18 GLINT

18.1 Introduction

18.1.1 This Chapter reports the likely significant effects of the Proposed Development in terms of Glint in the context of the Site and surrounding area. In particular, it considers the likely significant effects of glint caused by the photovoltaic (PV) array elements of the Proposed Development on ground-based receptors, including road, rail and local dwellings. In addition, glint effects on aircrafts operating in the surrounding area will be considered.

18.1.2 This Chapter (and its associated figures and appendices) is not intended to be read as a standalone assessment and reference should be made to the front end of this ES (Chapters 1 – 6).

18.2 Legislation, Policy and Guidance

18.2.1 The relevant legislation, policy and guidance are listed below, with details provided in Appendix 18.1.

Legislative Framework

18.2.2 The applicable legislative framework is The National Plan 2040.

Planning Policy

18.2.3 The applicable planning policy is summarised as follows:

National Policy Statements

- Future Wales, The National Plan 2040, Policy 17, (September 2020)[1]
- Caerphilly County Borough Council Local Development Plan (2010)
- Planning Policy Wales Edition 11 (2021)

Guidance

18.2.4 The applicable guidance is summarised as follows:

- Aviation Guidance (CAA);
- Aviation Guidance (FAA); and
- Aviation Guidance (CAST).

[1] Future Wales - The National Plan 2040 (gov.wales)

Scope of the Assessment

18.2.5 The scope of the assessment includes consideration of effects on aviation in the vicinity of the Site, motorists using local roads and any effects on buildings and the railway. It also includes the assessment of cumulative effects of other solar sites in the area that are either approved or in planning.

Effects Not Considered within the Scope

18.2.6 Whilst not entirely scoped out of the assessment, Table 18.1, below, highlights the effects that have not been subject to detailed numerical modelling. These relate to construction and decommissioning and have been considered empirically instead based on anticipated construction methods and actions. In addition, ground receptors that lie further than 5km away from the Site and outside the ZTV are not considered within the scope.

Table 18.1: Matters to be scoped out of the assessment

Project Phase	Rationale
Construction	The installation works are temporary, and it is not possible to model effects within the standard software. Although there is a slight risk of reflections from steel legs prior to mounting the panels on top, this is limited and adopting a progressive approach to installation should considerably limit these. Consideration is given to the effects, but detailed calculation of duration or glint intensity is not provided.
Decommissioning	The decommissioning works will be virtually the mirror opposite of installation. No different effects are expected to be present and all will be temporary.

18.3 Assessment Methodology and Significance Criteria

Extent of the Study Area

18.3.1 A study area of 5km has been applied for motorists, buildings and railways. Glint intensity diminishes with increasing distance from the source, and visibility to low-lying objects (i.e. 3.5m above ground level), generally becomes more difficult the further away the viewer is as well, due to intervening objects obscuring visibility and more distant objects appearing smaller. Sensitive receptors beyond 5km will still be considered where there is expected to be direct visibility to the Site.

18.3.2 The 5km study area is refined by generating a Zone of Theoretical Visibility (ZTV), and a Ground Glint Zone (GGZ), i.e. the area theoretically capable of receiving ground glint. More detailed drawings are included in the Appendices which support this ES chapter. Ground receptors that lie in both the ZTV and GGZ are evaluated and then selected to be modelled for glint.

18.3.3 Aerodromes within 15km of the Proposed Development have been considered. In most cases, aerodromes located more than 5km away will be unaffected by glint effects although, since air traffic control towers (ATCT) are often much taller than their surroundings, they tend to have better visibility. Final approach flightpaths are assumed to extend 2 miles (~3.2km) from the runway threshold so pilots at the start of this approach could be much closer to the solar array than the aerodrome, itself.

Assessment Methodology

18.3.4 The method of baseline data collection and assessment is in accordance with current guidance and industry best practice.

18.3.5 The assessment considers the potential effects of glint caused by the solar PV array elements of the Proposed Development on ground-based receptors, including road, rail and local dwellings, as well as aviation receptors, where relevant.

Defining Glint

18.3.6 Glint, glare and dazzle are often used interchangeably but the definitions used in this report are described below and shown in Figure 18.1.

18.3.7 **Glint** – Also known as a specular reflection is produced as a direct reflection of the sun on the surface of the solar PV panel. It occurs with the reflection of light from smooth surfaces such as glass, steel, and calm water.

18.3.8 **Glare** – A scattered reflection of light. Glare is significantly less intense than glint and is produced from rougher surfaces such as concrete, tarmac, and vegetation.

18.3.9 **Dazzle** – An effect caused by intense glint and glare, which can cause distraction, and if strong enough reduce the ability of the receptor to distinguish details and objects.

18.3.10 It should be noted that different organisations and agencies apply slightly different definitions to these terms, and some refer to the terms glint and glare interchangeably.

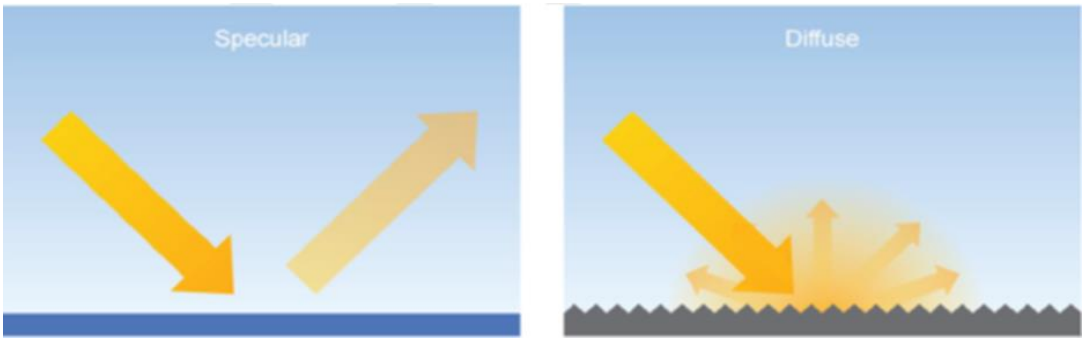


Figure 18.1: Types of Reflection[2]

18.3.11 Due to the intensity of glint being much higher than glare, this Chapter will focus on assessing glint effects alone. The perceived intensity of glint will vary depending on the ambient light level, direction and distance to the receptor.

Significance Criteria

18.3.12 Effects that are deemed to be '**Significant**' for the purposes of this assessment are those that are predicted 'yellow or red glint' before mitigation. In general, low intensity green glint is considered to be '**Not Significant**' unless the receptor in question happens to be an ATCT, which, due to its high sensitivity, is not permitted to tolerate green glint.

Sensitivity

18.3.13 For the purposes of this assessment, the sensitivity of the receptor is judged based on the likely consequence of a negative effect. For example, the potential consequence of a motorist or train driver being dazzled by glint could be (in a worst-case scenario) a collision or major accident.

18.3.14 A receptor that is considered to present a possible health and safety risk is allocated as having High sensitivity. A receptor that has little or no potential for physical harm, but where residents could experience a nuisance, such as glint being visible from a property, is allocated as Medium sensitivity. A receptor that is uninhabited and irregularly frequented, or a building that does not have windows, such as a substation or warehouse, is allocated as Low sensitivity. A place where people are not usually present, such as an agricultural field with no public access, is considered to have Negligible sensitivity (i.e. it is unlikely to cause any issues even if glint were to be

[2] Federal Aviation Administration, "Technical Guidance for Evaluating Selected Solar Technologies on Airports" Chapter 3, Nov 2010

visible).**Error! Reference source not found.** illustrates how the sensitivity is defined for each receptor.

Table 18.2: Sensitivity Criteria for Receptors										
SENSITIVITY										
	Type of Receptor:	Dwelling	Commercial Property	Minor Rd	Major Rd	Motorway	Railway	Footpath	Aircraft	ATCT
Distance from receptor	0-500m	High	Medium	Medium	High	High	High	Low	Medium	High
	500m-1km	Medium	Medium	Low	Medium	High	High	Low	Medium	High
	1-2km	Medium	Low	Low	Medium	High	Medium	Low	Medium	High
	2-3km	Low	Low	Low	Low	Medium	Low	Low	Low	High
	3-4 km	Low	Low	Low	Low	Medium	Low	Low	Low	High
	4-5km	Low	Low	Low	Low	Low	Low	Low	Low	Medium

Magnitude

18.3.15 For the purpose of this assessment, the magnitude of effect is primarily based on the output of the computer model, which, in the event that any glint is visible, provides a binary result for standard glint effects. Green glint is low intensity glint with low potential for temporary after image. In this context 'after image' is the residual effect that remains temporarily visible after glancing towards and then away from a very bright light source. Yellow glint is medium intensity glint that has some potential for temporary after image. Further context for the magnitude of effect is provided by the duration of effect and the time of the day that it occurs.

18.3.16 Minutes of glint during 'Peak' times of day would denote morning and evening rush hours for roads and the working day for the sociable hours of the day for fixed point receptors such as commercial or residential dwellings. However, this could vary with differing building purposes. Minutes of glint during 'Off-Peak' times would be at times of the day when there is less frequented use at that particular receptor; for example in the early morning or late evening for road users or outside operational hours of airfields or commercial buildings.

18.3.17 The computer model predicts glint effects in the absence of any consideration of screening and it assumes optimum sunlight conditions persist throughout the year. It does not recognise whether there is any intervisibility between the solar panels and the receptor and does not of its own accord account for changing weather. These

elements of assessment require human intervention to consider whether, in reality, visibility to panels capable of reflecting light is possible.

18.3.18 Table 18.3 illustrates how the magnitude of effects is defined for each receptor.

Table 18.3: Magnitude Criteria							
MAGNITUDE							
Minutes	Green Glint			Yellow Glint			Red Glint
	No Screening	Partial screening	Full Screening	No Screening	Partial screening	Full Screening	All Instances
0-3000 Peak	Minor	Minor	Negligible	Major	Moderate	Minor	Major
0-3000 Off Peak	Negligible	Negligible	Negligible	Moderate	Minor	Minor	Major
3000-6000 Peak	Minor	Minor	Negligible	Major	Moderate	Minor	Major
3000-6000 Off Peak	Negligible	Negligible	Negligible	Moderate	Minor	Minor	Major
6000-9000 Peak	Minor	Minor	Negligible	Major	Moderate	Minor	Major
6000-9000 Off Peak	Negligible	Negligible	Negligible	Moderate	Minor	Minor	Major
9000 + Peak	Minor	Minor	Negligible	Major	Moderate	Minor	Major

Significance

18.3.19 This assessment is focussed on considering High and Medium sensitivity receptors. It is considered that, unless guidance suggests otherwise, yellow glint received at these receptors should be considered to be Significant. If yellow glint is predicted in the Forge Solar model (which does not account for screening), but, in reality, the receptor is already screened and there is no visibility or if visibility to potential glint effects will be removed by mitigation, effects at these receptors will be considered to be Not Significant. In general, low intensity green glint is considered to be Not Significant unless the receptor in question happens to be an ATCT is not permitted to tolerate green glint.

