

Dwelling Receptor	Geometric Modelling Results (without consideration of screening)	Identified Screening and Predicted Visibility (desk-based review)	Duration of effects (with consideration of screening) ¹⁶	Relevant Factors	Predicted Impact Classification
79	Solar reflections <u>are geometrically possible</u> for: <u>More</u> than three months <u>Less</u> than 60 minutes	Existing vegetation screening Views of the reflecting panels may be <u>possible</u> despite the partial screening	<u>Less</u> than three months <u>Less</u> than 60 minutes	N/A	Low impact
81 – 82, 86	Solar reflections <u>are geometrically possible</u> for: <u>More</u> than three months <u>Less</u> than 60 minutes	Existing vegetation screening Views of the reflecting panels may be <u>possible</u> despite the partial screening	<u>More</u> than three months <u>Less</u> than 60 minutes	Effects would mostly coincide with direct sunlight	Moderate Impact (Mitigation recommended, see Section 5.4)
80, 83 – 85	Solar reflections <u>are geometrically possible</u> for: <u>More</u> than three months <u>Less</u> than 60 minutes	Existing vegetation screening Views of the reflecting panels may be <u>possible</u> despite the partial screening	<u>More</u> than three months <u>Less</u> than 60 minutes	Effects would mostly coincide with direct sunlight Any effects are likely to be limited to an observer above the ground floor	Low impact

Table 2 Geometric modelling results and predicted impact classification - dwelling receptors

5.3.3 Desk-Based Review of Available Imagery

A desk-based review of the available imagery is presented in Figures 19 to 29 on the following pages. The cumulative reflecting panel areas are indicated by regions of yellow. The identified screening in the form of existing vegetation and buildings are outlined in green and blue respectively. Streetview images are used to show the point-of-view of a dwelling at specific locations, with blue triangles to indicate the direction that the corresponding street view image displays. High-level Zones of Theoretical Visibility generated¹⁷ by Google Earth have been used to show the intervening terrain between the proposed development and dwelling receptors.

¹⁷ The green highlighted extents show the areas of terrain from the relevant receptor point that is visible to an observer. For dwellings receptors, viewing height is set to 5m agl to account for views above ground level, unless stated otherwise.

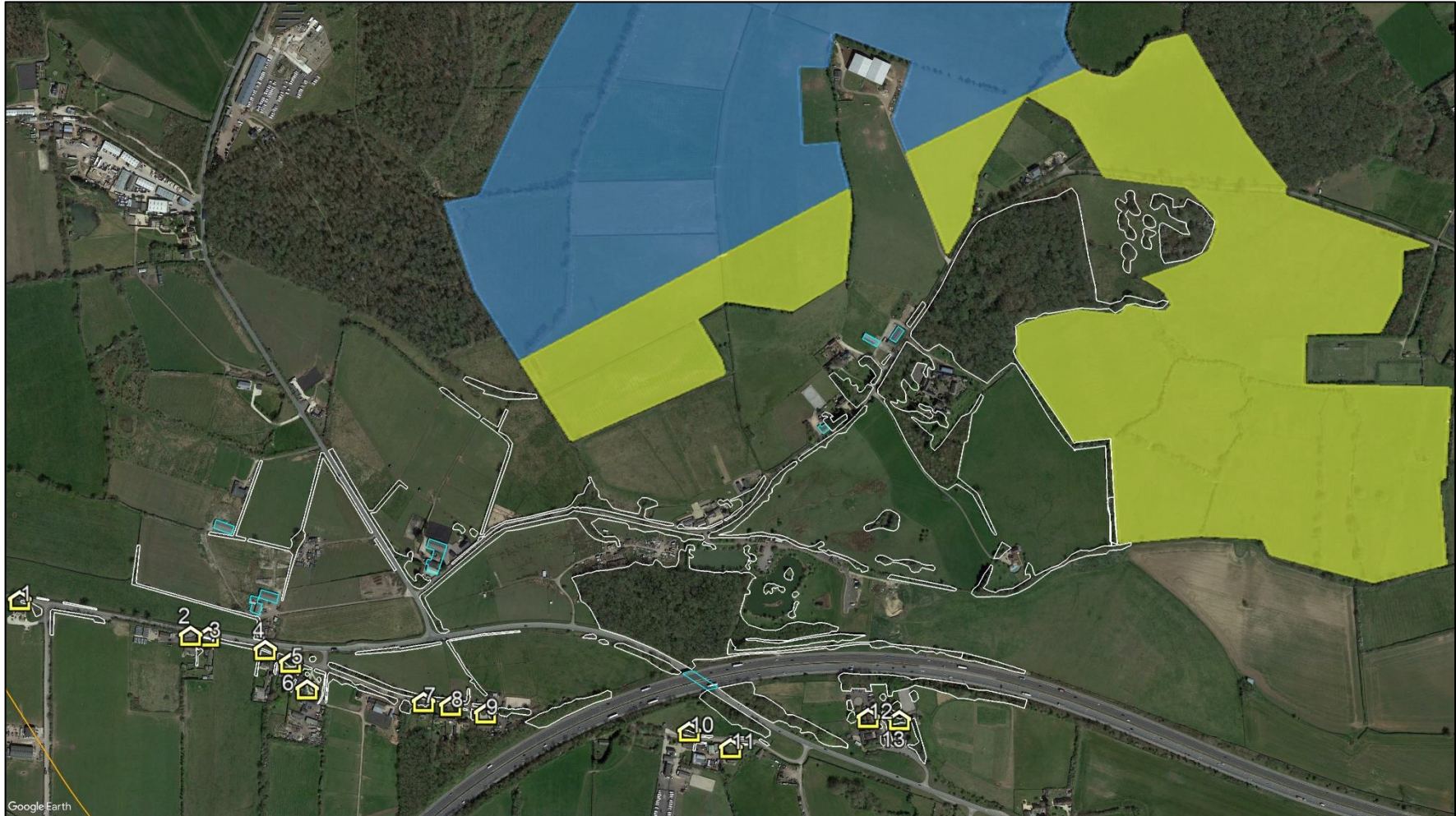


Figure 19 Reflecting panels and screening for dwellings 1 to 13

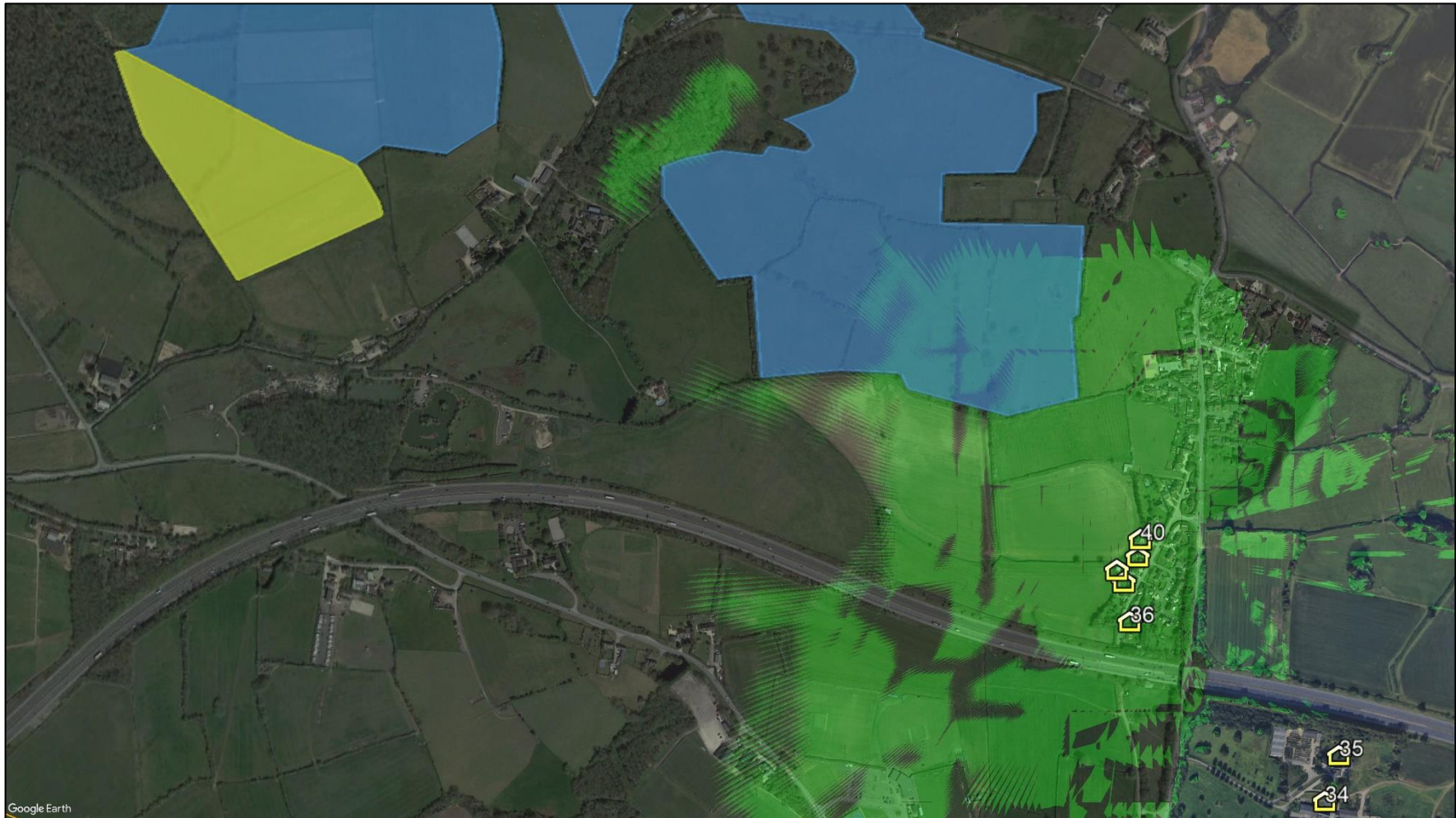


Figure 20 Reflecting panels for dwellings 34 to 40, with representative ZTV viewshed from dwelling 40



