Fferm Solar Larnog

Environmental Statement

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Volume IV, Appendix 11B: Solar Glint and Glare Assessment

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Executive Summary

This report presents a Glint and Glare assessment for the Larnog Solar Farm (hereafter, 'the Proposed Development'). The Proposed Development would be located on land approximately 500 m south-west of Penarth and 550 m east of Sully (hereafter 'the Site'). The objective of the assessment was to evaluate the potential risk of solar glint and glare from the proposed ground-mounted photovoltaic panels (PVs) on surrounding sensitive receptors.

The assessment was conducted using the Sandia National Laboratories' Solar Glare Hazard Analysis Tool (SGHAT)[1], developed for the United States' Federal Aviation Administration (FAA). The assessment was undertaken using Forge Solar software, which implements the SGHAT methodology for the assessment of glint and glare which is widely considered to align with UK best practice for the assessment of glint and glare in the aviation sector.

Key findings of the assessment include:

- **Sensitive Receptors**: The receptors considered for this assessment included residential buildings and roads within and outside of the Site, aerodromes, flight paths, and helipads. Due to their distance from the Site, operational rail tracks were scoped out of the assessment as they are outside the identified impact zones;
- **Assessment Methodology**: The potential occurrences of solar glint and glare were determined through solar geometry and intensity analyses, accounting for reflected sunlight over each solar PV array on a minute-by-minute basis throughout the year. The bare earth model is conducted without considering obstructions such as vegetation or buildings;
- **Results**: The initial analysis found that there would be glint and glare effects on the following receptors; the Cardiff Airport Air Traffic Control Tower (ATCT), a dwelling along Fort Road, two dwellings along St Mary's Well Bay Road, and a caravan park to the south-west of the Site. Following the initial modelling, a qualitative review of existing vegetation screening and embedded mitigation measures was undertaken to inform the glint and glare assessment (see below);
- **Mitigation**: The Proposed Development will deliver a Landscape and Ecological Management Plan that includes hedgerow strengthening, hedgerow planting, and other habitat creation across the Site. This planting will provide additional screening (in combination with existing vegetation screening at the Site) to mitigate any potential glint and glare effects on residential and aviation receptors;

[1] ForgeSolar tool, based on the Solar Glare Hazard Analysis Tool ("SGHAT") licensed from Sandia National Laboratories.

- **Assessment**: When accounting for existing vegetation at the Site and the proposed Landscape and Ecological Management Plan delivered as part of the Proposed Development, the potential glint and glare effects identified at the dwelling along Fort Road, dwellings along St Mary's Well Bay Road, and caravan park to the south-west of the Site are not significant. The assessment also identified the potential for glint and glare effects at Cardiff Airport ATCT under the conservative assessment assumptions applied, which do not take account of existing or proposed screening. As such, further assessment and modelling will be undertaken as part of the final Environmental Statement to confirm the nature and extent of any potential effects on the ATCT and the need for any additional mitigation; and
- **Further Studies**: A further assessment of glint and glare effects associated with the Proposed Development will be undertaken as part of the final Environmental Statement.

1. Introduction

1.1.1. This Glint and Glare assessment has been prepared by WSP UK Ltd (WSP) on behalf of Trydan Gwyrdd Cymru (hereafter, 'the Applicant') in support of the planning application for the proposed Larnog Solar Farm (hereafter, the 'Proposed Development'). The Proposed Development would be located on land approximately 500 m south-west of Penarth and 550 m east of Sully (hereafter 'the Site'). The location of the Proposed Development is illustrated in **Figure 1.1: Site Location Plan** (Volume III of the ES).

1.1.2. The study assesses the potential glint and glare effect of the Proposed Development on the local surroundings and identifies the receptors that may be significantly impacted.

1.1.3. Glare is a phenomenon caused by a bright source of light that inhibits the ability to view a task or scene, due to an uncomfortable or even blinding effect on the viewer. Glare or dazzle can occur when sunlight is reflected from reflective surfaces onto pedestrians, vehicles, trains and aircraft. The impact can be significant when reflected sunlight is within the observer's field of view. When the level of discomfort due to glare prompts evasive action, such as turning away from the reflection or shielding the eyes, this is called disability glare.

1.1.4. Based on the Sandia National Laboratories' Solar Glare Hazard Analysis Tool (SGHAT) this assessment has used modelling software developed by Forge Solar, an internationally used tool for the assessment of glint and glare.

2. Guidance

2.1. Introduction

2.1.1. There is no specific legislation or guidance in relation to glint and glare assessments for PV solar developments. Therefore, assessments typically draw upon established industry guidance and methodologies.

2.2. UK Guidance

Solar Photovoltaic and Building Development – Glint and Glare Guidance[2]

2.2.1. Pager Power has developed a document with the aim to provide guidance for assessing the impact of glint and glare from solar PV panels and building developments with large reflective façades upon surrounding receptors to dwellings, roads, rail, and aviation receptors. The fourth edition of 'Solar Photovoltaic and Building Development – Glint and Glare Guidance' was published in 2022.

2.3. US Federal Aviation Agency (FAA) Guidance

2.3.1. The US FAA provides a detailed methodology for assessing glint and glare. These are the most comprehensive guidelines available for the assessment of glint and glare for aviation and are recognised internationally. The following documents have therefore been used to inform the glint and glare assessment when considering aviation receptors.

FAA Review of Solar Energy System Projects on Federally Obligated Airports[3]

2.3.2. The FAA acknowledges the fact that solar energy developments have the potential to cause glint and glare effects that could result in ocular impact to pilots or air traffic controllers, compromising the safety of the air transportation system.

Technical Guidance for Evaluating Selected Solar Technologies on Airports[4]

2.3.3. This document supersedes the previous version of the guidance issued in 2010. In relation to glint and glare analyses, the FAA updated Section 3.1.2 'Reflectivity' to incorporate the latest guidance for evaluating solar glint and glare and the corresponding references to glare throughout the document.

[2] Scrivener, D. et al. Solar Photovoltaic and Building Development – Glint and Glare Guidance, Fourth Edition, Pager Power Urban and Renewable
[3] Department of Transportation, Federal Aviation Administration (FAA), 2013, Interim Policy, FAA Review of Solar Energy System Projects on Federally Obligated Airports
[4] Federal Aviation Administration (FAA), 2018, Technical Guidance for Evaluating Selected Solar Technologies on Airports

3. Methodology and Criteria

3.1. Assessment Methodology

3.1.1. The methodology of the assessment includes the following key steps:

- Identify sensitive receptors including residential buildings, main roads, railways, and aerodromes, where applicable;
- Create a 3D model of the Proposed Development;
    - For building receptors: assess windows facing the Site within 1 km of the Site at a height of 1.8 m above floor level, representing the eye level of a standing person;
    - For route receptors: assess roads within 1 km from the Site at a height of 1.5 m above ground level (AGL);
    - For rail receptors: assess train tracks within 0.5 km of the Site at a height of 2.75 m AGL, representing a train driver's eye level; and
    - For aviation receptors: consider an azimuthal field-of-view (FOV) of 100° and a vertical FOV of 30° for the pilots, in accordance with FAA guidance. Glare beyond these ranges is considered not visible.
- Undertake the analysis to determine whether a solar reflection is geometrically possible between the proposed solar PV panels and the receptors;
- Identify the potential glare at the receptors, and the time and duration of occurrence, if applicable;
- Determine whether the identified solar reflection is significant; and
- Identify/consider mitigation measures, where required.

3.1.2. The above methodology has been developed with reference to Solar Photovoltaic and Building Development – Glint and Glare Guidance[5], which provides guidance on the assessment and qualification of potential glint and glare.

3.2. Tools and Criteria

3.2.1. The SGHAT[5] is a validated tool developed by Sandia National Laboratories specifically designed to assess glint and glare. Public access to SGHAT is now restricted, and its functionality has been incorporated into Forge Solar. Based on the SGHAT methodology, this assessment uses modelling software developed by Forge Solar, a recognised tool for the assessment of glint and glare that is used internationally, and it is widely adopted in the UK for the assessment of glint and glare impacts to aviation receptors.

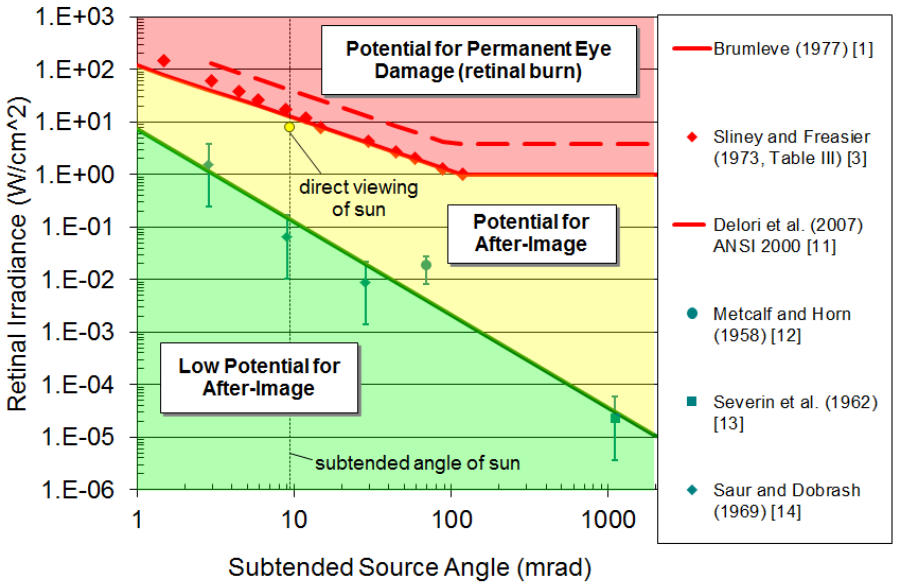
[5] Forge Solar tool, based on the Solar Glare Hazard Analysis Tool ("SGHAT") licensed from Sandia National Laboratories.

3.2.2. The ocular impact of solar glare is quantified into three categories:

- Green - low potential to cause after-image (flash blindness);
- Yellow - potential to cause temporary after-image; and
- Red - potential to cause retinal burn (permanent eye damage).

3.2.3. The above categories of ocular impacts of solar glare can be visualized with the Glare Hazard Plot. The chart below (**Plate 1**) represents a universal Hazard Plot. **Plate 1** displays the ocular impact as a function of glare-subtended source angle and retinal irradiance. Each minute of glare is displayed on the chart as a small circle in its respective hazard zone. A reference point is provided that illustrates the hazard from viewing the sun without filtering, i.e., staring at the sun.

Plate 1 - Ocular Hazard Plot



3.2.4. For route and building receptors, the following significance of effect criteria has been adopted:

- Any red glare with potential to cause retinal burn is not acceptable;
- Yellow glare, which can cause a temporary after-image, is not acceptable if it persists for 60 minutes or more on any given day; and
- Green glare with '*low potential for after-image*' is acceptable.

3.2.5. When determining the significance of effect on railway receptors, the location of origin of the solar reflection is more significant than its duration because the receptor is moving. Therefore, the length of time a solar reflection persists is largely dependent on a train's speed rather than the solar PV development itself. The significance of effects is therefore assessed on a case-by-case basis, taking into account the location of origination of the solar reflection, the length of railway affected, and the infrastructure present on the assessed railway line, in accordance with the SGHAT guidelines.

3.3. Study Area

3.3.1. The study area has been defined in accordance with the Solar Photovoltaic and Building Development - Glint and Glare Guidance. The study area comprises the Proposed Development together with the surrounding area required to identify and assess sensitive receptors that may experience solar glint and glare effects.

3.3.2. The 3D assessment model includes the proposed solar PV arrays and all relevant surrounding receptors. The topographical characteristics of the Site and the surrounding area have been incorporated using geographical elevation data, ensuring that the relative positions and elevations of the PV arrays and receptors are accurately represented. Please refer to **Figure 1 (Annex A)**.

3.3.3. The assessment also considers nearby consented developments, where relevant, to understand the future context of the Site and its surrounding area.

3.3.4. The solar PV arrays have been modelled based on information and drawings provided by the Project Team in August and September 2026 and supplemented with available aerial photographic data for the area. The information used to inform the model are presented in **Table 3.1**.

Table 3.1 - Drawing sets used to construct the model

Filename/Description	Note
Indicative Site Layout (**Figure 5.1: Indicative Site Layout** – Volume III of the ES)	Solar PV array
Landscape and Ecological Masterplan (**Appendix 6G: Outline LEMP –** Volume IV of the ES)	PV array and landscape
EIA Scoping Report (**Appendix 1B: EIA Scoping Report –** Volume IV of the ES)	PV array and structure
Cumulative Long-List of Projects (**Chapter 2: Approach to the EIA –** Volume II of the ES)	Consented schemes

3.3.5. The details of the modules' orientation, tilt, height, and surface material have been drawn from **Chapter 5: Project Description** (Volume II of the ES).