18.3.20 Table 18.4 illustrates the significance of the magnitude of change impact and the sensitivity of the receptors assessed.

Table 18.4: Significance of Effect Matrix					
		Sensitivity of Receptor			
		High	Medium	Low	Negligible
Magnitude of Change (Impact)	Major	Significant	Significant	Significant	Significant
	Moderate	Significant	Significant	Not Significant	Not Significant
	Minor	Not Significant	Not Significant	Not Significant	Not Significant
	Negligible	Not Significant	Not Significant	Not Significant	Not Significant

Sensitive Receptors

18.3.21 In summary, the key sensitive receptors that, if present within the study area, will need to be assessed, include:

- Motorists on local roads;
- Railway lines;
- Aerodromes; and
- Residential/commercial properties.

Limitations

18.3.22 There are a number of limitations associated with the modelling that it is important to be aware of. These are summarised, below.

18.3.23 This glint assessment is a desk-based assessment and in some cases, it may have been difficult to determine definitively whether there is visibility of the Site, based on the resources available. These included Google Earth aerial imagery and Google Earth Streetview, plus information from the ZTV and GGZ.

18.3.24 The ForgeSolar model calculates its results based upon the geometric relationship between the observation point at a specific height, the reflective plane at height (panels) and the position of the sun at each time interval. It, therefore, takes no account of any screening features whatsoever. The ZTV is used to aid in determining visibility, along with analysis of available site photography and aerial imagery.

18.3.25 Although the dates and times when glint has the potential to be visible for specific stretches of the road may vary, the results reported are expected to be representative of the road in general. Similarly, where Observation Points have been selected to represent several properties in relatively close proximity, the results reported will be

specific to the location of the OP, but will be broadly representative of all the dwellings in that location.

18.3.26 Glint can only occur when direct sunlight can reach the solar panels. Diffused lighting, caused by weather conditions such as cloud, fog, and mist do not allow the formation of glint due to the low energy intensity of the light incident on the panels.

18.3.27 However, the software assumes a worst-case scenario, where it is sunny, at the maximum intensity possible given the season, 365 days per year. The computer model suggests when glint can happen not when it will happen, which is why further interpretation by the assessor is important. The model is discussed further in Appendix 18.2.

18.3.28 It will be essential to interpret results in the context of the wider assessment and the methods and limitations discussed. The results will be further refined to account for local prevailing weather conditions, such as cloud cover.

18.3.29 The modelling software is limited in its ability to assess the construction and decommissioning effects prior to installation of the panels. In the absence of this information, it is assumed that glint effects from bare metal will be minimised by a staged approach to panel deployment with the panels themselves being swiftly mounted on the frames to prevent prolonged or excessive glint from the steel structures. Alongside the temporary nature of effects, and partial screening from existing and the proposed planting, there is assumed to be no more than brief and intermittent visibility to frames from ground level receptors prior to the panels being installed.

18.4 Baseline Conditions

Current Baseline

Site Description and Context

18.4.1 There will already be some baseline glint at receptors due to the presence of multiple reflective surfaces in the local area, such as other solar farms, glasshouses, waterbodies, agricultural polythene, windows in houses and windscreens in vehicles.

18.4.2 **Figure 18.2** shows the Site Boundary in red, the area containing the solar PV arrays in blue, the ZTV shaded purple, the GGZ, i.e. the area theoretically capable of receiving ground glint, hatched in grey and the 5km buffer in orange. A more detailed drawing is included in the Appendices which support this ES chapter (Appendix 18.3).

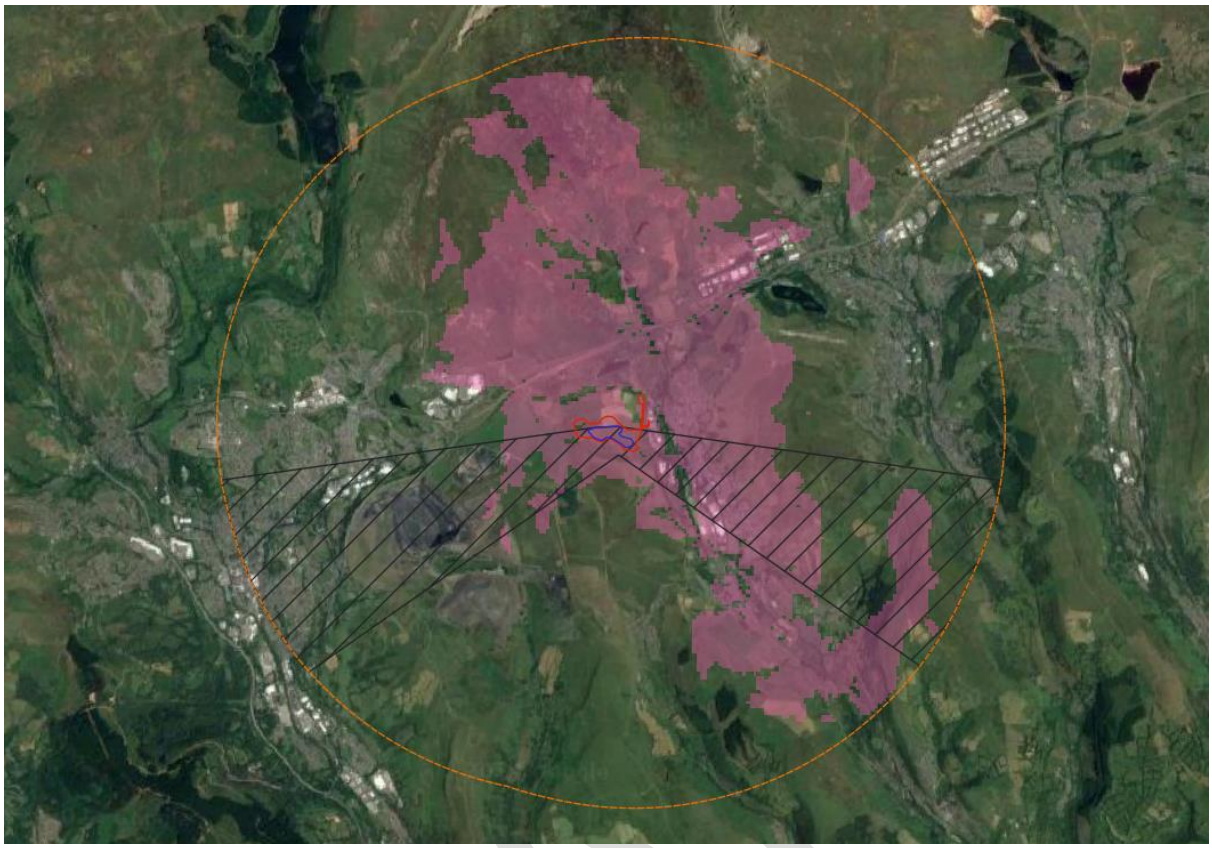


Figure 18.2: Map of the Site Boundary, Panel Area, 5km Buffer, ZTV and GGZ

(Google Earth 2024)

18.4.3 The Site is located to the west of Rhymney, in Caerphilly, South Wales and comprises grassland, surrounded by hills, mature treelines and hedgerows. It is at the head of the Rhymney River valley on land east of Gelli-Gaer Common and northeast of Bryn Pyllog Tips.

Baseline Survey Information

18.4.4 The start of the railway line at Rhymney connects to Cardiff and the track runs within approximately 800m to the east from the Site boundary, but travels south, away from the Site. Rhymney station is situated at the start of this line and is within 1km of the Site. To the west, the line that runs from Merthyr Tydfil south towards Cardiff lies approximately 5km from the Site. There are no other active railway receptors within the 5km study area. There is a disused mineral line at Cwm Bargoed, 2.5km to the south of the Site.

18.4.5 There are numerous roads and small country lanes within the 5km study area of the Site. Not all of these roads will need to be assessed as many of them lie outside of the area within which effects could theoretically be received. Studies have therefore focused on receptors lying within the ZTV and within the GGZ. Where receptors such

as roads cross areas within the ZTV and GGZ, only those sections within the area predicted to have capacity to receive glint have been assessed. There are 24 route receptors that have been considered in the assessment which form part of the existing baseline. These include the following:

- Route 1 - Heads of the Valleys Industrial Estate Road
- Route 2 – A469
- Route 3 – The Terrace
- Route 4 – The Edward Terrace
- Route 5 – Old Brewery Lane
- Route 6 - B4257
- Route 7 – Tan-Y-Llan Terrace
- Route 8 – Colenso Terrace
- Route 9 – Back lane to the B4257
- Route 10 – Goshen Street
- Route 11 – Cross Street
- Route 12 – Manest Street
- Route 13 – Tre-York Street
- Route 14 – B4256/Hill Street
- Route 15 – Moriah Street
- Route 16 – Plantation Terrace
- Route 17 – Wellington Way
- Route 18 – Garden City
- Route 19 – Tan-Y-Bryn
- Route 20 – Sunny Hill
- Route 21 – Nursery Crescent
- Route 22 – Brookfield Avenue
- Route 23 – Benjamin Court
- Route 24 – Hafod-Y-Mynydd

18.4.6 The routes identified are shown in Appendix 18.4 and Figure 18.6.

18.4.7 There are no airfields within 15km of the Site.

18.4.8 Within the study area, there are three main populated areas. These include the town of Rhymney, which lies c. 230m to the east on the opposite side of the A469, the town

of Merthyr Tydfil, which is located c. 1.86km to the west, and the village of Fochriw, which is located c. 1.96km to the south.