Figure 21 Reflecting panels and screening for dwellings 41 to 54, with representative sunlight diagram from dwelling 51



Figure 22 Reflecting panels and screening for dwellings 55 to 58, with representative sunlight diagram from dwelling 55

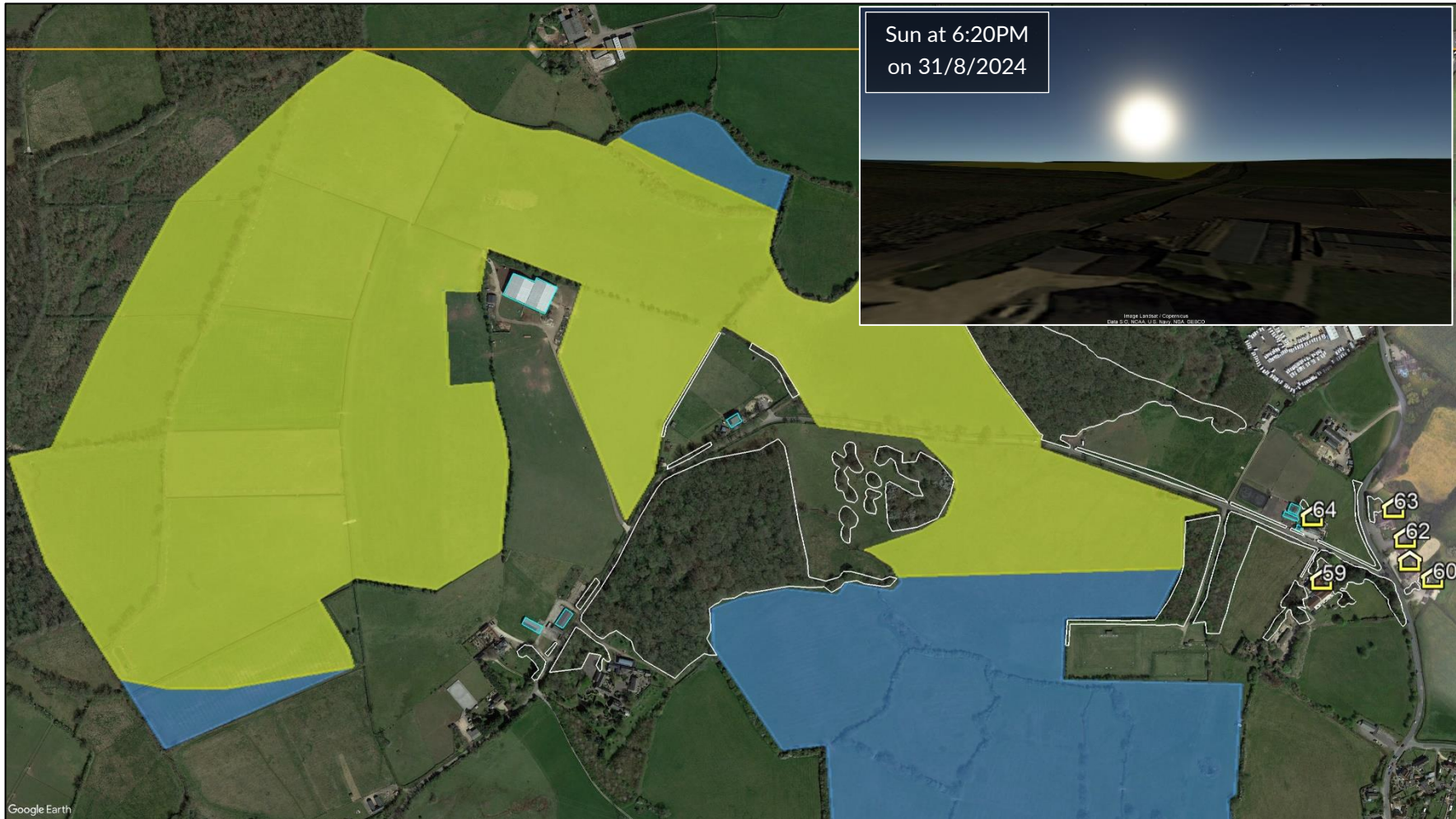


Figure 23 Reflecting panels and screening for dwellings 59 to 64, with representative sunlight diagram from dwelling 64

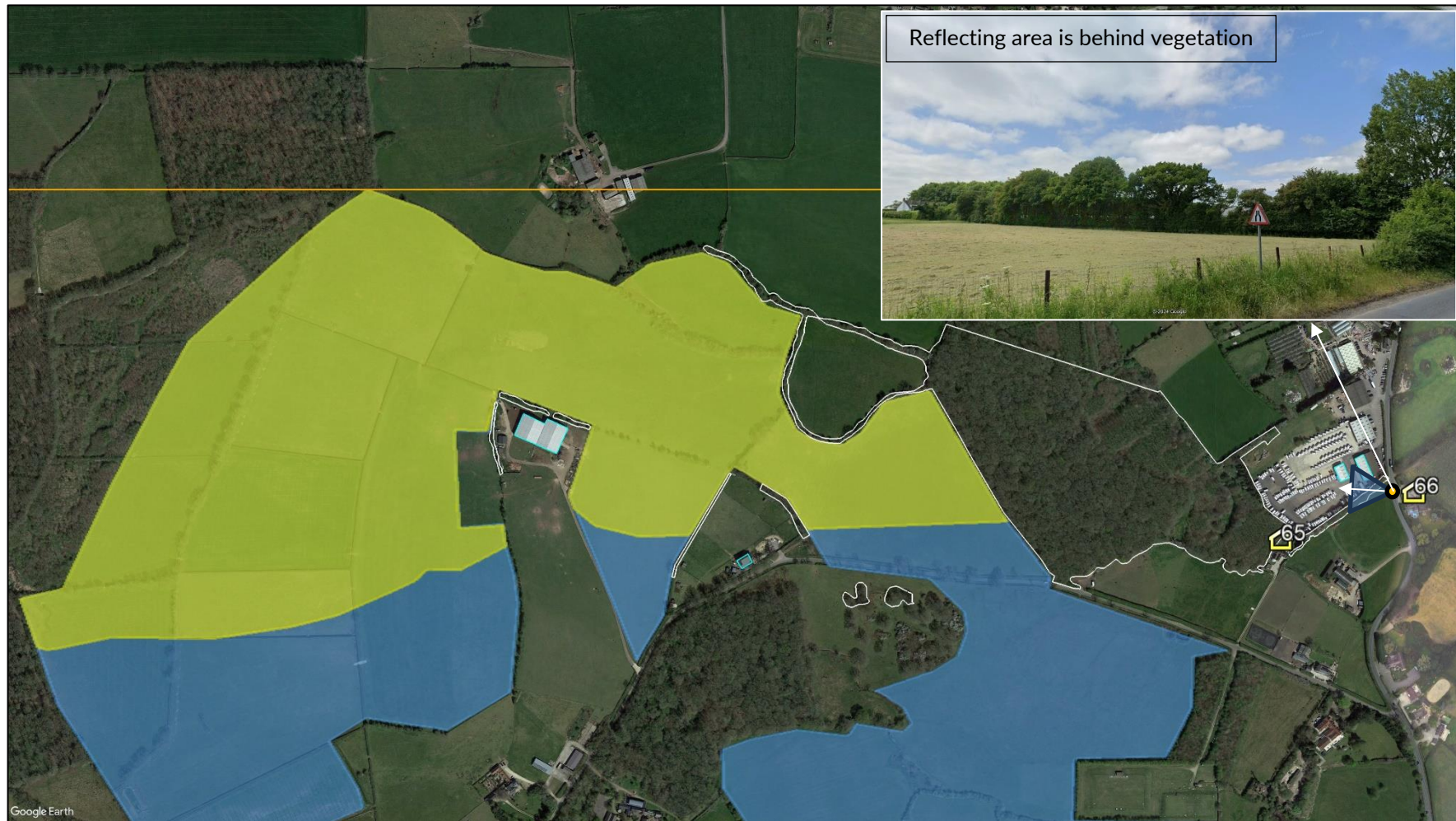


Figure 24 Reflecting panels and screening for dwellings 65 and 66, with representative Streetview imagery from dwelling 66