3.3.6. A smooth glass with anti-reflection coating for the solar PV modules' material has been assumed for the assessment, based on the current design. The orientation of the panels is 180°, i.e. south orientated. The tilt angle is fixed at 17°. The height of the solar PV panels from the ground as measured from the drawings is considered as 2 m to the centre of the panels. It has been assumed that existing ground levels will be retained for the purposes of the assessment.

3.3.7. Details of all elements included in the model are available in **Annex B**.

3.4. Assessment Modelling

3.4.1. A computational model of the proposed Solar Farm and the surrounding area within approximately 1 km of the Site was constructed (**Annex A**). This was undertaken to account for the influence of the surrounding context on the solar geometry of the site. The model used an interactive map interface, where the locations of the Site and the receptors modelled were all recorded (latitude, longitude and elevation) allowing the calculation of the sun and vectors positions specific to them.

3.4.2. Solar PV systems were represented by a planar polygon footprint and a set of customisable parameters. Each solar PV array was modelled and positioned at the proposed height AGL. The solar reflectivity of the PV has also been introduced.

3.4.3. During the annual computational analysis, sunlight reflected over each solar PV array has been calculated on a minute-by-minute basis according to the specified tilt and orientation of the modules. The analysis then checks whether the resulting solar reflections intersect with the receptors.

3.4.4. The analysis does not consider obstructions such as vegetation and buildings at this stage. This approach considers the worst-case scenario since vegetation and buildings can help obstruct glare. Where glare is identified at a receptor, advice regarding suitable mitigation is provided. Following the initial modelling, a qualitative review of existing screening features, including vegetation, buildings and local landform, together with proposed embedded mitigation forming part of the Proposed Development, is undertaken to inform the glint and glare assessment (see **Section 5**).

3.5. Weather Data

3.5.1. For this assessment, all time references are in local UTC +0 time in Wales, UK.

4. Receptors for the Assessment

4.1. Receptors within the Study Area

4.1.1. Sensitive receptors have been selected based on the likelihood of being affected by the Proposed Development. The sensitive receptors which have been identified within the Study Area include:

- Train drivers on tracks within 0.5 km of the Site;
- Car drivers on roads within approximately 1 km of the Site;
- Dwellings located within 1 km of the Site; and
- Aircraft pilots and air traffic control personnel operating within a 30 km radius of the Site.

4.1.2. While pedestrians may experience discomfort from glare, the potential for severe accidents is significantly lower compared to other identified sensitive receptors. Therefore, pedestrians have not been included in the detailed glare assessment.

4.1.3. A review of consented developments within the study area identified two residential schemes at South Cosmeston (Ref. 2020/1170/OUT) and Swanbridge Road, Sully (Ref. 2025/00509/RES), together with the proposed Sully to Cosmeston Active Travel Route (2025/00493/RG3). These schemes have been included within the assessment to ensure that potential glint and glare effects on future receptors are considered as part of the glint and glare assessment.

4.2. Aviation Receptors

4.2.1. The primary aviation receptors considered within a glint and glare assessment are aircraft pilots and air traffic controllers. In accordance with FAA guidance, a 30 km study area has been adopted to identify airports, airfields and heliports that may fall within the zone of influence (ZOI) of the Proposed Development.

4.2.2. The ZoI identified several aviation receptors in the Study Area comprising of airports, ATCTs and heliports. Please refer to **Table 4.1**.

Table 4.1 - Aviation receptors identified with site proximity

Number	Receptors	Distance from the site
Two-mile flight paths		
FP1	Cardiff Airport	9.25 km
FP2	Cardiff Airport	9.25 km
FP3	Cardiff Heliport	6.86 km
FP4	St Athans Airfield	15.7 km
	Bristol Airport	31.17km
	RAF Llandow	21.1 km

Number	Receptors	Distance from the site
Air Traffic Control Towers (ATCT)		
	Bristol Airport -ATCT	33.2 km
OP1	Cardiff Airport - ATCT	10.2 km
OP59	St Athan Airfield - ATCT	17.2 km
Heliports and Helipads		
OP2	Flat Holm Helipad	5.1 km
OP40-47	Two-mile flight path around the helipad	-
OP48	Cardiff Heliport	6.86 km
OP49-56	Two-mile flight path around the helipad	-

4.2.3. Aviation receptors within 10 km of the Site were considered for further assessment, please refer to **Figure 3** (**Annex A**).

4.2.4. In the absence of published helicopter flight paths or approach procedures for the identified helipads, a precautionary assessment approach has been adopted.

4.2.5. Helipad receptors were represented by observation points at the helipad and along representative approach and departure corridors extending up to 3.2 km from the helipad. In the absence of defined flight paths, observation points were positioned along the cardinal directions and at heights corresponding to a 10° approach angle, providing a conservative assessment of potential glare effects on helicopter operations.

4.2.6. The nearest aviation receptors to the Site are Cardiff Airport, Cardiff Airport ATCT, Flat Holm Helipad and Cardiff Heliport. These receptors were assessed for potential glint and glare effects from the proposed solar PV arrays in accordance with current guidance. Cardiff Airport ATCT is located marginally beyond the 10 km radius for further assessment. However, given its proximity to this threshold and the potential visibility of the Site from the ATCT due to the relative altitude of the Site and airport, it was included within the assessment as a precautionary measure based on professional judgement.

4.3. Railway Infrastructure

4.3.1. Solar farms have the potential to cause glare to train drivers within 0.5 km. The nearest operational railway infrastructure to the Site is the Vale of Glamorgan Line, which runs between Cadoxton, Cogan and Grangetown.

4.3.2. A review of the railway network surrounding the Site confirmed that there are no sections of operational railway track within 0.5 km of the Site. Therefore, they are not considered susceptible to significant glint and glare effects, and railway receptors have been **scoped out** of the detailed assessment.

4.4. Route Receptors

4.4.1. Solar farms have the potential to cause glare to car drivers within 1 km of the solar PV arrays. Where a road has a direct line of view to the solar PV array, a solar reflection is possible which may potentially impact the car drivers on these roads depending on the intensity of the reflection.

4.4.2. The assessment identified road receptors within approximately 1 km of the Site that have potential views towards the Site. These receptors were included within the assessment to evaluate the potential for glint and glare effects on road users.

4.4.3. In addition to the existing road network, a consented Active Travel Route (ATR) is proposed along a former railway alignment between Sully and Cosmeston (2025/00493/RG3). Although the consented ATR is not a vehicular road, it has been included within the assessment as a future transport receptor. The route will be used by pedestrians and cyclists who may have views towards the proposed solar PV arrays and therefore have the potential to experience glint and glare effects. Its inclusion ensures that the future surroundings has been appropriately considered.

4.4.4. The route receptors identified for the assessment are listed in **Table 4.2** and illustrated on **Figure 4** (**Annex A**).

Table 4.2 - Sensitive Receptors - Roads

Receptor Number	Route Name	Status	Height from the ground (m)
1	St Mary's Well Bay Road	Existing	1.5
2	Fort Road	Existing	1.5
3	B4267 Lavernock Road	Existing	1.5
4	B4267 Lavernock Road - Cosmeston	Existing	1.5
5	Beach Road	Existing	1.5
6	South Road	Existing	1.5
7-11	Residential roads – Clevedon Avenue, Winsford Road, Highbridge Close, Swanbridge Grove and Swanbridge Road.	Existing	1.5
12-17	Cosmeston Drive, Falcon Grove, Osprey Close, Raven Way, Fulmar Close and Shearwater Close.	Existing	1.5
18	Consented active travel route	Consented	1.5

4.5. Dwellings

4.5.1. The Study Area includes residential receptors within 1 km of the proposed solar PV arrays, please refer to **Table 4.3** and **Figure 5** (**Annex A**). Most of the dwellings are located within and between the villages of Sully and Penarth. Each of these receptors, or a group of receptors where relevant, is represented by a numbered observation point.

4.5.2. In addition to existing residential receptors, the assessment has considered two consented residential developments within the future surroundings.

- The consented scheme at South Cosmeston (Receptors OP31-35; Ref. 2020/1170/OUT); and
- The consented development at Swanbridge Road, Sully (Receptors OP36-39; Ref. 2025/00509/RES).

4.5.3. Observation points have been placed at representative locations based on the planning application drawings and publicly available information. These locations are considered sufficient for assessing the potential glint and glare effects on future residents.

4.5.4. Building receptors are considered at a height of 1.8 m AGL based on the Solar Glint and Glare Guidance. This is because ground floors typically contain living rooms, which are considered more sensitive compared to bedrooms, which are assumed to be on the upper floors. These assumptions follow standard practice and are generally adopted for this type of assessments.

Table 4.3 - Sensitive Receptors - Dwellings

Receptor Number	Building	Height from ground (m)
OP 3-7	Dwellings on Swanbridge Road to the west	1.8
OP 8 OP 41,42	Dwellings to the southwest of site on Beach Road	1.8
OP 9	Dwelling to the north of the Site	1.8
OP 10-12	Dwellings to the north-east of the Site near Plot 19	1.8
OP 13-18	Dwelling located at the edge of Site on Fort Road	1.8
OP 20	Dwelling located on the south-west edge of Site	1.8
OP19 OP21-27	Caravan Park on the southwest of the Site	1.8
OP 28-30	Caravan Park on the southeast of the Site	1.8
OP 31 - 35	Consented scheme on the northeast in South Cosmeston (2020/1170/OUT)	1.8
OP 36-39	Consented scheme on the northwest in Swanbridge Road, Sully (2025/00509/RES)	1.8

5. Assessment Results

5.1. Introduction

5.1.1. The potential occurrences of glint and glare have been determined via solar geometry, identifying the reflections and the intensity for the year. The annual analysis accounts for the reflected sunlight over each solar PV array on a minute-by-minute basis for the year. The results of the assessment are presented in this chapter, and details of the results are provided in **Annex C** of this report.

5.1.2. It should be noted that the initial modelling is a 'bare-earth' calculation method and is therefore a conservative worst-case scenario which does not account for screening from existing or proposed vegetation, buildings or other local obstructions. Following this, subsequent indicative qualitative review has then been undertaken to consider the extent to which existing vegetation and proposed embedded mitigation would restrict views of solar panels from identified receptors where potential glint and glare effects have been predicted.

5.1.3. The Proposed Development incorporates embedded landscape mitigation through the oLEMP (see **Appendix 6G: Outline LEMP**), including the retention of existing vegetation, strengthening of existing hedgerows and additional boundary planting. This has been considered below, following the initial modelling results.

5.1.4. Where the embedded landscape measures are insufficient, additional glare-specific mitigation may be required.

5.2. Aviation Receptors

5.2.1. The predicted glint and glare results on aviation receptors are summarised below in **Table 5.1**. Consideration has been given to the duration of the glare, the stage of flight affected, and where the glare comes from. The potential impact is presented as follows:

- None: No glare is predicted;
- Low: Only green glare (low potential for temporary after-image) is predicted on a flight path. This is considered acceptable; and
- Mitigation required: Glare of any intensity is predicted at an ATCT, or yellow glare (potential for temporary after-image) is predicted on a flight path.

Table 5.1 - Aviation Receptors Summary

Receptor Number	Receptor Name	Green Glare (mins)	Yellow Glare (mins)	Impact?
Two-mile flight paths				
FP1	Cardiff Airport	0	0	**None**

Receptor Number	Receptor Name	Green Glare (mins)	Yellow Glare (mins)	Impact?
FP2	Cardiff Airport	1,239	0	Low
Air Traffic Control Tower (ATCT)				
OP1	Cardiff Airport ATCT	913	0	Mitigation required
Heliports and Helipads				
OP2	Cardiff Heliport Centre	0	0	None
OP48	Flat Holm Centre	0	0	None
FP 5 to FP12	Flat Holm Flight Paths	Up to 7,845	0	Low
FP3,FP 13 to FP 19	Cardiff Heliport Flight Paths	0	0	None

Flight Paths and Heliports

5.2.2. No glare was predicted for Cardiff Heliport flight paths. Green glare (low potential for temporary after image) was predicted for one Cardiff Airport Flight path (FP2) and some Flat Holm Heliport Flight Paths (FP6, FP10). No yellow glare was predicted.

