TECHNICAL APPENDIX 6: GLINT & GLARE ASSESSMENT

Ballydonagh Solar Farm – Amendment Application

05/12/2025

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EXECUTIVE SUMMARY

6.1 There is no guidance or policy available across Ireland in relation to the assessment of glint and glare from a Proposed Amendment. However, as identified by UK policy, it is recognised as a potential impact which needs to be considered for a proposed solar development.

6.2 This assessment considers the potential impacts on ground-based receptors such as roads and residential dwellings. A 1km survey area around the Application Site is considered adequate for the assessment of ground-based receptors, whilst a 30km study area is chosen for aviation receptors. Within 1km of the Application Site, there are 63 residential receptors, including one residential areas, and 59 road receptors which were considered. As per the methodology section, where there are a number of residential receptors within close proximity, a representative dwelling or dwellings is/are chosen for the glint and glare analysis as the impacts will not vary to any significant degree. Where small groups of receptors have been evident, the receptors on either end of the group have been included in the glint and glare analysis with some context to all receptors given in the visual analysis. Nine residential receptors and 11 road receptors were dismissed as they are located within the no reflection zones and therefore, will not be impacted upon by the Proposed Amendment. There are two aerodromes within 30km of the Proposed Amendment, none of which require a detailed assessment due to their size and orientation in relation to the Proposed Amendment.

6.3 The solar panels will face south and will be inclined at an angle of 10 - 40 degrees. The maximum above ground level height of the panels is 3.5 m and points at the top of the panels are used to determine the potential for glint and glare generation.

6.4 Geometric analysis was conducted for 54 individual residential receptors, including one residential areas, and 48 road receptors.

6.5 Following an initial assessment, rail receptors were scoped out as assets that will be impacted upon from the Proposed Amendment as no rail receptors fell within the 1km study area. The assessment concludes that:

6.6 Following an initial assessment, rail receptors were scoped out as assets that will be impacted upon from the Proposed Amendment as no rail receptors fell within the 1km study area. The assessment concludes that:

- Solar reflections are possible at 28 of the 54 residential receptors assessed within the 1km study area. Initial impacts were **High** at three receptors, **Medium** at three receptors, **Low** at 22 receptors, including one residential area, and **None** at the remaining 26 receptors, including one residential areas. Upon reviewing the actual visibility of the receptors, glint and glare impacts remain **High** at two receptors, **Medium** at one receptor, reduce to **Low** at five receptors and to **None** at all remaining receptors,

including one residential areas. Once mitigation measures were considered, impacts remain **Low** at one receptor and reduce to **None** at all remaining receptors.

- Solar reflections are possible at 41 of the 48 road receptors assessed within the 1km study area. Initial impacts were **High** at 31 receptors, **Low** at 10 receptors and **None** at the remaining seven receptors. Upon reviewing the actual visibility of the receptors, glint and glare impacts remain **High** at four receptors, **Low** at one receptor, and reduce to **None** at all remaining receptors. Once mitigation measures were considered, impacts reduce to **None** at all receptors.
- **No impact** on train drivers or railway infrastructure is predicted.
- **No impact** on aviation assets is predicted.

6.7 Mitigation is required in order to screen the **High and Medium** impacts views into the Proposed Amendment from Residential Receptor 6, 7 and 27 and Road Receptors 1, 2, 4 and 5. Mitigation is also included to screen the **Low** impact views from Residential Receptors 21, 25, 26 and 33 and Road Receptor 14. This includes native hedgerows to be planted/infilled along the western boundary of Field 2, 4, 6, 7, 8, 12, 13 and 14 and the southern boundary of Field 25 and 31 in the Proposed Amendment and maintained to a height of at least 3m as shown on the LEMP submitted with this application.

6.8 The effects of glint and glare and their impact on local receptors has been analysed in detail and there is predicted to be **Low** and **None** impacts, and therefore **No Significant Effects**.

INTRODUCTION

Background

6.9 Neo Environmental Ltd has been appointed by Renewable Energy Systems Limited on behalf of Ballydonagh Solar Limited to undertake a Glint and Glare Assessment for a proposed amendment to a previously consented solar farm (Planning Reference: 2361049) with associated infrastructure on lands at Ballydonagh, Cloonineen, Skecoor, Kiltormer East and Graveshill, Co. Galway (the "Application Site").

6.10 Please see **Figure 2, Volume 2** for the layout of the Proposed Amendment.

Development Description

6.11 The Proposed Amendment will consist of several minor amendments to the previously consented development under Planning Reference 2361049. The amendments comprise the following; re alignment of the main entrance and access gate; re alignment and widening of internal access tracks; alteration of the boundary fence at the main entrance and at the northeast corner of the site; removal of the consented 38 kV substation in Field 22 to facilitate the Gortnalug Loop in and out 110 kV substation and associated grid connection; combined central inverters and MV transformers are replaced by separate string inverters and central MV transformers; reduction in the size of related hardstanding areas; updated table layout to accommodate the 110 kV substation and grid cable including a reduction in PV table numbers from 3209 to 3120; new overhead line separation areas to reflect that a section of the existing 110 kV overhead line will be removed to facilitate the substation grid connection; inclusion of an additional badger sett buffer and extension the operational lifetime of the solar farm from 35 years to 40 years.

6.12 These alterations are considered minor in nature and do not alter the overall design intent or scale of the consented solar development.

Site Description

6.13 The Application Site is located in a rural setting, approximately 9.5km south of Ballinasloe, 33km east of Athenry and 21km northeast of Loughrea. The area of the Proposed Amendment lies at an elevation of approximately 71 – 96m AOD and covers a total area of c. 81.9 hectares. It is centred at approximate Irish Grid Reference (ITM) X 583549 Y 720440 and is located c. 7km northeast of the N65 and 8.4km south of the M6.

6.14 Comprising of 26 agricultural fields (31 were surveyed in total, however fields 1, 5, 9, 10 and 11 have since been removed from the Proposed Amendment boundary), the site is currently being used for pastoral farming. The fields are bound by a mixture of trees, hedgerows and post-and-wire fencing.

6.15 Access to both parcels of land is gained from existing access points off the L4301 which dissects the site.

Scope of Report

6.16 Although there may be small amounts of glint and glare from the metal structures associated with the solar farm, the main source of glint and glare will be from the panels themselves and this will be the focus of this assessment.

6.17 Solar panels are designed to absorb as much light as possible and not to reflect it. However, glint can be produced as a reflection of the sun from the surface of the solar PV panel. This can also be described as a momentary flash. This may be an issue due to visual impact and viewer distraction on ground-based receptors and on aviation.

6.18 Glare is significantly less intense in comparison to glint and can be described as a continuous source of bright light, relative to diffused lighting. This is not a direct reflection of the sun, but a reflection of the sky around the sun.

6.19 This report will concentrate on the effects of glint and glare and its impact on local receptors and will be supported with the following Figures and Appendices.

- Appendix 6A: Figures
  - Figure 6.1: Residential Based Receptors
  - Figure 6.2: Road Based Receptors
  - Figure 6.3: Panel Area Labels
  - Figure 6.4: Mitigation Measures
- Appendix 6B: Residential Receptor Glare Results 10 degrees
- Appendix 6C: Residential Receptor Glare Results 40 degrees
- Appendix 6D: Road Receptor Glare Results 10 degrees
- Appendix 6E: Road Receptor Glare Results 40 degrees
- Appendix 6F: Visibility Assessment Evidence
- Appendix 6G: Solar Module Glare and Reflectance Technical Memo[1]

[1] Sunpower Corporation (September 2009), T09014 Solar Module Glare and Reflectance Technical Memo

Statement of Authority

6.20 This Glint and Glare Assessment has been produced by Oliver Henderson, Tom Saddington, Michael McGhee of Neo Environmental.

6.21 Having completed a civil engineering degree in 2012, Michael has produced Glint and Glare assessments for over 1GW of solar farm developments across the UK and Ireland.

