East Pye Solar

Environmental Statement

Volume 3: Appendix 18.1 – Glint and Glare Assessment

Revision 1

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PAGERPOWER
Urban & Renewables

Glint and Glare Assessment

Island Green Power

East Pye Solar

March 2026

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ADMINISTRATION PAGE

Issue	Date	Detail of Changes
1	May 2024	Initial issue
2	May 2025	Additional panel area and dwellings
3	December 2025	Administrative revisions
4	February 2026	Adminstrative revisions (Site 10)

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EXECUTIVE SUMMARY

Report Purpose

Pager Power has been retained to assess the possible effects of glint and glare with respect to both fixed and single-axis tracking (SAT) panels from a ground-mounted solar photovoltaic development, located in Long Stratton, Norwich, UK. This assessment pertains to the possible impact upon road safety, residential amenity, and aviation activity, in conjunction with existing solar developments.

Overall Conclusions

No significant impact is predicted upon road safety and residential amenity. Solar reflections towards all aerodromes could be operationally accommodated for, and consultation is recommended to confirm their position.

Guidance and Studies

Guidelines exist in the UK (produced by the Civil Aviation Authority) and in the USA (produced by the Federal Aviation Administration) with respect to solar developments and aviation activity. The UK CAA guidance is relatively high-level and does not prescribe a formal methodology. There is no formal planning guidance for the assessment of solar reflections from solar panels towards roads and nearby dwellings. Pager Power has however produced guidance for glint and glare and solar photovoltaic developments, which was published in early 2017, with the fourth edition[1] published in 2022. This methodology defines a comprehensive process for determining the impact upon road safety, residential amenity, and aviation activity.

Pager Power's approach is to undertake geometric reflection calculations and, where a solar reflection is predicted, consider the screening (existing and/or proposed) between the receptor and the reflecting solar panels. For aviation activity, where a solar reflection is predicted, solar intensity calculations are undertaken where appropriate in line with the Sandia National Laboratories' FAA methodology[2]. The scenario in which a solar reflection can occur for all receptors is then identified and discussed, and a comparison is made against the available solar panel reflection studies to determine the overall impact.

The available studies have measured the intensity of reflections from solar panels with respect to other naturally occurring and manmade surfaces. The results show that the reflections produced are of intensity similar to or less than those produced from still water and significantly less than reflections from glass and steel[3].

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[1] Pager Power Glint and Glare Guidance, Fourth Edition, September 2022.

[2] Formerly mandatory for on-airfield solar developments in the USA under the FAA's interim policy, superseded in 2021 with a policy that effectively requires individual airports to sign off on their on-airfield development as they see fit.

[3] SunPower, 2009, SunPower Solar Module Glare and Reflectance (appendix to Solargen Energy, 2010).

Assessment Results – Roads

Solar reflections from fixed panels and SAT panels are geometrically possible towards 4.2km and 7.9km sections of the A140 and B1527 respectively. Screening in the form of existing vegetation, buildings and intervening terrain is predicted to significantly obstruct views of reflecting panels for the entire 4.2km section of the A140, and a total 5.8km section of the B1527. No impact is predicted and mitigation is not required for these sections.

For remaining sections of road totalling 1.3km of the B1527, solar reflections occur within a road user's primary horizontal field-of-view (50 degrees either side relative to the direction of travel). The Scheme's proposed landscape mitigation is predicted to significantly obstruct views of reflecting panels, such that no significant impact is predicted for road users. No impact is predicted, and (further) mitigation is not required for these sections.

Assessment Results – Dwellings

Solar reflections from fixed panels and SAT panels are geometrically possible towards all of the 482 assessed dwellings. Screening in the form of existing vegetation, buildings and intervening terrain is predicted to significantly obstruct views of reflecting panels for residents at 414 dwellings. No impact is predicted and mitigation is not required for these dwellings.

For the remaining 68 dwellings, solar reflections are geometrically possible for more than three months per year but less than 60 minutes on any given day. For 22 dwellings, screening in the form of existing vegetation, buildings and intervening terrain is predicted to obstruct views of reflecting panels with marginal views considered possible from above ground floor levels, such that any remaining impacts experienced is predicted to be for less than three months per year and less than 60 minutes on any given day. A low impact is predicted, and mitigation is not recommended.

For 46 (of the remaining 68) dwellings, the proposed landscape mitigation is predicted to significantly obstruct views of reflecting panels from ground floor levels, with marginal views considered possible from above ground floor levels, such that any remaining impacts experienced is predicted to be for less than three months per year and less than 60 minutes on any given day. A low impact is predicted, and (further) mitigation is not recommended.

Assessment Results – Aviation

Solar reflections with glare intensities of 'potential for temporary after-image' (referred to as 'yellow' glare) are geometrically possible towards the approach path or final section of visual circuits for all assessed aerodromes. The glare scenario is considered in context of the airfield's operations, in addition to mitigating factors (see Section 5.2.4). When considering these mitigating factors, the effects could potentially be operationally accommodated subject to consultation with the aerodromes.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 59 countries within Europe, Africa, America, Asia and Australasia.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects;
- Building developments;
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

1 INTRODUCTION

1.1 Overview

Pager Power has been retained to assess the possible effects of glint and glare with respect to both fixed and single-axis tracking (SAT) panels from a ground-mounted solar photovoltaic development, located in Norwich, UK. This assessment pertains to the possible impact upon road safety, residential amenity and aviation activity, in conjunction with existing solar developments.

This report contains the following:

- Solar development details;
- Explanation of glint and glare;
- Overview of relevant guidance and studies;
- Overview of Sun movement;
- Assessment methodology;
- Identification of receptors;
- Glint and glare assessment for identified receptors;
- Results discussion;
- High-level overview of aviation concerns;
- High-level overview of cumulative impacts;
- Overall conclusions.

1.2 Pager Power's Experience

Pager Power has undertaken over 1,300 Glint and Glare assessments in the UK and internationally. The studies have included assessment of civil and military aerodromes, railway infrastructure and other ground-based receptors including roads and dwellings.

1.3 Glint and Glare Definition

The definition[4] of glint and glare is as follows:

- Glint – a momentary flash of bright light typically received by moving receptors or from moving reflectors;
- Glare – a continuous source of bright light typically received by static receptors or from large reflective surfaces.

The term 'solar reflection' is used in this report to refer to both reflection types i.e. glint and glare.

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[4] These definitions are aligned with those presented within the National Policy Statement for Renewable Energy Infrastructure (EN-3) – published by the Department for Energy Security and Net Zero in November 2023 and the Federal Aviation Administration in the USA.

2 SOLAR DEVELOPMENT LOCATION AND DETAILS

2.1 Overview

The following sections present the solar development location and key details pertaining to this assessment.

2.2 Reflector Areas

Figure 1 below shows the assessed reflector areas that have been used for modelling purposes, relative to the site areas as defined in the Works Plans. The coordinate data can be found in Appendix G.

Figure 1 *Assessed reflector areas*

The Pager Power model has used a resolution of 50m for this assessment. This means that a geometric calculation is undertaken for each identified receptor every 50m from within the defined areas. This resolution is sufficiently high to maximise the accuracy of the results – increasing the resolution further would not significantly change the modelling output. If a reflection is experienced from an assessed panel location, then it is likely that a reflection will be viewable from similarly located panels within the proposed solar development.

Solar panels will be installed during the construction phase in preparation for the operation and maintenance phase. However, as panel installation is gradual, the duration and glare intensity of solar reflections during the construction phase will be less than or equal to the operation and maintenance phase. Similarly, impacts during the decommissioning phase will be less than or equal to the operational phase as the panels areas decrease gradually. Therefore, the geometric assessment has modelled the operation and maintenance phase and the maximum panel areas which is considered the worst-case.

2.3 Solar Panel Technical Information

The Scheme would utilise either Single-Axis Tracker Panels and/or Fixed Panels. The assessment has considered both fixed panels and single-axis tracking (SAT) panels. The technical information of the modelled solar panels used in both assessments is summarised below.

- Fixed panels:
    - Azimuth angle : 180°;
    - Elevation angle : 25°;
    - Assessed centre height[5] above ground level: 1.95m.
- Single-axis tracker panels:
    - Horizontal single-axis tracs the Sun from East to West;
    - Tilt of tracking axis: 0°;
    - Orientation of tracking axis: 180°;
    - Offset angle of module: 0°;
    - Tracker range of motion: ±60°;
    - Resting angle: 0°;
    - Assessed centre height[6] above ground level: 2.45m.

Further information regarding the surface material and backtracking modelling method is presented in the following subsections.

2.3.1 Solar Panel Backtracking

Shading considerations dictate the panel tilt. This is affected by:

- The elevation angle of the Sun;
- The vertical tilt of the panels;
- The spacing between the panel rows.

This means that early in the morning (sunrise) and late in the evening (sunset), the panels will not be directed exactly towards the Sun, as the loss from shading of the panels (caused by facing the sun directly when the Sun is low in the horizon), would be greater than the loss from lowering the panels to a less direct angle in order to avoid the shading.

The graphics in Figure 2 on the following page show two lines illustrating the paths of light from the Sun towards the solar panels. In reality, the lines from the Sun to each panel would be effectively parallel due to the large separation distance. The figure is for illustrative purposes only.

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[5] Relative to maximum (3.5m) and minimum (0.4m) above ground level

[6] Relative to maximum (4.5m) and minimum (0.4m) above ground at greatest inclinations

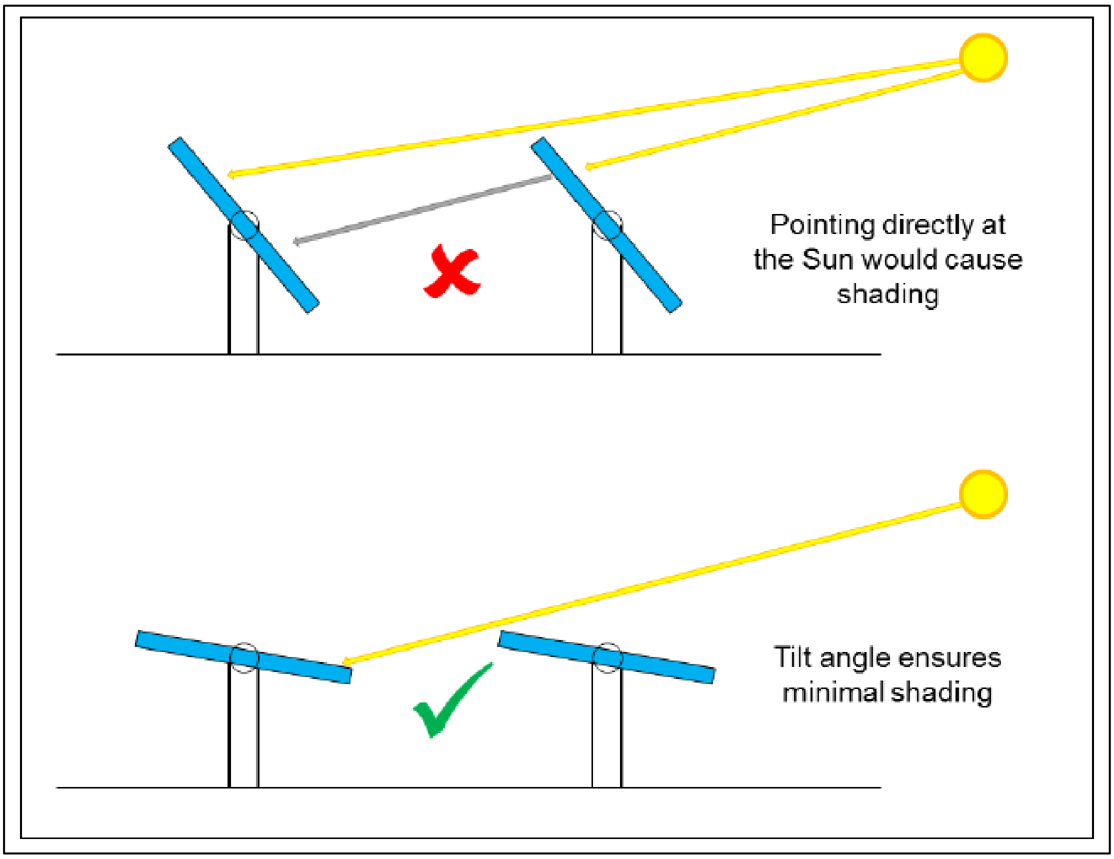

Figure 2 *Shading Considerations*

Later in the day, the panels can be directed towards the Sun without any shading issues. This is illustrated in Figure 3 below.

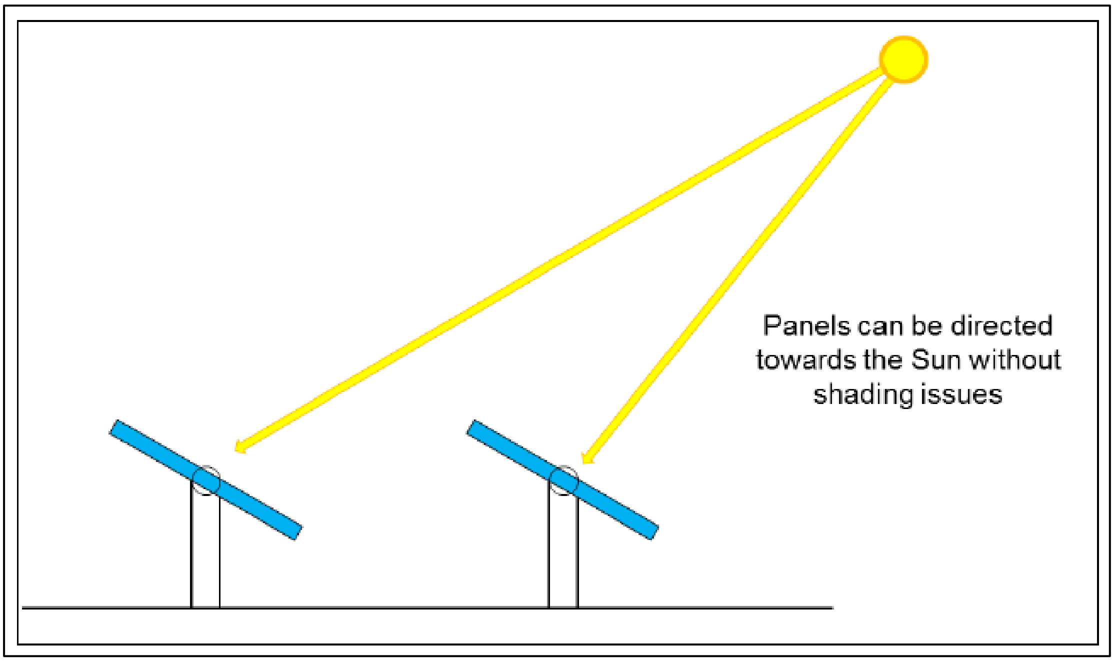

Figure 3 *Panel alignment at high solar angles*

The solar panels backtrack (where the panel angle gradually declines to prevent shading) by reverting to 0 degrees (flat) once the maximum elevation angle of the panels (60 degrees) becomes ineffective due to the low height of the Sun above the horizon and to avoid shading.

2.3.2 Back Tracking Solar Panel Model

Back tracking systems are sensitive to panel length, row spacing, topography and the level of shading which varies throughout the year. The Forge Solar model used in this assessment is a widely accepted model within this area. The model approximates a backtracking system by assuming the panels instantaneously revert to its resting angle of 0 degrees whenever the Sun is outside the rotation range (60 degrees in this instance). Panels with a maximum tracking angle of 60 degrees and resting angle of 0 degrees would therefore lie horizontally from sunrise until the Sun enters the rotation range, and immediately after the sun leaves the rotation range until sunset daily. This definition is taken from Forge (see Appendix E) and by rotation range it is assumed the panels remain at 0 degrees until the Sun reaches 30 degrees above the horizon – when the Sun is at right angles to the panels at 60 degrees. It is understood that this option was created specifically to account for backtracking to the extent possible.

Whilst this model simplifies the backtracking process to be used by the solar panels within the solar development, panels that revert back to their resting angle immediately in many cases present a worst-case scenario for reflectors. This is because flatter panels can produce solar reflections in a much greater range of azimuth angles at ground level. The results would in most cases be more conservative than modelling a detailed back tracking system.

3 GLINT AND GLARE ASSESSMENT METHODOLOGY

3.1 Guidance and Studies

Appendices A and B (of this report) present a review of relevant guidance and independent studies with regard to glint and glare issues from solar panels. The overall conclusions from the available studies are as follows:

- Specular reflections of the Sun from solar panels are possible;
- The measured intensity of a reflection from solar panels can vary from 2% to 30% depending on the angle of incidence;
- Published guidance shows that the intensity of solar reflections from solar panels are equal to or less than those from water. It also shows that reflections from solar panels are significantly less intense than many other reflective surfaces, which are common in an outdoor environment.

3.2 Background

Details of the Sun's movements and solar reflections are presented in Appendix C.

3.3 Methodology

3.3.1 Pager Power Methodology

The glint and glare assessment methodology has been derived from the information provided to Pager Power through consultation with stakeholders and by reviewing the available guidance and studies. The methodology for this glint and glare assessments is as follows:

- Identify receptors in the area surrounding the solar development;
- Consider direct solar reflections from the solar development towards the identified receptors by undertaking geometric calculations;
- Consider the visibility of the panels from the receptor's location. If the panels are not visible from the receptor then no reflection can occur;
- Based on the results of the geometric calculations, determine whether a reflection can occur, and if so, at what time it will occur;
- Consider both the solar reflection from the solar development and the location of the direct sunlight with respect to the receptor's position;
- Consider the solar reflection with respect to the published studies and guidance;
- Determine whether a significant detrimental impact is expected in line with the process presented in Appendix D.

3.3.2 Sandia National Laboratories' Methodology

Sandia National Laboratories developed the Solar Glare Hazard Analysis Tool (SGHAT) which is no longer freely available however it is now developed by Forge Solar. Pager Power uses this model where required for aviation receptors. Whilst strictly applicable in the USA and to solar photovoltaic developments only, the methodology is widely used by aviation stakeholders internationally.

3.4 Assessment Methodology and Limitations

Further technical details regarding the methodology of the geometric calculations and limitations are presented in Appendix E and F.

4 IDENTIFICATION OF RECEPTORS

4.1 Overview

The following sections present the relevant receptors assessed within this report. Terrain data has been interpolated based on Ordnance Survey of Great Britain (OSGB) 50 Digital Terrain Model (DTM) data. The receptor details for all receptors are presented in Appendix G.

4.2 Aviation Receptors

Glint and glare assessment for aviation receptors is typically undertaken for licensed aerodromes within 10km of a proposed solar development. Geometric modelling for general aviation unlicensed aerodromes is typically required within 5km of a Proposed Development. At ranges of 10-20km, the requirement for assessment is much less common for unlicensed aerodromes, with typically assessment only being undertaken for licensed aerodromes at these ranges. The assessment of any aviation effects for developments over 20km is not a usual requirement.

The glint and glare assessment has considered aerodromes within 15km of the panel areas of the Proposed Development.

4.2.1 Identified Aerodrome Receptors

Table 1 below summarises the assessed aerodromes for this Scheme.

Airfield	Type	ATC Tower	Operational Runway(s)	Distance to Nearest Panel Area
Seething Airfield	Unlicensed General Aviation (GA)	N/A	06/24	560m east
Long Stratton Airfield			17/35	2.14km southwest
Hardwick Airfield			13/31	30m south
Topcroft Farm Airfield			10/28	1.10km southeast
Nut Tree Farm Airfield			09/27	2.31km south
Norfolk Gliding Airfield			03/21, 08/26, 15/33	1.88km east

Table 1 *Identified aerodromes*

The identified aerodromes relative to the Scheme is shown in Figure 4 on the following page.

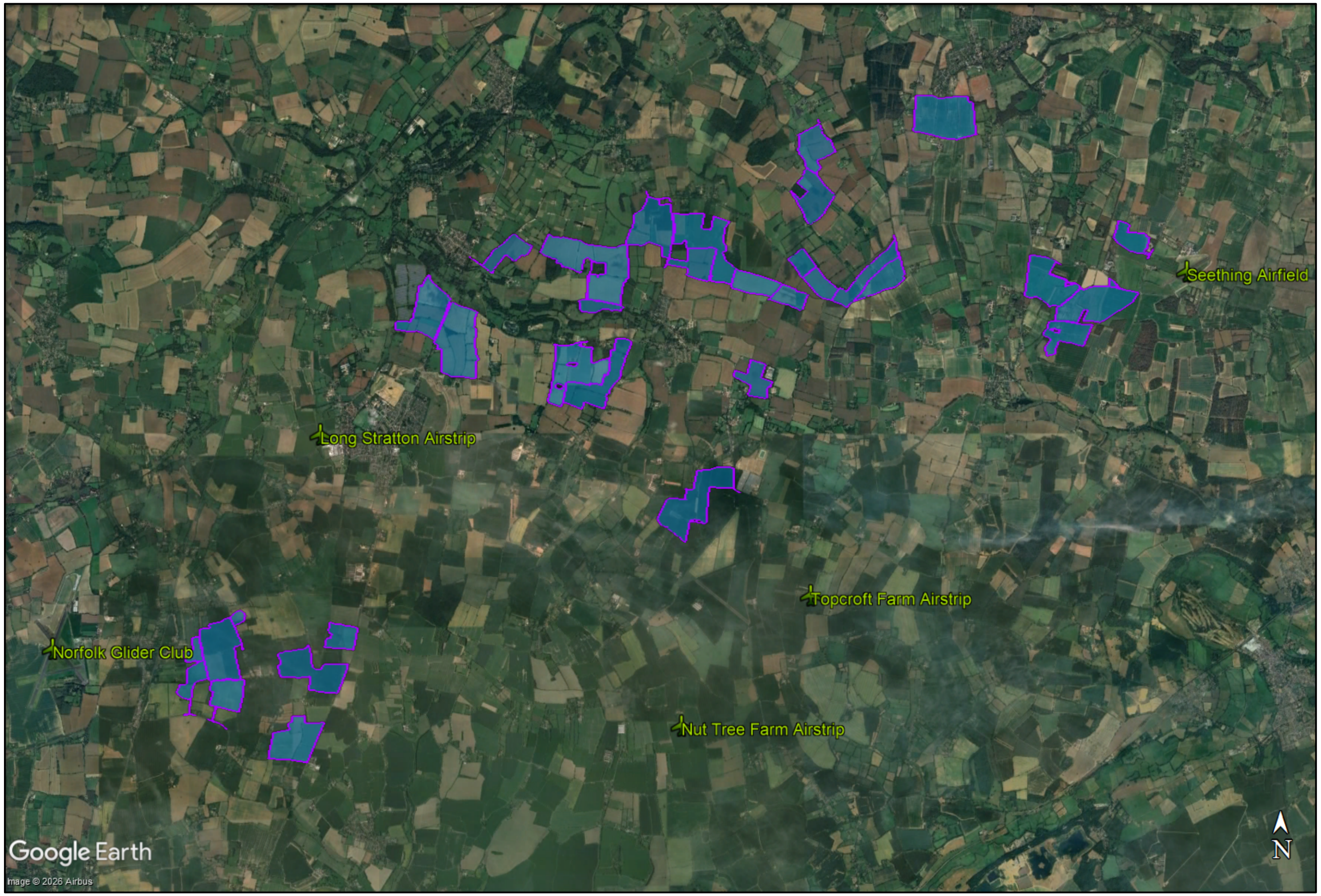

Figure 4 *Identified aerodromes relative to Scheme*

4.2.2 Runway Approach Path and Visual Circuits

The identified aerodromes are GA airfields where aviation activity is dynamic and does not necessarily follow the typical approaches / flight paths of a larger licensed aerodrome or airport. It is not possible to assess every single location of airspace that an aircraft travels in flight around an aerodrome; however, it is possible to assess the most frequently flown flight paths and the most critical stages of flight, which would cover most, or all, of the relevant locations.

As such, Pager Power's methodology is to assess whether a solar reflection can be experienced on the following characteristics:

- 1-mile approach path with a splay angle of 5 degrees, considering 2.5 degrees either side of the extended runway centreline;
- A descent angle of 5 degrees;
- Circuit width of 1 nautical mile from runway centreline;
- Maximum altitude of 500 feet above the average threshold altitude.

Figure 5 below illustrates the splayed approach and final sections of the visual circuits.

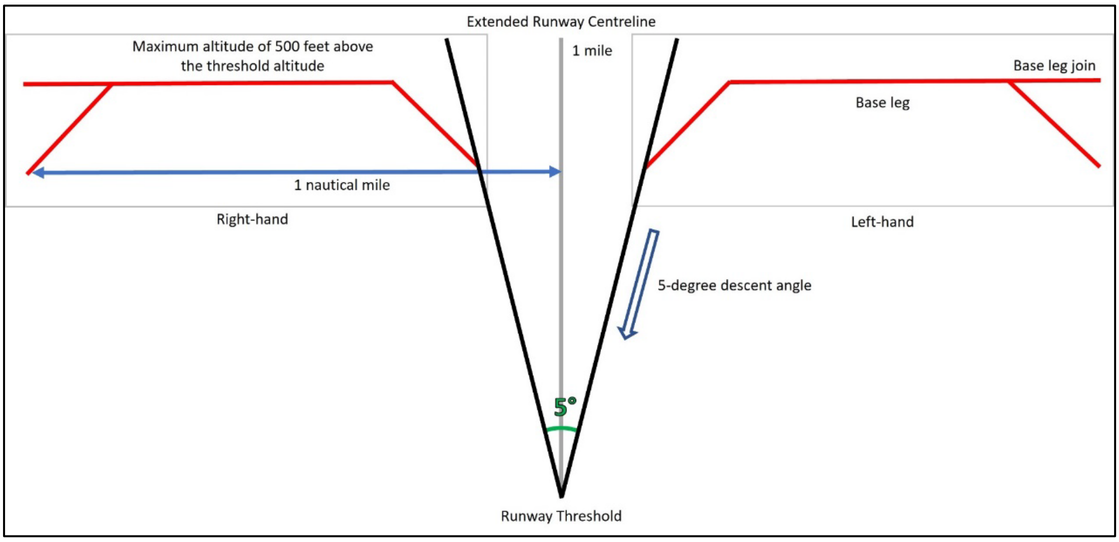

Figure 5 *Splayed approach and final sections of visual circuits*

Figure 6 on the following page shows the assessed aircraft receptor points of the splayed approach and final sections of the visual circuits at all airfields.

The geometric glint and glare assessment has also considered the specific circuit and approach paths for both powered and gliding aircraft, as defined by Norfolk Gliding Club. The details of these modelled receptors, and modelling results are presented in Appendix J.

In total, 38 circuit and approach paths have been modelled considering both the minimum and maximum heights at each section of the downwind, base legs and final approaches for both powered and gliding aircraft.

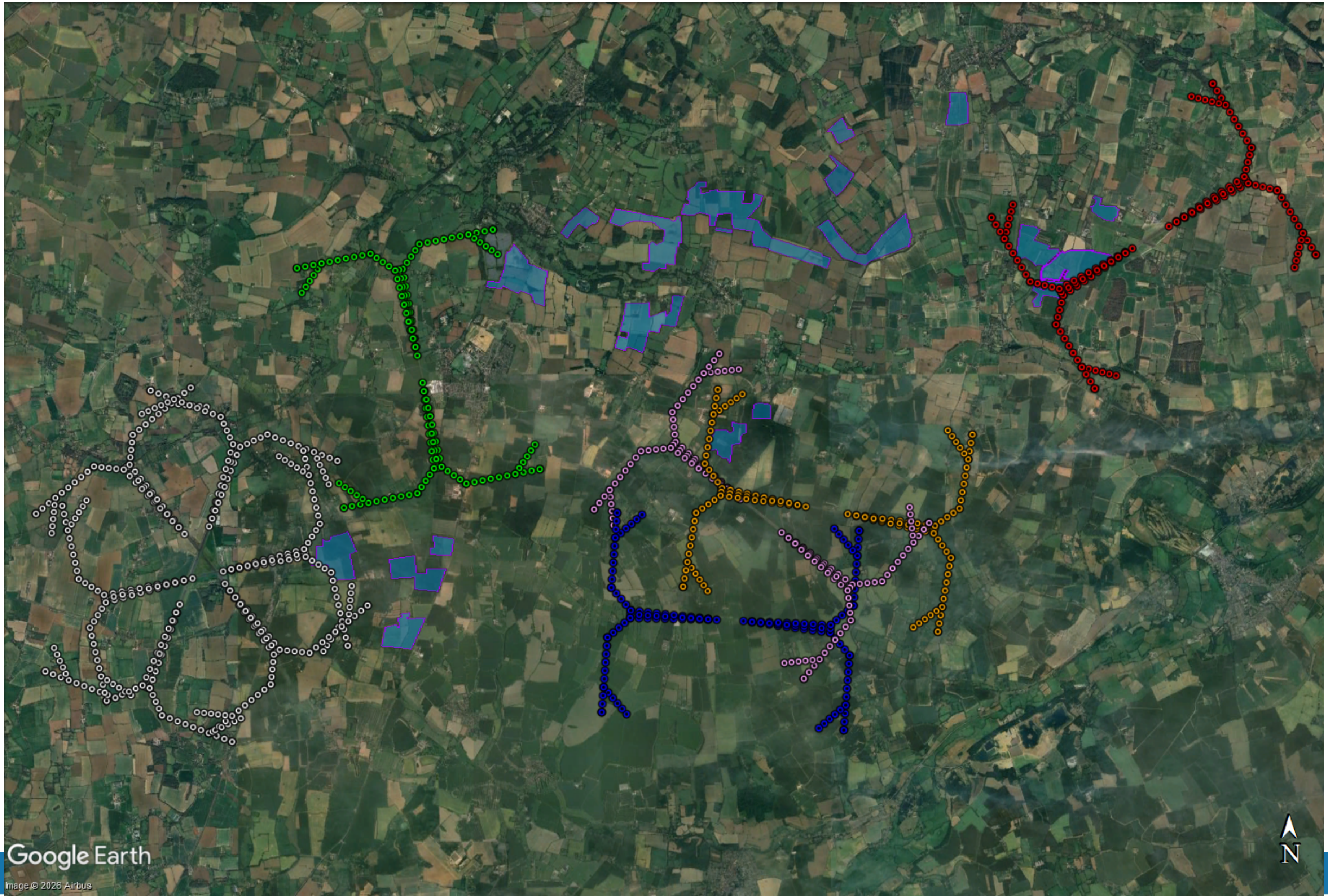
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Image © 2026 Airbus
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Figure 6 *Modelled receptors for identified aerodromes*

4.3 Ground Based Receptors Overview

There is no formal guidance with regard to the maximum distance at which glint and glare should be assessed. From a technical perspective, there is no maximum distance for potential reflections. The significance of a reflection however decreases with distance because the proportion of an observer's field of vision that is taken up by the reflecting area diminishes as the separation distance increases. Terrain and shielding by vegetation are also more likely to obstruct an observer's view at longer distances.

The above parameters and industry experience over a significant number of glint and glare assessments undertaken, shows that a 1km assessment area from the Scheme is considered appropriate for glint and glare effects on road users and dwellings. The assessment area (white outlined area in Figure 7) has been designed accordingly as 1km from the Scheme.

Potential receptors within the associated assessment area are identified based on mapping and aerial photography of the region. The initial judgement is made based on high-level consideration of aerial photography and mapping i.e. receptors are excluded if it is clear from the outset that no visibility would be possible. A more detailed assessment is made if the modelling reveals a reflection would be geometrically possible.

4.4 Road Receptors

4.4.1 Road Receptors Overview

Road types can generally be categorised as:

- Major National – Typically a road with a minimum of two carriageways with a maximum speed limit of up to 70mph. These roads typically have fast moving vehicles with busy traffic;
- National – Typically a road with one or more carriageways with a maximum speed limit of 60mph or 70mph. These roads typically have fast moving vehicles with moderate to busy traffic density;
- Regional – Typically a single carriageway with a maximum speed limit of up to 60mph. The speed of vehicles will vary with a typical traffic density of low to moderate;
- Local – Typically roads and lanes with the lowest traffic densities. Speed limits vary.

Technical modelling is not recommended for local roads, where traffic densities are likely to be relatively low. Any solar reflections from the proposed development that are experienced by a road user along a local road would be considered low impact in the worst case in accordance with the guidance presented in Appendix D. The analysis has also considered major national, national, and regional roads that:

- Are within the one-kilometre assessment area;
- Have a potential view of the panels.

Receptors along each road are placed circa 100m apart. A height of 1.5 metres above ground level has been used to model the typical eye-level[7] of a road user.

4.4.2 Identified Road Receptors

Table 2 below summarises the major national, national and regional roads, including the lengths and specific receptors geometrically modelled in this assessment.

Road	Total Length Assessed	Receptors
A140	4.2km	A1 – A43
B1527	7.9km	B1 – B80

Table 2 *Identified roads*

Figure 7 on the following page shows the assessed road receptors.

