Appendix 24-2:

Glint and Glare Analysis

PAGERPOWER
Urban & Renewables

Solar Photovoltaic Glint and Glare Study

NextEra Energy Resources

Garnet Energy Center

June 2021

PLANNING SOLUTIONS FOR:

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ADMINISTRATION PAGE

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Issue	Date	Detail of Changes
1	May 2021	Initial issue
2	June 2021	Minor amendments and screening analysis for road receptors 48 to 50.

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EXECUTIVE SUMMARY

Report Purpose

Pager Power has been retained to assess the possible effects of glint and glare from a solar photovoltaic (PV) development located at Conquest, Cayuga County, New York, USA. The assessment pertains to the possible impact upon surrounding road users and dwellings.

Pager Power

Pager Power has undertaken over 600 glint and glare assessments in the UK, Europe, the USA, and internationally. The company's own glint and glare guidance is based on industry experience and extensive consultation with industry stakeholders including airports and aviation regulators.

Conclusions

Overall, mitigation has been recommended for seven dwellings and three sections of Cayuga County Route 17B where a moderate impact was predicted. For one section of road located along Cayuga County Route 17B, a high impact has been predicted and mitigation is required.

The assessment results are presented on the following page.

Guidance and Studies

Guidelines exist in the UK (produced by the Civil Aviation Authority) and in the USA (produced by the Federal Aviation Administration) with respect to solar developments and aviation activity, however a specific methodology for determining the impact upon road safety or residential amenity has not been produced to date. Therefore, Pager Power has reviewed existing guidelines and the available studies (discussed below) in the process of defining its own glint and glare assessment guidance document and methodology[1]. This guidance document defines the process for determining the impact upon road safety and residential amenity.

Pager Power's approach is to undertake geometric reflection calculations and, where a solar reflection is predicted, undertake solar intensity calculations in line with the Sandia National Laboratories' FAA methodology. The scenario in which a solar reflection can occur is identified and discussed, and a comparison is made against the available solar panel reflection studies to determine the overall impact.

The available studies have measured the intensity of reflections from solar panels with respect to other naturally occurring and manmade surfaces. The results show that the reflections produced are of intensity similar to or less than those produced from still water and significantly less than reflections from glass and steel[2].

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[1] Pager Power Glint and Glare Guidance, Third Edition (3.1), April 2021.

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

Assessment Results – Roads

Most of the roads surrounding the proposed development are considered local roads. Assessment is not recommended for local roads, where traffic densities are likely to be relatively low. Any solar reflections from the proposed development that are experienced by a road user along a local road would be considered low impact in the worst case in accordance with the guidance presented in Appendix D. Only receptors along New York State Route 38 and Cayuga County Route 17B were therefore taken forward for geometric modelling.

The modelling has shown that solar reflections are geometrically possible towards:

- 24 of the 28 modelled road receptors along approximately 1.43 miles of New York State Route 38
- 50 of the 51 modelled road receptors along 3.04 miles of Cayuga County Route 17B.

A conservative review of the available imagery and landscape plan has shown that for most of the receptors where a solar reflection is predicted, screening in the form of existing vegetation, terrain, dwellings, buildings and/or proposed screening will significantly obstruct the views of the reflecting panels or solar reflections will originate from panels which are outside of a road user's field of view. No mitigation requirement was identified for these sections of road.

For three sections of road along Cayuga County Route 17B located close to the proposed development, views of the proposed solar development may be possible and within a road user's field of view. For these three sections of road, a moderate impact has been predicted and mitigation has been recommended.

For one section of road along Cayuga County Route 17B on elevated terrain, solar reflections are predicted to originate in front of a road user and proposed screening will not mitigate effects immediately. For this section of road, a high impact is predicted, and mitigation is required.

Assessment Results – Dwellings

The results of the modelling indicate that solar reflections are geometrically possible towards 149 out of the 167 modelled dwelling receptors.

Following a conservative review of the available imagery and landscape plan a mitigation requirement has not been identified for 142 receptors because:

- Screening in the form of existing vegetation, terrain, dwellings, buildings and/or proposed screening will significantly obstruct the views of the reflecting panels; or
- There is sufficient separation distance between the dwelling and the closest visible reflecting panel to the mitigate the impact; and/or
- Solar reflections would occur within 2hrs of sunrise/sunset; therefore, effects would likely coincide with direct sunlight.

The review has also shown that for seven dwellings located close to the proposed development, views of the reflecting solar panels may be possible, a moderate impact is predicted, and mitigation has been recommended.

Mitigation

Following the assessment, mitigation requirements and recommendations have been identified. The predicted visible reflecting areas for the associated sections of road and dwellings are shown in sections 6.4.1 and 6.4.2.

An overview of possible mitigation strategies has been provided (See Section 6.4).

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 50 countries within Europe, Africa, America, Asia and Australasia.

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

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

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

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

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

1 INTRODUCTION

1.1 Overview

Pager Power has been retained to assess the possible effects of glint and glare from a solar photovoltaic (PV) development located at Conquest, Cayuga County, New York, USA. The assessment pertains to the possible impact upon surrounding road users and dwellings.

This report contains the following:

- Solar development details.
- Explanation of glint and glare.
- Overview of relevant guidance.
- Overview of relevant studies.
- Overview of Sun movement.
- Assessment methodology.
- Identification of receptors.
- Glint and glare assessment for identified receptors.
- Results discussion.

Following this a summary of findings and overall conclusions and recommendations is presented. This report is entirely a desk-based review of the available imagery and landscape plan. Any effects predicted are with respect to glint and glare only.

1.2 Pager Power's Experience

Pager Power has undertaken over 600 glint and glare assessments in the UK, Europe, the USA, and internationally. The company's own glint and glare guidance is based on industry experience and extensive consultation with industry stakeholders including airports and aviation regulators.

1.3 Glint and Glare Definition

The definition of glint and glare can vary however, the definition used by Pager Power is as follows[3]:

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

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

[3]These definitions are aligned with those of the Federal Aviation Administration (FAA) in the United States of America.

2 SOLAR DEVELOPMENT LOCATION AND DETAILS

2.1 Overview

The following section presents the solar development location and key details pertaining to this assessment.

2.2 Solar Panel Location – Aerial Image

Figure 1[4] below, shows the location of the solar panel areas. The red areas denote the solar panel locations. The yellow lines denote the proposed development project area site boundary.

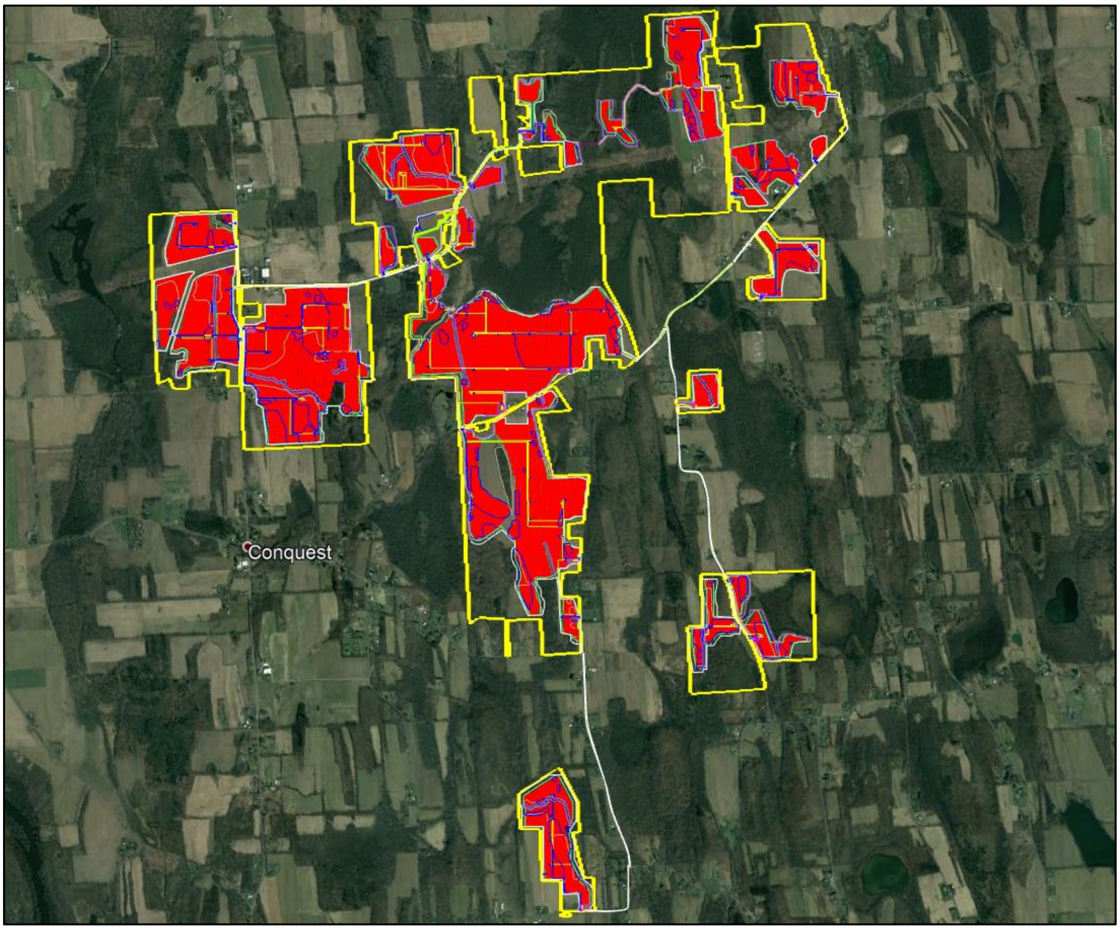

Figure 1 *Solar panel location – aerial image*

[4] Copyright © 2021 Google.

2.3 Solar Panel Information

The solar panel characteristics are presented in Table 1 below.

Panel Information	
Azimuth angle (°)	180
Elevation angle (°)	18
Assessed centre height (feet / metres)	4.5 feet / 1.3716m agl (above ground level)[5]

Table 1 *Panel information*

2.4 Proposed Screening

The Garnet Energy Centre Landscape Plan for the proposed development[6] lists three types of visual mitigation (types 1 to 3). Vegetation planting will be installed in the form of deciduous and evergreen trees and shrubs. Type 1 (VM 1 to 6, 9, 11 to 14, 16 to 24, 26, 29 to 41) will provide new screening buffers. Type 2 (VM 7, 8, 10, 15, 27, and 28) buffer is a supplement to existing vegetation. Type 3 (VM 25) is to provide screening for the collection substation.

Vegetation planting in the form of trees will be installed at heights mostly between 5 to 6 feet and shrubs at heights between 2 to 4 feet. Mature heights for trees are between 15 and 60 feet for types 1 and 2 and between 15 and 70 feet for type 3. Mature heights for shrubs are between 6 and 25 feet for types 1 and 2. Mature heights for trees are between 15 and 70 feet for type 3.

The proposed planting has been considered within Section 6 of this report in the context of likely visibility from the surrounding receptors.

[5] Average heights are used for Glint & Glare Assessment. This average is taken from a minimum of 2 feet (0.6096m) up to a maximum of 7 feet (2.1336m).
[6] 2021.04.28 Garnet Landscaping Plan.pdf

3 GLINT AND GLARE ASSESSMENT METHODOLOGY

3.1 Guidance and Studies

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

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

3.2 Background

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

3.3 Pager Power's Methodology

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

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

Within the Pager Power model, the solar development area is defined, as well as the relevant receptor locations. The result is a chart that states whether a reflection can occur, the duration and the panels that can produce the solar reflection towards the receptor.

3.4 Assessment Methodology and Limitations

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

4 GROUND-BASED RECEPTORS

4.1 Ground-Based Receptors – Overview

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

Following consultation carried out between NextEra Energy Resources and the local planning authority, receptors within 1,500 feet (457.2m) buffer (orange lines in the proceeding figures) of the proposed development project area site boundary have been considered for potential dwelling receptors. The same buffer has been used for the inclusion of road receptors.

