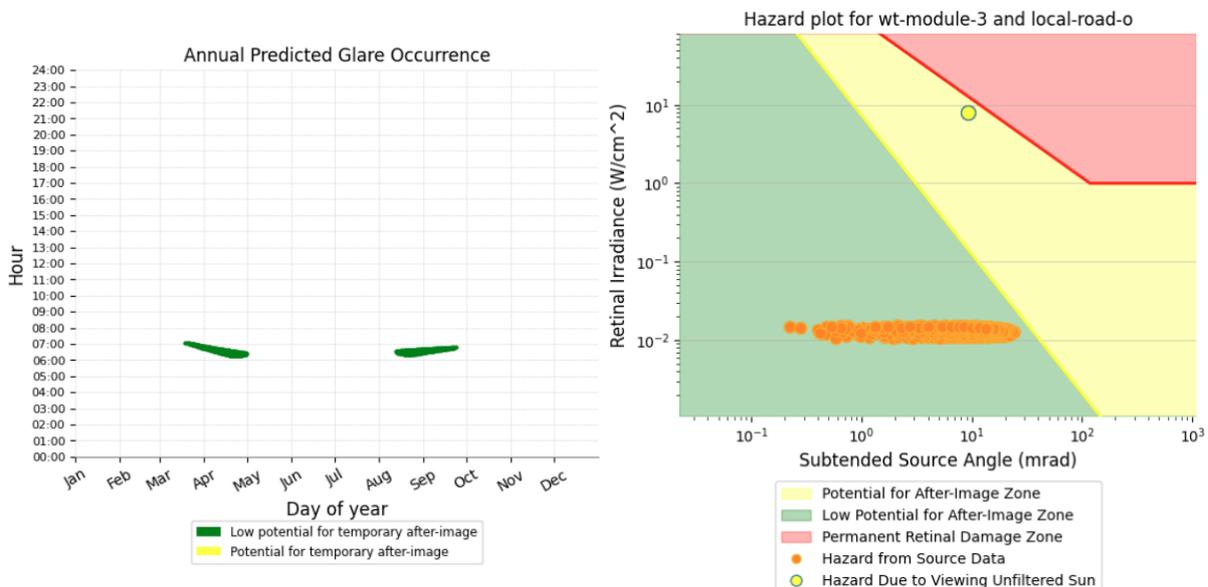


Figure A- 105 Time of day/year of glare occurrence at the local road off the R496 (left) and associated hazard plot (right)



A.3.3 Rail Line Receptor Modelled at 3m Height

A.3.3.1 Route Receptors Results Tables

A.3.3.1.1 Chemical Manifold Building

Table A- 42 Route receptor glare at the chemical manifold building

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	1878	0

A.3.3.1.2 Control Building

Table A- 43 Route receptor glare at the control building

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	289	0

A.3.3.1.3 Field Array

Table A- 44 Route receptor glare at the field array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	871	0

A.3.3.1.4 Large Field Array

Table A- 45 Route receptor glare at the large field array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	3301	0

A.3.3.1.5 Sludge Dewatering Building 1 – East

Table A- 46 Route receptor glare at the sludge dewatering building 1- east

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	2353	0

A.3.3.1.6 Sludge Dewatering Building 2 – East

Table A- 47 Route receptor glare at the sludge dewatering building 2- east

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	1557	0

A.3.3.1.7 Sludge Storage Building 2

Table A- 48 Route receptor glare at the sludge storage building 2

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	425	0

A.3.3.1.8 UV Dosing Building

Table A- 49 Route receptor glare at the uv dosing building

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	2246	0

A.3.3.1.9 Water Treatment Module 1

Table A- 50 Route receptor glare at the water treatment module 1

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	1811	0

A.3.3.1.10 Water Treatment Module 2

Table A- 51 Route receptor glare at the water treatment module 2

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	624	0

A.3.3.1.11 Water Treatment Module 3

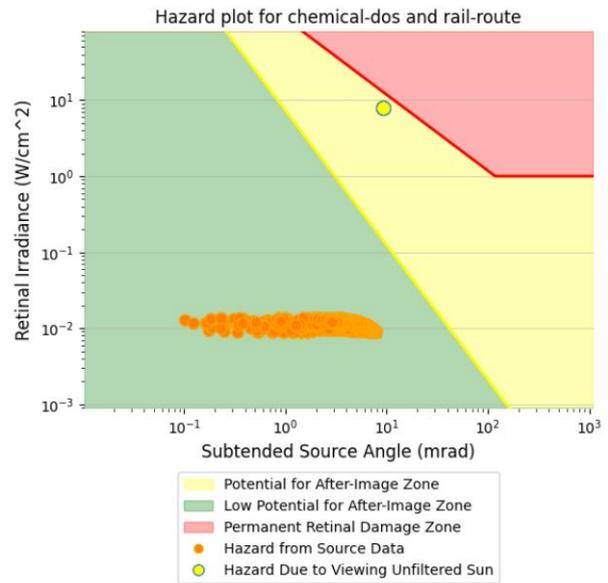
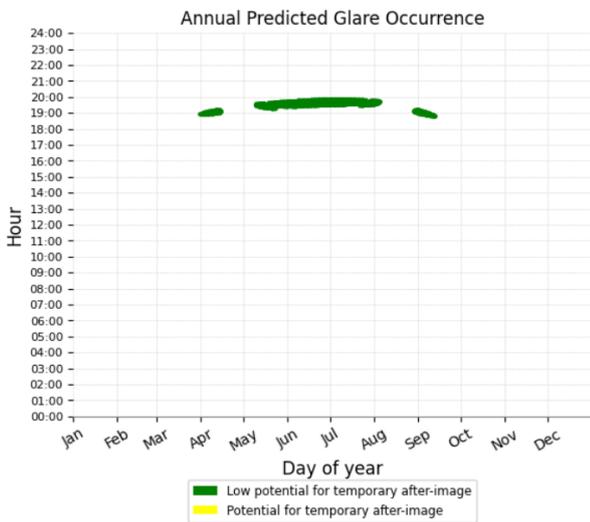
Table A- 52 Route receptor glare at the water treatment module 3

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	61	0

A.3.4 Glare Graphs

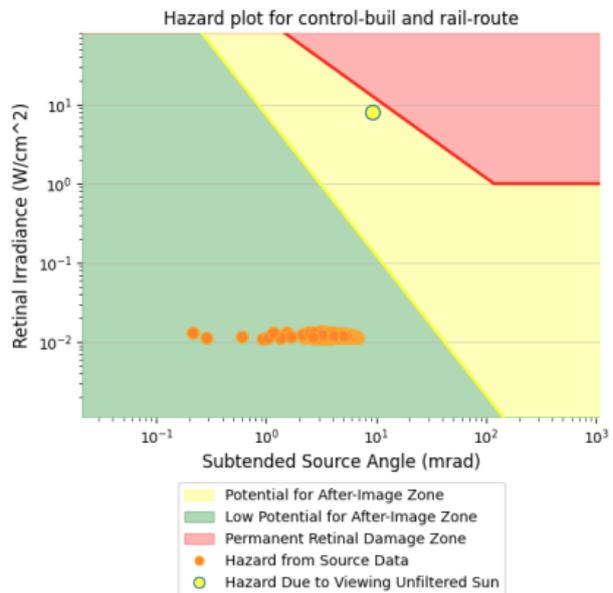
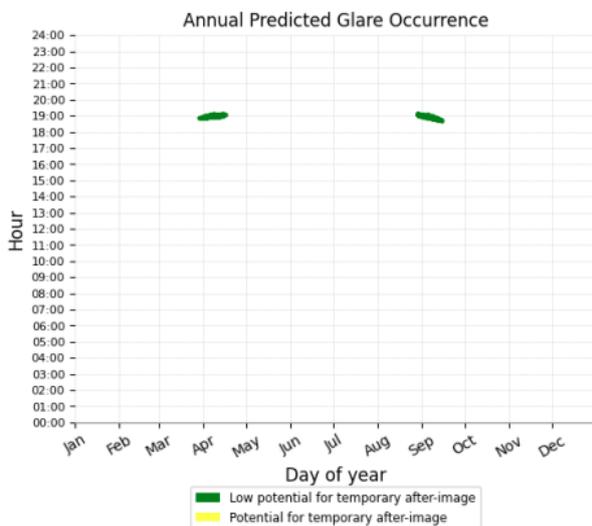
A.3.4.1.1 Chemical Dosing Manifold Building

Figure A- 107 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



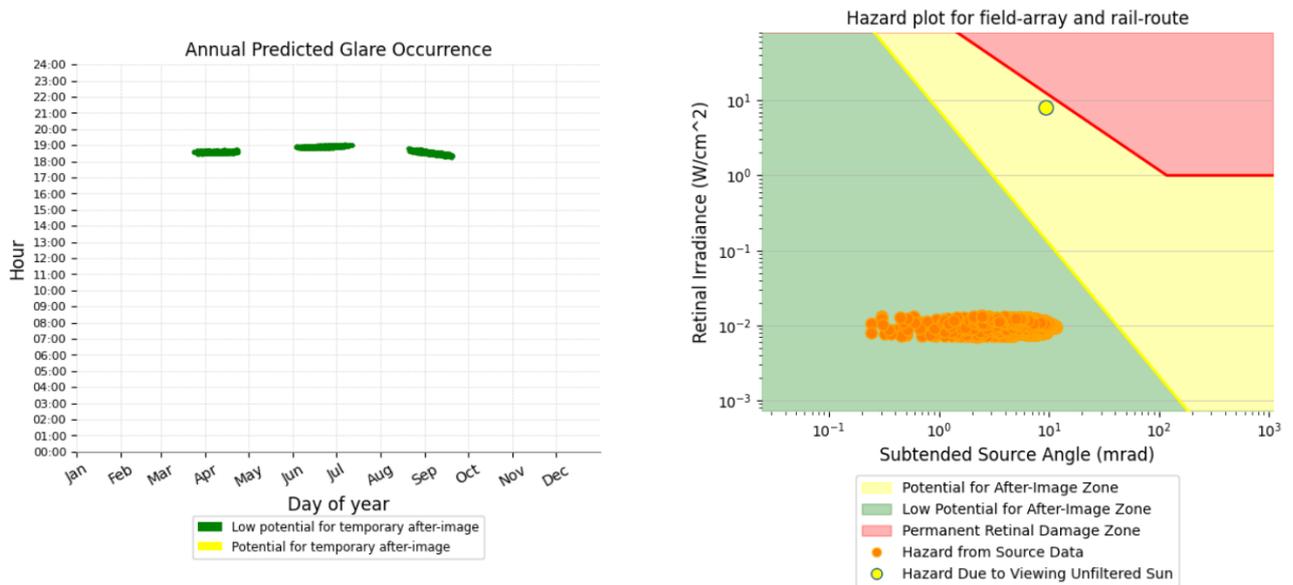
A.3.4.1.2 Control Building

Figure A- 108 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



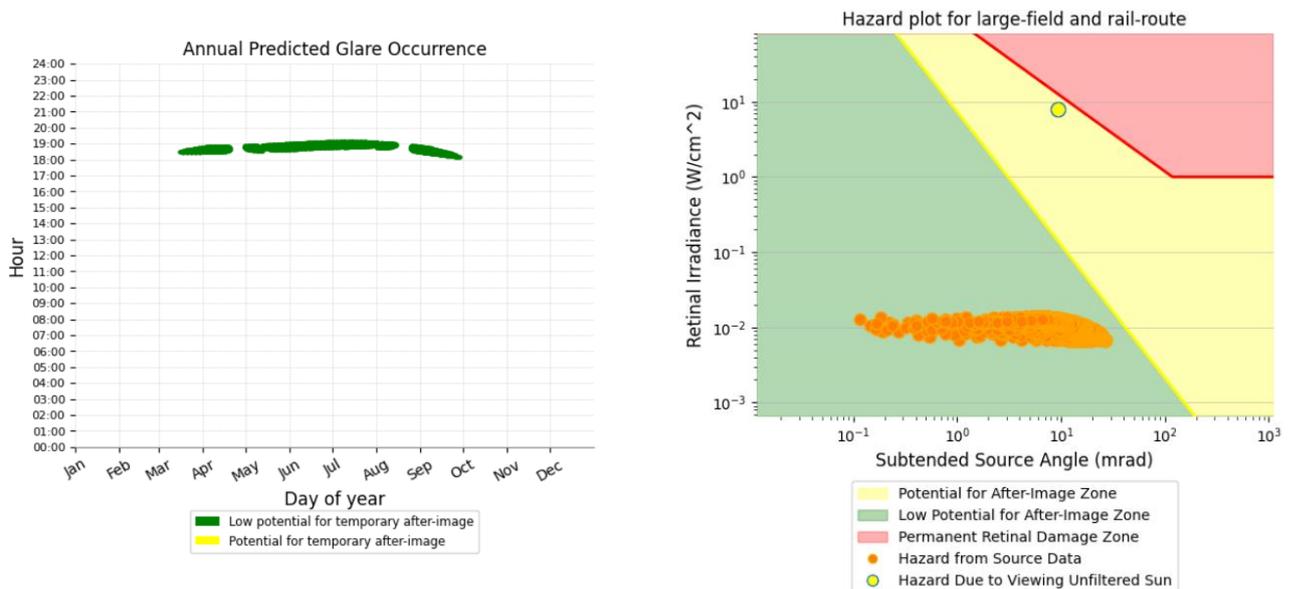
A.3.4.1.3 Field Array

Figure A- 109 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



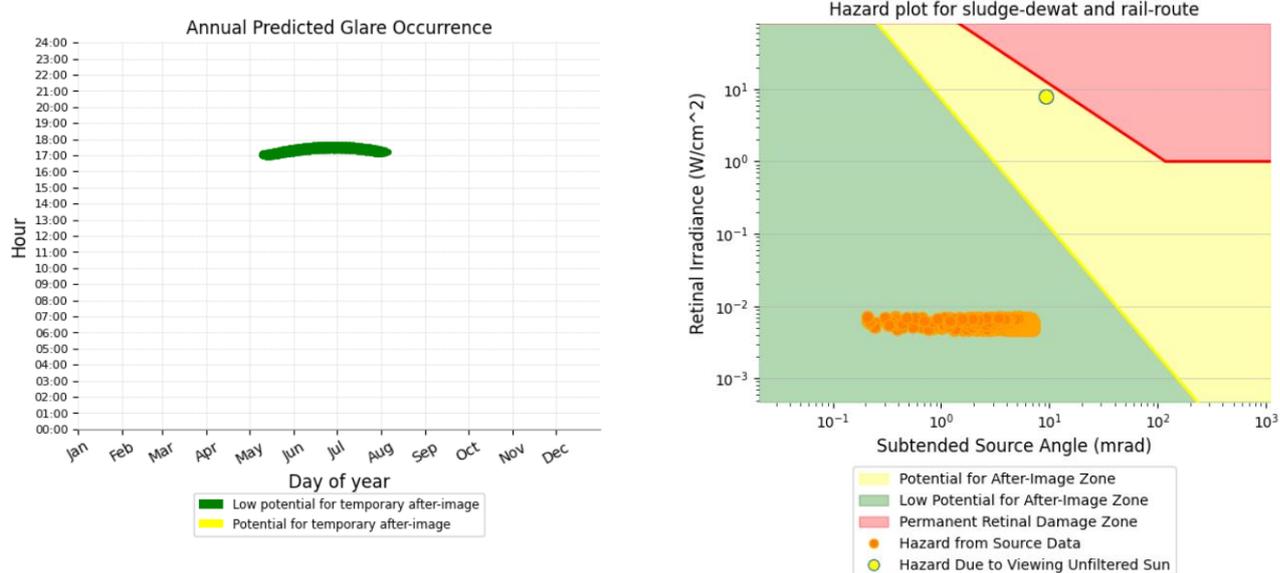
A.3.4.1.4 Large Field Array

Figure A- 110 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



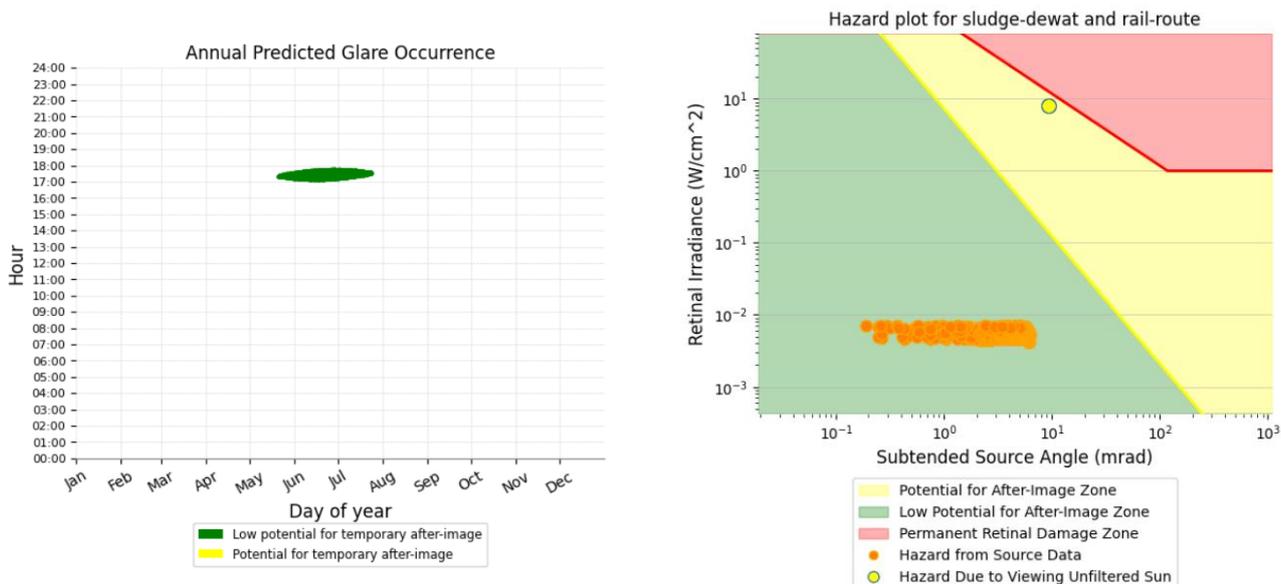
A.3.4.1.5 Sludge Dewatering Building 1 – East

Figure A- 111 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



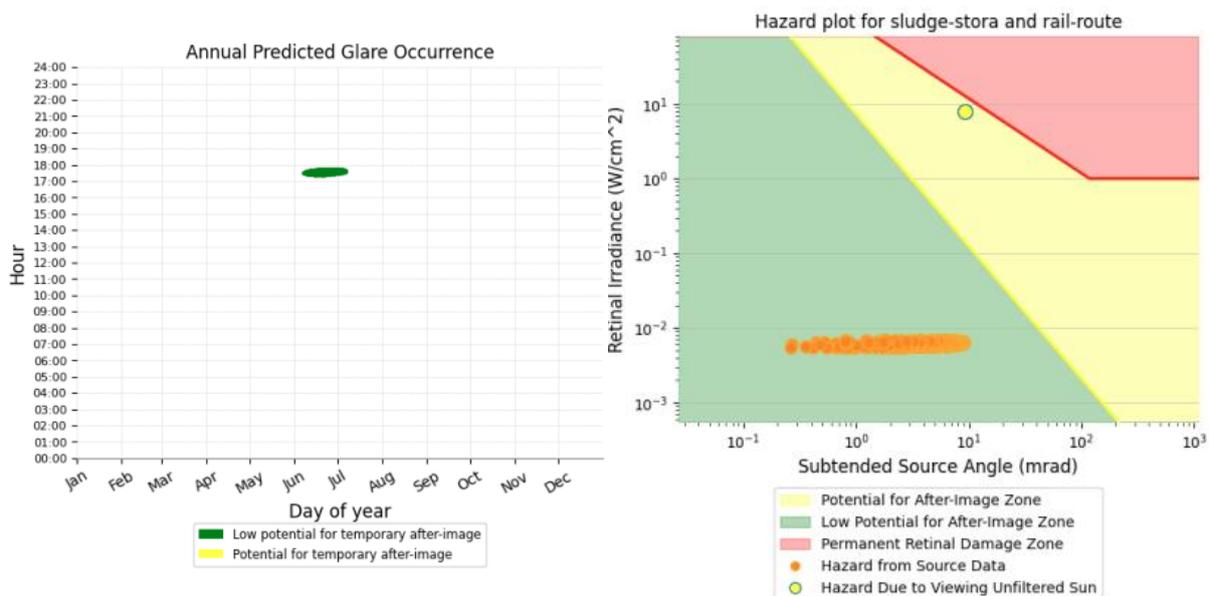
A.3.4.1.6 Sludge Dewatering Building 2 - East