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[7] This fixed height for the road receptors is for modelling purposes. Small changes to the modelling height by a few metres is not expected to significantly change the modelling results. Views for elevated drivers are also considered in the results discussion, where appropriate

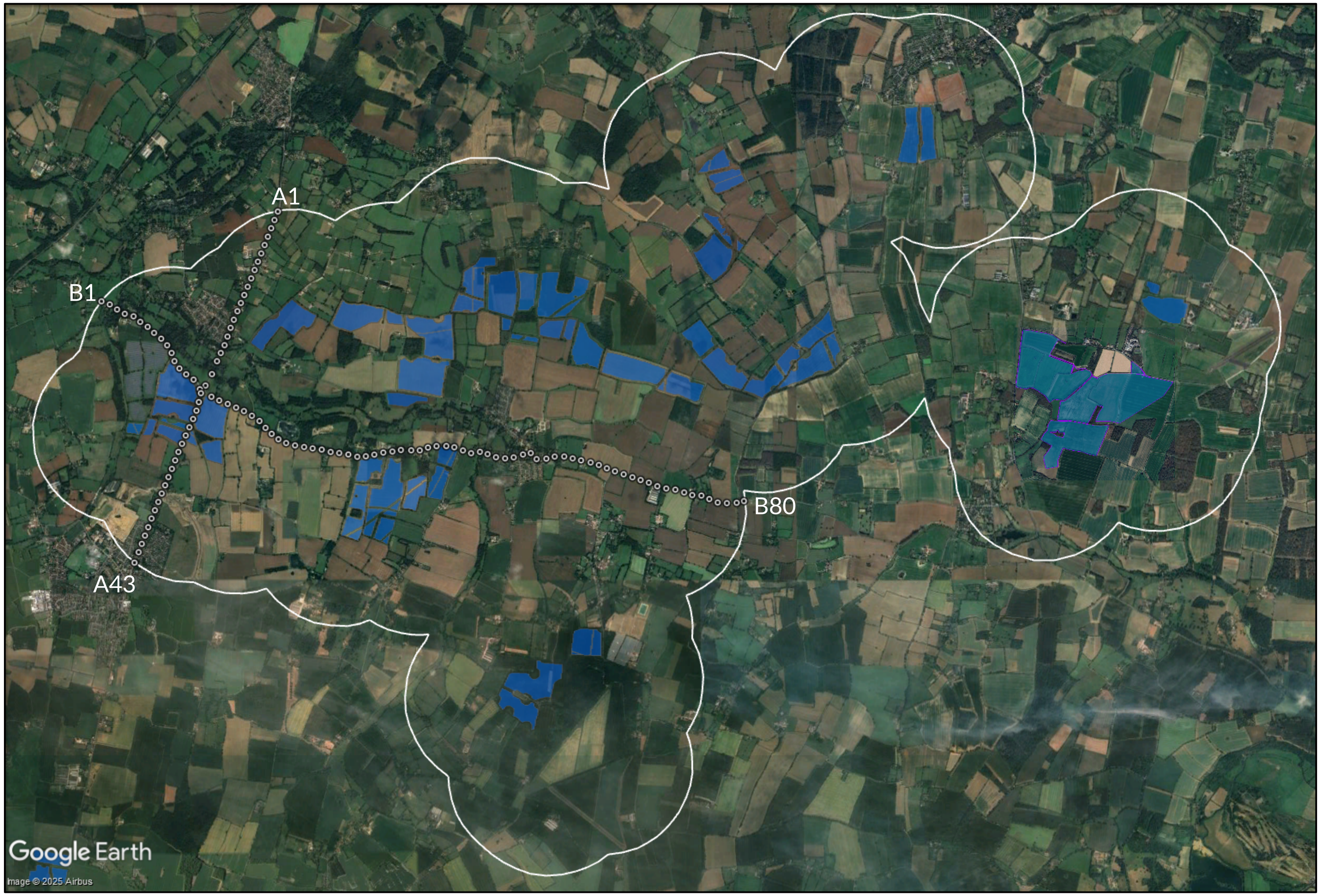

Figure 7 *Modelled receptors for identified road receptors*

4.5 Dwelling Receptors

4.5.1 Dwelling Receptors Overview

The analysis has considered dwellings that:

- Are within the one-kilometre assessment area; and
- Have a potential view of the panels.

In residential areas with multiple layers of dwellings, only the outer dwellings have been considered for assessment. This is because they will mostly obscure views of the solar panels to the dwellings behind them, which will therefore not be impacted by the proposed development because line of sight will be removed, or they will experience comparable effects to the closest assessed dwelling.

Additionally, in some cases, a single receptor point may be used to represent a small number of separate addresses. In such cases, the results for the receptor will be representative of the adjacent observer locations, such that the overall level of effect in each area is captured reliably.

A height of 1.8 metres above ground level has been used to model the typical eye-level from the ground floor[8].

4.5.2 Identified Dwelling Receptors

In total, 482 dwellings have been assessed. An overview of the dwelling receptors is shown in Figures 8 on the following page.

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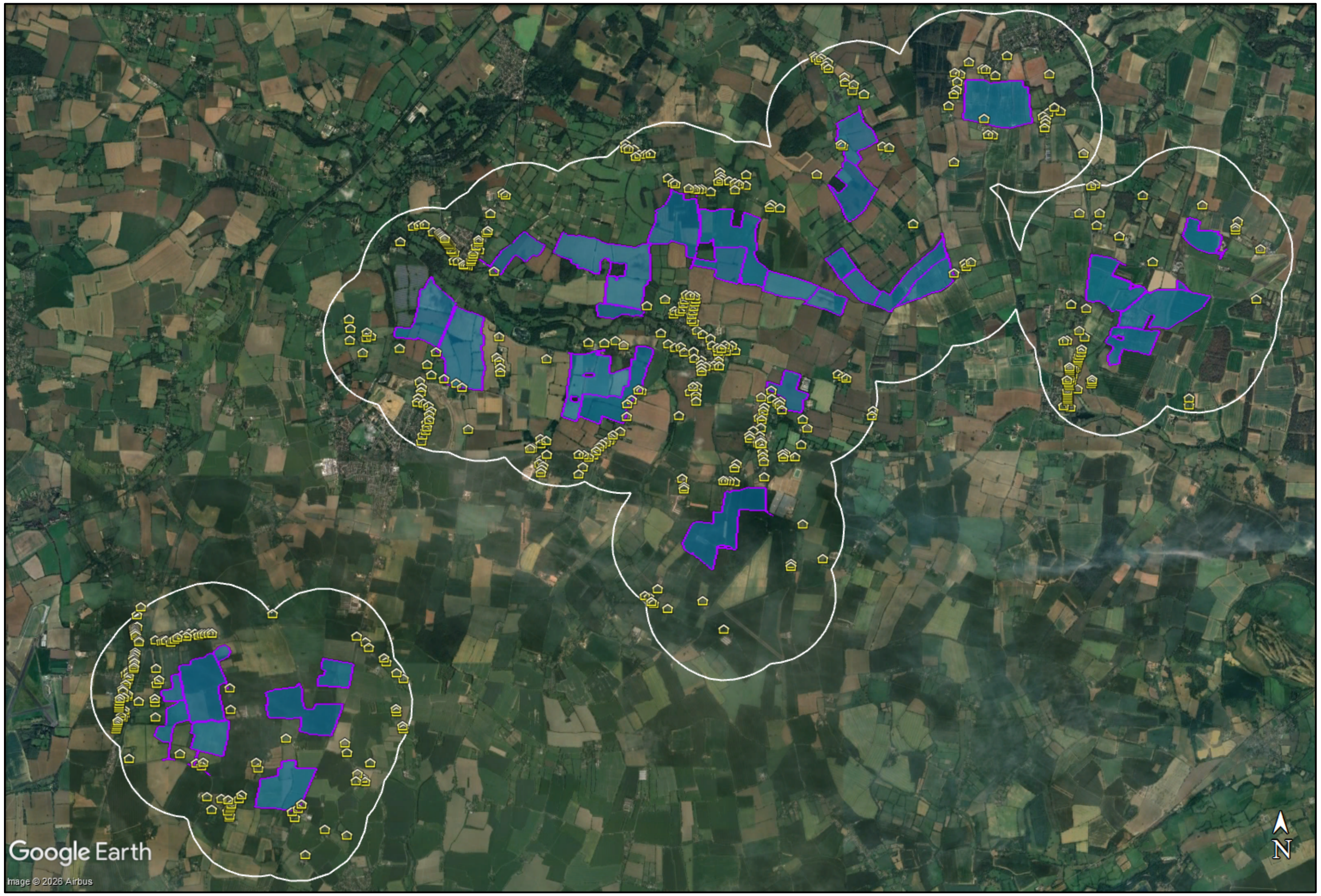
[8] This fixed height for the dwelling receptors if for modelling purposes. Changes to the modelling height by a few metres is not expected to significantly change modelling results. Views above ground floor are considered in the results discussion where necessary.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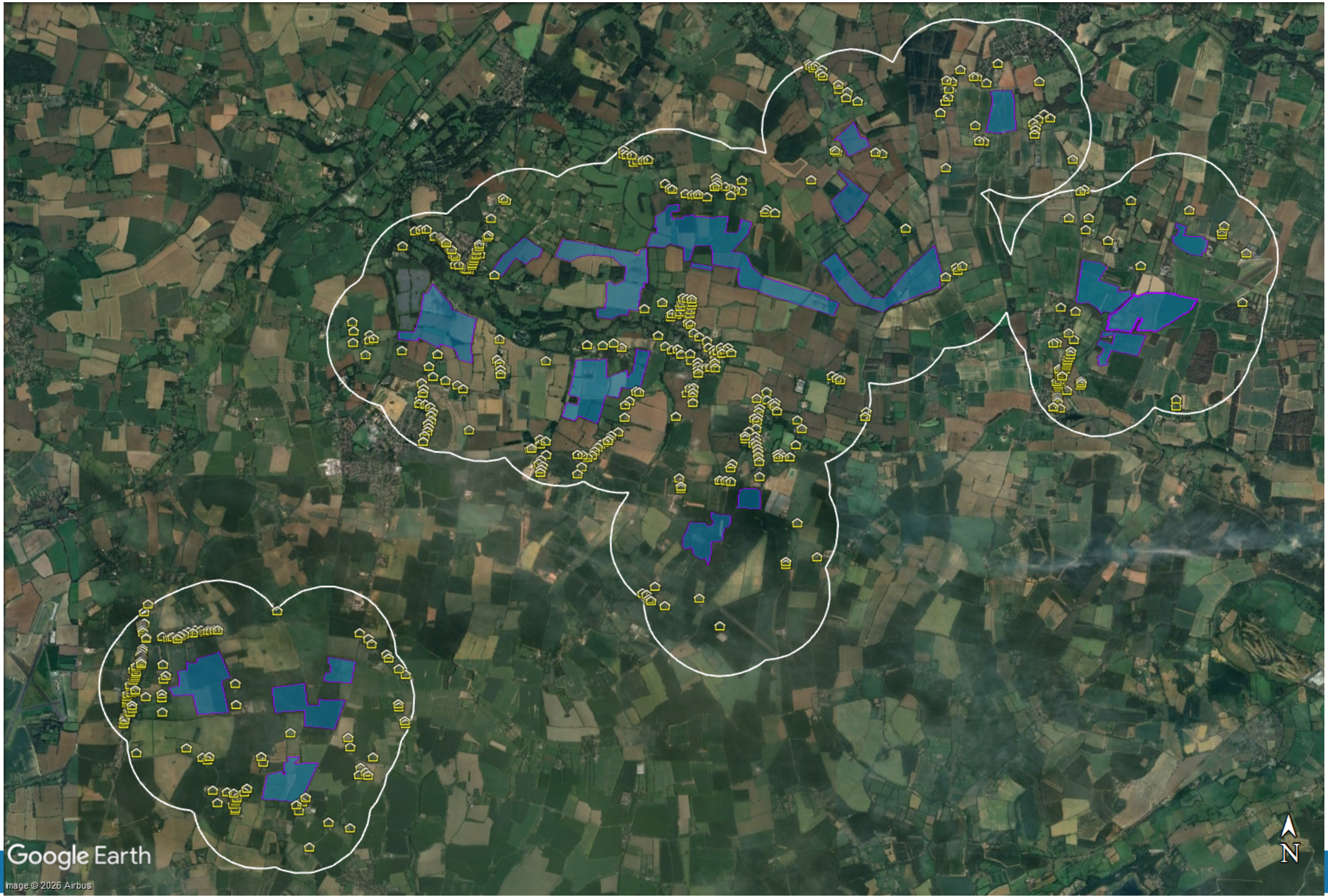

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Image © 2026 Airbus
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Figure 8 *Overview of assessed dwelling receptors*

5 GEOMETRIC ASSESSMENT RESULTS AND DISCUSSION

5.1 Overview

The following sub-sections summarise the results of the assessment:

- The key considerations for each receptor type. The criteria are determined by the assessment process for each receptor, which are set out in Appendix D.
- Geometric results of the assessment based solely on bare-earth terrain i.e., without consideration of screening in the form of buildings, dwellings, (existing or proposed) vegetation, and/or terrain. The modelling output for receptors, shown in Appendix H, presents the precise predicted times and the reflecting panel areas.
- Whether a reflection will be experienced in practice. When determining the visibility of the reflecting panels for an observer, a conservative review of the available imagery, landscape strategy plan, google earth viewshed (high-level terrain analysis), and/or site photography (if available) is undertaken, whereby it is assumed views of the panels are possible if it cannot be reliably determined that existing and/or proposed screening will remove effects. Detailed screening analysis may be undertaken to determine visibility, where appropriate.
- The impact significance and any mitigation recommendations/requirements.
- The desk-based review of the available imagery, where appropriate.

5.2 Aviation Receptors

5.2.1 Glare Intensity Categorisation

The Pager Power and Forge models have been used to determine whether reflections are possible for aviation receptors. Intensity calculations (Forge Model) in line with the Sandia National Laboratories methodology have been undertaken. These calculations are routinely required for solar photovoltaic developments on or near aerodromes. The intensity model calculates the expected intensity of a reflection with respect to the potential for an after-image (or worse) occurring. The designation used by the model is presented in Table 3 below along with the associated colour coding.

Coding Used	**Intensity Key**
Glare beyond 50°	‘Glare outside a pilot’s field-of-view’
‘Green’	‘Low potential for temporary after-image’
‘Yellow’	‘Potential for temporary after-image’
‘Red’	‘Potential for permanent eye damage’

Table 3 *Glare intensity designation*

This coding has been used in the table where a reflection has been calculated and is in accordance with Sandia National Laboratories' methodology.

This coding has been used in the table where a reflection has been calculated and is in accordance with Sandia National Laboratories' methodology. In addition, the intensity model allows for the assessment of a variety of solar panel surface materials. This assessment has considered solar panels with a surface material of 'smooth glass with an anti-reflective coating'. It is understood that this is the most commonly used solar panel surface material. Other surfaces that could be modelled include:

- Smooth glass without an anti-reflective coating;
- Light textured glass without an anti-reflective coating;
- Light textured glass with an anti-reflective coating; or
- Deeply textured glass.

Appendix H presents the results charts showing specific times and dates.

5.2.2 Key Considerations – Runway Approach Paths

The process for determining impact significance is defined in Appendix D. For the runway approach paths, the key considerations are:

- Whether a reflection is predicted to be experienced in practice;
- The location of glare relative to a pilot's primary field of view (50 degrees either side of the approach bearing).
- The intensity of glare for the solar reflections:
    - Glare with 'low potential for temporary after-image' ('green' glare).
    - Glare with 'potential for temporary after-image' ('yellow' glare).
    - Glare with 'potential for permanent eye damage' ('red' glare).
- Whether a reflection is predicted to be operationally significant in practice or not.

Where no solar reflections are geometrically possible or where solar reflections are predicted to be significantly screened, no impact is predicted, and mitigation is not required.

Where solar reflections are of an intensity no greater than 'low potential for temporary after-image' (green glare) or occur outside of a pilot's primary field-of-view (50 degrees either side of the runway approach relative to the approach bearing), the impact significance is low, and mitigation is not required.

Glare with 'potential for a temporary after-image' (yellow glare) was formerly not permissible under the interim guidance provided by the Federal Aviation Administration in the USA[9] for on-airfield solar. Pager Power recommends a pragmatic approach whereby instances of 'yellow' glare are evaluated in a technical and operational context. Where solar reflections are of an

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[9] This FAA guidance from 2013 has since been superseded by the FAA guidance in 2021 whereby airports are tasked with determining safety requirements themselves.

intensity no greater than 'low potential for temporary after-image' expert assessment of the following mitigating factors is required to determine the impact significance[10]:

- The likely traffic volumes and level of safeguarding at the aerodrome – licensed aerodromes typically have higher traffic volumes and are formally safeguarded;
- The time of day at which glare is predicted and whether the aerodrome will be operational such that pilots can be on the approach at these times;
- The duration of any predicted glare – glare that occurs for low durations throughout the year is less likely to be experienced than glare that occurs for longer durations throughout the year;
- The location and size of the reflecting panel area relative to a pilot's primary field-of-view;
- The location of the source of glare relative to the position of the Sun at the times and dates in which solar reflections are geometrically possible – effects that coincide with direct sunlight appear less prominent than those that do not;
- The level of predicted effect relative to existing sources of glare – a solar reflection is less noticeable by pilots when there are existing reflective surfaces in the surrounding environment.

Following consideration of these mitigating factors, where the solar reflection does not remain significant, a low impact is predicted, and mitigation is not recommended; however, consultation with the aerodrome is recommended to understand their position along with any feedback or comments regarding the Scheme.

Where the solar reflection remains significant, the impact significance is moderate, and mitigation is recommended. Where solar reflections are of an intensity greater than 'potential for temporary after-image', the impact significance is high, and mitigation is required.

In all cases, however, consultation with the aerodrome is recommended to understand their position pertaining to solar reflections towards the ATC Tower or approach paths, along with any feedback or comments regarding the Scheme.

5.2.3 Assessment Results

Table 4 on the following page presents the geometric modelling results for receptors associated with each airfield.

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[10] This approach taken is reflective of the changes made in the 2021 FAA guidance; however, it should be noted that this guidance states that it is up to the airport to determine the safety requirements themselves. Therefore, an airport may not accept any yellow glare towards approach paths.

Aerodrome	Receptor/Runway	Geometric Modelling Result	Maximum Glare Intensity	Discussion
Seething Airfield	Threshold 06 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	See Section 5.2.4
	Threshold 24 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
	Final Sections of Visual Circuits	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
Long Stratton Airfield	Threshold 17 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	See Section 5.2.4
	Threshold 35 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
	Final Sections of Visual Circuits	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
Hardwick Airfield	Threshold 13 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	See Section 5.2.4
	Threshold 31 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
	Final Sections of Visual Circuits	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	

Aerodrome	Receptor/Runway	Geometric Modelling Result	Maximum Glare Intensity	Discussion
Topcroft Farm Airfield	Threshold 10 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	See Section 5.2.4
	Threshold 28 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
	Final Sections of Visual Circuits	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
Nut Tree Farm Airfield	Threshold 09 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Green'	Solar reflections are of an acceptable intensity in accordance with the associated guidance (Appendix D) and industry best practice Low impact is predicted, and mitigation is not required
	Threshold 27 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Green'	
	Final Sections of Visual Circuits	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	See Section 5.2.4

Aerodrome	Receptor/Runway	Geometric Modelling Result	Maximum Glare Intensity	Discussion
Norfolk Gliding Airfield	Threshold 03 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	See Section 5.2.4
	Threshold 21 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
	Threshold 08 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
	Threshold 26 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
	Threshold 15 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
	Threshold 33 Splayed Approach	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	
	Final Sections of Visual Circuits	Solar reflections are geometrically possible considering both fixed and SAT panels	'Yellow'	

Table 4 *Geometric modelling results - aviation receptors*

5.2.4 Further Analysis of Yellow Glare

Glare with ‘potential for a temporary after-image’ (yellow glare) was formerly not permissible under the interim guidance provided by the Federal Aviation Administration in the USA for on-airfield solar. Pager Power recommends a pragmatic approach whereby instances of ‘yellow’ glare are evaluated in a technical and operational context. Where solar reflections are of an intensity no greater than ‘low potential for temporary after-image’ expert assessment of the following mitigating factors.

Table 5 on the following page presents the maximum duration of ‘yellow’ glare annually towards representative sections of the splayed approach paths. The duration is also considered as a percentage relative to average daylight hours[11] in any given year.

The instances of ‘yellow’ glare occur along the final sections of the visual circuits for Nut Tree Farm, during which the Scheme will be momentarily within the field-of-view of a pilot. Due to the fleeting view of the Scheme during this section, and the limited short duration, Nut Tree Farm is not included in Table 5.

The following points are also considered for all instances of ‘yellow glare’ for all aerodromes:

- The instances of ‘yellow’ glare are predicted for at most 8.64% of daylight hours per year;
- Solar reflections with ‘yellow’ glare are predicted at times when the Sun is low in the sky beyond the reflecting panels. This means that a pilot will likely have a view of the Sun within the same viewpoint of the reflecting solar. The Sun is a far more significant source of light, and therefore the glare originating from the proposed development will not be significant;
- The ‘yellow’ glare only marginally exceeds the ‘yellow’ threshold on the intensity chart. ‘Green’ glare (or glare with ‘low potential for temporary after-image’) is considered an acceptable level of glare intensity for aircrafts on approach;
- The volume of air traffic at all aerodromes is expected to be relatively low compared to licensed aerodromes;
- Effects would be fleeting due to their short duration along the visual circuits and the restricted size of the reflecting panel area;
- The weather would have to be clear and sunny at the specific times when the glare was possible to be experienced. A pilot would also have to be on approach/the circuit path at the times when solar reflections are possible.

It is expected that measures already used by pilots to mitigate the effects of direct sunlight could potentially be used to mitigate the effects of solar glare from the panels. The instances of ‘yellow’ glare could potentially be operationally accommodated, subject to consultation with the airfields.

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[11] Based on 12 hours of sunlight a day / 262,800 minutes per year

Aerodrome	Fixed Panels			SAT Panels		
	Distance (miles) from Threshold	Annual Duration (mins)	Percentage of Daylight Hours (%)	Distance from Threshold	Annual Duration (mins)	Percentage of Daylight Hours (%)
Seething Airfield	0.4 miles from 06	8,444	3.21	0.3 miles from 06	22,711	8.64
Long Stratton Airfield	0.5 miles from 17	2,539	0.97	0.7 miles from 17	863	0.32
Hardwick Airfield	0.2 miles from 13	8,389	3.19	0.2 miles from 13	11,304	4.30
Topcroft Farm Airfield	0.2 miles from 10	2,213	0.84	1.0 miles from 10	2,993	1.14
Norfolk Gliding Airfield	0.7 miles from 26	4,774	1.82	0.8 miles from 26	10,094	3.62

Table 5 *Duration of 'yellow' glare*

5.3 Assessment Results – Road Receptors

5.3.1 Key Considerations

The key considerations for road users along major national, national, and regional roads are:

- Whether a reflection is predicted to be experienced in practice; and
- The location of the reflecting panel relative to a road user's direction of travel.

Where solar reflections are not geometrically possible, or the reflecting panels are predicted to be significantly obstructed from view, no impact is predicted, and mitigation is not required.

Where solar reflections originate from outside of a road user's primary horizontal field-of-view (FOV), defined as 50 degrees either side relative to the direction of travel, or the closest reflecting panel is over 1km from the road user, the impact significance is low, and mitigation is not recommended.

Where solar reflections are predicted to be experienced from inside of a road user's primary field-of-view, expert assessment of the following factors is required to determine the impact significance and mitigation requirement:

- Whether the solar reflection originates from directly in front of a road user – a solar reflection that is directly in front of a road user is more hazardous than a solar reflection to one side;
- Whether visibility is likely for elevated drivers (relevant to dual carriageways and motorways[12]);
- The separation distance to the panel area. Larger separation distances reduce the proportion of an observer's field of view that is affected by glare;
- Whether a solar reflection is fleeting in nature. Small gap/s in screening, e.g. an access point to the site, may not result in a sustained reflection for a road user;
- The position of the Sun. Effects that coincide with direct sunlight appear less prominent than those that do not. The Sun is a far more significant source of light.

Following consideration of these relevant factors, where the solar reflection is not deemed significant, a low impact is predicted, and mitigation is not recommended. Where the solar reflection is deemed significant, the impact significance is moderate, and mitigation is recommended.

Where solar reflections originate from directly in front of a road user and there are no mitigating factors, the impact significance is high, and mitigation is required.

5.3.2 Geometric Modelling Results and Discussion

Table 6 on the following pages presents the geometric modelling results and predicted impact significance for the assessed road receptors. The geometric modelling results consider both fixed and SAT panels within 1km of the assessed receptor.

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[12] There is typically a higher density of elevated drivers (such as HGVs) along dual carriageways and motorways compared to other types of road.

Road Receptor	Geometric Modelling Results (screening not considered)	Identified Screening and Predicted Visibility (desk-based review)	Whether reflections occur inside a road user's primary FOV (with consideration of screening) [13]	Mitigating Factors	Predicted Impact Classification
A1 – A14	Solar reflections are geometrically possible **outside** a road user's FOV from fixed panels and SAT panels	Existing vegetation, buildings and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
A15 – A42	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels and SAT panels	Existing vegetation, buildings and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
B1 – B8	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels and SAT panels	Existing vegetation, buildings and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

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[13] Assessment scenario may include an initial conservative qualitative consideration of screening in determining the duration of predicated effects in practice. The reflecting area of the solar development may be partially screened such that it does not meet the two key criteria i.e. 1) The solar reflection occurs for more than three months per year 2) and/or for more than 60 minutes on any given day.

Road Receptor	Geometric Modelling Results (screening not considered)	Identified Screening and Predicted Visibility (desk-based review)	Whether reflections occur inside a road user's primary FOV (with consideration of screening)[13]	Mitigating Factors	Predicted Impact Classification
B9 – B12	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels and SAT panels	Existing vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
B13 – B16	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels and SAT panels	Existing and proposed vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
B17 – B24	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels Solar reflections are not geometrically possible from SAT panels	Existing vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

Road Receptor	Geometric Modelling Results (screening not considered)	Identified Screening and Predicted Visibility (desk-based review)	Whether reflections occur inside a road user's primary FOV (with consideration of screening) [13]	Mitigating Factors	Predicted Impact Classification
B25 – B32	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels Solar reflections are not geometrically possible from SAT panels	Existing vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
B33 – B38	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels and SAT panels	Existing and proposed vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
B39 – B43	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels and SAT panels	Existing vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

Road Receptor	Geometric Modelling Results (screening not considered)	Identified Screening and Predicted Visibility (desk-based review)	Whether reflections occur inside a road user's primary FOV (with consideration of screening) [13]	Mitigating Factors	Predicted Impact Classification
B44 – B48	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels and SAT panels	Existing and proposed vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
B49 – B64	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels and SAT panels	Existing vegetation, buildings and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
B65 – B67	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels Solar reflections are not geometrically possible from SAT panels	Existing vegetation and buildings predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

Road Receptor	Geometric Modelling Results (screening not considered)	Identified Screening and Predicted Visibility (desk-based review)	Whether reflections occur inside a road user's primary FOV (with consideration of screening) [13]	Mitigating Factors	Predicted Impact Classification
B68 – B69	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels and SAT panels	Existing and proposed vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
B70 – B72	Solar reflections are geometrically possible **inside** a road user's FOV from fixed panels Solar reflections are not geometrically possible from SAT panels	Existing vegetation, buildings and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

Table 6 *Geometric modelling results - road receptors*

A desk-based screening review of the available imagery is presented in Appendix I.

5.4 Assessment Results – Dwelling Receptors

5.4.1 Key Considerations

The key considerations for residential dwellings are:

- Whether a reflection is predicted to be experienced in practice;
- The duration of the predicted effects, relative to thresholds of:
    - Three months per year;
    - 60 minutes on any given day.

Where solar reflections are not geometrically possible, or the reflecting panels are predicted to be significantly obstructed from view, no impact is predicted, and mitigation is not required.

Where effects occur for **less** than three months per year and **less** than 60 minutes on any given day, or the closest reflecting panel is over 1km from the dwelling, the impact significance is low, and mitigation is not recommended.

Where reflections are predicted to be experienced for **more** than three months per year and/or for **more** than 60 minutes on any given day, expert assessment of the following factors is required to determine the impact significance and mitigation requirement:

- The separation distance to the panel area – larger separation distances reduce the proportion of an observer's field of view that is affected by glare;
- The position of the Sun – effects that coincide with direct sunlight appear less prominent than those that do not;
- Whether visibility is likely from all storeys – the ground floor is typically considered the main living space and has a greater significance with respect to residential amenity;
- Whether the dwelling appears to have windows facing the reflecting area – factors that restrict potential views of a reflecting area reduce the level of impact.

Following consideration of these mitigating factors, where the solar reflection is not deemed significant, a low impact is predicted, and mitigation is not recommended. Where the solar reflection is deemed significant, the impact significance is moderate, and mitigation is recommended.

If effects last for **more** than 3 months per year and for **more** than 60 minutes on any given day, and there are no mitigating factors, the impact significance is high, and mitigation is required.

5.4.2 Geometric Modelling Results and Discussion

Table 7 on the following pages presents the geometric modelling results and predicted impact significance for the assessed dwelling receptors. The geometric modelling results consider both fixed and SAT panels within 1km of the assessed receptor.

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
1 – 7	Solar reflections are geometrically possible for **less** than three months per year and **less** than 60 minutes on any given day	Existing vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
8 – 21	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and buildings predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
22 – 40	Solar reflections are geometrically possible for **less** than three months per year and **less** than 60 minutes on any given day	Existing vegetation and buildings predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

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[14] Assessment scenario may include an initial conservative qualitative consideration of screening in determining the duration of predicated effects in practice. The reflecting area of the solar development may be partially screened such that it does not meet the two key criteria i.e. 1) The solar reflection occurs for more than three months per year 2) and/or for more than 60 minutes on any given day.

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
41 – 47	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
48 – 49	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation predicted to significantly obstruct views of reflecting panels with marginal views considered possible above ground floor	**Less** than three months per year and **less** than 60 minutes on any given day	N/A	Low impact
50 – 52	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

Dwelling Receptor	**Geometric Modelling Results (without consideration of screening)**	**Identified Screening and Predicted Visibility (desk-based review)**	**Duration of effects (with consideration of screening)[14]**	**Mitigating Factors**	**Predicted Impact Classification**
53	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Proposed vegetation is predicted to obstruct views of reflecting panels with marginal views above ground level considered possible	**Less** than three months per year but **less** than 60 minutes on any given day	N/A	Low impact
54 – 70	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
71 – 75	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Proposed vegetation is predicted to obstruct views of reflecting panels with marginal views above ground level considered possible	**Less** than three months per year but **less** than 60 minutes on any given day	N/A	Low impact

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
76	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Intervening terrain predicted to obstruct views of reflecting panels at ground level, with marginal views above ground level considered possible	**Less** than three months and **less** than 60 minutes on any given day	N/A	Low impact
77 – 88	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
89 – 96	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day Solar reflections are not geometrically possible from SAT panels	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
97	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
98 – 101	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Proposed vegetation is predicted to obstruct views of reflecting panels with marginal views above ground level considered possible	**Less** than three months per year but **less** than 60 minutes on any given day	N/A	Low impact
102 – 118	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
119 – 136	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Proposed vegetation is predicted to obstruct views of reflecting panels with marginal views above ground level considered possible	**Less** than three months per year but **less** than 60 minutes on any given day	N/A	Low impact
137 - 142	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
143 – 145	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Proposed vegetation is predicted to obstruct views of reflecting panels with marginal views above ground level considered possible	**Less** than three months per year but **less** than 60 minutes on any given day	N/A	Low impact

Dwelling Receptor	**Geometric Modelling Results (without consideration of screening)**	**Identified Screening and Predicted Visibility (desk-based review)**	**Duration of effects (with consideration of screening)[14]**	**Mitigating Factors**	**Predicted Impact Classification**
146 – 197	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
198 – 205	Solar reflections are not geometrically possible from fixed panels or SAT panels	N/A	N/A	N/A	No impact
206 – 210	Solar reflections are geometrically possible for **less** than three months per year and **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
211 – 212	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
213	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to obstruct views of reflecting panels with marginal views considered possible	**Less** than three months per year and **less** than 60 minutes on any given day	N/A	Low impact
214	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
215 – 218	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to obstruct views of reflecting panels with marginal views considered possible	**Less** than three months per year and **less** than 60 minutes on any given day	N/A	Low impact

Dwelling Receptor	**Geometric Modelling Results (without consideration of screening)**	**Identified Screening and Predicted Visibility (desk-based review)**	**Duration of effects (with consideration of screening)[14]**	**Mitigating Factors**	**Predicted Impact Classification**
219 – 264	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
265 – 270	Solar reflections are not geometrically possible from fixed panels or SAT panels	N/A	N/A	N/A	No impact
271 – 276	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
277	Solar reflections are not geometrically possible from fixed panels or SAT panels	N/A	N/A	N/A	No impact

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
278 - 279	Solar reflections are geometrically possible for less than three months per year and less than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
280 – 282	Solar reflections are not geometrically possible from fixed panels or SAT panels	N/A	N/A	N/A	No impact
283	Solar reflections are geometrically possible for less than three months per year and less than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
284	Solar reflections are not geometrically possible from fixed panels or SAT panels	N/A	N/A	N/A	No impact

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
285 – 289	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
290 – 291	Solar reflections are geometrically possible for **less** than three months per year and **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
292 – 407	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
408 – 410	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Proposed vegetation is predicted to obstruct views of reflecting panels with marginal views above ground level considered possible	**Less** than three months per year but **less** than 60 minutes on any given day	N/A	Low impact
411 – 427	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
428 – 429	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Proposed vegetation is predicted to obstruct views of reflecting panels with marginal views above ground level considered possible	**Less** than three months per year but **less** than 60 minutes on any given day	N/A	Low impact

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
430 – 449	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
450 – 456	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Proposed vegetation is predicted to obstruct views of reflecting panels with marginal views above ground level considered possible	**Less** than three months per year but **less** than 60 minutes on any given day	N/A	Low impact
457 – 461	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
462 – 463	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to obstruct views of reflecting panels with marginal views considered possible	**Less** than three months per year and **less** than 60 minutes on any given day	N/A	Low impact
464 - 474	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact
475 – 477	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Proposed vegetation is predicted to obstruct views of reflecting panels with marginal views above ground level considered possible	**Less** than three months per year but **less** than 60 minutes on any given day	N/A	Low impact

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening)[14]	Mitigating Factors	Predicted Impact Classification
478 – 479	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to obstruct views of reflecting panels with marginal views considered possible	**Less** than three months per year and **less** than 60 minutes on any given day	N/A	Low impact
480 – 482	Solar reflections are geometrically possible for **more** than three months per year but **less** than 60 minutes on any given day	Existing vegetation and intervening terrain predicted to significantly obstruct views of reflecting panels	N/A	N/A	No impact

Table 7 *Geometric modelling results - dwelling receptor*

6 HIGH-LEVEL ASSESSMENT OF CUMULATIVE EFFECTS

6.1 Overview

This section presents analysis of cumulative effects of solar reflections, from the existing and proposed solar developments in the surrounding area in respect to shared receptors between the Scheme and the existing development.