5.2.3. To determine the significance of effect on flight paths, the FAA guidelines[4] advise that in addition to duration of the glare effect, the location of the source of glare, whether it occurs in critical flight stages, frequency of occurrence in the operational context of the aerodrome should be considered:

- Cardiff Airport (FP2): Green glare is identified for 21 hours a year. It occurs for less than 45 mins a day between 6-7 AM. At these times, the sun is low, so reflections are likely to appear close to direct sunlight already within the pilot's field; and
- Flat Holm Helipad (FP6, FP10): Green glare occurs for less than 40 mins a day in the late evenings. The glare also is limited to the outer part of the assessed flight paths, further away from the helipad threshold and does not occur in the final stage of approach and landing.

5.2.4. Green glare is considered acceptable for approach paths, according to the guidance. The glare at both receptors is green only, short and limited to specific times and parts of the flight path, so the impact on aircraft and helicopter operations is **low** and **no mitigation is required**.

Air Traffic Control Towers (ATCT)

5.2.5. The assessment identified green glare and no yellow glare at the ATCT receptor. The Cardiff Airport ATCT (OP1) has 913 minutes of predicted glare per year. Green glare at Cardiff ATCT comes mainly from arrays on the north and eastern side of the Site. It occurs in the early morning when the sun is low in the east.

5.2.6. As in the case of the flight path, the guidelines[4] advise that in addition to duration of the glare effect, the location of the source of glare, distance of reflecting surfaces and the tower and operational context of the aerodrome should be considered to determine significance.

5.2.7. However, FAA guidance also states that no glare of any intensity should be experienced at an ATCT. Although the predicted glare is short (less than 45 mins a day) and occurs within a limited seasonal window, a precautionary approach has been taken in line with the guidance. Accordingly, a further detailed glint and glare assessment will be undertaken as part of the final ES, which will consider both existing and proposed screening within the modelling. Should the detailed assessment identify the need for additional mitigation beyond that currently proposed, appropriate mitigation measures will be refined and incorporated into the Proposed Development.

5.3. Route Receptors

5.3.1. The results of the assessment for the route receptors, summarised in **Table 5.2**, show that many of the existing road receptors experience no-glare or limited periods of green glare only.

5.3.2. Some of the receptors adjacent to the Site experience both yellow and green glare and require further consideration. However, the glare modelling is conservative. Existing trees, hedges and buildings along the routes were not included in the model. These features may screen some of the predicted glare.

5.3.3. The impact on route receptors has been assessed considering the intensity of the predicted glare, the type of road and the time of the day that glare occurs. The results consider:

- None: no glare is predicted;
- Low: glare is predicted, but existing screening, the road type or a low sun angle means it is not expected to affect road users significantly; and
- Mitigation required: glare is predicted, and existing screening may not enough to block views of the panels. In such instances, the embedded mitigation incorporated into the Proposed Development is considered.

Table 5.2 - Route Receptors Summary

Baseline Conservative Scenario (As currently assessed)					Potential mitigation	
Receptor Number	**Route Name**	**Status**	**Green Glare (mins)**	**Yellow Glare (mins)**	**Existing Screening?**	**Potential Impact? (with existing screening and road status)**
1	St Mary's Well Bay Road	Existing, major road	1,596	4,994	Yes, avenue trees on both sides of the road	**Low**
2	Fort Road	Existing, minor road	4,883	5,270	Narrow road corridor with boundary hedgerows and intermittent tree cover.	**Mitigation required**
3	Lavernock Road	Existing, major road	10,954	3,076	Yes, avenue trees for the road	**Low**
4	Lavernock Road - Cosmeston	Existing, major road	0	0	-	**None**
5	Beach Road	Existing	4,580	287	Yes, buildings along the road	**Low**
6	South Road	Existing, major road	8,963	1768	Yes, avenue trees for the road	**Low**
7-11	Residential roads – Clevedon Avenue, Winsford Road, Highbridge Close,	Existing	Up to 7,757	Up to 772	Yes, buildings along the roads	**Low**

Baseline Conservative Scenario (As currently assessed)					Potential mitigation	
Receptor Number	Route Name	Status	Green Glare (mins)	Yellow Glare (mins)	Existing Screening?	Potential Impact? (with existing screening and road status)
	Swanbridge Grove and Swanbridge Road.					
12-17	Cosmeston Drive, Falcon Grove, Osprey Close, Raven Way, Fulmar Close and Shearwater Close.	Existing	0	0	-	None
18	Consented cycling route	Consented	7,061	5,323	Yes, avenue trees along the route	Low

Existing roads around the site

Major roads

5.3.4. Green and yellow glare was predicted for St. Mary's Well Bay Road, Lavernock Road, and South Road. The glare occurs in the early morning or evening, when the sun is low and the reflection is likely to appear close to the direction of the sun.

5.3.5. All three roads are lined with mature trees. These are expected to block most of the glare, as the glare is expected between spring and late summer, when trees are in leaf. The impact on the users of these roads is therefore considered to be low.

Fort Road

5.3.6. Fort Road runs along the eastern side of the Site. Under the conservative modelling scenario, significant yellow and green glare was predicted in the evenings between spring and summer months.

5.3.7. Existing screening along the road is limited to low height hedges and trees. The proposed Landscape and Ecological Management Plan (please refer to **Appendix 6G: Outline LEMP** (Volume III of the ES) includes strengthening of the hedgerows along Fort Road and increasing the height to 2 m, screening views of the panels from road users.

Given that Fort Road is a minor road with relatively low traffic volumes and based on the indicative review, the implementation of the proposed mitigation measures is expected to reduce effects on road users to **low**.

Residential Roads

5.3.8. Green glare and very limited yellow glare were predicted for Beach Road and several residential roads in Sully. Buildings along these roads are expected to block views of the reflecting panels, so the impact is low. No glare was predicted for B4267 Lavernock Road (Cosmeston) or the residential roads in Cosmeston.

Consented Routes

Proposed Active Travel Route (ATR) – Cosmeston to Sully

5.3.9. Green and yellow glare was predicted along the proposed ATR. The glare occurs at low sun angles, and the route is lined with mature trees, which are expected to block most views of the reflecting panels. Cyclists also travel more slowly than vehicles and can adjust their view more easily, which further reduces the risk. The impact is therefore considered to be low.

5.3.10. Overall, no significant impacts are predicted for road users or cyclists. For most routes, existing trees and buildings are expected to screen views of the reflecting panels, and the glare occurs at low sun angles, close to the direction of the Sun. The impact on all route receptors is considered **low** and **no mitigation is required**.

5.4. Dwelling Receptors

5.4.1. The results for dwelling receptors are summarised in **Table 5.3**. In line with the Pager Power guidance, the impact on residential amenity is assessed by how often and for how long glare occurs:

- Low impact: glare on fewer than three months of the year and for less than 60 minutes on any day;
- Moderate impact: glare on more than three months of the year, or for more than 60 minutes on any day. This can be reduced to low where there are mitigating factors, such as screening or the glare coinciding with direct sunlight; and
- Mitigation required: glare is predicted, and existing screening is not sufficient to block views of the panels. In such instances, the embedded mitigation incorporated into the Proposed Development is considered.

Table 5.3 - Dwelling Receptor Summary

Baseline Conservative Scenario (As currently assessed)					Potential Mitigation	
Receptor Number	**Route Name**	**Status**	**Green Glare (mins)**	**Yellow Glare (mins)**	**Existing Screening?**	**Potential Impact? (with existing screening)**
OP 3-7	Dwellings on Swanbridge Road to the west	Existing	Up to 8,079	Up to 1,131 for OP6 and OP7	Yes, trees on edge	**Low**
OP 8 OP 41,42	Dwellings to the southwest of site on Beach Road	Existing	Up to 8,409	Up to 107	Yes, buildings and landscape buffer	**Low**
OP 9	Dwelling to the north of the site	Existing	3,705	291	Yes, trees along the road	**Low**
OP 10-12	Dwellings to the north-east of the site	Existing	0	0	-	**None**
OP 13-18	Dwelling located at the edge of site on Fort Road	Existing	Up to 2,567	Up to 3,575	Yes, self-obstruction and minor hedges	**Mitigation required**
OP 19, 20	Dwelling located on the south-west edge of site	Existing	Up to 3,564	Up to 3,063	Yes, existing trees and hedges	**Mitigation required**
OP21-27	Caravan Park on the southwest of the site	Existing	Up to 2240	Up to 7544	Yes, existing trees and hedges	**Mitigation required**
OP 28-30	Caravan Park on the southeast of the site	Existing	Up to 5,656	Up to 6,810	Yes, landscape and trees	**Low**
OP 31-35	Dwellings in South Cosmeston (2020/1170/OUT)	Consented	0	0	-	**None**

Baseline Conservative Scenario (As currently assessed)					Potential Mitigation	
Receptor Number	**Route Name**	**Status**	**Green Glare (mins)**	**Yellow Glare (mins)**	**Existing Screening?**	**Potential Impact? (with existing screening)**
OP 36-39	Dwellings in Swanbridge Road, Sully (2025/00509/RES)	Consented	Up to 907	0	Yes, trees along road	Low

Existing dwellings

5.4.2. The results showed that no glare was predicted for dwellings north-east of the site (OP10-12).

5.4.3. Green and yellow glare was predicted for the dwellings on Swanbridge Road (OP3–7) and Beach Road (OP8, OP41–42). For Swanbridge Road, it is less than 60 mins daily for 3 months and therefore, is considered a low impact. The dwellings on Beach Road have a barrier of mature trees that will screen any predicted glare and has been considered a **low** impact.

5.4.4. Dwellings to the north (OP9) and the caravan park dwellings to the south-east (OP28 – OP30) are predicted to have green and yellow glare. Existing trees, buildings and landscape buffers are expected to block most views of the reflecting panels from these properties. The impact is therefore considered to be **low**, and **no mitigation is required**.

5.4.5. Under the conservative modelling scenario which does not account for existing screening provided by vegetation or embedded mitigation proposed, significant glare was identified for the dwelling on Fort Road (OP13–18), the dwellings on the south-west edge of the Site (OP19–20) and the caravan park to the south-west (OP21–27). The potential effect and design response is described below:

- Fort Road Dwelling (OP13-18): this property is located next to the solar panels, and existing hedges and trees only partly screen the views. Glare could therefore be potentially seen from parts of this property for several months. Some of the receptors are self-shaded by the building structure on the northern side (OP13-15) and hence do not require mitigation. Other receptors (OP16-OP18) are affected by the panels on Plot 19. The Proposed Development incorporates embedded mitigation through the oLEMP (**Appendix 6G: Outline LEMP**), including the strengthening and enhancement of boundary hedgerows along the northern boundary of this property. The boundary hedgerow will be maintained at approximately 3 m in height to provide effective screening of the solar panels. Evergreen species will be included where practicable to provide year-round

screening, and the planting will be maintained throughout the operational life of the Proposed Development. This planting would restrict views of the solar panels from the property and reduce the potential for glare effects. Taking account of the embedded mitigation, the impact is considered to be **low**.

- Caravan Park (OP21-27): Although the caravan park is not a permanent residential site, caravans may remain in fixed positions and be occupied during the period in which glare is predicted. However, the predicted glare generally occurs during the early morning at low sun angles, limiting the potential period of exposure. However, the caravan park benefits from existing vegetation and boundary planting, together with additional planting proposed as part of the embedded mitigation secured through the oLEMP (**Appendix 6G: Outline LEMP**). The hedgerow along the western boundary of Plot 13 and 14, adjacent to the Caravan Park, would be maintained at a height of 3 m during the operation of the Proposed Development. The combination of existing and embedded planting are expected to provide the required screening to mitigate any glare effect. Therefore, the impact is considered to be **low**.
- South-west Dwellings (OP19-20): Green and yellow glare is predicted for the dwelling (OP19, OP20) on the south-western side of the Site. At OP19, the glare lasts less than 30 minutes a day, so the impact is considered to be low. At OP20, the glare comes from the panels on Plots 13, 14 and 18. Existing vegetation, together with the hedgerow strengthening and maintenance as proposed in the oLEMP (**Appendix 6G: Outline LEMP**), would provide additional screening of these panels and reduce the potential for glare effects. Taking account of the embedded mitigation, the impact is considered to be **low**.

5.4.6. Therefore, taking account of the embedded mitigation incorporated into the Proposed Development, the indicative review shows the impact at these dwelling receptors would be **low**.

Consented dwellings

5.4.7. No glare was predicted for the consented dwellings in South Cosmeston (OP31–35). Green glare only was predicted for the consented dwellings in Sully (OP36–39). The glare is limited in duration, and existing trees along the road are expected to screen views of the panels. The impact is therefore considered to be low, and **no mitigation is required**.