Potential receptors within the buffer are identified based on mapping and aerial photography of the region[7]. The initial judgement is made based on high-level consideration of aerial photography and mapping i.e. receptors are excluded if it is clear from the outset that no visibility would be possible. A more detailed assessment is made if the modelling reveals a reflection would be geometrically possible.

Reflections towards ground-based receptors located further north than any proposed panel are highly unlikely for fixed, south-facing panels at this latitude. Any receptors located north of and close to the proposed development are included for the purpose of grouping receptors for modelling purposes.

Terrain elevation heights have been interpolated based on SRTM data. Receptor details can be found in Appendix G.

4.2 Road Receptors

Road types can generally be categorised as:

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

[7] Most dwelling receptors identified have been provided by the applicant.

Most of the roads surrounding the proposed development are considered local roads. Assessment is not recommended for local roads, where traffic densities are likely to be relatively low. Any solar reflections from the proposed development that are experienced by a road user along a local road would be considered low impact in the worst case in accordance with the guidance presented in Appendix D.

The analysis has therefore considered major national, national, and regional roads that:

- Are within 1,500 feet of the proposed development.
- Have a potential view of the panels.

The assessed road receptor points along New York State Route 38 and Cayuga County Route 17B are shown in Figure 2[4] on the following page. A height of 4.92 feet (1.5 metres) above ground level has been taken as typical eye level for a road user. The distance between road receptors is circa 100m positioned along the purple lines.

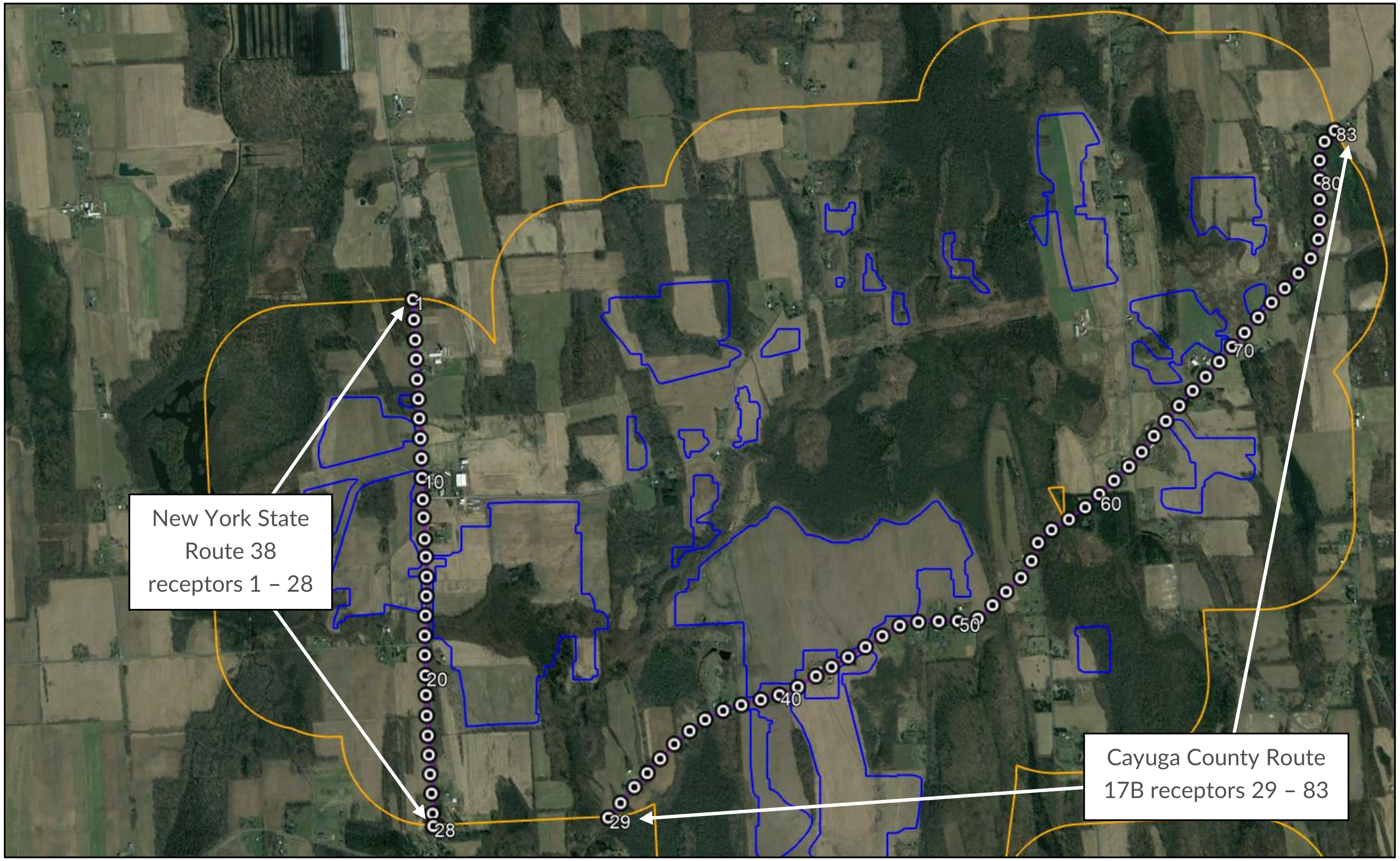

Figure 2 *Assessed road receptors*

4.3 Dwelling Receptors

The analysis has considered dwellings that:

- Are within 1,500 feet of the proposed development.
- Have a potential view of the panels.

The individual assessed dwelling receptors and an overview of all dwelling receptors are shown in Figures 3 to 38[4] below and on the following pages. In total, 188 dwelling receptor locations have been considered for the assessment. A height of 5.9 feet (1.8 metres) above ground level has been taken as typical eye level for an observer on the ground floor of the dwellings[8].

Figure 3 *Assessed dwelling receptors – 1 and 2*

[8] This fixed height for the dwelling receptors is for modelling purposes. Viewpoints at ground level and above are considered in the results discussion.