18.4.9 There are a number of dwellings and commercial premises within the study area that lie within the ZTV and GGZ. In some cases, the identified receptor is considered to be representative of several discrete receptors in close proximity. For the purposes of this report these receptors that lie within the ZTV and GGZ are called Observation Points (OP) and include:

- OP1 – HSNF Wales Warehouse
- OP2 – South of industrial site with Karabar and Prima Fabrications
- OP3 – Sharp Clinical Services, UK industrial site
- OP4 – Rear of residential properties on The Edwards Terrace
- OP5 – residential properties off The Edwards Terrace
- OP6 – Rhymney Youth Centre and houses to the north
- OP7 – Residential properties on Grove Villas/B4257 road
- OP8 – Residential properties on High Street and Saint David's Church
- OP9 – Parkside Funeral Home
- OP10 – Brewery Sports and Social Club
- OP11 – Residential properties on The Terrace
- OP12 – Residential properties on Tan-Y Llan Terrace
- OP13 – Cwrt Andrew Buchan
- OP14 – Cluster of residential properties on Cross Street
- OP15 – Residential properties on Manest Street
- OP16 – St David's Community Centre
- OP17 – The Royal Arms Pub
- OP18 – Ysgol Y Lawnt Primary School
- OP19 – Police Station and Shops
- OP20 – Rhymney Fire Station
- OP21 - Rhymney Integrated Health and Social Care Centre

- OP22 – Sofasofa
- OP23 – Visqueen bpi recycled products
- OP24 – The rear of residential properties on Brynteg Crescent
- OP25 – Residential properties on the road Mountbatten
- OP26 – Residential properties on Lady Tyler Terrace
- OP27 – Bryn Awel Primary School
- OP28 – Residential properties on Forge Crescent
- OP29 – Residential properties on Moriah Street
- OP30 – Residential properties surrounding the triangular green On Garden City road.
- OP31 – Residential properties on Hafod-Y-Mynydd
- OP32 – Residential properties off Wellington Way
- OP33 – Residential properties on Nursery Way and surrounding area

18.4.10 The routes identified are shown in Appendix 18.5.

18.4.11 There are several recreational routes within the site and surrounding area. Footpath RHYM/FP96/1, RHYM/FP95/5 and RHYM/FP91/1 are the main footpaths that pass through the Site in a broadly east to west direction. There are a number of other Public Rights of Way (PRoW) within the study area, forming a comprehensive network of public access throughout the Heads of the Valley Area.

18.4.12 In addition, National Cycle Network Route (NCN) 468 runs the length of the Rhymney Valley (bar a gap to the south), through Rhymney town centre and up to the A465 via the A469.

18.4.13 There is currently one operational solar development in the immediate vicinity of the Proposed Development, within the 5km study area. The operational site is at Land at Cwm Bargoed located approximately 2.4km to the southwest of the Site.

18.4.14 In the wider area (beyond 5km) there are a number of other solar PV developments which form existing sources of potential glint, but the distance between these and the Site is such that the intensity of any effect would be low and there is very little likelihood of any intervisibility.

18.4.15 There are a range of other common materials and surfaces likely to cause glint that are already present in the study area. These include, inter alia:

- glass in windows;
- conservatories or greenhouses;
- polythene used in agricultural practices;
- exposed metal surfaces;
- flashes caused by light reflecting off passing vehicles; and
- waterbodies.

18.4.16 The nearest bodies of standing water are Butetown Reservoir c. 100m to the north and Rhaslas Pond, c. 600m to the south of the Site.

18.4.17 It is not possible to accurately quantify the full level of glint currently experienced by receptors in the vicinity of the Site, as there are a huge variety of sources, wide spread of receptors and some reflections could arise from mobile sources such as moving vehicles. For the purposes of this assessment, it is therefore presumed that no baseline glint currently occurs at these receptors.

Future Baseline

18.4.18 The likely evolution of the current baseline without the implementation of the Proposed Development, would be the continuation of agricultural practices.

18.4.19 Overall, the future baseline will broadly reflect that of the current baseline.

18.5 Assessment of Effects

Design Solutions and Assumptions

18.5.1 This Chapter assesses the following panel specifications:

- Panels are fixed with a maximum height of 2.5m at their back edge;
- Panel inclination (pitch) is 15 degrees; and
- Panel orientation is 180 degrees (they face due south).

18.5.2 Only fixed solar PV panels are under consideration for the Proposed Development.

18.5.3 It is anticipated that the Proposed Development will be constructed sequentially in sections, with one part of being built out before the next is commenced. In this way different sections of the proposed infrastructure will help provide screening from ongoing construction activities, providing an element of self-mitigation.

18.5.4 A panel height of 2.5m and an observer height of 1.8m has been used to generate the ZTV. The ZTV uses OS Terrain 50 data which has a 50m resolution. This does not account for intervening topography and surface screening from trees and buildings. The ZTV then informs potential receptors that are then assessed further in the ForgeSolar computer model.

18.5.5 The Sun's path is used to calculate a GGZ where glint can be experienced at ground level. This uses the panel angle and orientation to determine where ground reflections are geometrically possible.

PV Array

18.5.6 In order to model the panels in the software accurately, the arrays had to be represented by two discrete areas to prevent the over prediction of glint. This helps to avoid a limitation in the software whereby convex shapes are assumed to contain panels. The modelled panel array area was therefore divided into 2 parts, as shown in Figure 18.3.

18.5.7 It should be noted that the analysis of the ForgeSolar data takes into account the potential duplication of glint at one receptor from both panel areas. Appendix 18.4 states that there could be duplication of glint in the results, but in the results discussed in this Chapter, this has been addressed.

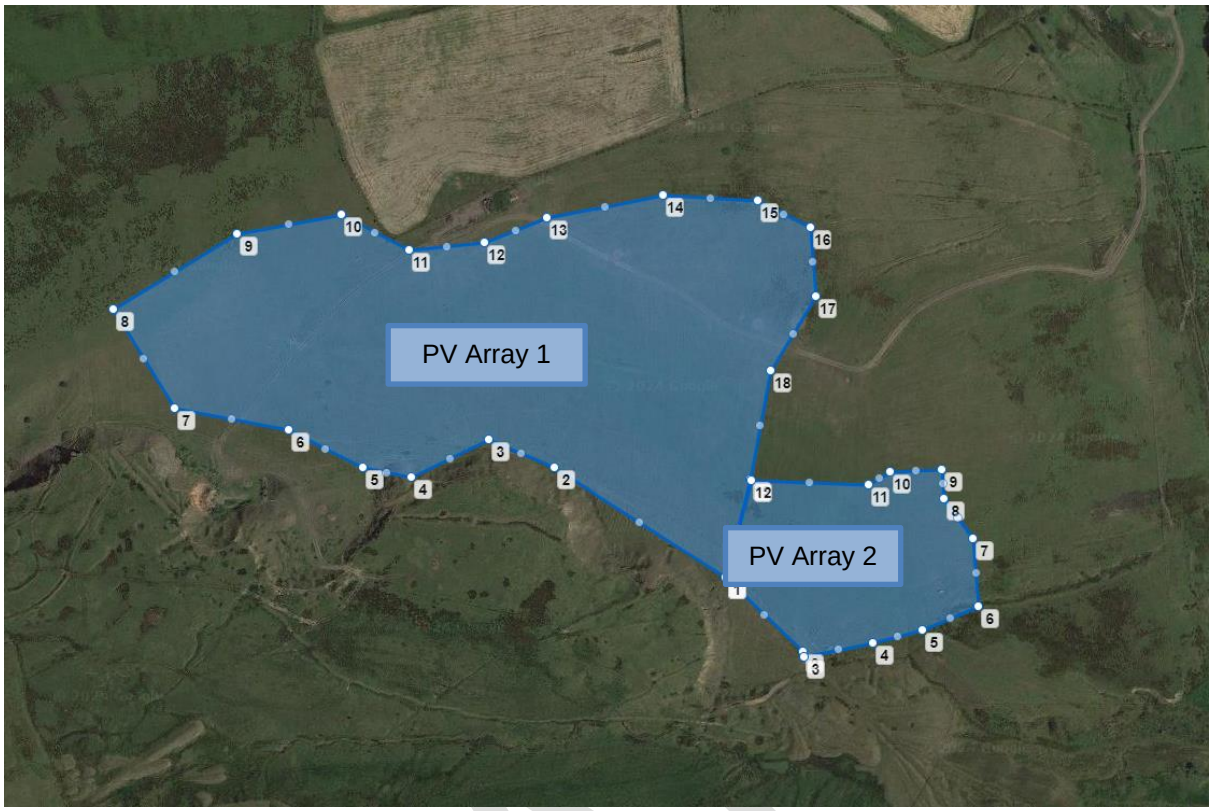


Figure 18.3: The PV Array identification as given in the ForgeSolar software

Assessment of Effects – Construction Phase

18.5.8 The construction phase is considered across a number of receptors, separately. These include rail and road receptors, observation points (representative of dwellings in the surrounding area) and aviation receptors.

18.5.9 During the initial phase of ground preparation, there are not likely to be any reflections present other than possibly from the windscreens of vehicles used in the site preparation works. It is anticipated that the Proposed Development will be constructed sequentially in sections, with one part of being built out before the next is commenced. In this way, different sections will help provide screening from ongoing construction activities, providing an element of self-mitigation.

18.5.10 Until such time as the panels are installed on the mounting structures, there will be some potential for the mounting structures themselves to reflect sunlight. Since the mounting structures are likely to be made of steel, their reflectivity will most likely be higher than the panels, so there is some chance of glint impacts during this time. The surface area for the mounting structures is considerably smaller than the surface area for the panels and the time between the installation of the mounting structures and the mounting of the panels will be minimised, so any potential impacts will be limited.

18.5.11 Numerical modelling of glint effects from the mounting structures has not been undertaken as the computer model is not designed to enable this type of analysis. Any impacts would be short-lived and temporary. If any particular issues are identified during the construction process, temporary screening could be used to mitigate them.

18.5.12 There are no specific aviation receptors present in the study area and so there are no significant glint effects.

18.5.13 Rail receptors are considered to be of high sensitivity. Impacts on rail receptors during the construction phase are assessed as temporary and the magnitude of the impact is not quantifiable but expected to be Negligible. The overall significance of effect on rail receptors is **Not Significant** without mitigation.

18.5.14 The sensitivity of road receptors is Medium to High, depending on the road type. During the construction phase, impacts are temporary, and the magnitude of the impact is not quantifiable, but likely to be Low. The overall significance of effect on road receptors is **Not Significant** without mitigation.

18.5.15 Dwelling receptors are considered to have Medium sensitivity (depending on the distance of the property) as potential impacts pose no health and safety risk but may cause nuisance. During the construction phase, any effects are temporary, but the magnitude of impact is not directly quantifiable. However, it is likely to be Low. The overall significance of effect on dwelling receptors **Not Significant** without mitigation.

Assessment of Effects – Operational Phase

18.5.16 During the operational phase, impacts will vary during the course of each year as the sun attains different heights in the sky and weather patterns vary.

18.5.17 The operational phase is considered across a number of receptors, separately. These include rail and road receptors, observation points (representative of dwellings in the surrounding area) and aviation receptors.

18.5.18 A ZTV has been modelled to show which areas potentially have visibility to the panels (See Appendix 18.3).

18.5.1 The ZTV is a computer model which determines whether any part of the Site is visible from land surrounding the Site based on local topography only; it does not account for screening from land obstacles such as trees, hedgerows, or buildings. It does not determine whether views of the Site will exist, but rather whether they can theoretically exist if no surface features are present. It is calculated as described below

and is an effective tool used to reduce the study area and eliminate multiple receptors that have no risk of experiencing glint.