The cumulative assessment considers the existing solar development located to the west of the Scheme. Figure 9 below shows the existing development (orange area bounded in red) relative to the Scheme.

Figure 9 *Existing development relative to proposed development*

6.2 High-Level Assessment

Shared ground-based receptors within 1km of the Scheme and the existing solar development are as follows:

- Dwellings 4 to 52, 67, and 89
- Road receptors A11 to A36, and B1 to B16.

Dwelling receptors 4 to 52, 67 and 89 are predicted to experience no impact from the Scheme, as such no cumulative impacts are predicted.

Road receptors A11 to A36 and B1 to B16 are predicted to experience no impact from the Scheme, as such no cumulative impacts are predicted.

It is not predicted that the cumulative glare from the proposed and existing developments would exceed the geometric results for assessed aerodromes in this report, due to the panels of both developments existing adjacent to each other, and therefore will not cause solar reflections at a different time. As such the cumulative impact is not predicted to exceed the geometric results at all aerodromes.

6.3 High-Level Assessment Conclusions

Shared receptors between the Scheme and existing developments are predicted to either experience no impact from either the Scheme or relevant existing development, or experience cumulative effects that do not exceed a low impact. Therefore, no mitigation is recommended.

7 APPENDIX A – OVERVIEW OF GLINT AND GLARE GUIDANCE

Overview

This section presents details regarding the relevant guidance and studies with respect to the considerations and effects of solar reflections from solar panels, known as 'Glint and Glare'.

This is not a comprehensive review of the data sources, rather it is intended to give an overview of the important parameters and considerations that have informed this assessment.

UK Planning Policy

National Policy Statement for Renewable Energy Infrastructure

The National Policy Statement for Renewable Energy Infrastructure (EN-3)[15] sets out the primary policy for decisions by the Secretary of State for nationally significant renewable energy infrastructure. Sections 2.10.94-98 state:

'2.10.94 Solar panels are specifically designed to absorb, not reflect, irradiation.[16] However, solar panels may reflect the sun's rays at certain angles, causing glint and glare. Glint is defined as a momentary flash of light that may be produced as a direct reflection of the sun in the solar panel. Glare is a continuous source of excessive brightness experienced by a stationary observer located in the path of reflected sunlight from the face of the panel. The effect occurs when the solar panel is stationed between or at an angle of the sun and the receptor.

2.10.95 Applicants should map receptors to qualitatively identify potential glint and glare issues and determine if a glint and glare assessment is necessary as part of the application.

2.10.96 When a quantitative glint and glare assessment is necessary, applicants are expected to consider the geometric possibility of glint and glare affecting nearby receptors and provide an assessment of potential impact and impairment based on the angle and duration of incidence and the intensity of the reflection.

2.10.97 The extent of reflectivity analysis required to assess potential impacts will depend on the specific project site and design. This may need to account for 'tracking' panels if they are proposed as these may cause differential diurnal and/or seasonal impacts.

2.10.98 When a glint and glare assessment is undertaken, the potential for solar PV panels, frames and supports to have a combined reflective quality may need to be assessed, although the glint and glare of the frames and supports is likely to be significantly less than the panels.'

The EN-3 does not state which receptors should be considered as part of a quantitative glint and glare assessment. Based on Pager Power's extensive project experience, typical receptors include residential dwellings, road users, aviation infrastructure, and railway infrastructure (not relevant to this specific assessment).

Sections 2.10.134-136 state:

'2.10.134 Applicants should consider using, and in some cases the Secretary of State may require, solar panels to comprise of (or be covered with) anti-glare/anti-reflective coating with a specified angle of maximum reflection attenuation for the lifetime of the permission.

2.10.135 Applicants may consider using screening between potentially affected receptors and the reflecting panels to mitigate the effects.

2.10.136 Applicants may consider adjusting the azimuth alignment of or changing the elevation tilt angle of a solar panel, within the economically viable range, to alter the angle of incidence.

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[15] National Policy Statement for Renewable Energy Infrastructure (EN-3), Department for Energy Security & Net Zero, date: November 2023, accessed on: 21/12/2023.

[16] *'Most commercially available solar panels are designed with anti-reflective glass or are produced with anti-reflective coating and have a reflective capacity that is generally equal to or less hazardous than other objects typically found in the outdoor environment, such as bodies of water or glass buildings.'*

> *In practice this is unlikely to remove the potential impact altogether but in marginal cases may contribute to a mitigation strategy.'*

The mitigation strategies listed within the EN-3 are relevant strategies that are frequently utilised to eliminate or reduce glint and glare effects towards surrounding observers. The most common form of mitigation is the implementation of screening along the site boundary.

Sections 2.10.158-159 state:

2.10.158 Solar PV panels are designed to absorb, not reflect, irradiation. However, the Secretary of State should assess the potential impact of glint and glare on nearby homes, motorists, public rights of way, and aviation infrastructure (including aircraft departure and arrival flight paths).

2.10.159 Whilst there is some evidence that glint and glare from solar farms can be experienced by pilots and air traffic controllers in certain conditions, there is no evidence that glint and glare from solar farms results in significant impairment on aircraft safety. Therefore, unless a significant impairment can be demonstrated, the Secretary of State is unlikely to give any more than limited weight to claims of aviation interference because of glint and glare from solar farms.

The EN-3 goes some way in acknowledging that the issue is more complex than presented in the early draft issues; though, this is still unlikely to be welcomed by aviation stakeholders, who will still request a glint and glare assessment on the basis that glare may lead to a potentially significant impact upon aviation safety.

Renewable and Low Carbon Energy

The National Planning Policy Guidance Renewable and Low Carbon Energy[17] (specifically regarding the consideration of solar farms, paragraph 013) states:

'What are the particular planning considerations that relate to large scale ground-mounted solar photovoltaic Farms?

The deployment of large-scale solar farms can have a negative impact on the rural environment, particularly in undulating landscapes. However, the visual impact of a well-planned and well-screened solar farm can be properly addressed within the landscape if planned sensitively.

Particular factors a local planning authority will need to consider include:

…

- the proposal's visual impact, the effect on landscape of glint and glare (see guidance on landscape assessment) and on **neighbouring uses and aircraft safety**;
- the extent to which there may be additional impacts if solar arrays follow the daily movement of the sun;

…

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[17] Renewable and low carbon energy, Ministry of Housing, Communities & Local Government, date: 18 June 2015, accessed on: 01/11/2021

The approach to assessing cumulative landscape and visual impact of large scale solar farms is likely to be the same as assessing the impact of wind turbines. However, in the case of ground-mounted solar panels it should be noted that with effective screening and appropriate land topography the area of a zone of visual influence could be zero.'

Assessment Process – Ground-Based Receptors

No process for determining and contextualising the effects of glint and glare has been determined when assessing the impact of solar reflections upon surrounding roads and dwellings. Therefore, the Pager Power approach is to determine whether a reflection from the proposed solar development is geometrically possible and then to compare the results against the relevant guidance/studies to determine whether the reflection is significant.

The Pager Power approach has been informed by the policy presented above, current studies (presented in Appendix B) and stakeholder consultation. Further information can be found in Pager Power's Glint and Glare Guidance document[18] which was produced due to the absence of existing guidance and a specific standardised assessment methodology.

Aviation Assessment Guidance

The UK Civil Aviation Authority (CAA) issued interim guidance relating to Solar Photovoltaic Systems (SPV) on 17 December 2010 and was subject to a CAA information alert 2010/53. The formal policy was cancelled on September 7th 2012[19]; however, the advice is still considered applicable[20] until a formal policy is developed. In July 2023, the Combined Aerodrome Safeguarding Team, supported by the CAA, have issued the Aerodrome Safeguarding Guidance Note providing safeguarding advice in relation to solar photovoltaic developments.

The relevant aviation guidance from the CAA interim guidance is presented in the section below.

CAA Interim Guidance

This interim guidance makes the following recommendations (p.2-3):

'8. It is recommended that, as part of a planning application, the SPV developer provide safety assurance documentation (including risk assessment) regarding the full potential impact of the SPV installation on aviation interests.

9. Guidance on safeguarding procedures at CAA licensed aerodromes is published within CAP 738 Safeguarding of Aerodromes and advice for unlicensed aerodromes is contained within CAP 793 Safe Operating Practices at Unlicensed Aerodromes.

10. Where proposed developments in the vicinity of aerodromes require an application for planning permission the relevant LPA normally consults aerodrome operators or NATS when aeronautical interests might be affected. This consultation procedure is a statutory obligation in the case of certain major airports, and may include military establishments and certain air traffic surveillance technical

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

[19] Archived at Pager Power

[20] Reference email from the CAA dated 19/05/2014.

sites. These arrangements are explained in Department for Transport Circular 1/2003 and for Scotland, Scottish Government Circular 2/2003.

11. In the event of SPV developments proposed under the Electricity Act, the relevant government department should routinely consult with the CAA. There is therefore no requirement for the CAA to be separately consulted for such proposed SPV installations or developments.

12. If an installation of SPV systems is planned on-aerodrome (i.e. within its licensed boundary) then it is recommended that data on the reflectivity of the solar panel material should be included in any assessment before installation approval can be granted. Although approval for installation is the responsibility of the ALH[21]*, as part of a condition of a CAA Aerodrome Licence, the ALH is required to obtain prior consent from CAA Aerodrome Standards Department before any work is begun or approval to the developer or LPA is granted, in accordance with the procedures set out in CAP 791 Procedures for Changes to Aerodrome Infrastructure.*

13. During the installation and associated construction of SPV systems there may also be a need to liaise with nearby aerodromes if cranes are to be used; CAA notification and permission is not required.

14. The CAA aims to replace this informal guidance with formal policy in due course and reserves the right to cancel, amend or alter the guidance provided in this document at its discretion upon receipt of new information.

15. Further guidance may be obtained from CAA's Aerodrome Standards Department via aerodromes@caa.co.uk.'

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[21] Aerodrome Licence Holder.

FAA Guidance

The most comprehensive guidelines available for the assessment of solar developments near aerodromes has been produced by the United States Federal Aviation Administration (FAA). The first guidelines were produced initially in November 2010 and updated in 2013. A final policy was released in 2021, which superseded the interim guidance.

The 2010 document is entitled '*Technical Guidance for Evaluating Selected Solar Technologies on Airports'*[22], the 2013 update is entitled '*Interim Policy, FAA Review of Solar Energy System Projects on Federally Obligated Airports'*[23], and the 2021 final policy is entitled '*Federal Aviation Administration Policy: Review of Solar Energy System Projects on Federally-Obligated Airports'*[24].

Key excerpts from the final policy are presented below:

Initially, FAA believed that solar energy systems could introduce a novel glint and glare effect to pilots on final approach. FAA has subsequently concluded that in most cases, the glint and glare from solar energy systems to pilots on final approach is similar to glint and glare pilots routinely experience from water bodies, glass-façade buildings, parking lots, and similar features. However, FAA has continued to receive reports of potential glint and glare from on-airport solar energy systems on personnel working in ATCT cabs. Therefore, FAA has determined the scope of agency policy should be focused on the impact of on-airport solar energy systems to federally-obligated towered airports, specifically the airport's ATCT cab.

The policy in this document updates and replaces the previous policy by encouraging airport sponsors to conduct an ocular analysis of potential impacts to ATCT cabs prior to submittal of a Notice of Proposed Construction or Alteration Form 7460-1 (hereinafter Form 7460-1). Airport sponsors are no longer required to submit the results of an ocular analysis to FAA. Instead, to demonstrate compliance with 14 CFR 77.5(c), FAA will rely on the submittal of Form 7460-1 in which the sponsor confirms that it has analyzed the potential for glint and glare and determined there is no potential for ocular impact to the airport's ATCT cab. This process will enable FAA to evaluate the solar energy system project, with assurance that the system will not impact the ATCT cab.

FAA encourages airport sponsors of federally-obligated towered airports to conduct a sufficient analysis to support their assertion that a proposed solar energy system will not result in ocular impacts. There are several tools available on the open market to airport sponsors that can analyze potential glint and glare to an ATCT cab. For proposed systems that will clearly not impact ATCT cabs (e.g., on-airport solar energy systems that are blocked from the ATCT cab's view by another structure), the use of such tools may not be necessary to support the assertion that a proposed solar energy system will not result in ocular impacts.

The excerpt above states where a solar PV development is to be located on a federally obligated aerodrome with an ATC Tower, it will require a glint and glare assessment to accompany its

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[22] Archived at Pager Power

[23] Interim Policy, FAA Review of Solar Energy System Projects on Federally Obligated Airports, Department of Transportation, Federal Aviation Administration (FAA), date: 10/2013, accessed on: 08/12/2021.

[24] Federal Aviation Administration Policy: Review of Solar Energy System Projects on Federally-Obligated Airports, Federal Aviation Administration, date: May 2021, accessed on: 08/12/2021.

application. It states that pilots on approach are no longer a specific assessment requirement due to effects from solar energy systems being similar to glint and glare pilots routinely experience from water bodies, glass-façade buildings, parking lots, and similar features. Ultimately it comes down to the specific aerodrome to ensure it is adequately safeguarded, and it is on this basis that glint and glare assessments are routinely still requested.

The policy also states that several different tools and methodologies can be used to assess the impacts of glint and glare, which was previously required to be undertaken by the Solar Glare Hazard Analysis Tool (SGHAT) using the Sandia National Laboratories methodology.

In 2018, the FAA released the latest version (Version 1.1) of the '*Technical Guidance for Evaluating Selected Solar Technologies on Airports'*[25]. Whilst the 2021 final policy also supersedes this guidance, many of the points are still relevant because aerodromes are still safeguarding against glint and glare irrespective of the FAA guidance. The key points are presented below for reference:

- *Reflectivity refers to light that is reflected off surfaces. The potential effects of reflectivity are glint (a momentary flash of bright light) and glare (a continuous source of bright light). These two effects are referred to hereinafter as "glare," which can cause a brief loss of vision, also known as flash blindness*[26].
- *The amount of light reflected off a solar panel surface depends on the amount of sunlight hitting the surface, its surface reflectivity, geographic location, time of year, cloud cover, and solar panel orientation.*
- *As illustrated on Figure 16*[27]*, flat, smooth surfaces reflect a more concentrated amount of sunlight back to the receiver, which is referred to as specular reflection. The more a surface is polished, the more it shines. Rough or uneven surfaces reflect light in a diffused or scattered manner and, therefore, the light will not be received as bright.*
- *Because the FAA has no specific standards for airport solar facilities and potential glare, the type of glare analysis may vary. Depending on site specifics (e.g., existing land uses, location and size of the project) an acceptable evaluation could involve one or more of the following levels of assessment:*
    - *A qualitative analysis of potential impact in consultation with the Control Tower, pilots and airport officials;*
    - *A demonstration field test with solar panels at the proposed site in coordination with FAA Tower personnel;*
    - *A geometric analysis to determine days and times when an impact is predicted.*

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[25] Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration (FAA), date: 04/2018, accessed on: 08/12/2021.

[26] Flash Blindness, as described in the FAA guidelines, can be described as a temporary visual interference effect that persists after the source of illumination has ceased. This occurs from many reflective materials in the ambient environment.

[27] First figure in Appendix B.

- *The extent of reflectivity analysis required to assess potential impacts will depend on the specific project site and system design.*
- ***1. Assessing Baseline Reflectivity Conditions** – Reflection in the form of glare is present in current aviation operations. The existing sources of glare come from glass windows, auto surface parking, rooftops, and water bodies. At airports, existing reflecting surfaces may include hangar roofs, surface parking, and glassy office buildings. To minimize unexpected glare, windows of air traffic control towers and airplane cockpits are coated with anti-reflective glazing. Operators also wear polarized eye wear. Potential glare from solar panels should be viewed in this context. Any airport considering a solar PV project should first review existing sources of glare at the airport and the effectiveness of measures used to mitigate that glare.*
- ***2. Tests in the Field** – Potential glare from solar panels can easily be viewed at the airport through a field test. A few airports have coordinated these tests with FAA Air Traffic Controllers to assess the significance of glare impacts. To conduct such a test, a sponsor can take a solar panel out to proposed location of the solar project, and tilt the panel in different directions to evaluate the potential for glare onto the air traffic control tower. For the two known cases where a field test was conducted, tower personnel determined the glare was not significant. If there is a significant glare impact, the project can be modified by ensuring panels are not directed in that direction.*
- ***3. Geometric Analysis** – Geometric studies are the most technical approach for reflectivity issues. They are conducted when glare is difficult to assess through other methods. Studies of glare can employ geometry and the known path of the sun to predict when sunlight will reflect off of a fixed surface (like a solar panel) and contact a fixed receptor (e.g., control tower). At any given site, the sun moves across the sky every day and its path in the sky changes throughout year. This in turn alters the destination of the resultant reflections since the angle of reflection for the solar panels will be the same as the angle at which the sun hits the panels. The larger the reflective surface, the greater the likelihood of glare impacts.*
- *Facilities placed in remote locations, like the desert, will be far from receptors and therefore potential impacts are limited to passing aircraft. Because the intensity of the light reflected from the solar panel decreases with increasing distance, an appropriate question is how far you need to be from a solar reflected surface to avoid flash blindness. It is known that this distance is directly proportional to the size of the array in question*[28] *but still requires further research to definitively answer.*
- ***Experiences of Existing Airport Solar Projects** – Solar installations are presently operating at a number of airports, including megawatt-sized solar facilities covering multiple acres. Air traffic control towers have expressed concern about glint and glare from a small number of solar installations. These were often instances when solar installations were sited between the tower and airfield, or for installations with inadequate or no reflectivity analysis.*

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[28] Ho, Clifford, Cheryl Ghanbari, and Richard Diver. 2009. Hazard Analysis of Glint and Glare From Concentrating Solar Power Plants. SolarPACES 2009, Berlin Germany. Sandia National Laboratories.

> *Adequate reflectivity analysis and alternative siting addressed initial issues at those installations.*

Air Navigation Order (ANO) 2016

In some instances, an aviation stakeholder can refer to the ANO 2016[29] with regard to safeguarding. Key points from the document are presented below.

Lights liable to endanger

224. (1) A person must not exhibit in the United Kingdom any light which—

(a) by reason of its glare is liable to endanger aircraft taking off from or landing at an aerodrome; or

(b) by reason of its liability to be mistaken for an aeronautical ground light is liable to endanger aircraft.

(2) If any light which appears to the CAA to be a light described in paragraph (1) is exhibited, the CAA may direct the person who is the occupier of the place where the light is exhibited or who has charge of the light, to take such steps within a reasonable time as are specified in the direction—

(a) to extinguish or screen the light; and

(b) to prevent in the future the exhibition of any other light which may similarly endanger aircraft.

(3) The direction may be served either personally or by post, or by affixing it in some conspicuous place near to the light to which it relates.

(4) In the case of a light which is or may be visible from any waters within the area of a general lighthouse authority, the power of the CAA under this article must not be exercised except with the consent of that authority.

Lights which dazzle or distract

225. A person must not in the United Kingdom direct or shine any light at any aircraft in flight so as to dazzle or distract the pilot of the aircraft.'

The document states that no 'light', 'dazzle' or 'glare' should be produced which will create a detrimental impact upon aircraft safety.

Endangering safety of an aircraft

240. A person must not recklessly or negligently act in a manner likely to endanger an aircraft, or any person in an aircraft.

Endangering safety of any person or property

241. A person must not recklessly or negligently cause or permit an aircraft to endanger any person or property.

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[29] The Air Navigation Order 2016. [online] Available at: <https://www.legislation.gov.uk/uksi/2016/765/contents/made> [Accessed 4 February 2022].

Civil Aviation Authority consolidation of UK Regulation 139/2014

The Civil Aviation Authority (CAA) published a consolidating document[30] of UK regulations, (Implementing Rules, Acceptable Means of Compliance and Guidance Material), in 2023. A summary of material relevant to aerodrome safeguarding is presented below:

(a) The aerodrome operator should have procedures to monitor the changes in the obstacle environment, marking and lighting, and in human activities or land use on the aerodrome and the areas around the aerodrome, as defined in coordination with the CAA. The scope, limits, tasks and responsibilities for the monitoring should be defined in coordination with the relevant air traffic services providers, and with the CAA and other relevant authorities.

(b) The limits of the aerodrome surroundings that should be monitored by the aerodrome operator are defined in coordination with the CAA and should include the areas that can be visually monitored during the inspections of the manoeuvring area.

(c) The aerodrome operator should have procedures to mitigate the risks associated with changes on the aerodrome and its surroundings identified with the monitoring procedures. The scope, limits, tasks, and responsibilities for the mitigation of risks associated to obstacles or hazards outside the perimeter fence of the aerodrome should be defined in coordination with the relevant air traffic services providers, and with the CAA and other relevant authorities.

(d) The risks caused by human activities and land use which should be assessed and mitigated should include:

1. obstacles and the possibility of induced turbulence;
2. the use of hazardous, confusing, and misleading lights;
3. the dazzling caused by large and highly reflective surfaces;
4. sources of non-visible radiation, or the presence of moving, or fixed objects which may interfere with, or adversely affect, the performance of aeronautical communications, navigation and surveillance systems; and
5. non-aeronautical ground light near an aerodrome which may endanger the safety of aircraft and which should be extinguished, screened, or otherwise modified so as to eliminate the source of danger.

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[30] https://regulatorylibrary.caa.co.uk/139-2014-pdf/PDF.pdf

APPENDIX B – OVERVIEW OF GLINT AND GLARE STUDIES

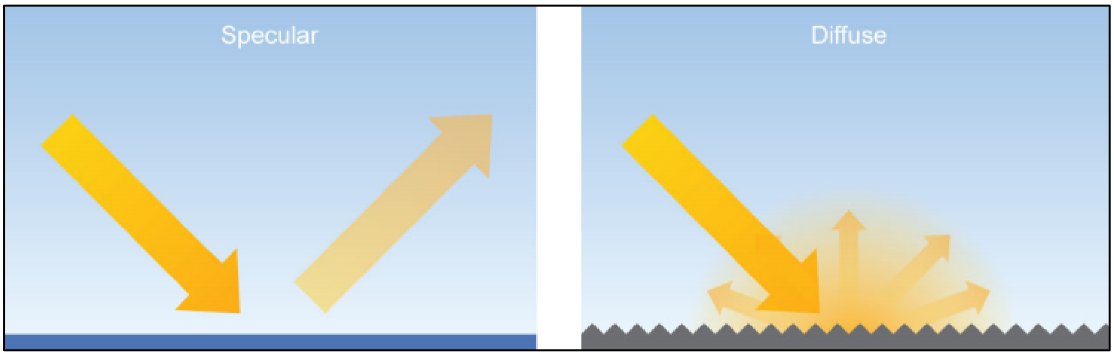
Overview

Studies have been undertaken assessing the type and intensity of solar reflections from various surfaces including solar panels and glass. An overview of these studies is presented below.

The guidelines presented are related to aviation safety. The results are applicable for the purpose of this analysis.

Reflection Type from Solar Panels

Based on the surface conditions reflections from light can be specular and diffuse. A specular reflection has a reflection characteristic similar to that of a mirror; a diffuse will reflect the incoming light and scatter it in many directions. The figure below, taken from the FAA guidance[31], illustrates the difference between the two types of reflections. Because solar panels are flat and have a smooth surface most of the light reflected is specular, which means that incident light from a specific direction is reradiated in a specific direction.



Specular and diffuse reflections

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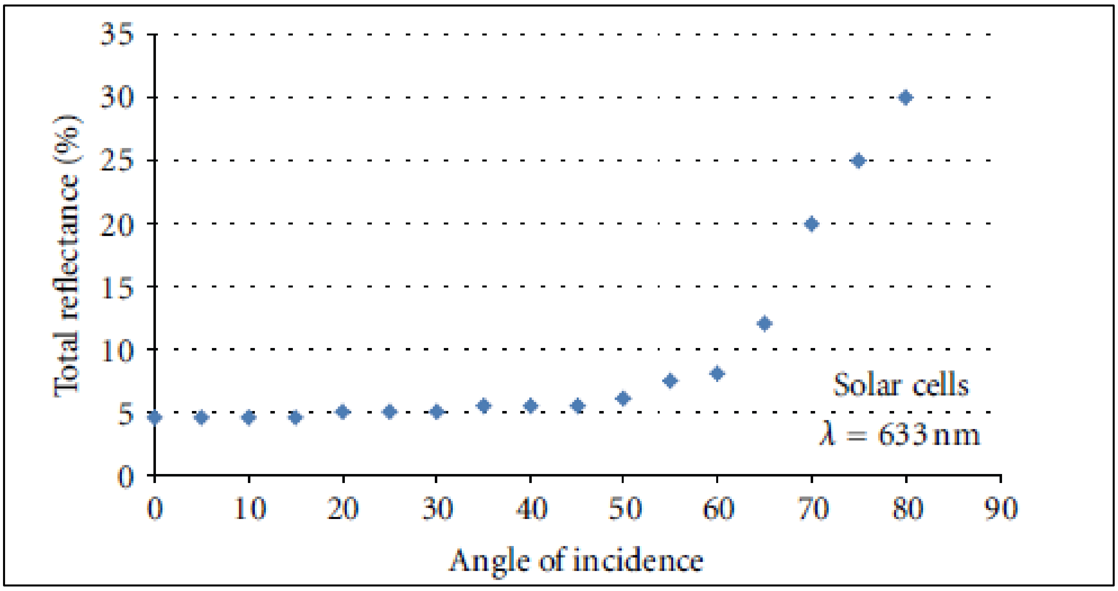
[31] Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration (FAA), date: 04/2018, accessed on: 20/03/2019.

Solar Reflection Studies

An overview of content from identified solar panel reflectivity studies is presented in the subsections below.

Evan Riley and Scott Olson, "A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems"

Evan Riley and Scott Olson published in 2011 their study titled: *A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems*[32]". They researched the potential glare that a pilot could experience from a 25 degree fixed tilt PV system located outside of Las Vegas, Nevada. The theoretical glare was estimated using published ocular safety metrics which quantify the potential for a postflash glare after-image. This was then compared to the postflash glare after-image caused by smooth water. The study demonstrated that the reflectance of the solar cell varied with angle of incidence, with maximum values occurring at angles close to 90 degrees. The reflectance values varied from approximately 5% to 30%. This is shown on the figure below.



Total reflectance % when compared to angle of incidence

The conclusions of the research study were:

- The potential for hazardous glare from flat-plate PV systems is similar to that of smooth water;
- Portland white cement concrete (which is a common concrete for runways), snow, and structural glass all have a reflectivity greater than water and flat plate PV modules.

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[32] Evan Riley and Scott Olson, "A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems," ISRN Renewable Energy, vol. 2011, Article ID 651857, 6 pages, 2011. doi:10.5402/2011/651857

FAA Guidance – “Technical Guidance for Evaluating Selected Solar Technologies on Airports”[33]

The 2010 FAA Guidance included a diagram which illustrates the relative reflectance of solar panels compared to other surfaces. The figure shows the relative reflectance of solar panels compared to other surfaces. Surfaces in this figure produce reflections which are specular and diffuse. A specular reflection (those made by most solar panels) has a reflection characteristic similar to that of a mirror. A diffuse reflection will reflect the incoming light and scatter it in many directions. A table of reflectivity values, sourced from the figure within the FAA guidance, is presented below.

Surface	Approximate Percentage of Light Reflected[34]
Snow	80
White Concrete	77
Bare Aluminium	74
Vegetation	50
Bare Soil	30
Wood Shingle	17
Water	5
Solar Panels	5
Black Asphalt	2

Relative reflectivity of various surfaces

Note that the data above does not appear to consider the reflection type (specular or diffuse).

An important comparison in this table is the reflectivity compared to water which will produce a reflection of very similar intensity when compared to that from a solar panel. The study by Riley and Olsen study (2011) also concludes that still water has a very similar reflectivity to solar panels.

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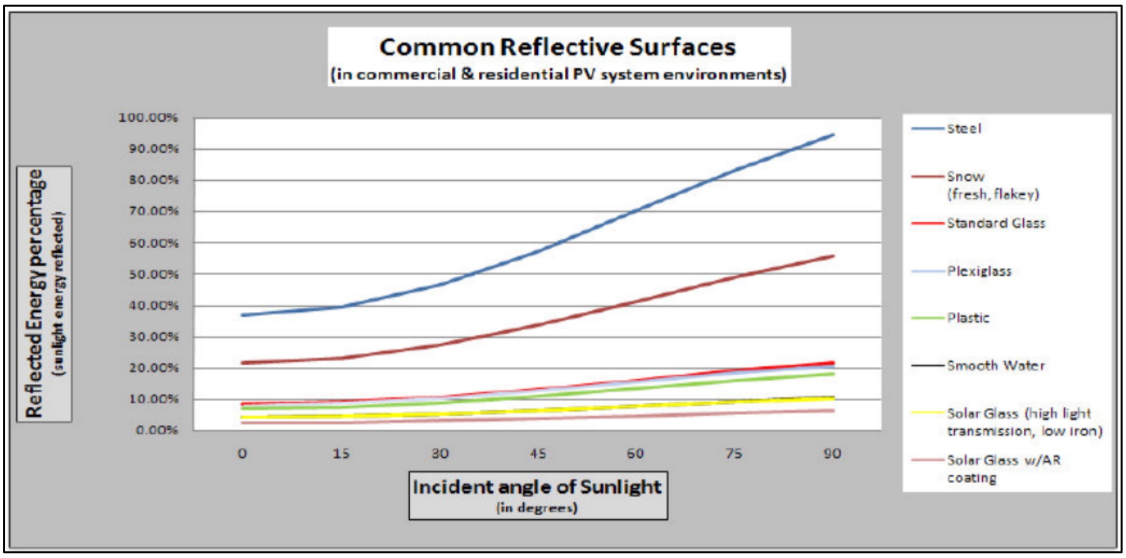
[33] Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration (FAA), date: 04/2018, accessed on: 20/03/2019.

[34] Extrapolated data, baseline of 1,000 W/m^2 for incoming sunlight.

SunPower Technical Notification (2009)

SunPower published a technical notification[35] to '*increase awareness concerning the possible glare and reflectance impact of PV Systems on their surrounding environment*'.

The figure presented below shows the relative reflectivity of solar panels compared to other natural and manmade materials including smooth water, standard glass and steel.



Common reflective surfaces

The results, similarly to those from Riley and Olsen study (2011) and the FAA (2010), show that solar panels produce a reflection that is less intense than those of '*standard glass and other common reflective surfaces*'.

With respect to aviation and solar reflections observed from the air, SunPower has developed several large installations near airports or on Air Force bases. It is stated that these developments have all passed FAA or Air Force standards with all developments considered "No Hazard to Air Navigation". The note suggests that developers discuss any possible concerns with stakeholders near proposed solar farms.

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[35] Source: Technical Support, 2009. SunPower Technical Notification – Solar Module Glare and Reflectance.

APPENDIX C – OVERVIEW OF SUN MOVEMENTS AND RELATIVE REFLECTIONS

The Sun's position in the sky can be accurately described by its azimuth and elevation. Azimuth is a direction relative to true north (horizontal angle i.e. from left to right) and elevation describes the Sun's angle relative to the horizon (vertical angle i.e. up and down).