6.22 Tom has an undergraduate degree in Bioengineering and graduated with an MSc in Environmental and Energy Engineering in January 2020. He has been working on various technical assessments including glint and glare reports for numerous solar farms in Ireland and the UK.

6.23 Oliver graduated from Keele University in 2024 with a Bachelor of Science degree in Geography and has previously worked in the Geo-Environmental consultancy field before joining Neo as a Graduate Environmental Engineer in 2025.

Definitions

6.24 This study examined the potential hazard and nuisance effects of glint and glare in relation to ground-based receptors, this includes the occupants of surrounding dwellings as well as road users. The Federal Aviation Guidance (FAA) in their "Technical Guidance for Evaluating Selected Solar Technologies on Airports"[2] have defined the terms 'Glint' and 'Glare' as meaning;

- Glint – "*A momentary flash of bright light*"
- Glare – "*A continuous source of bright light*"

6.25 Glint and glare are essentially the unwanted reflection of sunlight from reflective surfaces. This study used a multi-step process of elimination to determine which receptors have the potential to experience the effects of glint and glare. It then examined, using a computer-generated geometric model, the times of the year and the times of the day such effects could occur. This is based on the relative angles between the sun, the panels and the receptor throughout the year.

General Nature of Reflectance from Photovoltaic Panels

6.26 In terms of reflectance, photovoltaic solar panels are not highly reflective surfaces. They are designed to absorb sunlight and not to reflect it. Nonetheless, photovoltaic panels have a flat polished surface, which omits 'specular' reflectance rather than a 'diffuse' reflectance, which would occur from a rough surface. Several studies have shown that photovoltaic panels (as

[2] Harris, Miller, Miller & Hanson Inc. (November 2010). Technical Guidance for Evaluating Selected Solar Technologies on Airports; 3.1.2 Reflectivity. Technical Guidance for Evaluating Selected Solar Technologies on Airports. Available at: https://documents.pub/document/technical-guidance-for-evaluating-selected-solar-technologies-on.html?page=1

opposed to Concentrated Solar Power) have similar reflectance characteristics to water, which is much lower than glass, steel, snow and white concrete by comparison (see Appendix 6G for details). Similar levels of reflectance can be found in rural environments from shed roofs and the lines of plastic mulch used in cropping. In terms of the potential for reflectance from photovoltaic panels to cause hazard and/ or nuisance effects, there have been several studies undertaken in respect of schemes in close proximity to airports. The most recent of these was compiled by the Solar Trade Association (STA) in April 2016 which used a number of case studies and expert opinions, including from Neo Environmental. The summary of this report states that "*the STA does not believe that there is cause for concern in relation to the impact of glint and glare from solar PV on aviation and airports…*"[3].

Time Zones / Datum's

6.27 Locations in this report were given in Eastings and Northings using the 'OSNI 1952 Irish National Grid' grid reference system unless otherwise stated. Ireland uses Irish Standard Time (IST, UTC+01:00) in the summer months and Greenwich Mean Time (UTC+0) in the winter period. For the purposes of this report all time references were in GMT, however if reference was made to a time which falls within the IST then this was outlined in the report.

[3] Solar Trade Association. (April 2016). *Summary of evidence compiled by the Solar Trade Association to help inform the debate around permitted development for non - domestic solar PV in Scotland. Impact of solar PV on aviation and airports.* Available at https://docs.planning.org.uk/20210222/90/QNMZQ4EXINS00/i4uv1hvoemy3m7f5.pdf

LEGISLATION AND GUIDANCE

Planning Policy

6.28 The National Planning Framework (NPF) was adopted by the Irish Government on the 29th of May 2018. However, this policy document provides no current provision within the Irish Planning System for the requirement of Glint and Glare Assessments to support applications for the installation of ground mounted solar PV systems. It is therefore considered appropriate to defer to extant policy guidance within the UK planning system; the National Planning Policy Guidance (NPPG) on Renewable and Low Carbon Energy[4].

6.29 Paragraph 013 sets out planning considerations that relate to large scale ground-mounted solar PV farms. This determines that the deployment of large-scale solar farms can have a negative impact on the rural environment, particularly in undulating landscapes. However, the visual impact of a well-planned and well-screened solar farm can be properly addressed within the landscape if planned sensitively. Considerations to be taken into account by local planning authorities are;

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

Interim CAA Guidance – Solar Photovoltaic Systems (2010)

6.30 There is little guidance on the assessment of glint and glare from solar farms with regards to aviation safety. The Civil Aviation Authority (CAA) has published interim guidance on 'Solar Photovoltaic Systems[5]', they also intend to undertake a review of the potential impacts of solar PV developments upon aviation, however this is yet to be published.

6.31 The interim guidance identifies the key safety issues with regards to aviation, including *"glare, dazzling pilots leading them to confuse reflections with aeronautical lights."* It is outlined that solar farm developers should be aware of the requirements to comply with the Air Navigation

[4] NPPG Renewable and Low Carbon Energy. Available at: http://planningguidance.communities.gov.uk/blog/guidance/renewable-and-low-carbon-energy/particular-planning-considerations-for-hydropower-active-solar-technology-solar-farms-and-wind-turbines/#paragraph_012

[5] *CAA (2010) Interim CAA Guidance – Solar Photovoltaic Systems. Available at: https://webarchive.nationalarchives.gov.uk/ukgwa/20141202114709/https://www.caa.co.uk/docs/697/srg_asd_solarphotovoltaicsystguidance.pdf*

Order (ANO), published in 2016 and amended in 2022. In particular, developers should be cognisant of the following articles of the ANO[6], including:

- *Article 240 – Endangering safety of an aircraft – "A person must not recklessly or negligently act in a manner likely to endanger an aircraft, or any person in an aircraft."*
- *Article 224 - Lights liable to endanger – "A person must not exhibit in the United Kingdom any light which:*
  - *a) by reason of its glare is liable to endanger aircraft taking off or from landing at an aerodrome; or*
  - *b) by reason of its liability to be mistaken for an aeronautical ground light liable to endanger aircraft"*
- *Article 225 – Lights which dazzle or distract – "A person must not in the United Kingdom direct or shine any light at any aircraft in flight so as to dazzle or distract the pilot of the aircraft."*

6.32 Relevant studies generally agree that there is potential for glint and glare from photovoltaic panels to cause a hazard or nuisance for surrounding receptors, but that the intensity of such reflections is similar to that emanating from still water. This is considerably lower than for other manmade materials such as glass, steel or white concrete (SunPower – 2009).

6.33 These Articles are considered within the assessment of glint and glare of the Proposed Amendment.

CAA – CAP738: Safeguarding of Aerodromes 3rd Edition[7]

6.34 In 2003 the CAA first introduced the CAP738 document to help provide advice and guidance to ensure aerodrome safeguarding. Subsequently, there have been two updates to this document in 2006 and 2020.

6.35 Within the latest edition of CAP738, it outlines that the purpose of the document is to protect an aerodrome and to ensure safe operation. Specifically stating:

"Its purpose is to protect:

Aircraft from the risk of glint and glare e.g. solar panels."

6.36 Within the section named as "Appendix C – Solar Photovoltaic Cells", the following is stated:

[6] CAA (2016) Air Navigation: The Order and Regulations. Available at: https://www.legislation.gov.uk/uksi/2017/1112/contents/made

[7] Civil Aviation Authority (2020). CAP738 – Safeguarding of Aerodromes 3rd Edition. Available at: https://www.caa.co.uk/publication/download/12346

"Policy

1. In 2010 the CAA published interim guidance on Solar Photovoltaic Cells (SPCs). At that time, it was agreed that we would review our policy based on research carried out by the Federal Aviation Authorities (FAA) in the United States, in addition to reviewing guidance issued by other National Aviation Authorities. New information and field experience, particularly with respect to compatibility and glare, has resulted in the FAA reviewing its original document 'Technical Guidance for Evaluating Selected Solar Technologies on Airports', which is likely to be subject to change, see link;

https://www.federalregister.gov/documents/2013/10/23/2013-24729/interimpolicy-faa-review-of-solar-energy-system-projects-on-federally-obligated-airports

2. In the United Kingdom there has been a further increase in SPV cells, including some located close to aerodrome boundaries; to date the CAA has not received any detrimental comments or issues of glare at these established sites. Whilst this early indication is encouraging, those responsible for safeguarding should remain vigilant to the possibility."