5.5. Summary of Assessment

5.5.1. The assessment predicts glare at several aviation, route and dwelling receptors. For most receptors, effects are expected to be negligible or low due to a combination of existing screening, the low sun angle when glare occurs and the type of receptor.

5.5.2. Embedded mitigation incorporated into the Proposed Development would reduce potential glint and glare effects at the following receptors:

- Fort Road (OP2): hedgerow strengthening and enhancement secured through the oLEMP would reduce views from road users and reduce potential glare effects;
- Fort Road dwelling (OP13-18): hedgerow strengthening and enhancement would provide additional screening of solar panels and reduce potential glare effects;
- South-west dwellings (OP19-20): existing vegetation and embedded planting/strengthening would reduce views and reduce the potential for glare effects; and
- Caravan Park (OP21-27): existing and proposed boundary planting, which would be maintained at 3 m in height, would provide effective screening.

5.5.3. Further consideration is needed for the following:

- Cardiff Airport ATCT (OP1): Green glare is predicted at the Cardiff ATCT. Under the FAA criterion, no glare should be experienced at an ATCT. Although the predicted glare is of limited duration and occurs within a restricted seasonal window, a precautionary approach has been adopted. A further detailed glint and glare assessment will therefore be undertaken as part of the final ES, taking account of existing and proposed screening within the modelling. The findings of this assessment will inform whether any additional mitigation measures are required.

6. Conclusions

6.1. Overview

6.1.1. A Glint and Glare assessment has been prepared for the Proposed Development. The assessment investigated the potential risk of solar glint and glare from the proposed ground-mounted PV panels.

6.1.2. The main receptors for the assessment are the aviation and heliport receptors (comprising 19 receptors); the residential buildings (comprising 30 existing and 9 consented dwellings) and the main roads (comprising 16 existing and 1 consented receptor). Rail receptors would not be impacted by the Proposed Development due to their distance from the site.

6.2. Aviation

Flight Paths

6.2.1. The results of this analysis showed short periods of green glare: one a Cardiff Airport flight path (FP2) and parts of Flat Holm Heliport flight paths (FP6, FP10), away from the runway threshold or helipad. No yellow glare was predicted. Green glare is acceptable for approach paths and no mitigation is required.

ATCT

6.2.2. Green glare was predicted at the Cardiff Airport ATCT for under 45 minutes a day, in the early morning in spring and autumn. FAA guidance states no glare should occur at an ATCT, so mitigation is required. A further detailed glint and glare assessment will be undertaken as part of the final ES, taking account of existing and proposed screening within the modelling. The findings of this assessment will inform whether any additional mitigation measures are required and, if necessary, the nature and extent of those measures.

6.3. Route Receptors

6.3.1. Glare was predicted for several roads and the consented cycling route in the conservative modelling scenario. For most of these, existing trees and buildings are expected to screen views of the panels, so the impact is low. Along Fort Road, strengthening of existing hedgerows forms part of the embedded landscape mitigation and is expected to provide additional screening of the panels and reduce the predicted glare effects.

6.4. Dwellings

6.4.1. Most dwellings, including the consented developments, have no glare or a low impact.

6.4.2. The assessment identified potential glare effects at the Fort Road dwelling (OP13-18), the south-western dwellings (OP19-20) and the caravan park receptors (OP21-27), where glare lasts more than three months a year and existing screening is partial.

6.4.3. The embedded landscape mitigation is expected to provide effective screening for the identified residential receptors, thereby reducing or removing the predicted glare effects.

6.5. Summary

6.5.1. The assessment demonstrates that no significant glint and glare effects are predicted for road users, residential receptors, flight paths or heliport receptors, taking account of existing screening and embedded mitigation incorporated within the Proposed Development. The potential for green glare effects has been identified at Cardiff Airport ATCT when no mitigation is considered under the conservative assessment assumptions applied. Further assessment will be undertaken as part of the ES process to refine the understanding of these effects and determine whether any additional measures are required. The current assessment demonstrates that considering existing and embedded mitigation, no glint and glare has been identified at this stage that would represent a constraint to the delivery of the Proposed Development.

7. Limitations and Assumptions

7.1.1. All calculations have been based on best practice guidance and on drawings of the Proposed Development provided by the Applicant. Where required, estimations have been made with regards to the height of the PV panels and surrounding terrain elevations, based on available satellite photographs and mapping. Assumptions, estimations and simplifications have been made also regarding the receptors used in this assessment and height of existing obstructions nearby the Site. Where information is unavailable, the conclusions have been based on assumptions outlined in the report using professional judgment.

7.1.2. The results presented in this report are based on the available information and using professional judgement where applicable. If further information becomes available in the future, for example rail maps indicating presence of train signals in the affected area etc., the conclusions should be reviewed alongside the need for mitigation measures to reduce any risk of glare.

7.1.3. The limitations and assumptions of the Forge Solar tool can be found in **Annex D**.

7.1.4. The scope of this report focuses on glint and glare due to solar reflections only, as such, glare from artificial lighting is not included. Should further evidence or additional information not considered in this report becomes available in future, the findings and conclusions of the assessment should be reviewed and updated where necessary.

7.1.5. This report is intended for the sole benefit of the parties named above, WSP shall not be liable for any use of the report for any reasons other than that for which the report was originally prepared and provided.

Annex A – Figures

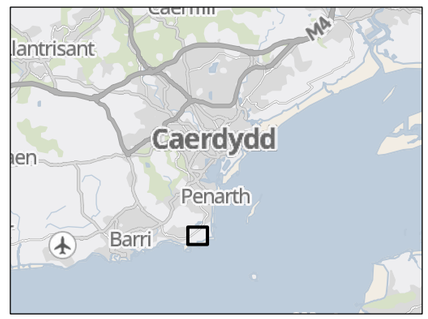
N

Plot 4
Plot 10
Plot 12
Plot 17
Plot 19
Plot 5
Plot 13
Plot 14
Plot 18

0 250 m

Legend

Proposed development PV arrays



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Rev.	Date	Revision Description	Drawn	Check	Rev.	App.
0	29/10/2026	Initial Issue	AR	RJ	DP	SM

Scale @ A3 | Scale: 1:5,000 | DO NOT SCALE

Project: Fferm Solar Larnog

Drawing Title: Proposed PV array areas within the Site

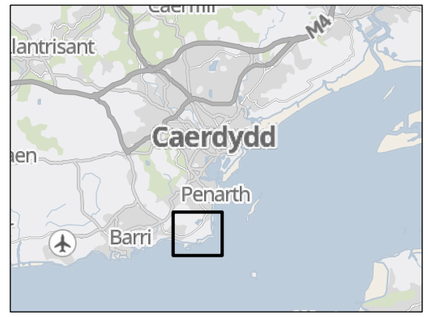
Trydan Gwyrdd Cymru

Drawing No.: Figure 1



Legend

- Proposed development PV arrays
- 1km Buffer from Site



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Rev.	Date	Revision Description	Drawn	Check	Rev.	App.
0	29/10/2026	Initial Issue	AR	RJ	DP	SM

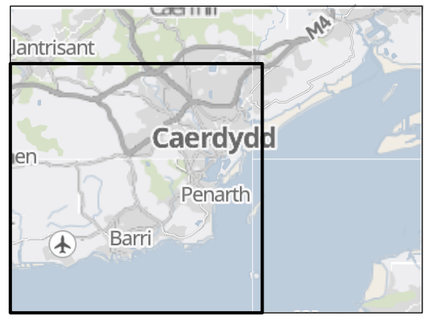
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Project	Fferm Solar Larnog
Drawing Title	Extent of the study area
Drawing No.	Figure 2

Trydan Gwyrdd Cymru



Legend

- Proposed development PV arrays
- 1km Buffer from Site
- Aviation Receptors
- 10km Study area



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Rev.	Date	Revision Description	Drawn	Check	Rev.	App.
0	29/10/2026	Initial Issue	AR	RJ	DP	SM

Scale @ A3 — Scale: 1:75,000 — DO NOT SCALE

Project: Fferm Solar Larnog

Drawing Title: Nearest airports around the site

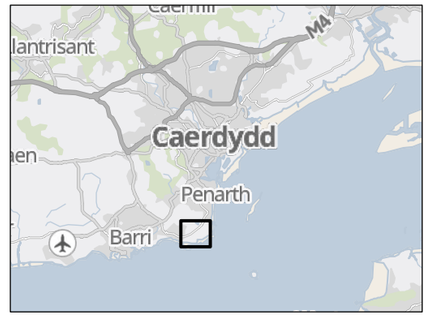
Trydan Gwyrdd Cymru

Drawing No.: Figure 3

N

Legend

- Proposed development PV arrays
- Existing roads around the proposed site
- Consented scheme



0 250 m

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Rev.	Date	Revision Description	Drawn	Check	Rev.	App.
0	29/10/2026	Initial Issue	AR	RJ	DP	SM

Scale @ A3 | Scale: 1:7,500 DO NOT SCALE

Project: Fferm Solar Larnog

Drawing Title: Route receptors around the site

Trydan Gwyrdd Cymru

Drawing No.: Figure 4

Legend

- Proposed development PV arrays
- Residential Areas
- Consented Schemes

Consented 1

OP 31 -35

OP 10-12

OP 36 -39

OP 3 -5

Consented 2

OP 13-18

OP 9

OP 28-30

OP 6-7

OP 8

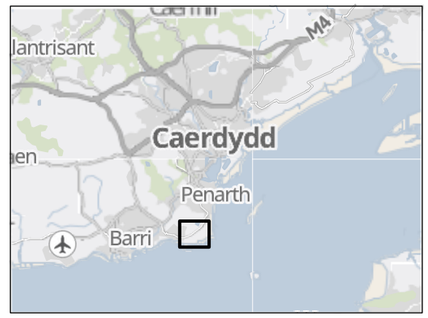
OP 19-20

OP 21-26

OP 27

OP 41-42

0 250 m



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Rev.	Date	Revision Description	Drawn	Check	Rev.	App.
0	29/10/2026	Initial Issue	AR	RJ	DP	SM

Scale @ A3 | Scale: 1:7,500 | DO NOT SCALE

Project: Fferm Solar Larnog

Drawing Title: Dwelling receptors around the site

Trydan Gwyrdd Cymru

Drawing No.: Figure 5

Annex B – Component Data

PV Arrays

PV Array - Plot 12-13-17

Name: PV Array - Plot 12-13-17
Axis tracking: Fixed (no rotation)
Tilt: 17.0°
Orientation: 180.0°
Rated power: -
Panel material: Smooth glass with AR coating

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.406261	-3.186579	33.54	2.00	35.54
2	51.406311	-3.186815	33.34	2.00	35.34
3	51.407619	-3.187233	32.18	2.00	34.18
4	51.407877	-3.187249	30.88	2.00	32.88
5	51.408560	-3.187153	28.86	2.00	30.86
6	51.409326	-3.186772	25.79	2.00	27.79
7	51.409557	-3.185929	29.23	2.00	31.23
8	51.409764	-3.184315	30.49	2.00	32.49
9	51.409788	-3.183918	30.08	2.00	32.08
10	51.409714	-3.183414	30.75	2.00	32.75
11	51.409600	-3.183242	31.82	2.00	33.82
12	51.409058	-3.184267	33.31	2.00	35.31
13	51.408901	-3.184722	33.30	2.00	35.30
14	51.408573	-3.185693	33.74	2.00	35.74
15	51.408473	-3.185570	33.96	2.00	35.96
16	51.408757	-3.184744	33.69	2.00	35.69
17	51.408346	-3.184395	35.95	2.00	37.95
18	51.408122	-3.184137	36.52	2.00	38.52
19	51.408048	-3.184078	36.78	2.00	38.78
20	51.407751	-3.184036	36.11	2.00	38.11
21	51.407352	-3.183644	35.22	2.00	37.22
22	51.406944	-3.183091	35.02	2.00	37.02
23	51.406723	-3.183628	32.36	2.00	34.36
24	51.407038	-3.183960	33.11	2.00	35.11
25	51.407265	-3.184127	33.92	2.00	35.92
26	51.407389	-3.184282	34.13	2.00	36.13
27	51.407503	-3.184492	34.12	2.00	36.12
28	51.407506	-3.184711	33.79	2.00	35.79
29	51.407469	-3.184797	33.78	2.00	35.78
30	51.408390	-3.185779	34.33	2.00	36.33
31	51.408470	-3.185586	34.03	2.00	36.03
32	51.408567	-3.185709	33.72	2.00	35.72
33	51.408435	-3.186041	33.93	2.00	35.93
34	51.408351	-3.186035	34.36	2.00	36.36
35	51.407277	-3.184909	34.87	2.00	36.87
36	51.407193	-3.184753	34.11	2.00	36.11
37	51.407220	-3.184576	34.07	2.00	36.07
38	51.407153	-3.184474	34.15	2.00	36.15
39	51.406588	-3.185526	36.43	2.00	38.43