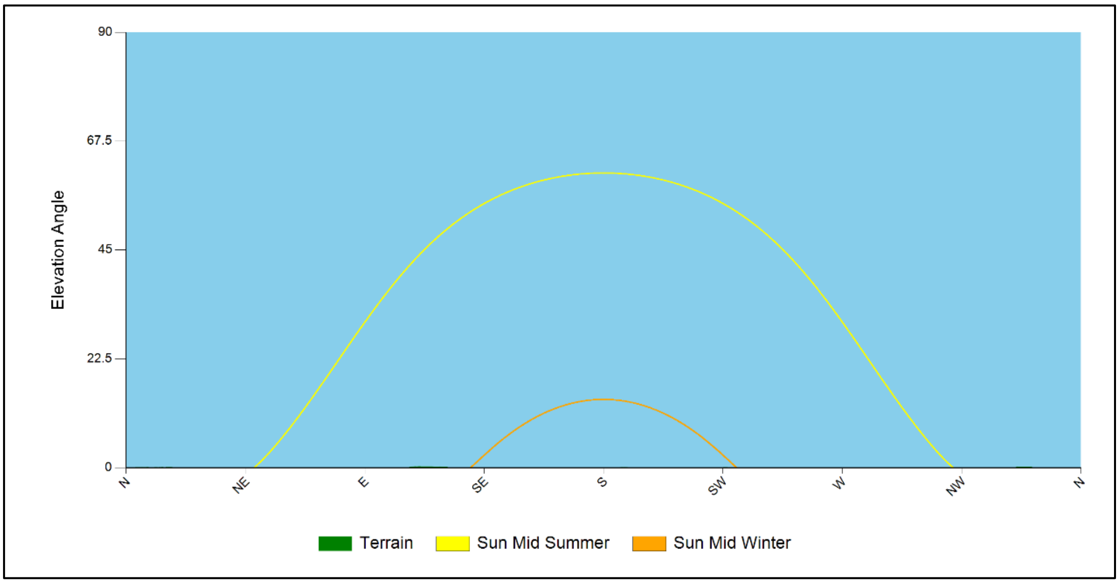
The Sun's position can be accurately calculated for a specific location. The following data being used for the calculation:

- Time;
- Date;
- Latitude;
- Longitude.

The following is true at the location of the solar development:

- The Sun is at its highest around midday and is to the south at this time;
- The Sun rises highest on 21 June (longest day);
- On 21 December, the maximum elevation reached by the Sun is at its lowest (shortest day).

The combination of the Sun's azimuth angle and vertical elevation will affect the direction and angle of the reflection from a reflector. The figure below shows terrain at the horizon from the proposed development location as well as the sunrise and sunset curves throughout the year.



Terrain at Sun horizon at loaction of the proposed development

APPENDIX D – GLINT AND GLARE IMPACT SIGNIFICANCE

Overview

The significance of glint and glare will vary for different receptors. The following section presents a general overview of the significance criteria with respect to experiencing a solar reflection.

Impact Significance Definition

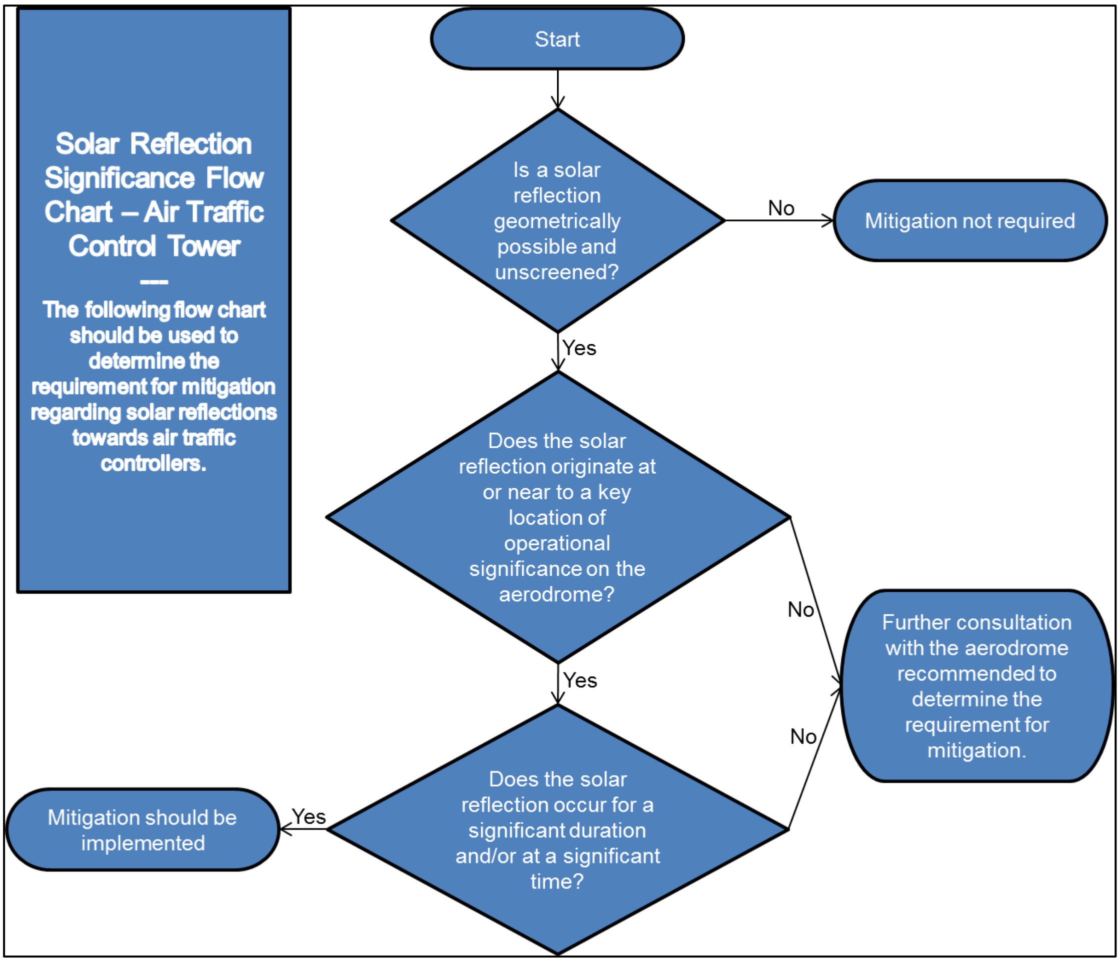
The table below presents the recommended definition of 'impact significance' in glint and glare terms and the requirement for mitigation under each.

Impact Significance	Definition	Mitigation Requirement
No Impact	A solar reflection is not geometrically possible or will not be visible from the assessed receptor.	No mitigation required.
Low	A solar reflection is geometrically possible however any impact is considered to be small such that mitigation is not required e.g. intervening screening will limit the view of the reflecting solar panels.	No mitigation required.
Moderate	A solar reflection is geometrically possible and visible however it occurs under conditions that do not represent a worst-case.	Whilst the impact may be acceptable, consultation and/or further analysis should be undertaken to determine the requirement for mitigation.
Major	A solar reflection is geometrically possible and visible under conditions that will produce a significant impact. Mitigation and consultation is recommended.	Mitigation will be required if the proposed solar development is to proceed.

Impact significance definition

Impact Significance Determination for an ATC Tower

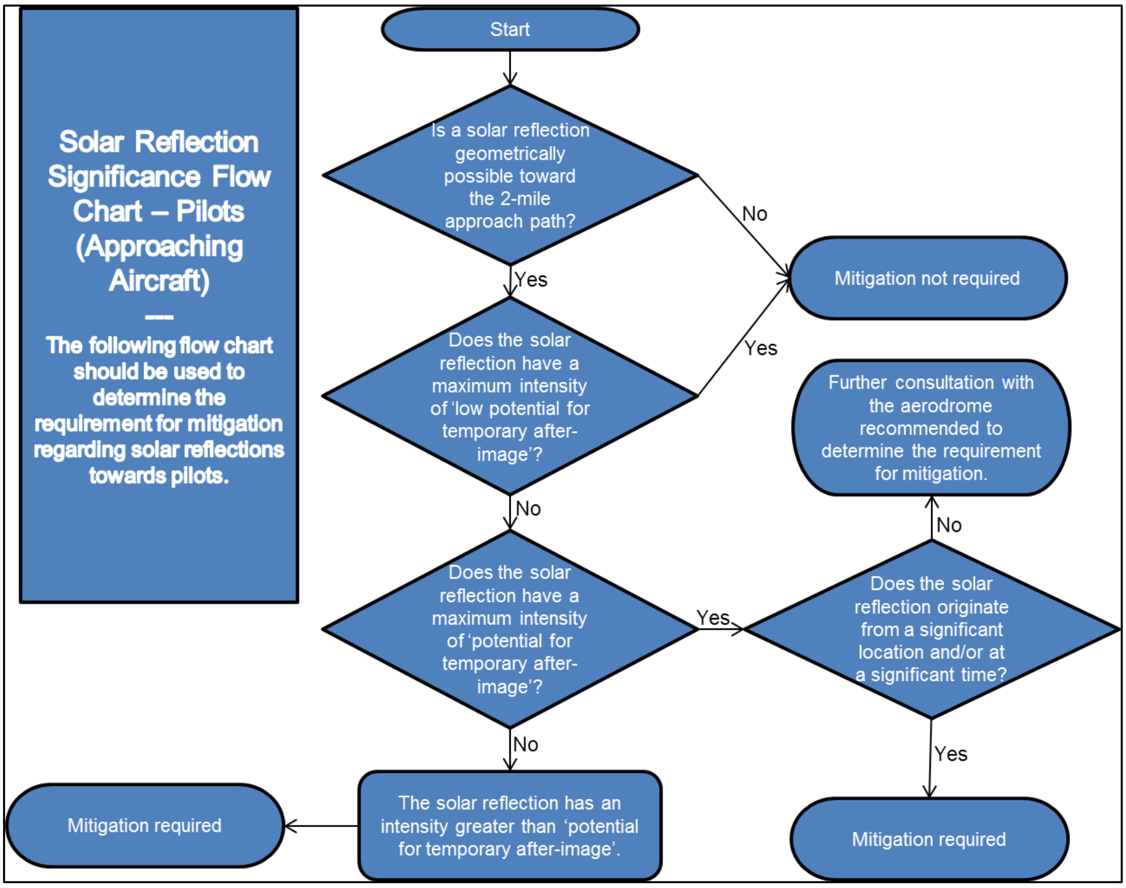
The flow chart presented below has been followed when determining the mitigation requirement for an ATC Tower.



ATC Tower mitigation requirement flow chart

Impact Significance Determination for Approaching Aircraft

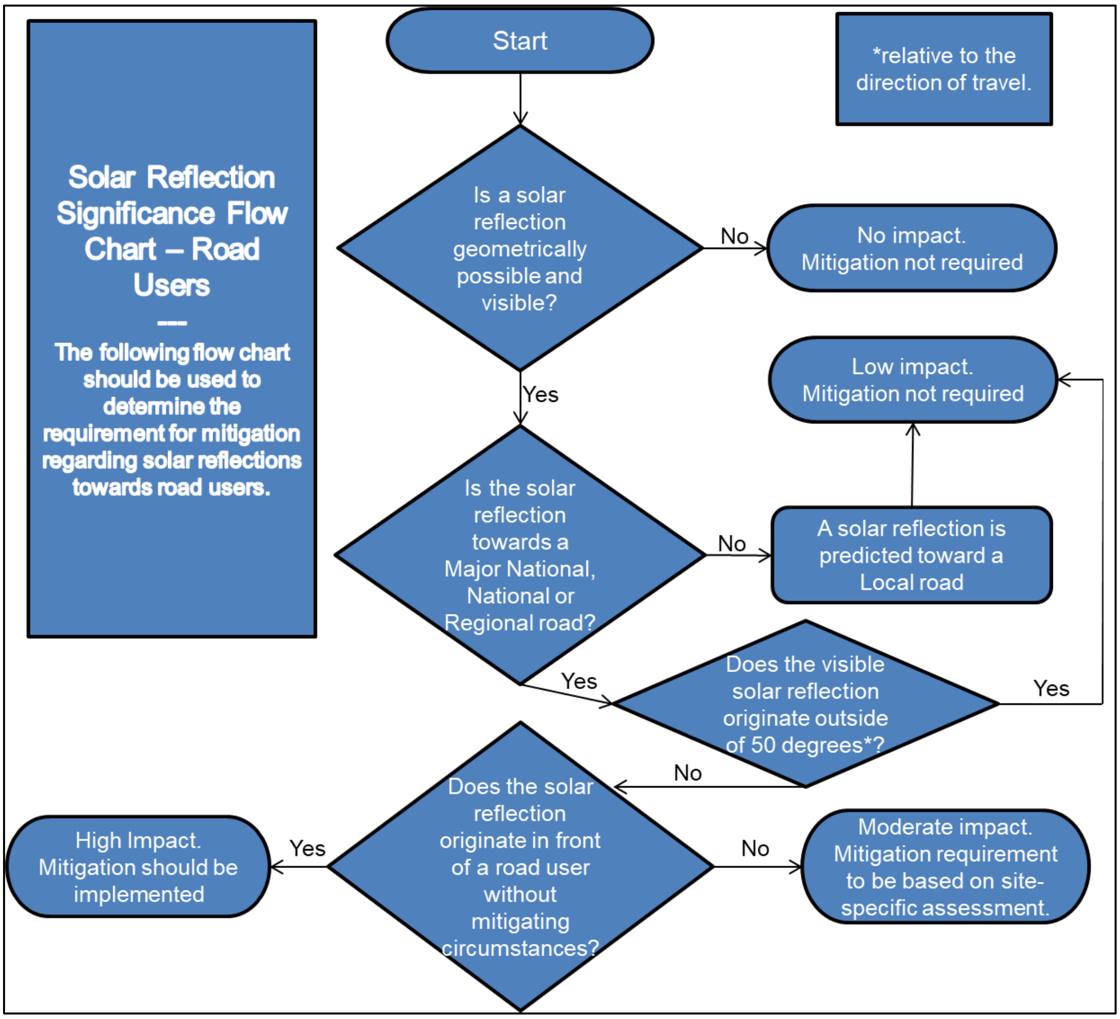
The flow chart presented below has been followed when determining the mitigation requirement for approaching aircraft.



Approaching aircraft receptor mitigation requirement flow chart

Impact Significance Determination for Road Receptors

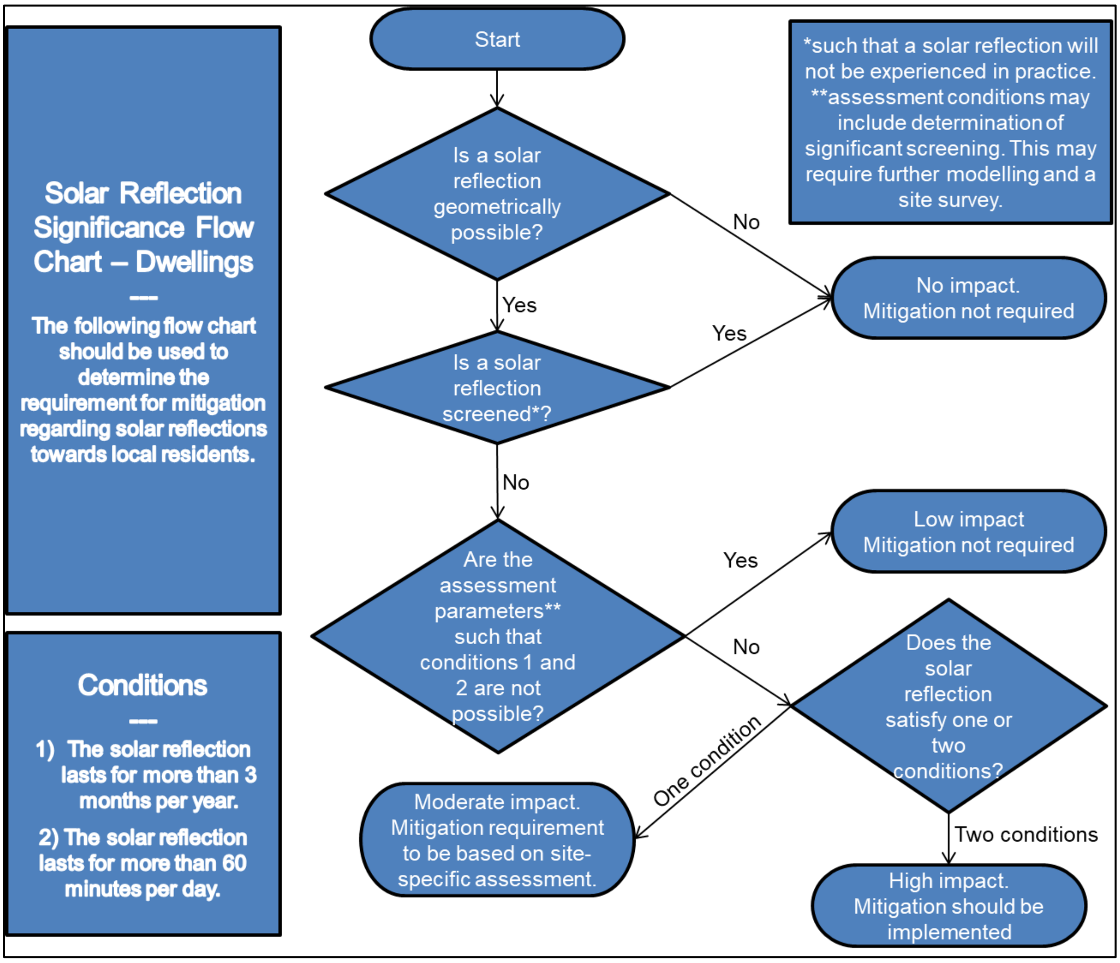
The flow chart presented below has been followed when determining the mitigation requirement for road receptors.



Road user impact significance flow chart

Impact Significance Determination for Dwelling Receptors

The flow chart presented below has been followed when determining the mitigation requirement for dwelling receptors.



Dwelling impact significance flow chart

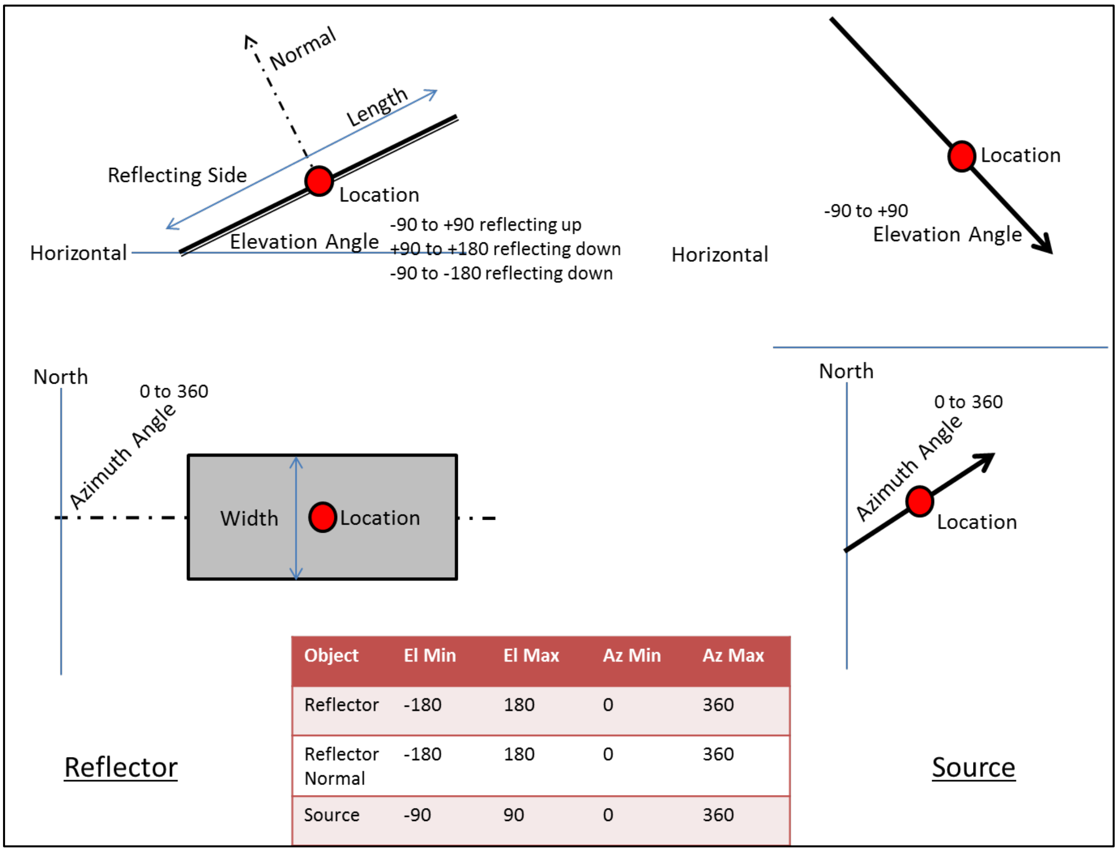
APPENDIX E – REFLECTION CALCULATIONS METHODOLOGY

Pager Power Methodology

The calculations are three dimensional and complex, accounting for:

- The Earth's orbit around the Sun;
- The Earth's rotation;
- The Earth's orientation;
- The reflector's location;
- The reflector's 3D Orientation.

Reflections from a flat reflector are calculated by considering the normal which is an imaginary line that is perpendicular to the reflective surface and originates from it. The diagram below may be used to aid understanding of the reflection calculation process.



Object	El Min	El Max	Az Min	Az Max
Reflector	-180	180	0	360
Reflector Normal	-180	180	0	360
Source	-90	90	0	360

The following process is used to determine the 3D Azimuth and Elevation of a reflection:

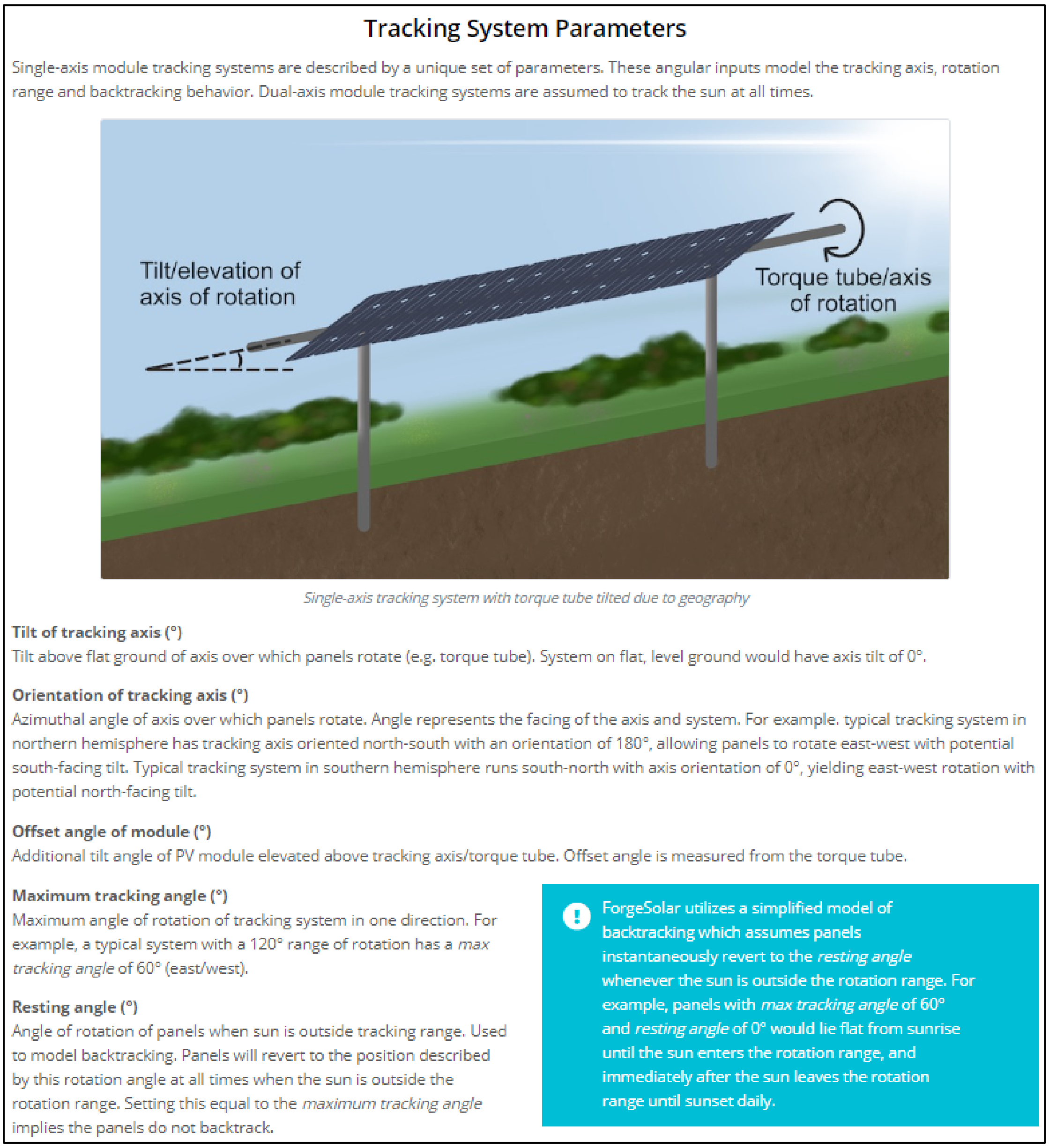
- Use the Latitude and Longitude of reflector as the reference for calculation purposes;
- Calculate the Azimuth and Elevation of the normal to the reflector;
- Calculate the 3D angle between the source and the normal;

- If this angle is less than 90 degrees a reflection will occur. If it is greater than 90 degrees no reflection will occur because the source is behind the reflector;
- Calculate the Azimuth and Elevation of the reflection in accordance with the following:
  - The angle between source and normal is equal to angle between normal and reflection;

Source, Normal and Reflection are in the same plane.

Forge Reflection Calculations Methodology

Extracts taken from the Forge Solar Model.



Tracking System Parameters

Single-axis module tracking systems are described by a unique set of parameters. These angular inputs model the tracking axis, rotation range and backtracking behavior. Dual-axis module tracking systems are assumed to track the sun at all times.

Single-axis tracking system with torque tube tilted due to geography

Tilt of tracking axis (°)
Tilt above flat ground of axis over which panels rotate (e.g. torque tube). System on flat, level ground would have axis tilt of 0°.

Orientation of tracking axis (°)
Azimuthal angle of axis over which panels rotate. Angle represents the facing of the axis and system. For example, typical tracking system in northern hemisphere has tracking axis oriented north-south with an orientation of 180°, allowing panels to rotate east-west with potential south-facing tilt. Typical tracking system in southern hemisphere runs south-north with axis orientation of 0°, yielding east-west rotation with potential north-facing tilt.

Offset angle of module (°)
Additional tilt angle of PV module elevated above tracking axis/torque tube. Offset angle is measured from the torque tube.

Maximum tracking angle (°)
Maximum angle of rotation of tracking system in one direction. For example, a typical system with a 120° range of rotation has a *max tracking angle* of 60° (east/west).

Resting angle (°)
Angle of rotation of panels when sun is outside tracking range. Used to model backtracking. Panels will revert to the position described by this rotation angle at all times when the sun is outside the rotation range. Setting this equal to the *maximum tracking angle* implies the panels do not backtrack.

ForgeSolar utilizes a simplified model of backtracking which assumes panels instantaneously revert to the *resting angle* whenever the sun is outside the rotation range. For example, panels with *max tracking angle* of 60° and *resting angle* of 0° would lie flat from sunrise until the sun enters the rotation range, and immediately after the sun leaves the rotation range until sunset daily.

Tracking System Parameters

APPENDIX F – ASSESSMENT LIMITATIONS AND ASSUMPTIONS

Pager Power's Model

The model considers 100% sunlight during daylight hours which is highly conservative.

The model does not account for terrain between the reflecting solar panels and the assessed receptor where a solar reflection is geometrically possible.

The model considers terrain between the reflecting solar panels and the visible horizon (where the sun may be obstructed from view of the panels)[36].

It is assumed that the panel elevation angle assessed represents the elevation angle for all of the panels within each solar panel area defined.

It is assumed that the panel azimuth angle assessed represents the azimuth angle for all of the panels within each solar panel area defined.

Only a reflection from the face of the panel has been considered. The frame or the reverse of the frame of the solar panel has not been considered.

The model assumes that a receptor can view the face of every panel (point, defined in the following paragraph) within the development area whilst in reality this, in the majority of cases, will not occur. Therefore any predicted solar reflection from the face of a solar panel that is not visible to a receptor will not occur in practice.

A finite number of points within each solar panel area defined is chosen based on an assessment resolution so that a comprehensive understanding of the entire development can be formed. This determines whether a solar reflection could ever occur at a chosen receptor. The model does not consider the specific panel rows or the entire face of the solar panel within the development outline, rather a single point is defined every 'x' metres (based on the assessment resolution) with the geometric characteristics of the panel. A panel area is however defined to encapsulate all possible panel locations. See the figure below which illustrates this process.

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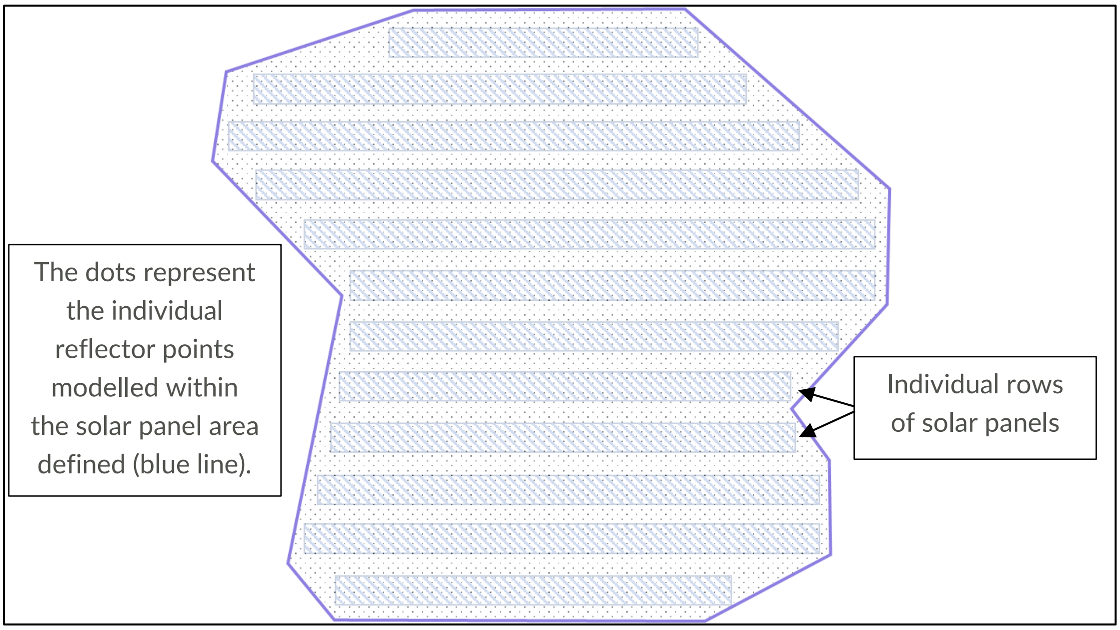
[36] UK only.