Figure 25 Reflecting panels and screening for dwellings 67 to 75

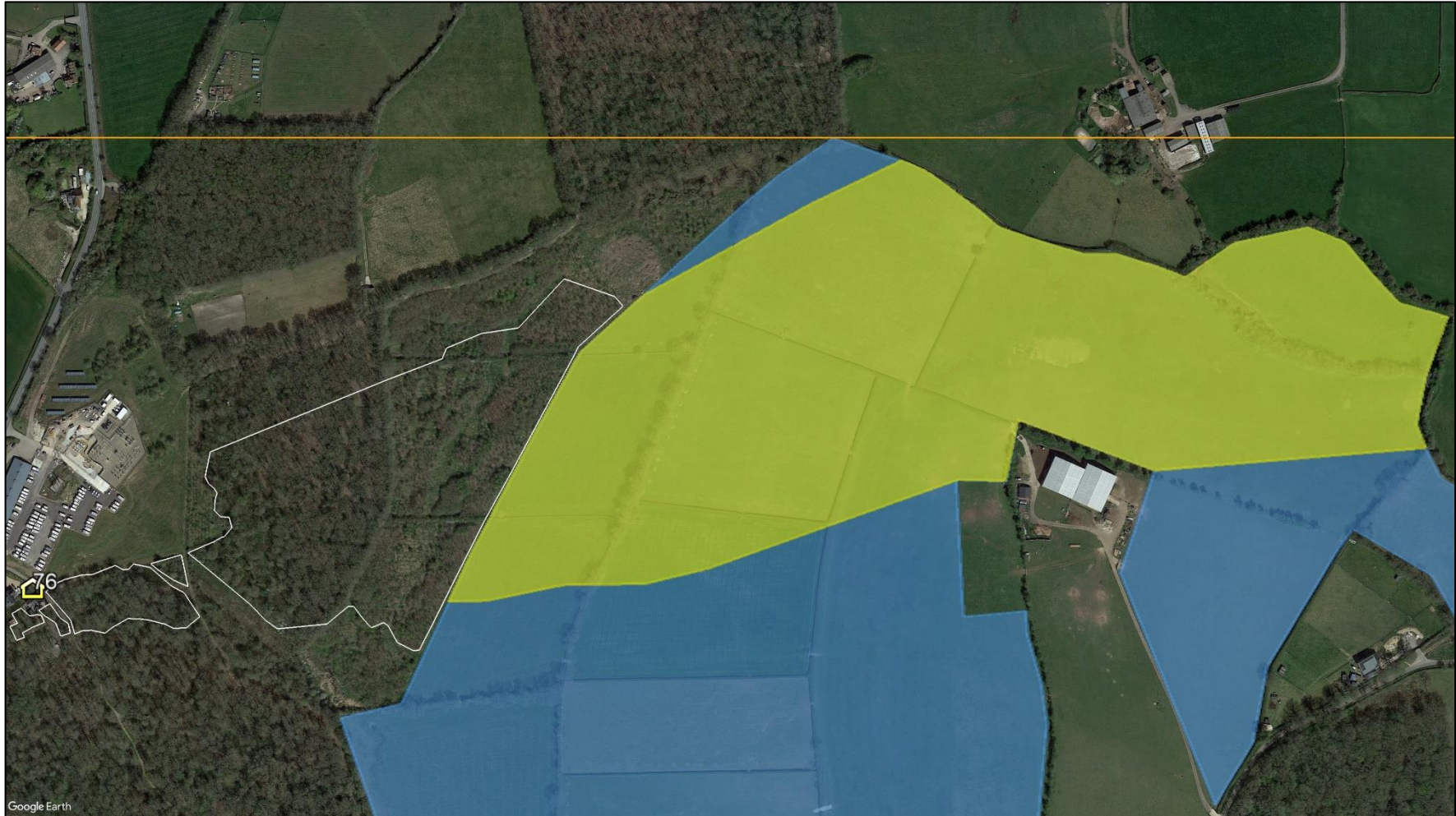


Figure 26 Reflecting panels and screening for dwelling 76

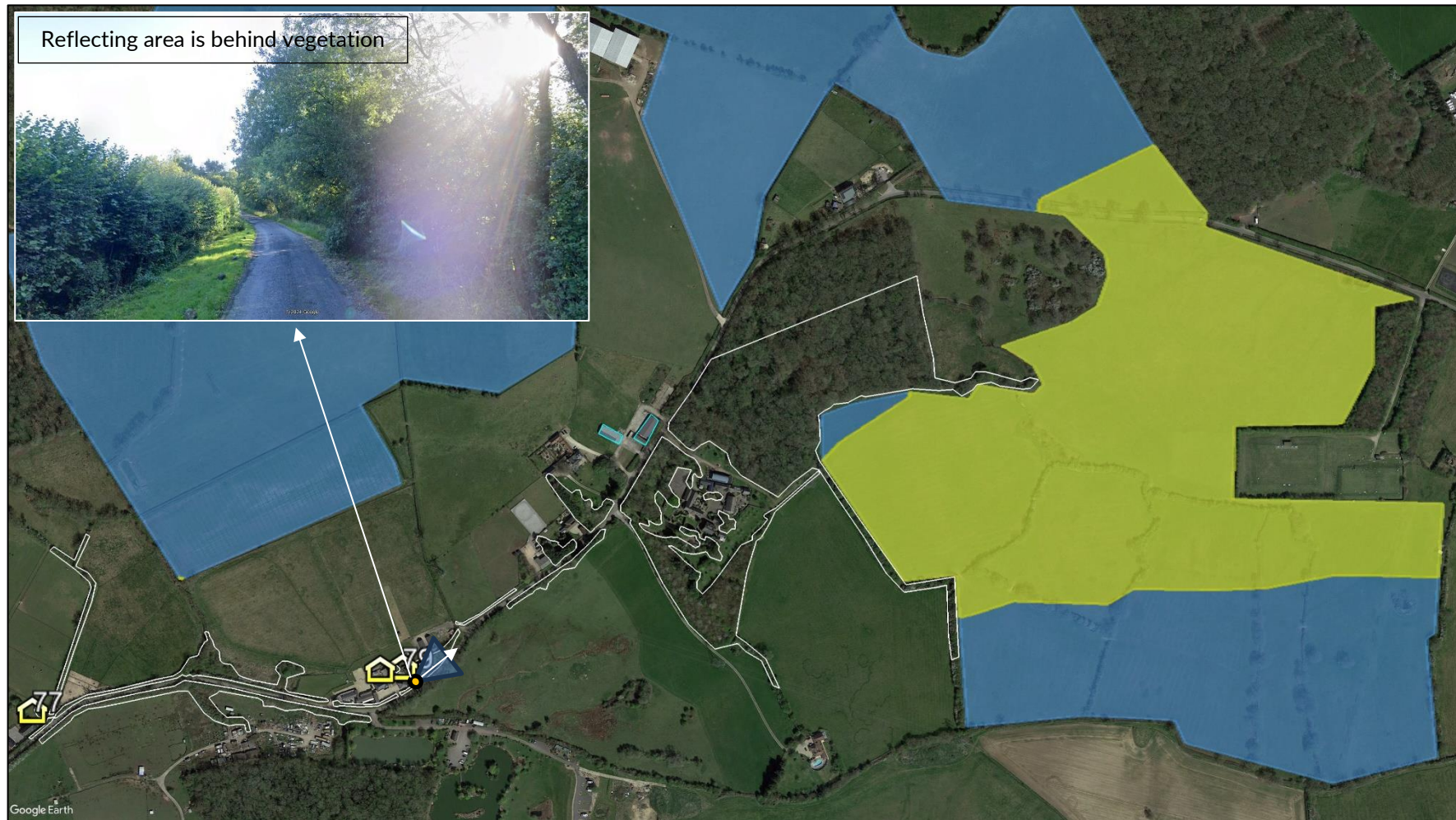


Figure 27 Reflecting panels and screening for dwellings 77 to 79, with representative Streetview imagery from dwelling 79



Figure 28 Reflecting panels and screening for dwelling 80, with sunlight diagram from dwelling 80



Figure 29 Reflecting panels and screening for dwellings 81 to 85, with representative sunlight diagram from dwelling 83

5.4 High-Level Mitigation

A moderate impact has been predicted upon three dwellings and no significant screening or sufficient mitigating factors have been identified. Therefore, mitigation is recommended.

The locations identified for proposed screening are highlighted in red in Figures 30 and 31 on the following pages. This screening could be in the form of planting or a fence and should be of a height such that views of the reflecting panels are obscured from the view of the affected dwellings for a typical observer.

If vegetation is used, such as allowing existing hedgerows to grow taller, it should be ensured that the screening significantly obstructs the reflecting panels during the periods when solar reflections are geometrically possible, mid-March until late-September, which coincides with the full leaf growth period.



Figure 30 Recommended screening for dwellings 81 and 82



Figure 31 Recommended screening for dwelling 86

6 OVERALL CONCLUSIONS

6.1 Assessment Conclusions – Road Safety

Solar reflections are geometrically possible towards approximately 2.96 km section of the M4, 1.71km section of Brinkworth Road, 1.39km section of the B4696 and 1.99km section of Greatfield Road.

For all sections of the M4, Brinkworth Road, the B4696, and Greatfield Road where a solar reflection is geometrically possible, screening in the form of existing vegetation, buildings, and/or intervening terrain is predicted to significantly obstruct views of reflecting panels, such that solar reflections will not be experienced in practice. No impact is predicted, and mitigation is not required.

6.2 Assessment Conclusions – Residential Amenity

Solar reflections are geometrically possible towards 66 of the 86 assessed dwellings.

For 34 dwellings, screening in the form of existing vegetation, buildings and/or intervening terrain is predicted to significantly obstruct views of reflecting panels such that solar reflections will not be experienced in practice. No impact is predicted, and mitigation is not required.

For one dwelling, solar reflections are geometrically possible for less than three months of the year and less than 60 minutes on any given day. Screening in the form of existing vegetation is predicted to partially obstruct the views of reflecting panels such that views may still be possible. A low impact is predicted for these dwellings and mitigation is not recommended.

For 28 dwellings, the solar reflections are predicted to occur for more than three months of the year but less than 60 minutes on any given day. Partial screening in the form of existing vegetation and/or buildings has been identified for the dwellings. Mitigating factors in the form of reflections coinciding with direct sunlight, and that effects are expected to be limited to observers above the ground floor, reduces the significance of these reflections. A low impact is predicted, and mitigation is not recommended.

For the remaining three dwellings, the solar reflections are predicted to occur for more than three months of the year but less than 60 minutes on any given day and no sufficient mitigating factors have been identified that decrease the level of impact. A moderate impact is predicted, and mitigation is recommended (see Section 5.4).

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

Overview

This section provides an overview of planning guidance, which is not exhaustive. The guidance presented here relates predominantly to England and Wales, which is not formally applicable but is relevant from a technical perspective.

Renewable and Low Carbon Energy

The National Planning Policy Framework under the planning practice guidance for Renewable and Low Carbon Energy¹⁸ (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;*

...

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.'

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

National Policy Statement for Renewable Energy Infrastructure

The National Policy Statement for Renewable Energy Infrastructure (EN-3)¹⁹ sets out the primary policy for decisions by the Secretary of State for nationally significant renewable energy infrastructure. Sections 2.10.102-106 state:

'2.10.102 Solar panels are specifically designed to absorb, not reflect, irradiation.²⁰ 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.'

2.10.103 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.

2.10.104 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.

2.10.105 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.

2.10.106 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.

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.