18.5.2 A selection of sample points is identified on the Site boundary and on land contained within the Site. Sample points are chosen as it is unfeasible to perform this calculation on every panel on the Site. Terrain data in the form of a Digital Terrain Model (DTM) forms the basis for determining whether the Site could be visible at local receptors. The DTM comprises a grid of cells where each cell has a given height value and the GIS allows this data to be displayed graphically.

18.5.3 Terrain data comes in various resolutions determined by the cell size, which dictates the overall accuracy and quality of the terrain data. The analysis uses OS Terrain 50 data which has a 50m resolution. The data used is considered to be sufficiently accurate for the purposes of modelling a ZTV.

18.5.4 The model predicts whether any of the sample points are visible out to 5km using a line-of-sight calculation between each cell and each sample point. The calculation assumes the sample points are the maximum panel height, 2.5m above ground level in this case, and an observer height of 1.8m representing the eyeline of a tall person standing up. The output is called a viewshed. For clarity, the output viewshed is converted to show binary results. Irrespective of whether a cell has visibility of one sample point or 100, they are both given a positive result, as opposed to no visibility which is ascribed a negative result.

18.5.5 The 'bare-earth' ZTV does not account for screening from surface features such as buildings, trees or hedgerows, but does account for intervening topography, for instance screening from a hill or other landform.

Conditions for Glint to Occur

18.5.6 During the operational phase, glint can only occur when direct sunlight can reach the solar panels. Diffused lighting, caused by weather conditions (e.g. cloud, fog and mist) cannot cause glint due to the low energy intensity of the light incident on the panels.

18.5.7 Figure 18.4 shows the total number of daylight hours available each month (red) based on the regional variation for the Site. Also shown is the average number of hours of sunshine each month (blue) taken from the Meteorological Office data recorded at Cardiff (the closest active weather station to the Site for which historic sunshine data is available). Cardiff is approximately 30km from the Site and is expected to be broadly representative of the weather conditions that the Site will experience.

18.5.8 Figure 18.4 also shows the ratio of sunshine to daylight displayed as a percentage (green) for each month at the Site. As can be seen, the sunniest month on average was June, with 196 hours of sunshine. Even then, conditions suitable for glint events to occur are only expected to be present approximately 39% of the theoretical maximum. This is because the ratio of sunshine to daylight is approximately 39% at this time. During less sunny months, glint events may occur for as little as 20% of the theoretical maximum because the ratio of sunshine to daylight is much less at these times.

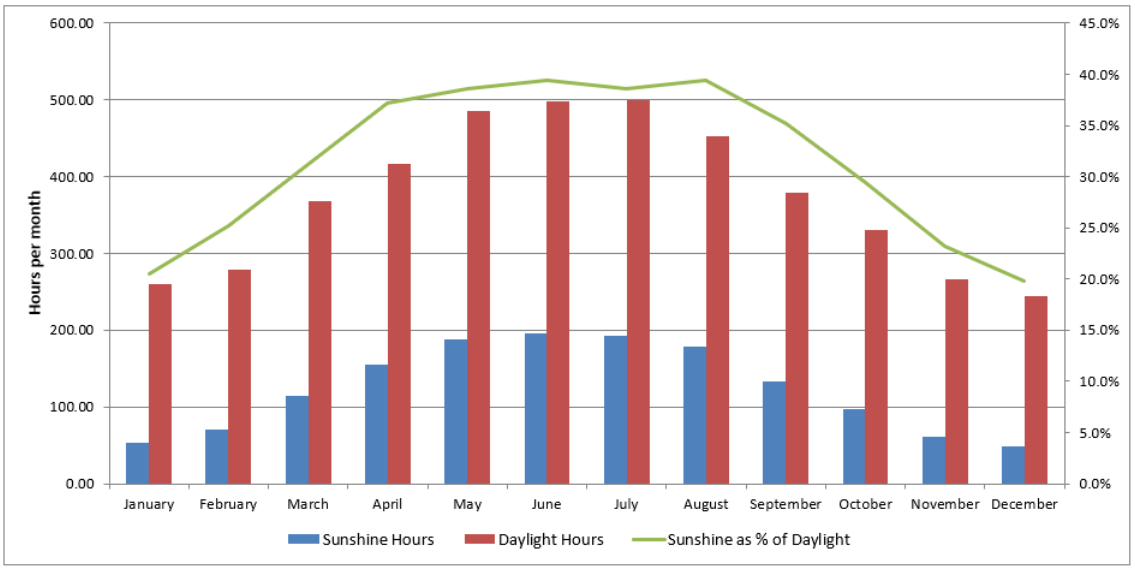


Figure 18.4: Number of Daylight and Sunshine Hours per Month in Cardiff

Aviation

18.5.9 There are no aviation receptors within 15km of the Site.

18.5.10 Therefore, there are no glint effects predicted at any aviation receptors.

Railways

18.5.11 The main rail receptor runs to the east of the Site, at a distance of approximately 2.4km. Rhymney is the station that is at the end of this line that runs to Cardiff. Only a very small section of the line lies within the 5km buffer, ZTV and GGZ; only this section of track has been assessed. For the purpose of the assessment, it is assumed that the driver of the train would be sat at a height 2.75m above ground level. The model, therefore, considers whether glint effects would be observable to the driver and could compromise their ability to safely control the train.

18.5.12 The section of track that has been considered in the glint assessment, is shown in orange in Figure 18.5. The ZTV, GGZ and 5km site buffer are also shown in this Figure. It should be noted that several lines are more than 5km from the Site and, at this distance, there are not expected to be any Significant glint effects, regardless of the panel specifications being used.

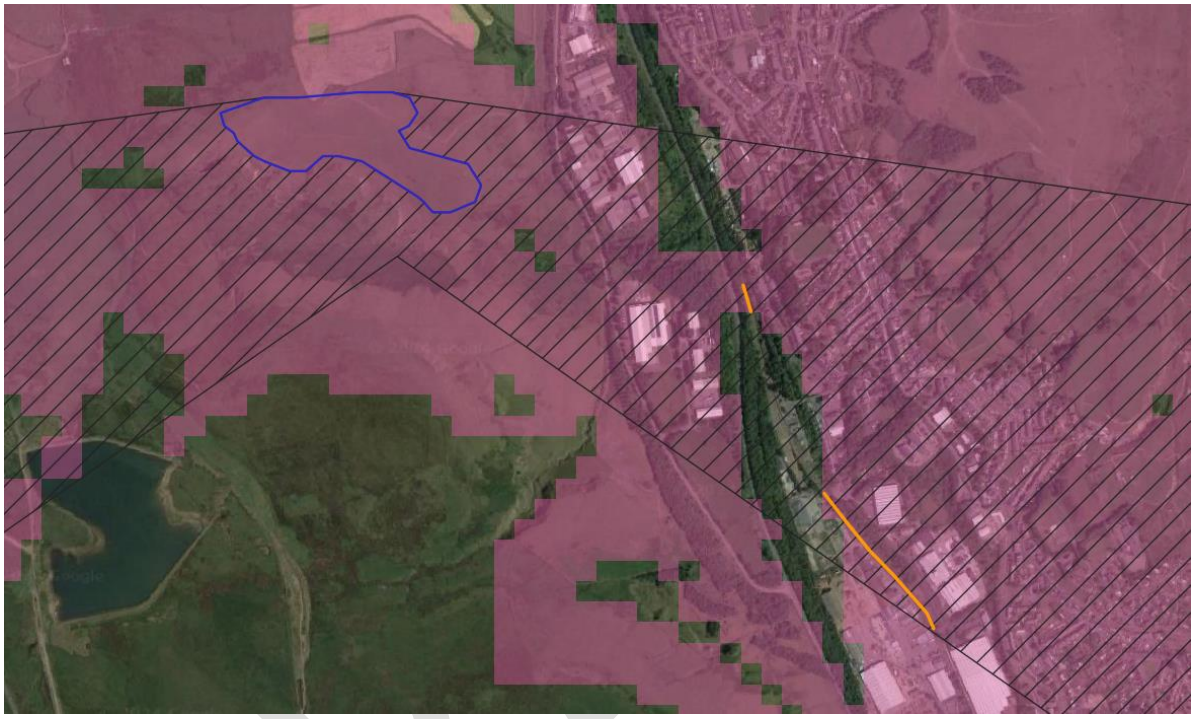


Figure 18.5: Section of the Railway line from Rhymney that lies in the GGZ and ZTV

(© Google Earth 2024)

Results

18.5.13 With fixed solar panels at a height of 2.5m and at 15 degrees, there was some glint predicted along the railway line. A total of 1305 minutes of yellow and green glint was predicted at the north section of the railway and 162 minutes of green glint predicted at the southern section of the railway. These values do not account for local weather conditions or local screening features. With the screening present in the form of thick trees that line the line and the industrial buildings, there will be no glint at the railway.

Roads

18.5.14 There are a number of roads within the study area comprising national, regional and local roads. There are no motorways. Motorists are, as a matter of routine, used to driving towards the sun, which provides a much more intense source of light than glint. Notwithstanding this, roads within the immediate vicinity of the Site have been assessed for glint effects.