Figure A- 112 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



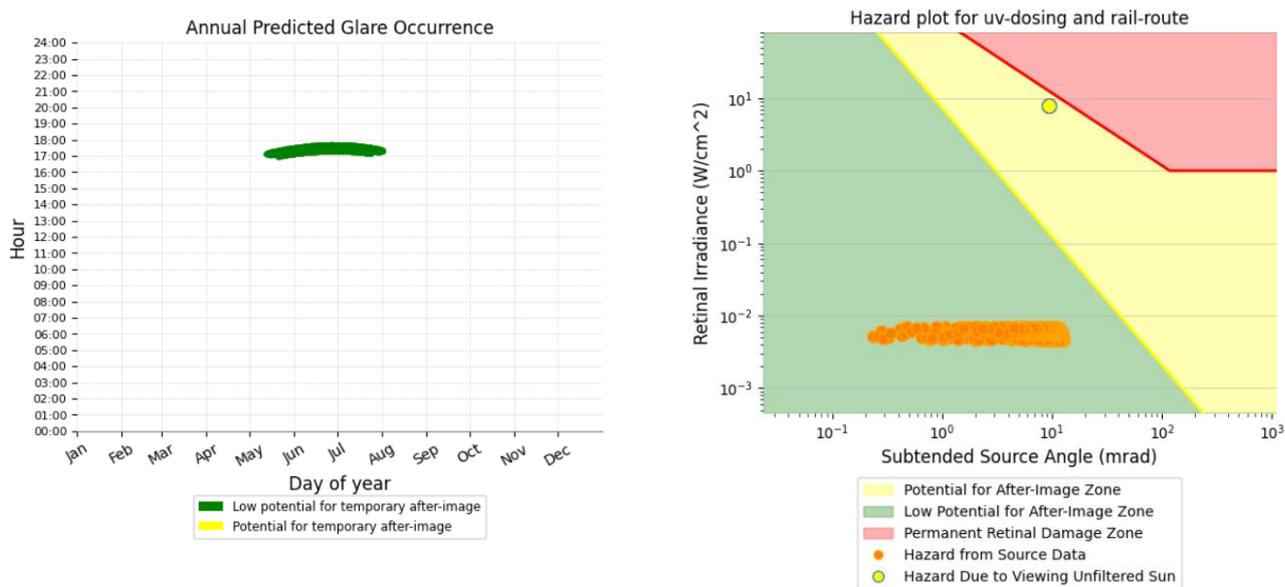
A.3.4.1.7 Sludge Storage Building 2

Figure A- 113 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



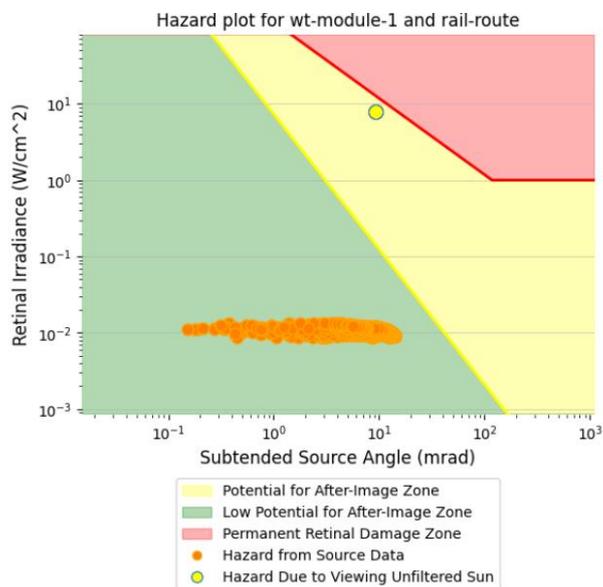
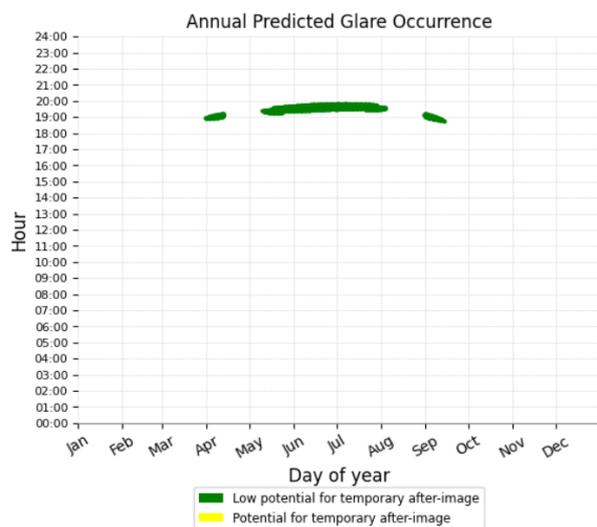
A.3.4.1.8 UV Dosing

Figure A- 114 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



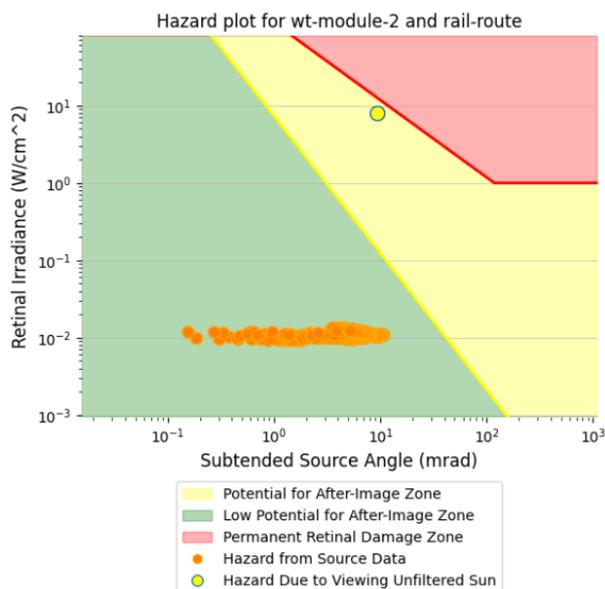
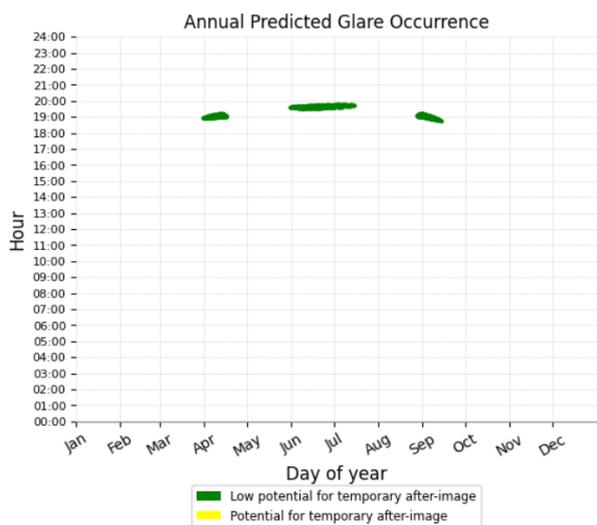
A.3.4.1.9 Water Treatment Module 1

Figure A- 115 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



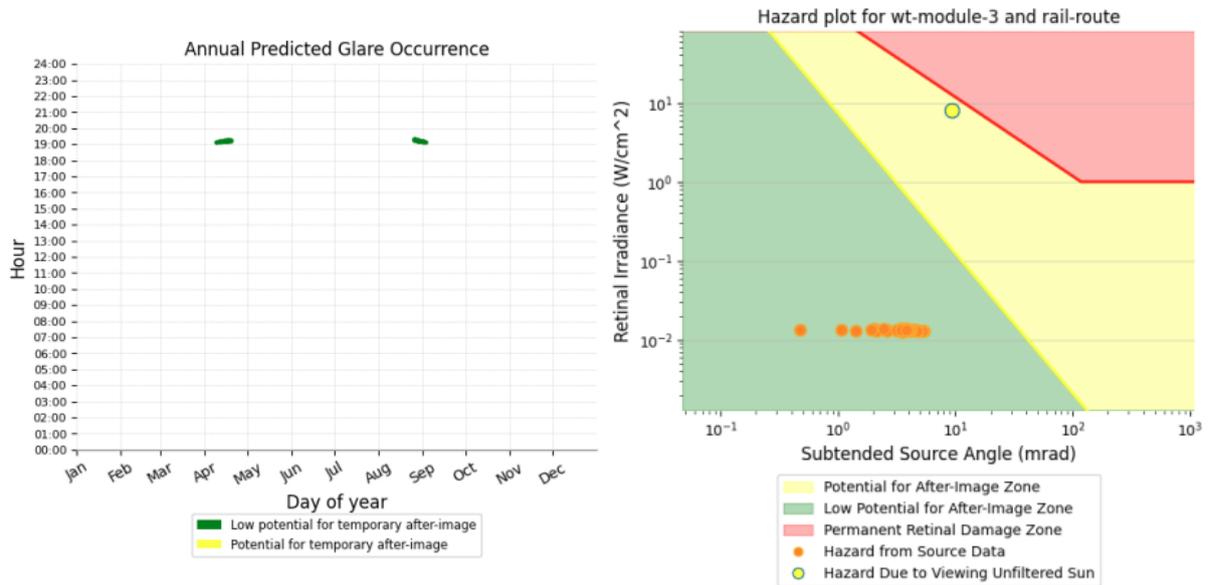
A.3.4.1.10 Water Treatment Module 2

Figure A- 116 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



A.3.4.1.11 Water Treatment Module 3

Figure A- 117 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



Appendix B. Break Pressure Tank (BPT) Glare Graphs

B.1 Site Overview

Figure B- 1 BPT site location

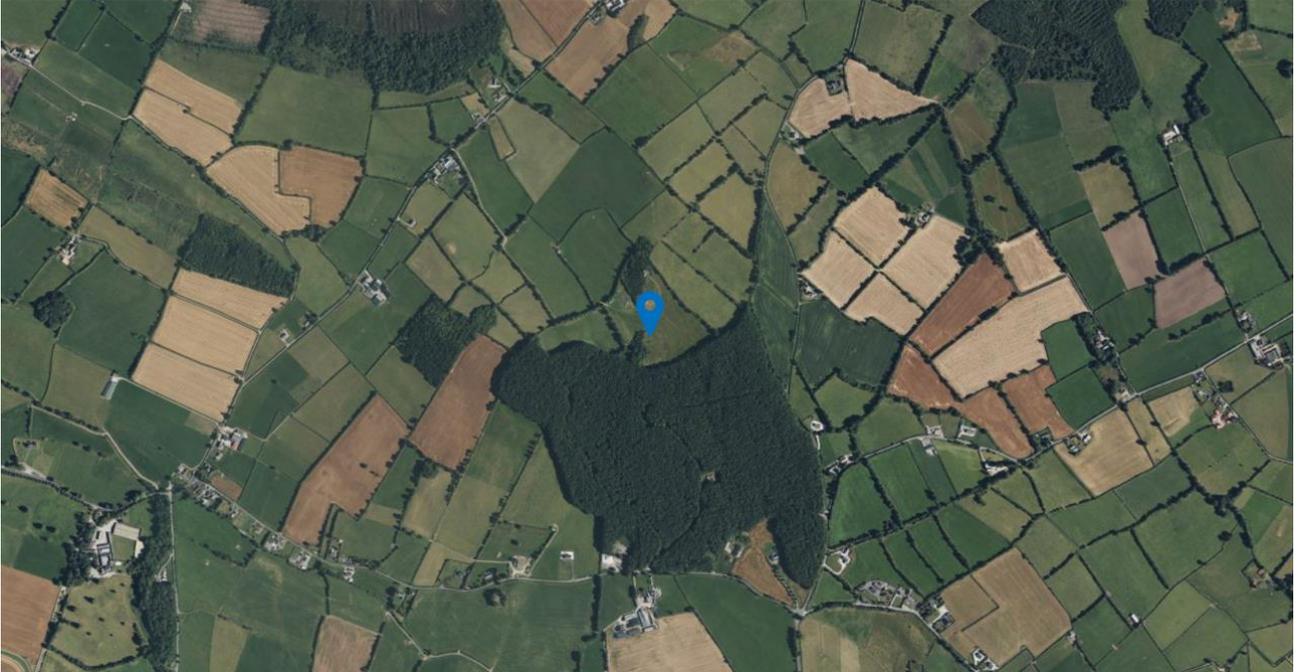
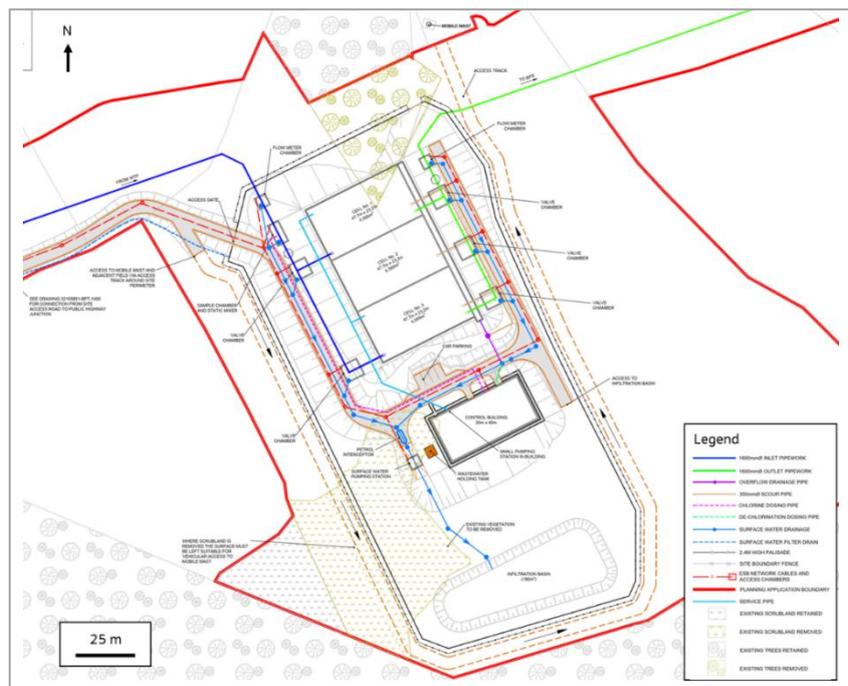


Figure B- 2 BPT site layout



B.2 Point Receptor Results

Figure B- 3 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at each point receptor, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all point receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones.

B.2.1 Point Receptor Results Tables

B.2.1.1 Array on Tank

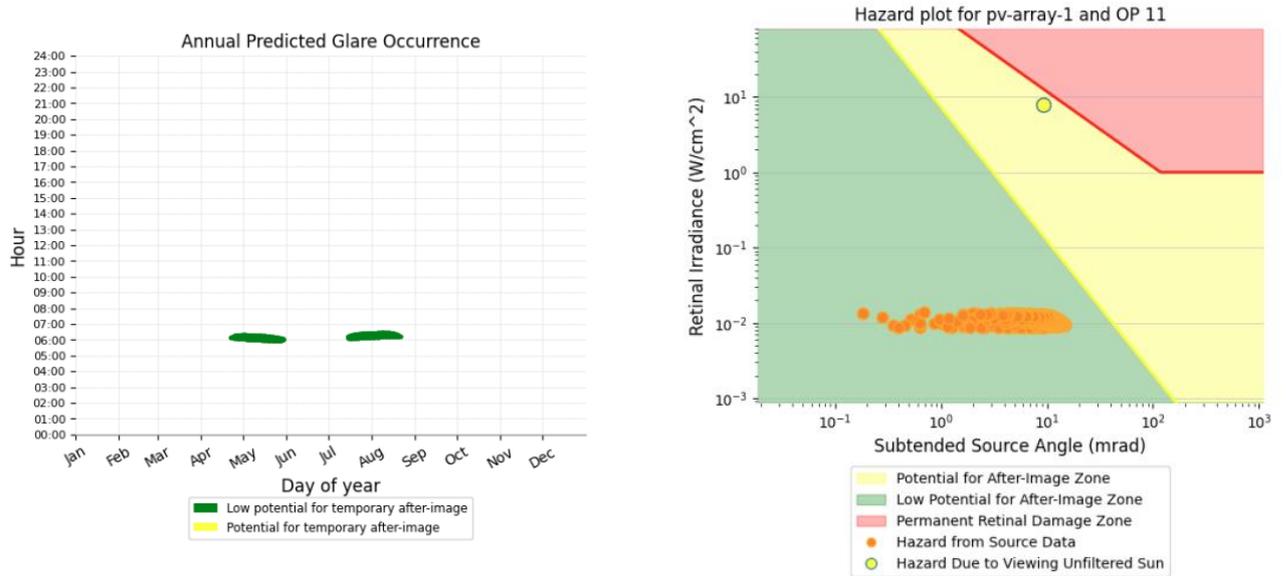
Table B- 1 Route receptor glare at PV array 1 – array on tank

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	0	0
OP3	0	0
OP4	0	0
OP5	0	0
OP6	0	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	0	0
OP11	1060	0

B.2.2 Glare Graphs

B.2.2.1 PV Array 1 – Array on Tank

Figure B- 3 Time of day/year of glare occurrence at OP11 (left) and associated hazard plot (right)



B.3 Route Receptor Results

Figure B- 4 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at each route receptor, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all route receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones. Route receptors were modelled at three different heights: 2.5m for heavy goods vehicles (HGVs), 1.5m for normal road vehicles, to ensure the results of the assessment were thorough and representative.