Figure 4 *Assessed dwelling receptors – 3 to 5*

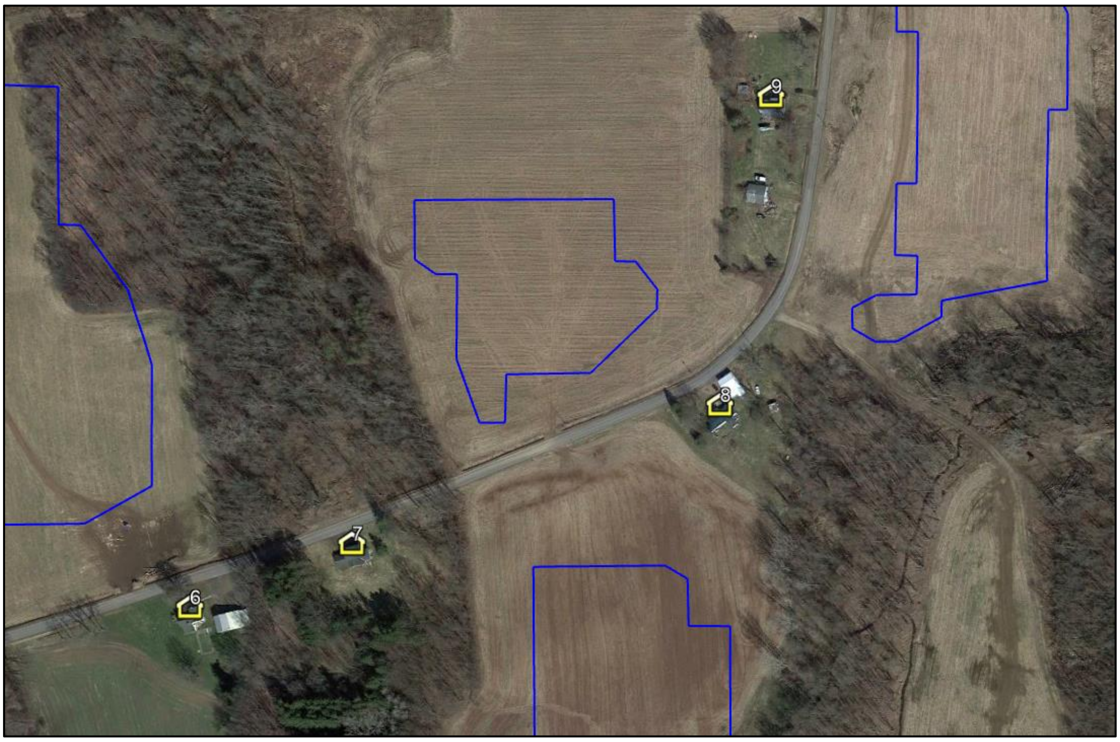

Figure 5 *Assessed dwelling receptors – 6 to 9*

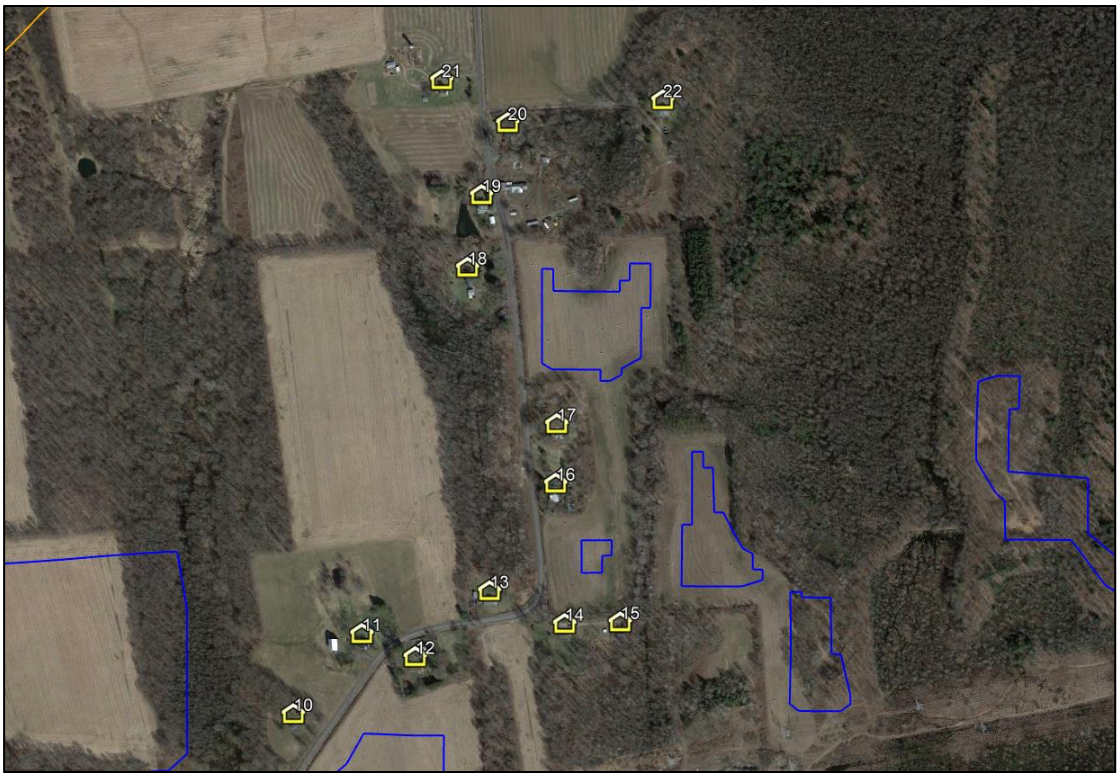

Figure 6 *Assessed dwelling receptors – 10 to 22*

Figure 7 *Assessed dwelling receptors – 23 to 28*

Figure 8 *Assessed dwelling receptors – 29 to 38*

Figure 9 *Assessed dwelling receptor – 39*

Figure 10 *Assessed dwelling receptors – 40 and 41*

Figure 11 *Assessed dwelling receptors – 42 to 60*

Figure 12 *Assessed dwelling receptors – 61 to 66*

Figure 13 *Assessed dwelling receptors – 67 to 74*

Figure 14 *Assessed dwelling receptors – 75 to 80*

Figure 15 *Assessed dwelling receptor – 81*

Figure 16 *Assessed dwelling receptors – 82 to 88*

Figure 17 *Assessed dwelling receptors – 89 to 93*

Figure 18 *Assessed dwelling receptors – 94 to 102*

Figure 19 *Assessed dwelling receptors – 103 to 106*

Figure 20 *Assessed dwelling receptors – 107 and 108*

Figure 21 *Assessed dwelling receptors – 109 to 114*

Figure 22 *Assessed dwelling receptors – 115 to 117*

Figure 23 *Assessed dwelling receptors – 118 to 121*

Figure 24 *Assessed dwelling receptors – 122 to 129*

Figure 25 *Assessed dwelling receptors – 130*

Figure 26 *Assessed dwelling receptors – 131*

Figure 27 *Assessed dwelling receptors – 132 to 137*

Figure 28 *Assessed dwelling receptors – 138 to 143*

Figure 29 *Assessed dwelling receptors – 144 to 149*

Figure 30 *Assessed dwelling receptors – 150*

Figure 31 *Assessed dwelling receptors – 151 to 156*

Figure 32 *Assessed dwelling receptors – 157 and 158*

Figure 33 *Assessed dwelling receptors – 159 to 166*

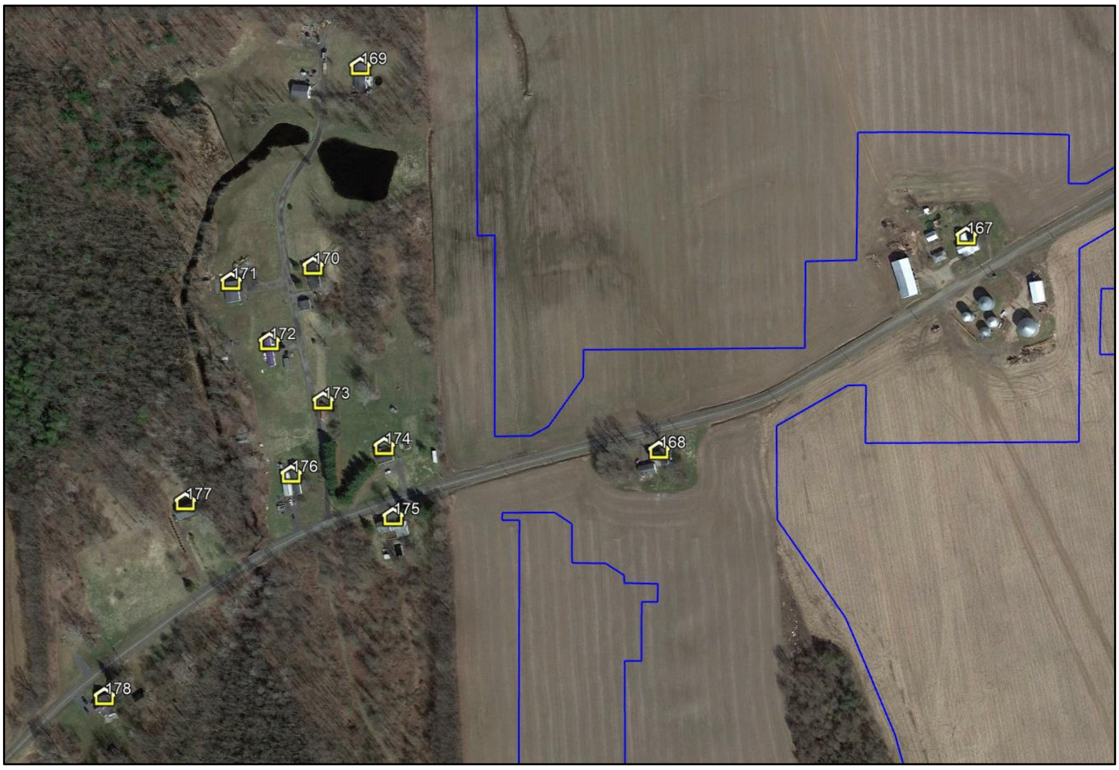

Figure 34 *Assessed dwelling receptors – 167 to 178*

Figure 35 *Assessed dwelling receptors – 179 and 180*

Figure 36 *Assessed dwelling receptors – 181 to 183*

Figure 37 *Assessed dwelling receptors – 184 to 188*

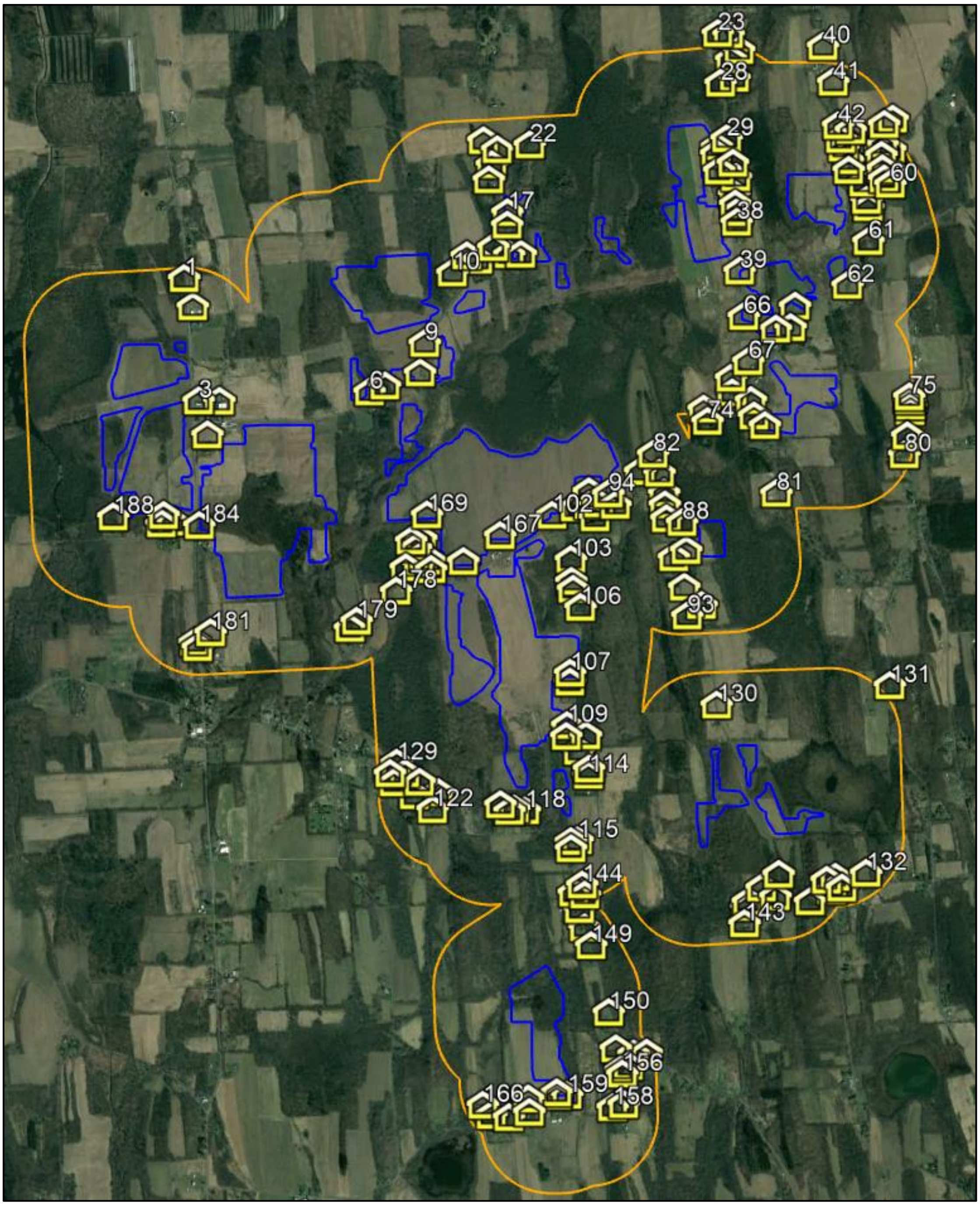

Figure 38 *Dwelling receptors overview*

5 ASSESSED REFLECTOR AREAS

5.1 Overview

The following section presents the modelled reflector areas.

5.2 Reflector Areas

A number of representative panel locations are selected within the proposed reflector areas with the number of modelled reflector points being determined by the size of the reflector areas and the assessment resolution. The bounding co-ordinates for the proposed solar development have been extrapolated from the site plans. The data can be found in Appendix G.

A resolution of 20m has been chosen for this assessment. This means that a geometric calculation is undertaken for each identified receptor every 20m from within the defined areas. This resolution is sufficiently high to maximise the accuracy of the results – increasing the resolution further would not significantly change the modelling output. If a reflection is experienced from an assessed panel location, then it is likely that a reflection will be viewable from similarly located panels within the proposed solar development.

The assessed reflector areas, 1 to 30, are shown in Figure 39[4] on the following page.

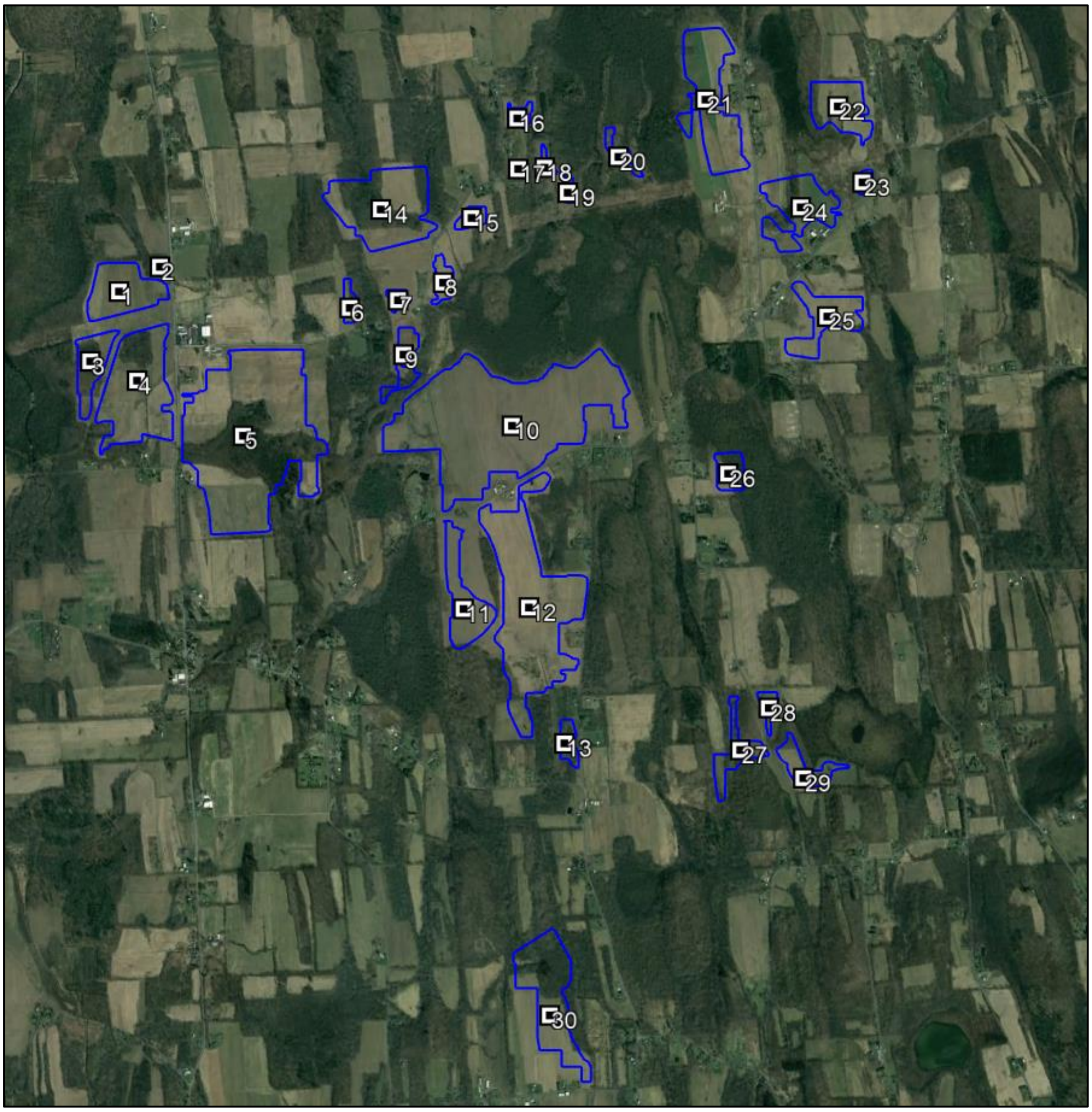

Figure 39 *Assessed reflector areas*

5.3 Modelled Receptors and Reflector Areas

Within the 1,500ft buffer (from the proposed development boundaries) groupings of receptors have been modelled with respective panel areas where:

- Solar reflections are considered geometrically possible (based on previous assessment experience[9]) and where a receptor is within 1,500ft of panel areas.
- If all panel areas are beyond 1500ft of a grouping of receptors, the nearest panel area within 1km[10] (where solar reflections are considered geometrically possible) has been considered for completeness.