6.37 The above is stating that to date, there has not been any complications on airfields due to glare originating from solar farms across the UK.

US Federal Aviation Administration Policy

6.38 The US Federal Aviation Administration (FAA) in their Solar Guide (Federal Aviation Authority, 2018)[8] incorporates a chapter on the impact and assessment of glint from solar panels. It concludes that (although subject to revision):

"Depending on site specifics (e.g., existing land uses, location and size of the project) an acceptable evaluation could involve one or more of the following levels of assessment:

(1) A qualitative analysis of potential impact in consultation with the Air Traffic Control Tower, pilots, and airport officials

(2) A demonstration field test with solar panels at the proposed site in coordination with Air Traffic Control Tower personnel

(3) A geometric analysis to determine days and times when there may be an ocular impact."

6.39 The interim policy (Federal Register, 2013)[9] demands that an ocular impact assessment must be assessed at 1-minute intervals from when the sun rises above the horizon until the sun sets below the horizon. Specifically, the developer must use the 'Solar Glare Hazard Analysis Tool'

[8] FAA (2018), Technical Guidance for Evaluating Selected Solar Technologies on Airports. Available at https://www.faa.gov/sites/faa.gov/files/airports/environmental/FAA-Airport-Solar-Guide-2018.pdf

[9] FAA (2013), Interim Policy, *FAA Review of Solar Energy System Projects on Federally Obligated Airports*. Available at https://www.federalregister.gov/documents/2013/10/23/2013-24729/interim-policy-faa-review-of-solar-energy-system-projects-on-federally-obligated-airports

(SGHAT) tool specifically and reference its results as this was developed by the FAA and Sandia National Laboratories as a standard and approved methodology for assessing potential impacts on aviation interests, although it notes other assessment methods may be considered. The SGHAT tool has since been licensed to a private organisation who were also involved in its development, and it is the software model used in this assessment.

6.40 Crucially, the policy provides a quantitative threshold which is lacking in the English guidance. This outlines that a solar development will not automatically receive an objection on glint grounds if low intensity glint is visible to pilots on final approach. In other words, low intensity glint with a low potential to form a temporary after-image (Green Glare) would be considered acceptable under US guidance. Due to the lack of legislation and guidance within England, this US document has been utilised as guidance for this report.

6.41 The FAA guidance states that for a solar PV development to obtain FAA approval or to receive no objection, the following two criteria must be met:

- No potential for glint or glare in the existing or planned Air Traffic Control Tower (ATCT); and
- No potential for glare or "low potential for after-image" (Green Glare) along the final approach path for any existing or future runway landing thresholds (including planned or interim phases), as shown by the approved layout plan (ALP). The final approach path is defined as 2 miles from 50 feet above the landing threshold using a standard 3-degree glide path.

6.42 The geometric analysis included later in this report, which defines the extent and time at which glint may occur, is required by the FAA as the methodology to be used when assessing glint and glare impacts on aviation receptors. This report follows the methodology required by the FAA as it offers the most robust assessment method currently available.

FAA Policy: Review of Solar Energy Systems Projects on Federally - Obligated Airports[10]

6.43 The FAA updated their Interim Policy from 2013 as part of their commitment to "*update policies and procedures as part of an iterative process as new information and technologies become available.*" The main development regarding Glint and Glare since the Interim Policy is the following:

"Initially, FAA believed that solar energy systems could introduce a novel glint and glare effect to pilots on final approach. FAA has subsequently concluded that in most cases, the glint and glare from solar energy systems to pilots on final approach is similar to glint and glare pilots

[10] FAA (2021). FAA Policy: Review of Solar Energy Systems Projects on Federally – Obligated Airports. Available at: https://www.federalregister.gov/documents/2021/05/11/2021-09862/federal-aviation-administration-policy-review-of-solar-energy-system-projects-on-federally-obligated

routinely experience from water bodies, glass-façade buildings, parking lots, and similar features. However, FAA has continued to receive reports of potential glint and glare from on-airport solar energy systems on personnel working in ATCT cabs."

6.44 This is outlining that solar panels are similar to nuisances that are already caused by other existing infrastructure, such as; car parks, glass buildings and water bodies. Furthermore, the ATCT has been outlined as the key receptor to be assessed when determining Glint and Glare impacts from a solar farm.

Galway County Development Plan 2022 - 2028

6.45 The Galway County Development Plan 2022 - 2028[11] was adopted by the Elected Members of Galway County Council at the conclusion of the Special Meeting on the 9th May 2022 and came into effect on the 20th June 2022.

6.46 The plan states the following in **Policy Objectives Climate Change - CC 2**:

'It is a policy objective of the Planning Authority to support the transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050, by way of reducing greenhouse gases, increasing renewable energy, and improving energy efficiency.'

6.47 The plan states the following in **Policy Objectives Renewable Energy - RE 4: Solar Energy Developments**:

'Promote and facilitate solar farm developments in suitable locations, having regard to areas of the County designated for this purpose in the Local Authority Renewable Energy Strategy. The Planning Authority will assess any planning application proposals for solar energy production having due regard to the Habitats Directive and to the detailed policy objectives and Development Standards set out in the Local Authority Renewable Energy Strategy.'

6.48 Other than this, there are no policies that are relevant to Glint and Glare in the Galway County Development Plan.

[11] Galway County Development Plan 2022 - 2028. Available at: https://www.galway.ie/en/services/planning/planspolicy/cdp28/

METHODOLOGY

6.49 A desk-based assessment was undertaken to identify when and where glint and glare may be visible at receptors within the vicinity of the Proposed Amendment, throughout the day and the year.

Sun Position and Reflection Model

Sun Data Model

6.50 The calculations in the solar position calculator are based on equations from Astronomical Algorithms[12]. The sunrise and sunset results are theoretically accurate to within a minute for locations between +/- 72° latitude, and within 10 minutes outside of those latitudes. However, due to variations in atmospheric composition, temperature, pressure and conditions, observed values may vary from calculations.

Solar Reflection Model

6.51 The position of the sun is calculated at one-minute intervals of a typical year, in this instance the year assessed is 2025.

6.52 In order to determine if a solar reflection will reach a receptor, the following variables are required:

- Sun position;
- Observer location; and
- Tilt, orientation, and extent of the modules in the solar array.

6.53 The model assumes that the azimuth and horizontal angle of the sun is the same across the whole solar farm. This is considered acceptable due to the distance of the sun from the Proposed Amendment and the miniscule differences in location of the sun over the Proposed Amendment.

6.54 Once the position of the sun is known for each time interval, a vector reflection equation determines the reflected sun vector, based on the normal vector of the solar array panels. This assumes that the angle of reflection is equal to the angle of incidence reflected across a normal plane. In this instance the plane being the vector which the solar panels are facing.

6.55 On knowing the vector of the solar reflection, the azimuth is calculated and the horizontal reflection from multiple points within the solar farm. These are then compared with the

[12] Jean Meeus, *Astronomical Algorithms* (Second Edition), 1999

azimuth and horizontal angle of the receptor from the solar farm to determine if it is within range to receive solar reflections.

6.56 The solar reflection in the model is considered to be specular as a worst-case scenario. In practice the light from the sun will not be fully reflected as solar panels are designed to absorb light rather than reflect it. The previous text and Appendix 6G outline the reflective properties of solar glass and compares it to other reflective surfaces. Although the exact figures in this report are not conclusive, it is included as a visual guide and it agrees with most other reports, in that solar glass has less reflective properties than other types of glass and that the amount of reflective energy drops as the angle of incidence decreases.

6.57 Most modern panels have a slight surface texture which should have a small effect on diffusing the solar radiation further; although, this has not been modelled to conform with the worst-case scenario assessment.