B.3.1 Route Receptor Modelled at 2.5m Height

B.3.1.1 Route Receptors Results Tables

B.3.1.1.1 Array on Tank

Table B- 2 Route receptor glare at PV array 1 – array on tank

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
East Road off R491	0	0
Old Birr Road	1080	0
Proposed access road	557	0
R491	0	0
South Road off R491	0	0

B.3.1.1.2 Control Building Rooftop Array

Table B- 3 Route receptor glare at PV array 2 – Control building rooftop array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
East Road off R491	0	0
Old Birr Road	17	0
Proposed access road	0	0
R491	0	0
South Road off R491	0	0

B.3.1.2 Glare Graphs

B.3.1.2.1 PV Array 1 – Array on Tank

Figure B- 4 Time of day/year of glare occurrence at the proposed access road (left) and associated hazard plot (right)

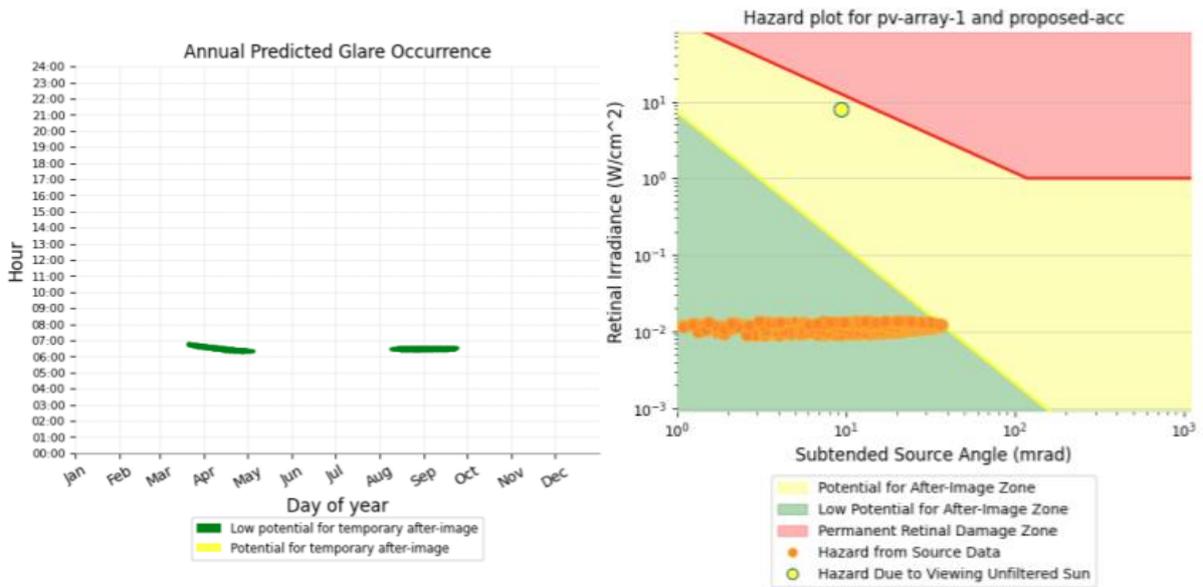
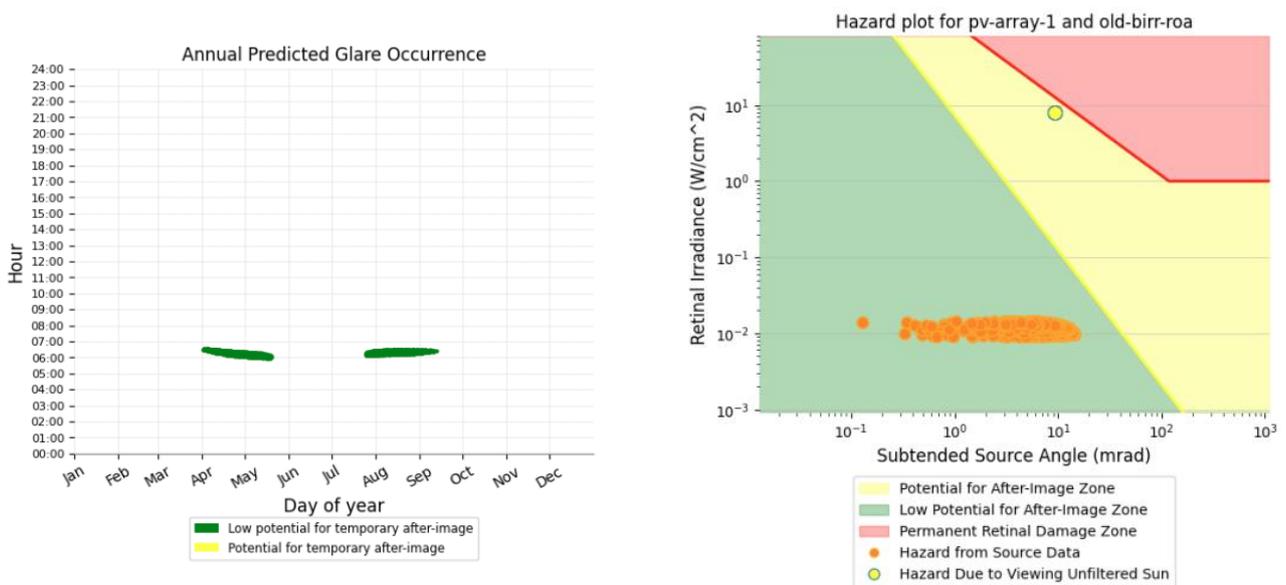
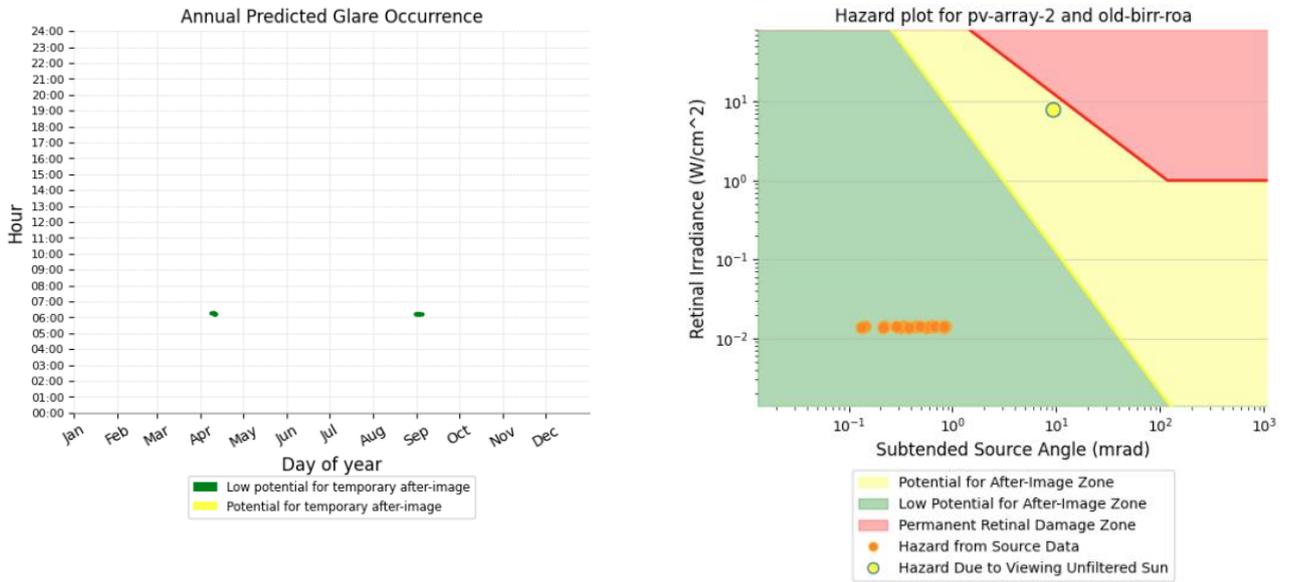


Figure B- 5 Time of day/year of glare occurrence at the Old Birr Road (left) and associated hazard plot (right)



B.3.1.2.2 PV Array 2 – Control Building Rooftop Array

Figure B- 6 Time of day/year of glare occurrence at Old Birr Road (left) and associated hazard plot (right)



B.3.2 Route Receptor Modelled at 1.5m Height

B.3.2.1 Route Receptors Results Tables

B.3.2.1.1 Array on Tank

Table B- 4 Route receptor glare at PV array 1 – array on tank

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
East Road off R491	0	0
Old Birr Road	999	0
Proposed access road	336	0
R491	0	0
South Road off R491	0	0

B.3.2.1.2 PV Array 2 – Control Building Rooftop Array

Table B- 5 Route receptor glare at PV array 2- control building rooftop array

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
East Road off R491	0	0
Old Birr Road	17	0
Proposed access road	0	0
R491	0	0
South Road off R491	0	0

B.3.2.2 Glare Graphs

B.3.2.2.1 PV Array 1 – Array on Tank

Figure B- 7 Time of day/year of glare occurrence at Old Birr Road (left) and associated hazard plot (right)

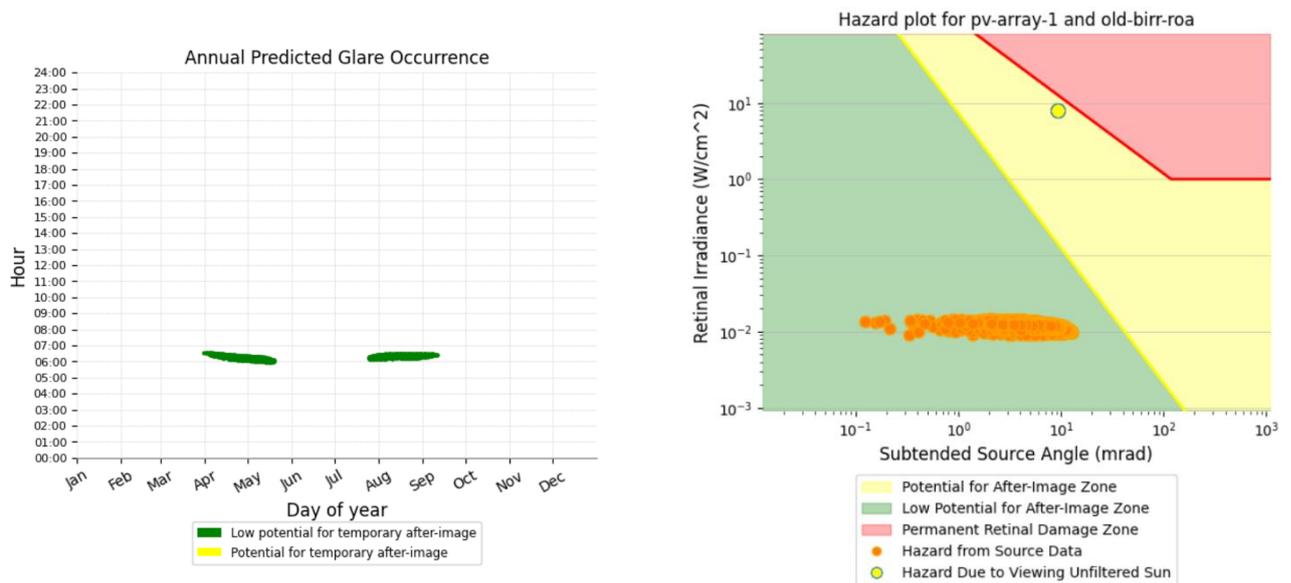
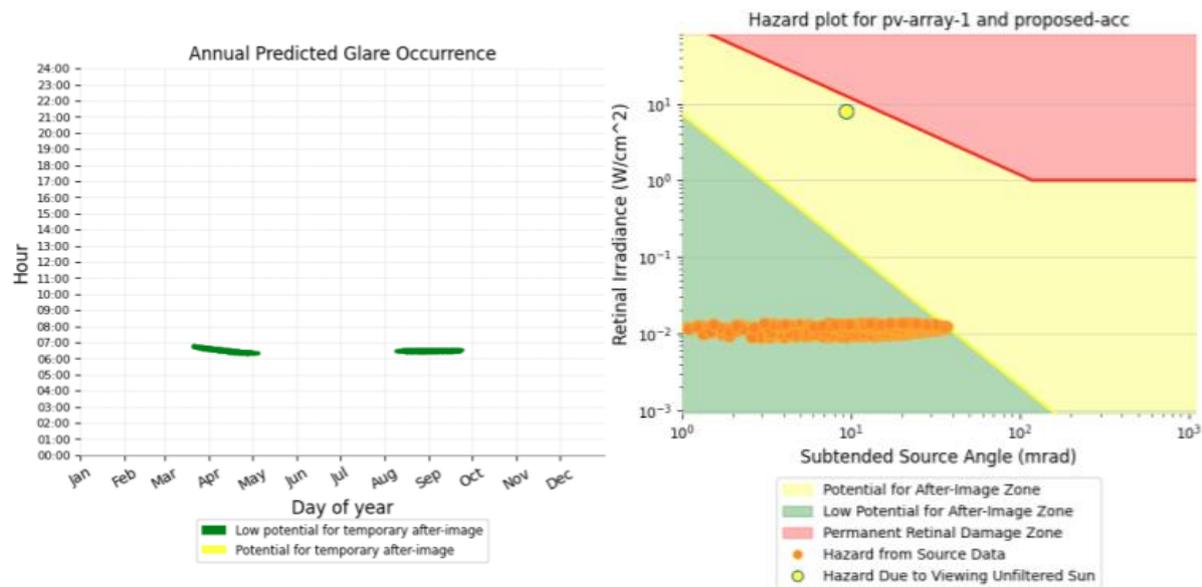
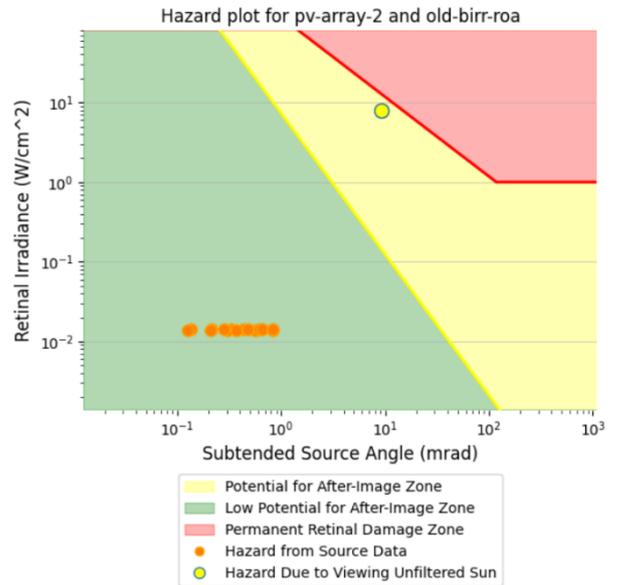
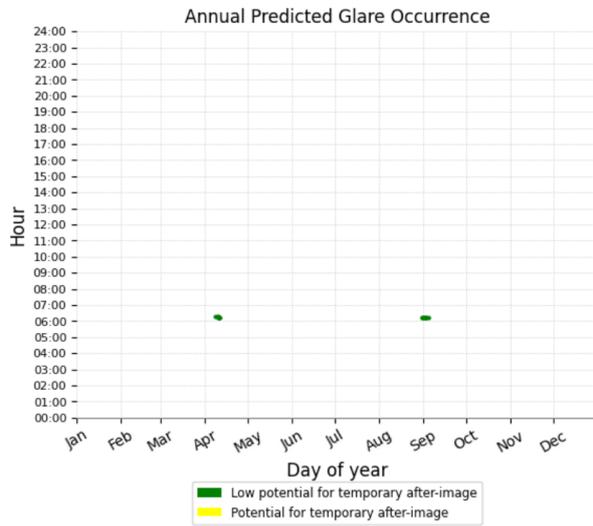


Figure B- 8 Time of day/year of glare occurrence at the proposed access road (left) and associated hazard plot (right)



B.3.2.2.2 PV Array 2 – Control Building Rooftop Array

Figure B- 9 Time of day/year of glare occurrence at Old Birr Road (left) and associated hazard plot (right)



Appendix C. Booster Pumping Station (BPS) Glare Graphs

C.1 Site Overview

Figure C- 1 BPS site location

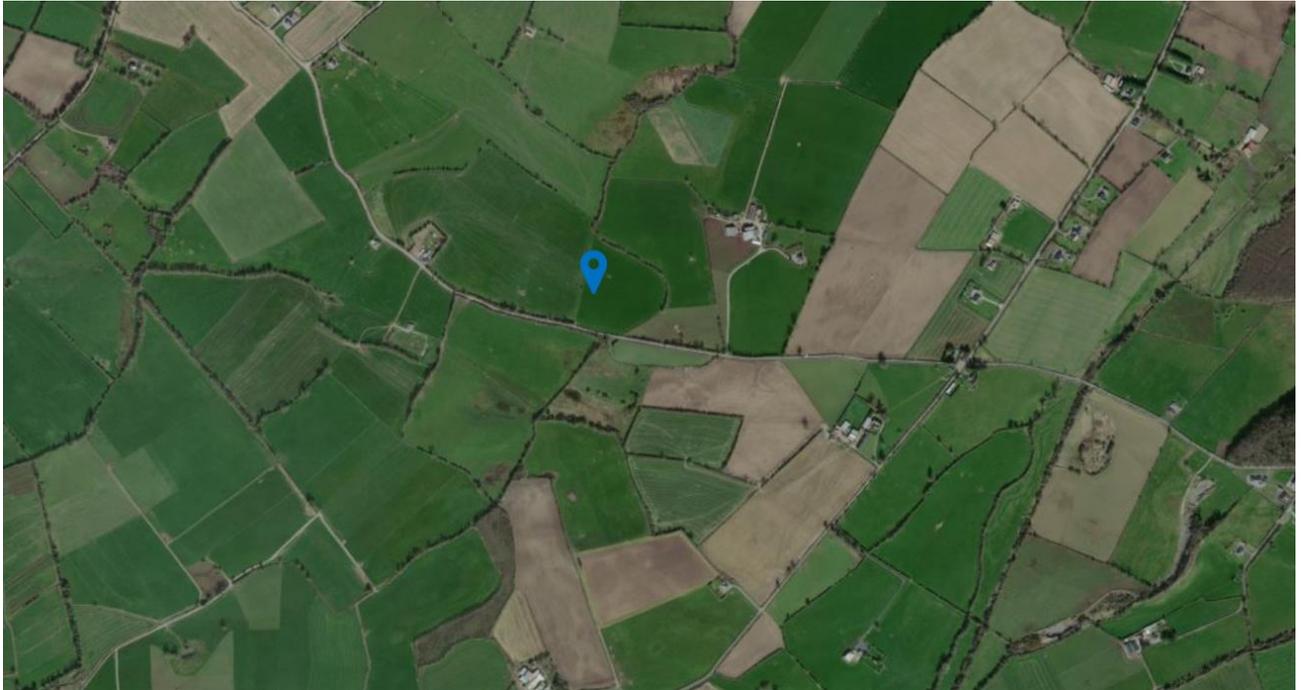
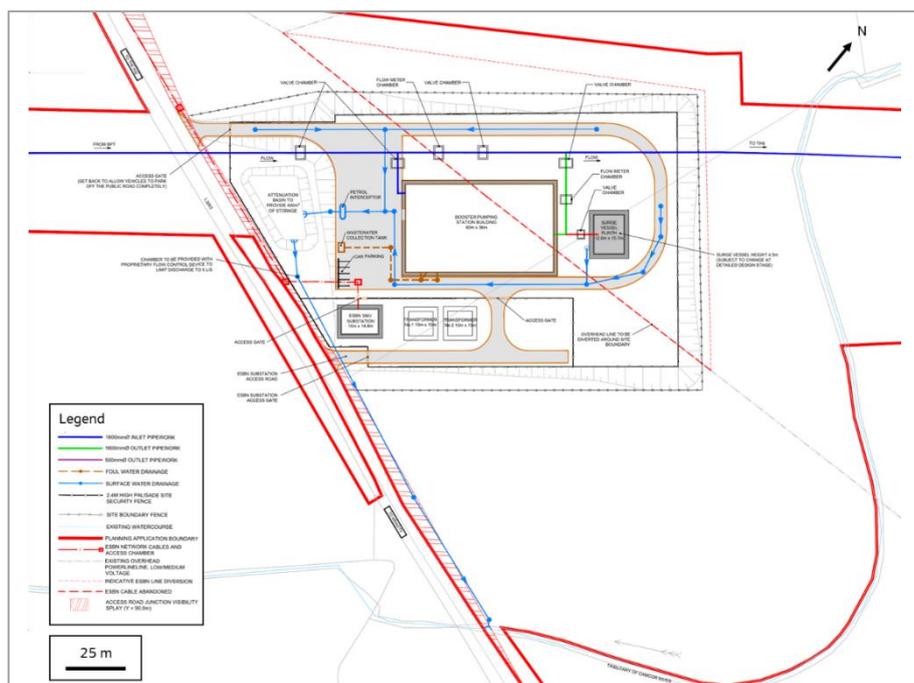


Figure C- 2 BPS site layout



C.2 Point Receptor Results

Figure C- 3 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at each point receptor, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all point receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones. No yellow or red glare was detected at the BPS.