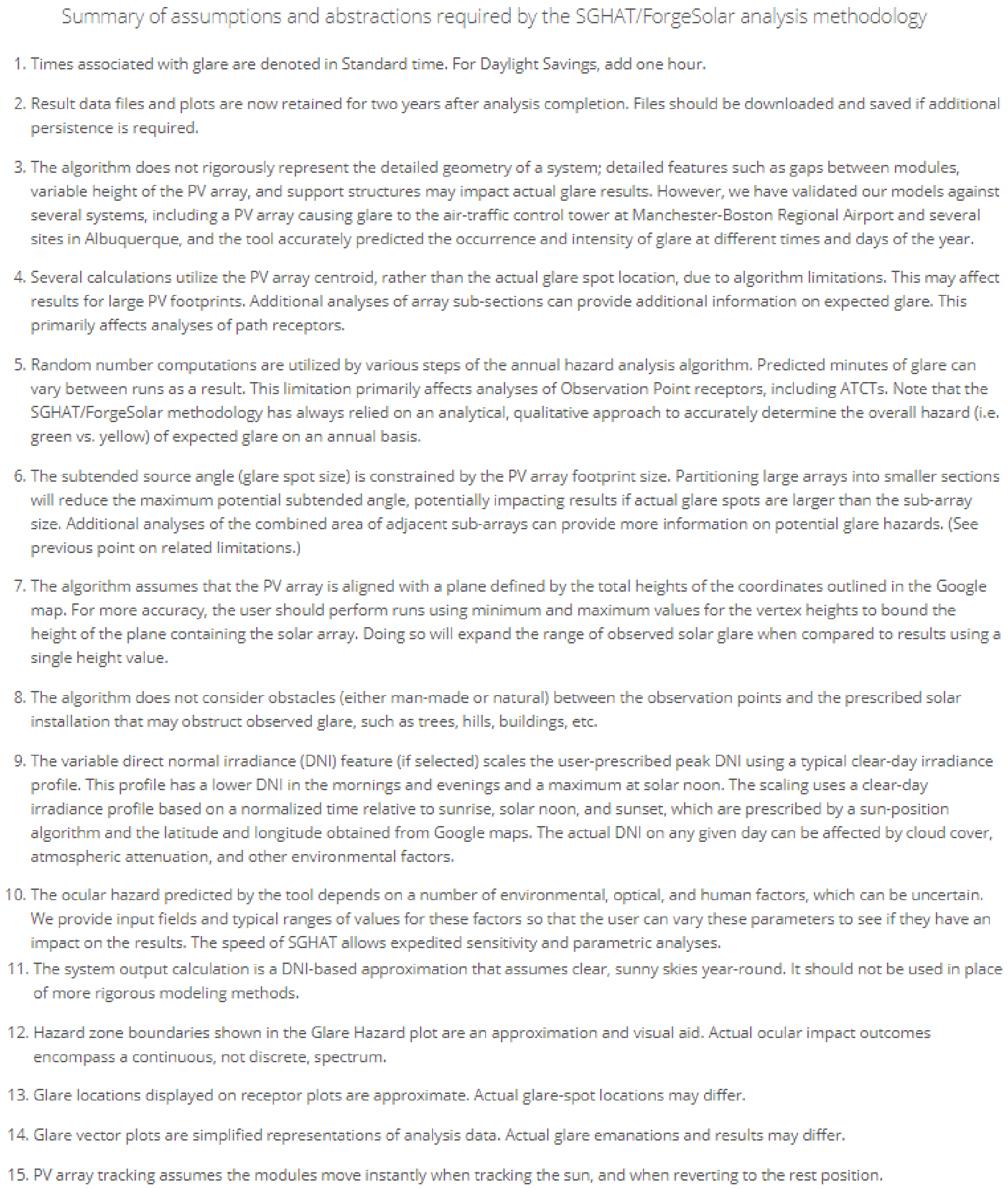
Solar panel area modelling overview

A single reflection point is chosen for the geometric calculations. This suitably determines whether a solar reflection can be experienced at a receptor location and the time of year and duration of the solar reflection. Increased accuracy could be achieved by increasing the number of heights assessed however this would only marginally change the results and is not considered significant.

The available street view imagery, satellite mapping, terrain and any site imagery provided by the developer has been used to assess line of sight from the assessed receptors to the modelled solar panel area, unless stated otherwise. In some cases, this imagery may not be up to date and may not give the full perspective of the installation from the location of the assessed receptor.

Any screening in the form of trees, buildings etc. that may obstruct the Sun from view of the solar panels is not within the modelling unless stated otherwise. The terrain profile at the horizon is considered if stated.

Forge's Sandia National Laboratories' (SGHAT) Model[37]



Summary of assumptions and abstractions required by the SGHAT/ForgeSolar analysis methodology

1. Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
2. Result data files and plots are now retained for two years after analysis completion. Files should be downloaded and saved if additional persistence is required.
3. The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
4. Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects analyses of path receptors.
5. Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
6. The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
7. The algorithm assumes that the PV array is aligned with a plane defined by the total heights of the coordinates outlined in the Google map. For more accuracy, the user should perform runs using minimum and maximum values for the vertex heights to bound the height of the plane containing the solar array. Doing so will expand the range of observed solar glare when compared to results using a single height value.
8. The algorithm does not consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
9. The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
10. The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
11. The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
12. Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
13. Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
14. Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
15. PV array tracking assumes the modules move instantly when tracking the sun, and when reverting to the rest position.

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[37] https://www.forgesolar.com/help/#assumptions

APPENDIX G – RECEPTOR AND REFLECTOR AREA DETAILS

Aviation Receptor Data

Full receptor data is available upon request.

Aerodrome	Threshold	Longitude (°)	Latitude (°)	Elevation (m amsl)
Seething	06	1.41215	52.50914	40.71
	24	1.42226	52.51283	34.00
Top Croft	10	1.32206	52.46602	51.00
	28	1.33358	52.46478	51.00
Long Stratton	17	1.21533	52.49143	50.00
	35	1.21678	52.48687	49.00
Nut Tree	09	1.29751	52.44710	52.00
	27	1.30486	52.44688	50.00
Hardwick	13	1.30405	52.46731	51.00
	31	1.31542	52.46170	52.00
Norfolk Gliding Club	03	1.15002	52.44975	56.00
	21	1.15807	52.46283	54.00
	08	1.15355	52.45410	56.00
	26	1.16196	52.45528	55.00
	15	1.15131	52.46155	53.00
	33	1.16243	52.45321	56.00

Aviation Receptor Data

Road Receptor Data

The road receptor data is presented in the table below. An additional 1.5m height has been added to the elevation to account for the eye-level of a road user.

A140

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
1	52.52501	1.25919	38.63	22	52.50688	1.24653	31.14
2	52.52417	1.25864	38.49	23	52.50599	1.24620	30.51
3	52.52334	1.25811	38.75	24	52.50513	1.24582	31.50
4	52.52249	1.25756	38.50	25	52.50431	1.24528	31.50
5	52.52167	1.25703	38.50	26	52.50348	1.24468	33.12
6	52.52083	1.25648	37.73	27	52.50266	1.24409	35.88
7	52.52000	1.25593	37.50	28	52.50183	1.24350	38.07
8	52.51918	1.25540	37.50	29	52.50101	1.24291	39.83
9	52.51833	1.25484	37.50	30	52.50018	1.24239	40.84
10	52.51750	1.25426	37.50	31	52.49932	1.24188	43.67
11	52.51668	1.25370	37.50	32	52.49850	1.24132	47.50
12	52.51588	1.25313	36.22	33	52.49769	1.24079	47.50
13	52.51507	1.25256	35.03	34	52.49686	1.24024	47.50
14	52.51421	1.25196	34.05	35	52.49602	1.23968	49.50
15	52.51341	1.25143	32.91	36	52.49520	1.23913	49.28
16	52.51253	1.25092	31.68	37	52.49437	1.23859	48.79
17	52.51168	1.25043	30.92	38	52.49350	1.23804	49.86
18	52.51090	1.24980	22.48	39	52.49267	1.23752	50.81

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
19	52.51008	1.24916	19.16	40	52.49184	1.23699	51.56
20	52.50879	1.24833	21.72	41	52.49101	1.23647	51.50
21	52.50765	1.24727	27.61	42	52.48996	1.23578	49.39

A140 receptor data

B1527

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
1	52.51606	1.23015	20.79	41	52.50119	1.28106	35.18
2	52.51575	1.23152	21.50	42	52.50118	1.28246	34.50
3	52.51524	1.23273	22.31	43	52.50146	1.28380	33.46
4	52.51481	1.23399	21.64	44	52.50160	1.28520	32.79
5	52.51457	1.23541	21.06	45	52.50161	1.28680	32.17
6	52.51401	1.23652	22.92	46	52.50149	1.28810	31.50
7	52.51351	1.23775	23.23	47	52.50118	1.28952	31.50
8	52.51290	1.23883	26.02	48	52.50090	1.29086	31.50
9	52.51233	1.23997	23.36	49	52.50103	1.29230	30.24
10	52.51167	1.24096	24.37	50	52.50081	1.29356	30.03
11	52.51090	1.24171	24.18	51	52.50049	1.29494	31.50
12	52.51008	1.24218	25.85	52	52.50038	1.29644	31.50
13	52.50935	1.24300	27.04	53	52.50048	1.29784	29.89
14	52.50877	1.24410	26.44	54	52.50077	1.29937	29.97

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
15	52.50824	1.24530	27.68	55	52.50091	1.30065	29.98
16	52.50728	1.24633	30.66	56	52.50031	1.30160	31.50
17	52.50653	1.24825	28.29	57	52.50035	1.30320	31.50
18	52.50616	1.24953	28.31	58	52.50056	1.30457	31.50
19	52.50581	1.25093	27.97	59	52.50057	1.30613	32.50
20	52.50545	1.25231	29.25	60	52.50038	1.30751	32.50
21	52.50510	1.25361	28.77	61	52.50018	1.30889	33.50
22	52.50463	1.25491	29.06	62	52.49997	1.31046	34.11
23	52.50411	1.25615	33.24	63	52.49972	1.31181	34.65
24	52.50342	1.25716	33.61	64	52.49939	1.31312	35.29
25	52.50282	1.25817	34.38	65	52.49909	1.31445	35.66
26	52.50229	1.25929	34.50	66	52.49879	1.31588	36.30
27	52.50191	1.26055	33.83	67	52.49849	1.31731	35.89
28	52.50167	1.26201	33.66	68	52.49822	1.31865	36.50
29	52.50151	1.26350	34.52	69	52.49796	1.32000	36.80
30	52.50138	1.26490	35.69	70	52.49760	1.32140	37.50
31	52.50125	1.26639	35.83	71	52.49737	1.32285	38.10
32	52.50102	1.26785	35.50	72	52.49726	1.32435	38.50
33	52.50091	1.26926	33.50	73	52.49698	1.32579	39.50
34	52.50077	1.27075	31.50	74	52.49671	1.32712	39.50
35	52.50054	1.27221	29.50	75	52.49667	1.32861	40.50

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
36	52.50059	1.27361	31.50	76	52.49632	1.32990	40.50
37	52.50075	1.27500	33.52	77	52.49597	1.33128	40.50
38	52.50096	1.27648	34.80	78	52.49591	1.33279	40.50
39	52.50107	1.27798	34.68	79	52.49595	1.33439	41.38
40	52.50122	1.27937	34.77	80	52.49612	1.33558	41.50

B1527 receptor data

Dwelling Receptor Data

The dwelling receptor data is presented in the table below. An additional 1.8m height has been added to the elevation to account for the eye-level of an observer at these dwellings.

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
1	52.52024	1.25745	39.80	229	52.49673	1.32930	40.80
2	52.52048	1.25686	38.80	230	52.49255	1.33492	44.80
3	52.51787	1.25425	37.80	231	52.49192	1.33469	45.54
4	52.51567	1.25369	35.68	232	52.49145	1.32011	42.80
5	52.51543	1.25340	35.06	233	52.49033	1.32106	44.09
6	52.51449	1.25172	34.94	234	52.48822	1.31977	46.80
7	52.51420	1.25170	34.64	235	52.48663	1.31846	47.80
8	52.51371	1.25119	34.17	236	52.48663	1.31717	48.80
9	52.51322	1.25186	32.01	237	52.48708	1.31641	48.80
10	52.51314	1.25107	32.86	238	52.48697	1.31586	48.80
11	52.51297	1.25083	33.07	239	52.48659	1.31600	48.80

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
12	52.51265	1.25062	33.18	240	52.48406	1.31198	49.65
13	52.51232	1.25043	32.99	241	52.48603	1.31190	48.80
14	52.51196	1.25018	32.15	242	52.48667	1.31170	48.80
15	52.51173	1.25007	31.50	243	52.48726	1.31165	48.80
16	52.51114	1.24945	24.57	244	52.48772	1.31155	48.80
17	52.51122	1.24898	21.15	245	52.48827	1.31127	48.80
18	52.51130	1.24856	21.37	246	52.48843	1.31067	47.80
19	52.51177	1.24731	21.69	247	52.48862	1.31065	47.80
20	52.51184	1.24652	19.86	248	52.48881	1.31118	48.80
21	52.51290	1.24659	29.18	249	52.48933	1.31101	48.66
22	52.51312	1.24615	25.06	250	52.48901	1.30894	48.76
23	52.51326	1.24593	25.93	251	52.48938	1.30886	47.95
24	52.51376	1.24580	32.19	252	52.49000	1.30968	47.80
25	52.51391	1.24549	32.07	253	52.49039	1.31127	47.80
26	52.51412	1.24527	33.53	254	52.49140	1.31145	46.80
27	52.51424	1.24511	33.96	255	52.49172	1.31085	46.69
28	52.51438	1.24497	33.30	256	52.49180	1.31160	46.80
29	52.51451	1.24480	33.14	257	52.49253	1.31179	45.82
30	52.51465	1.24462	33.72	258	52.49300	1.31202	44.65
31	52.51478	1.24435	33.86	259	52.49429	1.31137	43.80
32	52.51498	1.24410	32.58	260	52.49570	1.29781	36.67

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
33	52.51509	1.24389	32.80	261	52.49564	1.29699	35.77
34	52.51523	1.24370	32.80	262	52.49500	1.29635	35.28
35	52.51539	1.24343	31.20	263	52.49505	1.29768	37.27
36	52.51553	1.24209	26.45	264	52.49452	1.29758	39.66
37	52.51647	1.24032	31.61	265	52.49376	1.29764	41.80
38	52.51642	1.23906	21.47	266	52.49194	1.29401	32.42
39	52.51625	1.23784	20.03	267	52.48573	1.30614	46.80
40	52.51427	1.23518	24.25	268	52.48522	1.30574	47.39
41	52.50430	1.22444	43.24	269	52.48342	1.30579	48.38
42	52.50310	1.22472	45.65	270	52.48353	1.30468	48.25
43	52.50261	1.22819	40.80	271	52.48354	1.30388	48.46
44	52.50212	1.22904	38.80	272	52.48359	1.30339	48.80
45	52.50194	1.22806	40.65	273	52.47355	1.32432	47.80
46	52.50159	1.22461	43.65	274	52.47257	1.31759	51.80
47	52.49999	1.22732	36.13	275	52.47293	1.31762	51.80
48	52.50055	1.23510	38.56	276	52.47801	1.32009	46.80
49	52.50008	1.24278	41.20	277	52.53581	1.37224	31.79
50	52.49848	1.24094	47.80	278	52.53817	1.36328	36.26
51	52.49715	1.24183	47.80	279	52.53561	1.36081	38.44
52	52.49632	1.23939	49.80	280	52.53639	1.35878	38.80
53	52.49552	1.23982	49.66	281	52.53642	1.35809	38.80

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
54	52.49498	1.23965	50.68	282	52.53734	1.35521	39.80
55	52.49419	1.23907	50.16	283	52.53577	1.35337	40.56
56	52.49362	1.23886	50.94	284	52.53594	1.35221	40.80
57	52.49350	1.24015	50.96	285	52.53481	1.35274	40.80
58	52.49316	1.24123	51.60	286	52.53373	1.35257	41.18
59	52.49252	1.24179	51.52	287	52.53318	1.35199	41.80
60	52.49204	1.24140	52.53	288	52.53171	1.35090	43.34
61	52.49139	1.24140	52.90	289	52.53005	1.35841	42.80
62	52.49098	1.24079	53.80	290	52.52801	1.35925	42.92
63	52.49044	1.24091	53.35	291	52.52794	1.36026	42.44
64	52.48999	1.24064	52.83	292	52.53152	1.37327	32.80
65	52.48940	1.24001	51.43	293	52.53102	1.37458	32.07
66	52.48864	1.23973	50.75	294	52.53086	1.37203	33.72
67	52.49664	1.24450	45.81	295	52.53039	1.37090	33.80
68	52.49606	1.24705	45.90	296	52.52994	1.37149	33.30
69	52.49554	1.24830	47.80	297	52.52948	1.37137	35.27
70	52.49017	1.24961	52.80	298	52.52888	1.37120	37.21
71	52.50206	1.25608	37.26	299	52.52559	1.37942	39.21
72	52.49939	1.25556	43.54	300	52.52449	1.35205	41.80
73	52.49890	1.25612	43.80	301	52.52165	1.38192	29.94
74	52.49807	1.25631	45.41	302	52.52143	1.38107	30.17

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
75	52.49749	1.25635	46.11	303	52.51793	1.37856	33.71
76	52.49922	1.26609	41.64	304	52.51793	1.38283	31.80
77	52.48769	1.26265	49.59	305	52.52021	1.39194	31.45
78	52.48776	1.26304	48.80	306	52.51637	1.38219	34.10
79	52.48831	1.26489	47.80	307	52.51496	1.38696	34.80
80	52.48895	1.26483	47.74	308	52.51894	1.40447	37.03
81	52.48871	1.26605	47.06	309	52.51685	1.41197	35.80
82	52.48694	1.26616	47.80	310	52.51606	1.41149	36.80
83	52.48626	1.26505	48.65	311	52.51571	1.41149	36.80
84	52.48579	1.26459	49.70	312	52.51328	1.41673	36.80
85	52.48546	1.26541	49.43	313	52.51166	1.39397	37.00
86	52.48504	1.26509	49.80	314	52.50683	1.41582	40.80
87	52.48459	1.26492	50.54	315	52.50569	1.37996	33.00
88	52.51047	1.25498	21.51	316	52.50622	1.37677	33.80
89	52.52685	1.28272	26.04	317	52.50283	1.37848	33.80
90	52.52631	1.28271	26.62	318	52.50199	1.37961	32.43
91	52.52619	1.28339	26.67	319	52.50158	1.37588	32.80
92	52.52616	1.28452	26.84	320	52.50150	1.37517	32.80
93	52.52523	1.28489	28.66	321	52.50044	1.37900	29.48
94	52.52550	1.28565	28.53	322	52.49999	1.37886	27.80
95	52.52549	1.28690	29.07	323	52.49964	1.37851	27.89

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
96	52.52559	1.28803	29.80	324	52.49929	1.37823	27.80
97	52.52245	1.29170	38.57	325	52.49903	1.37818	27.80
98	52.52185	1.29269	40.89	326	52.49878	1.37803	27.80
99	52.52168	1.29324	41.07	327	52.49855	1.37800	27.58
100	52.52111	1.29609	41.80	328	52.49810	1.37774	27.41
101	52.52097	1.29746	41.80	329	52.49794	1.37736	26.89
102	52.52093	1.29822	41.52	330	52.49805	1.37696	27.18
103	52.52102	1.29878	40.80	331	52.49814	1.37643	27.56
104	52.52069	1.30071	40.80	332	52.49793	1.37652	26.97
105	52.52203	1.30233	39.04	333	52.49775	1.37650	26.80
106	52.52227	1.30292	38.80	334	52.49760	1.37651	26.80
107	52.52263	1.30284	38.50	335	52.49742	1.37649	26.66
108	52.52318	1.30265	37.22	336	52.49721	1.37709	26.58
109	52.52206	1.30459	38.80	337	52.49670	1.37651	25.80
110	52.52181	1.30579	40.02	338	52.49647	1.37590	25.80
111	52.52090	1.30582	41.13	339	52.49646	1.37682	25.80
112	52.52164	1.30669	40.36	340	52.49618	1.37625	25.80
113	52.52149	1.30813	40.50	341	52.49597	1.37629	25.80
114	52.52287	1.30821	37.46	342	52.49575	1.37643	25.80
115	52.51904	1.31351	38.77	343	52.49512	1.37600	25.80
116	52.51865	1.31321	38.66	344	52.49532	1.37813	26.24

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
117	52.51858	1.31532	41.50	345	52.49489	1.37606	25.58
118	52.50604	1.28725	28.58	346	52.49467	1.37605	25.36
119	52.50687	1.29109	34.52	347	52.49444	1.37603	25.36
120	52.50498	1.29289	30.01	348	52.49417	1.37604	25.38
121	52.50538	1.29311	31.24	349	52.49400	1.37607	25.35
122	52.50530	1.29416	31.02	350	52.49378	1.37615	25.06
123	52.50560	1.29482	32.82	351	52.49316	1.37521	25.80
124	52.50630	1.29494	35.44	352	52.49301	1.37666	24.11
125	52.50680	1.29526	37.10	353	52.49653	1.38118	31.80
126	52.50748	1.29552	39.97	354	52.49628	1.38125	31.50
127	52.50736	1.29636	39.80	355	52.49601	1.38101	30.81
128	52.50730	1.29738	40.37	356	52.49413	1.40162	34.80
129	52.50689	1.29756	39.78	357	52.49325	1.40162	34.08
130	52.50649	1.29733	38.02	358	52.46731	1.18067	49.85
131	52.50592	1.29712	35.70	359	52.46629	1.17983	51.41
132	52.50538	1.29696	34.56	360	52.46480	1.17990	49.80
133	52.50488	1.29672	33.35	361	52.46469	1.17924	49.80
134	52.50427	1.29664	32.16	362	52.46453	1.17929	49.80
135	52.50399	1.29715	31.50	363	52.46437	1.17935	49.80
136	52.50288	1.29784	31.65	364	52.46421	1.17941	50.05
137	52.50238	1.29902	31.80	365	52.46404	1.17945	50.24

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
138	52.50185	1.30066	31.57	366	52.46389	1.17949	50.50
139	52.50097	1.30101	29.88	367	52.46365	1.17958	50.80
140	52.50064	1.30215	31.06	368	52.46301	1.18029	51.57
141	52.50053	1.30295	31.49	369	52.46284	1.18029	51.72
142	52.50100	1.30371	30.93	370	52.46148	1.17950	51.80
143	52.50071	1.30442	31.80	371	52.46120	1.17948	51.80
144	52.50095	1.30519	31.65	372	52.46087	1.17921	52.06
145	52.50028	1.30590	32.96	373	52.46059	1.17909	52.33
146	52.50020	1.30396	32.15	374	52.46031	1.17936	52.80
147	52.50017	1.30227	31.80	375	52.46016	1.17936	52.80
148	52.49956	1.30245	32.75	376	52.46002	1.17928	52.80
149	52.49895	1.30234	32.80	377	52.45991	1.17921	52.80
150	52.49831	1.30248	33.56	378	52.45980	1.17912	52.80
151	52.49838	1.30137	33.31	379	52.45957	1.17926	53.13
152	52.49830	1.30049	33.52	380	52.45939	1.17917	53.40
153	52.49824	1.29967	33.67	381	52.45921	1.17814	52.80
154	52.49761	1.29879	33.80	382	52.45903	1.17812	52.80
155	52.49808	1.29874	33.80	383	52.45878	1.17757	53.11
156	52.49851	1.29872	33.27	384	52.45843	1.17817	53.70
157	52.49904	1.29872	32.80	385	52.45821	1.17808	53.80
158	52.49928	1.29726	32.80	386	52.45795	1.17796	53.80

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
159	52.50015	1.29708	31.80	387	52.45771	1.17782	53.80
160	52.50008	1.29513	31.80	388	52.45737	1.17752	54.18
161	52.50077	1.29437	31.70	389	52.45677	1.17684	54.80
162	52.50067	1.29315	29.00	390	52.45653	1.17695	54.80
163	52.50114	1.29172	31.68	391	52.45608	1.17798	54.80
164	52.50254	1.29020	30.80	392	52.45588	1.17795	54.80
165	52.50098	1.28234	35.10	393	52.45572	1.17713	54.80
166	52.50155	1.28063	33.67	394	52.45557	1.17634	54.80
167	52.50125	1.27829	34.47	395	52.45523	1.17621	54.80
168	52.50133	1.27492	33.30	396	52.45486	1.17615	54.80
169	52.49523	1.28548	35.80	397	52.45461	1.17615	54.80
170	52.49513	1.28610	35.80	398	52.45438	1.17610	54.80
171	52.49397	1.28403	36.55	399	52.45406	1.17727	54.80
172	52.49345	1.28311	37.72	400	52.45366	1.17736	54.80
173	52.49182	1.28300	37.98	401	52.45330	1.17655	54.80
174	52.48990	1.28162	40.55	402	52.45317	1.17692	54.80
175	52.48943	1.28012	39.95	403	52.45267	1.17588	54.80
176	52.48902	1.27971	41.01	404	52.45245	1.17581	54.80
177	52.48877	1.27940	41.09	405	52.45217	1.17568	54.71
178	52.48853	1.27860	41.94	406	52.45194	1.17559	54.53
179	52.48828	1.27779	44.95	407	52.45165	1.17548	54.31

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
180	52.48790	1.27723	45.80	408	52.44785	1.17824	51.30
181	52.48738	1.27655	46.80	409	52.44850	1.18899	53.80
182	52.48687	1.27601	46.80	410	52.44727	1.19241	53.91
183	52.48657	1.27502	46.80	411	52.44738	1.19388	54.80
184	52.48687	1.27399	46.80	412	52.44693	1.19351	54.14
185	52.48695	1.27289	46.92	413	52.44296	1.19464	51.48
186	52.48533	1.27377	47.28	414	52.44133	1.19563	48.70
187	52.48442	1.27287	47.80	415	52.44035	1.19932	48.85
188	52.48387	1.29470	50.07	416	52.44057	1.19945	49.92
189	52.48279	1.29510	50.80	417	52.44112	1.19902	51.24
190	52.48251	1.29506	51.07	418	52.44145	1.19946	51.29
191	52.46970	1.28952	48.07	419	52.44164	1.19956	51.80
192	52.46882	1.28685	49.91	420	52.44187	1.19969	52.23
193	52.46864	1.28770	50.49	421	52.44201	1.19980	52.14
194	52.46804	1.28822	50.80	422	52.44273	1.19770	52.80
195	52.46782	1.28867	51.18	423	52.44257	1.19913	52.80
196	52.46716	1.29163	51.17	424	52.44272	1.20141	52.80
197	52.46815	1.29902	51.90	425	52.44322	1.20196	53.49
198	52.46452	1.30345	52.95	426	52.44665	1.20546	55.80
199	52.53812	1.32263	30.64	427	52.44739	1.20505	55.80
200	52.53789	1.32292	30.41	428	52.45051	1.21132	55.80

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
201	52.53758	1.32361	30.90	429	52.45419	1.19966	54.80
202	52.53689	1.32507	33.48	430	52.45695	1.19948	54.80
203	52.53651	1.32558	36.13	431	52.46647	1.20848	53.80
204	52.53788	1.32404	30.80	432	52.46395	1.19570	52.80
205	52.53734	1.32543	31.80	433	52.46394	1.19501	52.80
206	52.53538	1.32894	42.80	434	52.46386	1.19420	52.80
207	52.53473	1.32905	42.80	435	52.46387	1.19362	52.80
208	52.53443	1.33089	43.06	436	52.46381	1.19326	53.12
209	52.53366	1.33061	42.80	437	52.46369	1.19287	53.19
210	52.53320	1.33305	43.67	438	52.46392	1.19213	53.69
211	52.52678	1.32821	30.12	439	52.46395	1.19085	52.84
212	52.52658	1.32863	31.36	440	52.46355	1.19036	53.51
213	52.52652	1.33697	37.97	441	52.46371	1.18937	52.80
214	52.52636	1.33839	36.83	442	52.46342	1.18842	52.80
215	52.52292	1.32310	42.36	443	52.46318	1.18785	53.71
216	52.51656	1.34342	41.80	444	52.46314	1.18753	53.39
217	52.51021	1.35202	45.80	445	52.46279	1.18703	53.66
218	52.51145	1.35427	45.03	446	52.46303	1.18598	52.80
219	52.51164	1.35557	46.01	447	52.46301	1.18555	52.80
220	52.51104	1.35461	45.80	448	52.46292	1.18507	52.80
221	52.49516	1.31348	41.98	449	52.46308	1.18377	52.00

No.	Longitude (°)	Latitude (°)	Assessed Height (m)	No.	Longitude (°)	Latitude (°)	Assessed Height (m)
222	52.49410	1.31359	43.80	450	52.45943	1.18392	53.80
223	52.49375	1.31538	43.73	451	52.45798	1.18455	54.80
224	52.49363	1.31478	44.05	452	52.45750	1.18405	54.80
225	52.49336	1.31520	43.85	453	52.45556	1.18366	54.80
226	52.49266	1.31572	44.80	454	52.45507	1.18371	54.80
227	52.49726	1.32753	39.80	455	52.45521	1.18026	54.80
228	52.49696	1.32858	40.80	456	52.45319	1.18380	54.80

Dwelling receptor data

Modelled Reflector Areas

The assessed reflector areas are shown in Figure 1 below.

Modelled Reflector Areas

The modelled reflector areas are presented in the table below.

Panel Area 1a

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.18760	52.45743	4	1.18969	52.45622
2	1.18533	52.45714	5	1.18877	52.45945
3	1.18598	52.45609	6	1.18732	52.45934

Panel Area 1a

Panel Area 1b

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.18990	52.45709	7	1.19835	52.45851
2	1.19011	52.45665	8	1.19608	52.46194
3	1.19128	52.45365	9	1.19131	52.46105
4	1.19491	52.45396	10	1.19149	52.46065
5	1.19797	52.45396	11	1.18911	52.46052
6	1.19657	52.45809	12	1.18924	52.45950

Panel Area 1b

Panel Area 1c

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.19736	52.45291	4	1.19159	52.45014
2	1.19566	52.45315	5	1.19786	52.44918
3	1.19258	52.45290	6	1.19850	52.45241

Panel Area 1c

Panel Area 2a

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.20520	52.44258	6	1.21065	52.44809
2	1.21333	52.44208	7	1.21065	52.44733
3	1.21731	52.44737	8	1.20975	52.44730

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
4	1.21274	52.44730	9	1.20998	52.44625
5	1.21327	52.44821	10	1.20620	52.44578

Panel Area 2a

Panel Area 2b

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.20772	52.45638	7	1.22291	52.45561
2	1.20781	52.45551	8	1.21754	52.45557
3	1.20800	52.45397	9	1.21744	52.45486
4	1.21447	52.45418	10	1.21510	52.45482
5	1.21448	52.45220	11	1.21432	52.45780
6	1.22064	52.45182	12	1.20733	52.45708

Panel Area 2b

Panel Area 2c

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.21915	52.46033	5	1.21837	52.45815
2	1.21985	52.46010	6	1.22439	52.45790
3	1.21966	52.45914	7	1.22525	52.46066
4	1.21865	52.45913	8	1.21943	52.46130

Panel Area 2c

Panel Area 3a

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.30720	52.48081	4	1.31136	52.48327
2	1.31218	52.48063	5	1.30867	52.48335
3	1.31222	52.48291	6	1.30763	52.48313

Panel Area 3a

Panel Area 3b

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.30145	52.47942	15	1.29762	52.47473
2	1.30198	52.47911	16	1.29937	52.47399
3	1.30204	52.47861	17	1.30050	52.47402
4	1.30143	52.47840	18	1.30074	52.47325
5	1.30073	52.47845	19	1.30120	52.47331
6	1.30033	52.47889	20	1.30219	52.47642
7	1.29711	52.47886	21	1.30388	52.47651
8	1.29537	52.47674	22	1.30455	52.47810
9	1.29551	52.47619	23	1.30561	52.47832
10	1.29532	52.47579	24	1.30579	52.47980
11	1.29622	52.47528	25	1.30244	52.47999
12	1.29662	52.47559	26	1.30219	52.48017
13	1.29731	52.47562	27	1.30148	52.48014
14	1.29775	52.47524			

Panel Area 3b

Panel Area 4

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.24044	52.50876	11	1.24648	52.50140
2	1.23991	52.50875	12	1.24762	52.50019
3	1.23851	52.50457	13	1.25027	52.49979
4	1.23787	52.50420	14	1.25029	52.50236
5	1.23773	52.50360	15	1.25097	52.50555
6	1.23451	52.50376	16	1.24718	52.50653
7	1.23442	52.50280	17	1.24560	52.50727

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
8	1.23934	52.50287	18	1.24205	52.50941
9	1.24298	52.50173	19	1.24168	52.51002
10	1.24330	52.50217			

Panel Area 4

Panel Area 5

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.27183	52.49774	12	1.28842	52.50091
2	1.26960	52.49265	13	1.28833	52.50120
3	1.27240	52.49214	14	1.28560	52.50150
4	1.27284	52.49286	15	1.28506	52.49952
5	1.27320	52.49288	16	1.28490	52.49909
6	1.27713	52.49167	17	1.28040	52.49812
7	1.27886	52.49541	18	1.27915	52.49801
8	1.28183	52.49517	19	1.27938	52.49999
9	1.28244	52.49655	20	1.27620	52.50065
10	1.28606	52.49619	21	1.27257	52.50019
11	1.28632	52.49725			

Panel Area 5

Panel Area 7a

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.25652	52.51103	6	1.26534	52.51453
2	1.25963	52.51363	7	1.26143	52.51611
3	1.26165	52.51263	8	1.25711	52.51387
4	1.26326	52.51357	9	1.25486	52.51199
5	1.26413	52.51342			

Panel Area 7a

Panel Area 7b

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.26804	52.51371	14	1.28349	52.50680
2	1.27121	52.51305	15	1.28588	52.50657
3	1.27382	52.51375	16	1.28651	52.50961
4	1.27561	52.51395	17	1.28722	52.50960
5	1.28043	52.51348	18	1.28713	52.51025
6	1.28342	52.51228	19	1.28789	52.51017
7	1.28290	52.51039	20	1.28757	52.51463
8	1.28188	52.51039	21	1.28629	52.51452
9	1.28117	52.50992	22	1.28629	52.51398
10	1.27990	52.51020	23	1.28558	52.51382
11	1.27905	52.51007	24	1.28456	52.51420
12	1.27877	52.50726	25	1.27715	52.51504
13	1.28089	52.50708	26	1.26986	52.51596

Panel Area 7b

Panel Area 7c

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.27722	52.50570	6	1.28368	52.50637
2	1.28024	52.50550	7	1.28203	52.50658
3	1.28176	52.50597	8	1.27925	52.50682
4	1.28251	52.50603	9	1.27753	52.50687
5	1.28361	52.50598	10	1.27692	52.50681