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
40	51.406400	-3.185282	35.48	2.00	37.48
41	51.406388	-3.185233	35.12	2.00	37.12
42	51.406859	-3.184265	33.20	2.00	35.20
43	51.406526	-3.183817	31.50	2.00	33.50
44	51.406480	-3.183629	31.21	2.00	33.21
45	51.406511	-3.183345	31.50	2.00	33.50
46	51.406797	-3.182800	34.25	2.00	36.25
47	51.405943	-3.181897	29.62	2.00	31.62
48	51.405754	-3.182677	29.15	2.00	31.15
49	51.406051	-3.183007	28.98	2.00	30.98
50	51.406157	-3.183168	29.60	2.00	31.60
51	51.406195	-3.183423	30.19	2.00	32.19
52	51.406120	-3.183643	31.44	2.00	33.44
53	51.406010	-3.183697	30.24	2.00	32.24
54	51.405913	-3.183654	29.33	2.00	31.33
55	51.405608	-3.183165	27.33	2.00	29.33
56	51.405496	-3.183112	27.87	2.00	29.87
57	51.405370	-3.183157	28.45	2.00	30.45
58	51.405073	-3.183417	27.27	2.00	29.27
59	51.404571	-3.184275	23.27	2.00	25.27
60	51.404864	-3.184728	25.56	2.00	27.56
61	51.405074	-3.185042	28.69	2.00	30.69
62	51.405345	-3.185611	31.45	2.00	33.45
63	51.405678	-3.186209	33.66	2.00	35.66
64	51.405846	-3.186056	34.63	2.00	36.63
65	51.406023	-3.185994	34.90	2.00	36.90
66	51.406132	-3.186059	35.55	2.00	37.55
67	51.406441	-3.185388	35.95	2.00	37.95
68	51.406570	-3.185563	36.27	2.00	38.27
69	51.406246	-3.186440	34.20	2.00	36.20

PV Array - Plot 14-18-19

Name: PV Array - Plot 14-18-19
Axis tracking: Fixed (no rotation)
Tilt: 17.0°
Orientation: 180.0°
Rated power: -
Panel material: Smooth glass with AR coating

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.407373	-3.183296	35.55	2.00	37.55
2	51.407580	-3.183570	36.32	2.00	38.32
3	51.407778	-3.183736	36.15	2.00	38.15
4	51.408032	-3.183800	36.03	2.00	38.03
5	51.408206	-3.183854	35.79	2.00	37.79
6	51.408327	-3.183972	35.82	2.00	37.82
7	51.408802	-3.184476	34.38	2.00	36.38
8	51.409682	-3.182588	31.16	2.00	33.16

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
9	51.409762	-3.182400	31.04	2.00	33.04
10	51.409735	-3.182127	31.33	2.00	33.33
11	51.409280	-3.181461	31.02	2.00	33.02
12	51.408661	-3.180812	29.72	2.00	31.72
13	51.408330	-3.181681	30.65	2.00	32.65
14	51.408230	-3.181778	30.51	2.00	32.51
15	51.408166	-3.182094	30.64	2.00	32.64
16	51.407975	-3.182545	31.48	2.00	33.48
17	51.407731	-3.182700	31.80	2.00	33.80
18	51.407641	-3.182835	32.57	2.00	34.57
19	51.407600	-3.182931	33.10	2.00	35.10
20	51.407068	-3.182314	32.11	2.00	34.11
21	51.407226	-3.182030	30.65	2.00	32.65
22	51.407356	-3.181687	29.76	2.00	31.76
23	51.407463	-3.181268	29.80	2.00	31.80
24	51.407460	-3.180796	29.06	2.00	31.06
25	51.407473	-3.180362	28.75	2.00	30.75
26	51.407507	-3.180050	27.66	2.00	29.66
27	51.407520	-3.179954	27.69	2.00	29.69
28	51.407196	-3.179664	27.17	2.00	29.17
29	51.406991	-3.179455	26.50	2.00	28.50
30	51.406888	-3.179299	26.86	2.00	28.86
31	51.406503	-3.179514	26.08	2.00	28.08
32	51.406001	-3.179600	26.66	2.00	28.66
33	51.405750	-3.179755	26.32	2.00	28.32
34	51.405312	-3.180303	25.54	2.00	27.54
35	51.405248	-3.180410	25.81	2.00	27.81
36	51.405967	-3.181579	28.10	2.00	30.10
37	51.405743	-3.181713	28.54	2.00	30.54
38	51.405101	-3.180732	24.47	2.00	26.47
39	51.403674	-3.182527	20.20	2.00	22.20
40	51.404427	-3.183965	22.89	2.00	24.89
41	51.405247	-3.182838	27.50	2.00	29.50
42	51.405424	-3.182785	28.09	2.00	30.09
43	51.405485	-3.182795	28.69	2.00	30.69
44	51.405622	-3.182484	28.97	2.00	30.97
45	51.405776	-3.181902	29.53	2.00	31.53
46	51.405759	-3.181728	28.75	2.00	30.75
47	51.405976	-3.181599	28.19	2.00	30.19
48	51.406243	-3.181962	29.70	2.00	31.70
49	51.406571	-3.182271	31.68	2.00	33.68
50	51.406879	-3.182558	34.07	2.00	36.07
51	51.407058	-3.182326	32.24	2.00	34.24
52	51.407527	-3.182885	33.44	2.00	35.44

PV Array - Plot 4-5-10

Name: PV Array - Plot 4-5-10
Axis tracking: Fixed (no rotation)
Tilt: 17.0°
Orientation: 180.0°
Rated power: -
Panel material: Smooth glass with AR coating

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.405500	-3.193376	52.70	2.00	54.70
2	51.405634	-3.193698	51.53	2.00	53.53
3	51.405741	-3.194122	51.33	2.00	53.33
4	51.405818	-3.194653	50.71	2.00	52.71
5	51.405902	-3.195178	49.14	2.00	51.14
6	51.406039	-3.195570	47.94	2.00	49.94
7	51.406196	-3.195726	46.23	2.00	48.23
8	51.406334	-3.195699	44.35	2.00	46.35
9	51.406471	-3.195522	41.98	2.00	43.98
10	51.407038	-3.193724	43.73	2.00	45.73
11	51.407243	-3.192962	45.39	2.00	47.39
12	51.407316	-3.192656	45.33	2.00	47.33
13	51.407222	-3.192479	45.71	2.00	47.71
14	51.407159	-3.192206	45.61	2.00	47.61
15	51.407082	-3.192104	45.35	2.00	47.35
16	51.407038	-3.192066	45.25	2.00	47.25
17	51.407132	-3.191626	41.05	2.00	43.05
18	51.407202	-3.191658	40.80	2.00	42.80
19	51.407554	-3.190709	30.72	2.00	32.72
20	51.407765	-3.190317	28.65	2.00	30.65
21	51.407731	-3.190140	28.32	2.00	30.32
22	51.407199	-3.189893	30.23	2.00	32.23
23	51.407145	-3.189829	30.56	2.00	32.56
24	51.407129	-3.189700	30.45	2.00	32.45
25	51.407169	-3.189513	29.62	2.00	31.62
26	51.407256	-3.189411	29.53	2.00	31.53
27	51.408176	-3.188815	25.88	2.00	27.88
28	51.408270	-3.188826	25.85	2.00	27.85
29	51.408384	-3.188912	25.66	2.00	27.66
30	51.408598	-3.188493	24.99	2.00	26.99
31	51.408598	-3.188139	25.65	2.00	27.65
32	51.408471	-3.188204	25.70	2.00	27.70
33	51.408410	-3.188064	26.46	2.00	28.46
34	51.408430	-3.187732	27.50	2.00	29.50
35	51.408036	-3.187817	28.45	2.00	30.45
36	51.407701	-3.187796	29.49	2.00	31.49
37	51.407507	-3.188601	28.84	2.00	30.84
38	51.407132	-3.188418	29.53	2.00	31.53
39	51.407232	-3.187710	30.14	2.00	32.14
40	51.406737	-3.187506	31.83	2.00	33.83
41	51.406436	-3.187399	33.29	2.00	35.29

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
42	51.406296	-3.187453	34.20	2.00	36.20
43	51.406028	-3.188397	37.03	2.00	39.03
44	51.405820	-3.188268	37.03	2.00	39.03
45	51.405867	-3.188064	36.85	2.00	38.85
46	51.405660	-3.187860	36.44	2.00	38.44
47	51.405492	-3.187635	34.68	2.00	36.68
48	51.405392	-3.187453	33.82	2.00	35.82
49	51.405164	-3.187549	33.02	2.00	35.02
50	51.405011	-3.187882	33.02	2.00	35.02
51	51.404910	-3.188783	35.64	2.00	37.64
52	51.404770	-3.189041	37.04	2.00	39.04
53	51.404589	-3.189330	38.98	2.00	40.98
54	51.405071	-3.189652	39.85	2.00	41.85
55	51.405606	-3.189813	41.24	2.00	43.24
56	51.405626	-3.189298	39.34	2.00	41.34
57	51.405707	-3.188794	37.87	2.00	39.87
58	51.405814	-3.188343	37.45	2.00	39.45
59	51.406001	-3.188461	37.00	2.00	39.00
60	51.405881	-3.189137	38.66	2.00	40.66
61	51.406008	-3.189727	40.17	2.00	42.17
62	51.406476	-3.189802	36.55	2.00	38.55
63	51.406523	-3.190264	36.65	2.00	38.65
64	51.406296	-3.190704	40.36	2.00	42.36
65	51.406443	-3.191197	41.18	2.00	43.18
66	51.406905	-3.191326	38.96	2.00	40.96
67	51.407119	-3.191594	40.71	2.00	42.71
68	51.407022	-3.192029	45.14	2.00	47.14
69	51.406848	-3.191921	45.81	2.00	47.81
70	51.406707	-3.191900	46.06	2.00	48.06
71	51.406386	-3.191589	44.64	2.00	46.64
72	51.406172	-3.191685	45.76	2.00	47.76
73	51.405944	-3.191975	47.49	2.00	49.49
74	51.405850	-3.192286	48.49	2.00	50.49
75	51.405676	-3.192940	51.05	2.00	53.05

7.2. Route Receptors

Beach Road

Name: Beach Road
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.404264	-3.202891	25.78	1.50	27.28
2	51.403989	-3.202784	25.93	1.50	27.43
3	51.403309	-3.202421	22.98	1.50	24.48

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
4	51.403085	-3.202332	21.75	1.50	23.25
5	51.402848	-3.202246	20.60	1.50	22.10
6	51.402424	-3.202047	19.64	1.50	21.14
7	51.402104	-3.201843	17.57	1.50	19.07
8	51.401816	-3.201615	16.89	1.50	18.39
9	51.401291	-3.201174	15.22	1.50	16.72
10	51.400779	-3.200794	13.00	1.50	14.50
11	51.400643	-3.200644	12.48	1.50	13.98
12	51.400575	-3.200456	12.36	1.50	13.86
13	51.400521	-3.200208	12.11	1.50	13.61
14	51.400477	-3.200060	11.48	1.50	12.98
15	51.400407	-3.199889	10.55	1.50	12.05
16	51.400337	-3.199677	10.69	1.50	12.19
17	51.400313	-3.199395	9.88	1.50	11.38
18	51.400343	-3.199147	8.81	1.50	10.31

Clevedon Avenue – Sully

Name: Clevedon Avenue - Sully
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.404151	-3.208764	21.56	1.50	23.06
2	51.403147	-3.208941	17.98	1.50	19.48
3	51.402327	-3.209095	14.96	1.50	16.46
4	51.401760	-3.209197	10.69	1.50	12.19

Cosmeston Drive

Name: Cosmeston Drive
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.417405	-3.180397	12.46	1.50	13.96
2	51.417343	-3.180148	13.06	1.50	14.56
3	51.417269	-3.179909	14.24	1.50	15.74
4	51.417177	-3.179659	15.24	1.50	16.74
5	51.417093	-3.179391	15.45	1.50	16.95
6	51.417072	-3.179198	15.43	1.50	16.93
7	51.417082	-3.178994	15.54	1.50	17.04
8	51.417139	-3.178697	16.34	1.50	17.84
9	51.417321	-3.177994	17.41	1.50	18.91
10	51.417369	-3.177693	18.45	1.50	19.95
11	51.417368	-3.177396	18.37	1.50	19.87
12	51.417351	-3.177157	18.71	1.50	20.21
13	51.417451	-3.176739	19.48	1.50	20.98
14	51.417642	-3.176156	20.75	1.50	22.25
15	51.417729	-3.175918	21.35	1.50	22.85
16	51.417722	-3.175703	23.50	1.50	25.00
17	51.417694	-3.175156	26.14	1.50	27.64
18	51.417727	-3.174984	27.11	1.50	28.61
19	51.417947	-3.174620	27.06	1.50	28.56