On further review, road receptors 80 to 83 have not been taken forward for detailed geometric modelling because there are no panel areas which could potentially cause a reflection and within 1km of the receptors.

On further review, dwelling receptors 19 to 21, 23 to 28, 40, 41, 52 to 56, 81, and 131 have not been taken forward for detailed geometric modelling because there are no panel areas which could potentially cause a reflection and within 1km of the receptors.

Dwelling receptors 39, 167, and 184 have not been taken forward for detailed geometric modelling because they are involved properties.

[9] See section 1.2 for Pager Power's assessment experience overview. Reflections are considered possible between north east and south east; and between north west and south west. Reflections to receptors north of panel areas at this latitude are considered highly unlikely.

[10] Pager Power Methodology is normally to consider receptors within 1km of panel areas; however, most of the modelling has been considered out to 1,500ft following consultation with the applicant further to their contact with the planning authority.

6 GEOMETRIC ASSESSMENT RESULTS AND DISCUSSION

6.1 Overview

The following sub-sections presents the significance of any predicted impact in the context of existing screening and the relevant criteria set out in each sub-section. The criteria are determined by the assessment process for each receptor, which are set out in Appendix D.

When determining the visibility of the reflecting panels for an observer, a conservative review of the available imagery and landscape plan is undertaken, whereby it is assumed views of the panels are possible if it cannot be reliably determined that existing screening will remove effects.

6.2 Road Receptor Results

The modelling has shown that solar reflections are geometrically possible towards:

- 24 of the 28 modelled road receptors along approximately 1.43 miles of New York State Route 38 (receptors 1 to 24).
- 50 of the 51 modelled road receptors along approximately 3.04 miles of Cayuga County Route 17B (receptors 29 to 65 and 67 to 79).

The key considerations when quantifying the impact significance for road users are:

- Whether a reflection is predicted in practice.
- The type of road (and associated likely traffic levels/speeds).
- The location of the reflecting panels relative to a road user's direction of travel (a reflection directly in front of a driver is more hazardous than a reflection from a location off to one side).

Where reflections towards a major national, national, or regional road originate from outside of a road user's field of view, the impact significance is low, and mitigation is not required.

Where reflections originate from inside of a road user's field of view but there are mitigating circumstances, the impact significance is moderate and expert assessment of the mitigating factors is required to determine the mitigation requirement (if any). Of particular relevance is whether the solar reflection originates from directly in front of a road user, the separation distance between the reflecting panels and the receptor location, and the extent to which effects coincide with direct sunlight.

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

Table 2 on the following pages summarises the predicted impact significance and mitigation requirement for the road receptors where solar reflections are geometrically possible. Where no-long term impacts have been identified, short term impacts are deemed to be acceptable. The predicted glare times are based solely on bare-earth terrain i.e. without consideration of screening from buildings and vegetation. The modelling output showing the precise predicted times and the reflecting panel areas is shown in Appendix H.

Cases where mitigation is recommended / required are shown in red for ease of reference within Table 2 and discussed further in Section 6.4.1.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
1 – 5	Yes.	No.	14 (14)	Existing vegetation and terrain. Predicted to significantly obstruct views.	No impact.	N/A	No.
6	No.	Yes.	1 – 5 (1 – 2)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
7	No.	Yes.	1 – 5 (1)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
8 – 9	No.	Yes.	1 – 5 (1)	Views may be possible for reflecting panels within area 1.	Low impact.	Reflections would originate from outside a road user's field of view.	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
10	No.	Yes.	1 – 5 (1,4)	Views may be possible for reflecting panels within areas 1,4.	Low impact.	Reflections would originate from outside a road user's field of view.	No.
11	No.	Yes.	1 – 5 (1,3,4)	Proposed screening VM20 and VM19. A small gap in this proposed screening exists. Views may be possible near receptor 11, for reflecting panels within areas 3,4, due to a small gap in screening between VM19 and VM20.	Low impact.	Reflections would originate from outside a road user's field of view.	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
12	Yes.	Yes.	1 – 5 (3,4,5)	Terrain and proposed screening VM17 and VM19. Proposed screening VM19 predicted to significantly obstruct views of reflecting panels within areas 3 and 4 when proposed planting matured. Terrain predicted to screen reflecting panels within area 5.	No long-term impact.	N/A	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
13	Yes.	Yes.	1 – 5 (3,4,5)	Existing vegetation, terrain, dwelling 5, and proposed screening VM17 and VM19. Predicted to significantly obstruct views of reflecting panels within areas 3 and 4 when proposed planting matured. Terrain predicted to screen reflecting panels within area 5.	No long-term impact.	N/A	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
14	Yes.	Yes.	1 – 5 (3,4,5)	Terrain and proposed screening VM18. Views may be possible for reflecting panels within areas 3 and 4. Views may be possible, for reflecting panels within area 5, despite partial screening in the form of terrain and VM18.	Low impact.	Reflections would originate from outside a road user's field of view.	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
15 – 17	Yes.	Yes.	1 – 5 (3,4,5)	Views may be possible for reflecting panels within areas 3,4, and 5.	Low impact.	Reflections would originate from outside a road user's field of view.	No.
18	Yes.	Yes.	1 – 5 (3,4,5)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
19	Yes.	Yes.	1 – 5 (4,5)	Existing vegetation, dwelling 184. Predicted to significantly obstruct views.	No impact.	N/A	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
20 – 24	Yes.	No.	1 – 5 (5)	Terrain and existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
29 – 33	Yes.	No.	11 (11)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
34 – 35	Yes.	No.	10 – 12 (11,12)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
36	Yes.	No.	10 – 12 (10 – 12)	Existing vegetation and proposed screening VM13 and VM14. Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
37	Yes.	No.	10 – 12 (10,12)	Existing vegetation, buildings, and proposed screening VM11, VM13, and VM14. Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
38	Yes.	No.	10,12 (12)	Existing vegetation, buildings, and proposed screening VM11, VM13, and VM14. Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
39	Yes.	Yes.	10,12 (10,12)	Existing vegetation, buildings, terrain, and proposed screening VM11 and VM13. Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
40	Yes.	Yes.	10,12 (10,12)	Buildings, terrain, and proposed screening VM11 and VM13. Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
41 – 44	Yes.	Yes.	10,12 (10,12)	Buildings and/or terrain. Views may be possible for reflecting panels within areas 10 and 12.	Moderate impact.	Reflections would originate from within a road user's field of view.	Yes.
45	No.	Yes.	12 (12)	Terrain. Views may be possible for reflecting panels within area 12.	Moderate impact.	Reflections would originate from within a road user's field of view.	Yes.
46 – 47	Yes.	Yes.	12 (12)	Terrain. Views may be possible for reflecting panels within area 12.	Moderate impact.	Reflections would originate from within a road user's field of view.	Yes.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
48 – 50	No.	Yes.	12 (12)	Existing vegetation, and proposed screening VM9. Views may be possible for reflecting panels within area 12.	High impact.	Reflections would originate from within a road user's field of view and in front of a road user. Proposed screening VM9 would provide partial screening of panels at installation. However, it would take a significant time for vegetation to mature to a height which would sufficiently screen views due to the relative terrain height at these receptors relative to the panel areas causing reflections. Given the initial impact and the sensitivity of the receptor, mitigation solutions are required.	Yes.
51	No.	Yes.	12 (12)	Terrain. Predicted to significantly obstruct views.	No impact.	N/A	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
52	No.	Yes.	12 (12)	Terrain. Views may be possible for reflecting panels within area 12.	Low impact.	Reflections would originate from outside a road user's field of view.	No.
53 – 54	No.	Yes.	12 (12)	Terrain and existing vegetation. Views may be possible for reflecting panels within area 12.	Moderate impact.	Reflections would originate from within a road user's field of view. Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer at receptor 53 and the nearest reflecting panel is approximately 623 feet (190m). Most views of the reflecting panel area will be screened by existing vegetation and terrain.	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
55 – 57	No.	Yes.	12 (12)	Terrain and existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
58 – 59	Yes.	No.	25 (25)	Terrain and existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
60 – 61	Yes.	No.	25 (25)	Existing vegetation, terrain, and proposed planting (VM 30). Predicted to significantly obstruct views.	No impact.	N/A	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
62 – 63	Yes.	No.	24 – 25 (25)	Existing vegetation, terrain, and proposed planting (VM 30). Predicted to significantly obstruct views.	No impact.	N/A	No.
64 – 65	Yes.	No.	24 – 25 (25)	Terrain and existing vegetation. Views may be possible for reflecting panels within area 25.	Moderate impact.	Reflections would originate from within a road user's field of view.	Yes.
67	No.	Yes.	23 – 24 (24)	Existing vegetation. Views may be possible for reflecting panels within area 24.	Low impact.	Reflections would originate from outside a road user's field of view.	No.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
68 – 72	No.	Yes.	23 – 24 (24)	Existing vegetation, terrain, buildings, proposed planting VM33, 34, 37, 38. Views may be possible for reflecting panels within area 24 due to small gaps in screening.	Moderate impact.	Reflections would originate from within a road user's field of view.	Yes[11].

[11] The visible reflecting area between receptors 69 and 70 represents a very small gap in the proposed screening necessary for access to the site and therefore no mitigation screening is considered necessary for this panel area. Mitigation recommendation remains for the other visible reflecting areas between road receptors 68 and 72.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
73	No.	Yes.	23 – 24 (24)	Proposed planting VM38. Views may be possible for reflecting panels within areas 23 and 24.	Moderate impact.	Reflections would originate from within a road user's field of view.	Yes.
74	No.	Yes.	22 – 23 (23)	Views may be possible for reflecting panels within area 23.	Moderate impact.	Reflections would originate from within a road user's field of view.	Yes.

Road Receptors	Solar Reflection Geometrically Possible Towards the Road Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
75 – 76	No.	Yes.	22 (22)	Existing vegetation, proposed planting VM39. Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
77 – 80	No.	Yes.	22 (22)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Table 2 *Assessment of mitigation requirement – road receptors*

6.3 Dwelling Receptor Results

The results of the modelling indicate that solar reflections are geometrically possible towards 149 out of the 167 modelled dwelling receptors (receptors 1 to 16, 18, 22, 29 to 38, 42 to 51, 57 to 64, 66 to 80, 82 to 130, 132 to 135, 150 to 166, 168 to 180, and 185 to 188).

The key considerations when quantifying the impact significance for dwellings are:

- Whether a significant reflection is predicted in practice.
- The duration of the predicted effects, relative to thresholds of:
  - 3 months per year.
  - 60 minutes per day.

Where effects occur for less than 3 months per year and less than 60 minutes per day, the impact significance is low, and mitigation is not required.

Where effects last for more than 3 months per year or for more than 60 minutes per day, the impact significance is moderate and expert assessment of any mitigating factors is required to determine the mitigation requirement (if any). Of particular relevance is the level of likely screening, the separation distance between the reflecting panels and the receptor location and the extent to which effects coincide with direct sunlight.