¹⁹ National Policy Statement for Renewable Energy Infrastructure (EN-3), Department for Energy Security & Net Zero, date: January 2024, accessed on: 17/01/2024.

²⁰ 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 an impact upon aviation safety.

Finally, the EN-3 relates solely to nationally significant renewable energy infrastructure and therefore does not apply to all planning applications for solar farms.

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 document²¹ which was produced due to the absence of existing guidance and a specific standardised assessment methodology.

²¹ Solar Photovoltaic Development Glint and Glare Guidance, Fourth Edition, September 2022. Pager Power.

APPENDIX B – OVERVIEW OF GLINT AND GLARE STUDIES

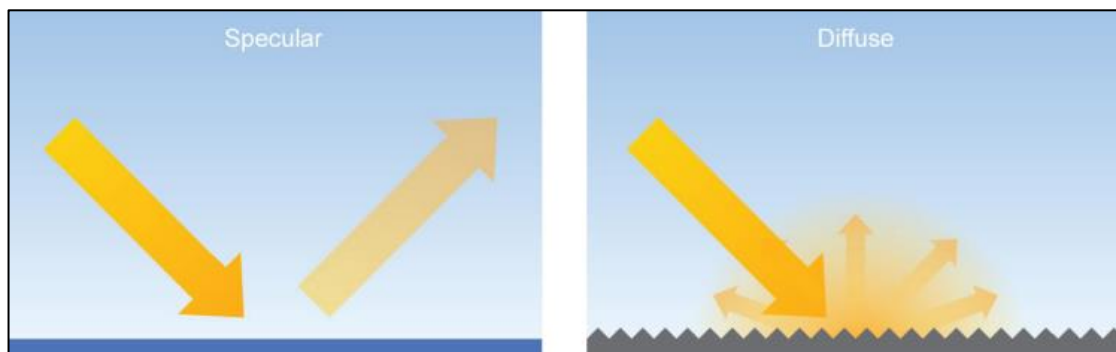
Overview

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 guidance²², 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

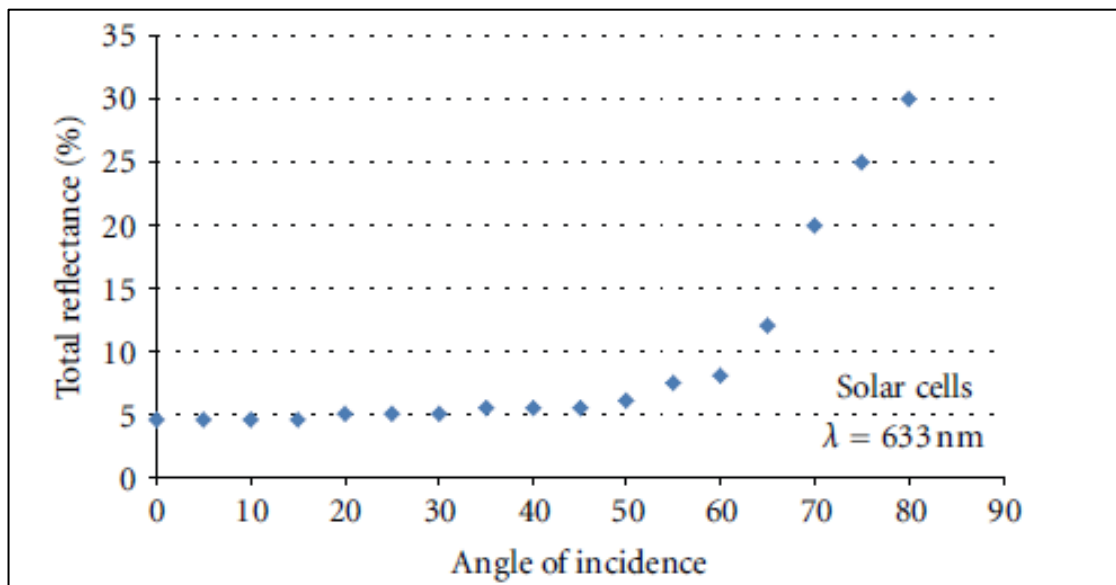
²²Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration (FAA), date: 04/2018, accessed on: 12/09/2022.

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*²³. 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.

²³ 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”²⁴

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 ²⁵
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.

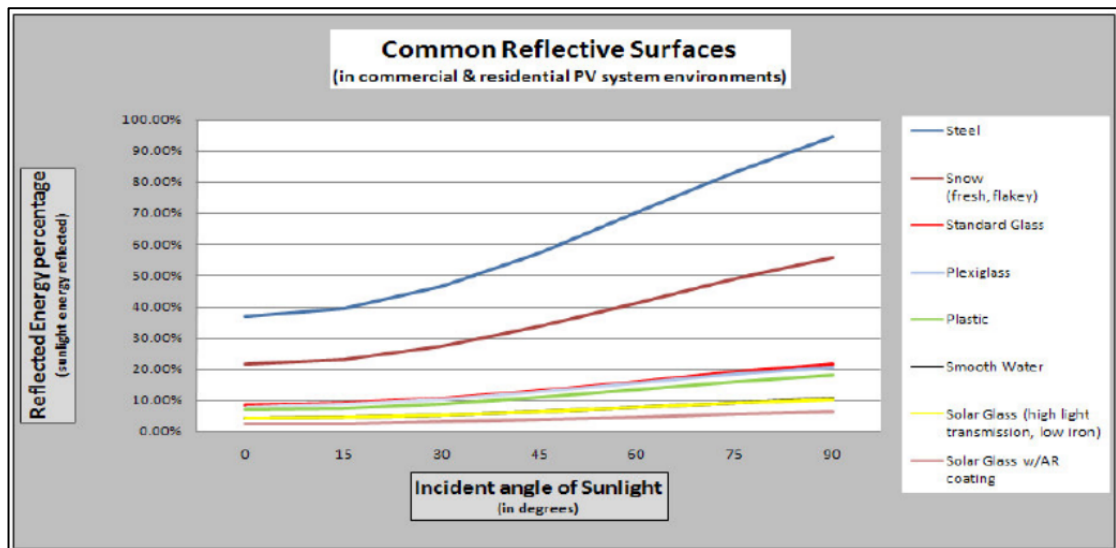
²⁴ Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration (FAA), date: 04/2018, accessed on: 12/09/2022.

²⁵ Extrapolated data, baseline of 1,000 W/m² for incoming sunlight.

SunPower Technical Notification (2009)

SunPower published a technical notification²⁶ 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.

²⁶ 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).

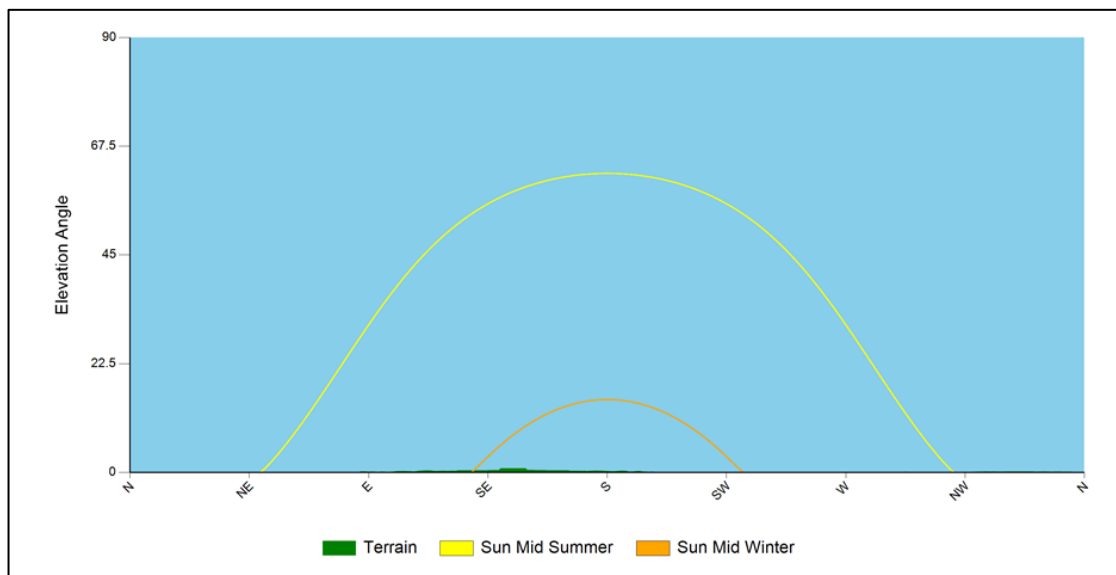
The Sun's position can be accurately calculated for a specific location. The following data being used for the calculation:

- 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.