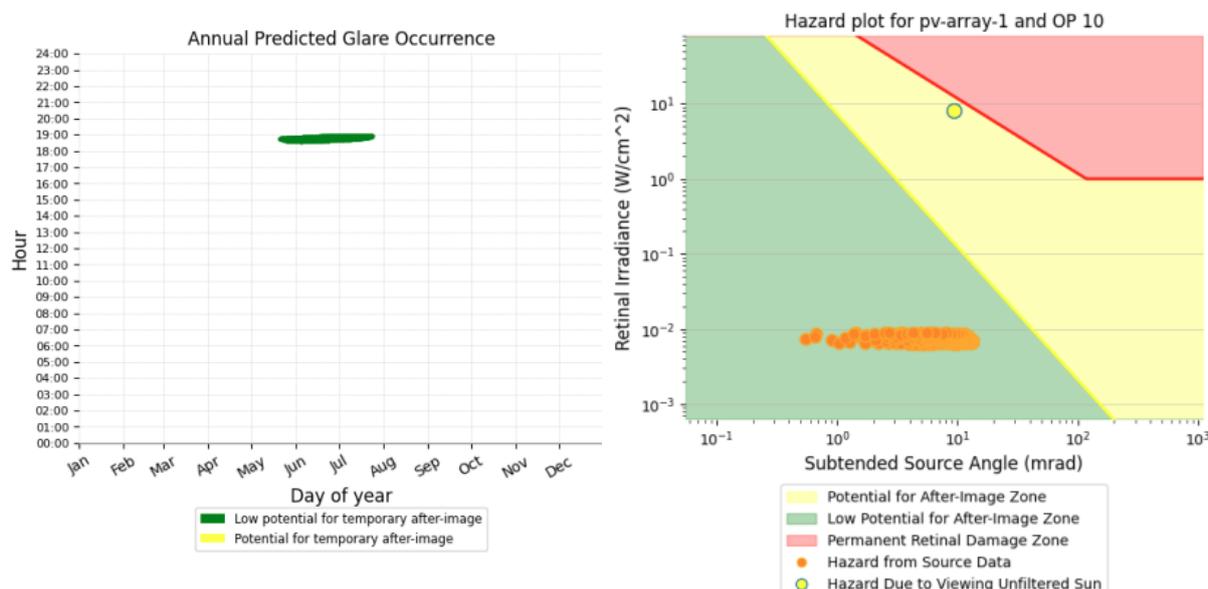
C.2.1 Point Receptor Results Tables

Table C- 1 Point receptor glare for PV array 1

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	0	0
OP3	0	0
OP4	0	0
OP5	0	0
OP6	0	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	942	0
OP11	0	0
OP12	0	0

C.2.2 Glare Graphs

Figure C- 3 Time of day/year of glare occurrence at OP10 (left) and associated hazard plot (right)



C.3 Route Receptor Results

Figure C- 5 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at each route receptor, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all route receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones. Route receptors were modelled at three different heights: 2.5m for heavy goods vehicles (HGVs), 1.5m for normal road vehicles, to ensure the results of the assessment were thorough and representative.

C.3.1 Route Receptor Modelled at 2.5m Height

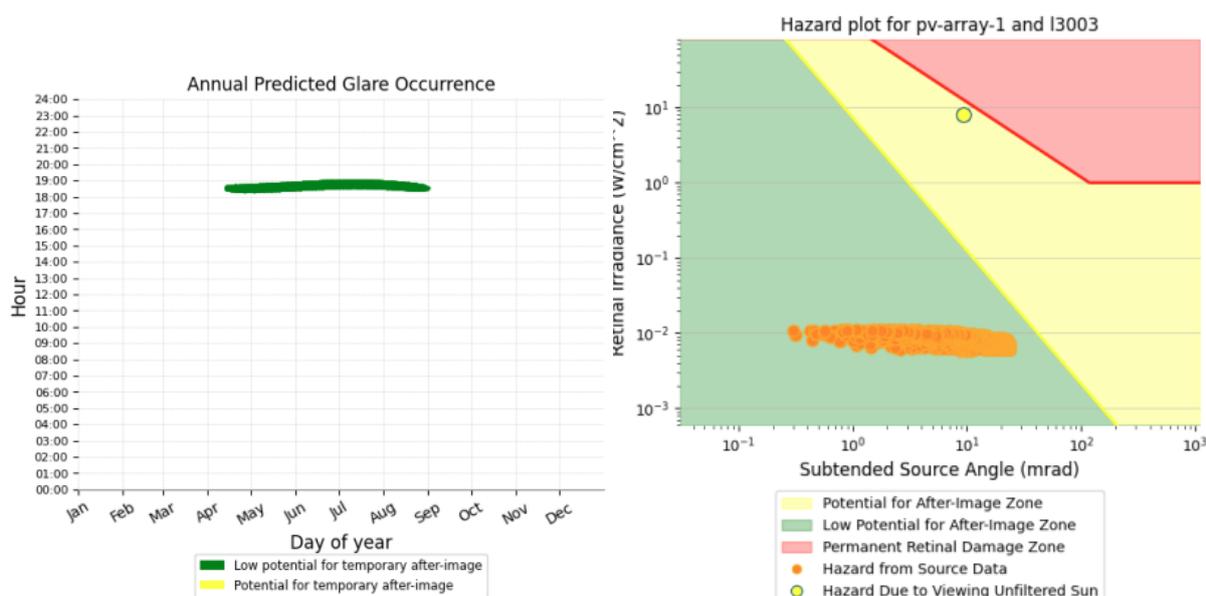
C.3.1.1 Route Receptors Results Tables

Table C- 2 Route receptor glare at PV array 1

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Access road to nearby barn	0	0
L3003	2603	0
Pass	0	0
Proposed Access Road	0	0

C.3.1.2 Glare Graphs

Figure C- 4 Time of day/year of glare occurrence at the L3003 (left) and associated hazard plot (right)



C.3.2 Route Receptor Modelled at 1.5m Height

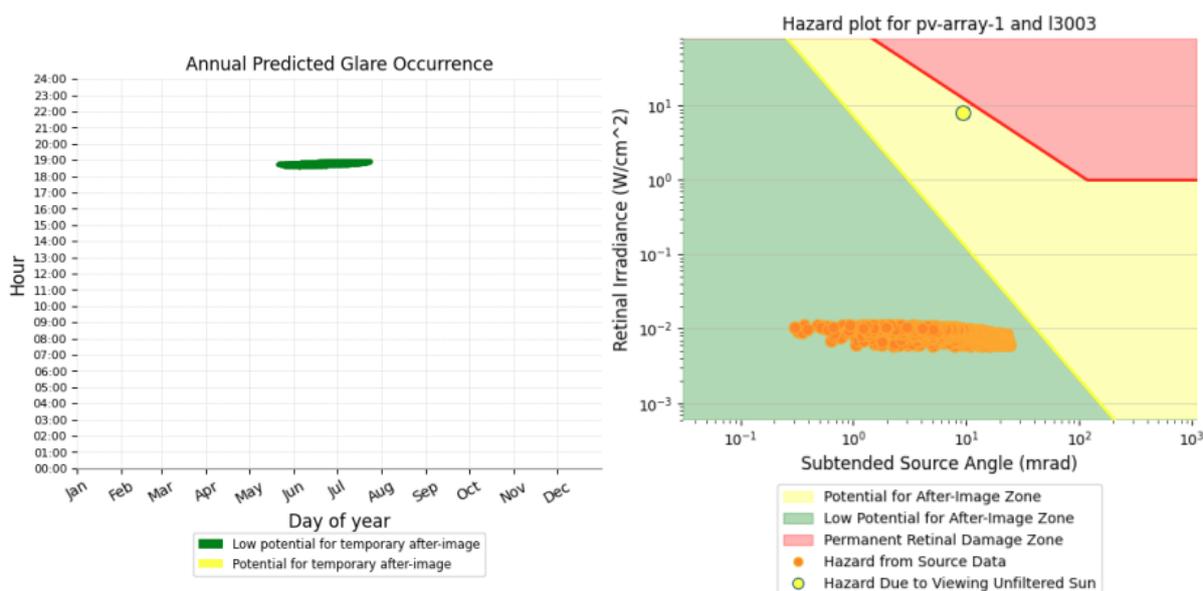
C.3.2.1 Route Receptors Results Tables

Table C- 3 Route receptor glare at PV array 1

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Access road to nearby barn	0	0
L3003	2550	0
Pass	0	0
Proposed Access Road	0	0

C.3.2.2 Glare Graphs

Figure C- 5 Time of day/year of glare occurrence at the L3003 (left) and associated hazard plot (right)



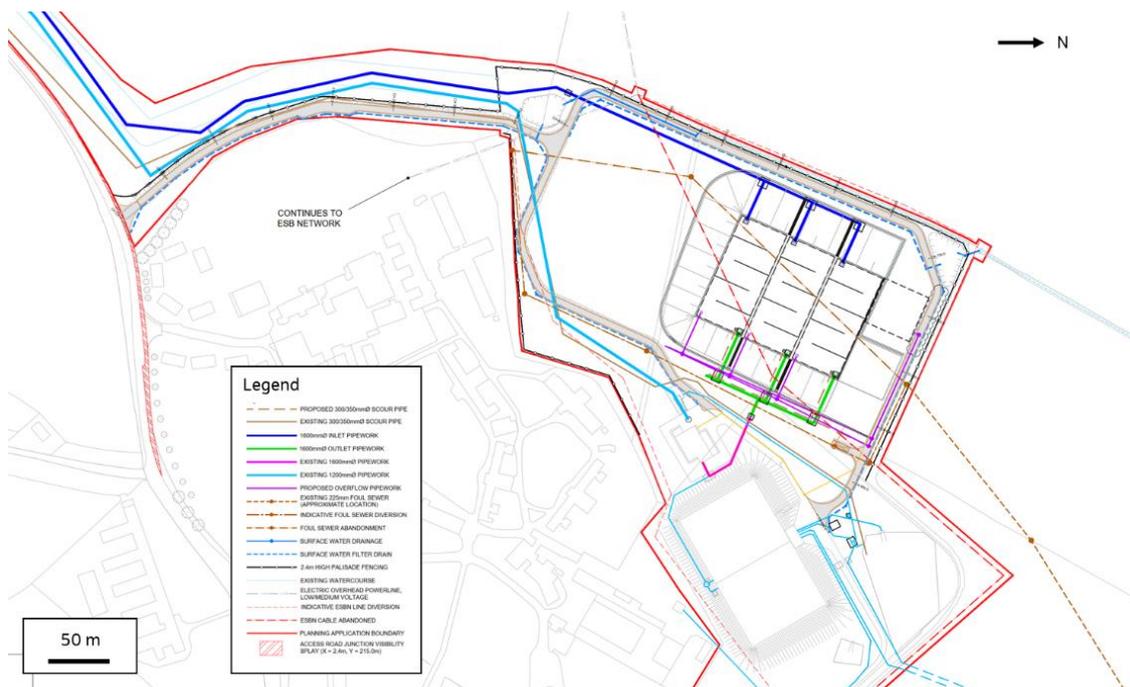
Appendix D. Terminator Point Reservoir (TPR) Glare Graphs

D.1 Site Overview

Figure D- 1 TPR site location



Figure D- 2 TPR site layout



D.2 Point Receptor Results

Figure D- 3 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at each point receptor, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all point receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones. No yellow or red glare was detected at the TPR.

D.2.1 Point Receptor Results Tables

Table D- 1 Observation point glare at PV array 1

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	0	0
OP3	0	0
OP4	0	0
OP5	0	0
OP6	0	0
OP7	0	0
OP8	673	0
OP9	0	0
OP10	0	0
OP11	783	0
OP12	0	0
OP13	0	0
OP14	0	0
OP15	0	0
OP16	0	0
OP17	223	0
OP18	0	0
19-ATCT	0	0
OP20	209	0
OP21	355	0
OP22	786	0
OP23	1646	0
OP24	1454	0
OP25	1075	0
OP26	0	0
OP27	0	0
OP28	307	0

OP29	184	0
OP30	0	0

D.2.2 Glare Graphs

Figure D- 3 Time of day/year of glare occurrence at OP8 (left) and associated hazard plot (right)

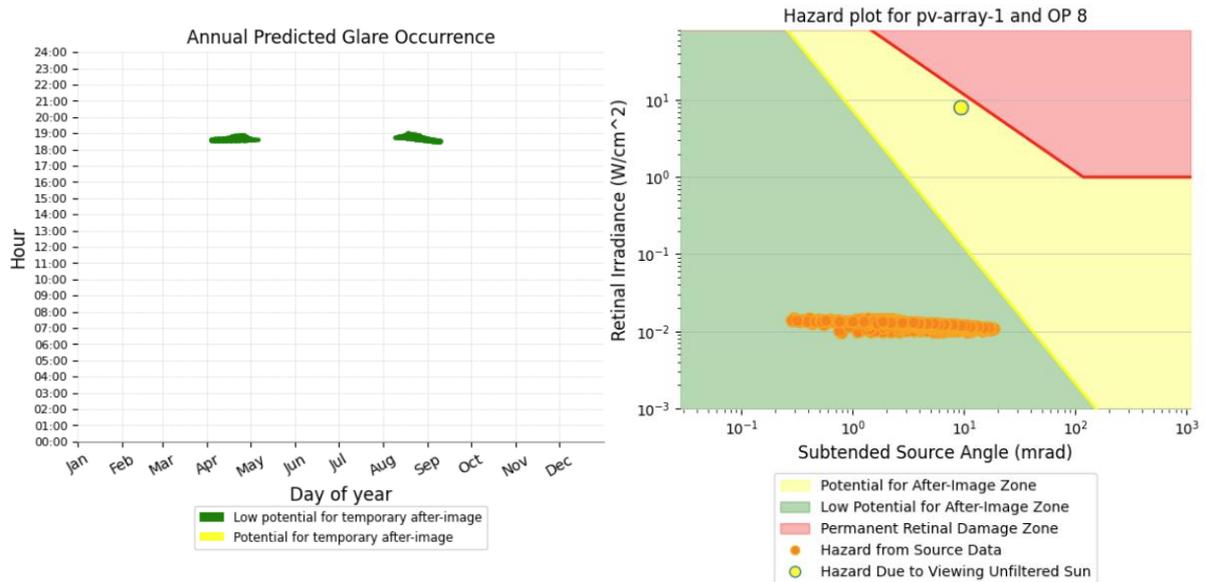


Figure D- 4 Time of day/year of glare occurrence at OP11 (left) and associated hazard plot (right)

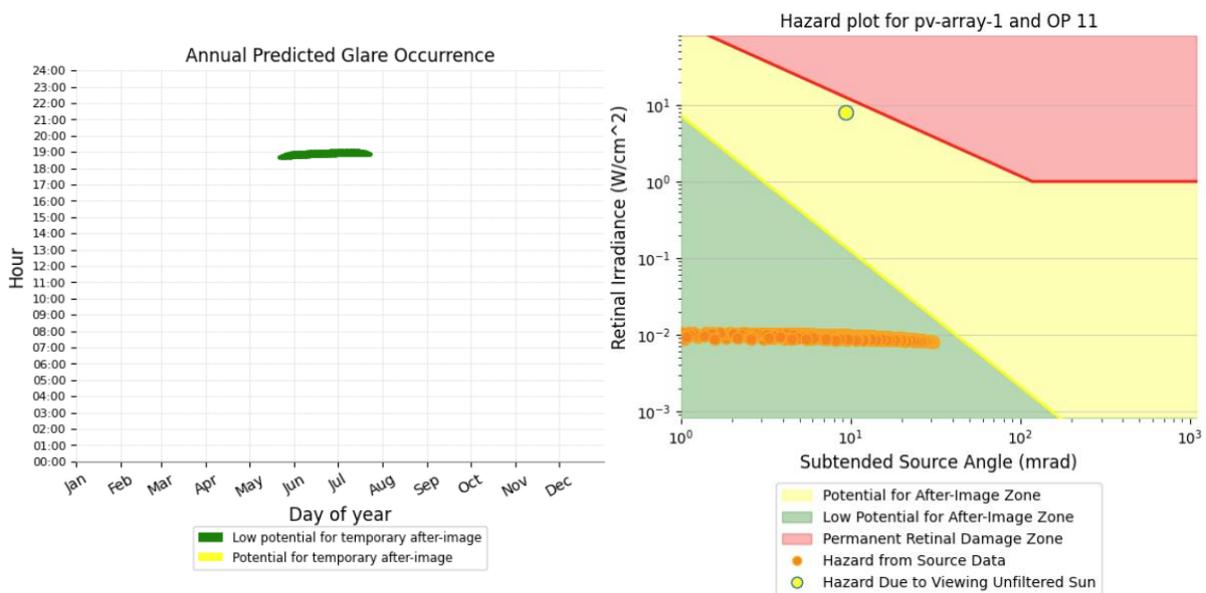


Figure D- 5 Time of day/year of glare occurrence at OP17 (left) and associated hazard plot (right)

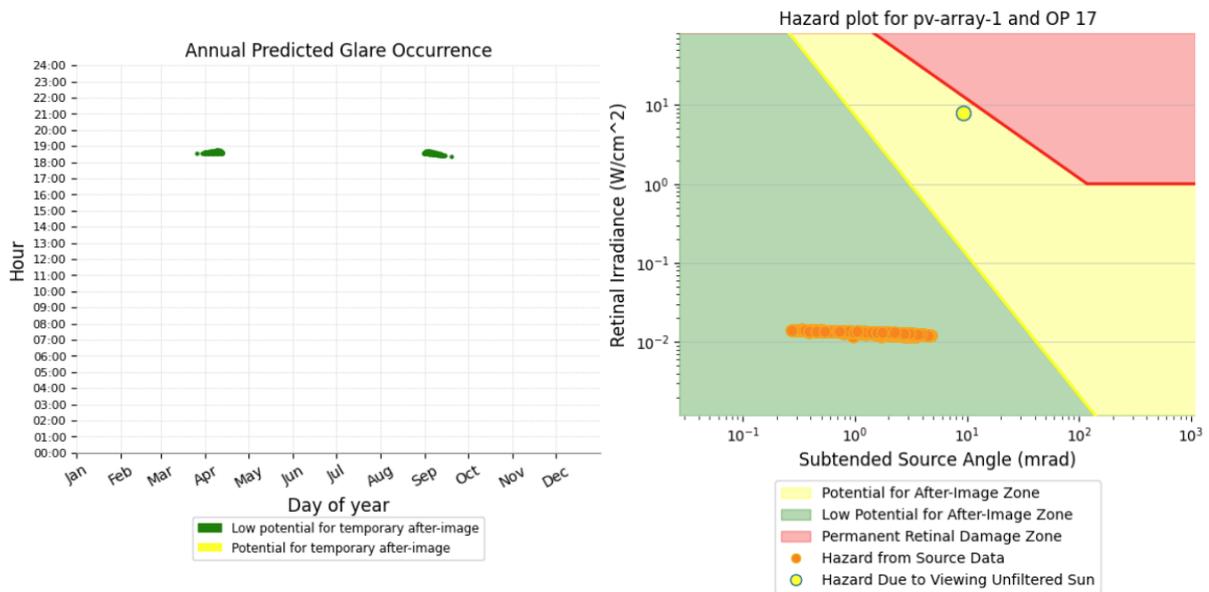


Figure D- 6 Time of day/year of glare occurrence at OP20 (left) and associated hazard plot (right)