6.58 The modelling software outputs a hazard plot for each receptor predicted to be impacted by glare from the photovoltaic (PV) array. An orange dot is plotted for each minute of glare indicating the irradiance (power density) of the reflected solar light. A yellow dot is plotted to show the irradiance of the Sun when it is viewed directly. The hazard plot shows that the irradiance of the Sun is approximately three orders of magnitude greater than the reflected irradiance, i.e., the power density of solar reflections from photovoltaic panels are approximately 0.1% that of viewing the Sun. Due to the disparity in irradiance, whenever the Sun is observed in the same frame as solar reflections from a PV array, the Sun will be main source of glare impacts upon the observer. In such a case, the impact is deemed to be Low as a worst-case scenario.

Determination of Ocular Impact

6.59 The software used for this assessment is based on the Sandia Laboratories Solar Glare Hazard Analysis Tool (SGHAT). This tool is specifically mentioned in the FAA guidance as the software which should be used in this type of assessment.

6.60 Determination of the ocular impact requires knowledge of the direct normal irradiance, PV module reflectance, size and orientation of the array, optical properties of the PV module, and ocular parameters. These values are used to determine the retinal irradiance and subtended source angle used in the ocular hazard plot.

6.61 The ocular impact[13] of viewed glare can be classified into three levels based on the retinal irradiance and subtended source angle: low potential for after-image (green), potential for after-image (yellow), and potential for permanent eye damage (red).

[13] Ho, C.K., C.M. Ghanbari, and R.B. Diver, 2011, Methodology to Assess Potential Glint and Glare Hazards From Concentrating Solar Power Plants: Analytical Models and Experimental Validation, Journal of Solar Energy Engineering-Transactions of the Asme, 133(3).

6.62 Green glare can be ignored when looking at ground based and some aviation receptors. Green glare does not cause temporary flash blindness and happens at an instant with very slight disturbance. As per FAA guidelines, mitigation is only required for green glare when affecting an Air Traffic Control Tower (ATCT), but not for when affecting pilots. Therefore, it can be assumed that green glare is acceptable for ground-based receptors.

6.63 The subtended source angle represents the size of the glare viewed by an observer, while the retinal irradiance determines the amount of energy impacting the retina of the observer. Larger source angles can result in glare of high intensity, even if the retinal irradiance is low.

Relevant Parameters of the Proposed Amendment

6.64 The photovoltaic panels are oriented in a southwards direction to maximise solar gain and will remain in a fixed position throughout the day and during the year (i.e. they will not rotate to track the movement of the sun). The panels will face south and will be inclined at an angle between 10 – 40 degrees.

6.65 The maximum above ground level height of the panels is 3.5m and points at the top of the panels are used to determine the potential for glint and glare generation.

Identification of Receptors

Ground Based Receptors

6.66 Glint is most likely to impact upon a ground-based receptor close to dusk and dawn when the sun is at its lowest in the sky. Therefore, any effect would likely occur early in the day or late in the day, reflected to the west at dawn and east at dusk.

6.67 A 1km study area from the panels was deemed appropriate for the assessment of ground-based receptors as this seemed to contain a good spread of residential and road receptors in most directions from the Proposed Amendment. The further distance a receptor is from a solar farm, the less chance it has of being affected by glint and glare due to scattering of the reflected beam and atmospheric attenuation, in addition to obstructions from ground sources, such as any intervening vegetation or buildings.

6.68 An observer height of 2m was utilised for residential receptors, as this is a typical height for a ground-floor window. Upper floor windows are not analysed geometrically; however, are considered as part of the visual analysis. With regards to road users, a receptor height of 1.5m was employed as this is typical of eye level. Rail driver's eye level was assumed to be 2.75m above the rail for signal signing purposes and therefore this is the height used for assessment purposes.

6.69 Where there are a number of residential receptors within close proximity, a representative dwelling or dwellings is/are chosen for full assessment as the impacts will not vary to any significant degree. Where small groups of receptors have been evident, the receptors on

either end of the group have been analysed in detail with the worst-case impacts attributed to that receptor.

Aviation

6.70 Glint is only considered to be an issue with regards to aviation safety when the solar farm lies within proximity to a runway, particularly when the aircraft is descending to land. En-route activities are not considered an issue as the flight will most likely be at a higher altitude than the solar reflection.

6.71 Should a solar farm be proposed within the safeguarded zone of an aerodrome, a full geometric study may be required (depending on the orientation from the Proposed Amendment) which would determine if there is potential for glint and glare at key locations, most likely on the descent to land.

6.72 Buffer zones to identify aviation assets vary depending on the safeguarding criteria of that asset. All aerodromes within 30km will be identified, however generally the detailed assessments are only required within 20km for large international aerodromes, 10km for military aerodromes and 5km for small aerodromes.

Magnitude of Impact

Static Receptors

6.73 Although there is no specific guidance set out to identify the magnitude of impact from solar reflections, the following criteria has been set out for the purposes of this report:

- High - Solar reflections impacts of over 30 hours per year or over 30 minutes per day
- Medium - Solar reflections impacts between 20 and 30 hours per year or between 20 minutes and 30 minutes per day
- Low - Solar reflections impacts between 0 and 20 hours per year or between 0 minutes and 20 minutes per day
- None - Effects not geometrically possible or no visibility of reflective surfaces likely due to high levels of intervening screening

Moving Receptors (Road and Rail)

6.74 Again, no specific guidance is available to identify the magnitude of impact from solar reflections on moving receptors except in aviation, however it is thought that a similar approach should be applied to moving receptors as aviation, based on the ocular impact and the potential for after-image.

6.75 The FAA guidance states that for a solar PV development to obtain FAA approval or to receive no objection the following criteria must be met:

- No potential for glare (glint) or "low potential for after-image" along the final approach path for any existing or future runway landing thresholds (including planned or interim phases), as shown by the ALP.

6.76 The following criteria has been set out for the purposes of this report:

- High - Solar reflections impacts consisting of any amount of yellow glare.
- Low - Solar reflections impacts consisting of any amount of only green glare.
- None - Effects not geometrically possible or no visibility of reflective surfaces likely due to high levels of intervening screening.

6.77 The FAA produced an evaluation of glare as a hazard and concluded in their report[14] that:

"The more forward the glare is and the longer the glare duration, the greater the impairment to the pilots' ability to see their instruments and to fly the aircraft. These results taken together suggest that any sources of glare at an airport may be potentially mitigated if the angle of the glare is greater than 25 deg from the direction that the pilot is looking in. We therefore recommend that the design of any solar installation at an airport consider the approach of pilots and ensure that any solar installation that is developed is placed such that they will not have to face glare that is straight ahead of them or within 25 deg of straight ahead during final approach."

6.78 It is reasonable to assume that although this report was assessing pilots vision impairment that it can be also used to drivers of other vehicles. Therefore, the driver's field of view will also be analysed where required and if the glare is out with 25 degrees either side of their line of sight then any impacts will reduce to None.

Moving Receptors (Aviation)

Approach Paths

6.79 Each final approach path which has the potential to receive glint is assessed using the Solar Glare Hazard Analysis Tool (SGHAT) model. The model assumes an approach bearing on the runway centreline, a 3-degree glide path with the origin 50ft (15.24m) above the runway threshold.

6.80 The computer model considers the pilots field of view. The azimuthal field of view (AFOV) or horizontal field of view (HFOV) as it is sometimes referred, refers to the extents of the pilot's

[14] Federal Aviation Authority, Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach (2015), Available at https://libraryonline.erau.edu/online-full-text/faa-aviation-medicine-reports/AM15-12.pdf

horizontal field of view measured in degrees left and right from directly in front of the cockpit. The vertical field of view (VFOV) refers to the extents of the pilot's vertical field of view measured in degrees from directly in front of the cockpit. The HFOV is modelled at 50 degrees left and right from the front of the cockpit whilst the VFOV is modelled at 30 degrees.

6.81 The FAA guidance states that there should be no potential for glare or 'low potential for after-image' at any existing or future planned runway landing thresholds in order for the Proposed Amendment to be acceptable.