Where effects last for more than 3 months per year and more than 60 minutes per day, the impact significance is high, and mitigation is required.

Table 3 on the following page summarises the predicted impact significance and mitigation requirement for the dwelling receptors where solar reflections are geometrically possible. Where no-long term impacts have been identified, short term impacts are deemed to be acceptable. The predicted glare times are based solely on bare-earth terrain i.e. without consideration of screening from buildings and vegetation. The modelling output showing the precise predicted times and the reflecting panel areas is shown in Appendix H.

Cases where mitigation is recommended are shown in red for ease of reference within Table 3 and discussed further in Section 6.4.2.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
1	Yes.	No.	14 (14)	Existing vegetation and terrain. Predicted to significantly obstruct views.	No impact.	N/A	No.
2	Yes.	No.	14 (14)	Existing vegetation, terrain, and buildings. Predicted to significantly obstruct views.	No impact.	N/A	No.
3	No.	Yes.	1 – 5 (1,3,4)	Existing vegetation and proposed planting (VM 20). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
4	No.	Yes.	1 – 5 (1,3,4)	Existing vegetation and building. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
5	Yes.	Yes.	1 – 5 (3,4,5)	Existing vegetation and proposed planting (VM 17 and 19). Existing vegetation predicted to significantly obstruct views of panel areas 3 and 4. Proposed planting (VM 17) predicted to significantly obstruct views of reflecting panels within area 5 when matured.	No long-term impact.	N/A	No.
6	Yes.	No.	6 – 9 (8,9)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
7	Yes.	Yes.	6 – 9 (6,8,9)	Existing vegetation and proposed planting (VM 16). Existing vegetation predicted to significantly obstruct views of panel areas 8 and 9. Existing vegetation and proposed planting predicted to significantly obstruct views of reflecting panels within area 6.	No impact.	N/A	No.
8	Yes.	Yes.	6 – 9 (6,7,8)	Existing vegetation. Predicted to significantly obstruct views of reflecting panels within areas 6 and 8. Views may be possible, for reflecting panels within area 7, despite partial existing vegetation screening.	Moderate.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 246 feet (75m).	Yes.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
9	Yes.	No.	6 – 9 (8)	Proposed planting (VM 24). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
10	Yes.	Yes.	14 – 19 (14,18,19)	Existing vegetation, and terrain and proposed planting (VM 26). Predicted to significantly obstruct views.	No impact.	N/A	No.
11	Yes.	Yes.	14 – 19 (14,17,18,19)	Existing vegetation and terrain. Predicted to significantly obstruct views.	No impact.	N/A	No.
12	Yes.	Yes.	14 – 19 (14,18,19)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
13	Yes.	Yes.	14 – 19 (14,17,18,19)	Existing vegetation. Marginal views may be possible, for reflecting panels within area 17, despite partial screening in the form of existing vegetation.	Low impact.	Existing vegetation is predicted to reduce effects such that a low impact is predicted.	No.
14	Yes.	Yes.	14 – 19 (14,18,19)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
15	Yes.	Yes.	14 – 19 (14,18,19)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
16	Yes.	No.	14 – 19 (18)	Existing vegetation and proposed planting (VM 27). Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
18	Yes.	No.	14 – 19 (16)	Existing vegetation and proposed planting (VM 28). Predicted to significantly obstruct views.	No impact.	N/A	No.
22	Yes.	No.	21 (21)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
29	No.	Yes.	21 – 22 (21)	Proposed planting (VM 40). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
30	No.	Yes.	21 – 22 (21)	Existing vegetation and proposed planting (VM 40). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
31	No.	Yes.	21 – 22 (21)	Proposed planting (VM 40). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
32	Yes.	Yes.	21 – 22 (21,22)	Existing vegetation and proposed planting (VM 40). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
33	Yes.	Yes.	21 – 22 (21,22)	Existing vegetation and proposed planting (VM 40). Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
34	Yes.	Yes.	21 – 22 (21,22)	Existing vegetation, dwelling 33, a building, and proposed planting (VM 40). Predicted to significantly obstruct views.	No impact.	N/A	No.
35	Yes.	Yes.	21 – 22 (21,22)	Existing vegetation and proposed planting (VM 36). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
36	Yes.	Yes.	21 – 22 (21,22)	Existing vegetation and proposed planting (VM 36). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
37	Yes.	Yes.	21 – 22 (21,22)	Existing vegetation and proposed planting (VM 36). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
38	Yes.	Yes.	21 – 22 (21,22)	Proposed planting (VM 36). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
42 – 46	No.	Yes.	21 (21)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
47 – 48	No.	Yes.	22 (22)	Existing vegetation, terrain, and proposed planting (VM 41). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
49	No.	Yes.	22 (22)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
50 – 51	No.	Yes.	22 (22)	Existing vegetation and proposed planting (VM 39). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
57 – 60	No.	Yes.	22 (22)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
61	No.	Yes.	22 – 24 (23,24)	Existing vegetation and terrain. Terrain predicted to obstruct views of reflecting panels within area 24. Marginal views may be possible, for reflecting panels within area 23, despite existing vegetation screening.	Low impact.	N/A	No.
62	No.	Yes.	23,24 (24)	Proposed planting (VM 34). Views may be possible, for reflecting panels within area 24, despite partial screening in the form of proposed planting (VM34).	Moderate.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 705 feet (215m).	Yes.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
63	No.	Yes.	23,24 (24)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
64	No.	Yes.	23,24 (24)	Existing vegetation and proposed planting (VM32). Predicted to significantly obstruct views.	No impact.	N/A	No.
66	Yes.	No.	23,24 (24)	Proposed planting (VM 32). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
67	Yes.	No.	25 (25)	Existing vegetation, buildings, and proposed planting (VM 30). Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
68	Yes.	No.	25 (25)	Existing vegetation, buildings, and terrain. Predicted to significantly obstruct views.	No impact.	N/A	No.
69	Yes.	No.	25 (25)	Existing vegetation, terrain, and proposed planting (VM 30). Predicted to significantly obstruct views.	No impact.	N/A	No.
70 – 71	Yes.	No.	25 (25)	Terrain and proposed planting (VM 30). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
72	Yes.	No.	25 (25)	Existing vegetation and proposed planting (VM 29). Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
73	Yes.	No.	25 (25)	Existing vegetation and terrain. Predicted to significantly obstruct views.	No impact.	N/A	No.
74	Yes.	No.	25 (25)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
75 – 80	No.	Yes.	25 (25)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
82	No.	Yes.	10 (10)	Existing vegetation and terrain. Marginal views may be possible, for reflecting panels within area 10, despite partial screening in the form of existing vegetation and terrain. Views would possibly be limited to observers located on the top floor of this dwelling.	Moderate impact.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 722 feet (220m). Most views of the reflecting panel area will be screened by existing vegetation and terrain which will reduce effects.	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
83	No.	Yes.	10 (10)	Existing vegetation and terrain. Marginal views may be possible, for reflecting panels within area 10, despite partial screening in the form of existing vegetation and terrain.	Moderate impact.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 541 feet (165m). Most views of the reflecting panel area will be screened by existing vegetation and terrain which will reduce effects.	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
84	No.	Yes.	10 (10)	Existing vegetation and terrain. Marginal views may be possible, for reflecting panels within area 10, despite partial screening in the form of existing vegetation and terrain.	Moderate impact.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 935 feet (285m). Most views of the reflecting panel area will be screened by existing vegetation and terrain which will reduce effects.	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
85	No.	Yes.	10 (10)	Existing vegetation and terrain. Marginal views may be possible, for reflecting panels within area 10, despite partial screening in the form of existing vegetation and terrain.	Moderate impact.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 1050 feet (320m). Most views of the reflecting panel area will be screened by existing vegetation and terrain.	No.
86 – 87	Yes.	Yes.	10,26 (10,26)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
88	Yes.	No.	26 (26)	Existing vegetation and proposed planting (VM 8). Predicted to significantly obstruct views.	No impact.	N/A	No.
89 – 90	Yes.	No.	26 (26)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
91 – 93	No.	Yes.	12 (12)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
94	No.	Yes.	10 (10)	Existing vegetation and proposed planting (VM 9). Marginal views may be possible, for reflecting panels within area 10, despite partial screening in the form of existing vegetation. Views would possibly be limited to observers located on the top floor of this dwelling.	Low impact.	Solar reflections would occur within 2hrs of sunrise; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 410 feet (125m). Existing vegetation is predicted to reduce effects such that a low impact is predicted.	No.
95	Yes.	Yes.	10 (10)	Proposed planting (VM 9). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
96	No.	Yes.	10 (10)	Existing vegetation and a building. Predicted to significantly obstruct views.	No impact.	N/A	No.
97	No.	Yes.	10 (10)	Existing vegetation and proposed planting (VM 9). Marginal views may be possible, for reflecting panels within area 10, despite partial screening in the form of existing vegetation and proposed planting (VM9).	Moderate impact.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel, when accounting for VM9, is approximately 1017 feet (310m).	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
98	No.	Yes.	10 (10)	Existing vegetation and proposed planting (VM 10). Marginal views may be possible, for reflecting panels within area 10, despite partial screening in the form of existing vegetation.	Moderate impact.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 984 feet (300m).	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
99	No.	Yes.	10 (10)	Existing vegetation and proposed planting (VM 9). Marginal views may be possible, for reflecting panels within area 10, despite partial screening in the form of existing vegetation and proposed planting (VM9).	Moderate impact.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel, when accounting for VM9, is approximately 804 feet (245m).	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
100 – 101	No.	Yes.	10 (10)	Views may be possible for reflecting panels within area 10.	Moderate impact.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 558 feet (170m).	Yes.
102	No.	Yes.	10 (10)	Existing vegetation and proposed planting (VM10). Views may be possible, for reflecting panels within area 10, despite partial screening in the form of existing vegetation and proposed planting (VM10).	Moderate impact.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 262 feet (80m).	Yes.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
103	No.	Yes.	10 – 12 (10,12)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
104 – 106	No.	Yes.	10 – 12 (10 – 12)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
107 – 108	No.	Yes.	11 – 12 (11 – 12)	Existing vegetation and proposed planting (VM 6). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
109	No.	Yes.	11 – 12 (11 – 12)	Existing vegetation and proposed planting (VM 5). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
110	No.	Yes.	11 – 12 (11 – 12)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
111	No.	Yes.	11 – 12 (11 – 12)	Existing vegetation and a building. Predicted to significantly obstruct views.	No impact.	N/A	No.
112	No.	Yes.	11 – 13 (12)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
113	No.	Yes.	11 – 13 (12,13)	Existing vegetation and proposed planting (VM4). Existing vegetation predicted to obstruct views of reflecting panels within area 12. Views may be possible, for reflecting panels within area 13, despite proposed planting (VM4).	Moderate.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 427 feet (130m).	Yes.
114	No.	Yes.	11 – 13 (12,13)	Existing vegetation and proposed planting (VM3 and VM4). Existing vegetation predicted to obstruct views of reflecting panels within area 12. Views may be possible, for reflecting panels within area 13, despite proposed planting (VM3 and VM4).	Moderate.	Solar reflections would occur within 2hrs of sunset; therefore, effects would likely coincide with direct sunlight. Separation distance between an observer and the nearest reflecting panel is approximately 410 feet (125m).	Yes.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
115 – 117	Yes.	No.	27 (27)	Existing vegetation and terrain. Predicted to significantly obstruct views.	No impact.	N/A	No.
118 – 122	Yes.	No.	12 – 13 (13)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
123 – 129	Yes.	No.	12 – 13 (12 – 13)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
130	No.	Yes.	12 (12)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
132 – 135	No.	Yes.	27 – 29 (27)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
150 – 158	No.	Yes.	30 (30)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
159 – 161	Yes.	No.	30 (30)	Existing vegetation and proposed planting (VM2). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
162	Yes.	No.	30 (30)	Terrain and proposed planting (VM2). Predicted to significantly obstruct views.	No impact.	N/A	No.
163 – 166	Yes.	No.	30 (30)	Terrain. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
168	Yes.	Yes.	10,12 (10,12)	Existing vegetation and proposed planting (VM11 and VM13). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
169	Yes.	Yes.	10 (10)	Existing vegetation and proposed planting (VM15). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
170	Yes.	No.	10,12 (10,12)	Existing vegetation and proposed planting (VM14). Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
171	Yes.	No.	10,12 (10,12)	Existing vegetation, dwelling 170, and proposed planting (VM14). Predicted to significantly obstruct views.	No impact.	N/A	No.
172	Yes.	No.	10,12 (10,12)	Existing vegetation, a building, and proposed planting (VM14). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
173 – 174	Yes.	No.	10,12 (10,12)	Existing vegetation and proposed planting (VM14). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
175	Yes.	No.	10 – 12 (11,12)	Existing vegetation and proposed planting (VM11 and VM12). Predicted to significantly obstruct views when proposed planting matured.	No long-term impact.	N/A	No.
176	Yes.	No.	10,12 (10,12)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
177	Yes.	No.	10 – 12 (10,12)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
178	Yes.	No.	10 – 12 (11,12)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
179 – 180	Yes.	No.	11 (11)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
185	Yes.	Yes.	1 – 5 (4,5)	Existing vegetation and terrain. Existing vegetation predicted to obstruct views of reflecting panels within area 4. Marginal views may be possible, for reflecting panels within area 5, despite partial screening in the form of existing vegetation.	Low impact.	Existing vegetation (if retained between the outer boundary of panel area 5) will reduce effects such that a low impact is predicted.	No.
186	Yes.	No.	1 – 5 (5)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.
187	Yes.	Yes.	1 – 5 (4,5)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Dwelling Receptors	Solar Reflection Geometrically Possible Towards the Dwelling Receptors? (GMT - 5)		Panel areas modelled (Panel areas for which reflections are geometrically possible)	Existing and Proposed Screening (desk-based review)	Predicted Impact Classification	Relevant Factors	Mitigation Recommended
	am	pm					
188	Yes.	No.	1 – 5 (4,5)	Existing vegetation. Predicted to significantly obstruct views.	No impact.	N/A	No.