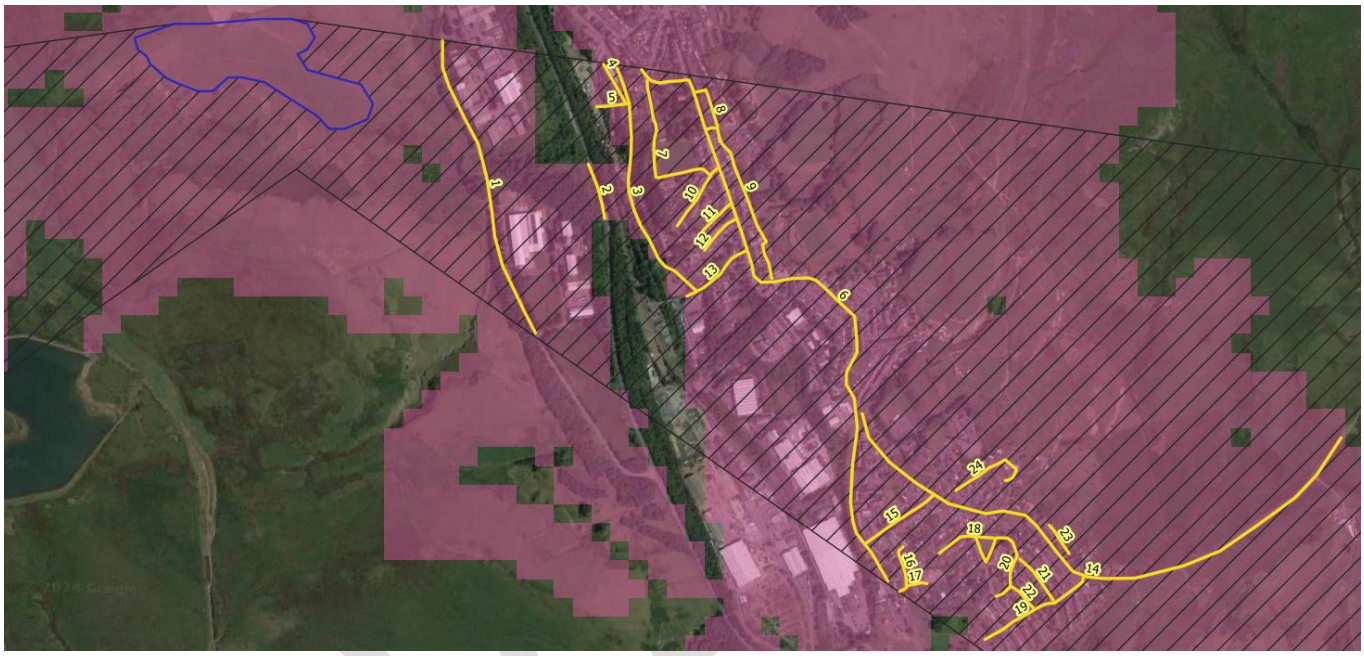


Figure 18.6: Routes identified within the GGZ and ZTV

(Google Earth 2024)

18.5.15 The routes considered in this assessment that lie in both the ZTV and the GGZ are shown in Figure 18.6. These routes were identified in the Baseline assessment and represent an account of the main routes in the study area that theoretically could receive glint. These can be seen in more detail in Appendix 18.5.

18.5.16 Table 18.5 discusses the presence of screening at each of the route receptor locations identified in the Baseline and notes whether there is visibility to the Site. The level of screening present and visibility of the Site is determined by a desk-based assessment using Google Earth Streetview and viewpoints produced by the Wind Microclimate Chapter.

18.5.17 If there is adequate screening present resulting in limited to no visibility of the Site, the route is dismissed from further assessment.

18.5.18 The Significance is determined on routes that are proceeded to further assessment. These will include routes that have visibility to the Site and/or little-to-no screening.

Table 18.5: Initial Review of the Routes			
Route	**Screening Present**	**Site Visibility**	**Proceeded to Further Evaluation**
1 - Heads of the Valleys Industrial Estate Road	Yes, the route is lined with trees and there is a high mound that lines the road.	There is no visibility of the Site, only the hillside.	No – Dismissed from further evaluation
2 – A469	The road is lined with tall trees and the topography morphs into a hill, acting as screening to the industrial estate to the west and the Site which lies further to the west.	There is no visibility of the Site, only the adjacent hillside and mature trees. Only a small section of the road lies in both the ZTV and GGZ and there is no visibility to the Site.	No – Dismissed from further evaluation
3 – The Terrace	The west side of the road is lined with thick, dense, mature trees. The northern section of the road has houses lining the road providing immediate screening along the road.	There is no visibility to the area of land that the Site is situated on.	No – Dismissed from further evaluation
4 – The Edward Terrace	The route is lined with houses which provide screening to the route. The topography to the west consists of a valley with the industrial estate to the east on the opposite hillside. This also provides screening.	There is no visibility of the Site.	No – Dismissed from further evaluation
5 – Old Brewery Lane	The route is orientated to travel into the direction that the Site is situated. There is screening with the presence of houses and the hill that Convatec and the other buildings in the industrial estate are on.	Only the warehouses are visible. There is no visibility to the area of the Site where the panels would be situated.	No – Dismissed from further evaluation
6 -B4257	Screening is present in the form of houses that line the road and there is screening with the topography and local features along the southern sections of the road. To the northern sections there are junctions to roads that run to the west which provide a break in the screening but other features down the hill still provide screening.	There is a low likelihood of visibility to the Site due to its positioning on higher ground that is still screened by intervening higher ground, trees and residential properties. There is a small section of the route where there could be visibility,	Proceeded to additional evaluation

Table 18.5: Initial Review of the Routes			
Route	**Screening Present**	**Site Visibility**	**Proceeded to Further Evaluation**
7 – Tan-Y-Llan Terrace	Majority of the route (a minor road) is screened by trees that are situated directly on the edge of the road. Some sections of the route. The screening is less built in the northern section of the road. The industrial estate on the hill to the east of the Site provides some screening but it is uncertain if it provides full screening.	From the southern sections of the route there is no visibility to the Site. However at the northern sections, it is uncertain whether the screening provides full coverage due to the local topography.	Proceeded to additional evaluation
8 – Colenso Terrace	There is screening lining the road in the form of residential properties.	There is no visibility to the Site	No – Dismissed from further evaluation
9 – Back lane to the B4257	This is route is more of a single track at the back of residential properties so there is screening in the form of houses and garages.	There is a small potential for glimpses of the Site, but it is minimal from a track.	No – Dismissed from further evaluation
10 – Goshen Street	This residential street is travelling in a southwest direction away from the Site. The houses that line the street act as screening and the road travels towards the hills to the south of the Site.	There is no visibility of the Site.	No – Dismissed from further evaluation
11 – Cross Street	Similarly to route 10, this street is travelling southwest, away from the Site with the residential properties acting as screening	There is no visibility of the Site.	No – Dismissed from further evaluation
12 – Manest Street	Similarly to route 10 and 11, this street is travelling southwest, away from the Site with the residential properties acting as screening	There is no visibility of the Site.	No – Dismissed from further evaluation
13 – Tre-York Street	The screening along this route is more broken as there are not residential properties right along the road edge.	There is potential for small glimpses of the Site.	Proceeded to additional evaluation
14 – B4256/Hill Street	At the eastern section of the route out of the town of Rhymney there is no screening lining the route with the topography providing no	There is likely visibility to the Site from the eastern sections of the route that is not in Rhymney.	Proceeded to additional evaluation

Table 18.5: Initial Review of the Routes			
Route	**Screening Present**	**Site Visibility**	**Proceeded to Further Evaluation**
	screening. This changes as the route enters the town due to the presence of residential properties and the local topography.		
15 – Moriah Street	At the very top of the road there is no screening as the side of the road is a residential garden. The rest of the road is lined with residential properties and so there is adequate screening to the Site	There is minimal visibility along the road except for breaks where there are no houses. The northern end of the road at the top of the hill has some potential visibility of the Site. There is no visibility at the southern end of the road.	Proceeded to additional evaluation
16 – Plantation Terrace	There is screening in the form of residential properties.	There is no visibility to the Site	No – Dismissed from further evaluation
17 – Wellington Way	There is screening in the form of residential properties.	There is no visibility to the Site	No – Dismissed from further evaluation
18 – Garden City	There is screening in the form of residential properties that line the triangular green.	There is limited visibility to the Site along this minor road	No – Dismissed from further evaluation
19 – Tan-Y-Bryn	Most of the road is screened by residential properties. The top of the road is less screened as the topography prevents full coverage.	There is mainly no visibility of the Site but there could be some glimpses at upper levels.	No – Dismissed from further evaluation
20 – Sunny Hill	There is screening in the form of residential properties.	There is no visibility to the Site	No – Dismissed from further evaluation
21 – Nursery Crescent	There is screening in the form of residential properties and a large tree at the eastern side of the route.	There is no visibility to the Site	No – Dismissed from further evaluation
22 – Brookfield Avenue	There is screening in the form of residential properties.	There is no visibility to the Site	No – Dismissed from further evaluation

Table 18.5: Initial Review of the Routes			
Route	**Screening Present**	**Site Visibility**	**Proceeded to Further Evaluation**
23 – Benjamin Court	There is screening in the form of residential properties.	There is no visibility to the Site	No – Dismissed from further evaluation
24 – Hafod-Y-Mynydd	There is screening in the form of residential properties.	There is no visibility to the Site	No – Dismissed from further evaluation

18.5.19 The routes selected to proceed to further evaluation were modelled into the ForgeSolar software and the results are assessed below.

Results

18.5.20 The model predicts yellow glint being visible along a number of the routes. However, it is important to recall that the model does not account for any existing screening features and for local weather conditions. The durations of theoretical yellow glint (highlighted in yellow) and green glint (highlighted in green) for each route receptor are given in **Error! Reference source not found.**, below.

18.5.21 More details of the modelled results without the local weather adjustment can be found in Appendix 18.4.

Table 18.6: Occurrence of Glint Results for Route Receptors When Taking Into Account Local Weather Conditions						
Route	**Adjusted Maximum Annual Duration (minutes)**		**Earliest Start Time**	**Latest End Time**	**Earliest Start Date**	**Latest Finish Date**
Route 6 - B4257	29 minutes (yellow glint)	1,174 minutes (green glint)	18:13	19:20	28/03/2024	14/09/2024
Route 7 – Tan-Y-Llan Terrace	33 minutes (yellow glint)	657 minutes (green glint)	18:19	19:20	31/03/2024	10/09/2024
Route 13 – Tre-York Street	59 minutes (yellow glint)	918 minutes (green glint)	18:29	19:20	14/04/2024	27/08/2024
Route 14 – B4256/Hill Street	953 minutes (green glint)		18:32	19:20	09/05/2024	01/08/2024

Route 15 – Moriah Street	0 minutes (glint)	-	-	-	-

18.5.22 Table 18.7 illustrates the Sensitivity, the Magnitude and the Significance of each route receptor that was selected to be evaluated from the Baseline after a desk study was conducted to determine the visibility to the Site. The table summarises that Routes 6 and 7 are **Significant** Prior to Mitigation and Routes 13 and 14 are **Not Significant**.

Table 18.7: Significance Allocation to Route Receptors prior to mitigation

Route	Sensitivity	Magnitude	Magnitude		Significance
		Site Visibility	Glint Duration in a year (min)		
Route 6 - B4257	**LOW** Minor Road 500m-1km	Full Screening	29 minutes (yellow glint)	1,174 minutes (green glint)	**Not Significant**
Route 7 – Tan-Y-Llan Terrace	**LOW** Minor Road 500m-1km	Partial Screening	33 minutes (yellow glint)	657 minutes (green glint)	**Not Significant**
Route 13 – Tre-York Street	**LOW** Minor Road > 1km	Partial Screening	59 minutes (yellow glint)	918 minutes (green glint)	**Not Significant**
Route 14 – B4256/Hill Street	**LOW** Minor Road > 1km	Partial Screening	953 minutes (green glint)		**Not Significant**
Route 15 – Moriah Street	**LOW** Minor Road > 1km	Partial Screening	0 minutes (glint)		**Not Significant**

18.5.23 The values in Table 18.7 illustrate the predicted glint annually without taking into account screening features and so the glint at these routes is likely to be a lot less.