Air Traffic Control Tower (ATCT)

6.82 An air traffic controller uses the visual control room to monitor and direct aircraft on the ground, approaching and departing the aerodrome. It is essential that air traffic controllers have a clear unobstructed view of aviation activity. The key areas on an aerodrome are the views towards the runway thresholds, taxiways and aircraft bays.

6.83 The FAA guidance states that no solar reflection towards the ATCT should be produced by a proposed solar development, however this should be assessed on a site by site basis and will depend on the operations at a particular aerodrome.

6.84 In order to determine the impact on the ATCT, the location and height of the tower will need to be fed into the SGHAT model and where there is a potential for 'low potential for After-Image' or more, then mitigation measures will be required.

Assessment Limitations

6.85 Below is a list of assumptions and limitations of the model and methods used within this report:

- The model does not consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc;
- The model 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;
- Due to variations in atmospheric composition, temperature, pressure and conditions, observed values may vary slightly from calculated positions;
- The model does not account for the effects of diffraction; however, buffers are applied as a factor of safety; and

- The model assumes clear skies at all times and does not account for meteorological effects such as cloud cover, fog, or any other weather event which may screen the sun.

6.86 Due to these assumptions and limitations the model overestimates the number of minutes of glint and glare which are possible at each receptor and presents the worst-case scenario. Where glint and glare are predicted a visibility assessment is carried out to determine a more accurate, real-world prediction of the impacts.

BASELINE CONDITIONS

Ground Based Receptors Reflection Zones

6.87 In the northern hemisphere, there will never be solar reflections due south of a solar PV development as the position of the sun is always south. Furthermore, due to the slant of a solar panel (where the sun is due south, with an azimuth angle of 180 degrees), reflections will be directed skyward and not impact on ground-based receptors.

6.88 Based on the relatively flat topography in the area, solar reflections between five degrees below the horizontal plane to five degrees above it are described as near horizontal. Reflections from the Proposed Amendment within this arc have the potential to be seen by receptors at or near ground level.

6.89 Further analysis showed that this will only occur between the azimuth of 238.92 degrees and 298.18 degrees in the western direction (late day reflections) and 64.36 degrees and 129.27 degrees in the eastern direction (morning reflections) and therefore any ground-based receptor outside these arcs will not have any impact from solar reflections.

6.90 **Figure 6.1 and 6.2 of Appendix 6A** show the respective study areas whilst also subtracting from this the areas where solar reflections will not impact on ground-based receptors due to the reasons set out in **paragraphs 6.87 to 6.89.**

Residential Receptors

6.91 Residential receptors located within 1km of the panel area in the Proposed Amendment have been identified in Error! Reference source not found. below. Glint was assumed to be possible if the receptor is located within the ground-based receptor zones outlined previously. The number in brackets indicates which residential area the receptor belongs.

6.92 There are nine residential receptors (Receptors 55 - 63) which are within the no-reflection zones and is clearly identifiable in **Figure 6.1: Appendix 6A**. The process of how these are calculated is explained in **paragraphs 6.87 to 6.89** of this report.

Table 6 - 1: Residential Receptors

Receptor	Easting	Northing	Glint and Glare Possible
1	582206	721581	Yes
2	582180	721539	Yes
3	582343	721331	Yes
4	582115	721243	Yes

Receptor	Easting	Northing	Glint and Glare Possible
5	582067	721201	Yes
6	582969	720947	Yes
7	583143	720740	Yes
8	582688	720747	Yes
9	582557	720666	Yes
10	582056	720799	Yes
11 (1)	582047	720617	Yes
12 (1)	582056	720555	Yes
13 (1)	582152	720548	Yes
14 (1)	582279	720548	Yes
15 (1)	582295	720486	Yes
16 (1)	582440	720497	Yes
17 (1)	582507	720470	Yes
18 (1)	582468	720390	Yes
19 (1)	582606	720416	Yes
20	582740	720416	Yes
21	583532	720457	Yes
22	582899	720264	Yes
23	583091	720126	Yes
24	583277	720113	Yes
25	583458	719978	Yes
26	583487	719968	Yes
27	583515	719955	Yes

Receptor	Easting	Northing	Glint and Glare Possible
28	582158	718724	Yes
29	582200	718697	Yes
30	582383	718678	Yes
31	583586	718557	Yes
32	584015	718587	Yes
33	584030	718929	Yes
34	584546	719209	Yes
35	584618	719288	Yes
36	584707	719276	Yes
37	584390	719627	Yes
38	584804	719756	Yes
39	584815	719737	Yes
40	585209	719987	Yes
41	584605	720167	Yes
42	584634	720339	Yes
43	584606	720425	Yes
44	584617	720537	Yes
45	584571	720553	Yes
46	584899	720575	Yes
47	584340	720872	Yes
48	584172	720960	Yes
49	584228	721007	Yes
50	584779	721314	Yes

Receptor	Easting	Northing	Glint and Glare Possible
51	584707	721535	Yes
52	584655	721607	Yes
53	584606	721622	Yes
54	584608	721703	Yes
55	584409	721737	No
56	583762	721925	No
57	582847	721953	No
58	582651	721936	No
59	583212	721375	No
60	583223	718700	No
61	583383	718620	No
62	582989	718615	No
63	582927	718604	No

Road Receptors

6.93 There are four roads within the 1km study area that require detailed glint and glare analysis, which are the L4301, an unnamed local road to the east, south and west of the Proposed Amendment (see **Figure 6.2: Appendix 6A**) in the Proposed Amendment and an unnamed road to the south of the Proposed Amendment.

6.94 The ground receptor no-reflection zones are clearly identifiable on **Figure 6.2: Appendix 6A** and the process of how these are calculated is explained in **paragraphs 6.87 to 6.89** of this report.

6.95 Error! Reference source not found. shows a list of receptors points within the study area which are 200m apart.

Table 6 - 2: Road Based Receptors

Receptor	Easting	Northing	Glint and Glare Possible
1	583054	721093	Yes
2	583008	720898	Yes
3	583098	720796	Yes
4	583178	720649	Yes
5	583052	720496	Yes
6	582923	720360	Yes
7	582044	720593	Yes
8	582235	720547	Yes
9	582410	720465	Yes
10	582591	720379	Yes
11	582768	720296	Yes
12	582956	720215	Yes
13	583139	720140	Yes
14	583326	720065	Yes
15	583506	719989	Yes
16	583686	719915	Yes
17	583866	719842	Yes
18	584045	719769	Yes
19	584330	719722	Yes
20	584525	719715	Yes
21	584726	719733	Yes

Receptor	Easting	Northing	Glint and Glare Possible
22	584844	719605	Yes
23	584543	721731	Yes
24	584659	721575	Yes
25	584733	721379	Yes
26	584736	721179	Yes
27	584681	721000	Yes
28	584625	720816	Yes
29	584610	720616	Yes
30	584626	720423	Yes
31	584677	720224	Yes
32	584726	720030	Yes
33	584774	719843	Yes
34	584870	719781	Yes
35	585044	719881	Yes
36	585220	719973	Yes
37	584738	719454	Yes
38	584635	719273	Yes
39	584534	719116	Yes
40	584385	718922	Yes
41	584234	718804	Yes
42	584082	718683	Yes
43	583933	718604	Yes

Receptor	Easting	Northing	Glint and Glare Possible
44	583732	718604	Yes
45	583534	718603	Yes
46	582614	718639	Yes
47	582437	718694	Yes
48	582237	718710	Yes
49	582615	721998	No
50	582750	721879	No
51	582892	721741	No
52	583062	721770	No
53	583174	721616	No
54	583240	721433	No
55	583159	721247	No
56	583344	718640	No
57	583145	718649	No
58	582945	718647	No
59	582780	718561	No

6.96 There are no railway lines within the 1km study area which require a detailed assessment.

Aviation Receptors

6.97 Aerodromes within 30km of the proposed solar development can be found in Error! Reference source not found..

Table 6 - 3: Airfields within close proximity

Airfield	Distance (km)	Use
Ballynageeragh	28.88	Small grass strip

Birr	29.00	Small grass strip

6.98 There are no aerodromes which require a detailed assessment due to this airfield being located outside their respective safety buffer zones outlined in paragraph 6.72.