Cycling Route Consented

Name: Cycling Route consented
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.406293	-3.196826	43.83	1.50	45.33
2	51.406765	-3.195501	44.01	1.50	45.51
3	51.407698	-3.192846	43.12	1.50	44.62
4	51.407859	-3.192368	39.49	1.50	40.99
5	51.408123	-3.191478	32.56	1.50	34.06
6	51.408297	-3.190858	29.81	1.50	31.31
7	51.408923	-3.189098	26.80	1.50	28.30
8	51.409314	-3.187779	25.50	1.50	27.00
9	51.409622	-3.186588	26.83	1.50	28.33
10	51.409783	-3.185933	30.50	1.50	32.00
11	51.409943	-3.185112	30.61	1.50	32.11
12	51.410468	-3.183267	30.92	1.50	32.42
13	51.410723	-3.182538	30.16	1.50	31.66
14	51.410964	-3.182049	32.12	1.50	33.62
15	51.411265	-3.181733	33.04	1.50	34.54
16	51.412044	-3.180478	32.52	1.50	34.02
17	51.412729	-3.179353	29.59	1.50	31.09
18	51.413100	-3.178838	28.02	1.50	29.52
19	51.413421	-3.178484	28.86	1.50	30.36
20	51.414231	-3.177647	29.05	1.50	30.55
21	51.414870	-3.177111	27.43	1.50	28.93
22	51.415429	-3.176698	26.53	1.50	28.03
23	51.415700	-3.176537	27.23	1.50	28.73
24	51.416255	-3.176210	25.68	1.50	27.18
25	51.416640	-3.176007	27.93	1.50	29.43
26	51.416834	-3.175916	28.59	1.50	30.09
27	51.417294	-3.175752	27.24	1.50	28.74
28	51.417588	-3.175664	25.00	1.50	26.50
29	51.417692	-3.175646	24.33	1.50	25.83

Falcon Grove - Cosmeston

Name: Falcon Grove - Cosmeston
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.416573	-3.180476	13.28	1.50	14.78
2	51.416650	-3.180482	13.31	1.50	14.81
3	51.416712	-3.180436	13.26	1.50	14.76
4	51.416825	-3.180339	13.47	1.50	14.97
5	51.416999	-3.180315	13.77	1.50	15.27
6	51.417041	-3.180291	14.12	1.50	15.62
7	51.417070	-3.180230	14.35	1.50	15.85
8	51.417100	-3.180154	14.63	1.50	16.13
9	51.417163	-3.180080	14.43	1.50	15.93
10	51.417228	-3.180027	13.63	1.50	15.13
11	51.417280	-3.179996	13.65	1.50	15.15

Fort Road

Name: Fort Road
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.412879	-3.183810	16.02	1.50	17.52
2	51.412533	-3.183309	17.85	1.50	19.35
3	51.412244	-3.182895	18.77	1.50	20.27
4	51.411859	-3.182376	20.95	1.50	22.45
5	51.411772	-3.182302	21.70	1.50	23.20
6	51.411720	-3.182283	22.21	1.50	23.71
7	51.411601	-3.182257	24.81	1.50	26.31
8	51.411471	-3.182263	28.35	1.50	29.85
9	51.410567	-3.182275	30.73	1.50	32.23
10	51.410332	-3.182257	30.74	1.50	32.24
11	51.410078	-3.182173	30.89	1.50	32.39
12	51.409944	-3.182109	31.69	1.50	33.19
13	51.409734	-3.181865	32.42	1.50	33.92
14	51.409402	-3.181404	32.19	1.50	33.69
15	51.409280	-3.181253	31.63	1.50	33.13
16	51.408897	-3.180848	29.85	1.50	31.35

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
17	51.408556	-3.180368	29.08	1.50	30.58
18	51.408250	-3.179872	28.47	1.50	29.97
19	51.408164	-3.179652	28.70	1.50	30.20
20	51.408153	-3.179454	28.93	1.50	30.43
21	51.408171	-3.179279	28.93	1.50	30.43
22	51.408204	-3.179132	29.09	1.50	30.59
23	51.408260	-3.178885	29.27	1.50	30.77
24	51.408278	-3.178724	29.53	1.50	31.03
25	51.408241	-3.178558	29.76	1.50	31.26
26	51.408020	-3.178142	30.09	1.50	31.59
27	51.407691	-3.177649	29.99	1.50	31.49
28	51.407580	-3.177375	31.84	1.50	33.34
29	51.407538	-3.177136	32.35	1.50	33.85

Fulmar Close - Cosmeston

Name: Fulmar Close - Cosmeston
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.417362	-3.177104	18.75	1.50	20.25
2	51.417222	-3.177037	18.93	1.50	20.43
3	51.417140	-3.176968	19.09	1.50	20.59
4	51.417099	-3.176887	19.30	1.50	20.80
5	51.417091	-3.176753	19.72	1.50	21.22
6	51.417145	-3.176514	20.03	1.50	21.53

Highbridge Close - Sully

Name: Highbridge Close - Sully
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.404322	-3.205590	22.62	1.50	24.12
2	51.404441	-3.205424	22.63	1.50	24.13
3	51.404545	-3.205397	22.43	1.50	23.93
4	51.404803	-3.205502	22.56	1.50	24.06

Lavernock Road

Name: Lavernock Road
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.404373	-3.202894	25.13	1.50	26.63
2	51.404470	-3.201896	27.26	1.50	28.76
3	51.404591	-3.201033	29.24	1.50	30.74
4	51.404608	-3.200872	29.49	1.50	30.99
5	51.404792	-3.200122	31.43	1.50	32.93
6	51.404915	-3.199748	32.62	1.50	34.12
7	51.405068	-3.199368	33.54	1.50	35.04
8	51.405271	-3.198947	35.61	1.50	37.11
9	51.405582	-3.198353	38.15	1.50	39.65
10	51.405839	-3.197857	41.40	1.50	42.90
11	51.406162	-3.197229	40.32	1.50	41.82
12	51.406510	-3.196568	40.04	1.50	41.54
13	51.406969	-3.195702	41.87	1.50	43.37
14	51.407320	-3.195055	40.82	1.50	42.32
15	51.407788	-3.194060	40.84	1.50	42.34
16	51.408011	-3.193435	40.16	1.50	41.66
17	51.408284	-3.192387	34.35	1.50	35.85
18	51.408538	-3.191351	29.83	1.50	31.33
19	51.408874	-3.190431	26.50	1.50	28.00
20	51.409487	-3.189042	24.02	1.50	25.52
21	51.409945	-3.188009	23.28	1.50	24.78
22	51.410228	-3.187470	22.86	1.50	24.36
23	51.410823	-3.186585	22.61	1.50	24.11
24	51.411576	-3.185512	21.28	1.50	22.78
25	51.412264	-3.184646	17.27	1.50	18.77
26	51.412854	-3.183916	15.79	1.50	17.29
27	51.413600	-3.183020	13.26	1.50	14.76

Lavernock Road – Towards Cosmeston

Name: Lavernock Road - Towards Cosmeston
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.417072	-3.179262	15.24	1.50	16.74
2	51.417022	-3.179258	14.82	1.50	16.32
3	51.416938	-3.179277	14.79	1.50	16.29
4	51.416865	-3.179317	15.09	1.50	16.59

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
5	51.416767	-3.179377	14.41	1.50	15.91
6	51.416700	-3.179386	14.52	1.50	16.02
7	51.416638	-3.179369	14.65	1.50	16.15
8	51.416556	-3.179317	14.68	1.50	16.18
9	51.416532	-3.179290	14.69	1.50	16.19

Osprey Close - Cosmeston

Name: Osprey Close- Cosmeston
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.413664	-3.182924	13.37	1.50	14.87
2	51.414333	-3.182135	11.36	1.50	12.86
3	51.414909	-3.181411	13.08	1.50	14.58
4	51.415344	-3.181089	13.60	1.50	15.10
5	51.415799	-3.180874	12.92	1.50	14.42
6	51.416371	-3.180773	13.31	1.50	14.81
7	51.416899	-3.180628	12.09	1.50	13.59
8	51.417361	-3.180429	12.45	1.50	13.95
9	51.417793	-3.180156	12.07	1.50	13.57

Raven Way - Cosmeston

Name: Raven Way - Cosmeston
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.417213	-3.178368	16.72	1.50	18.22
2	51.417130	-3.178311	17.33	1.50	18.83
3	51.417009	-3.178255	17.82	1.50	19.32
4	51.416966	-3.178255	17.84	1.50	19.34
5	51.416859	-3.178290	18.22	1.50	19.72
6	51.416775	-3.178260	18.88	1.50	20.38
7	51.416644	-3.178201	19.11	1.50	20.61

Shear Water Close - Cosmeston

Name: Shearwater Close - Cosmeston
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.417680	-3.175181	26.07	1.50	27.57
2	51.417600	-3.175141	26.12	1.50	27.62
3	51.417496	-3.175114	26.99	1.50	28.49
4	51.417414	-3.175095	27.09	1.50	28.59
5	51.417340	-3.175103	27.08	1.50	28.58
6	51.417282	-3.175136	27.14	1.50	28.64
7	51.417210	-3.175275	27.58	1.50	29.08
8	51.417153	-3.175455	27.89	1.50	29.39

South Road

Name: South Road
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.404263	-3.209769	21.13	1.50	22.63
2	51.404227	-3.209383	21.33	1.50	22.83
3	51.404191	-3.208940	21.49	1.50	22.99
4	51.404103	-3.208212	21.48	1.50	22.98
5	51.404029	-3.207804	20.99	1.50	22.49
6	51.403964	-3.207343	20.08	1.50	21.58
7	51.403940	-3.207045	20.35	1.50	21.85
8	51.403920	-3.206630	20.55	1.50	22.05
9	51.403930	-3.206182	21.74	1.50	23.24
10	51.404079	-3.205106	23.19	1.50	24.69
11	51.404201	-3.204315	23.68	1.50	25.18
12	51.404257	-3.203953	24.54	1.50	26.04
13	51.404302	-3.203540	24.41	1.50	25.91
14	51.404350	-3.203070	24.73	1.50	26.23
15	51.404352	-3.203017	24.77	1.50	26.27

St. Marys Well Bay Road

Name: St Marys Well Bay Road
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.410930	-3.186083	22.46	1.50	23.96
2	51.409603	-3.186936	25.76	1.50	27.26
3	51.408796	-3.187277	27.84	1.50	29.34
4	51.408211	-3.187414	30.33	1.50	31.83
5	51.407784	-3.187442	31.73	1.50	33.23
6	51.407336	-3.187329	32.93	1.50	34.43
7	51.406399	-3.187037	33.75	1.50	35.25
8	51.406024	-3.186942	38.15	1.50	39.65
9	51.405721	-3.186955	38.96	1.50	40.46
10	51.405420	-3.187092	35.34	1.50	36.84
11	51.404766	-3.187428	32.56	1.50	34.06
12	51.404016	-3.187844	32.03	1.50	33.53
13	51.403399	-3.188166	30.94	1.50	32.44
14	51.403266	-3.188219	31.00	1.50	32.50
15	51.403133	-3.188247	31.16	1.50	32.66
16	51.402604	-3.188345	28.11	1.50	29.61
17	51.402087	-3.188419	20.53	1.50	22.03
18	51.401960	-3.188516	20.13	1.50	21.63
19	51.401843	-3.188679	20.93	1.50	22.43
20	51.401511	-3.189280	24.78	1.50	26.28
21	51.401444	-3.189390	25.56	1.50	27.06
22	51.401332	-3.189409	24.66	1.50	26.16

Swanbridge Grove - Sully

Name: Swanbridge Grove - Sully
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.404240	-3.204367	23.58	1.50	25.08
2	51.404305	-3.204407	23.84	1.50	25.34
3	51.404390	-3.204483	24.18	1.50	25.68
4	51.404481	-3.204509	24.33	1.50	25.83
5	51.404613	-3.204448	24.27	1.50	25.77
6	51.404889	-3.204461	23.54	1.50	25.04