18.5.24 Route 6 is predicted 1,174 minutes of green glint and 29 minutes of yellow glint throughout the year. Green glint has no potential for after image. With drivers

routinely exposed to such conditions from the sun setting or other reflective surface, there is no harm to health and safety.

18.5.25 The area along route 6 which is predicted yellow glint is shown in **Figure 18.7**. Only PV Array 1 predicts yellow glint.

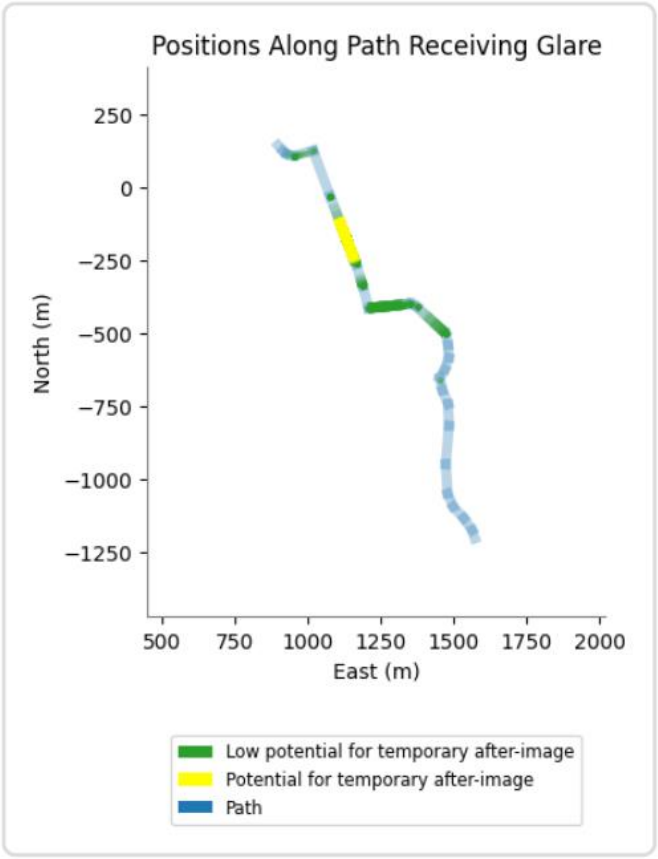


Figure 18.7: Sections along Route 6 that are predicted glint from PV Array 1

(ForgeSolar report 2024)

18.5.26 Figure 18.7 illustrates that the yellow glint is only predicted at the northern section of the road before the road bends away from the town.

18.5.27 Along this section of the route there are shops and residential properties as shown in Figure 18.8. The blue line on the left of the image represents the Site. As shown in this Figure, the road is screened from any glint and therefore there will be no glint effects.

Figure 18.8: Section of Route 6 that is predicted glint on Google Streetview

(Google Earth © 2024)

18.5.28 Routes 7 is predicted 657 minutes of green glint and 33 minutes of yellow glint throughout the year, taking into account local weather conditions but not the existing screening.

18.5.29 The sections of Route 7 that are predicted yellow glint by PV Array 1 is shown in Figure 18.9.

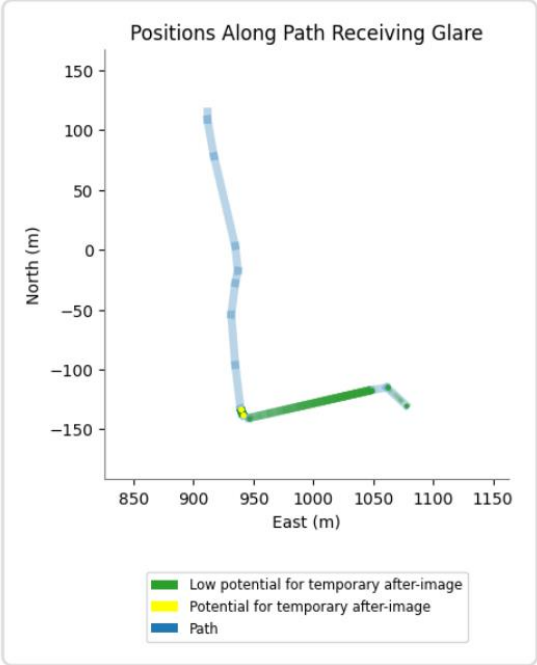


Figure 18.9: Sections along Route 7 that are predicted glint from PV Array 1

(ForgeSolar report 2024)

18.5.30 The yellow glint along Route 7 is predicted in the corner of the route which travels around the Rhymney Youth Centre Playing field. The area can be seen using Google Street View in Figure 18.10.

Figure 18.10: Section of Route 7 that is predicted glint on Google Streetview

(Google Earth © 2024)

18.5.31 This section of the route is partially-to-very-well screened by the existing trees. Due to the Sensitivity of the route being Low as it is a Minor Road, the glint effects are Not Significant.

18.5.32 Route 13 is predicted 59 minutes of yellow glint and 918 minutes of green glint annually, taking into account local weather conditions. This route represents a residential road, Tre-York Street which runs approximately east-west down a hill.

18.5.33 The sections of the route in which yellow glint is predicted is shown in Figure 18.11.

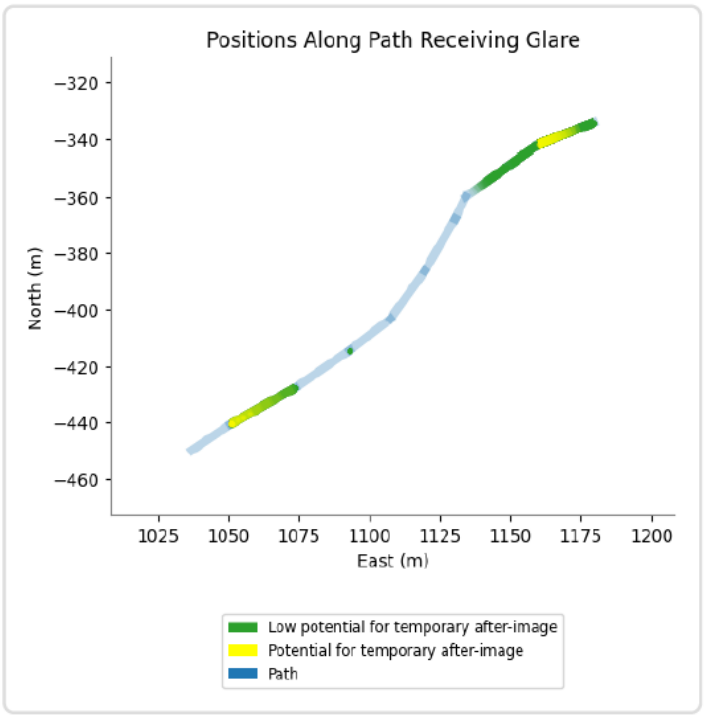


Figure 18.11: Sections along Route 13 that are predicted glint from PV Array 1

(ForgeSolar report 2024)

18.5.34 The model shows that glint is predicted at the eastern and most western sections of the road, at the top and the bottom of the hill. The route is greater than 1km away and so has a Low Sensitivity resulting in Not Significant effects with yellow glint that is partially screened.

18.5.35 The top of the hill (north east section of the route) is shown in Figure 18.12. From this section of the route, there is partial visibility of the Site, but it is a Minor Road and the predicted glint does not occur for long periods of time. Drivers are routinely exposed to driving into the sun or other reflective surfaces. There is no threat to health and safety.

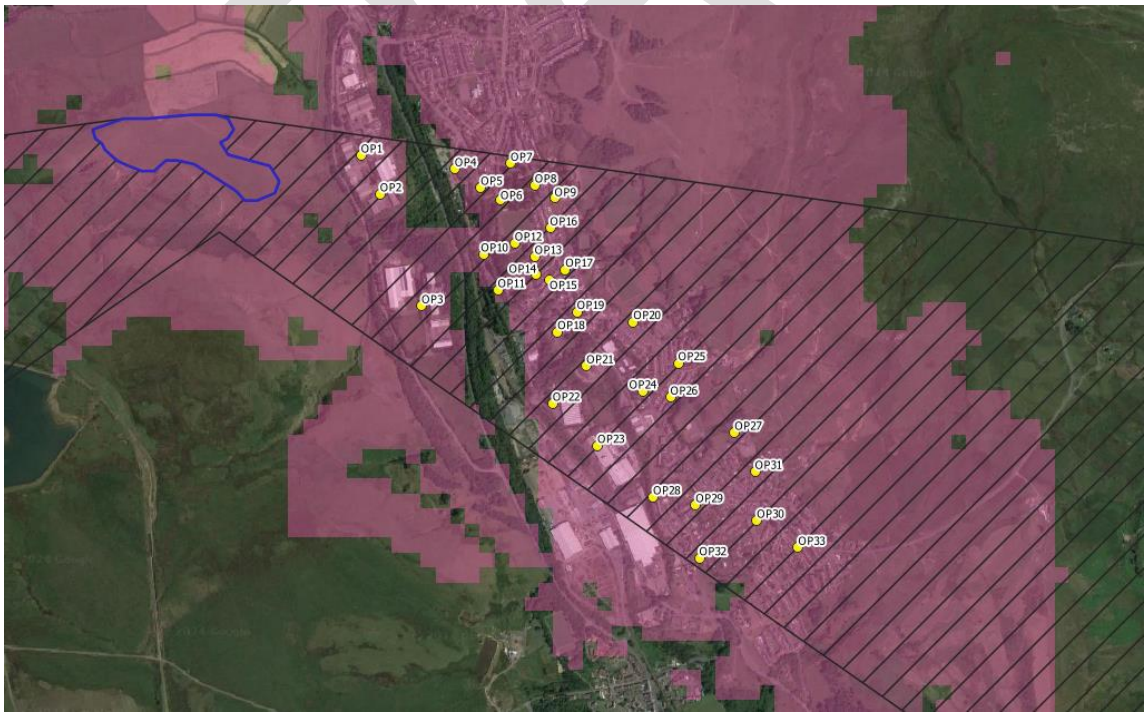
Figure 18.12: Section of Route 13 predicted glint, facing towards the Site (right)

(Google Earth © 2024)

Observation Points

18.5.36 Observation Points were selected in areas within the GGZ and ZTV, as shown in Figure 18.13. This is shown in more detail in Appendix 18.6.