Terrain at the visible horizon and sun paths

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

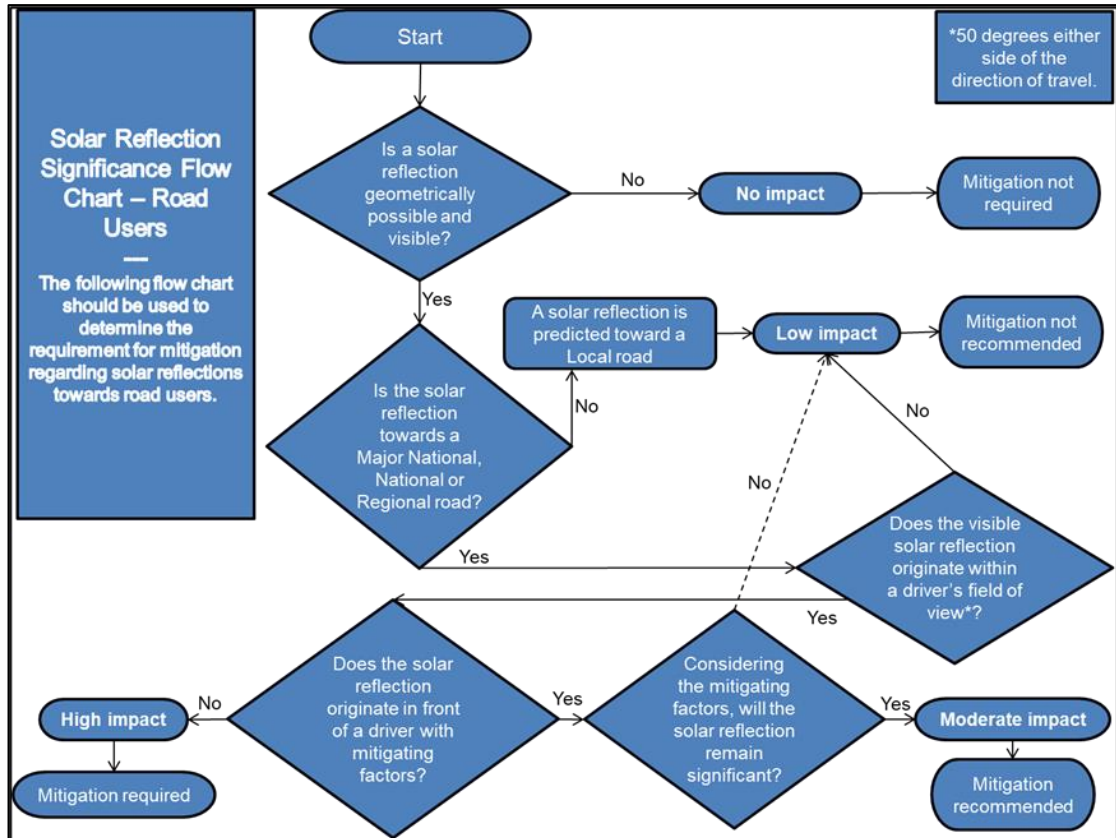
The table below presents the recommended definition of ‘impact significance’ in glint and glare terms and the requirement for mitigation under each.

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 significantly.	No mitigation recommended.
Moderate	A solar reflection is geometrically possible and visible however it occurs under conditions that do not represent a worst-case given individual receptor criteria.	Mitigation recommended.
High	A solar reflection is geometrically possible and visible under worst-case conditions that will produce a significant impact given individual receptor criteria	Mitigation will be required if the proposed development is to proceed.

Impact significance definition

Impact Significance Determination for Road Receptors

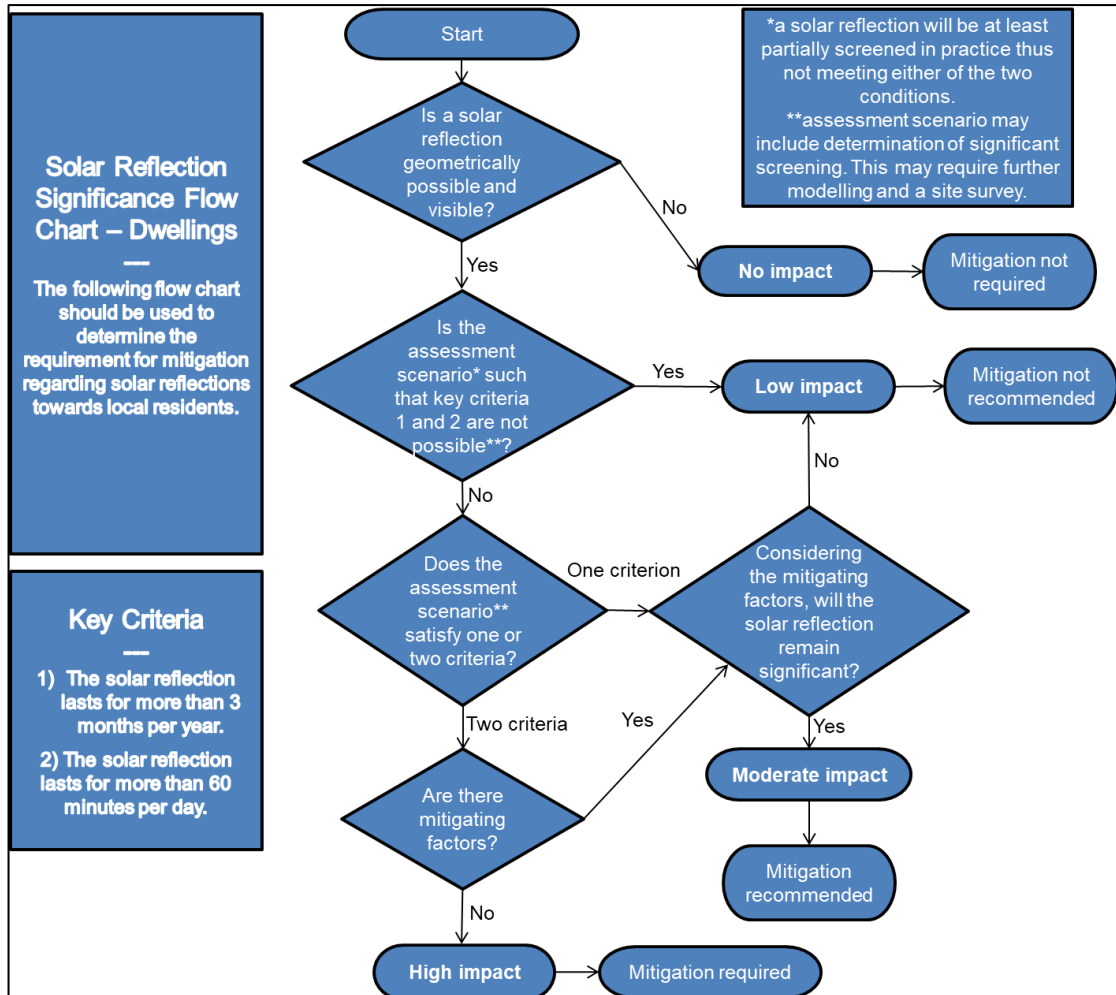
The flow chart presented below has been followed when determining the impact significance for road receptors.



Road receptor impact significance flow chart

Impact Significance Determination for Dwelling Receptors

The flow chart presented below has been followed when determining the impact significance for dwelling receptors.



Dwelling receptor impact significance flow chart

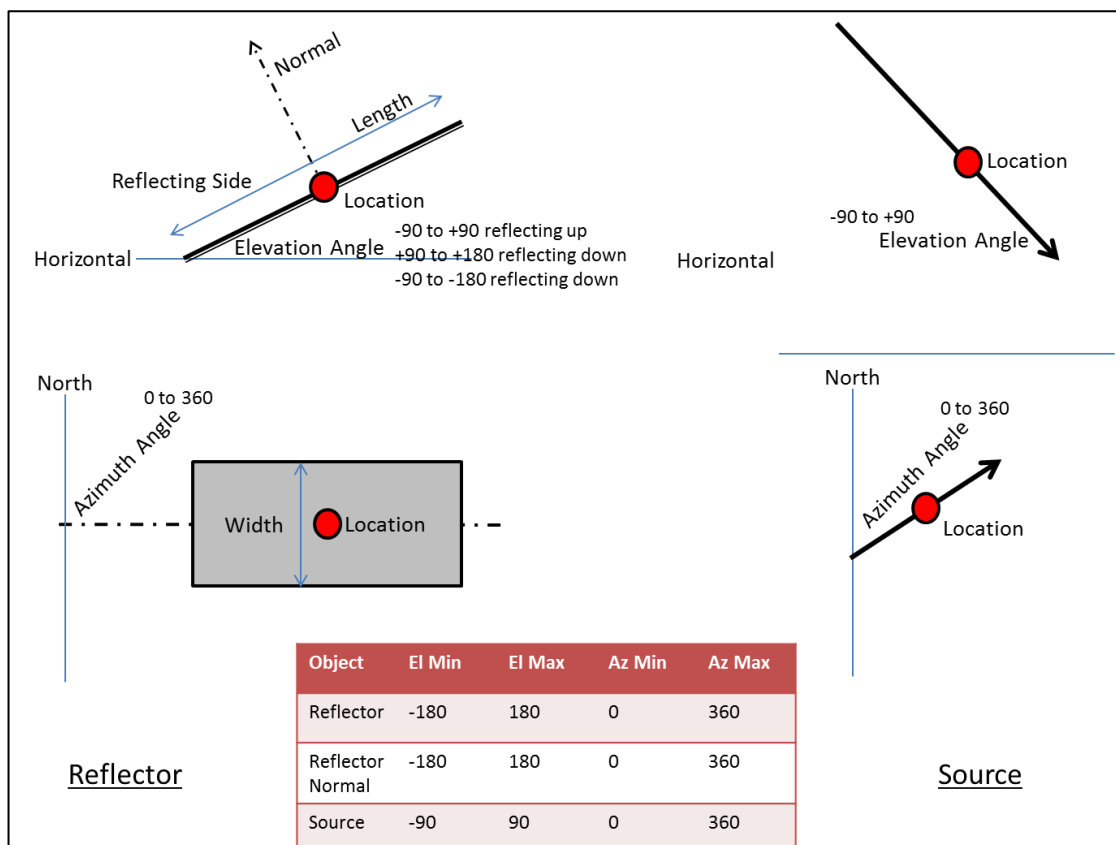
APPENDIX E – REFLECTION CALCULATIONS METHODOLOGY

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.



Reflection calculation process

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.

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)²⁷.