Swanbridge Road - Sully

Name: Swanbridge road - Sully
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.404393	-3.202994	24.94	1.50	26.44
2	51.404843	-3.203080	26.04	1.50	27.54
3	51.405196	-3.203123	27.95	1.50	29.45
4	51.405462	-3.203117	28.49	1.50	29.99
5	51.405687	-3.203132	29.32	1.50	30.82
6	51.405942	-3.203151	30.88	1.50	32.38
7	51.406218	-3.203255	32.07	1.50	33.57
8	51.406643	-3.203521	36.64	1.50	38.14
9	51.407421	-3.204026	42.42	1.50	43.92
10	51.407748	-3.204172	43.40	1.50	44.90
11	51.408097	-3.204237	45.78	1.50	47.28
12	51.408300	-3.204281	47.06	1.50	48.56
13	51.408818	-3.204338	46.60	1.50	48.10
14	51.409336	-3.204400	47.44	1.50	48.94
15	51.409749	-3.204461	44.66	1.50	46.16
16	51.409965	-3.204518	43.53	1.50	45.03

Winsford Road - Sully

Name: Winsford Road - Sully
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	51.404068	-3.206626	20.98	1.50	22.48
2	51.404078	-3.207012	20.50	1.50	22.00
3	51.404133	-3.207342	20.23	1.50	21.73
4	51.404199	-3.207465	20.51	1.50	22.01
5	51.404314	-3.207492	21.12	1.50	22.62
6	51.404568	-3.207479	22.49	1.50	23.99
7	51.404766	-3.207484	23.64	1.50	25.14
8	51.404953	-3.207524	23.85	1.50	25.35
9	51.405072	-3.207468	24.36	1.50	25.86
10	51.405139	-3.207318	24.55	1.50	26.05
11	51.405141	-3.207186	24.31	1.50	25.81
12	51.405057	-3.206650	23.24	1.50	24.74
13	51.404998	-3.206551	22.89	1.50	24.39
14	51.404916	-3.206518	22.39	1.50	23.89
15	51.404662	-3.206470	22.13	1.50	23.63
16	51.404411	-3.206454	21.22	1.50	22.72
17	51.404147	-3.206459	20.99	1.50	22.49
18	51.404098	-3.206416	21.37	1.50	22.87
19	51.404091	-3.206325	21.70	1.50	23.20
20	51.404270	-3.205775	22.35	1.50	23.85

Flight Path Receptors

FP1

Name: Cardiff Airport FP1
Description:
Threshold height: 15 m
Direction: 296.8°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.392538	-3.330475	64.39	15.24	79.63
Two-mile	51.379511	-3.289060	-0.48	248.79	248.31

FP2

Name: Cardiff Airport FP2
Description:
Threshold height: 15 m
Direction: 115.9°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.400496	-3.355622	61.88	15.24	77.12
Two-mile	51.413125	-3.397360	5.37	240.43	245.81

FP13

Name: Cardiff Heliport FP 13
Description:
Threshold height: 2 m
Direction: 0.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.465931	-3.138516	10.77	2.00	12.77
Two-mile	51.437018	-3.138516	-1.23	581.54	580.32

FP14

Name: Cardiff Heliport FP 14
Description:
Threshold height: 2 m
Direction: 45.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.465918	-3.138559	10.83	2.00	12.83
Two-mile	51.445473	-3.171414	8.52	571.86	580.38

FP15

Name: Cardiff Heliport FP 15
Description:
Threshold height: 2 m
Direction: 90.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.465903	-3.138598	10.83	2.00	12.83
Two-mile	51.465903	-3.185063	7.13	573.24	580.38

FP16

Name: Cardiff Heliport FP 16
Description:
Threshold height: 2 m
Direction: 135.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.465899	-3.138614	10.82	2.00	12.82
Two-mile	51.486343	-3.171470	14.49	565.87	580.37

FP17

Name: Cardiff Heliport FP 17
Description:
Threshold height: 2 m
Direction: 180.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.465899	-3.138614	10.82	2.00	12.82
Two-mile	51.486343	-3.171470	14.49	565.87	580.37

FP18

Name: Cardiff Heliport FP 18
Description:
Threshold height: 2 m
Direction: 270.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.465899	-3.138614	10.82	2.00	12.82
Two-mile	51.486343	-3.171470	14.49	565.87	580.37

FP19

Name: Cardiff Heliport FP 19
Description:
Threshold height: 2 m
Direction: 315.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.465884	-3.138611	10.83	2.00	12.83
Two-mile	51.445440	-3.105755	-2.65	583.03	580.37

FP3

Name: Cardiff Heliport FP3
Description:
Threshold height: 15 m
Direction: 198.1°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.468451	-3.137045	11.60	15.24	26.84
Two-mile	51.495933	-3.122608	23.96	570.42	594.38

FP10

Name: Flat Holm Heliport FP10
Description:
Threshold height: 2 m
Direction: 225.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.378994	-3.122617	15.68	2.00	17.68
Two-mile	51.399438	-3.089824	-7.37	592.60	585.23

FP11

Name: Flat Holm Heliport FP11
Description:
Threshold height: 10 m
Direction: 315.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.378994	-3.122615	15.68	10.00	25.68
Two-mile	51.358549	-3.089822	-5.64	598.87	593.23

FP12

Name: Flat Holm Heliport FP12
Description:
Threshold height: 2 m
Direction: 45.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.378990	-3.122647	15.66	2.00	17.66
Two-mile	51.358546	-3.155440	-16.21	601.41	585.20

FP5

Name: Flat Holm Heliport FP5
Description:
Threshold height: 2 m
Direction: 180.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.379003	-3.122610	15.72	2.00	17.72
Two-mile	51.407916	-3.122610	-7.34	592.61	585.26

FP6

Name: Flat Holm Heliport FP6
Description:
Threshold height: 2 m
Direction: 270.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.379001	-3.122612	15.72	2.00	17.72
Two-mile	51.379001	-3.076236	-18.85	604.11	585.26

FP7

Name: Flat Holm Heliport FP7
Description:
Threshold height: 2 m
Direction: 0.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.378996	-3.122615	15.72	2.00	17.72
Two-mile	51.350084	-3.122615	-4.89	590.16	585.26

FP8

Name: Flat Holm Heliport FP8
Description:
Threshold height: 2 m
Direction: 90.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.378993	-3.122616	15.68	2.00	17.68
Two-mile	51.379003	-3.168992	-6.98	592.21	585.23

FP9

Name: Flat Holm Heliport FP9
Description:
Threshold height: 2 m
Direction: 135.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	51.378997	-3.122623	15.71	2.00	17.71
Two-mile	51.399442	-3.155416	-2.49	587.75	585.25

Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	51.398636	-3.340635	63.59	18.00
OP 2	2	51.379006	-3.122608	15.75	2.00
OP 3	3	51.408217	-3.203538	46.24	1.80
OP 4	4	51.408846	-3.203276	47.43	1.80
OP 5	5	51.408595	-3.203866	47.47	1.80
OP 6	6	51.405095	-3.202729	27.17	1.80
OP 7	7	51.404711	-3.203239	25.65	1.80
OP 8	8	51.401971	-3.201184	18.73	1.80
OP 9	9	51.406911	-3.196345	38.48	1.80
OP 10	10	51.410646	-3.183509	27.25	1.80
OP 11	11	51.410180	-3.182496	30.46	1.80
OP 12	12	51.409915	-3.183100	31.13	1.80
OP 13	13	51.407755	-3.180995	29.20	1.80
OP 14	14	51.407963	-3.180781	29.68	1.80
OP 15	15	51.408017	-3.180832	29.80	1.80
OP 16	16	51.407826	-3.181001	29.88	1.80
OP 17	17	51.407937	-3.180987	30.34	1.80
OP 18	18	51.408068	-3.181052	30.15	1.80
OP 19	19	51.403367	-3.187730	27.52	1.80
OP 20	20	51.404072	-3.190236	49.02	1.80
OP 21	21	51.404035	-3.183673	21.88	1.80
OP 22	22	51.404271	-3.184097	22.74	1.80
OP 23	23	51.404470	-3.184529	23.54	1.80
OP 24	24	51.404892	-3.185186	28.37	1.80
OP 25	25	51.405085	-3.185536	31.05	1.80
OP 26	26	51.405296	-3.186156	33.20	1.80
OP 27	27	51.403828	-3.187377	27.10	1.80
OP 28	28	51.406610	-3.176955	35.96	1.80
OP 29	29	51.406258	-3.177312	37.03	1.80
OP 30	30	51.407167	-3.175867	32.87	1.80
OP 31	31	51.413735	-3.180869	15.36	1.80
OP 32	32	51.413437	-3.180327	17.82	1.80
OP 33	33	51.414290	-3.178334	25.38	1.80
OP 34	34	51.413812	-3.174552	34.22	1.80
OP 35	35	51.414708	-3.175174	33.22	1.80
OP 36	36	51.408388	-3.205159	45.23	1.80
OP 37	37	51.408154	-3.206372	42.69	1.80
OP 38	38	51.409410	-3.205205	46.70	1.80
OP 39	39	51.409036	-3.204980	46.73	1.80
OP 40	40	51.465958	-3.138514	10.72	2.00
OP 41	41	51.402080	-3.198501	22.12	1.80
OP 42	42	51.400733	-3.196425	9.36	1.80

Annex C – Glare Analysis Results

Glare Analysis – Detailed Results

Overall Summary of Results

PV Array	Tilt (°)	Orientation (°)	Annual Green Glare (min)	Annual Green Glare (hr)	Annual Yellow Glare (min)	Annual Yellow Glare (hr)
PV Array - Plot 12-13-17	17.0	180.0	49,763	829.4	31,854	530.9
PV Array - Plot 14-18-19	17.0	180.0	60,755	1,012.6	49,527	825.5
PV Array - Plot 4-5-10	17.0	180.0	55,368	922.8	20,910	348.5

Route receptors

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
Beach Road	4357	72.6	287	4.8
Clevedon Avenue - Sully	0	0.0	0	0.0
Cosmeston Drive	0	0	0	0
Cycling Route consented	7061	117.7	5323	88.7
Falcon Grove - Cosmeston	0	0	0	0
Fort Road	4883	81.4	5270	87.8
Fulmar Close - Cosmeston	0	0	0	0
Highbridge Close - Sully	7757	129.3	772	12.9
Lavernock Road	10630	177.2	3710	61.8
Lavernock Road - Towards Cosmeston	0	0	0	0
Osprey Close- Cosmeston	0	0	0	0
Raven Way - Cosmeston	0	0	0	0
Shearwater Close - Cosmeston	0	0	0	0
South Road	8963	149.4	1768	29.5
St Marys Well Bay Road	1596	26.6	4994	83.2
Swanbridge Grove - Sully	3423	57.0	66	1.1
Swanbridge road - Sully	0	0	0	0
Winsford Road - Sully	8125	135.4	658	11.0

Flight path receptors

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
Cardiff Airport FP1	0	0	0	0
Cardiff Airport FP2	1239	20.6	0	0
Cardiff Heliport FP 13	0	0	0	0
Cardiff Heliport FP 14	0	0	0	0
Cardiff Heliport FP 15	0	0	0	0
Cardiff Heliport FP 16	0	0	0	0

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
Cardiff Heliport FP 17	0	0	0	0
Cardiff Heliport FP 18	0	0	0	0
Cardiff Heliport FP 19	0	0	0	0
Cardiff Heliport FP3	0	0	0	0
Flat Holm Heliport FP10	2521	42.0	0	0
Flat Holm Heliport FP11	0	0	0	0
Flat Holm Heliport FP12	0	0	0	0
Flat Holm Heliport FP5	0	0	0	0
Flat Holm Heliport FP6	7845	130.8	0	0
Flat Holm Heliport FP7	0	0	0	0
Flat Holm Heliport FP8	0	0	0	0
Flat Holm Heliport FP9	0	0	0	0

Observation points and ATCT's

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
1-ATCT	913	15.2	0	0
OP 2	0	0	0	0
OP 3	1333	22.2	0	0
OP 4	861	14.3	0	0
OP 5	1045	17.4	0	0
OP 6	7226	120.4	898	15.0
OP 7	8079	134.7	1131	18.9
OP 8	8409	140.2	0	0
OP 9	3705	61.8	291	4.8
OP 10	0	0	0	0
OP 11	0	0	0	0
OP 12	0	0	0	0
OP 13	2567	42.8	3422	57.0
OP 14	2301	38.4	3364	56.1
OP 15	2234	37.2	3418	57.0
OP 16	2459	41.0	3349	55.8
OP 17	2315	38.6	3341	55.7
OP 18	2205	36.8	3575	59.6
OP 19	1666	27.8	2198	36.6
OP 20	3564	59.4	3063	51.0
OP 21	2671	44.5	3653	60.9
OP 22	2320	38.7	4726	78.8
OP 23	2002	33.4	5257	87.6
OP 24	2240	37.3	7544	125.7
OP 25	2113	35.2	6647	110.8
OP 26	2092	34.9	6321	105.3
OP 27	3930	65.5	3229	53.8