Table 3 *Assessment of mitigation requirement – dwelling receptors*

6.4 Mitigation Strategy Overview

Ordinarily, mitigation for ground-based receptors is achieved where necessary via screening to obstruct views. Therefore, the optimal strategy may include:

- Provision of screening (planting or opaque fence) at the proposed development boundary.
- Provision of screening (planting or opaque fence) elsewhere between the observer and the reflecting areas.
- Changes to site configuration.

The height and placement of screening should be managed such that views of the reflecting panels are sufficiently obstructed. The required height will depend on the relative elevation of the receptor, the location of the screening itself, and the reflecting panels. The strategy will overlap with other areas of the development process, including landscape and visual impacts. The reflecting areas that should be obscured from view, based on the proposed configuration, has therefore been defined, and the mitigation strategy should address this accordingly.

6.4.1 Roads and Panel Areas to Mitigate

For three sections of road along Cayuga County Route 17B located close to the proposed development, views of the proposed solar development may be possible and within a road user's field of view. For these three sections of road, a moderate impact has been predicted and mitigation has been recommended.

For one section of road along Cayuga County Route 17B on elevated terrain, solar reflections are predicted to originate in front of a road user and proposed screening will not mitigate effects immediately. For this section of road, a high impact is predicted, and mitigation is required.

The predicted visible reflecting panel areas associated with these sections of road (based on the modelling results and consideration of existing screening by terrain[12]) are shown as the yellow areas in Figures 40 to 43[4] on the following pages. The mitigation strategy should obstruct views of these panel areas to sufficiently reduce the level of impact. The potential locations for screening for road receptors 41 to 47, 64 to 65, and 68 to 74 are shown in pink lines[13] within the figures.

For road receptors 48 to 50 screening analysis was undertaken to determine the mitigation strategy due to the relative terrain height at these receptors relative to the panel areas causing reflections (following an initial review of the available imagery and terrain), the sensitivity of the receptors, and the impact significance.

The potential for retention of panels based on an increased screening height of up to 12 feet within VM9 has been evaluated in order to maximise development potential. The results of this analysis are presented within Appendix I and the panel areas for which removal is recommended have been informed by the results.

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[12] Visible terrain based on a realistic but conservative desk-based assessment.
[13] Height calculations for these sections of screening are not presented within this report.

For road receptors 48 to 50, it is recommended that a section of the visible panel area (in front of a road user) is removed and heightened screening plans at 10 to 12 feet (proposed by the applicant) is retained. The purpose of the removal of panels is to remove views of reflecting panels in front of road user and the retention of vegetation planting is to reduce views within a road user's field of view. The identified panels to remove is shown in Figure 44[4]. Further to the mitigation strategy, no significant impacts are predicted for road receptors 48 to 50.

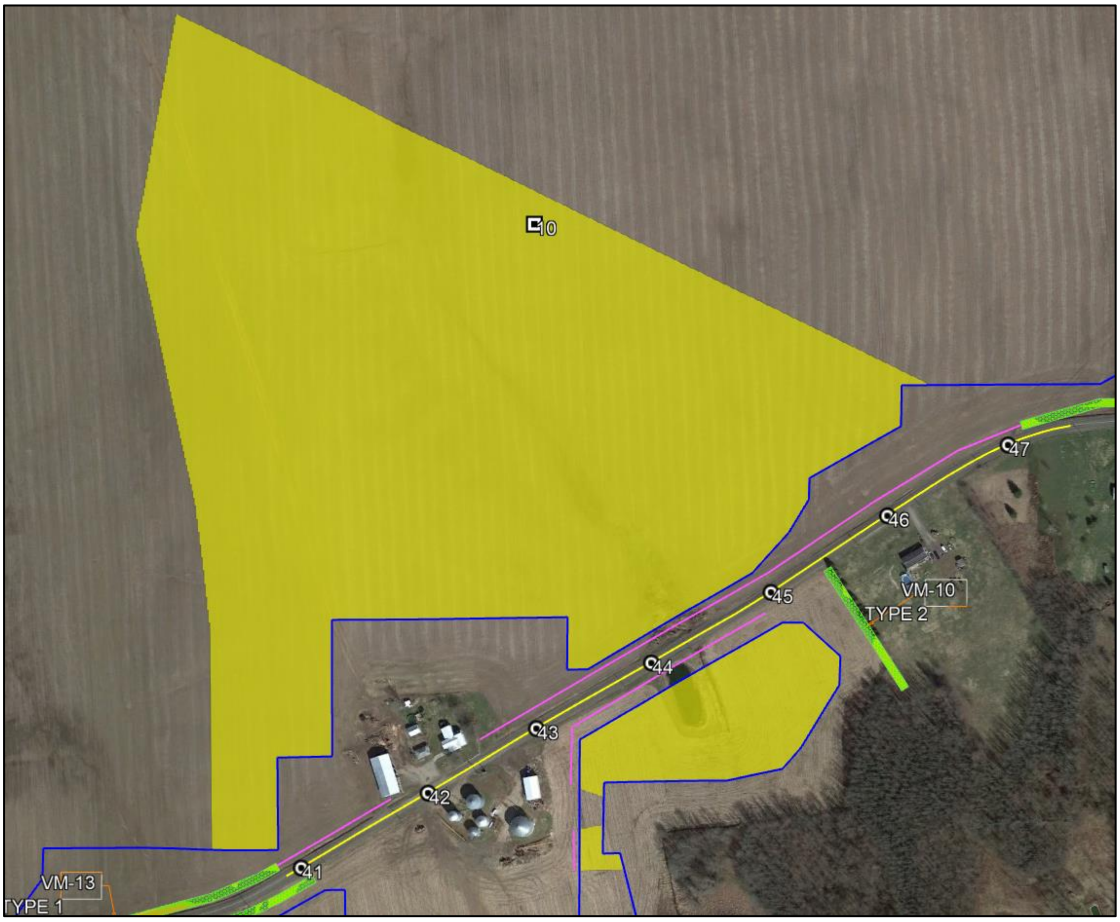

Figure 40 *Predicted visible reflecting areas – road receptors 41 to 47 (moderate impact)*

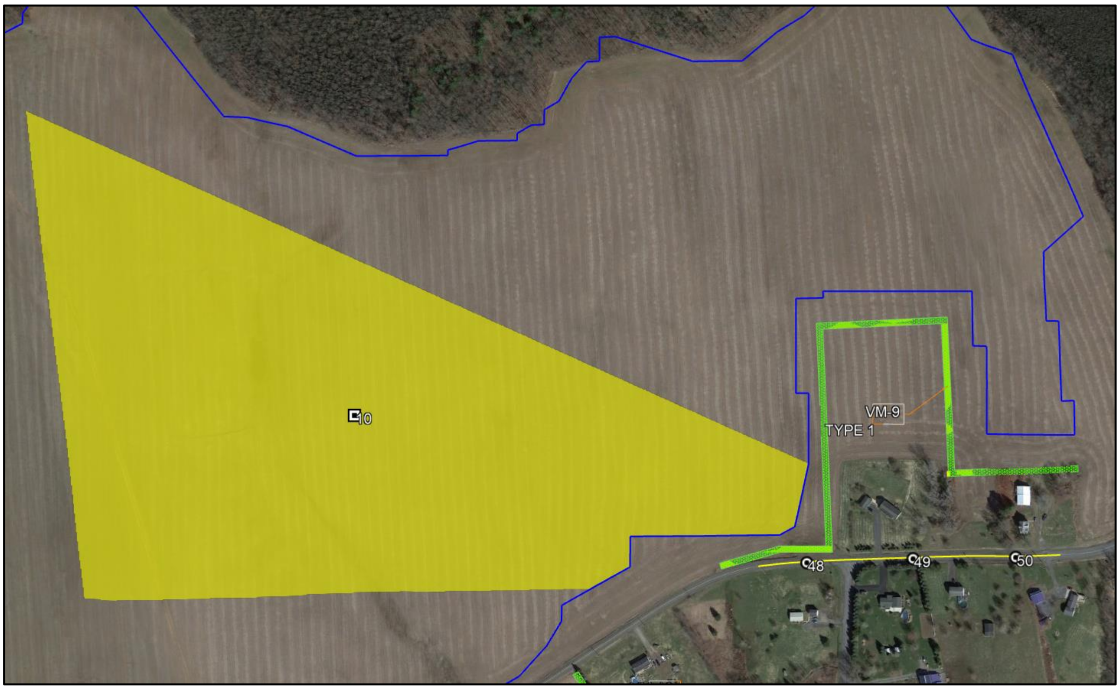

Figure 41 *Predicted visible reflecting area – road receptors 48 to 50 (high impact)*