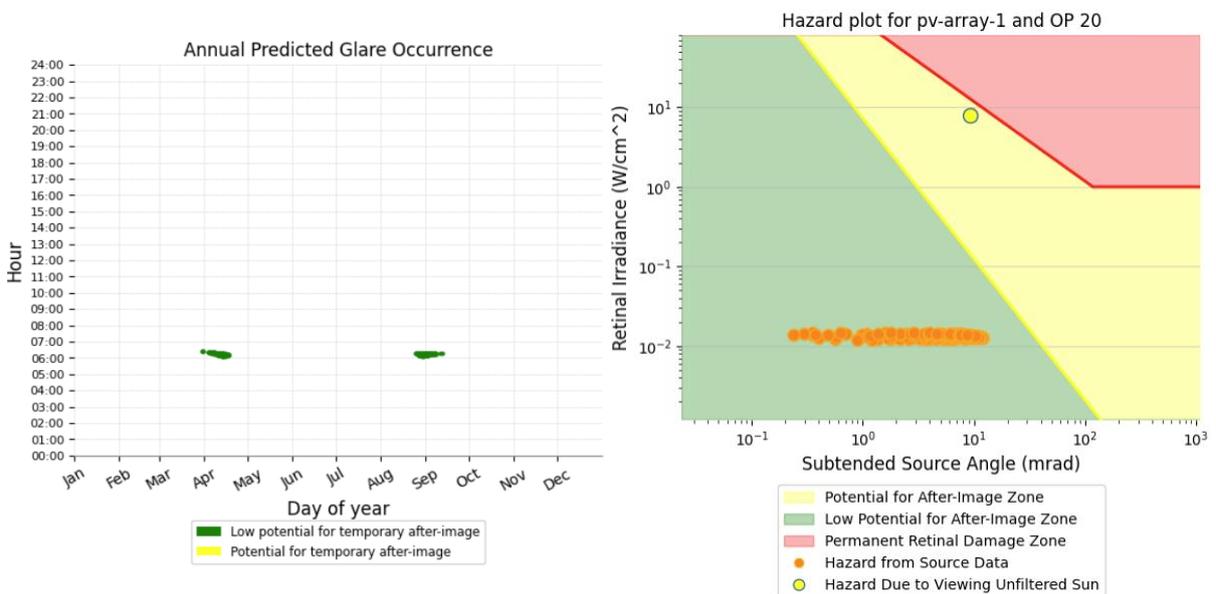


Figure D- 7 Time of day/year of glare occurrence at OP21 (left) and associated hazard plot (right)

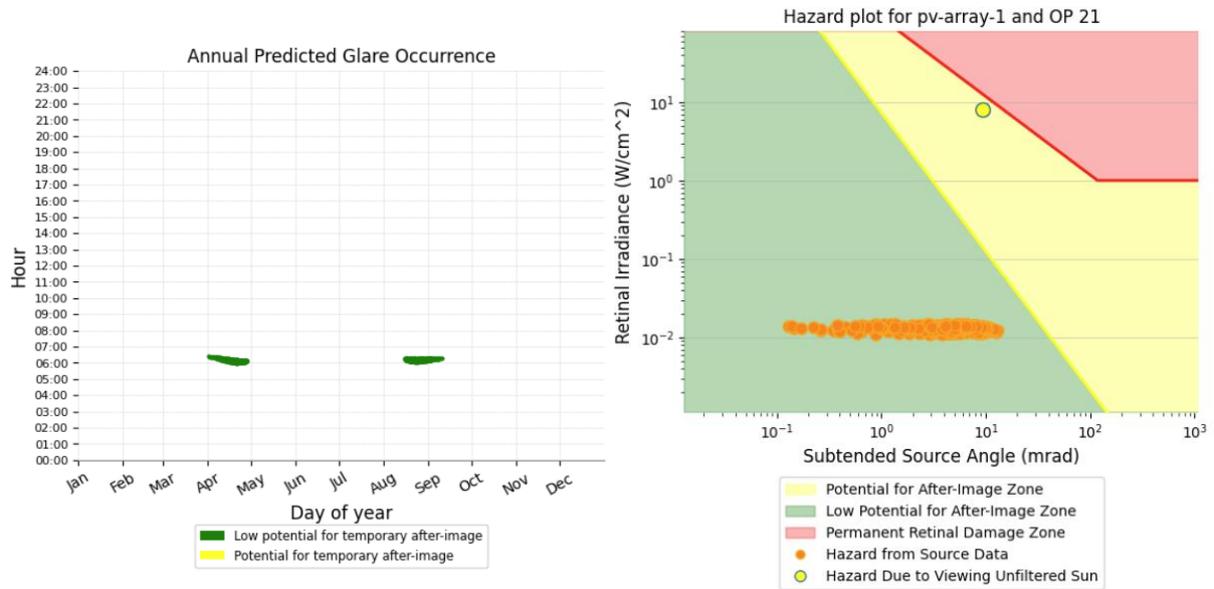


Figure D- 8 Time of day/year of glare occurrence at OP22 (left) and associated hazard plot (right)

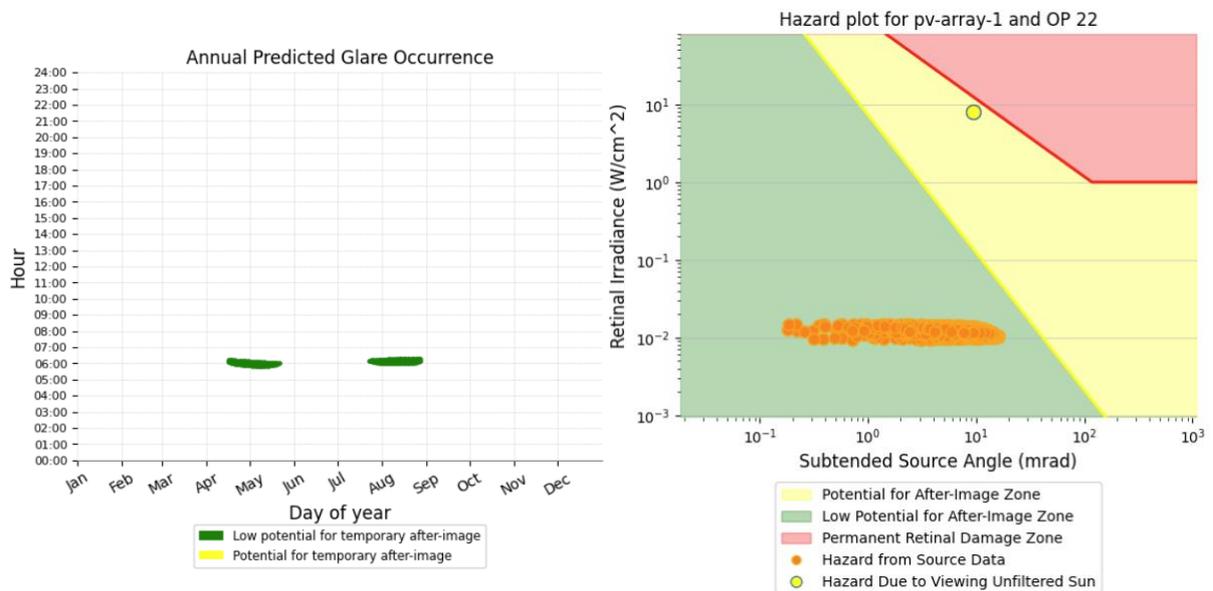


Figure D- 10 Time of day/year of glare occurrence at OP23 (left) and associated hazard plot (right)

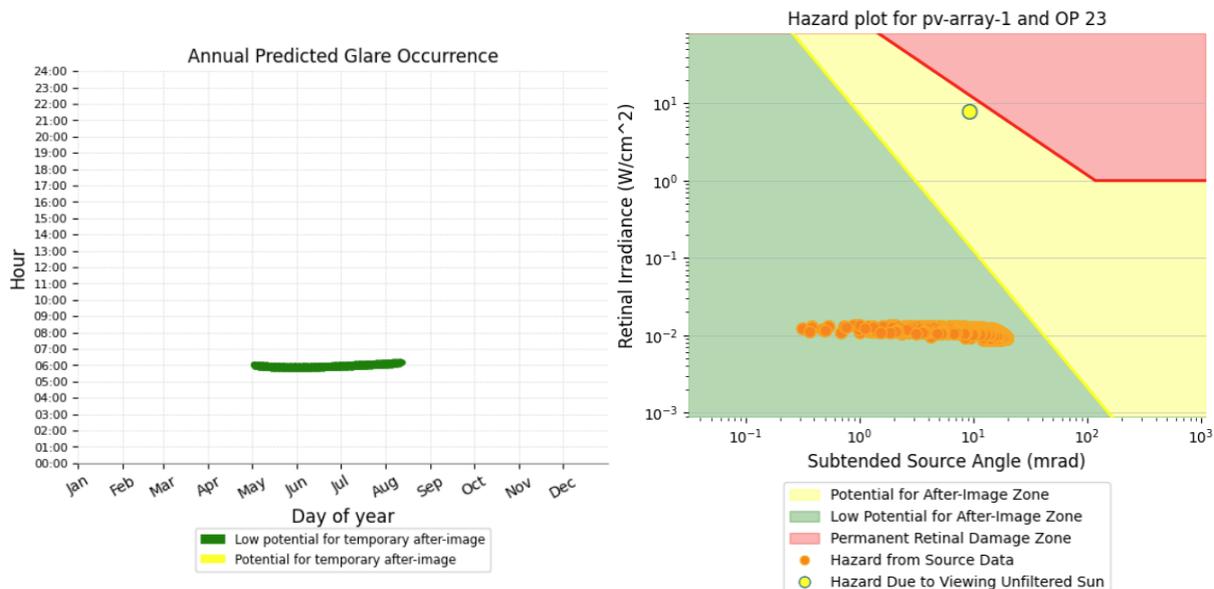


Figure D- 9 Time of day/year of glare occurrence at OP24 (left) and associated hazard plot (right)

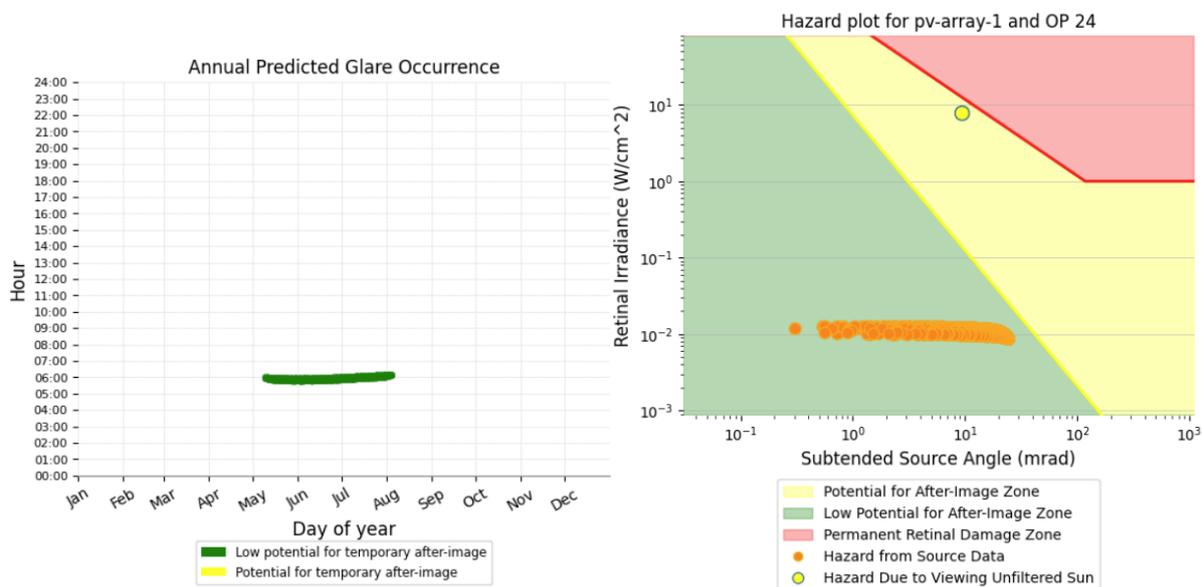


Figure D- 11 Time of day/year of glare occurrence at OP25 (left) and associated hazard plot (right)

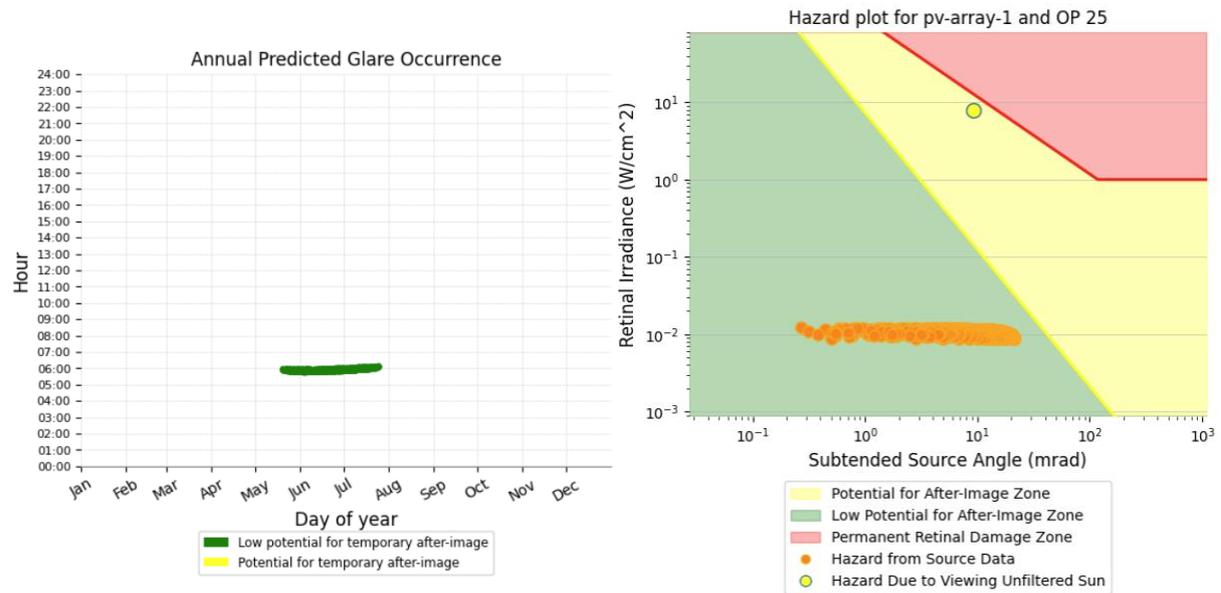


Figure D- 12 Time of day/year of glare occurrence at OP28 (left) and associated hazard plot (right)

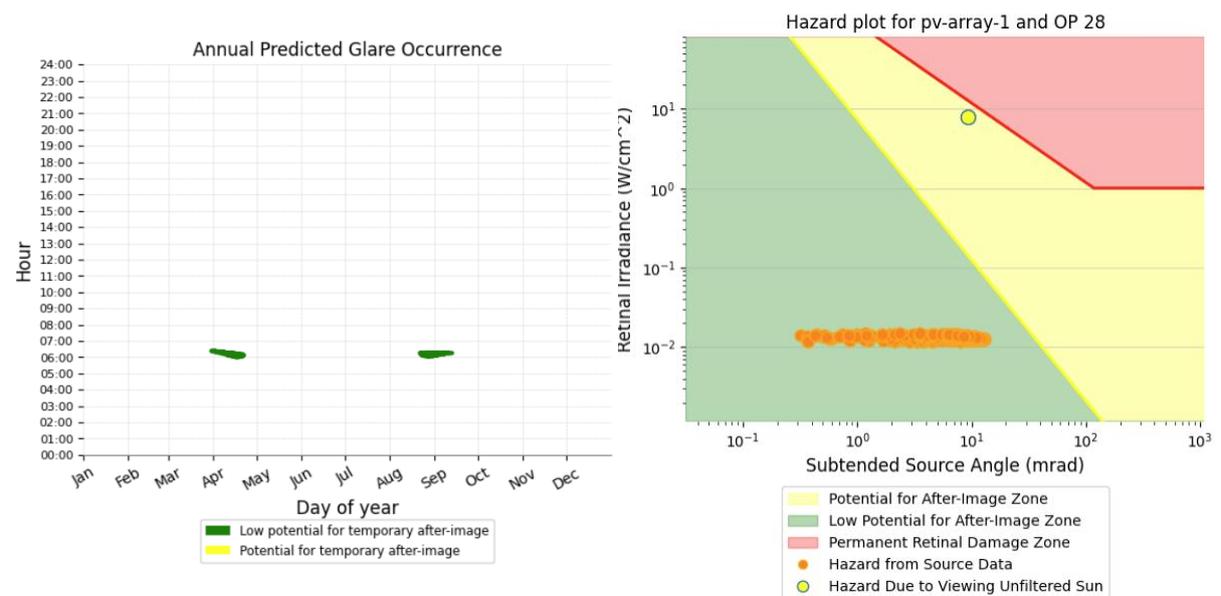
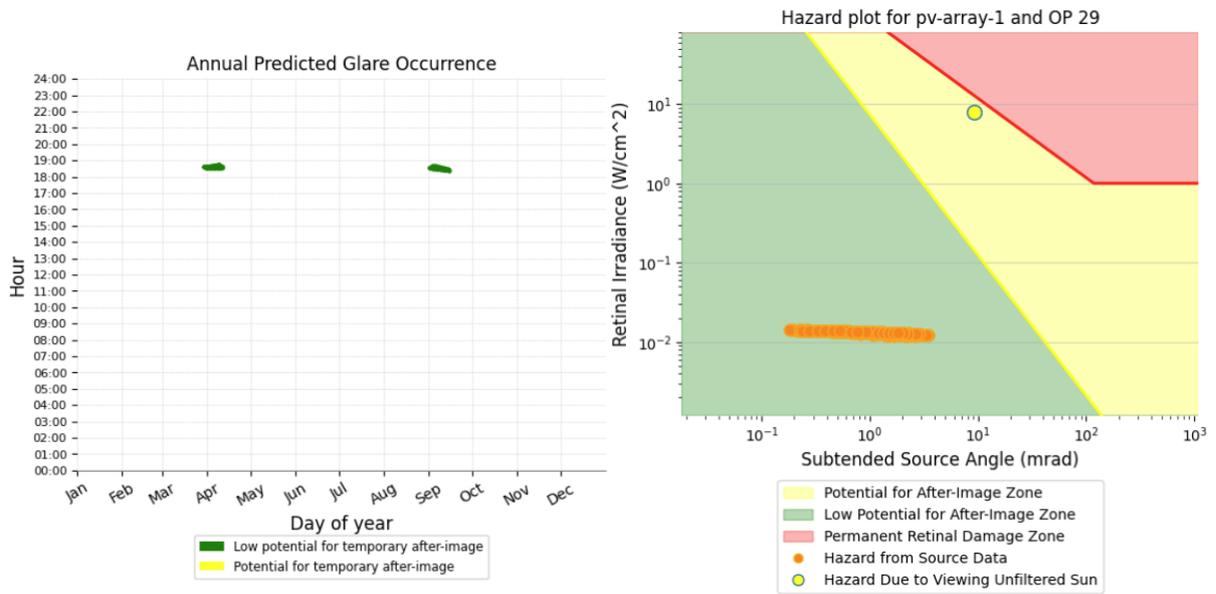


Figure D- 13 Time of day/year of glare occurrence at OP29 (left) and associated hazard plot (right)



D.3 Route Receptor Results

Figure D- 14 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at each route receptor, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all route receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones. Route receptors were modelled at three different heights: 2.5m for heavy goods vehicles (HGVs), and 1.5m for normal road vehicles, to ensure the results of the assessment were thorough and representative.