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

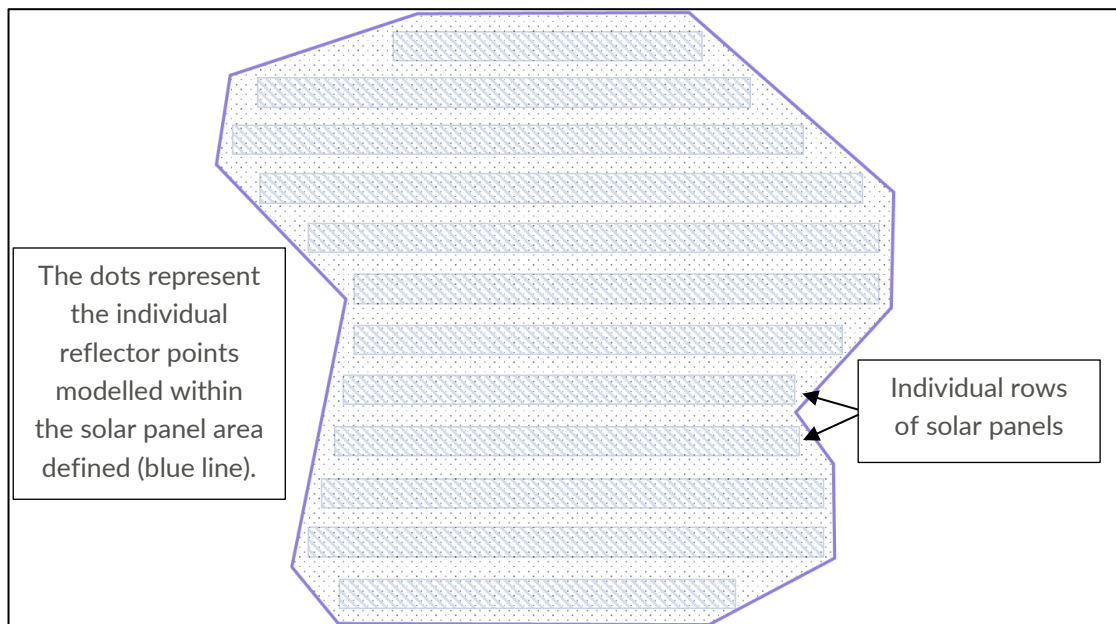
It is assumed that the panel azimuth angle assessed represents the azimuth angle for all of the panels within each solar panel area defined.

Only a reflection from the face of the panel has been considered. The frame or the reverse or 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.

²⁷ 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.

APPENDIX G – RECEPTOR AND REFLECTOR AREA DETAILS

Overview

Data and terrain heights are ascertained from OSGB 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 road user.

No.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)	No.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)
A1	51.55498	-1.92031	92.15	B20	51.55688	-1.90168	132.19
A2	51.55557	-1.91922	96.00	B21	51.55623	-1.90071	132.86
A3	51.55617	-1.91813	99.98	B22	51.55553	-1.89980	133.50
A4	51.55676	-1.91704	105.97	B23	51.55485	-1.89886	133.50
A5	51.55733	-1.91593	110.81	B24	51.55406	-1.89816	132.50
A6	51.55787	-1.91478	113.32	B25	51.55326	-1.89753	131.50
A7	51.55836	-1.91356	114.38	B26	51.55262	-1.89651	130.42
A8	51.55875	-1.91226	115.91	B27	51.55214	-1.89529	131.41
A9	51.55905	-1.91089	116.49	B28	51.55169	-1.89403	132.39
A10	51.55928	-1.90950	119.47	B29	51.55162	-1.89383	132.50
A11	51.55945	-1.90807	120.92	C1	51.57107	-1.91923	106.50
A12	51.55950	-1.90663	124.06	C2	51.57019	-1.91934	107.28
A13	51.55948	-1.90519	130.66	C3	51.56937	-1.91992	107.13
A14	51.55938	-1.90375	131.06	C4	51.56855	-1.92053	107.50
A15	51.55916	-1.90235	131.06	C5	51.56773	-1.92111	107.50
A16	51.55891	-1.90096	131.50	C6	51.56687	-1.92154	108.50

No.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)	No.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)
A17	51.55861	-1.89959	136.03	C7	51.56597	-1.92160	109.26
A18	51.55827	-1.89825	136.33	C8	51.56510	-1.92131	110.50
A19	51.55793	-1.89691	137.45	C9	51.56434	-1.92053	111.42
A20	51.55761	-1.89556	136.75	C10	51.56358	-1.91975	111.50
A21	51.55733	-1.89418	136.50	C11	51.56282	-1.91899	111.72
A22	51.55710	-1.89279	135.62	C12	51.56205	-1.91823	113.36
A23	51.55691	-1.89137	133.60	C13	51.56129	-1.91747	113.86
A24	51.55675	-1.88995	131.50	C14	51.56052	-1.91671	114.70
A25	51.55660	-1.88852	130.96	C15	51.55981	-1.91622	114.50
A26	51.55644	-1.88710	130.50	D1	51.55165	-1.89270	132.50
A27	51.55625	-1.88568	130.02	D2	51.55240	-1.89189	132.50
A28	51.55604	-1.88427	129.36	D3	51.55316	-1.89112	132.15
A29	51.55581	-1.88287	128.28	D4	51.55393	-1.89039	131.50
A30	51.55555	-1.88149	127.23	D5	51.55479	-1.88995	131.50
A31	51.55541	-1.88077	125.91	D6	51.55568	-1.88973	133.00
B1	51.56065	-1.92787	113.37	D7	51.55657	-1.88955	143.50
B2	51.56043	-1.92647	114.50	D8	51.55746	-1.88937	137.34
B3	51.56026	-1.92505	114.36	D9	51.55836	-1.88925	135.91
B4	51.56009	-1.92363	114.27	D10	51.55926	-1.88919	137.41
B5	51.55993	-1.92221	114.50	D11	51.56016	-1.88917	139.51
B6	51.55977	-1.92078	115.34	D12	51.56106	-1.88918	140.69

No.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)	No.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)
B7	51.55965	-1.91935	114.50	D13	51.56195	-1.88931	142.41
B8	51.55963	-1.91790	114.50	D14	51.56279	-1.88893	143.35
B9	51.55975	-1.91647	114.50	D15	51.56365	-1.88873	142.76
B10	51.55990	-1.91504	114.50	D16	51.56452	-1.88905	141.50
B11	51.55996	-1.91360	116.50	D17	51.56530	-1.88978	140.50
B12	51.55985	-1.91217	116.50	D18	51.56612	-1.88944	139.50
B13	51.55953	-1.91082	117.08	D19	51.56695	-1.88908	137.62
B14	51.55906	-1.90959	118.03	D20	51.56780	-1.88948	138.50
B15	51.55857	-1.90838	119.88	D21	51.56870	-1.88947	137.50
B16	51.55817	-1.90708	121.05	D22	51.56959	-1.88927	136.77
B17	51.55784	-1.90573	122.06	D23	51.57039	-1.88861	136.13
B18	51.55754	-1.90437	126.93	D24	51.57107	-1.88779	134.85
B19	51.55722	-1.90301	131.10				

Road 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.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)	No.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)
1	51.56016	-1.92593	114.38	44	51.55941	-1.89005	138.35
2	51.55963	-1.92189	114.20	45	51.55983	-1.88978	139.03
3	51.55962	-1.92146	115.19	46	51.56007	-1.88964	139.61

No.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)	No.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)
4	51.55943	-1.92013	115.04	47	51.56040	-1.88949	140.31
5	51.55924	-1.91952	114.35	48	51.56051	-1.88949	140.62
6	51.55885	-1.91914	113.80	49	51.56072	-1.88981	140.80
7	51.55866	-1.91639	114.33	50	51.56092	-1.88989	141.04
8	51.55861	-1.91574	114.19	51	51.56099	-1.89048	141.62
9	51.55849	-1.91492	114.80	52	51.56117	-1.88965	140.89
10	51.55823	-1.91010	116.17	53	51.56135	-1.88959	141.49
11	51.55799	-1.90912	116.98	54	51.56155	-1.88960	141.80
12	51.55843	-1.90588	126.25	55	51.56180	-1.88946	142.43
13	51.55840	-1.90514	129.56	56	51.56212	-1.88962	143.01
14	51.55710	-1.90372	128.30	57	51.56239	-1.88894	142.80
15	51.55682	-1.90259	130.12	58	51.56252	-1.88865	143.04
16	51.55730	-1.90184	133.44	59	51.56456	-1.89059	145.74
17	51.55738	-1.90127	134.62	60	51.56459	-1.88851	140.77
18	51.55522	-1.89973	133.78	61	51.56479	-1.88889	141.67
19	51.55324	-1.89912	130.70	62	51.56507	-1.88901	140.90
20	51.55209	-1.89896	125.80	63	51.56543	-1.88927	140.51
21	51.55218	-1.89854	127.80	64	51.56532	-1.89076	143.02
22	51.55222	-1.89809	127.80	65	51.56673	-1.89157	141.80
23	51.55219	-1.89759	129.67	66	51.56729	-1.88900	137.80
24	51.55219	-1.89717	130.39	67	51.56923	-1.88952	137.80

No.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)	No.	Latitude (°)	Longitude (°)	Assessed Height (m amsl)
25	51.55204	-1.89634	131.67	68	51.56947	-1.88949	137.80
26	51.55221	-1.89610	131.62	69	51.56961	-1.88975	137.80
27	51.55201	-1.89539	131.80	70	51.56949	-1.89084	138.80
28	51.55180	-1.89479	132.43	71	51.56985	-1.89069	139.06
29	51.55237	-1.89250	132.80	72	51.56995	-1.89151	139.80
30	51.55287	-1.89255	132.80	73	51.57034	-1.89181	140.44
31	51.55308	-1.89206	132.80	74	51.57052	-1.89216	140.69
32	51.55380	-1.89077	131.80	75	51.56958	-1.89760	146.80
33	51.55426	-1.89108	131.80	76	51.56716	-1.92008	108.80
34	51.55453	-1.88611	129.80	77	51.56119	-1.91533	113.53
35	51.55523	-1.88576	129.80	78	51.56161	-1.90961	118.80
36	51.55728	-1.89092	134.38	79	51.56163	-1.90924	119.80
37	51.55788	-1.89106	135.79	80	51.56096	-1.90240	135.54
38	51.55806	-1.89124	136.10	81	51.56325	-1.90646	133.42
39	51.55827	-1.89072	136.16	82	51.56413	-1.90670	132.80
40	51.55854	-1.89067	136.67	83	51.56320	-1.90423	139.54
41	51.55875	-1.89044	136.70	84	51.56350	-1.90447	139.06
42	51.55898	-1.89038	137.09	85	51.56346	-1.90385	140.10
43	51.55926	-1.89020	137.89	86	51.56767	-1.90691	138.08