Panel Area 7c

Panel Area 7d,e,f,g,h

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.29110	52.51950	23	1.32105	52.50721
2	1.28973	52.51891	24	1.32775	52.50589
3	1.28945	52.51747	25	1.32890	52.50756
4	1.29019	52.51750	26	1.32654	52.50821
5	1.28959	52.51661	27	1.32281	52.50916
6	1.28878	52.51668	28	1.31252	52.51116
7	1.28778	52.51500	29	1.31003	52.51242
8	1.29151	52.51499	30	1.30920	52.51378
9	1.29279	52.51535	31	1.30797	52.51413
10	1.29367	52.51524	32	1.30613	52.51422
11	1.29599	52.51473	33	1.30620	52.51457
12	1.29581	52.51307	34	1.30914	52.51627
13	1.29725	52.51307	35	1.31023	52.51803
14	1.29739	52.51233	36	1.30787	52.51847
15	1.30179	52.51180	37	1.30743	52.51667
16	1.30230	52.51261	38	1.30475	52.51693
17	1.30782	52.51202	39	1.30522	52.51892
18	1.30726	52.51072	40	1.30247	52.51883
19	1.30805	52.50962	41	1.29802	52.51898
20	1.31162	52.50928	42	1.29483	52.51883
21	1.31222	52.50891	43	1.29472	52.52040
22	1.32128	52.50763	44	1.29215	52.52035

Panel Area 7d,e,f,g,h

Panel Area 7i,j,k,l

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.33206	52.50769	12	1.35139	52.51088
2	1.33504	52.50720	13	1.34939	52.51503
3	1.33846	52.50633	14	1.34743	52.51363
4	1.33978	52.50708	15	1.34322	52.51160
5	1.34130	52.50723	16	1.34067	52.50964
6	1.34698	52.50869	17	1.33871	52.50806
7	1.34727	52.50895	18	1.33611	52.50831
8	1.34815	52.50901	19	1.33103	52.51174
9	1.34889	52.50895	20	1.32845	52.51415
10	1.35075	52.50967	21	1.32541	52.51278
11	1.35046	52.51023			

Panel Area 7i,j,k,l

Panel Area 8a

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.32884	52.51920	10	1.33193	52.52281
2	1.33061	52.51810	11	1.33272	52.52326
3	1.33268	52.51905	12	1.33240	52.52346
4	1.33363	52.52108	13	1.33213	52.52329
5	1.33436	52.52121	14	1.33134	52.52440
6	1.33481	52.52098	15	1.32893	52.52490
7	1.33533	52.52162	16	1.32899	52.52462
8	1.33275	52.52279	17	1.33122	52.52310
9	1.33219	52.52258	18	1.32745	52.52087

Panel Area 8a

Panel Area 8b

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.33325	52.52952	9	1.33044	52.52801
2	1.33327	52.53008	10	1.33077	52.52766
3	1.33291	52.53016	11	1.33059	52.52723
4	1.33221	52.53117	12	1.33092	52.52685
5	1.32949	52.53000	13	1.33330	52.52720
6	1.32810	52.52882	14	1.33569	52.52801
7	1.32962	52.52898	15	1.33474	52.52918
8	1.32988	52.52806	16	1.33363	52.52922

Panel Area 8b

Panel Area 9

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.36215	52.53376	5	1.36715	52.53024
2	1.36071	52.52999	6	1.36669	52.53454
3	1.36363	52.52980	7	1.36615	52.53539
4	1.36455	52.52989	8	1.36193	52.53529

Panel Area 9

Panel Area 10a,b,c

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.38014	52.50764	21	1.38766	52.50135
2	1.38130	52.50745	22	1.39322	52.50060
3	1.38252	52.50769	23	1.39540	52.50396
4	1.38308	52.50755	24	1.39644	52.50391
5	1.38460	52.50685	25	1.39916	52.50340
6	1.38566	52.50615	26	1.39966	52.50421

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
7	1.38606	52.50649	27	1.40335	52.50439
8	1.38775	52.50630	28	1.40427	52.50642
9	1.38712	52.50379	29	1.40596	52.50780
10	1.38587	52.50378	30	1.40080	52.50863
11	1.38550	52.50307	31	1.39851	52.50870
12	1.38833	52.50349	32	1.39510	52.50864
13	1.38797	52.50209	33	1.39346	52.50817
14	1.38525	52.50276	34	1.39209	52.50853
15	1.38451	52.50204	35	1.39157	52.50913
16	1.38624	52.50145	36	1.38877	52.50868
17	1.38464	52.50026	37	1.38919	52.50976
18	1.38501	52.49931	38	1.38495	52.51056
19	1.38670	52.49946	39	1.38656	52.51234

Panel Area 10a,b,c

Panel Area 10e

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	1.40149	52.51748	14	1.40739	52.51430
2	1.40189	52.51727	15	1.40785	52.51430
3	1.40206	52.51686	16	1.40844	52.51570
4	1.40187	52.51654	17	1.40763	52.51583
5	1.40163	52.51635	18	1.40770	52.51611
6	1.40124	52.51628	19	1.40556	52.51634
7	1.40083	52.51626	20	1.40434	52.51624
8	1.40065	52.51604	21	1.40323	52.51635
9	1.40095	52.51565	22	1.40375	52.51748

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
10	1.40172	52.51496	23	1.40294	52.51776
11	1.40393	52.51411	24	1.40163	52.51796
12	1.40574	52.51372	25	1.40149	52.51748
13	1.40707	52.51371			

Panel Area 10e

APPENDIX H – DETAILLED MODELLING RESULTS

Overview

The modelling results present model areas based on the Works Plans. The modelling results aren't considered to significantly change the overall conclusions.

The Pager Power charts for the assessed receptors are shown on the following pages. Each chart shows:

- The receptor (observer) location – top right image. This also shows the azimuth range of the Sun itself at times when reflections are possible. If sunlight is experienced from the same direction as the reflecting panels, the overall impact of the reflection is reduced as discussed within the body of the report;
- The reflecting panels – bottom right image. The reflecting area is shown in yellow. If the yellow panels are not visible from the observer location, no issues will occur in practice. Additional obstructions which may obscure the panels from view are considered separately within the analysis;
- The reflection date/time graph – left hand side of the page. The blue line indicates the dates and times at which geometric reflections are possible. This relates to reflections from the yellow areas.
- The sunrise and sunset curves throughout the year (red and yellow lines).

The Forge charts for the receptors are shown on the following pages. Each chart shows:

- The annual predicted solar reflections.
- The daily duration of the solar reflections.
- The location of the proposed development where glare will originate.
- The calculated intensity of the predicted solar reflections.

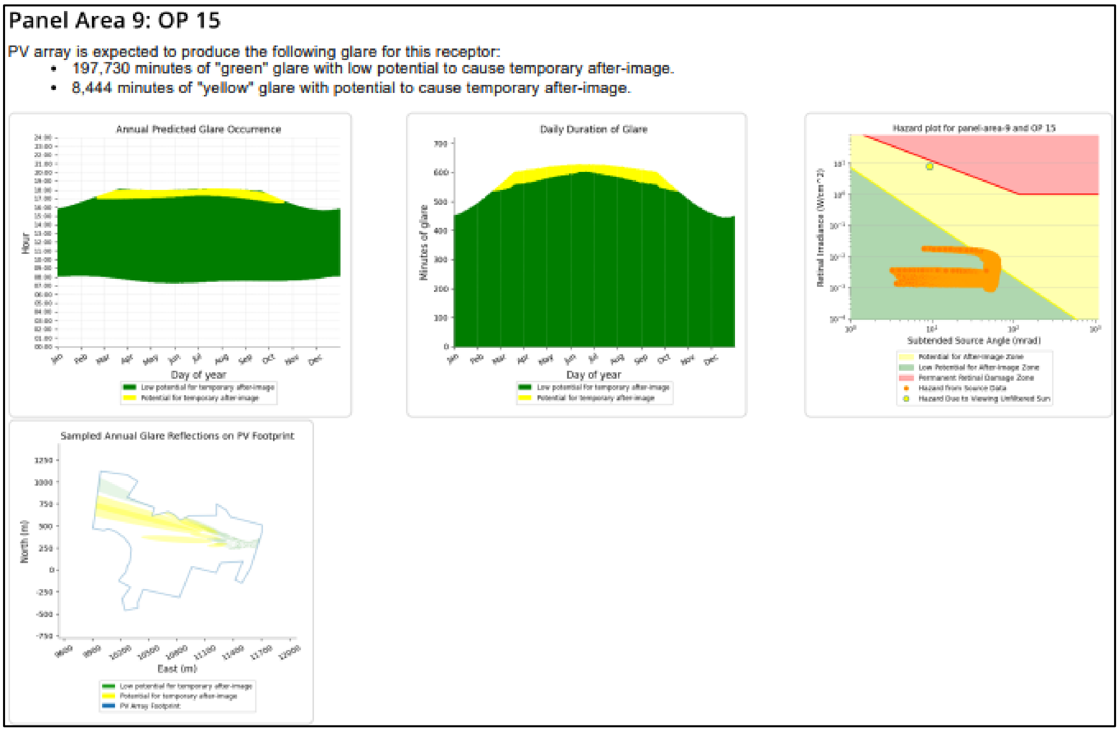
Full modelling results are available upon request.

Aviation Receptors

The modelling results are shown for the receptors where ‘yellow’ glare occurs for the longest duration.

Seething Airfield

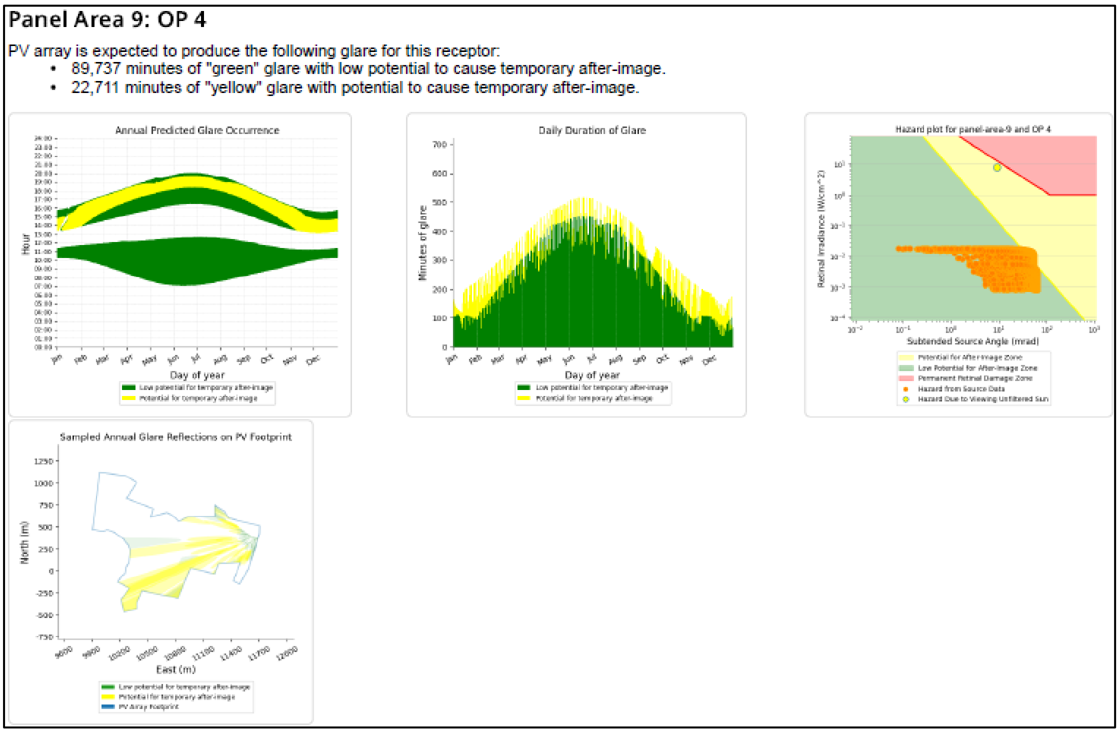
SAT Panels



Panel Area 9: OP 15

PV array is expected to produce the following glare for this receptor:

- 197,730 minutes of "green" glare with low potential to cause temporary after-image.
- 8,444 minutes of "yellow" glare with potential to cause temporary after-image.



Panel Area 9: OP 4

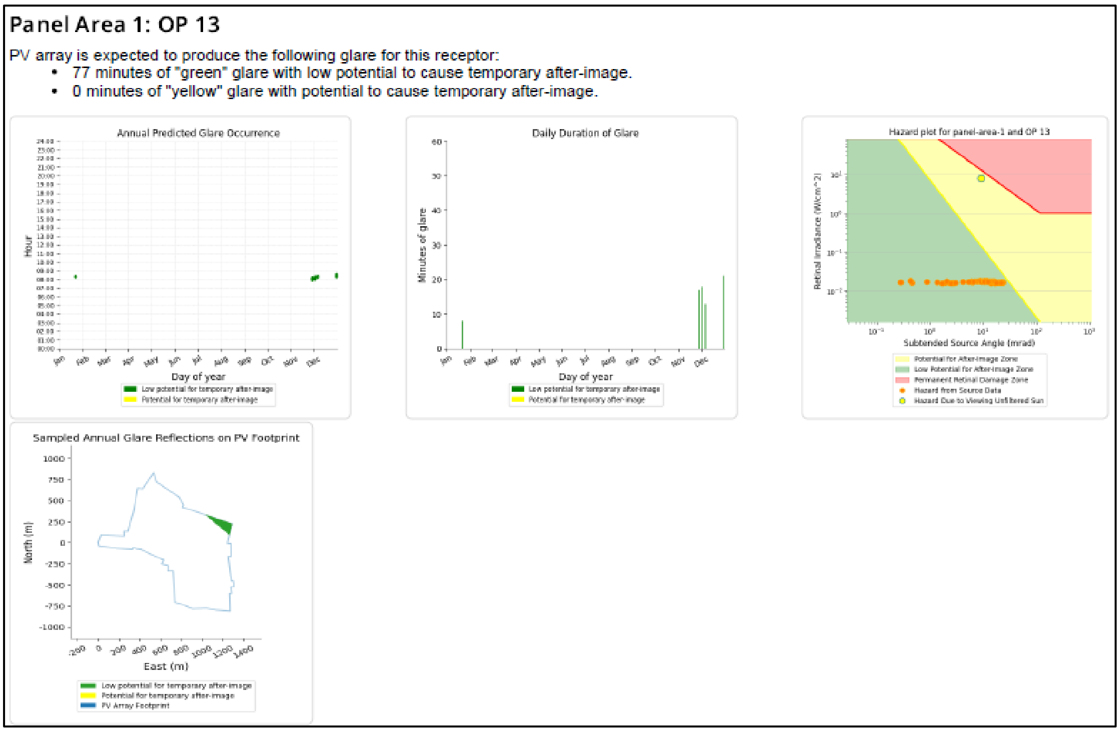
PV array is expected to produce the following glare for this receptor:

- 89,737 minutes of "green" glare with low potential to cause temporary after-image.
- 22,711 minutes of "yellow" glare with potential to cause temporary after-image.

Road Receptors

Selective results are presented for reference. Full modelling results are available upon request.

B13

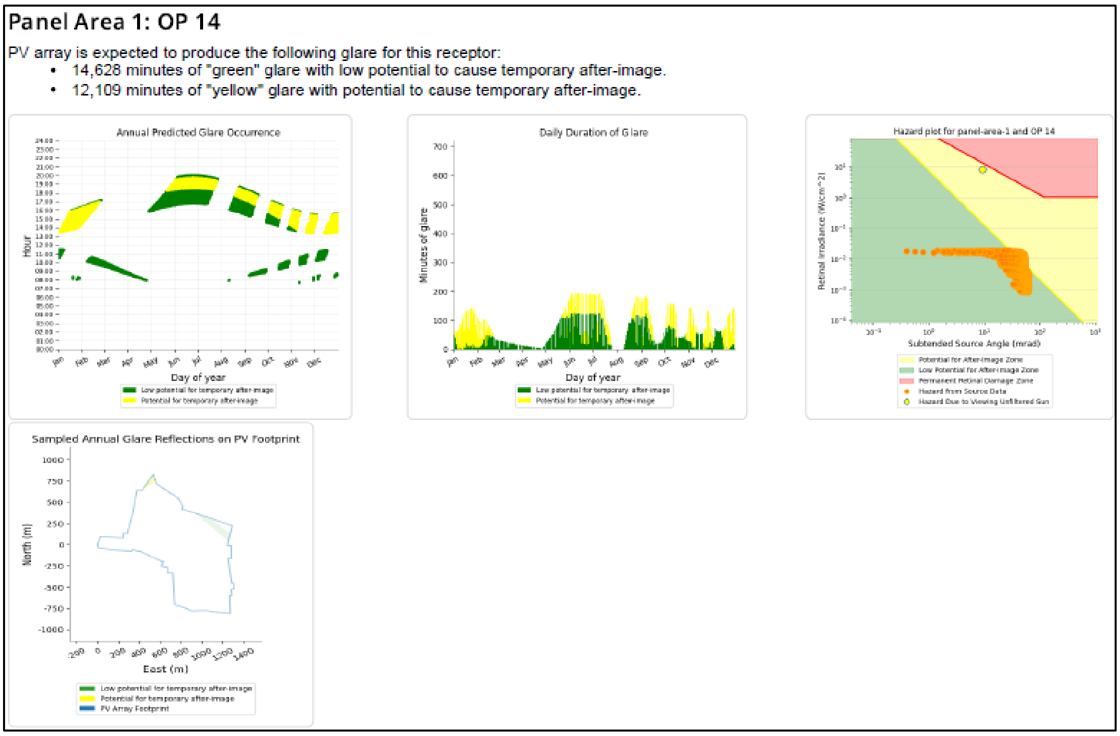


Panel Area 1: OP 13

PV array is expected to produce the following glare for this receptor:

- 77 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.

B14

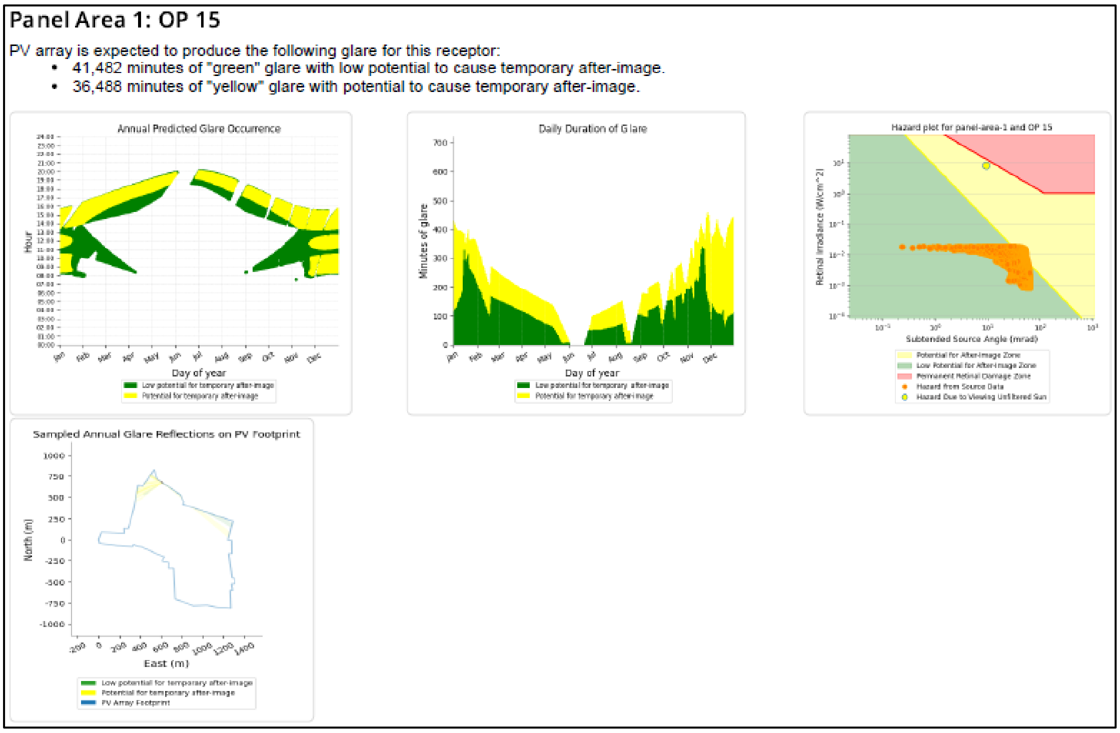


Panel Area 1: OP 14

PV array is expected to produce the following glare for this receptor:

- 14,628 minutes of "green" glare with low potential to cause temporary after-image.
- 12,109 minutes of "yellow" glare with potential to cause temporary after-image.

B15

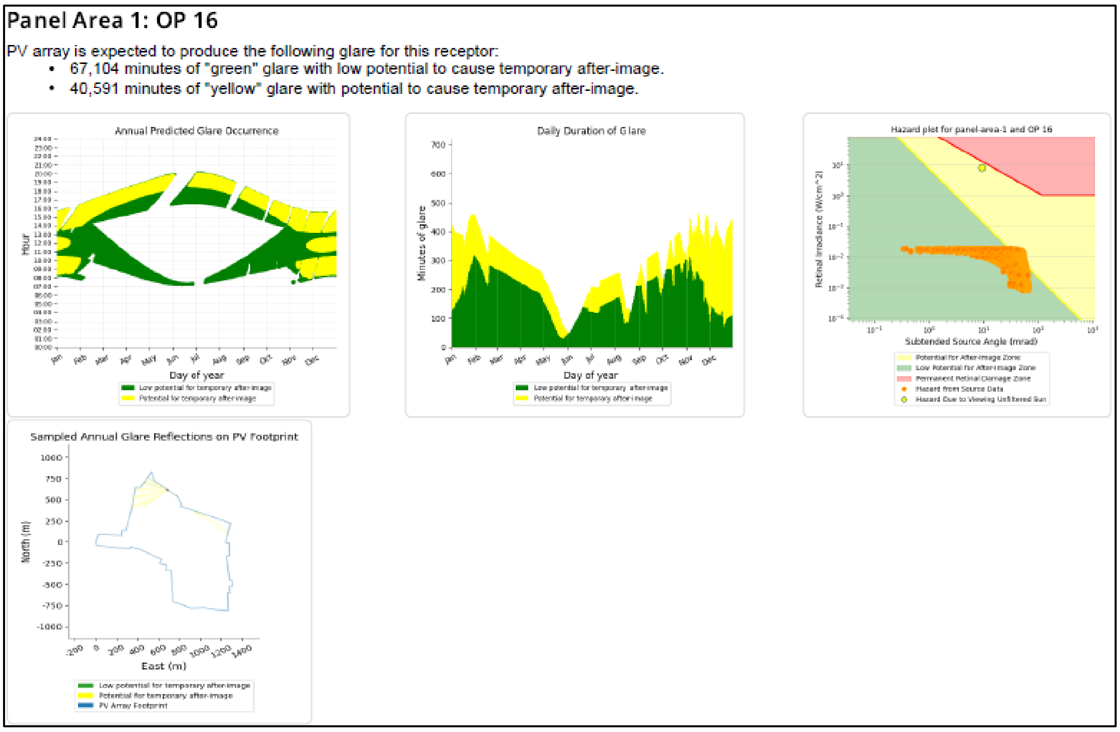


Panel Area 1: OP 15

PV array is expected to produce the following glare for this receptor:

- 41,482 minutes of "green" glare with low potential to cause temporary after-image.
- 36,488 minutes of "yellow" glare with potential to cause temporary after-image.

B16

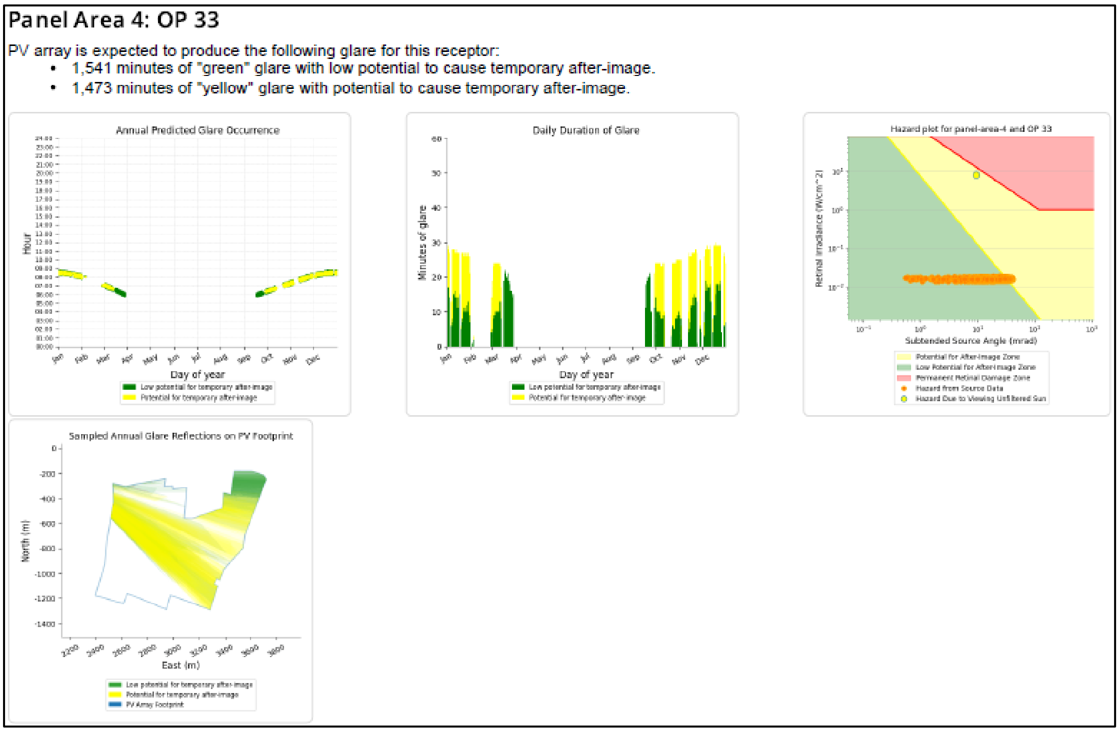


Panel Area 1: OP 16

PV array is expected to produce the following glare for this receptor:

- 67,104 minutes of "green" glare with low potential to cause temporary after-image.
- 40,591 minutes of "yellow" glare with potential to cause temporary after-image.

B33



Panel Area 4: OP 33

PV array is expected to produce the following glare for this receptor:

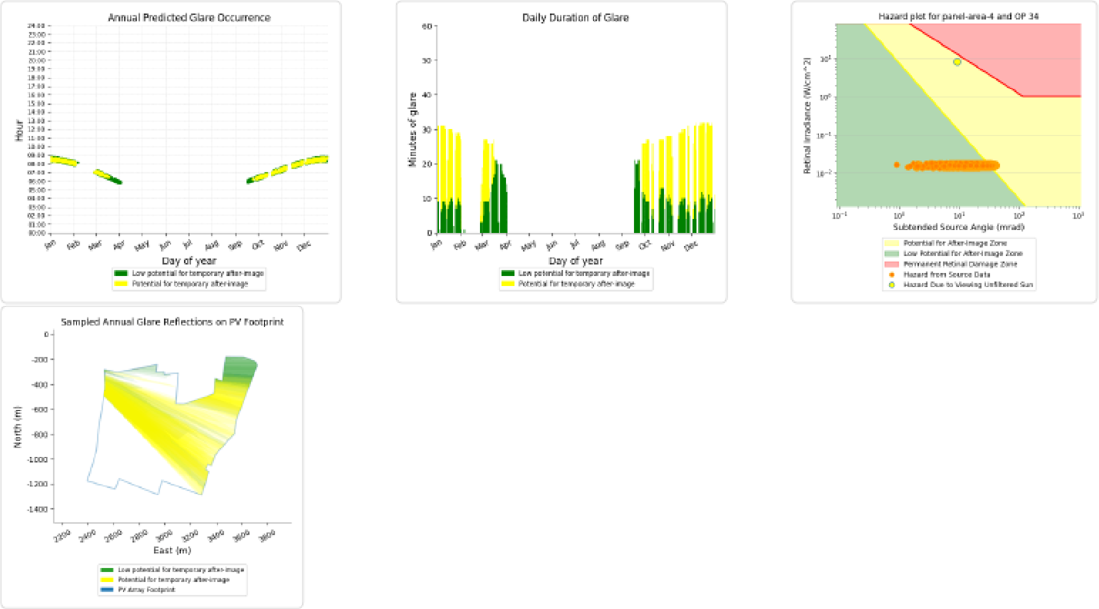
- 1,541 minutes of "green" glare with low potential to cause temporary after-image.
- 1,473 minutes of "yellow" glare with potential to cause temporary after-image.

B34

Panel Area 4: OP 34

PV array is expected to produce the following glare for this receptor:

- 1,361 minutes of "green" glare with low potential to cause temporary after-image.
- 1,998 minutes of "yellow" glare with potential to cause temporary after-image.

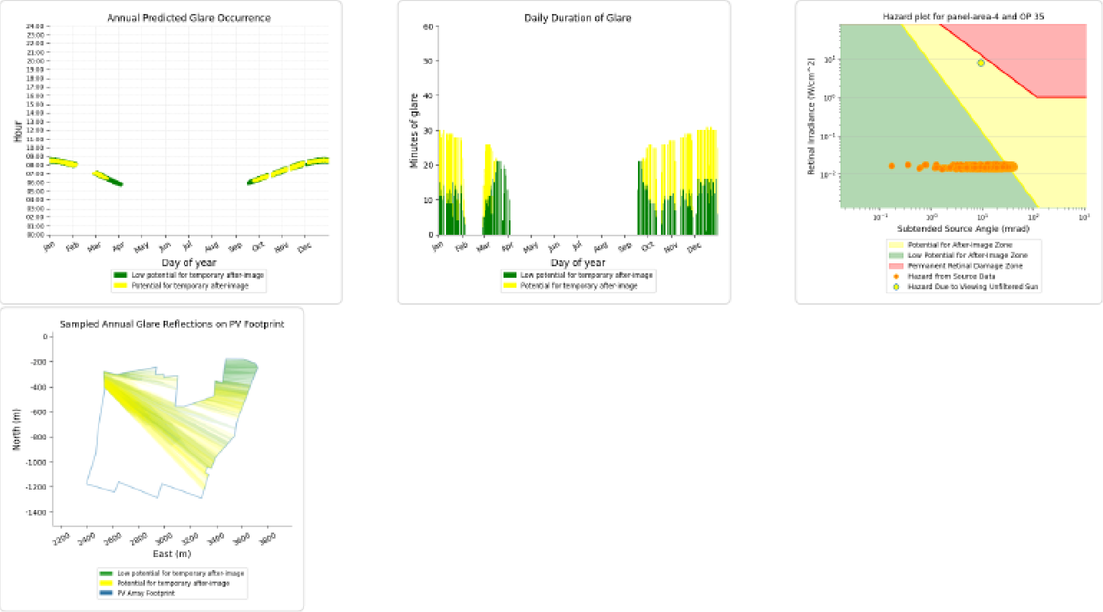


B35

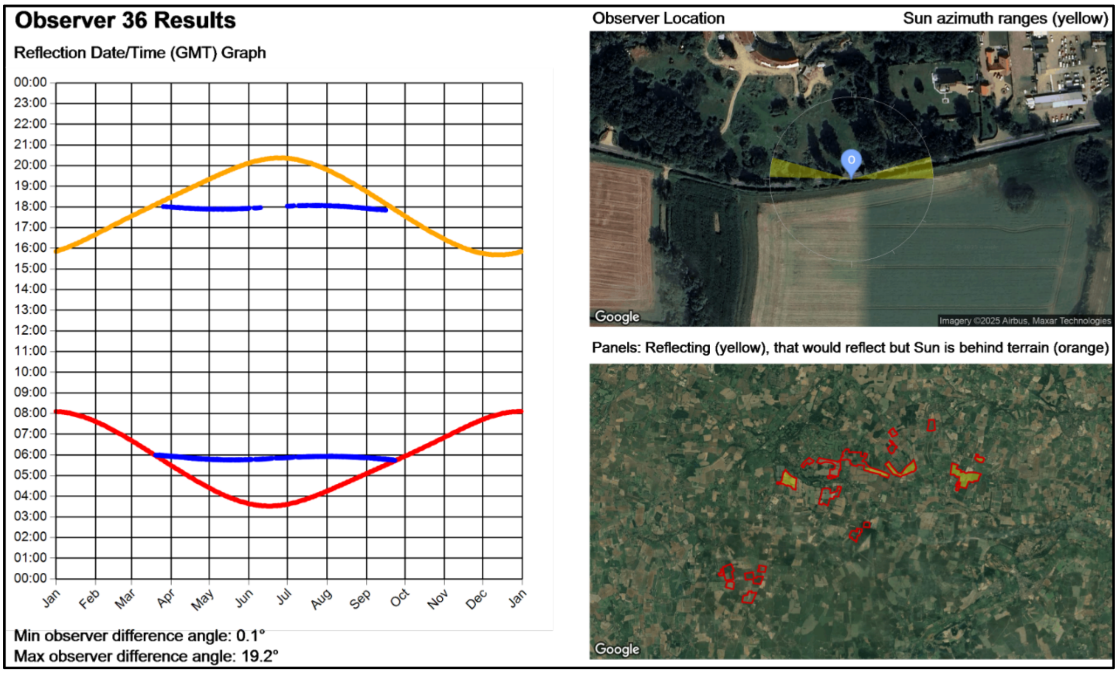
Panel Area 4: OP 35

PV array is expected to produce the following glare for this receptor:

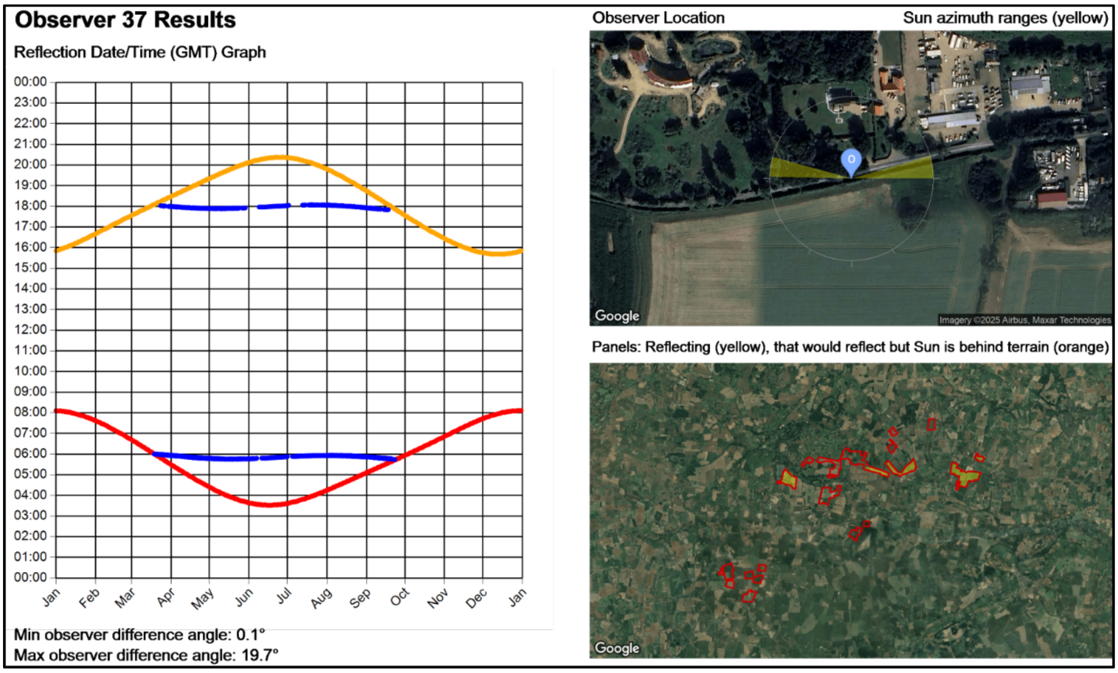
- 1,529 minutes of "green" glare with low potential to cause temporary after-image.
- 1,636 minutes of "yellow" glare with potential to cause temporary after-image.