D.3.1 Route Receptor Modelled at 2.5m Height

D.3.1.1 Route Receptors Results Tables

Table D- 2 Route receptor glare at TPR site

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Access Road	0	0
Loughtown Road	2305	0
Milltown Lane	1416	0
Newcastle Golf Centre	0	0
Peamount Church	0	0
Peamount Road	1427	0
Peamount Wellness Centre	0	0
Relickeen Lane	677	0
Travelling West towards TSL Mountpark Office	0	0
Peamount Reservoir Access Road	1930	0

D.3.1.2 Glare Graphs

Figure D- 14 Time of day/year of glare occurrence at Loughtown Road (left) and associated hazard plot (right)

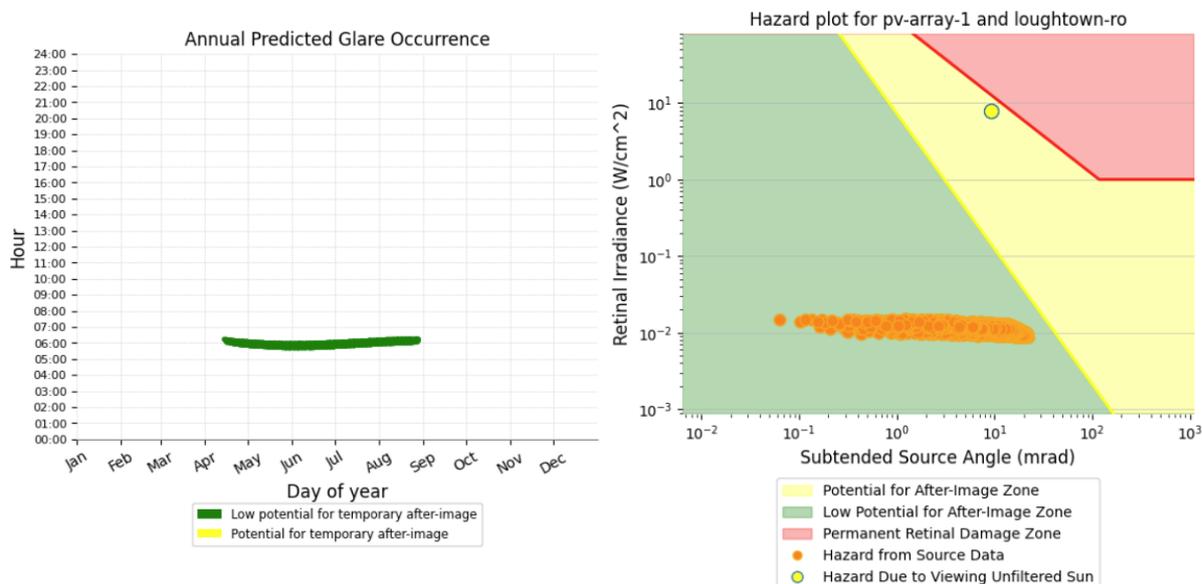


Figure D- 15 Time of day/year of glare occurrence at Milltown Lane (left) and associated hazard plot (right)

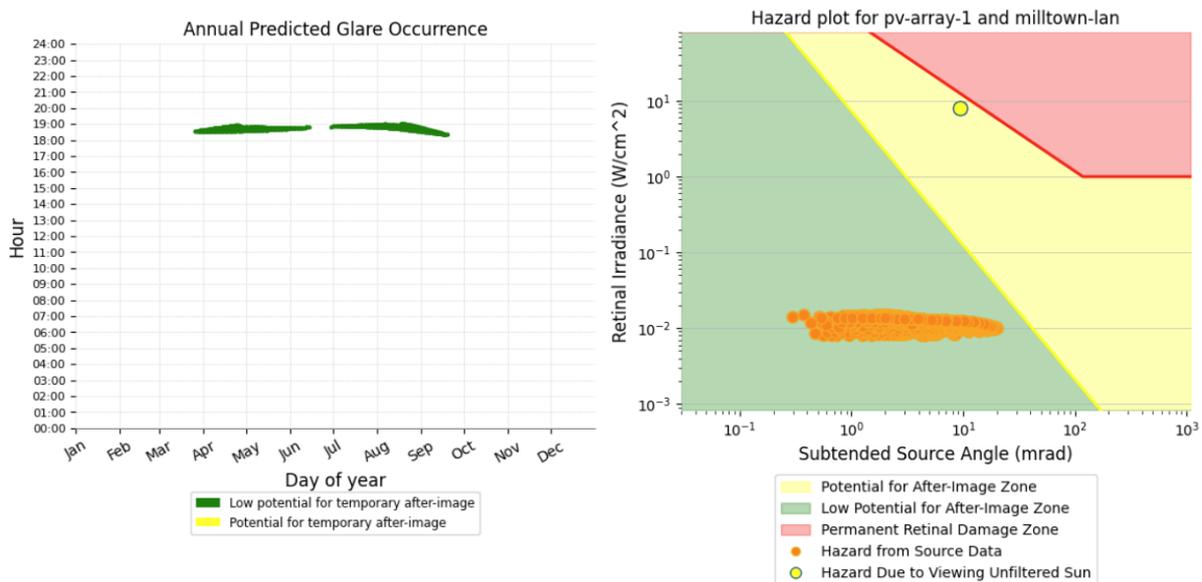


Figure D- 16 Time of day/year of glare occurrence at Peamount Reservoir Access Road (left) and associated hazard plot (right)

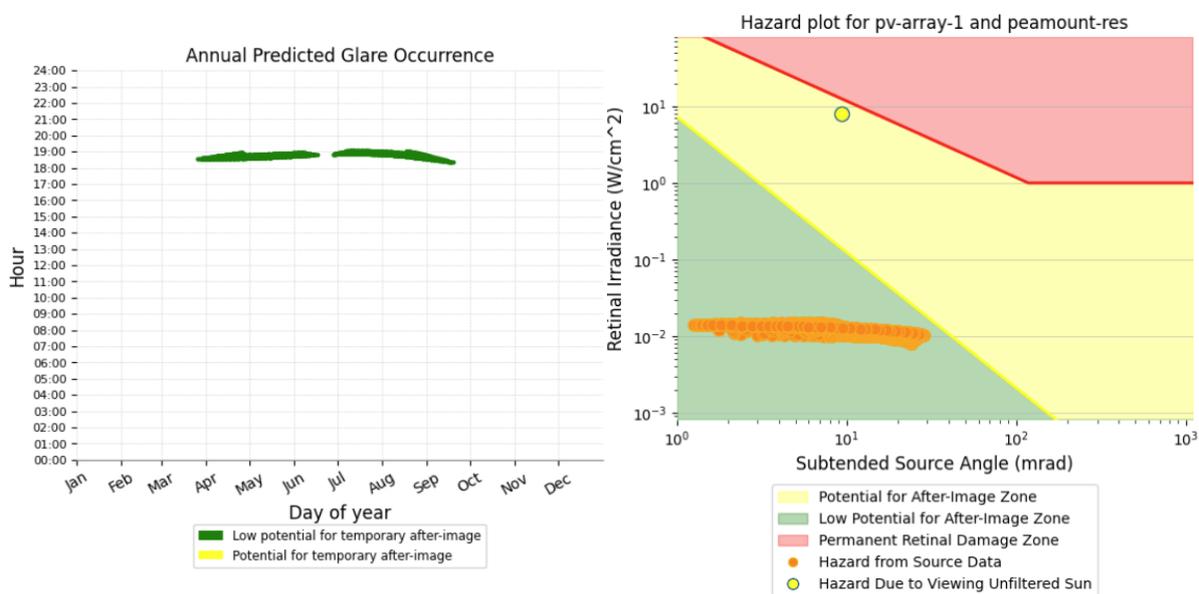


Figure D- 17 Time of day/year of glare occurrence at Peamount Road (left) and associated hazard plot (right)

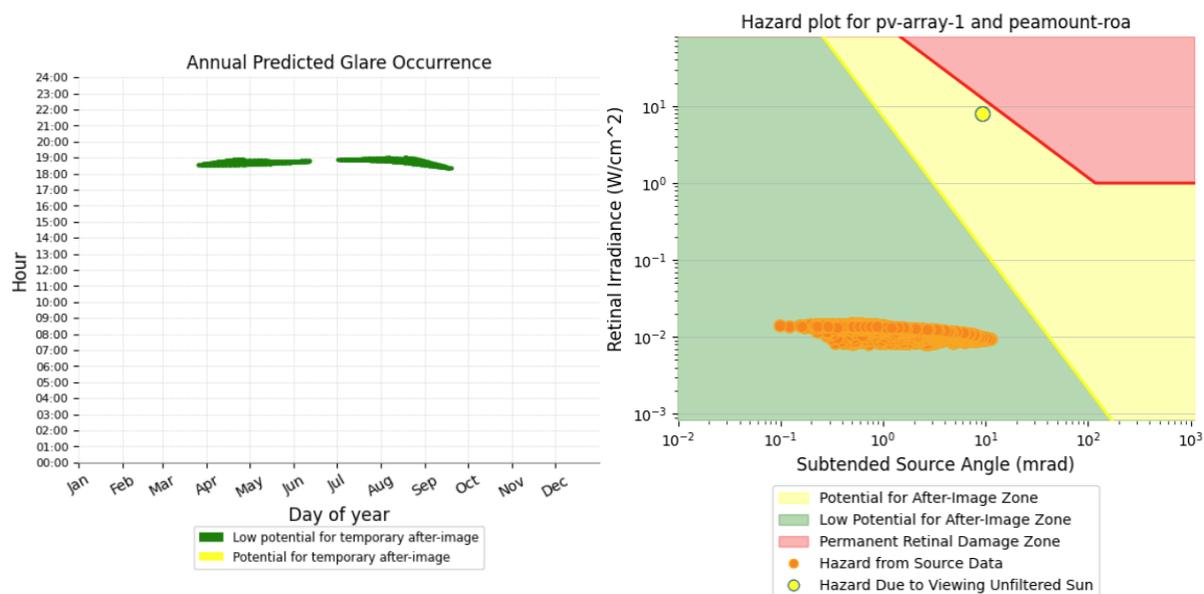
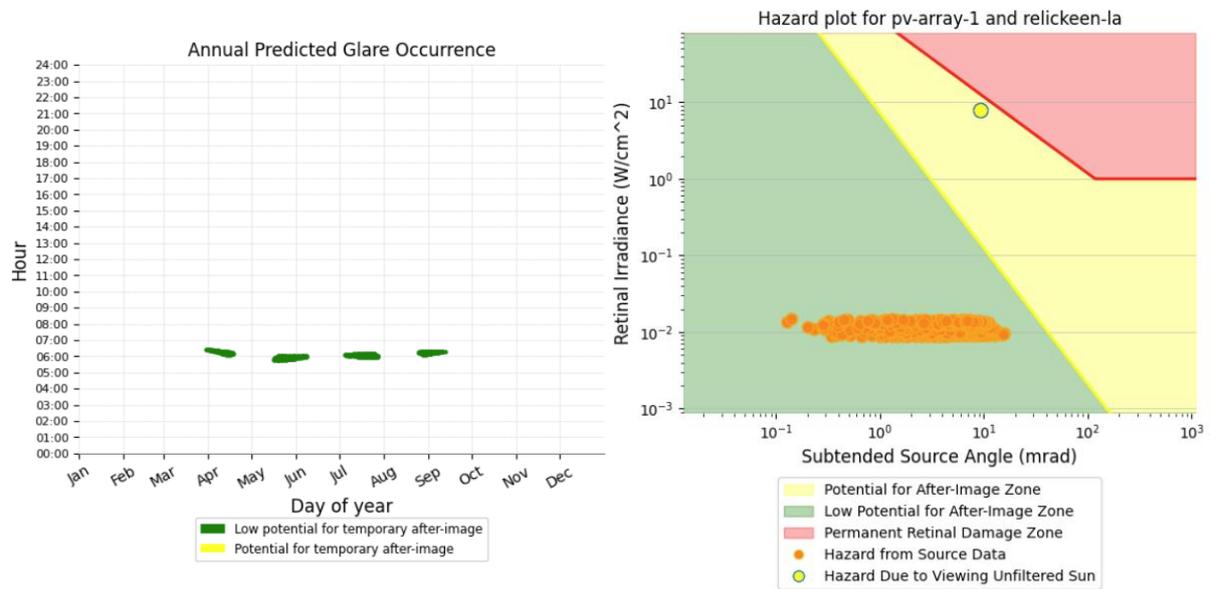


Figure D- 18 Time of day/year of glare occurrence at Relickeen Lane (left) and associated hazard plot (right)



D.3.2 Route Receptor Modelled at 1.5m Height

D.3.2.1 Route Receptors Results Tables

Table D- 3 Route receptor glare at TPR site

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Access Road	0	0
Loughtown Road	2340	0
Milltown Lane	1502	0
Newcastle Golf Centre	0	0
Peamount Church	0	0
Peamount Road	1465	0
Peamount Wellness Centre	0	0
Relickeen Lane	674	0
Travelling West towards TSL Mountpark Office	0	0
Peamount Reservoir Access Road	1001	0

D.3.2.2 Glare Graphs

Figure D- 19 Time of day/year of glare occurrence at Loughtown Road (left) and associated hazard plot (right)

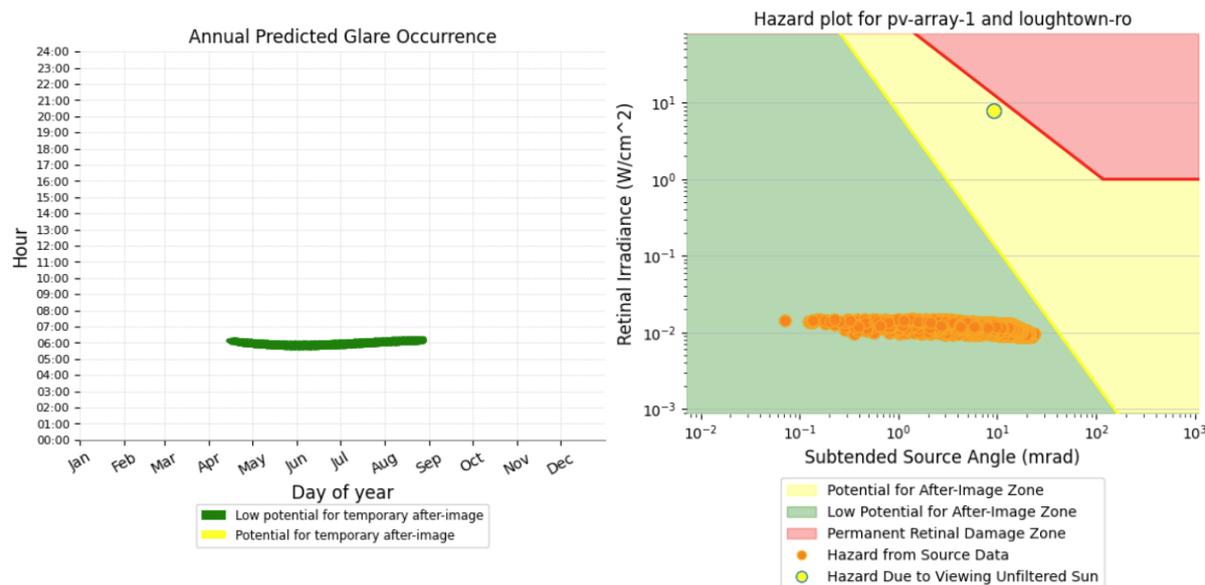


Figure D- 21 Time of day/year of glare occurrence at Milltown Lane (left) and associated hazard plot (right)

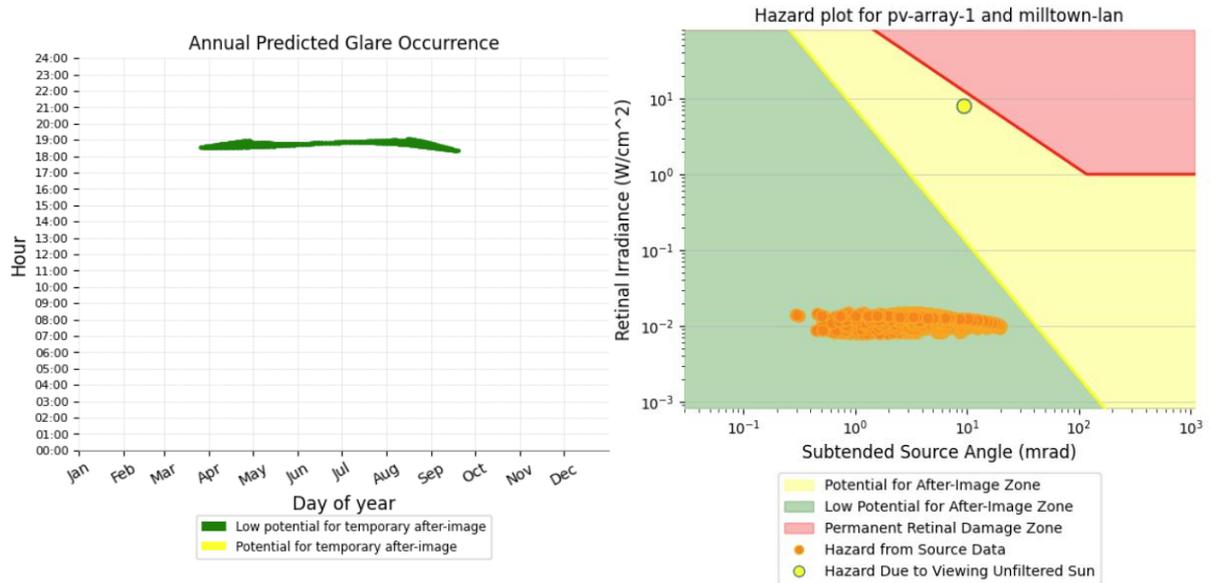


Figure D- 20 Time of day/year of glare occurrence at Peamount Reservoir Access Road (left) and associated hazard plot (right)

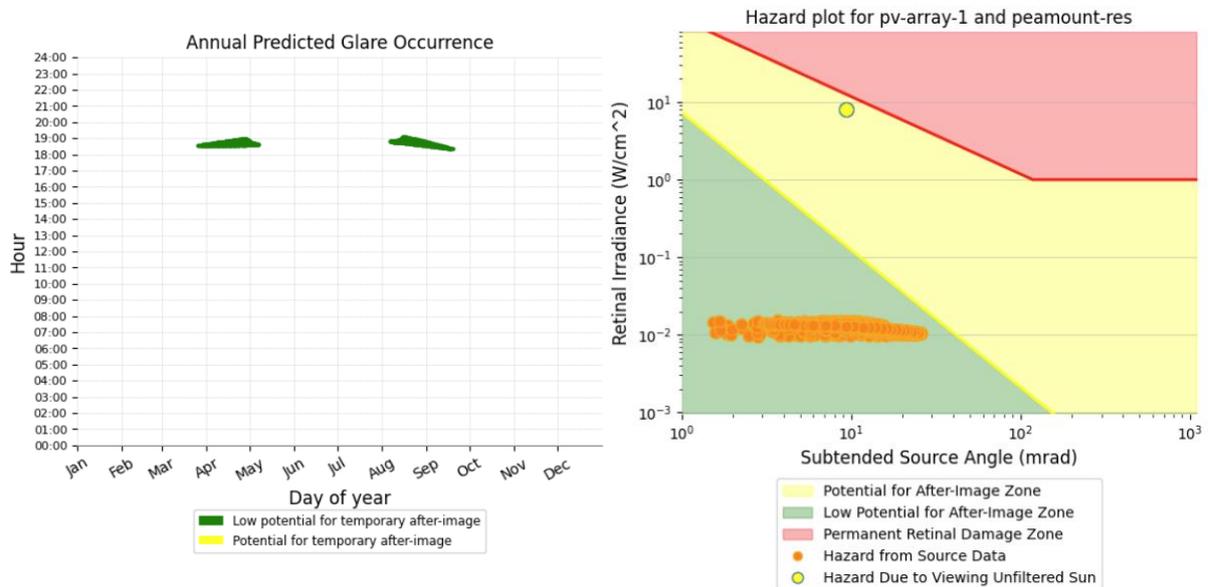


Figure D- 22 Time of day/year of glare occurrence at Peamount Road (left) and associated hazard plot (right)