Dwelling receptor data

Modelled Panel Area

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	-1.91518	51.56490	52	-1.89212	51.56346
2	-1.91289	51.56268	53	-1.89558	51.56351
3	-1.90927	51.56366	54	-1.89555	51.56426
4	-1.90937	51.56389	55	-1.89378	51.56428
5	-1.90993	51.56447	56	-1.89328	51.56487
6	-1.90922	51.56474	57	-1.89327	51.56548
7	-1.90766	51.56460	58	-1.89260	51.56555
8	-1.90643	51.56505	59	-1.89555	51.56618
9	-1.90628	51.56611	60	-1.89605	51.56629
10	-1.90636	51.56646	61	-1.89602	51.56644
11	-1.90655	51.56687	62	-1.89621	51.56659
12	-1.90657	51.56708	63	-1.89695	51.56718
13	-1.90742	51.56703	64	-1.89835	51.56866
14	-1.90752	51.56818	65	-1.89921	51.56852
15	-1.90684	51.56816	66	-1.89966	51.56817
16	-1.90669	51.56869	67	-1.90001	51.56802
17	-1.90483	51.56826	68	-1.90009	51.56801
18	-1.90530	51.56739	69	-1.90033	51.56804
19	-1.90400	51.56543	70	-1.90058	51.56807
20	-1.90348	51.56597	71	-1.90093	51.56820
21	-1.90329	51.56660	72	-1.90114	51.56845

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
22	-1.90236	51.56756	73	-1.90127	51.56864
23	-1.90213	51.56776	74	-1.90124	51.56876
24	-1.90107	51.56737	75	-1.90114	51.56906
25	-1.90029	51.56656	76	-1.90084	51.56956
26	-1.89835	51.56641	77	-1.90151	51.56968
27	-1.89769	51.56601	78	-1.90186	51.56991
28	-1.89763	51.56579	79	-1.90224	51.57019
29	-1.89781	51.56548	80	-1.90274	51.57031
30	-1.89826	51.56531	81	-1.90375	51.57018
31	-1.89941	51.56507	82	-1.90441	51.56989
32	-1.89931	51.56505	83	-1.90450	51.56992
33	-1.89885	51.56486	84	-1.90480	51.56999
34	-1.89870	51.56468	85	-1.90515	51.57005
35	-1.89886	51.56458	86	-1.90534	51.57009
36	-1.89977	51.56467	87	-1.90578	51.57009
37	-1.89992	51.56453	88	-1.90642	51.57021
38	-1.90091	51.56460	89	-1.90694	51.57032
39	-1.90184	51.56448	90	-1.90722	51.57047
40	-1.90235	51.56436	91	-1.90761	51.57065
41	-1.90233	51.56390	92	-1.90791	51.57079
42	-1.90099	51.56267	93	-1.90814	51.57085
43	-1.90013	51.56273	94	-1.90919	51.57107

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
44	-1.89996	51.56118	95	-1.90992	51.57077
45	-1.89802	51.56129	96	-1.91035	51.57054
46	-1.89655	51.56125	97	-1.91263	51.56926
47	-1.89637	51.56101	98	-1.91323	51.56860
48	-1.89394	51.56060	99	-1.91413	51.56754
49	-1.89222	51.56087	100	-1.91507	51.56629
50	-1.89239	51.56208	101	-1.91589	51.56617
51	-1.89225	51.56213			

Modelled Panel area

APPENDIX H – DETAILED MODELLING RESULTS

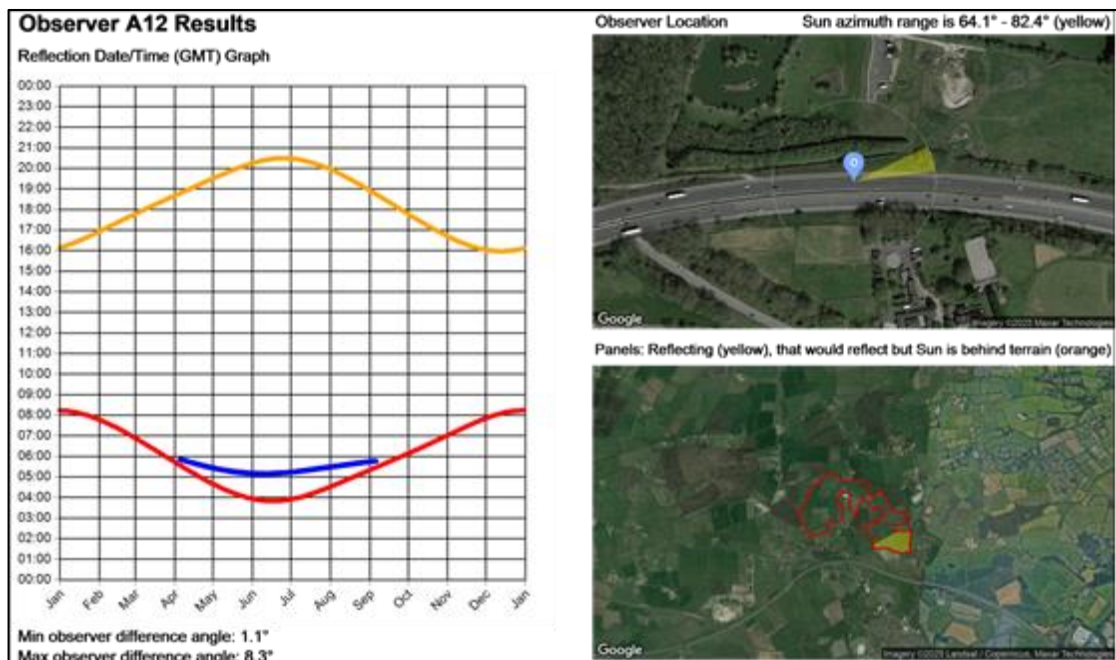
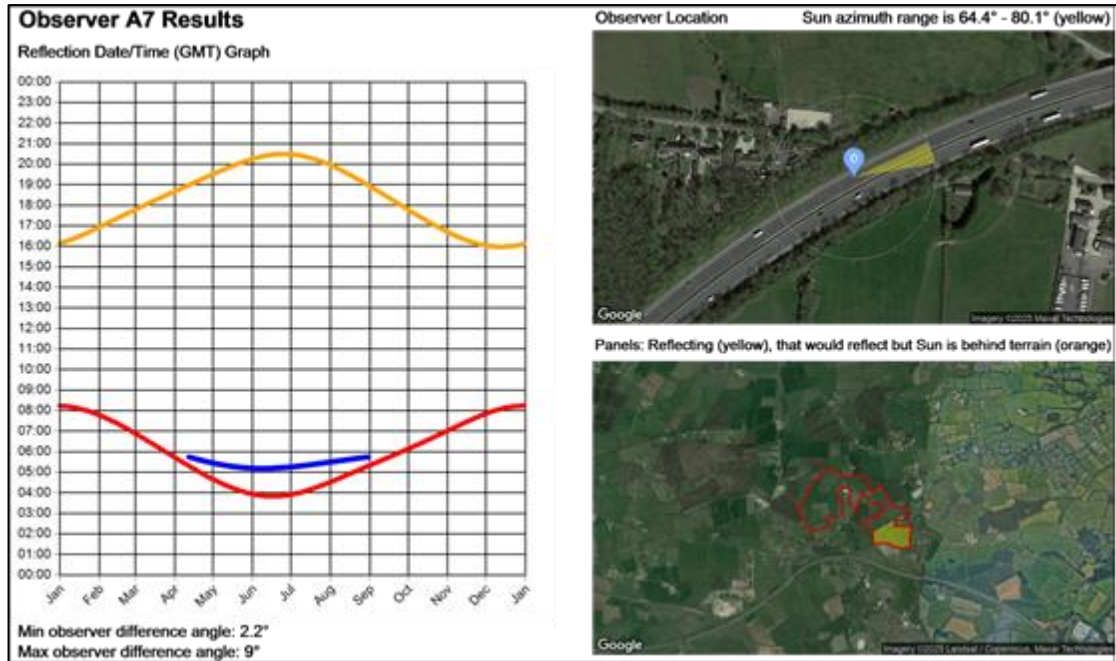
Overview

The Pager Power charts for a selection of representative receptors where solar reflections are predicted to be geometrically possible, are shown on the following pages. Full modelling results are available upon request. 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).

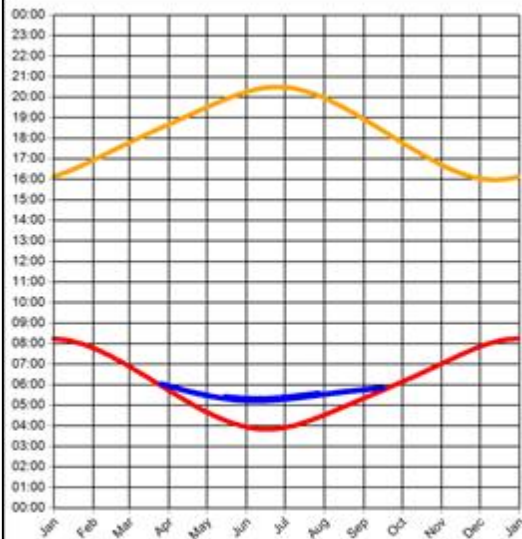
Road Receptors

Selective results have been shown for completeness. Full modelling results are available upon request.