IMPACT ASSESSMENT

6.99 Following the methodology outlined earlier in this report, geometrical analysis comparing the azimuth and horizontal angle of the receptors from the Proposed Amendment and the solar reflection was conducted. Although this assessment did not consider obstructions such as vegetation and buildings, discussion on the potentially impacted receptors is provided where necessary.

Ground Based Receptors

Residential Receptors

6.100 Error! Reference source not found.**4** identifies the receptors that will experience solar reflections based on solar reflection modelling and whether the reflections will be experienced in the morning (AM), evening (PM), or both.

6.101 The nine receptors which were within the no-reflection zones outlined previously have been excluded from the detailed modelling as they will never receive any glint and glare impacts from the Proposed Amendment.

6.102 **Appendix 6B and 6C** contain the detailed analysis of the glint and glare impacts. Error! Reference source not found.**4** shows the worst-case impact at each receptor (bald earth scenario – not including actual visibility or actual visibility with mitigation).

Table 6 - 4: Potential for Glint and Glare Impact on Residential Receptors

Receptor	Glint Possible from Site		Potential Glare Impact (per year)		Magnitude of Impact	Worst Case Tilt
	AM	PM	Minutes	Hours		
1	No	No	0	0.00	None	N/A
2	No	No	0	0.00	None	N/A
3	No	No	0	0.00	None	N/A
4	No	No	0	0.00	None	N/A
5	No	No	0	0.00	None	N/A
6	Yes	No	2104	35.07	High	40
7	Yes	No	2313	38.55	High	40
8	Yes	No	162	2.70	Low	40
9	No	No	0	0.00	None	N/A

Receptor	Glint Possible from Site		Potential Glare Impact (per year)		Magnitude of Impact	Worst Case Tilt
	AM	PM	Minutes	Hours		
10	No	No	0	0.00	None	N/A
11 (1)	Yes	No	6	0.10	Low	40
12 (1)	No	No	0	0.00	None	N/A
13 (1)	Yes	No	1	0.02	Low	40
14 (1)	Yes	No	15	0.25	Low	40
15 (1)	Yes	No	18	0.30	Low	40
16 (1)	Yes	No	209	3.48	Low	10
17 (1)	Yes	No	246	4.10	Low	40
18 (1)	Yes	No	440	7.33	Low	40
19 (1)	Yes	No	529	8.82	Low	40
20	Yes	No	796	13.27	Low	40
21	Yes	No	2965	49.42	High	40
22	Yes	No	927	15.45	Low	10
23	Yes	No	1433	23.88	Medium	10
24	Yes	No	516	8.60	Low	10
25	Yes	No	88	1.47	Low	40
26	Yes	No	883	14.72	Low	40
27	Yes	No	1645	27.42	Medium	40
28	No	No	0	0.00	None	N/A
29	Yes	No	439	7.32	Low	10
30	No	No	0	0.00	None	N/A
31	No	No	0	0.00	None	N/A
32	No	No	0	0.00	None	N/A
33	No	Yes	366	6.10	Low	10
34	No	No	0	0.00	None	N/A
35	No	No	0	0.00	None	N/A

Receptor	Glint Possible from Site		Potential Glare Impact (per year)		Magnitude of Impact	Worst Case Tilt
	AM	PM	Minutes	Hours		
36	No	No	0	0.00	None	N/A
37	No	No	0	0.00	None	N/A
38	No	Yes	131	2.18	Low	40
39	No	Yes	92	1.53	Low	40
40	No	Yes	893	14.88	Low	10
41	No	Yes	105	1.75	Low	10
42	No	Yes	744	12.40	Low	40
43	No	No	0	0.00	None	N/A
44	No	Yes	1328	22.13	Medium	10
45	No	Yes	421	7.02	Low	10
46	No	No	0	0.00	None	N/A
47	No	No	0	0.00	None	N/A
48	No	No	0	0.00	None	N/A
49	No	No	0	0.00	None	N/A
50	No	No	0	0.00	None	N/A
51	No	No	0	0.00	None	N/A
52	No	No	0	0.00	None	N/A
53	No	No	0	0.00	None	N/A
54	No	No	0	0.00	None	N/A

6.103 As detailed in Error! Reference source not found., under the 'bald earth scenario', there is a **High** impact at three receptors, **Medium** impact at three receptors, **Low** impact at 22 receptors, including one residential area, and a **None** impact at the remaining 26 receptors. **Appendix 6B and 6C** shows detailed analysis of when the glare impacts are possible, whilst also showing which parts of the solar farm glint is reflected from.

6.104 **Appendix 6F** shows Google Earth images that give an insight into how each receptor will be impacted by the glint and glare from the Proposed Amendment. There is a mixture of images used, which include aerial, ground level and street level. The aerial images show the location of the receptor with the solar farm drawn as a white polygon and can be seen on the images

when the solar farm is theoretically visible. The area of the solar farm from where reflections may be possible has been drawn as a yellow polygon. The ground level terrain is based on the height data of the surrounding land showing no intervening vegetation or buildings. The white and yellow polygons can be seen in this view also. The street view gives a good indication as to whether the area of the solar farm where reflections are theoretically possible will be visible from the receptor point. Also, where appropriate images that have been taken from within the Application Site have been used to show up to date imagery.

Receptor 6

6.105 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a northern section of Array 1 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.106 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the Proposed Amendment. This image confirms that the vegetation is insufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact remains **High**.

Receptor 7

6.107 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of Array 1 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.108 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a site photo taken from within Field 4 with a view towards the Proposed Amendment. This image confirms that the vegetation is insufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact remains at **High**.

Receptor 8

6.109 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of Array 1 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.110 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the receptor. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 11

6.111 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of the Array 1 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.112 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the Proposed Amendment. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 13

6.113 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central and northern section of the Array 1 and 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.114 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the Proposed Amendment. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 14

6.115 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of the Array 1 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.116 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the receptor. This image confirms that the vegetation and residential dwellings are sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 15

6.117 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of the Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.118 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the receptor. This image confirms that the vegetation and residential dwellings are sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 16

6.119 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of the Array 1 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.120 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the Proposed Amendment. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 17

6.121 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central and northern section of the Array 1 and 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.122 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the receptor. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 18

6.123 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of the Array 1 and a northern and central section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.124 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the receptor. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 19

6.125 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of the Array 1 and a northern and central section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.126 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the receptor. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 20

6.127 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of the Array 1 and a northern and central section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.128 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second and third image was taken (red and blue dot respectively). The second and third images are street view images with a view towards the receptor. These images confirm that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 21

6.129 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of the Array 1 and a northern and central section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.130 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second and third image was taken (red and blue dot respectively). The second image is a photo taken from within Field 7 with a view towards the receptor. This image confirms that the vegetation is sufficient to screen all views of the Proposed Development to the west of the receptor where glint and glare is possible. The third image is a photo taken from within Field 13 with a view towards the receptor. This image confirms that the vegetation is sufficient to screen most views of the Proposed Development to the east of the receptor where glint and glare is possible. Therefore, the impact reduces to **Low**.

Receptor 22

6.131 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a southern section of the Array 1 and a northern and central section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.132 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second and third image was taken (red and blue dot respectively). The second image is a site photo taken from Field 8 and the third image is a site photo taken from Field 25, which both have a view towards the Proposed Amendment. These images confirm that the vegetation is sufficient to screen all views of the Array 1 and 2 of the Proposed Amendment. Therefore, the impact reduces to **None**.

Receptor 23

6.133 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a southern, central and northern section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.134 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the Proposed Amendment. This image confirms that the vegetation and topography are sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 24

6.135 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a southern, central and northern section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.136 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a site photo taken from within Field 25 with a view towards the Proposed Amendment. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptors 25 - 27

6.137 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a southern, central and northern section of Array 3 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptors.