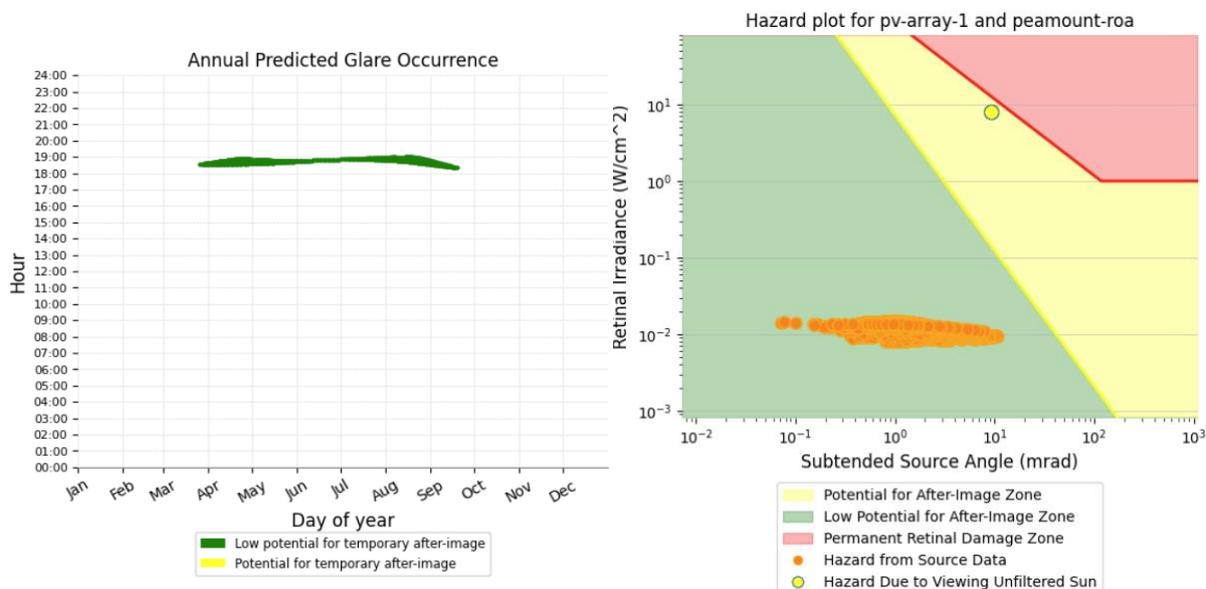
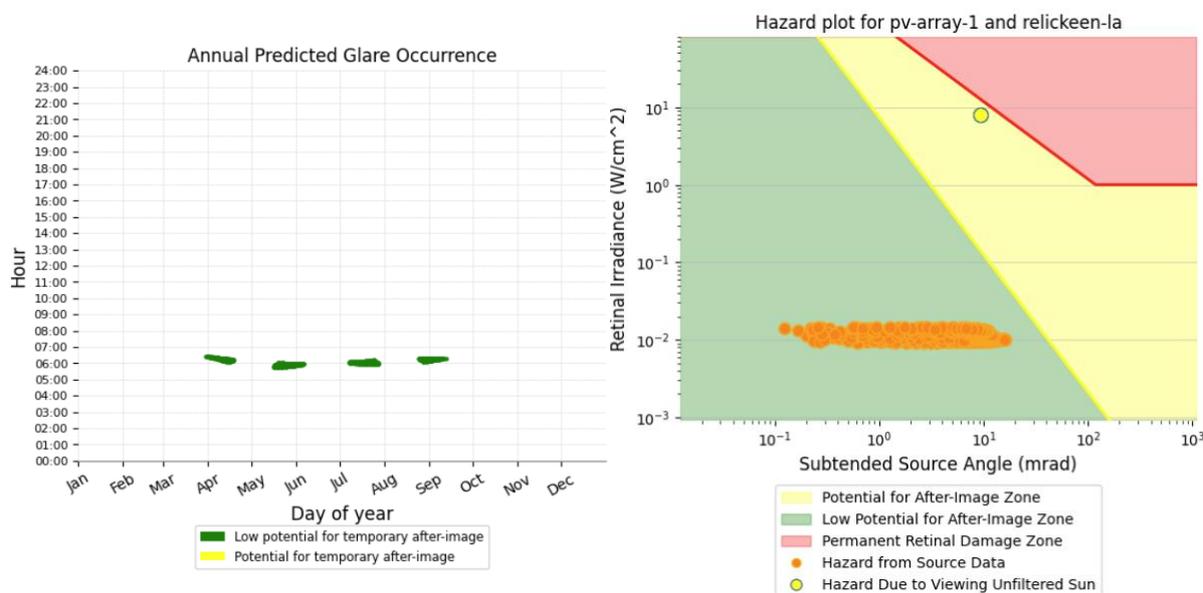


Figure D- 23 Time of day/year of glare occurrence at Relickeen Lane (left) and associated hazard plot (right)



D.4 Flight Path Receptor Results

Figure D- 24 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at the flight path receptors at Weston Airport and Casement Aerodrome, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all route receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones.

D.4.1.1 Route Receptors Results Tables

Table D- 4 Flight path receptors with predicted glare (black indicates no glare is predicted)

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
FP1	0	0
FP2	0	0
FP3	0	0
FP4	676	0
FP5	368	0
FP6	771	0

D.4.1.2 Glare Graphs

Figure D- 24 Time of day/year of glare occurrence at flight path receptor 4 (Casement Aerodrome) (left) and associated hazard plot (right)

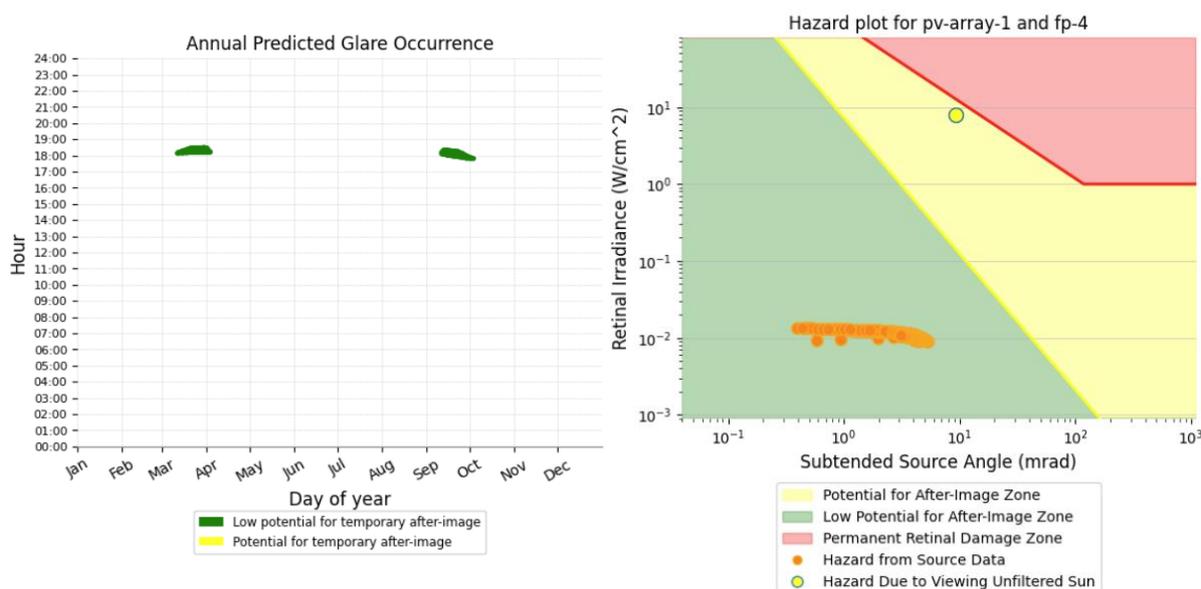


Figure D- 26 Time of day/year of glare occurrence at flight path receptor 5 (Casement Aerodrome) (left) and associated hazard plot (right)

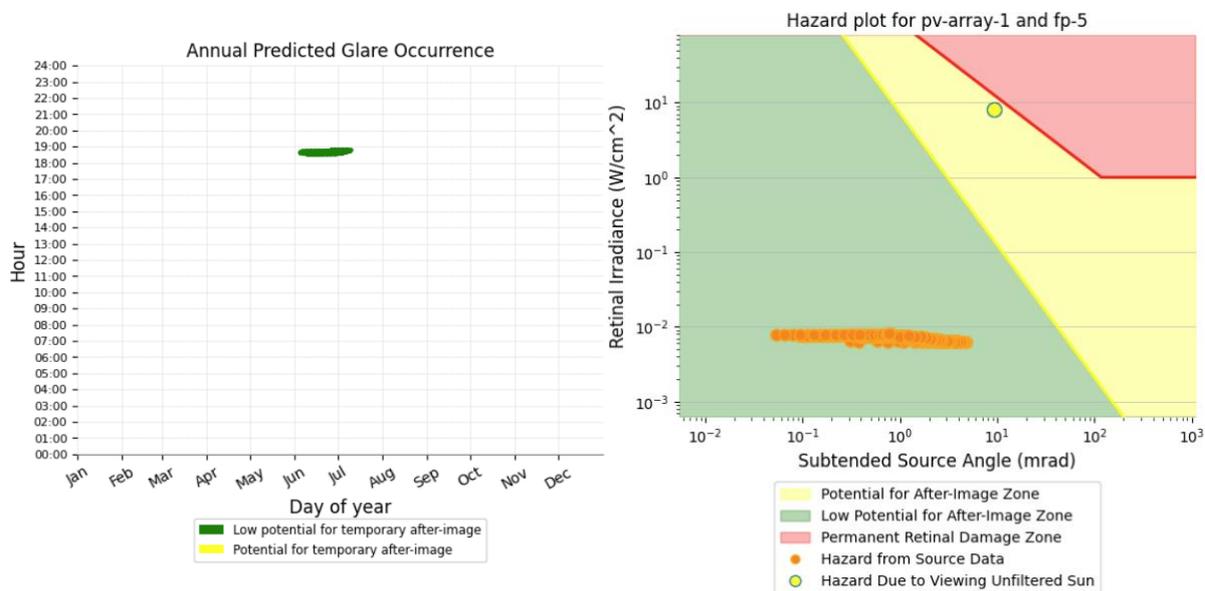
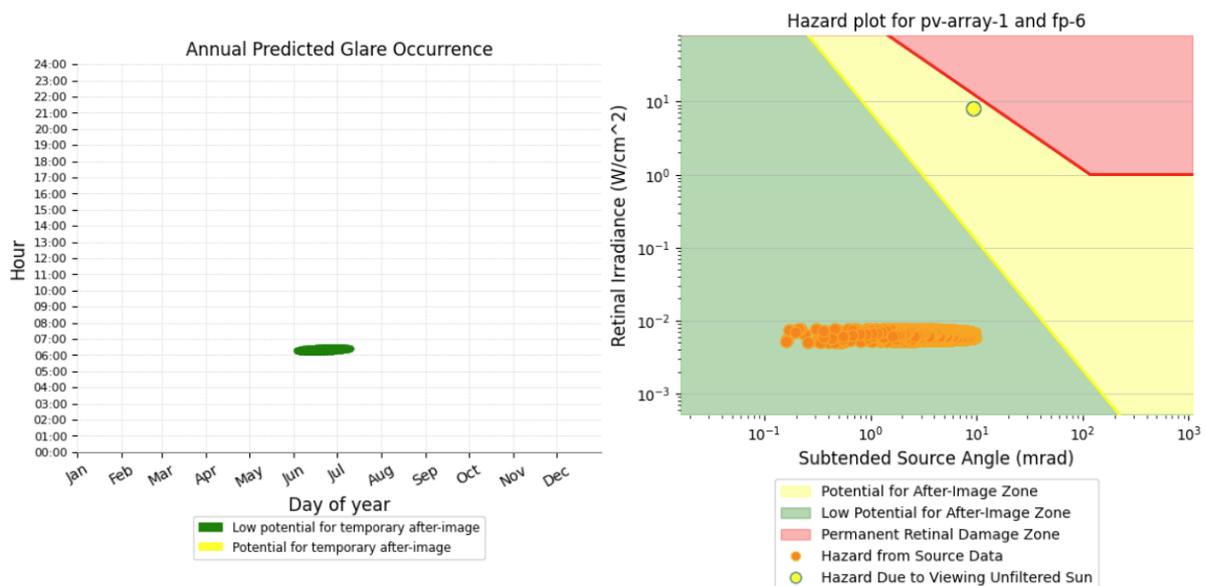


Figure D- 25 Time of day/year of glare occurrence at flight path receptor 6 (Casement Aerodrome) (left) and associated hazard plot (right)



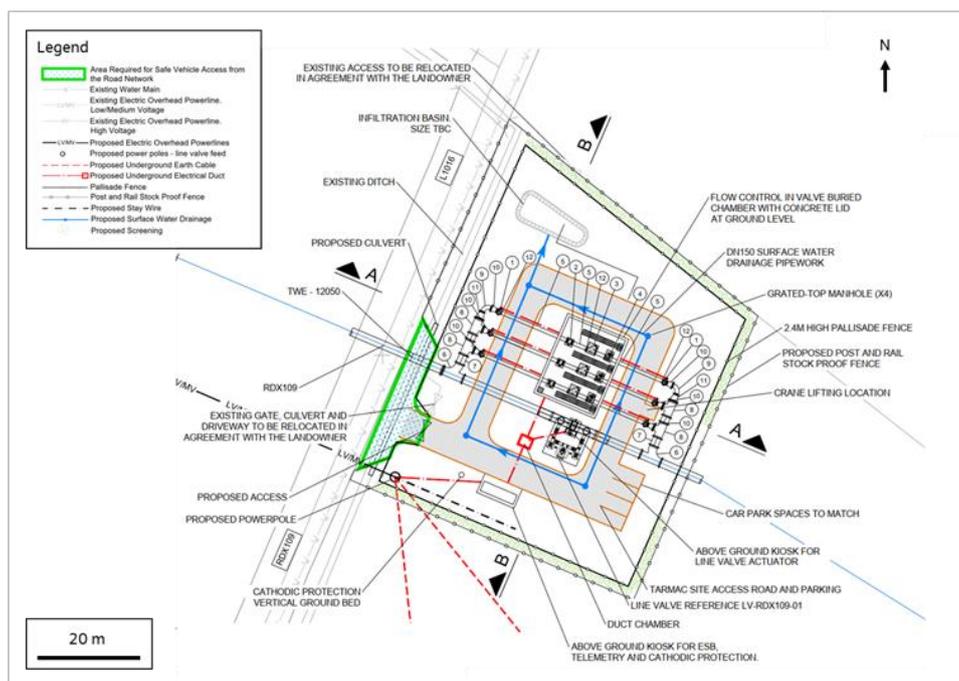
Appendix E. Flow Control Valve Glare Graphs

E.1 Site Overview

Figure E- 1 FCV site location



Figure E- 2 FCV site layout



E.2 Point Receptor Results

Figure E- 3 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at each point receptor, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all point receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones.

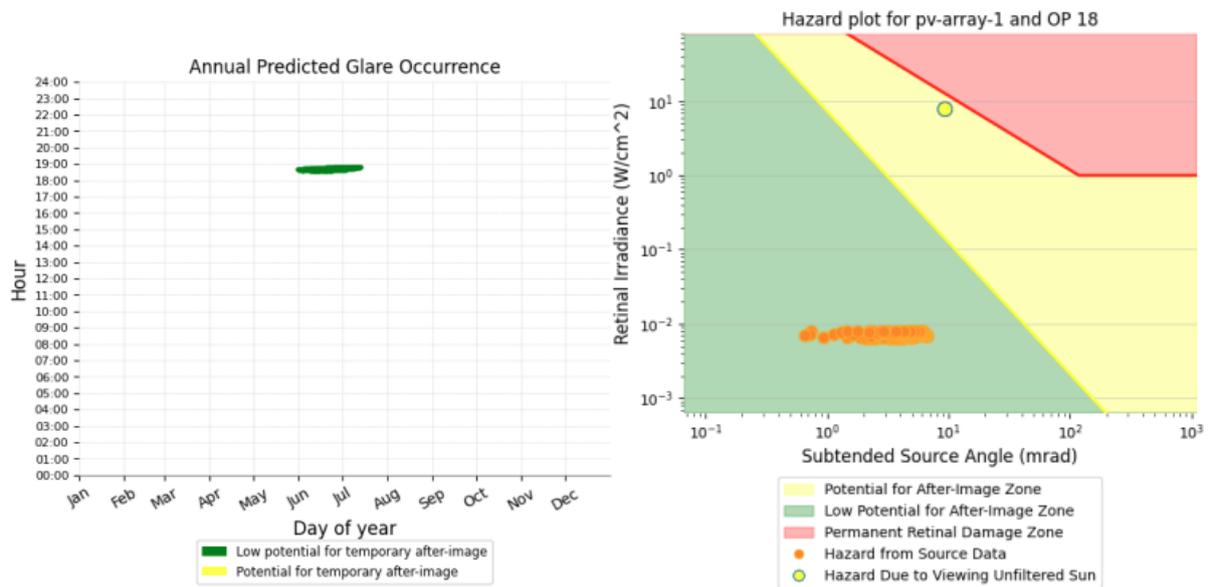
E.2.1 Point Receptor Results Tables

Table E- 1 Observation point glare at PV array 1

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
OP1	0	0
OP2	0	0
OP3	0	0
OP4	0	0
OP5	111	0
OP6	0	0
OP7	0	0
OP8	0	0
OP9	0	0
OP10	0	0
OP11	0	0
OP12	0	0
OP13	0	0
14-ATCT	0	0
OP15	0	0
OP16	0	0
OP17	0	0
OP18	385	0
OP19	0	0
OP20	0	0

E.2.2 Glare Graphs

Figure E- 3 Time of day/year of glare occurrence at OP18 (left) and associated hazard plot (right)



E.3 Route Receptor Results

Figure E- 4 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at each route receptor, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all route receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones. Route receptors were modelled at three different heights: 2.5m for heavy goods vehicles (HGVs), 1.5m for normal road vehicles, and 3m for rail routes, to ensure the results of the assessment were thorough and representative.