Observer B4 Results

Reflection Date/Time (GMT) Graph



Min observer difference angle: 0°
Max observer difference angle: 11.6°

Observer Location Sun azimuth range is 64.8° - 86.4° (yellow)

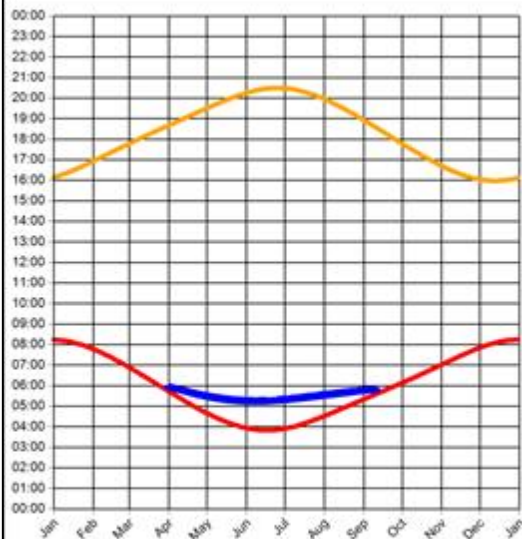


Panels: Reflecting (yellow), that would reflect but Sun is behind terrain (orange)



Observer C10 Results

Reflection Date/Time (GMT) Graph



Min observer difference angle: 0°
Max observer difference angle: 11.5°

Observer Location Sun azimuth range is 64.6° - 84.6° (yellow)

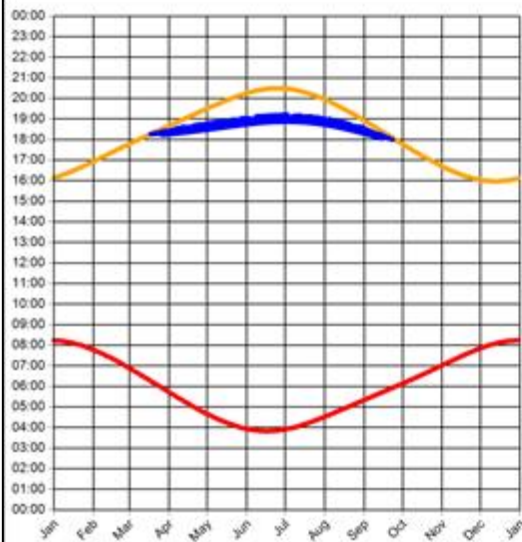


Panels: Reflecting (yellow), that would reflect but Sun is behind terrain (orange)



Observer D13 Results

Reflection Date/Time (GMT) Graph



Min observer difference angle: 0.3°
Max observer difference angle: 13.4°

Observer Location Sun azimuth range is 269.7° - 296.3° (yellow)

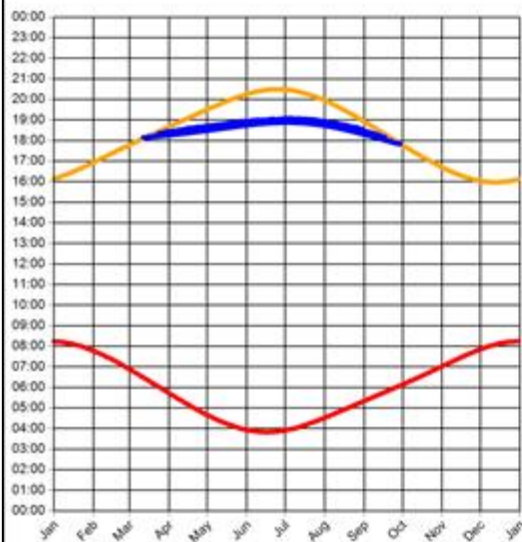


Panels: Reflecting (yellow), that would reflect but Sun is behind terrain (orange)



Observer D15 Results

Reflection Date/Time (GMT) Graph



Min observer difference angle: 0.2°
Max observer difference angle: 13.4°

Observer Location Sun azimuth range is 266.7° - 294.8° (yellow)

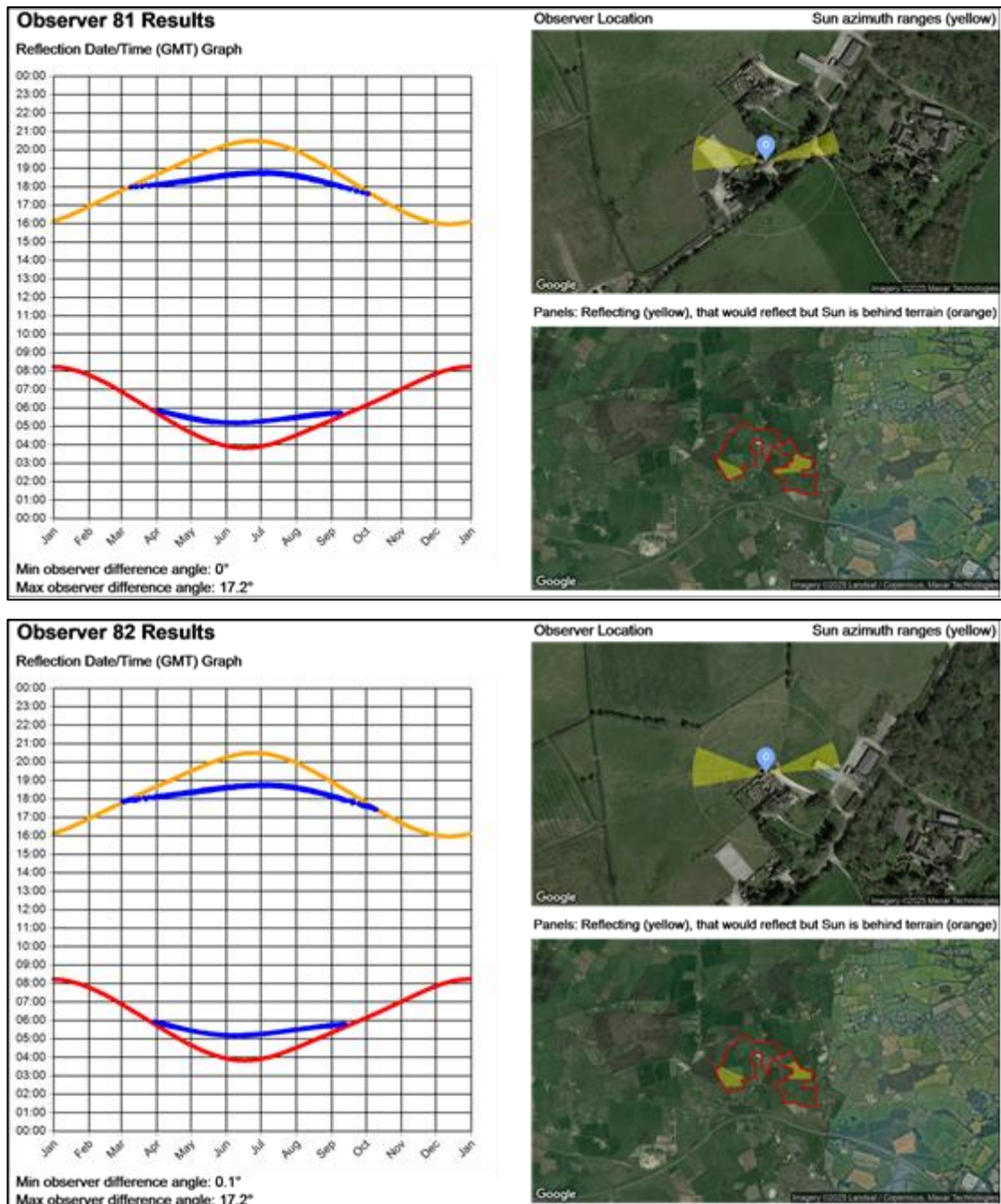


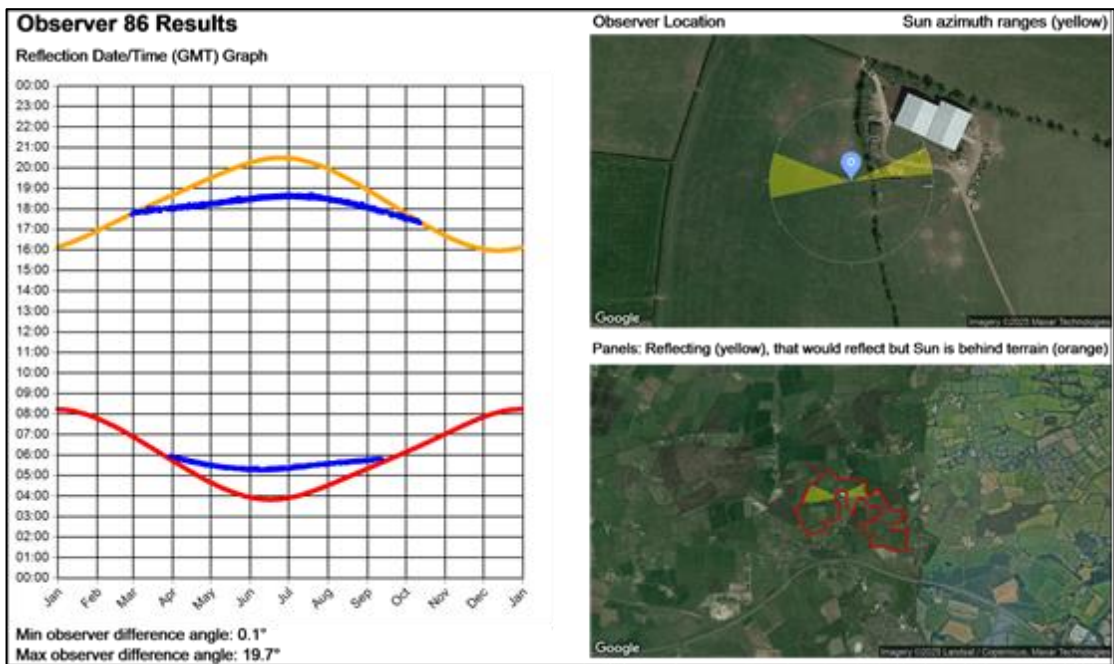
Panels: Reflecting (yellow), that would reflect but Sun is behind terrain (orange)



Dwelling Receptors

The results are shown for dwellings where mitigation has been recommended. Full modelling results are available upon request.







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