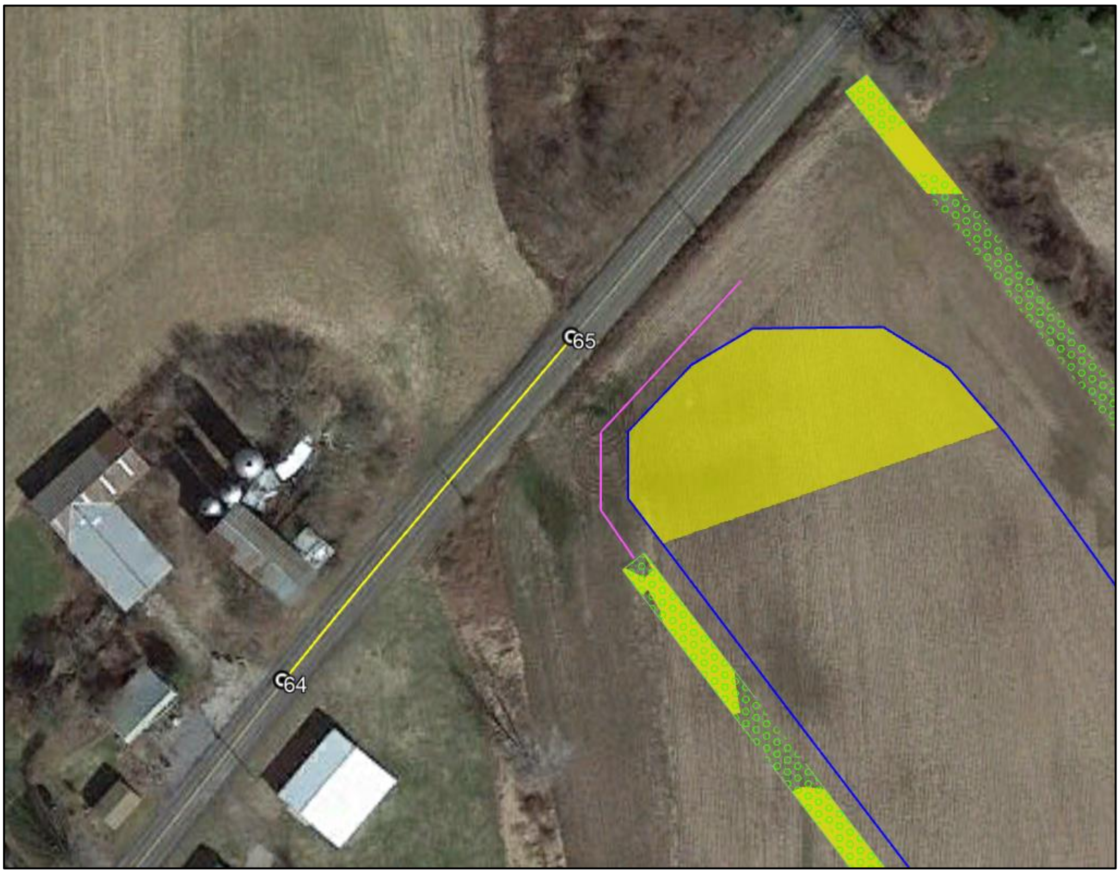

Figure 42 *Predicted visible reflecting area – road receptors 64 to 65 (moderate impact)*

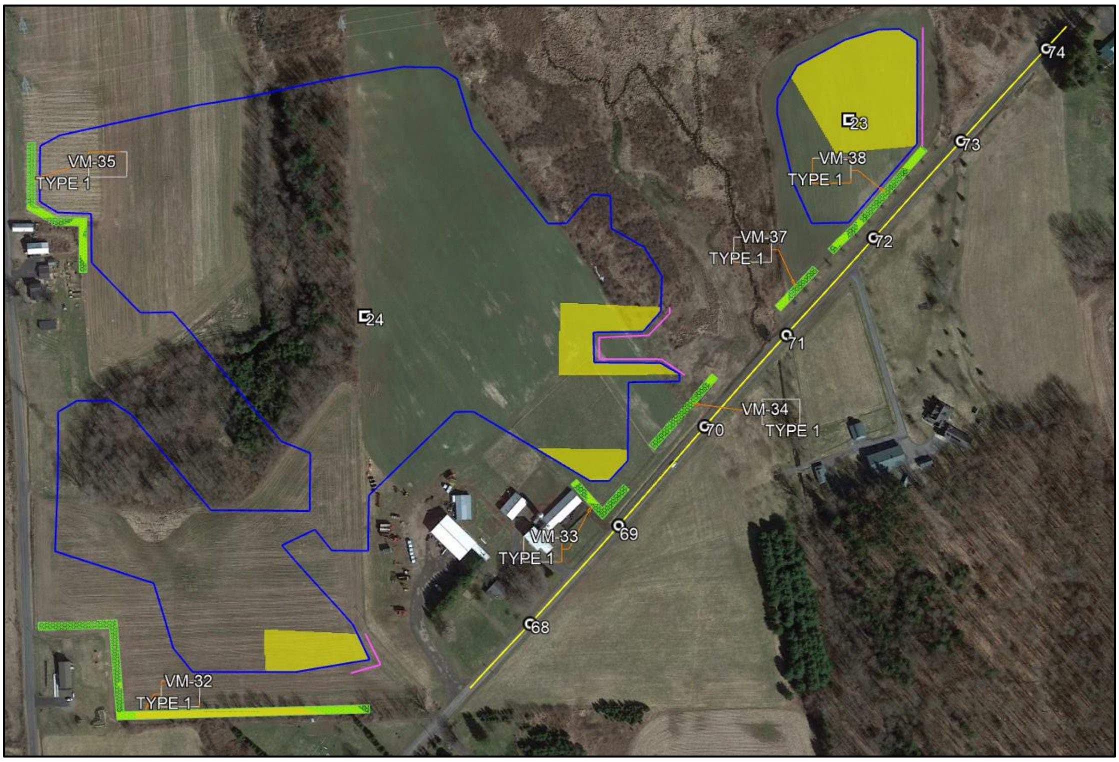

Figure 43 *Predicted visible reflecting areas[14] – road receptors 68 to 74 (moderate impact)*

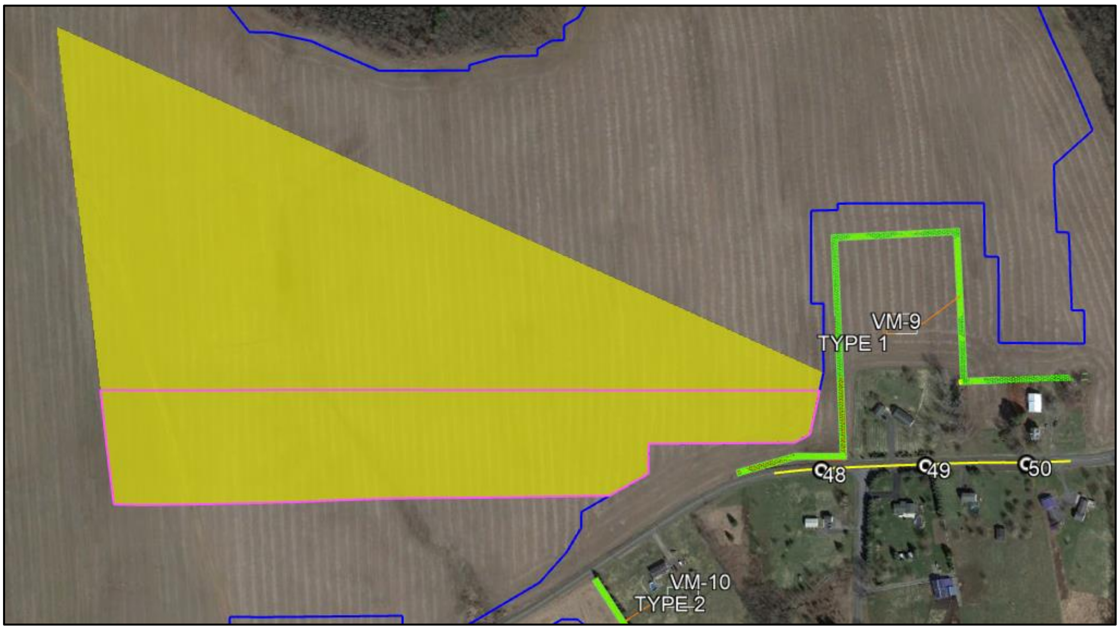

Figure 44 Recommended mitigation strategy for road receptors 48 to 50 - Removal of panel areas (pink outlined area) and retention of heightened screening for VM9

[14] The visible reflecting area between receptors 69 and 70 represents a very small gap in the proposed screening necessary for access to the site and therefore no mitigation screening is considered necessary for this panel area. Mitigation recommendation remains for the other visible reflecting areas between road receptors 68 and 72.

6.4.2 Dwellings and Panel Areas to Mitigate

Mitigation is recommended for seven dwellings located close to the proposed development, where a moderate impact has been predicted. The predicted visible reflecting panel areas associated with these dwellings (based on the modelling results and consideration of existing screening by terrain[15]) shown as the yellow areas in Figures 45 to 52[4] below and on the following pages. The mitigation strategy should obstruct views of these panel areas to sufficiently reduce the level of impact. The potential locations for screening for the identified dwelling receptors are shown in pink lines[16] within the figures.

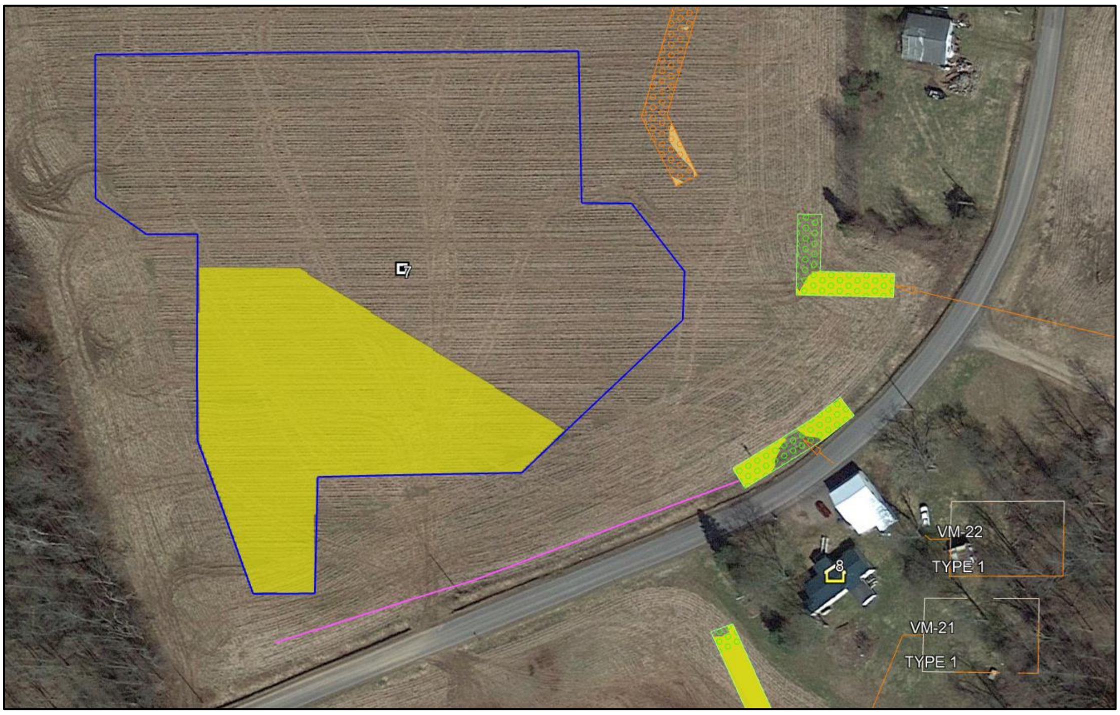

Figure 45 *Predicted visible reflecting area for dwelling 8 (moderate impact)*

[15] Visible terrain based on a realistic but conservative desk-based assessment.

[16] Height calculations for these sections of screening are not presented within this report.