E.3.1 Route Receptor Modelled at 2.5m Height

E.3.1.1 Route Receptors Results Tables

Table E- 2 Route receptors with predicted glare (black indicates no glare is predicted)

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
L2008	2804	0
Lyons Road	1736	0
Route 4- Liffey View	0	0
Route 5- Liffey View	2465	0

E.3.1.2 Glare Graphs

Figure E- 4 Time of day/year of glare occurrence at the L2008 (left) and associated hazard plot (right)

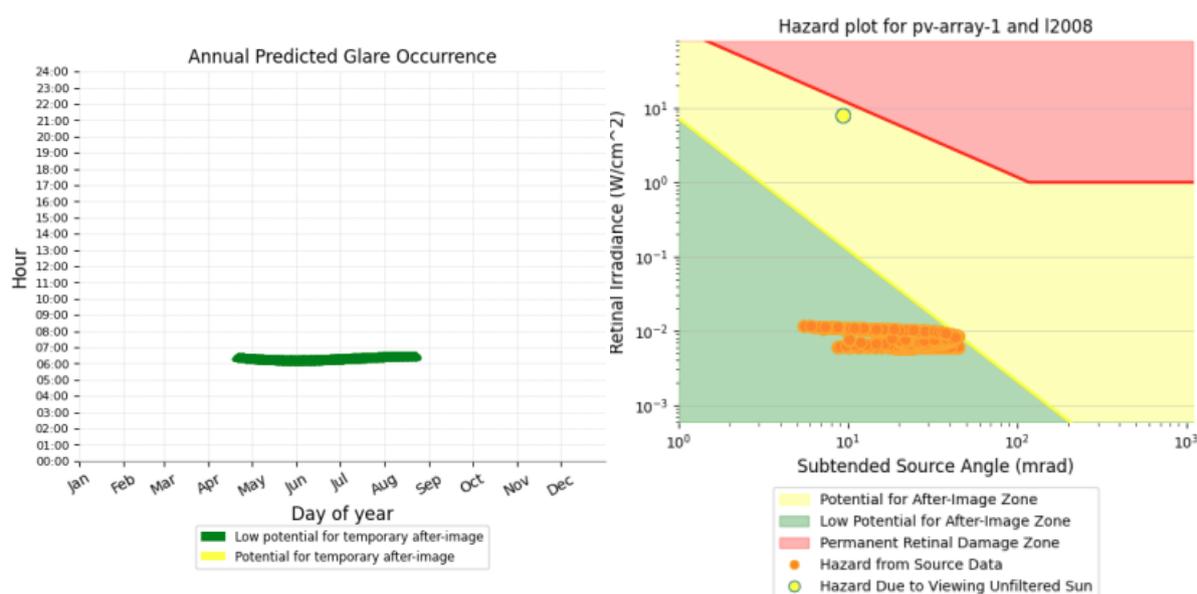


Figure E- 5 Time of day/year of glare occurrence at Lyons Road (left) and associated hazard plot (right)

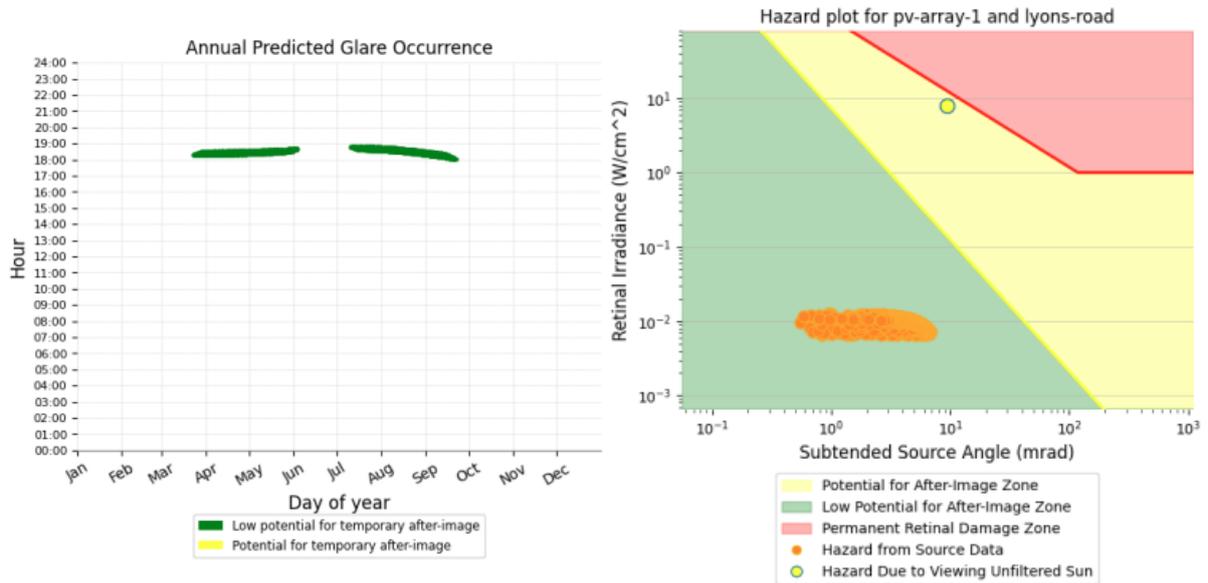
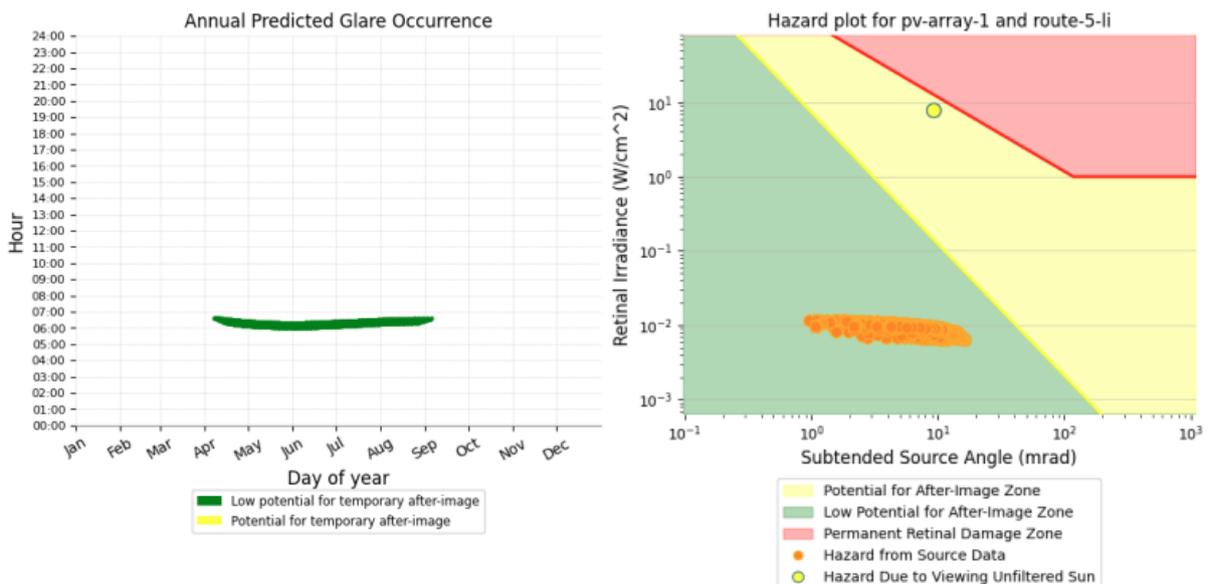


Figure E- 6 Time of day/year of glare occurrence at Route 5- Liffey View (left) and associated hazard plot (right)



E.3.2 Route Receptor Modelled at 1.5m Height

E.3.2.1 Route Receptors Results Tables

Table E- 3 Route receptors with predicted glare (black indicates no glare is predicted)

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
L2008	2301	0
Lyons Road	1090	0
Route 4- Liffey View	0	0
Route 5- Liffey View	2274	0

E.3.2.2 Glare Graphs

Figure E- 7 Time of day/year of glare occurrence at l2008 (left) and associated hazard plot (right)

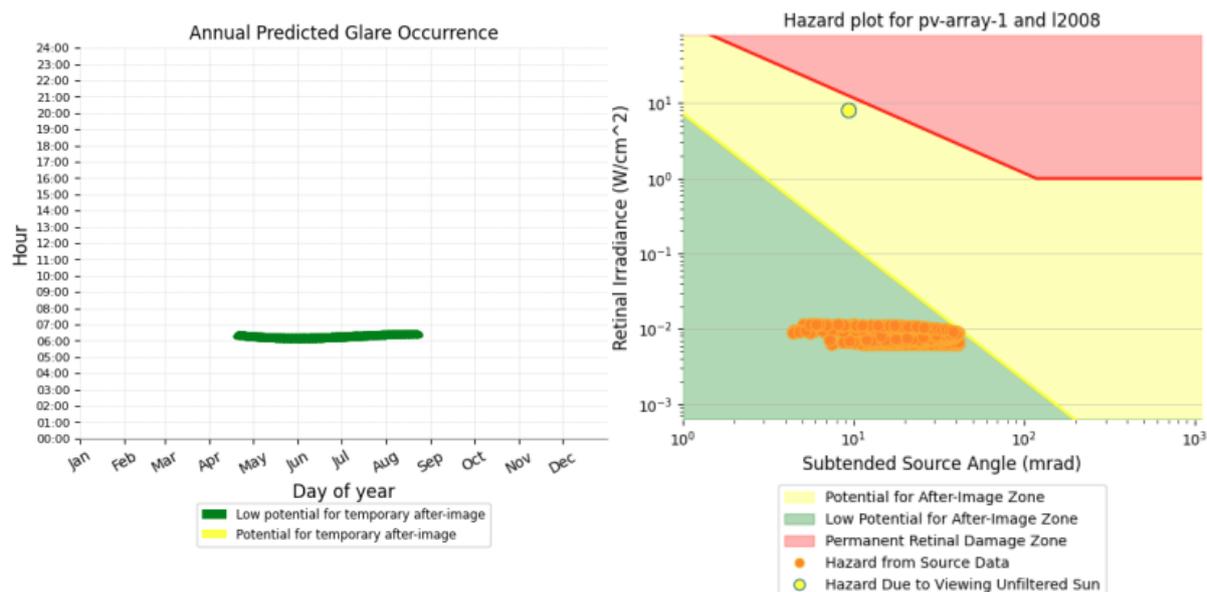


Figure E- 8 Time of day/year of glare occurrence at Lyons Road (left) and associated hazard plot (right)

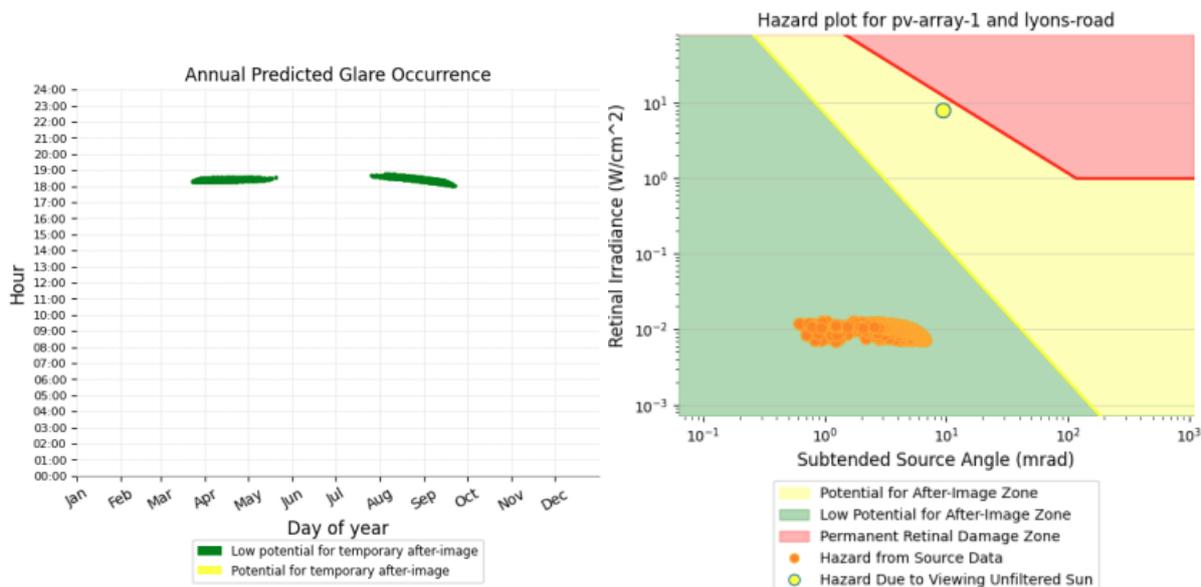
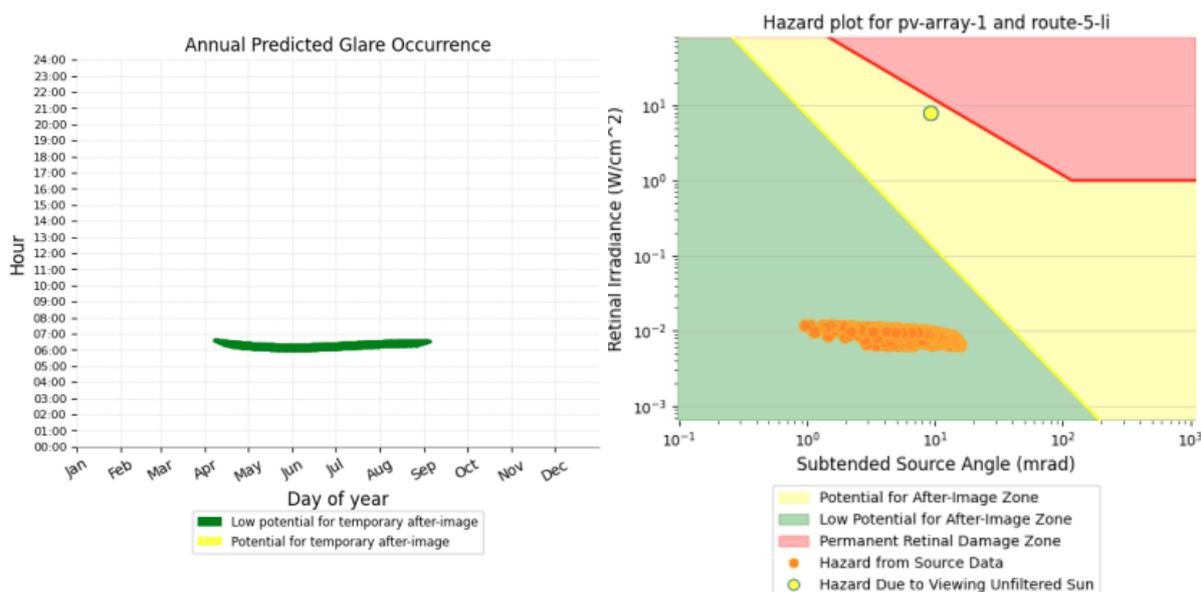


Figure E- 9 Time of day/year of glare occurrence at Route 5- Liffey View (left) and associated hazard plot (right)



E.3.3 Rail Line Receptor Modelled at 3m Height

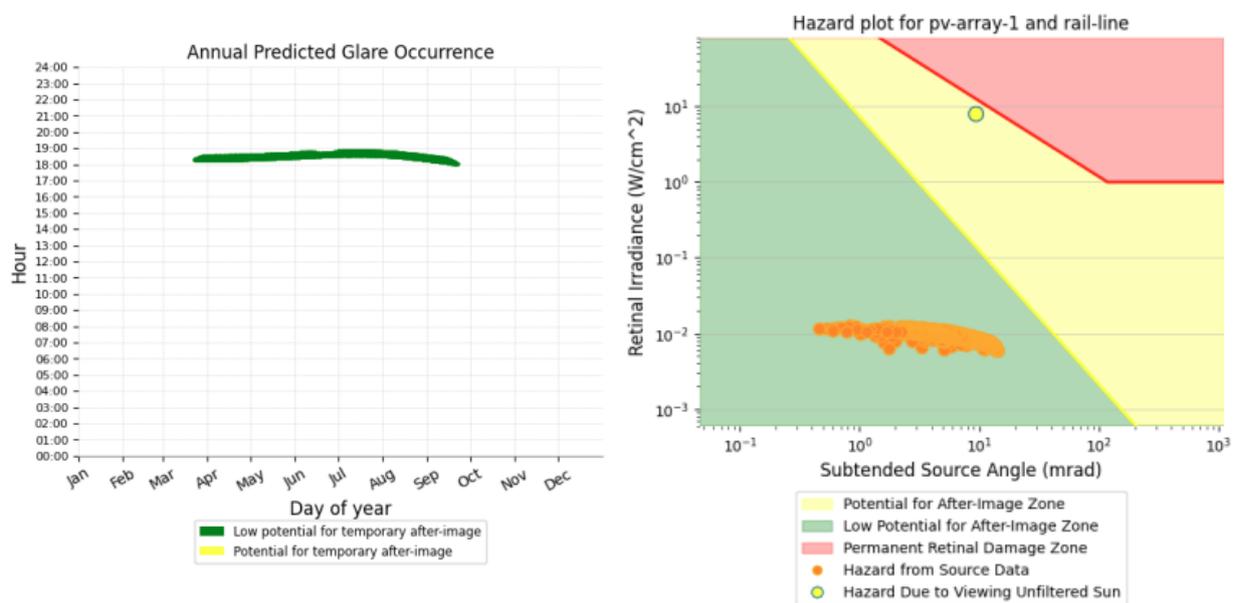
E.3.3.1 Route Receptors Results Tables

Table E- 4 Route receptors with predicted glare (black indicates no glare is predicted)

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
Rail Route	2487	0

E.3.3.2 Glare Graphs

Figure E- 10 Time of day/year of glare occurrence at the rail route (left) and associated hazard plot (right)



E.4 Flight Path Receptor Results

Figure E- 11 and the equivalent figures for the other arrays show a hazard plot of glare occurrence at the flight path receptors at Casement Aerodrome, illustrating the magnitude of the glare relative to looking directly at the sun, and the 'red', 'yellow' and 'green' glare zones. Glare estimated at all route receptors is in the 'green' glare zones, with retinal irradiance having a significantly lower impact than looking directly at the sun. Looking directly at the sun is near the boundary between the 'red' and 'yellow' glare zones.

E.4.1.1 Flight Path Receptors Results Tables

Table E- 5 Flight path receptors with predicted glare (black indicates no glare is predicted)

ID	Green glare (mins per annum)	Yellow glare (mins per annum)
FP1	0	0
FP2	0	0
FP3	0	0
FP4	60	0
FP5	521	0
FP6	0	0

E.4.1.2 Glare Graphs

Figure E- 11 Time of day/year of glare occurrence at flight path receptor 4 (Casement Aerodrome) (left) and associated hazard plot (right)

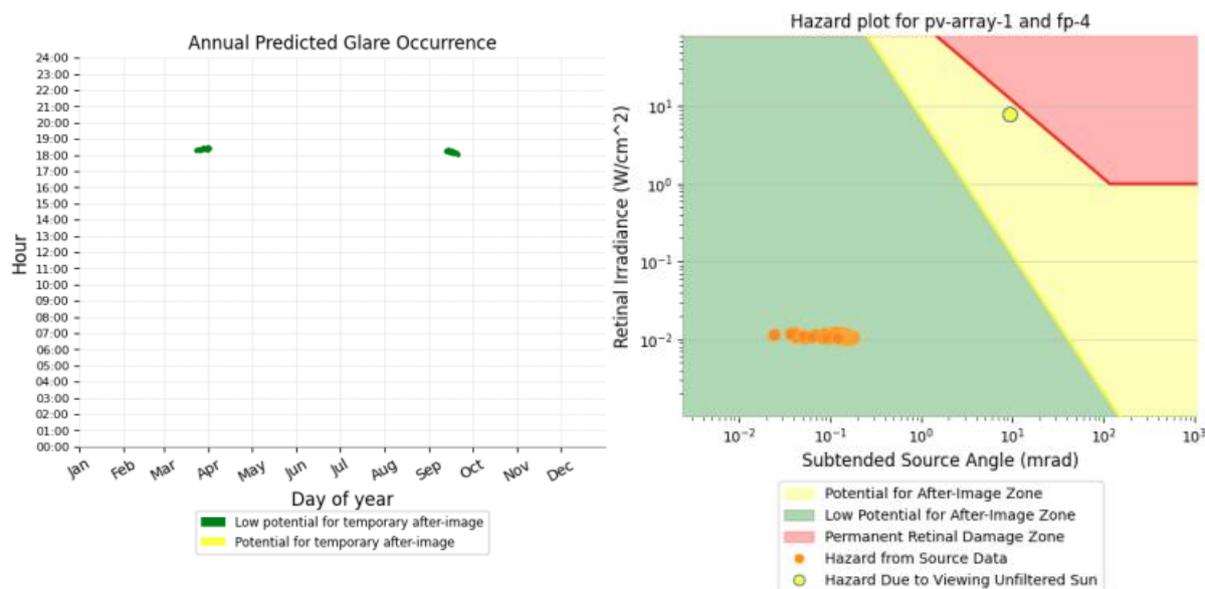


Figure E- 12 Time of day/year of glare occurrence at flight path receptor 5 (Casement Aerodrome) (left) and associated hazard plot (right)