B36

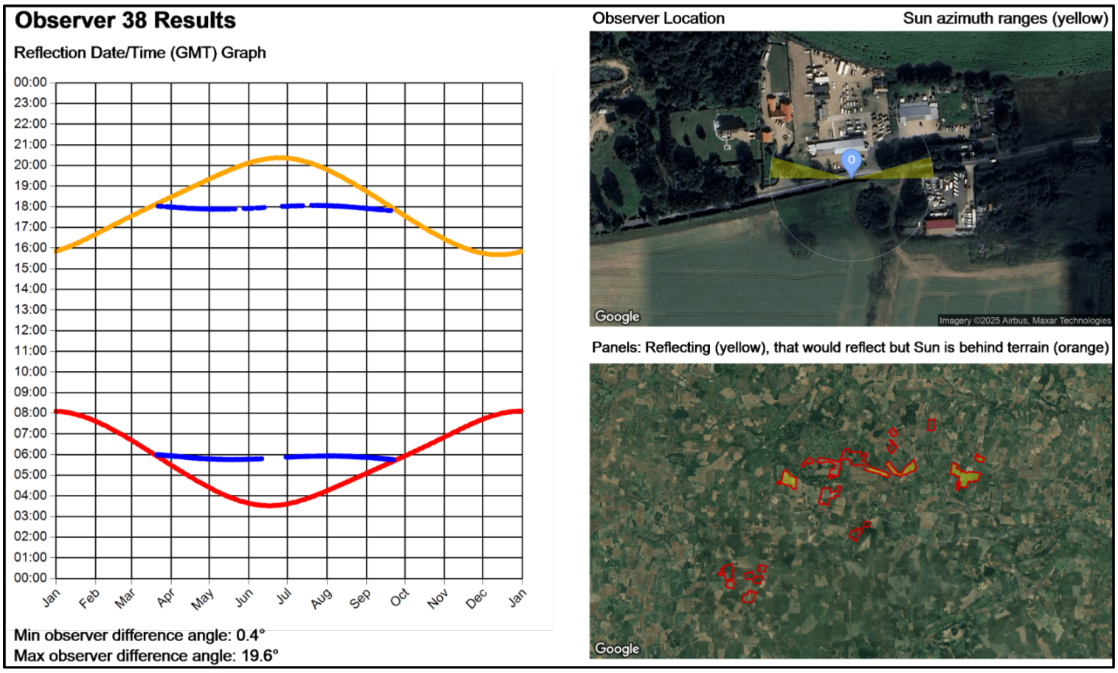

Observer 36 Results
Reflection Date/Time (GMT) Graph
00:00
23:00
22:00
21:00
20:00
19:00
18:00
17:00
16:00
15:00
14:00
13:00
12:00
11:00
10:00
09:00
08:00
07:00
06:00
05:00
04:00
03:00
02:00
01:00
00:00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Min observer difference angle: 0.1°
Max observer difference angle: 19.2°
Observer Location
Sun azimuth ranges (yellow)
Google
Imagery ©2025 Airbus, Maxar Technologies
Panels: Reflecting (yellow), that would reflect but Sun is behind terrain (orange)
Google

B37


Observer 37 Results
Reflection Date/Time (GMT) Graph
00:00
23:00
22:00
21:00
20:00
19:00
18:00
17:00
16:00
15:00
14:00
13:00
12:00
11:00
10:00
09:00
08:00
07:00
06:00
05:00
04:00
03:00
02:00
01:00
00:00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Min observer difference angle: 0.1°
Max observer difference angle: 19.7°
Observer Location
Sun azimuth ranges (yellow)
Google
Imagery ©2025 Airbus, Maxar Technologies
Panels: Reflecting (yellow), that would reflect but Sun is behind terrain (orange)
Google

B38

14.67



Observer 38 Results

Reflection Date/Time (GMT) Graph

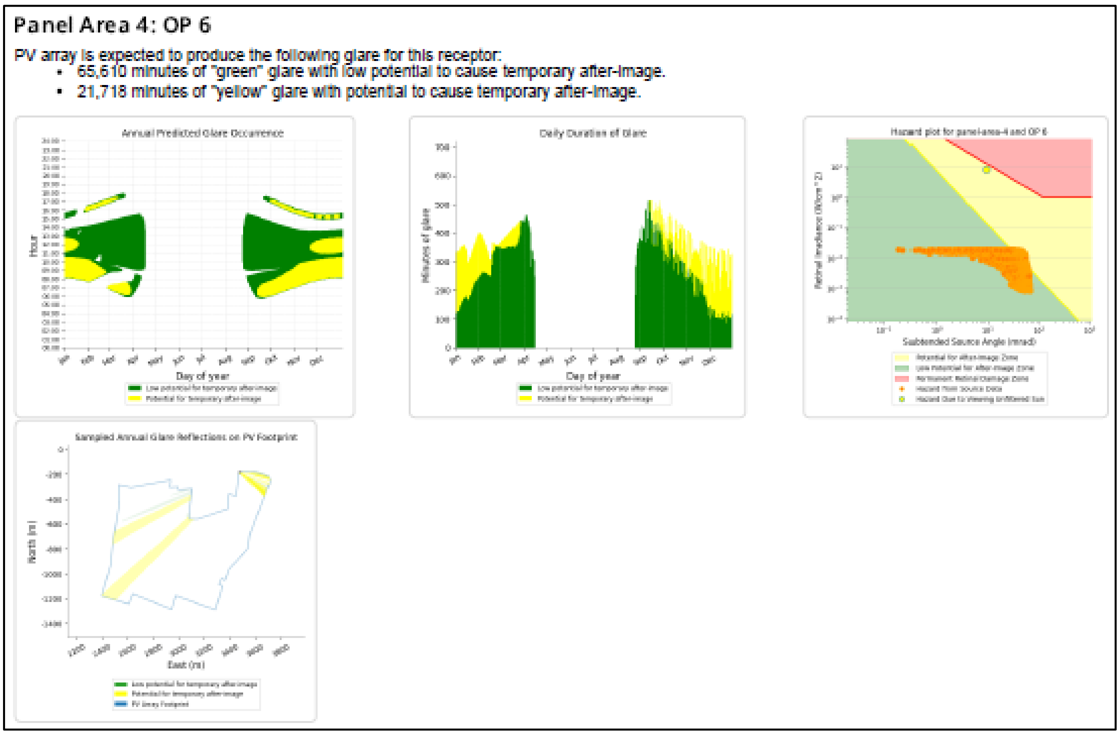
Min observer difference angle: 0.4°
Max observer difference angle: 19.6°

Observer Location

Sun azimuth ranges (yellow)

Panels: Reflecting (yellow), that would reflect but Sun is behind terrain (orange)

B44

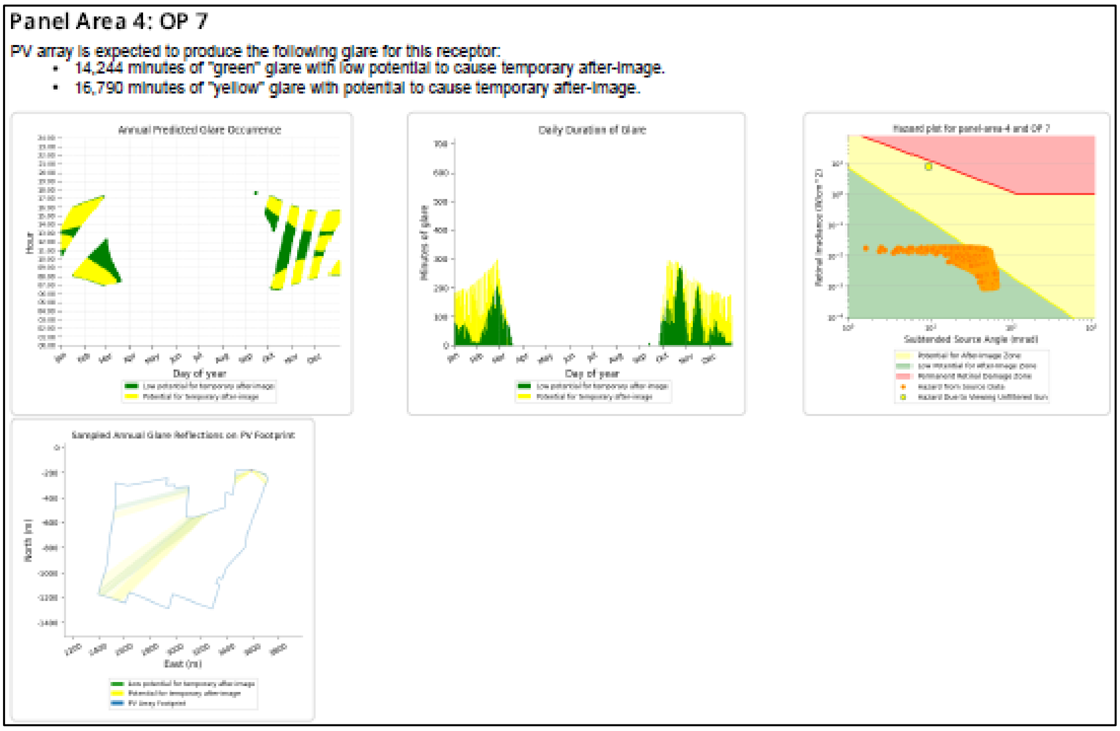


Panel Area 4: OP 6

PV array is expected to produce the following glare for this receptor:

- 65,610 minutes of "green" glare with low potential to cause temporary after-image.
- 21,718 minutes of "yellow" glare with potential to cause temporary after-image.

B45

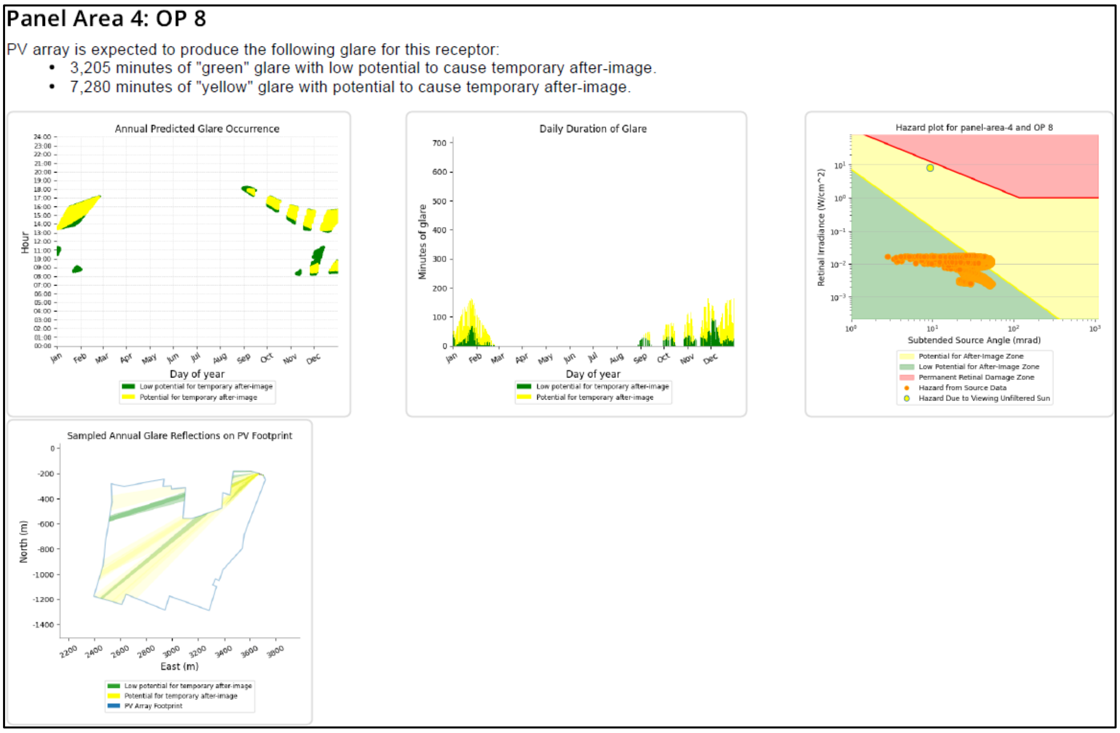


Panel Area 4: OP 7

PV array is expected to produce the following glare for this receptor:

- 14,244 minutes of "green" glare with low potential to cause temporary after-image.
- 16,790 minutes of "yellow" glare with potential to cause temporary after-image.

B46

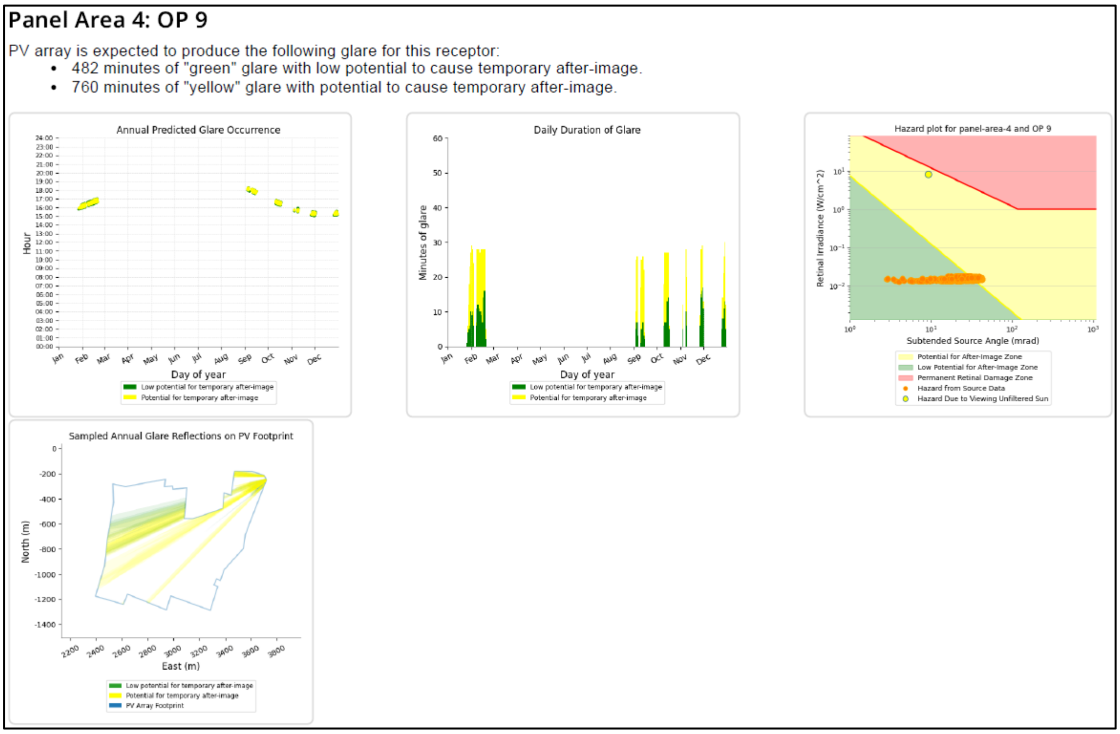


Panel Area 4: OP 8

PV array is expected to produce the following glare for this receptor:

- 3,205 minutes of "green" glare with low potential to cause temporary after-image.
- 7,280 minutes of "yellow" glare with potential to cause temporary after-image.

B47

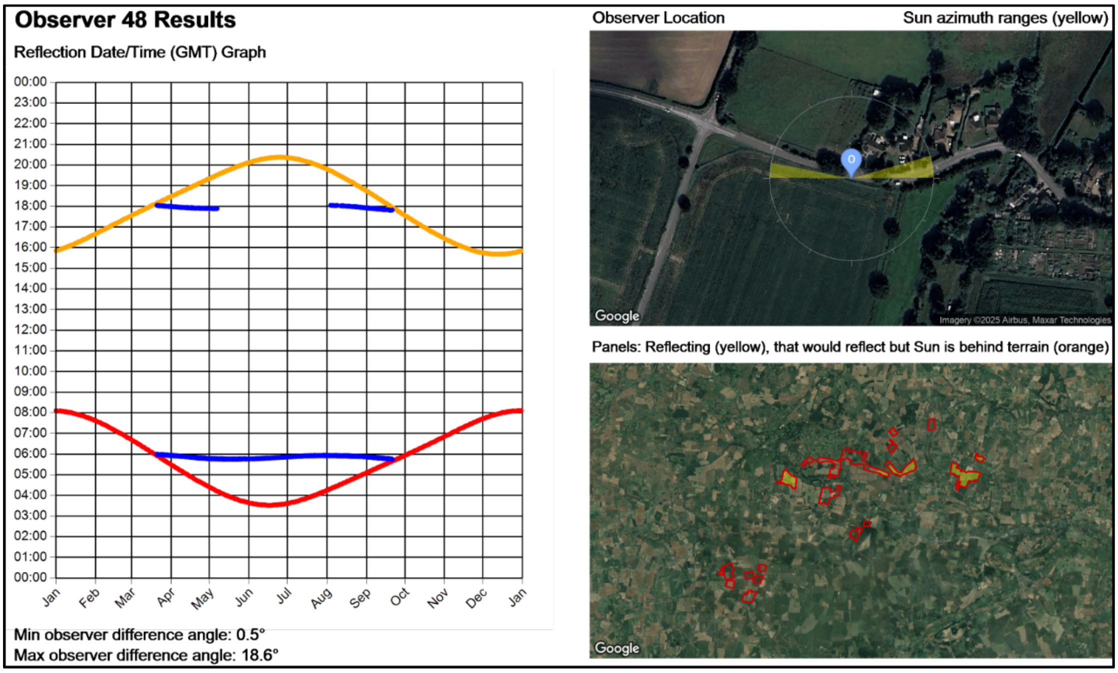


Panel Area 4: OP 9

PV array is expected to produce the following glare for this receptor:

- 482 minutes of "green" glare with low potential to cause temporary after-image.
- 760 minutes of "yellow" glare with potential to cause temporary after-image.

B48



Observer 48 Results

Reflection Date/Time (GMT) Graph

Observer Location

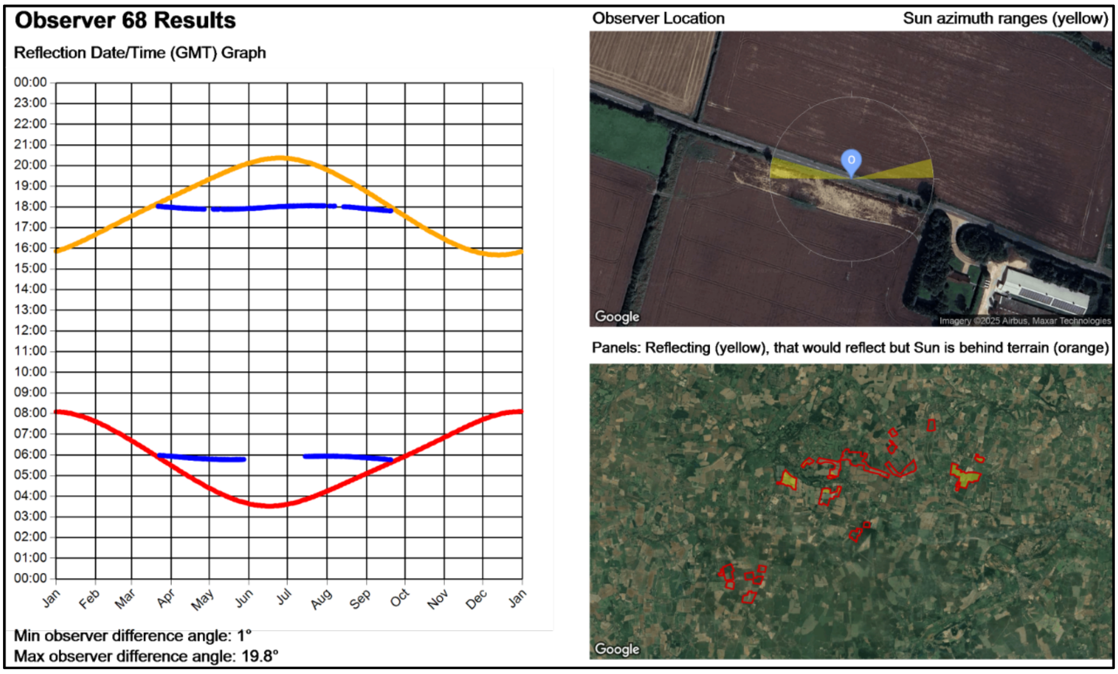
Sun azimuth ranges (yellow)

Panels: Reflecting (yellow), that would reflect but Sun is behind terrain (orange)

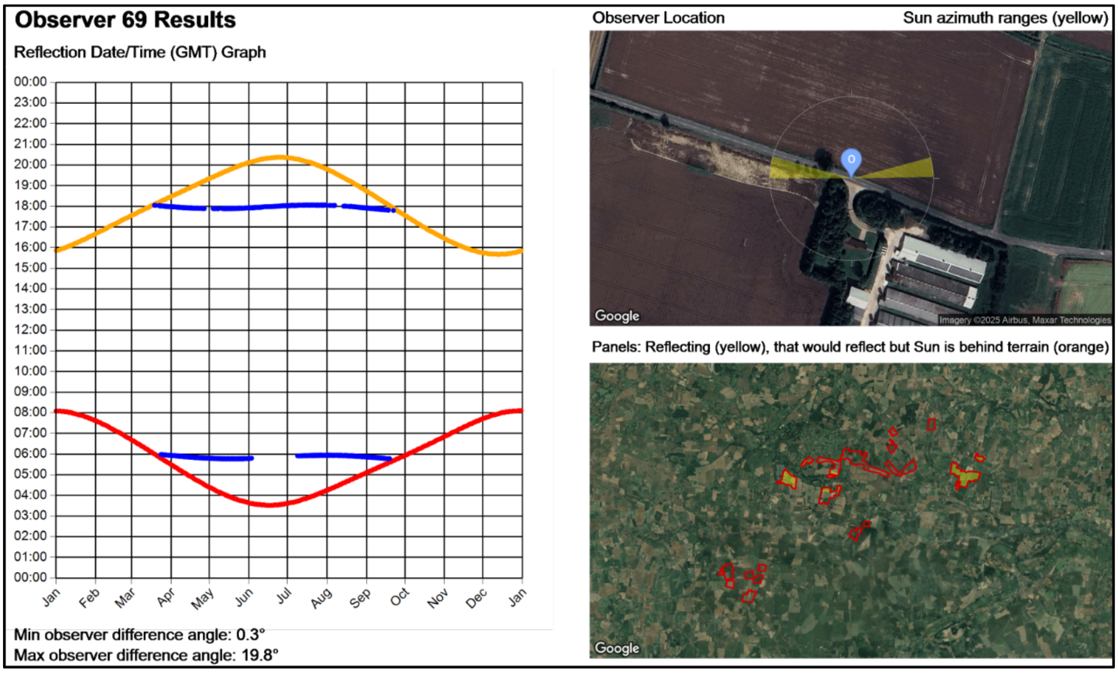
Min observer difference angle: 0.5°

Max observer difference angle: 18.6°

B68

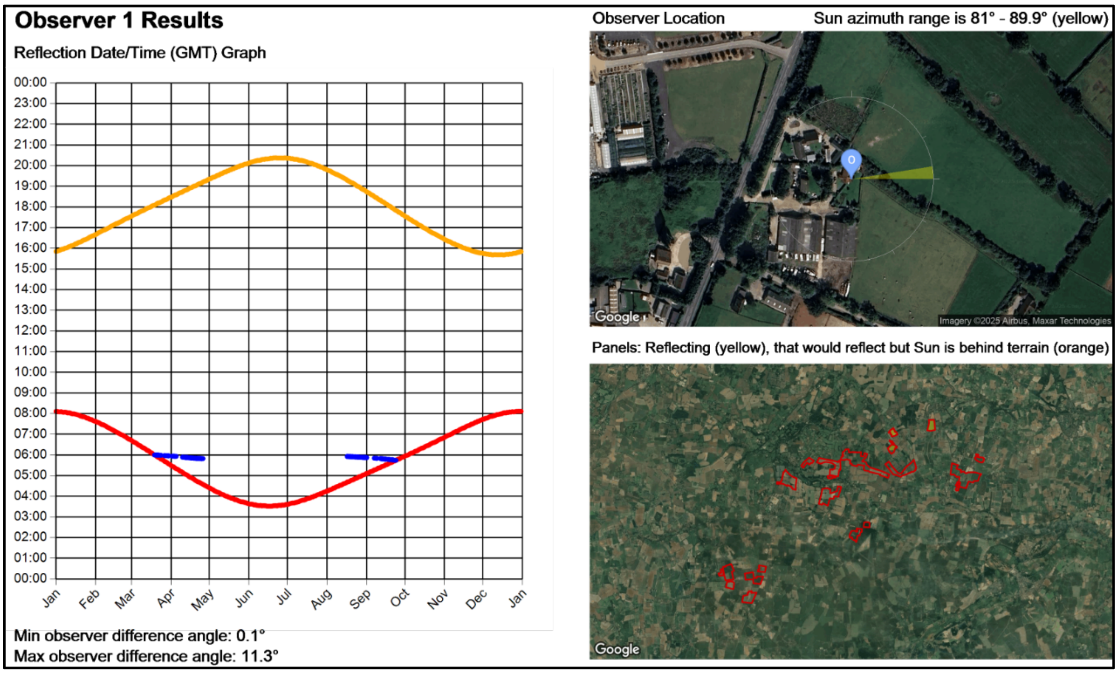

Observer 68 Results
Reflection Date/Time (GMT) Graph
00:00
23:00
22:00
21:00
20:00
19:00
18:00
17:00
16:00
15:00
14:00
13:00
12:00
11:00
10:00
09:00
08:00
07:00
06:00
05:00
04:00
03:00
02:00
01:00
00:00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Min observer difference angle: 1°
Max observer difference angle: 19.8°
Observer Location
Sun azimuth ranges (yellow)
Google
Imagery ©2025 Airbus, Maxar Technologies
Panels: Reflecting (yellow), that would reflect but Sun is behind terrain (orange)
Google

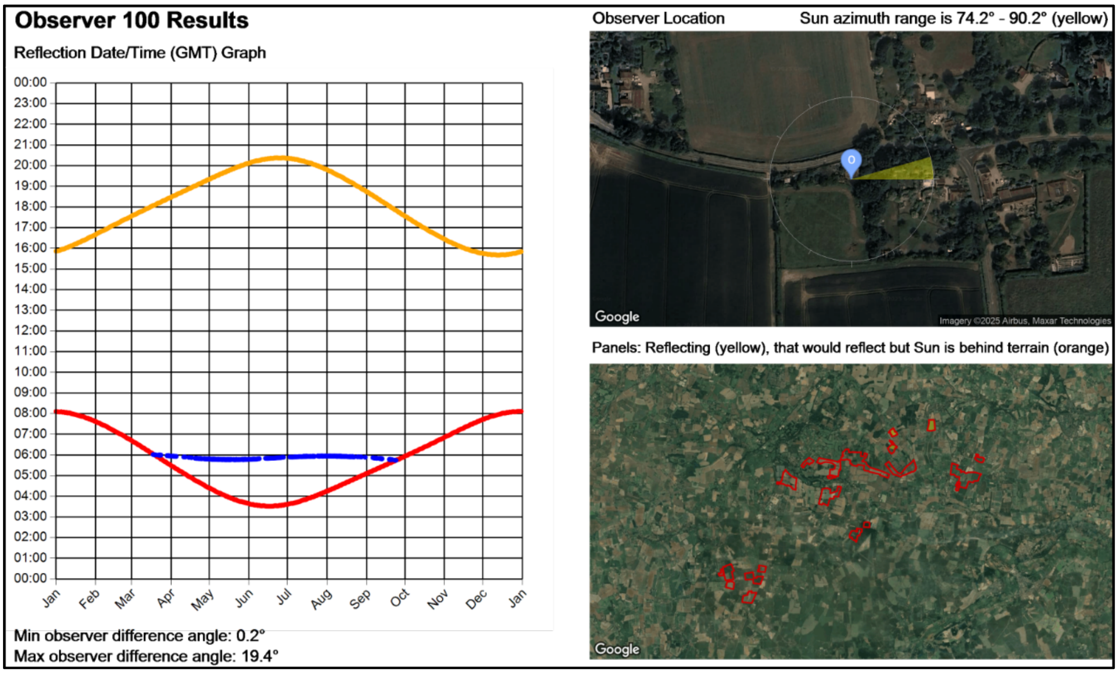
B69


Observer 69 Results
Reflection Date/Time (GMT) Graph
00:00
23:00
22:00
21:00
20:00
19:00
18:00
17:00
16:00
15:00
14:00
13:00
12:00
11:00
10:00
09:00
08:00
07:00
06:00
05:00
04:00
03:00
02:00
01:00
00:00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Min observer difference angle: 0.3°
Max observer difference angle: 19.8°
Observer Location
Sun azimuth ranges (yellow)
Google
Imagery ©2025 Airbus, Maxar Technologies
Panels: Reflecting (yellow), that would reflect but Sun is behind terrain (orange)
Google

Dwelling Receptors

Selective results are provided for reference. Full modelling results are available upon request.