Figure 18.13: Observation Points (OPs) identified within the GGZ and ZTV



18.5.37 A total of 33 observation point (OP) receptors were identified and assessed for likely glint effects based on the use of the fixed panels. The majority of these observation

points represent residential dwellings, although there are a few commercial premises and public areas included as well.

18.5.38 In many cases, the receptors selected are intended to represent more than one property in the immediate area. Although the levels of screening differ slightly for the different receptors, in general the level of glint recorded will be about the same for those surrounding properties.

18.5.39 It is important to understand the level of intervisibility between the receptor and the Site as this will determine whether any glint is able to arrive at the receptor. As shown in Appendix 18.3, only some of the 5km buffer around the site boundary falls within the visible area according the ZTV, but this does not account for the level of surface feature screening present at each receptor.

18.5.40 For the fixed panel layout, the glint effects will be visible to the east and west of the site, when the sun is low in the sky, with a small amount visible to the south. It will not be possible for reflections to reach receptors located towards the north of the panels as the south facing pitches of the arrays will prevent this from happening.

18.5.41 Table 18.8 includes commentary on the visibility of the Site from the receptor locations and notes the results of the modelling in terms of the duration and predicted intensity of glint effects (i.e. whether green glint or yellow glint would be present).

Table 18.8: Initial Review of Observation Points (OP)

OP	Screening Present	Site Visibility	Proceeded to further evaluation
OP1 – HSNF Wales Warehouse	Yes, the warehouses and surrounding trees.	No visibility	No
OP2 – South of industrial site with Karabar and Prima Fabrications	Yes, the warehouses and surrounding trees.	No visibility	No
OP3 – Sharp Clinical Services, UK industrial site	Yes, warehouses and surrounding buildings and trees.	Limited	No
OP4 – Rear of residential properties on The Edwards Terrace	Yes, trees that are backing the gardens and the industrial estate to the west that sits on a hill.	No visibility	No
OP5 – residential properties off The Edwards Terrace	Yes, other residential properties and the nature of the topography.	No	No

Table 18.8: Initial Review of Observation Points (OP)			
OP	**Screening Present**	**Site Visibility**	**Proceeded to further evaluation**
OP6 – Rhymney Youth Centre and houses to the north	Some screening present with thick trees surrounding the Youth Centre, opposite the houses there is less and due to the topography, the houses to the west do not serve as continuous screening.	Mixed visibility	Yes
OP7 – Residential properties on Grove Villas/B4257 road	Some screening due to residential properties but due to the downhill nature of the road that the properties are on, the screening adequacy varies.	Mixed visibility	Yes
OP8 – Residential properties on High Street and Saint David's Church	Due to all the trees and vegetation in the cemetery of the church, the residential properties are screened from the Site. There is limited visibility from the Church due to the vegetation but it is not completely screened.	Limited, potentially some visibility at rear of Church	Yes
OP9 – Parkside Funeral Home	There is screening from the residential properties opposite the Funeral Home and the vegetation from the cemetery.	No visibility	No
OP10 – Brewery Sports and Social Club	Screening present in the form of residential houses and tall trees and vegetation to the rear of these properties.	No visibility	No
OP11 – Residential properties on The Terrace	There is screening in the form of trees and vegetation on the mound to the opposite of the dwellings, in between the houses and the Site	No visibility	No
OP12 – Residential properties on Tan-Y Llan Terrace	The residential properties act as screening and the trees in gardens and to the west of the Youth Centre playing field provide dense screening.	No visibility	No
OP13 – Cwrt Andrew Buchan	The residential properties opposite act as screening with the vegetation to the rear of the properties providing additional screening.	No visibility	No
OP14 – Cluster of residential properties on Cross Street	Similarly to OP13, the properties are screened by the trees to the west of the playing fields and those	No visibility	No

Table 18.8: Initial Review of Observation Points (OP)			
OP	**Screening Present**	**Site Visibility**	**Proceeded to further evaluation**
	in the surrounding gardens of residential properties.		
OP15 – Residential properties on Manest Street	Similarly to OP13 and OP14 , the properties are screened by the trees to the west of the playing fields and those in the surrounding gardens of residential properties and other properties. The road travels down the hill but does not travel in the direction of the Site so it is not visible.	No visibility	No
OP16 – St David's Community Centre	This OP is situated on the High Street and is surrounded by other properties. These screen the Site from view at this particular part of the road.	No visibility	No
OP17 – The Royal Arms Pub	This OP is further south to OP16 and represents a pub and surrounding properties. The tops of houses that are further downhill to the east act as screening.	No visibility	No
OP18 – Ysgol Y Lawnt Primary School	Various types of screening exist with tall trees lining the school's exterior wall, trees and vegetation in fields opposite. There are also properties and thick woodlands around the train line and tennis courts.	No visibility	No
OP19 – Police Station and Shops	This OP represents a parade of shops and the Police Station towards the south end of the High Street. No visibility due to distance and surrounding features acting as screening. Potential for visibility at rear upper levels.	No visibility	No
OP20 – Rhymney Fire Station	As this section of the town is further up a hill there is potential for visibility across the valley as features that would normally provide screening are in downhill topography.	Partial visibility	Yes
OP21 - Rhymney Integrated Health and Social Care Centre	The whole north and western sides of the Centre are surrounded by	No visibility	No

Table 18.8: Initial Review of Observation Points (OP)			
OP	**Screening Present**	**Site Visibility**	**Proceeded to further evaluation**
	woodlands, trees and vegetation providing screening.		
OP22 – Sofasofa	This OP represents a few commercial buildings. They are screened due to the presence of tall trees and hedges.	No visibility	No
OP23 – Visqueen bpi recycled products	This OP represents a Visqueen recycling commercial buildings, near to OP22. They are screened due to the presence of tall trees.	No visibility	No
OP24 – The rear of residential properties on Brynteg Crescent	This OP is to the east of OP22 and OP23 but on higher ground. There is potential of visibility to the Site from upper levels. The side of the properties facing the road are screened from the Site. The track road behind the properties shows that there are tall trees which act as thick screening to the Site, even at upper levels.	No visibility	No
OP25 – Residential properties on the road Mountbatten	There is potential of visibility to the Site from upper levels. At lower levels there is screening from other residential buildings.	Potential for visibility at upper levels	Yes
OP26 – Residential properties on Lady Tyler Terrace	Road does not lie in the direction of the Site so houses facing the road are screened. Due to topography, backs of houses (even at upper levels) which can face towards the Site, have no visibility.	No visibility	No
OP27 – Bryn Awel Primary School	Due to the topography and the fact the school is on higher ground, there is potential for visibility across the valley so the screening present may not be fully adequate. There are tall trees surrounding the school but parts of the school on higher ground could have visibility.	Potential for visibility	Yes
OP28 – Residential properties on Forge Crescent	There is screening directly by the houses opposite the road which provide screening to anything that lies beyond the trees and the Site	No visibility	No

Table 18.8: Initial Review of Observation Points (OP)			
OP	**Screening Present**	**Site Visibility**	**Proceeded to further evaluation**
OP29 – Residential properties on Moriah Street	Similarly discussed in the routes, there is some potential for visibility at the top end of the road with the western side of the road screened	Potential for visibility	Yes
OP30 – Residential properties surrounding the triangular green on Garden City Road.	There is limited vegetational screening surrounding the properties. Glimpses of the Site is likely at higher levels.	Potential for visibility at upper levels	Yes
OP31 – Residential properties on Hafod-Y-Mynydd	Trees and vegetation surround the rear of the properties. Glimpses of the Site is likely at higher levels.	Potential for visibility at upper levels	Yes
OP32 – Residential properties off Wellington Way	There is limited vegetational screening surrounding the properties. There are trees and thick vegetation to the north west which might provide some screening. Glimpses of the Site is likely at higher levels.	Potential for visibility at upper levels	Yes
OP33 – Residential properties on Nursery Way and surrounding area	Limited visibility due to surrounding screening by houses and vegetation. Glimpses of the Site could occur at higher levels.	Potential for visibility at upper levels	Yes

18.5.42 Glint is only expected in amounts that could have a material impact on receptors at OPs 6, 7, 8, 20, 25, 27, and 29-33. As such, computer modelling results will only be considered for these OPs.

18.5.43 The level of visibility of the Site from the remaining OPs is not deemed to be high enough for glint to pose a tangible risk to these receptors, so they are dismissed from further assessment.

18.5.44 Visibility to the Site could be greater for buildings that have multiple levels. Upper storeys could have greater visibility than ground floor windows, but views from inside buildings will (to some extent) be restricted by walls. Generally, effects from upper storey windows will be lower simply because bedrooms tend to be less frequented during the daylight hours and, in most houses, these rooms will not hold the primary views.

18.5.45 The results of the computer modelling are shown in Table 18.9. It should be noted that these results show when glint can occur based on the sun's path and relative locations

of the panels and receptors. No consideration of screening is provided in the results. The presence of such features as trees, hedgerows, buildings, intervening topography and other obstacles will reduce the dates, times and durations when glint is predicted to occur.

18.5.46 As shown in Figure 18.4 direct sunshine is only present for approximately 41% of the daylight hours during summer and even less during winter months due to inclement weather. The results shown in Table 18.9 does not assume it is always sunny and does account for variations in local weather conditions.

18.5.47 The computer model used is of industry standard, approved and recommended by regulators in the United States and aviation authorities around the world. The model is regularly upgraded to account for technological progression and to improve accuracy. Details of the calculations used by the computer model can be found in Appendix 18.2.

Table 18.9: Occurrence of Glint Results for Observation Points When Taking Into Account Local Weather Conditions

Observation Point (OP)	Maximum Annual Duration (minutes)	Earliest Start Time	Latest End Time	Earliest Start Date	Latest Finish Date
OP6 – Rhymney Youth Centre and houses to the north	26 minutes (green glint)	18:38	19:01	19/04/2024	20/08/2024
OP7 – Residential properties on Grove Villas/B4257 road	0	-	-	-	-
OP8 – Residential properties on High Street and Saint David's Church	0	-	-	-	-
OP20 – Rhymney Fire Station	1,098 minutes (green glint)	18:28	19:20	17/04/2024	23/08/2024
OP25 – Residential properties on the road Mountbatten	1,067 minutes (green glint)	18:30	19:20	26/04/2024	14/08/2024
OP27 – Bryn Awel Primary School	848 minutes (green glint)	18:36	19:20	10/05/2024	01/08/2024
OP29 – Residential properties on Moriah Street	0	-	-	-	-
OP30 – Residential properties surrounding the triangular green On Garden City road.	194 minutes (green glint)	18:57	19:19	03/06/2024	07/07/2024
OP31 – Residential properties on Hafod-Y-Mynydd	607 minutes (green glint)	18:44	19:20	18/05/2024	24/07/2024
OP32 – Residential properties off Wellington Way	0	-	-	-	-

OP33 – Residential properties on Nursery Way and surrounding area	138 minutes (green glint)	18:59	19:17	06/06/2024	04/07/2024

18.5.48 Although the earliest and latest times and dates when glint is expected to occur is reported in Table 18.9, glint would not occur continuously between these periods at a fixed receptor. These represent the limits of when glint effects are predicted.