6.138 The first image in **Appendix 6F** is an aerial image showing the position of the receptors (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the Proposed Amendment. This image confirms that the vegetation is insufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact remains at **Low** at Receptors 25 and 26 and remains **Medium** at Receptor 27.

Receptor 29

6.139 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a southern and central section of Array 5 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.140 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the Proposed Amendment. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 33

6.141 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a northern and central section of Array 5 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.142 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second and third image was taken (red respectively). The second image is a site photo taken from within Field 31 with a view towards the receptor. This image confirms that the vegetation and topography are sufficient to screen all lower floor views, but insufficient to screen all upper floor views of the Proposed Amendment where glint and glare is possible. Therefore, the impact remains at **Low**.

Receptor 38 and 39

6.143 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from the majority of Array 3 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptors.

6.144 The first image in **Appendix 6F** is an aerial image showing the position of the receptors (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the Proposed Amendment. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 40

6.145 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.146 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the Proposed Amendment. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 41

6.147 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central and southern section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.148 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a site photo taken from within Field 22 with a view towards the receptor. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 42

6.149 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a central section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.150 The first image in **Appendix 6F** is an aerial image showing the position of the receptors (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a site photo taken from within Field 22 with a view towards the receptor. This image confirms that the vegetation is insufficient to screen all views

of the Proposed Amendment where glint and glare is possible. Therefore, the impact remains at **Low**.

Receptor 44

6.151 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a northern and central section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.152 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the receptor. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 45

6.153 The 'Glare Reflections on PV Footprint' chart in **Appendix 6B and 6C** shows that reflections from a northern and central section of Array 2 (see **Figure 6.1: Appendix 6A**) in the Proposed Amendment can potentially impact on the receptor.

6.154 The first image in **Appendix 6F** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Amendment, and the location from which the second image was taken (red dot). The second image is a site photo taken from Field 23 with a view towards the receptor. This image confirms that the vegetation is sufficient to screen all views of the Proposed Amendment where glint and glare is possible. Therefore, the impact reduces to **None**.

Residential Area 1

6.155 This encompasses a number of residential receptors including those at Receptors 11 - 19 (assessed previously) (see **Figure 6.1: Appendix 6A**) Each receptor assessed represents multiple receptors as they are in close proximity of each other, so the worst-case scenario is assumed for the impact of glint and glare. All receptors were considered within the visibility analysis, and it was concluded their impacts were similar. As per the assessments of these seven receptors, the impacts on the other receptors within this area are assessed as being **None (worst case scenario)**.

Road Receptors

6.156 Error! Reference source not found.**5** shows a summary of the modelling results for each of the Road Receptor Points, whilst the detailed results and ocular impact charts can be viewed in **Appendix 6D and 6E**.

6.157 There are 11 receptors within the no-reflection zones outlined previously, and therefore have been excluded from the detailed modelling of glint and glare impacts from the Proposed Amendment.

Table 6 - 5: Potential for Glint and Glare Impact on Road Based Receptors

Receptor	Green Glare (mins)	Yellow Glare (mins)	Red Glare (mins)	Magnitude of Impact	Worst Case Tilt
1	2450	4137	0	High	40
2	1990	1457	0	High	40
3	2941	3958	0	High	40
4	1261	3203	0	High	40
5	2279	3774	0	High	40
6	3663	2516	0	High	40
7	3066	3	0	High	40
8	3296	33	0	High	40
9	3489	139	0	High	40
10	3209	744	0	High	40
11	4140	1128	0	High	40
12	2109	1622	0	High	10
13	2907	1434	0	High	10
14	5326	260	0	High	10
15	3054	2500	0	High	40
16	1695	2698	0	High	40
17	4309	832	0	High	10
18	1241	859	0	High	10
19	1021	0	0	Low	40
20	3327	85	0	High	40
21	3652	90	0	High	40
22	3910	0	0	Low	40

Receptor	Green Glare (mins)	Yellow Glare (mins)	Red Glare (mins)	Magnitude of Impact	Worst Case Tilt
23	0	0	0	None	N/A
24	0	0	0	None	N/A
25	0	0	0	None	N/A
26	0	0	0	None	N/A
27	782	0	0	Low	10
28	1370	0	0	Low	10
29	5379	290	0	High	10
30	3700	0	0	Low	10
31	4623	586	0	High	10
32	4665	126	0	High	10
33	3809	119	0	High	40
34	3986	53	0	High	40
35	4704	124	0	High	10
36	4696	839	0	High	10
37	2456	49	0	High	10
38	1757	0	0	Low	40
39	1445	0	0	Low	40
40	2647	13	0	High	10
41	1808	32	0	High	10
42	1717	0	0	Low	40
43	882	0	0	Low	40
44	0	0	0	None	N/A
45	0	0	0	None	N/A
46	0	0	0	None	N/A
47	892	0	0	Low	10
48	1804	389	0	High	40

6.158 As can be seen in Error! Reference source not found. - 5, 31 out of the 48 receptor points have potential glare impacts consisting of "potential for after-image" (yellow glare) which is a **High** impact and 10 receptor points have potential glare impacts consisting of "low-potential for after-image" (green glare) which is a **Low** impact, and with the remaining seven receptors having a **None** impact. **Appendix 6D and 6E** shows detailed analysis of when the glint and glare impacts are possible, whilst also showing which parts of the solar farm the solar glint is reflected from.

6.159 **Appendix 6F** shows Google Earth images that give an insight into how each receptor will be impacted by glint and glare from the Proposed Amendment. There is a mixture of images used, which include aerial, ground level and street level. The aerial images show the location of the receptor with the solar farm drawn as a white polygon and can be seen on the images when the solar farm is theoretically visible. The area of the solar farm from where reflections may be possible has been drawn as a yellow polygon. The ground level terrain is based on the height data of the surrounding land showing no intervening vegetation or buildings. The white and yellow polygons can be seen in this view also. The driver's field of view, as outlined in **paragraph 6.77**, has been drawn as red cones. The street view gives a good indication as to whether the area of the solar farm where reflections are theoretically possible will be visible from the receptor point. Also, where appropriate images that have been taken from within the Application Site have been used to show up to date imaging.

6.160 As can be seen in **Appendix 6F**, all receptors, except Receptors 1, 2, 4, 5 and 14, will have views of the Proposed Amendment blocked by intervening vegetation, topography or buildings or are outside the driver's field of view, and therefore their impact can be reduced to **None**.

GROUND BASED RECEPTOR MITIGATION

6.161 Mitigation is required in order to screen the **High and Medium** impacts views into the Proposed Amendment from Residential Receptors 6, 7 and 27 and Road Receptors 1, 2, 4 and 5. Mitigation is also included to screen the **Low** impact views from Residential Receptors 21, 25, 26 and 33 and Road Receptor 14. This includes;

- This includes native hedgerows to be planted/infilled along the western boundary of Field 2, 4, 6, 7, 8, 12, 13 and 14 and the southern boundary of Field 25 and 31 (see **Figure 6.4: Appendix 6A**) in the Proposed Amendment and maintained to a height of at least 3m as shown on the Landscape and Ecological Management Plan (LEMP) submitted with this application. Therefore, all Residential and Road Receptors reduce to **None**.

6.162 Error! Reference source not found.**6 - 6 and 6 -7** show the impacts at each stage of the glint and glare analysis, with the final residual impacts considered once the mitigation, if any, is in place.