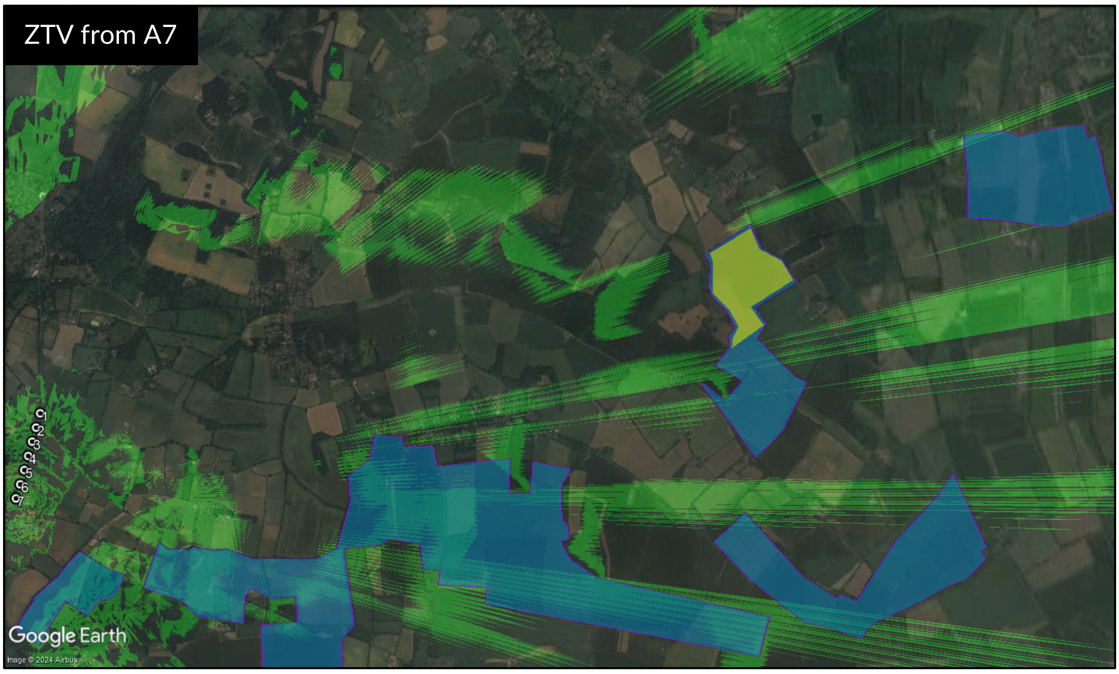




APPENDIX I – DESK-BASED SCREENING REVIEW OF AVAILABLE IMAGERY

Roads

A desk-based review of the available imagery is presented in the figures (in this subsection) below and on the following pages. The cumulative reflecting panel areas from either fixed (indicated by yellow dots) or SAT panels (indicated by regions of yellow) are included within the figures. The identified screening in the form of existing vegetation and buildings is outlined in pink and blue respectively. High-level Zones of Visible Terrain[38] (ZTV) are indicated by shaded regions of green. Proposed screening as per the landscape mitigation plan is indicated in red.



Screening for road receptors A1-A7

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[38] Generated by Google Earth Viewshed at a height of 2.0m above ground level

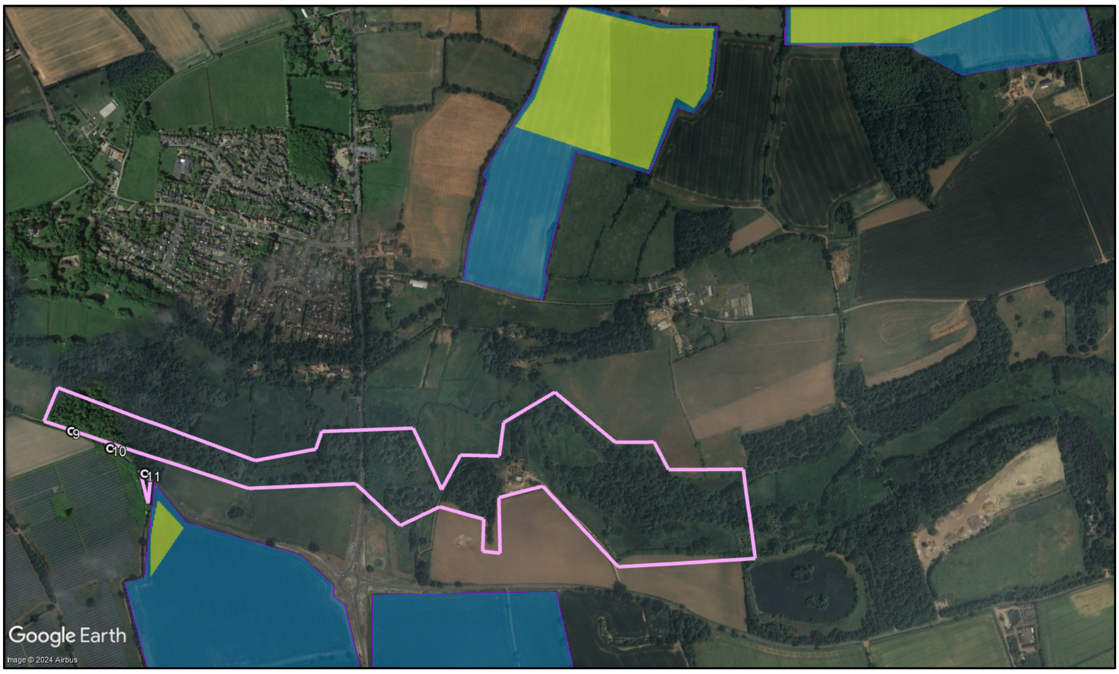
Screening for road receptors A8 to A14

Screening for road receptors A15 to A21

Screening for road receptors A22 to A29

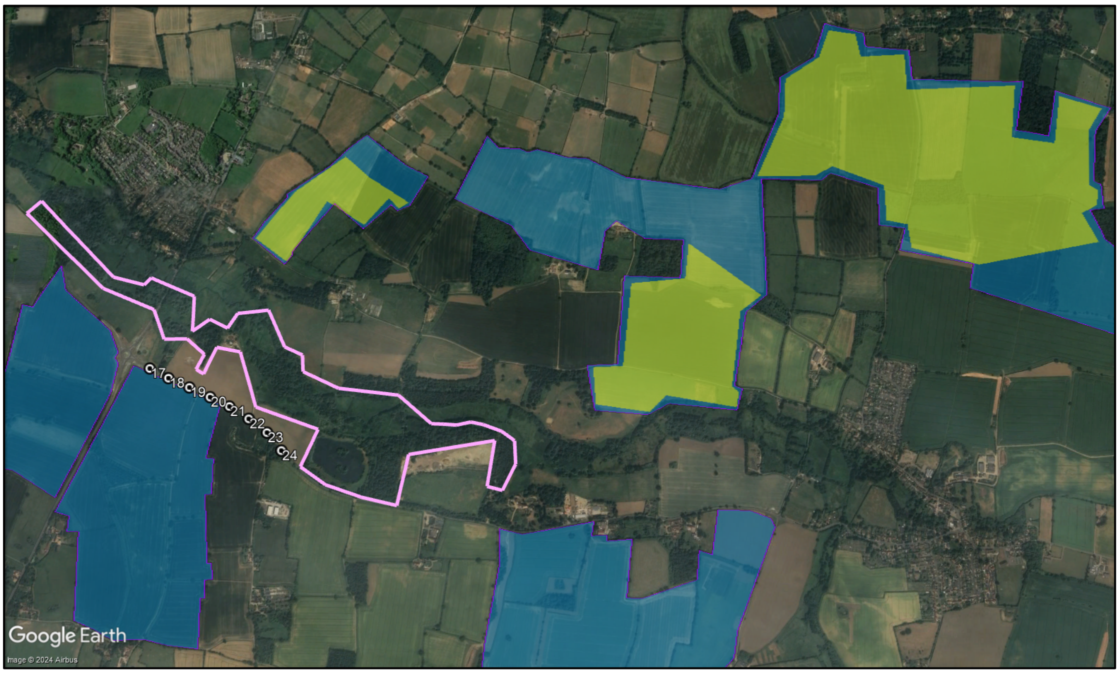
Screening for road receptors A30 to A42

Screening for road receptors B1 to B8



Screening for road receptors B9 to B11

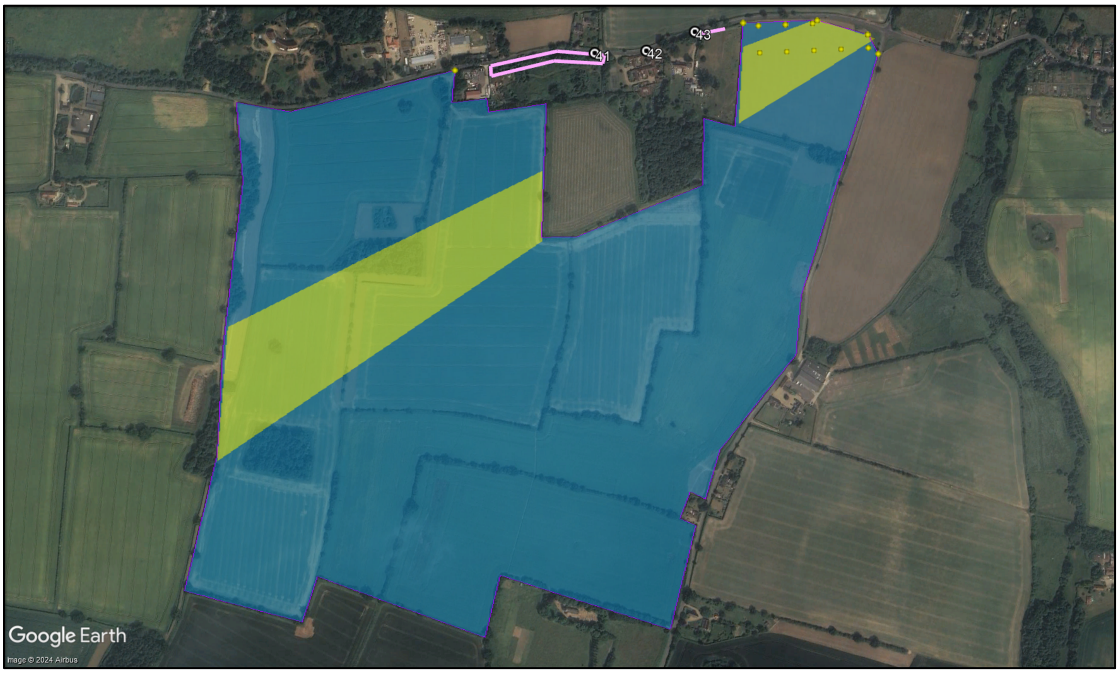
Screening for road receptors B13 to B16



Screening for road receptors B17 to B24

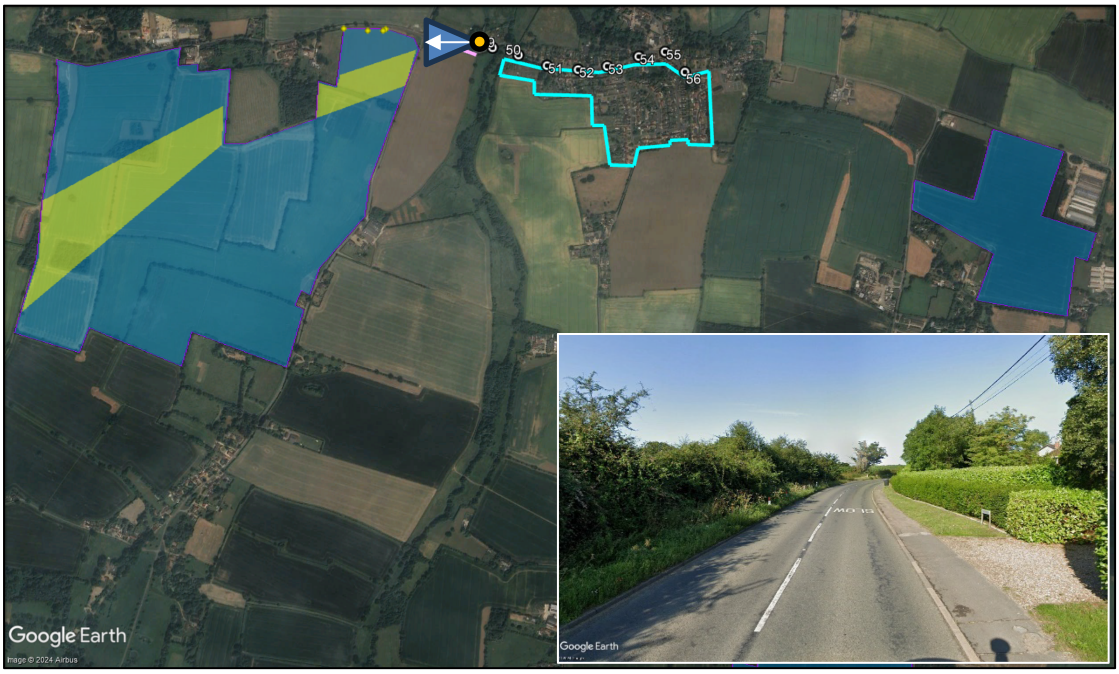
Screening for road receptors B25 to B32

Screening for road receptors B33 to B38



Screening for road receptors B41 to B43

Screening for road receptors B44 to B48

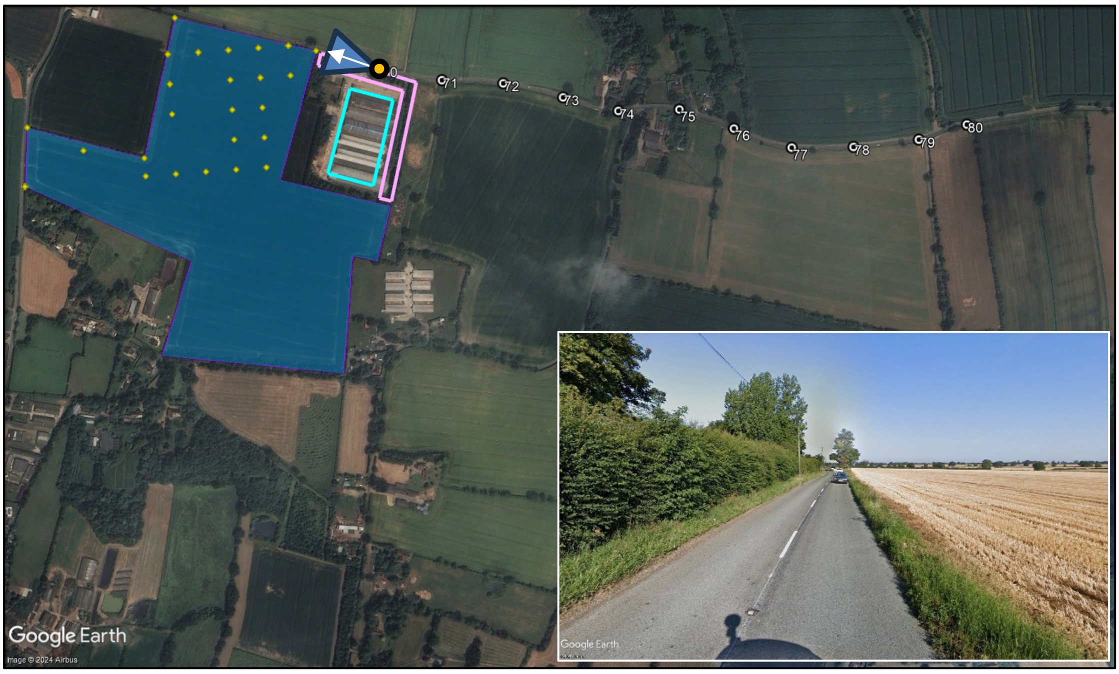


Screening for road receptors B49 to B56

Screening for road receptors B57 to B64

Screening for road receptors B65 to B67

Screening for road receptors B68 to B69



Screening for road receptors B70 to B80

Dwellings

A desk-based review of the available imagery is presented in the figures (in this subsection) below and on the following pages. The cumulative reflecting panel areas from either fixed (indicated by yellow dots) or SAT panels (indicated by regions of yellow) are included within the figures. The identified screening in the form of existing vegetation and buildings is outlined in pink and blue respectively. High-level Zones of Visible Terrain[39] (ZTV) are indicated by shaded regions of green. Proposed screening as per the landscape mitigation plan is indicated in red.

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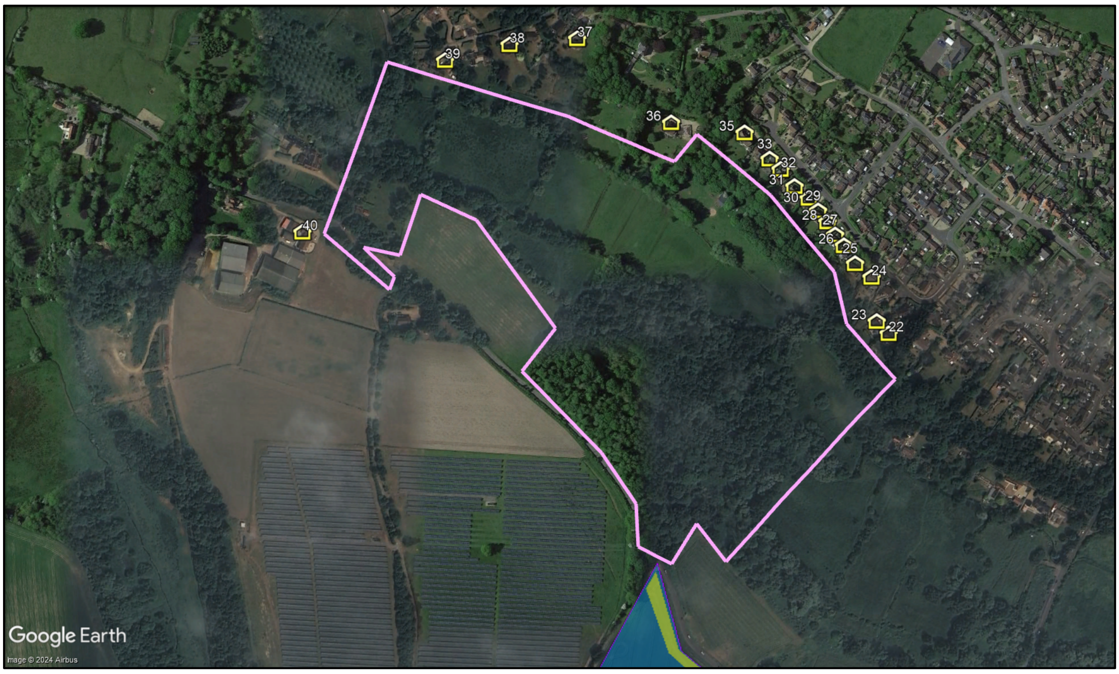
[39] Generated by Google Earth Viewshed at a height of 5.0m above ground level

Screening for dwelling receptors 1 to 7

Screening for dwelling receptors 8 to 21

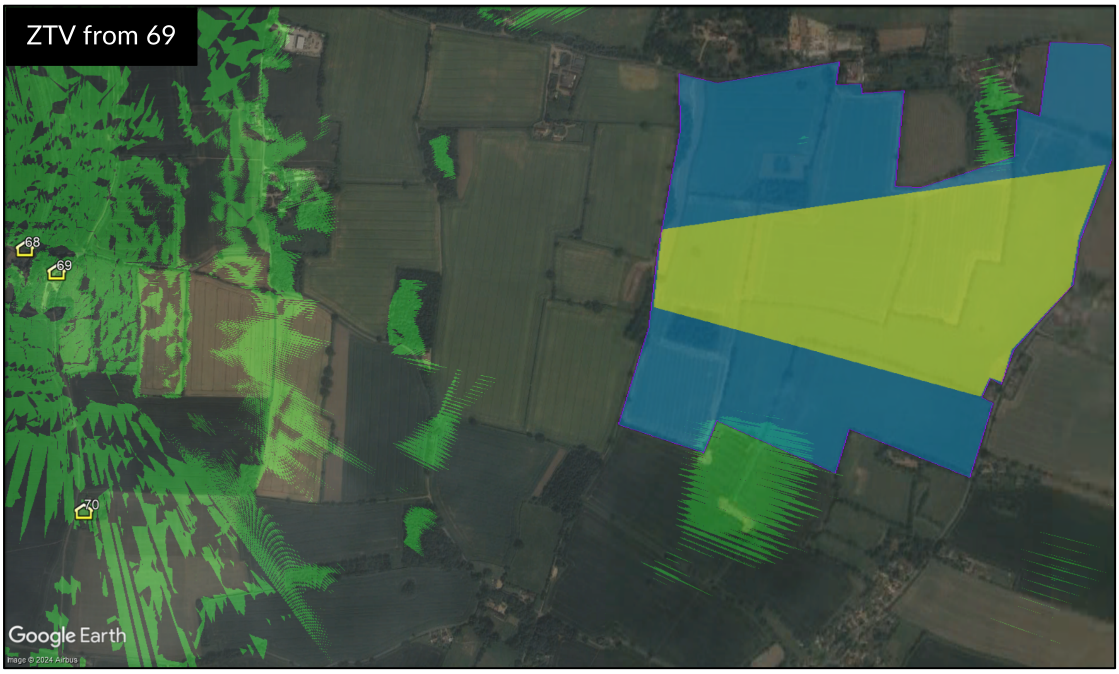


Screening for dwelling receptors 22 to 40

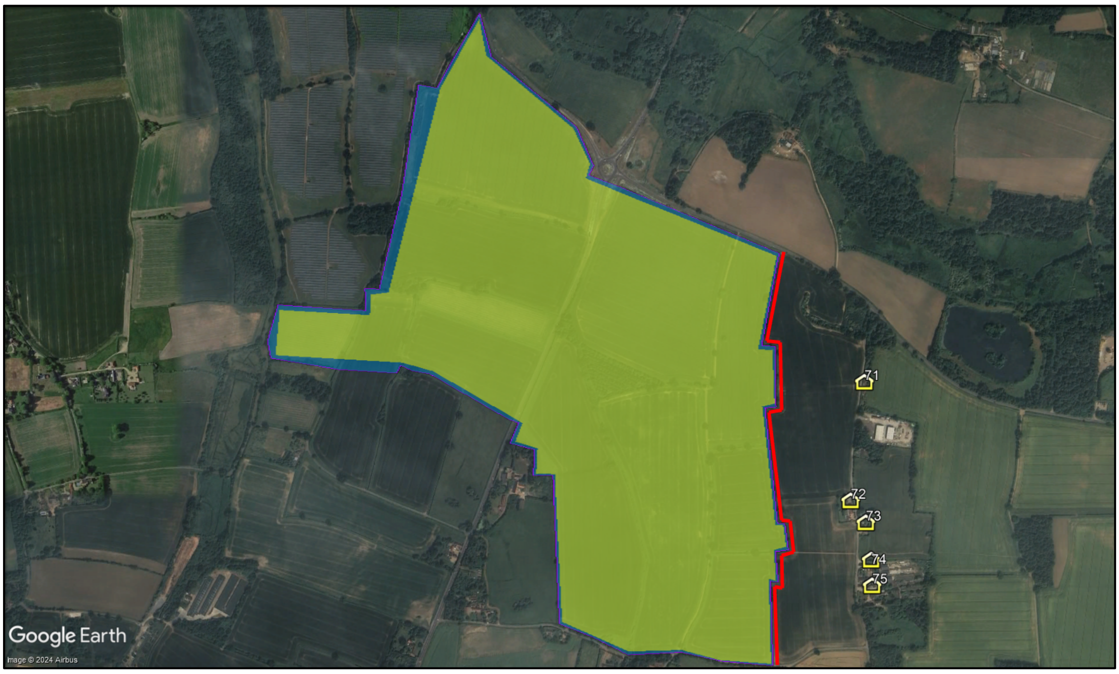
Screening for dwelling receptors 41 to 47

Screening for dwelling receptors 48 to 52 and 54 to 67

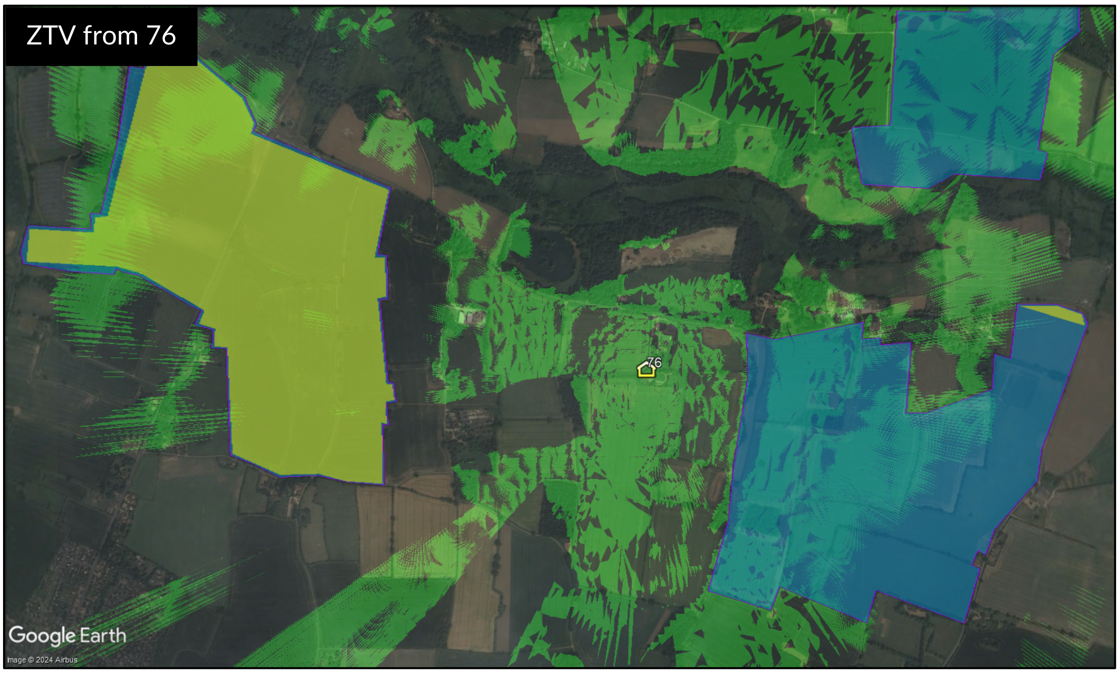
Screening for dwelling receptor 53



Screening for dwelling receptors 68 to 70



Screening for dwelling receptors 71 to 75

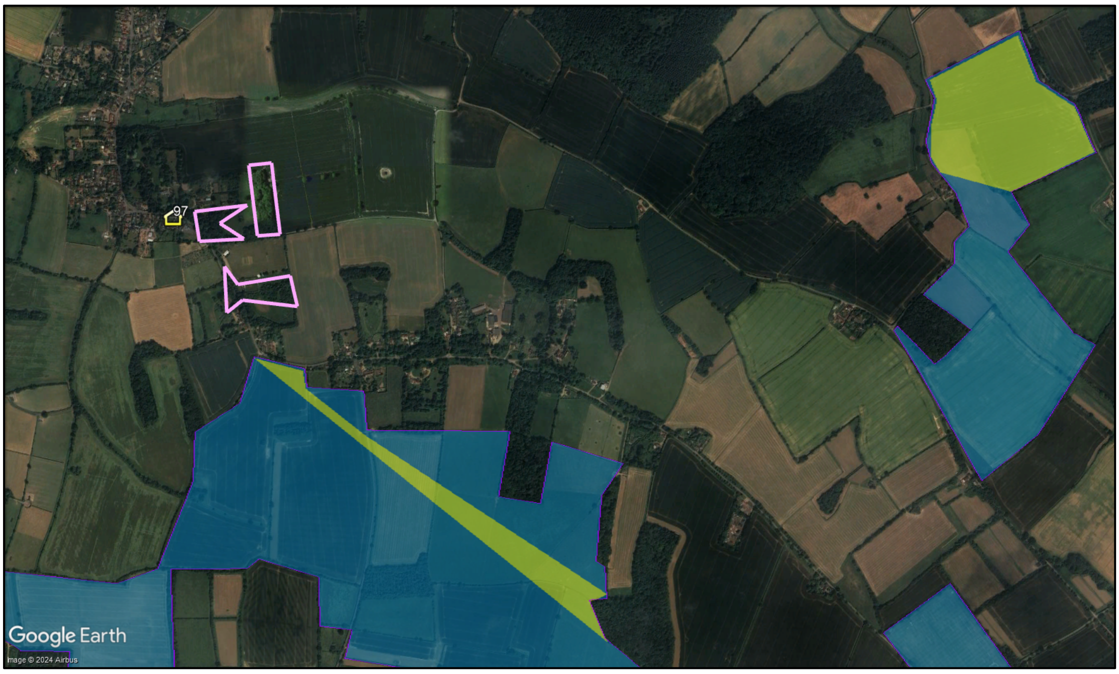


Screening for dwelling receptor 76

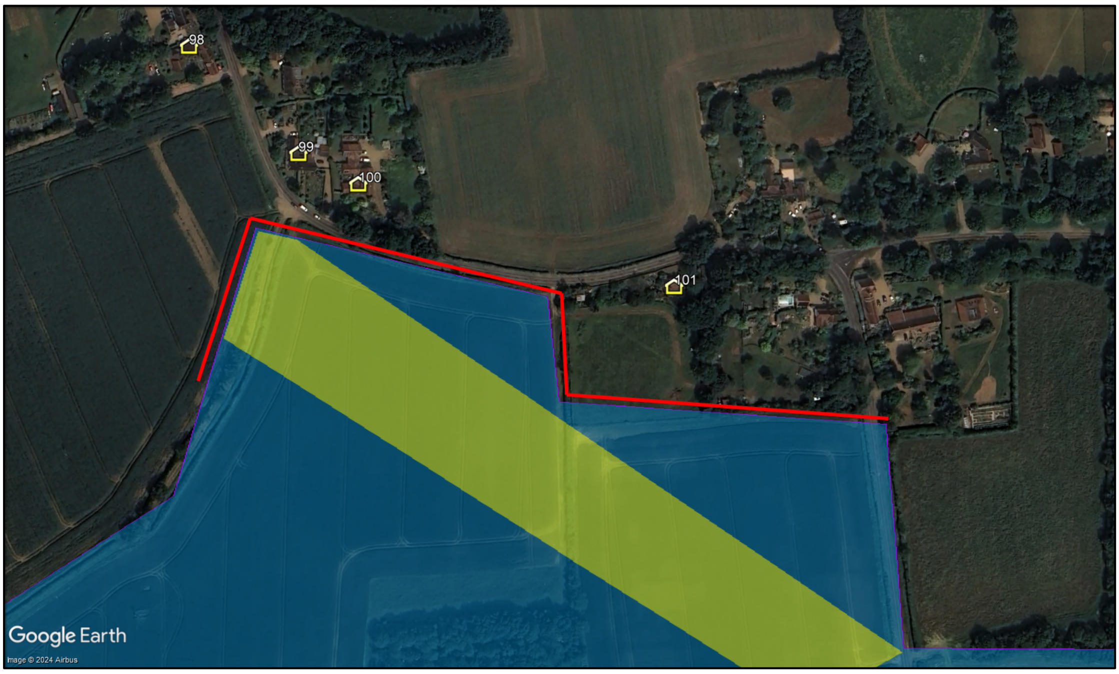
Screening for dwelling receptors 77 to 88

Screening for dwelling receptor 89

Screening for dwelling receptors 90 to 96

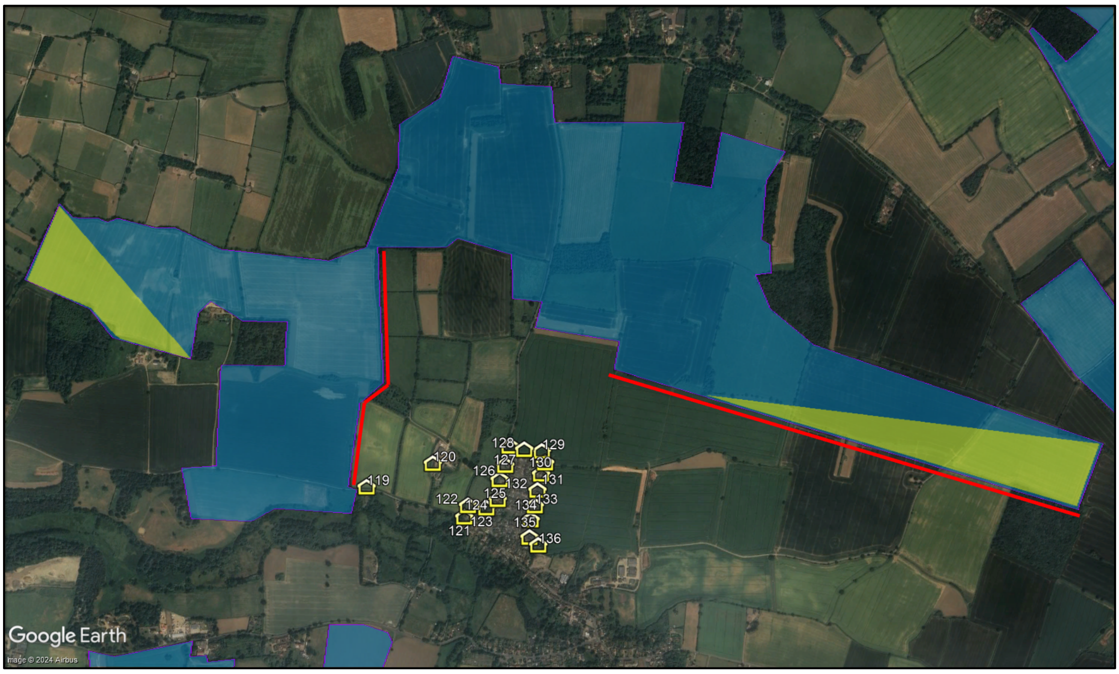


Screening for dwelling receptor 97



Screening for dwelling receptors 98 to 101

Screening for dwelling receptors 102 to 118



Screening for dwelling receptors 119 to 136