18.5.49 All of the OPs are only predicted green glint and even if there was no screening the magnitude would be Minor. Green glint is low intensity and there is no after image. Any glint that is observed from a residential property will, at most, be a nuisance issue. There is no threat to health and safety.

18.5.50 None of the OPs are predicted yellow glint.

18.5.51 Table 18.10, below, summarises the magnitude, sensitivity and significance of effects for each OP.

Table 18.10: Significance Allocation to Observation Points prior to mitigation

Observation Point (OP)	Sensitivity	Magnitude	Magnitude	Significance
		Site Visibility	Glint Duration in a year (min)	
OP6 – Rhymney Youth Centre and houses to the north	**MEDIUM** Residential Dwelling (500-2km)	Partial Screening	26 minutes (green glint)	**Not Significant**
OP20 – Rhymney Fire Station	**LOW** Commercial Property (1-2km)	Partial Screening	1,098 minutes (green glint)	**Not Significant**
OP25 – Residential properties on the road Mountbatten	**MEDIUM** Residential Dwelling (1-2km)	Partial Screening	1,067 minutes (green glint)	**Not Significant**
OP27 – Bryn Awel Primary School	**LOW** Commercial Property (1-2km)	Partial Screening	848 minutes (green glint)	**Not Significant**
OP30 – Residential properties surrounding the triangular green On Garden City road	**LOW** Residential Dwelling (2-3km)	Partial Screening	194 minutes (green glint)	**Not Significant**
OP31 – Residential properties on Hafod-Y-Mynydd	**MEDIUM** Residential Dwelling (1-2km)	Partial Screening	607 minutes (green glint)	**Not Significant**

Table 18.10: Significance Allocation to Observation Points prior to mitigation				
Observation Point (OP)	**Sensitivity**	**Magnitude**	**Magnitude**	**Significance**
		Site Visibility	**Glint Duration in a year (min)**	
OP33 – Residential properties on Nursery Way and surrounding area	**LOW** Residential Dwelling (2-3km)	Partial Screening	138 minutes (green glint)	**Not Significant**

18.5.52 As all OPs are predicted green glint, with partial screening this results in all OPs having Significance Effects of **Not Significant** during the Operational Phase.

Public Rights of Way (PRoW)

18.5.53 Public Rights of Way (PRoW) have been assessed as having low sensitivity in relation to their intermittent use and low risk of harm from experiencing glint. Embedded mitigation includes the planting and infill planting of hedgerows bordering those footpaths and bridleways crossing the Site. Consequently, the magnitude of impact is described as 'no glint'. Therefore there would be no effect and this is classed as not significant.

Assessment of Effects – Decommissioning Phase

18.5.54 The decommissioning process will largely be the exact reverse of the construction process, with activities involving the removal of the site infrastructure piece-by-piece. As panels are removed from the mounting frames, the mounting structures will become more visible again and these will still have potential to reflect glint. It is anticipated that the Site will be decommissioned in sections, with panels being removed from one section, then the mounting structures, cabling and other site infrastructure being removed before the next section of the Site undergoes the same procedure.

18.5.55 Whilst the mounting structures are visible, there is some potential for glint to be reflected back towards receptors, but this will be a temporary effect for a short period of time, so it is not considered necessary to further mitigate against it.

18.5.56 There are no aviation receptors in the study area so there will be no effects during this phase.

18.5.57 Rail receptors (High sensitivity) will experience temporary effects during the decommissioning phase. The magnitude of impact is not quantifiable, but with the levels of screening, likely to be low. The overall significance of effect on rail receptors is **Not Significant** without mitigation.

18.5.58 Road receptors (Medium to High sensitivity depending on the type of road) will similarly experience temporary effects during the decommissioning phase. Again, the magnitude of impact is not quantifiable, but it is expected to be Low. The overall significance of effect on roads receptors is **Not Significant** without mitigation.

18.5.59 For dwelling receptors (High sensitivity within 500m, Medium sensitivity within 500m-2km), during the decommissioning phase, impacts will be temporary and the magnitude of impact, whilst not quantifiable, will be Low. The overall significance of effect on dwelling receptors is **Not Significant** without mitigation.

18.5.60 Public Rights of Way (PRoW) are considered to have low sensitivity. Screening that is in place to minimise visibility during the operational phase will continue to provide the same effect during the decommissioning phase, therefore the magnitude of impact will be 'no glint'. Impacts on PRoW during the decommissioning phase are considered to be None and **Not Significant**.

18.6 Mitigation

Mitigation by Design

18.6.1 Design work is ongoing for the Proposed Development and opportunities to reduce glint effects through the intelligent selection of design options will be undertaken alongside further consultation as part of the iterative design process. This may include choosing different panel heights and angles.

18.6.2 For fixed panel systems, specifically, varying angles of inclination and orientation, as well as the arrangement and heights of panel arrays, will all affect the amount of glint that might be received at specific receptors. This can be used, if necessary, to help ameliorate glint effects.

Monitoring

18.6.3 No monitoring is required.

18.7 Residual Effects

18.7.1 With suitable mitigation it is expected that all glint effects can be managed effectively and there will be **no residual effects**.

18.8 Assessment of Cumulative Effects

18.8.1 As noted in the earlier discussion, there are a number of other sources of reflection within the local environment. These include, but are not limited to, water bodies,

windows and car windscreens, metal infrastructure, and agricultural polythene, and other solar farms. In the right conditions, even tarmac and grass can reflect light and cause glare.

18.8.2 Owing to the sheer number of reflective surfaces present, it is not possible to assess all of the potential sources of glint in the local environment when considering inter-cumulative effects. However, other solar farms in the vicinity have been assessed.

18.8.3 In combination effects, where effects from glint and other environmental effects collectively affect the same receptor would theoretically be possible in an unmitigated design, but assuming the Site is appropriately screened and given the rolling landscape within which it is situated, it should be possible to eradicate almost all glint effects (except possibly from upper storeys windows with views down into the Site).

18.8.4 The operational solar farm on Land at Cwm Bargoed is located approximately 2.4km to the southwest of the Site. It was assessed for cumulative effects as it lies within the 5km modellable boundary. As there will be no Significant glint from the Green Manufacturing Hub, there can be no cumulative Significant effects.

18.8.5 The Cwm Bargoed site is also to the south of the Proposed Development. Any visibility of the panels would be the backs of them so there will be no visibility to glint.

18.8.6 There are no cumulative effects with the Proposed Development.

18.8.7 Intra-cumulative effects are where glint effects and other environmental effects collectively affect the same receptor. For glint to occur, the receptor must have visibility of the panels. There is, therefore, a degree of overlap between the glint assessment and the visual impact assessment. There can be no glint without some degree of visual impact, but it is not the case that all receptors that experience visual impacts will be exposed to glint.

18.8.8 Other intra-cumulative effects would theoretically be possible in an unmitigated design but, assuming the proposed Green Manufacturing Hub is appropriately screened, and the other environmental effects are also adequately mitigated, there would be little risk of intra-cumulative effects occurring.

18.9 Summary

18.9.1 The Assessment has considered fixed panels at a height of 2.5m and 15 degrees, facing south at the proposed Convatec Green Manufacturing Hub.

Baseline Conditions

18.9.2 There are a range of other common materials and surfaces likely to cause glint that are already present within the study area. These include, inter alia:

- glass in windows;
- conservatories or greenhouses;
- flashes caused by light reflecting off passing vehicles; and
- calm water.

18.9.3 Since it is not possible to assess all reflective materials in the 5km study area due to the sheer number of potential reflective surfaces present, the baseline has assumed there is no other glint present.

Assessment of Effects

18.9.4 The assessment considered ground and air receptors including residential dwellings, commercial buildings, roads, railway and aviation receptors.

18.9.5 During construction phase, for rail and road receptors, the overall significance of effect is **Not Significant** without mitigation.

18.9.6 For dwelling receptors, the significance of effect is **Not Significant** without mitigation.

18.9.7 There are no aviation receptors in the study area so there will be no effects during this phase.

18.9.8 During the operational phase, effects will vary throughout the year as the sun reaches different heights in the sky and different weather conditions are observed. The ground receptors are selected based on the ZTV.

18.9.9 For ground receptors, a mixture of green and yellow glint was predicted at some of the OPs and routes, but with the current levels of screening and future design updates, these effects will be **Not Significant**.

18.9.10 For the route receptors, a mixture of green and yellow glint was predicted, but with the current levels of screening and future design updates, these effects will be **Not Significant**.

18.9.11 For the Railway, a small amount of yellow glint, but predominantly green glint was predicted. However, the section of the railway assessed is well screened and so the railway will not experience any glint. Therefore, these effects will be **Not Significant.**

18.9.12 There are no aviation receptors in the study area so there will be no effects during this phase.

18.9.13 During the decommissioning phase, the effects on rail, road and aviation receptors are assessed as temporary, of high sensitivity and of a magnitude (not quantifiable, but) likely to be low. The overall significance of effect on railway, road and aviation receptors is **Not Significant** without mitigation.

18.9.14 For dwellings, during the decommissioning phase, the receptors are assessed as temporary, of medium sensitivity, and of a magnitude (not quantifiable, but) likely to be low. The overall significance of effect on dwelling receptors is **Not Significant** without mitigation.

Mitigation

18.9.15 For this project, design work is ongoing for the Proposed Development and opportunities to reduce glint effects through the intelligent selection of design options will be undertaken alongside further consultation as part of the iterative design process. This may include choosing different panel heights and angles.

18.9.16 Furthermore, as the project develops, updates to the design will inform any addition mitigation against glint. This will be considered, as appropriate and discussed within the final ES Chapter when it is prepared.

Monitoring

18.9.17 No monitoring is required.

Residual Effects

18.9.18 With suitable mitigation, it is expected that all glint effects can be managed effectively and there will be **no residual effects**.

Assessment of Cumulative Effects

18.9.19 The only solar farm that was considered for cumulative effects was on land at Cwm Bargoed. This site was the only scheme that fell within the range able to be modelled in ForgeSolar. As the panels lie to the south of the site and all receptors, any visibility of the panels would be the backs of them so there will be no visibility to glint.

18.9.20 Therefore, there should not be any potential for other inter-cumulative glint effects to arise.

Conclusion

18.9.21 **There are no predicted Significant Effects at any of the ground-based receptors assessed. There will be no residual effects**.