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
OP 28	5470	91.2	5193	86.5
OP 29	5656	94.3	6810	113.5
OP 30	4987	83.1	1823	30.4
OP 31	0	0	0	0
OP 32	0	0	0	0
OP 33	0	0	0	0
OP 34	0	0	0	0
OP 35	0	0	0	0
OP 36	907	15.1	0	0
OP 37	681	11.3	0	0
OP 38	280	4.7	0	0
OP 39	495	8.2	0	0
OP 40	0	0	0	0
OP 41	7143	119.0	83	1.4
OP 42	3238	54.0	107	1.8

PV Array - Plot 12-13-17

Route receptors

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
Cycling Route consented	3376	56.3	2505	41.8
Fort Road	1933	32.2	853	14.2
Lavernock Road	4165	69.4	1266	21.1
St Marys Well Bay Road	820	13.7	3403	56.7
Beach Road	1678	28.0	0	0.0
Highbridge Close - Sully	2248	37.5	0	0.0
South Road	2441	40.7	0	0.0
Swanbridge Grove - Sully	1104	18.4	0	0.0
Winsford Road - Sully	2293	38.2	0	0.0
Clevedon Avenue - Sully	0	0.0	0	0.0
Cosmeston Drive	0	0.0	0	0.0
Falcon Grove - Cosmeston	0	0.0	0	0.0
Fulmar Close - Cosmeston	0	0.0	0	0.0
Lavernock Road - Towards Cosmeston	0	0.0	0	0.0
Osprey Close- Cosmeston	0	0.0	0	0.0
Raven Way - Cosmeston	0	0.0	0	0.0
Shearwater Close - Cosmeston	0	0.0	0	0.0
Swanbridge road - Sully	0	0.0	0	0.0

Flight path receptors

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
Cardiff Airport FP2	474	7.9	0	0.0

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
Flat Holm Heliport FP10	781	13.0	0	0.0
Flat Holm Heliport FP6	2428	40.5	0	0.0
Cardiff Airport FP1	0	0.0	0	0.0
Cardiff Heliport FP 13	0	0.0	0	0.0
Cardiff Heliport FP 14	0	0.0	0	0.0
Cardiff Heliport FP 15	0	0.0	0	0.0
Cardiff Heliport FP 16	0	0.0	0	0.0
Cardiff Heliport FP 17	0	0.0	0	0.0
Cardiff Heliport FP 18	0	0.0	0	0.0
Cardiff Heliport FP 19	0	0.0	0	0.0
Cardiff Heliport FP3	0	0.0	0	0.0
Flat Holm Heliport FP11	0	0.0	0	0.0
Flat Holm Heliport FP12	0	0.0	0	0.0
Flat Holm Heliport FP5	0	0.0	0	0.0
Flat Holm Heliport FP7	0	0.0	0	0.0
Flat Holm Heliport FP8	0	0.0	0	0.0
Flat Holm Heliport FP9	0	0.0	0	0.0

Observation points and ATCT's

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
OP 13	733	12.2	1646	27.4
OP 14	813	13.6	1530	25.5
OP 15	809	13.5	1539	25.6
OP 16	744	12.4	1583	26.4
OP 17	758	12.6	1539	25.6
OP 18	770	12.8	1576	26.3
OP 20	1694	28.2	2001	33.4
OP 24	556	9.3	3209	53.5
OP 25	680	11.3	2733	45.5
OP 26	618	10.3	2724	45.4
OP 27	1500	25.0	177	3.0
OP 28	1558	26.0	1413	23.6
OP 29	1142	19.0	2074	34.6
OP 41	1917	31.9	83	1.4
OP 3	613	10.2	0	0.0
OP 4	501	8.3	0	0.0
OP 5	563	9.4	0	0.0
OP 6	2191	36.5	0	0.0
OP 7	2344	39.1	0	0.0
OP 8	2218	37.0	0	0.0
OP 9	36	0.6	0	0.0
OP 30	1765	29.4	0	0.0
OP 36	333	5.5	0	0.0
OP 38	143	2.4	0	0.0

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
OP 39	281	4.7	0	0.0
OP 42	742	12.4	0	0.0
1-ATCT	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 40	0	0.0	0	0.0

PV Array - Plot 14-18-19

Route receptors

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
Beach Road	2679	44.6	287	4.8
Cycling Route consented	2285	38.1	18	0.3
Fort Road	1836	30.6	4417	73.6
Lavernock Road	3210	53.5	2	0.0
St Marys Well Bay Road	747	12.4	1543	25.7
Highbridge Close - Sully	2354	39.2	0	0.0
South Road	3090	51.5	0	0.0
Swanbridge Grove - Sully	671	11.2	0	0.0
Winsford Road - Sully	2425	40.4	0	0.0
Clevedon Avenue - Sully	0	0.0	0	0.0
Cosmeston Drive	0	0.0	0	0.0
Falcon Grove - Cosmeston	0	0.0	0	0.0
Fulmar Close - Cosmeston	0	0.0	0	0.0
Lavernock Road - Towards Cosmeston	0	0.0	0	0.0
Osprey Close- Cosmeston	0	0.0	0	0.0
Raven Way - Cosmeston	0	0.0	0	0.0
Shearwater Close - Cosmeston	0	0.0	0	0.0
Swanbridge road - Sully	0	0.0	0	0.0

Flight path receptors

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
Cardiff Airport FP2	332	5.5	0	0.0
Flat Holm Heliport FP10	903	15.1	0	0.0
Flat Holm Heliport FP6	2584	43.1	0	0.0
Cardiff Airport FP1	0	0.0	0	0.0
Cardiff Heliport FP 13	0	0.0	0	0.0
Cardiff Heliport FP 14	0	0.0	0	0.0
Cardiff Heliport FP 15	0	0.0	0	0.0
Cardiff Heliport FP 16	0	0.0	0	0.0
Cardiff Heliport FP 17	0	0.0	0	0.0
Cardiff Heliport FP 18	0	0.0	0	0.0
Cardiff Heliport FP 19	0	0.0	0	0.0
Cardiff Heliport FP3	0	0.0	0	0.0
Flat Holm Heliport FP11	0	0.0	0	0.0
Flat Holm Heliport FP12	0	0.0	0	0.0
Flat Holm Heliport FP5	0	0.0	0	0.0
Flat Holm Heliport FP7	0	0.0	0	0.0
Flat Holm Heliport FP8	0	0.0	0	0.0
Flat Holm Heliport FP9	0	0.0	0	0.0

Observation points and ATCT's

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
OP 13	583	9.7	1776	29.6
OP 14	505	8.4	1834	30.6
OP 15	498	8.3	1879	31.3
OP 16	522	8.7	1766	29.4
OP 17	488	8.1	1802	30.0
OP 18	532	8.9	1999	33.3
OP 19	1422	23.7	2198	36.6
OP 20	1870	31.2	1062	17.7
OP 21	1639	27.3	2123	35.4
OP 22	1351	22.5	3086	51.4
OP 23	1046	17.4	3542	59.0
OP 24	929	15.5	2694	44.9
OP 25	792	13.2	2360	39.3
OP 26	848	14.1	2107	35.1
OP 27	1064	17.7	2592	43.2
OP 28	1828	30.5	3780	63.0
OP 29	1825	30.4	4730	78.8
OP 30	1934	32.2	1823	30.4
OP 42	2496	41.6	107	1.8
1-ATCT	413	6.9	0	0.0
OP 3	440	7.3	0	0.0
OP 4	271	4.5	0	0.0

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
OP 5	328	5.5	0	0.0
OP 6	2216	36.9	0	0.0
OP 7	2538	42.3	0	0.0
OP 8	3192	53.2	0	0.0
OP 9	1692	28.2	0	0.0
OP 36	362	6.0	0	0.0
OP 37	403	6.7	0	0.0
OP 38	137	2.3	0	0.0
OP 39	214	3.6	0	0.0
OP 41	3105	51.8	0	0.0
OP 2	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	0	0.0	0	0.0
OP 40	0	0.0	0	0.0

PV Array - Plot 4-5-10

Route receptors

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
Cycling Route consented	1400	23.3	2800	46.7
Highbridge Close - Sully	3155	52.6	772	12.9
Lavernock Road	3255	54.2	2442	40.7
South Road	3432	57.2	1768	29.5
St Marys Well Bay Road	29	0.5	48	0.8
Swanbridge Grove - Sully	1648	27.5	66	1.1
Winsford Road - Sully	3407	56.8	658	11.0
Fort Road	1114	18.6	0	0.0
Beach Road	0	0.0	0	0.0
Clevedon Avenue - Sully	0	0.0	0	0.0
Cosmeston Drive	0	0.0	0	0.0
Falcon Grove - Cosmeston	0	0.0	0	0.0
Fulmar Close - Cosmeston	0	0.0	0	0.0
Lavernock Road - Towards Cosmeston	0	0.0	0	0.0
Osprey Close- Cosmeston	0	0.0	0	0.0
Raven Way - Cosmeston	0	0.0	0	0.0
Shearwater Close - Cosmeston	0	0.0	0	0.0
Swanbridge road - Sully	0	0.0	0	0.0

Flight path receptors

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
Cardiff Airport FP2	433	7.2	0	0.0
Flat Holm Heliport FP10	837	13.9	0	0.0
Flat Holm Heliport FP6	2833	47.2	0	0.0
Cardiff Airport FP1	0	0.0	0	0.0
Cardiff Heliport FP 13	0	0.0	0	0.0
Cardiff Heliport FP 14	0	0.0	0	0.0
Cardiff Heliport FP 15	0	0.0	0	0.0
Cardiff Heliport FP 16	0	0.0	0	0.0
Cardiff Heliport FP 17	0	0.0	0	0.0
Cardiff Heliport FP 18	0	0.0	0	0.0
Cardiff Heliport FP 19	0	0.0	0	0.0
Cardiff Heliport FP3	0	0.0	0	0.0
Flat Holm Heliport FP11	0	0.0	0	0.0
Flat Holm Heliport FP12	0	0.0	0	0.0
Flat Holm Heliport FP5	0	0.0	0	0.0
Flat Holm Heliport FP7	0	0.0	0	0.0
Flat Holm Heliport FP8	0	0.0	0	0.0
Flat Holm Heliport FP9	0	0.0	0	0.0

Observation points and ATCT's

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
OP 6	2819	47.0	898	15.0
OP 7	3197	53.3	1131	18.9
OP 9	1977	33.0	291	4.8
OP 21	1032	17.2	1530	25.5
OP 22	969	16.1	1640	27.3
OP 23	956	15.9	1715	28.6
OP 24	755	12.6	1641	27.4
OP 25	641	10.7	1554	25.9
OP 26	626	10.4	1490	24.8
OP 27	1366	22.8	460	7.7
OP 29	2689	44.8	6	0.1
1-ATCT	500	8.3	0	0.0
OP 3	280	4.7	0	0.0
OP 4	89	1.5	0	0.0
OP 5	154	2.6	0	0.0
OP 8	2999	50.0	0	0.0
OP 13	1251	20.9	0	0.0
OP 14	983	16.4	0	0.0
OP 15	927	15.4	0	0.0
OP 16	1193	19.9	0	0.0
OP 17	1069	17.8	0	0.0
OP 18	903	15.1	0	0.0
OP 19	244	4.1	0	0.0

Receptor	Green (min)	Green (hr)	Yellow (min)	Yellow (hr)
OP 28	2084	34.7	0	0.0
OP 30	1288	21.5	0	0.0
OP 36	212	3.5	0	0.0
OP 37	278	4.6	0	0.0
OP 41	2121	35.4	0	0.0
OP 2	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	0	0.0	0	0.0
OP 38	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 40	0	0.0	0	0.0
OP 42	0	0.0	0	0.0

Annex D – Tool Assumptions

Tool Assumptions

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

The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more
rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular
impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at www.forgesolar.com/help/ for assumptions and limitations not listed here.

ForgeSolar default analysis parameters and observer eye characteristics, listed for reference only. The values used for this analysis are given in
the site summary above.

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

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This analysis was conducted using the best available radiometric modelling at the time of generation. Future updates to the modelling
methodology may yield different results.