Table 6 - 6: Potential Residual Glint and Glare Impacts on Residential Receptors

Receptor	Magnitude of Impact		
	Theoretical Visibility	Actual Visibility (No Mitigation)	Actual Visibility with Mitigation
1	None	None	None
2	None	None	None
3	None	None	None
4	None	None	None
5	None	None	None
6	High	High	None
7	High	High	None
8	Low	None	None
9	None	None	None
10	None	None	None
11 (1)	Low	None	None
12 (1)	None	None	None

Receptor	Magnitude of Impact		
	Theoretical Visibility	Actual Visibility (No Mitigation)	Actual Visibility with Mitigation
13 (1)	Low	None	None
14 (1)	Low	None	None
15 (1)	Low	None	None
16 (1)	Low	None	None
17 (1)	Low	None	None
18 (1)	Low	None	None
19 (1)	Low	None	None
20	Low	None	None
21	High	Low	None
22	Low	None	None
23	Medium	None	None
24	Low	None	None
25	Low	Low	None
26	Low	Low	None
27	Medium	Medium	None
28	None	None	None
29	Low	None	None
30	None	None	None
31	None	None	None
32	None	None	None
33	Low	Low	None
34	None	None	None
35	None	None	None
36	None	None	None
37	None	None	None

Receptor	Magnitude of Impact		
	Theoretical Visibility	Actual Visibility (No Mitigation)	Actual Visibility with Mitigation
38	Low	None	None
39	Low	None	None
40	Low	None	None
41	Low	None	None
42	Low	Low	Low
43	None	None	None
44	Medium	None	None
45	Low	None	None
46	None	None	None
47	None	None	None
48	None	None	None
49	None	None	None
50	None	None	None
51	None	None	None
52	None	None	None
53	None	None	None
54	None	None	None

Table 6 - 7: Potential Residual Glint and Glare Impacts on Road Receptors

Receptor	Magnitude of Impact		
	Theoretical Visibility	Actual Visibility (No Mitigation)	Actual Visibility with Mitigation
1	High	High	None

Receptor	Magnitude of Impact		
	Theoretical Visibility	Actual Visibility (No Mitigation)	Actual Visibility with Mitigation
2	High	High	None
3	High	None	None
4	High	High	None
5	High	High	None
6	High	None	None
7	High	None	None
8	High	None	None
9	High	None	None
10	High	None	None
11	High	None	None
12	High	None	None
13	High	None	None
14	High	Low	None
15	High	None	None
16	High	None	None
17	High	None	None
18	High	None	None
19	Low	None	None
20	High	None	None
21	High	None	None
22	Low	None	None
23	None	None	None
24	None	None	None
25	None	None	None
26	None	None	None

Receptor	Magnitude of Impact		
	Theoretical Visibility	Actual Visibility (No Mitigation)	Actual Visibility with Mitigation
27	Low	None	None
28	Low	None	None
29	High	None	None
30	Low	None	None
31	High	None	None
32	High	None	None
33	High	None	None
34	High	None	None
35	High	None	None
36	High	None	None
37	High	None	None
38	Low	None	None
39	Low	None	None
40	High	None	None
41	High	None	None
42	Low	None	None
43	Low	None	None
44	None	None	None
45	None	None	None
46	None	None	None
47	Low	None	None
48	High	None	None

6.163 Table 6 - 8 and 6 - 9Error! Reference source not found. show the overall impacts for all residential and road receptors.

Table 6 - 8: Solar Reflections: Residential Receptors

Magnitude	Theoretical Visibility	Actual Visibility (No Mitigation)	Actual Visibility with Mitigation
High	3	2	0
Medium	3	1	0
Low	22	5	1
None	26	46	53

- **High –** Solar reflections impacts of over 30 hours per year or over 30 minutes per day
- **Medium -** Solar reflections impacts between 20 and 30 hours per year or between 20 minutes and 30 minutes per day
- **Low -** Solar reflections impacts between 0 and 20 hours per year or between 0 minutes and 20 minutes per day
- **None -** Effects not geometrically possible or no visibility of reflective surfaces likely due to high levels of intervening screening

Table 6 - 9: Solar Reflections: Road Receptors

Magnitude	Theoretical Visibility	Actual Visibility (No Mitigation)	Actual Visibility with Mitigation
High	31	4	0
Low	10	1	0
None	7	43	48

- **High -** Solar reflections impacts with yellow glare (potential for after-image).
- **Low -** Solar reflections impacts with only green glare (low potential for after-image)
- **None -** Effects not geometrically possible or no visibility of reflective surfaces likely due to high levels of intervening screening or being outside the drivers field of view

SUMMARY

6.164 There is no guidance or policy available across Ireland in relation to the assessment of glint and glare from a Proposed Amendment. However, as identified by UK policy, it is recognised as a potential impact which needs to be considered for a proposed solar development.

6.165 This assessment considers the potential impacts on ground-based receptors such as roads and residential dwellings. A 1km survey area around the Application Site is considered adequate for the assessment of ground-based receptors, whilst a 30km study area is chosen for aviation receptors. Within 1km of the Application Site, there are 63 residential receptors, including one residential areas, and 59 road receptors which were considered. As per the methodology section, where there are a number of residential receptors within close proximity, a representative dwelling or dwellings is/are chosen for the glint and glare analysis as the impacts will not vary to any significant degree. Where small groups of receptors have been evident, the receptors on either end of the group have been included in the glint and glare analysis with some context to all receptors given in the visual analysis. Nine residential receptors and 11 road receptors were dismissed as they are located within the no reflection zones and therefore, will not be impacted upon by the Proposed Amendment. There are two aerodromes within 30km of the Proposed Amendment, none of which require a detailed assessment due to their size and orientation in relation to the Proposed Amendment.

6.166 The solar panels will face south and will be inclined at an angle of 10 - 40 degrees. The maximum above ground level height of the panels is 3.5 m and points at the top of the panels are used to determine the potential for glint and glare generation.

6.167 Geometric analysis was conducted for 54 individual residential receptors, including one residential areas, and 48 road receptors.

6.168 Following an initial assessment, rail receptors were scoped out as assets that will be impacted upon from the Proposed Amendment as no rail receptors fell within the 1km study area. The assessment concludes that:

- Solar reflections are possible at 28 of the 54 residential receptors assessed within the 1km study area. Initial impacts were **High** at three receptors, **Medium** at three receptors, **Low** at 22 receptors, including one residential area, and **None** at the remaining 26 receptors, including one residential areas. Upon reviewing the actual visibility of the receptors, glint and glare impacts remain **High** at two receptors, **Medium** at one receptor, reduce to **Low** at five receptors and to **None** at all remaining receptors, including one residential areas. Once mitigation measures were considered, impacts remain **Low** at one receptor and reduce to **None** at all remaining receptors.
- Solar reflections are possible at 41 of the 48 road receptors assessed within the 1km study area. Initial impacts were **High** at 31 receptors, **Low** at 10 receptors and **None** at

the remaining seven receptors. Upon reviewing the actual visibility of the receptors, glint and glare impacts remain **High** at four receptors, **Low** at one receptor, and reduce to **None** at all remaining receptors. Once mitigation measures were considered, impacts reduce to **None** at all receptors.

- **No impact** on train drivers or railway infrastructure is predicted.
- **No impact** on aviation assets is predicted.

6.169 Mitigation is required in order to screen the **High and Medium** impacts views into the Proposed Amendment from Residential Receptor 6, 7 and 27 and Road Receptors 1, 2, 4 and 5. Mitigation is also included to screen the **Low** impact views from Residential Receptors 21, 25, 26 and 33 and Road Receptor 14. This includes native hedgerows to be planted/infilled along the western boundary of Field 2, 4, 6, 7, 8, 12, 13 and 14 and the southern boundary of Field 25 and 31 in the Proposed Amendment and maintained to a height of at least 3m as shown on the LEMP submitted with this application.

6.170 The effects of glint and glare and their impact on local receptors has been analysed in detail and there is predicted to be **Low** and **None** impacts, and therefore **No Significant Effects**.

APPENDICES

Appendix 6A: Figures

- Figure 6.1: Residential Based Receptors
- Figure 6.2: Road Based Receptors
- Figure 6.3: Panel Area Labels
- Figure 6.4: Mitigation Measures

Appendix 6B: Residential Receptor Glare Results 10 degrees

Appendix 6C: Residential Receptor Glare Results 40 degrees

Appendix 6D: Road Receptor Glare Results 10 degrees

Appendix 6E: Road Receptor Glare Results 40 degrees

Appendix 6F: Visibility Assessment Evidence

Appendix 6G: Solar Module Glare and Reflectance Technical Memo

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