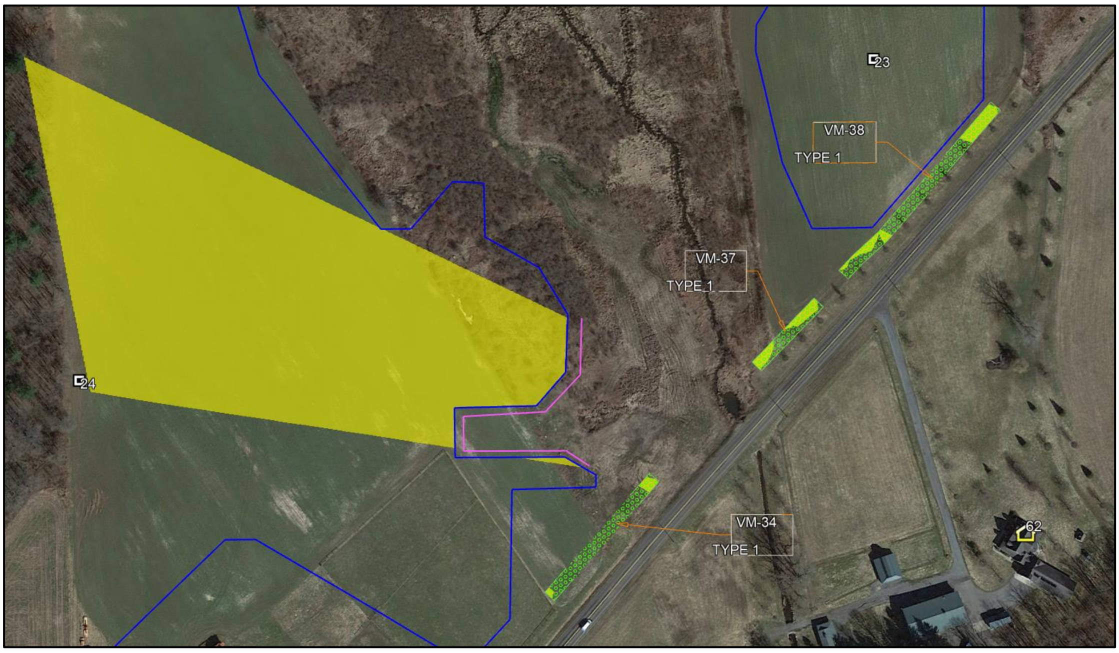

Figure 46 *Predicted visible reflecting area for dwelling 62 (moderate impact)*

Figure 47 *Predicted visible reflecting area for dwellings 100 and 101 (moderate impact)*

Figure 48 *Predicted visible reflecting area for dwelling 102 (moderate impact)*

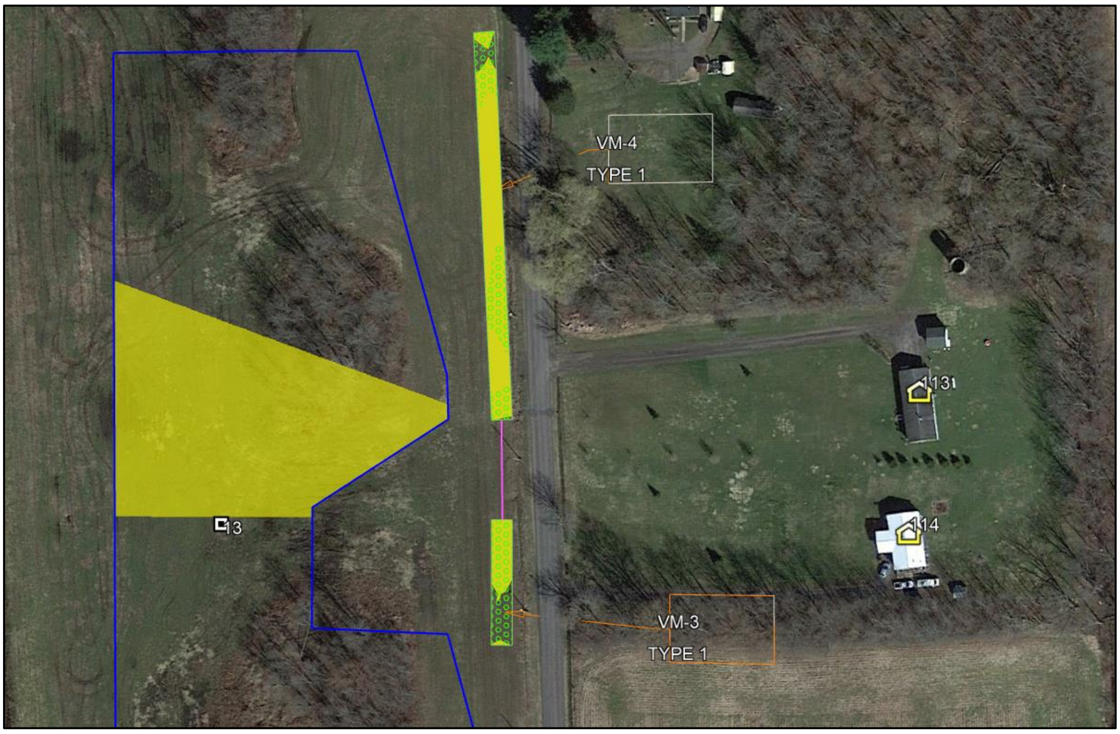

Figure 49 *Predicted visible reflecting area for dwellings 113 and 114 (moderate impact)*

7 OVERALL CONCLUSIONS

7.1 Roads

Most of the roads surrounding the proposed development are considered local roads. Assessment is not recommended for local roads, where traffic densities are likely to be relatively low. Any solar reflections from the proposed development that are experienced by a road user along a local road would be considered low impact in the worst case in accordance with the guidance presented in Appendix D. Only receptors along New York State Route 38 and Cayuga County Route 17B were therefore taken forward for geometric modelling.

The modelling has shown that solar reflections are geometrically possible towards:

- 24 of the 28 modelled road receptors along approximately 1.43 miles of New York State Route 38
- 50 of the 51 modelled road receptors along 3.04 miles of Cayuga County Route 17B.

A conservative review of the available imagery and landscape plan has shown that for most of the receptors where a solar reflection is predicted, screening in the form of existing vegetation, terrain, dwellings, buildings and/or proposed screening will significantly obstruct the views of the reflecting panels or solar reflections will originate from panels which are outside of a road user's field of view. No mitigation requirement was identified for these sections of road.

For three sections of road along Cayuga County Route 17B located close to the proposed development, views of the proposed solar development may be possible and within a road user's field of view. For these three sections of road, a moderate impact has been predicted and mitigation has been recommended.

For one section of road along Cayuga County Route 17B on elevated terrain, solar reflections are predicted to originate in front of a road user and proposed screening will not mitigate effects immediately. For this section of road, a high impact is predicted, and mitigation is required.

7.2 Dwellings

The results of the modelling indicate that solar reflections are geometrically possible towards 149 out of the 167 modelled dwelling receptors.

Following a conservative review of the available imagery and landscape plan a mitigation requirement has not been identified for 142 receptors because:

- Screening in the form of existing vegetation, terrain, dwellings, buildings and/or proposed screening will significantly obstruct the views of the reflecting panels; or
- There is sufficient separation distance between the dwelling and the closest visible reflecting panel to the mitigate the impact; and/or
- Solar reflections would occur within 2hrs of sunrise/sunset; therefore, effects would likely coincide with direct sunlight.

The review has also shown that for seven dwellings located close to the proposed development, views of the reflecting solar panels may be possible, a moderate impact is predicted, and mitigation has been recommended.

7.3 Conclusions

Overall, mitigation has been recommended for seven dwellings and three sections of Cayuga County Route 17B where a moderate impact was predicted. For one section of road located along Cayuga County Route 17B, a high impact has been predicted and mitigation is required.

APPENDIX A – OVERVIEW OF GLINT AND GLARE GUIDANCE

Overview

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

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

UK Planning Policy

The National Planning Policy Framework under the planning practice guidance for Renewable and Low Carbon Energy[17] (specifically regarding the consideration of solar farms, paragraph 013) states:

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

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

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

…

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

…

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

Assessment Process – Ground-Based Receptors

No process for determining and contextualising the effects of glint and glare are, however, provided for assessing the impact of solar reflections upon surrounding roads and dwellings. Therefore, the Pager Power approach is to determine whether a reflection from the proposed solar development is geometrically possible and then to compare the results against the relevant guidance/studies to determine whether the reflection is significant. The Pager Power approach has been informed by the policy presented above, current studies (presented in Appendix B) and

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[17] Renewable and low carbon energy, Ministry of Housing, Communities & Local Government, date: 18 June 2015, accessed on: 17/06/2020

stakeholder consultation. Further information can be found in Pager Power's Glint and Glare Guidance document[18] which was produced due to the absence of existing guidance and a specific standardised assessment methodology.

[18] Pager Power Glint and Glare Guidance, Third Edition (3.1), April 2021.

APPENDIX B – OVERVIEW OF GLINT AND GLARE STUDIES

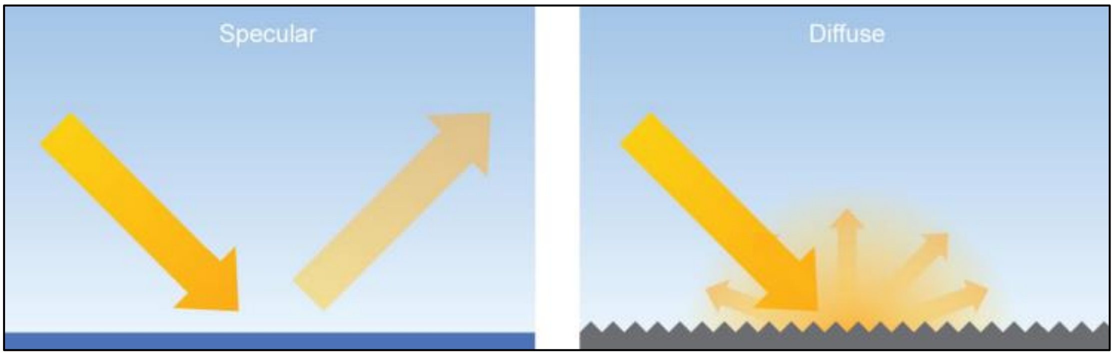
Overview

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

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

Reflection Type from Solar Panels

Based on the surface conditions reflections from light can be specular and diffuse. A specular reflection has a reflection characteristic similar to that of a mirror; a diffuse will reflect the incoming light and scatter it in many directions. The figure below, taken from the FAA guidance[19], illustrates the difference between the two types of reflections. Because solar panels are flat and have a smooth surface most of the light reflected is specular, which means that incident light from a specific direction is reradiated in a specific direction.



Specular and diffuse reflections

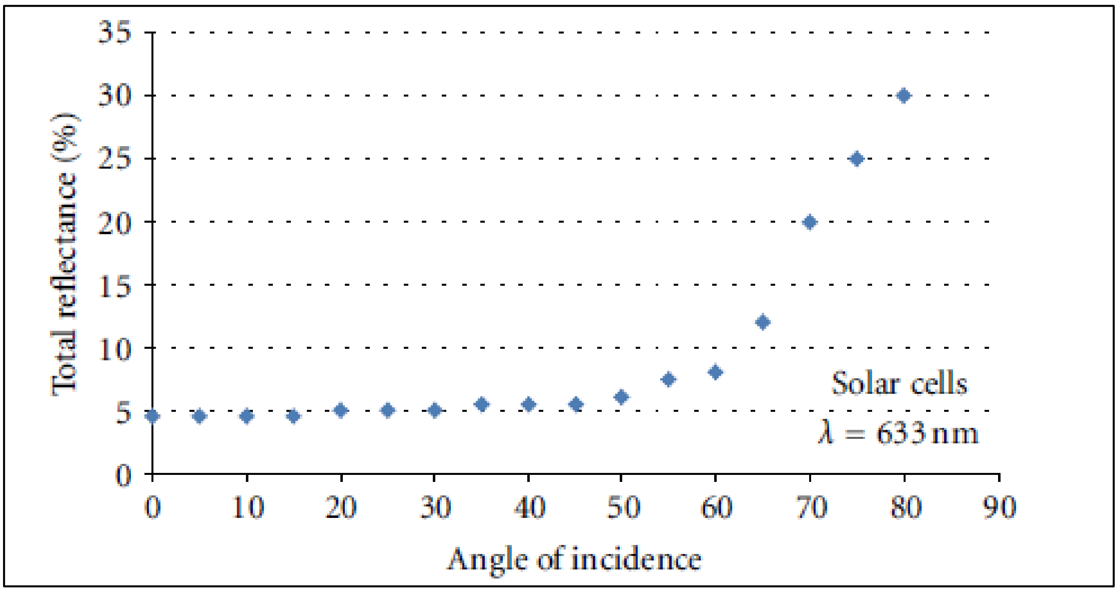
[19] Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration (FAA), date: 04/2018, accessed on: 20/03/2019.

Solar Reflection Studies

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

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

Evan Riley and Scott Olson published in 2011 their study titled: *A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems*[20]". They researched the potential glare that a pilot could experience from a 25 degree fixed tilt PV system located outside of Las Vegas, Nevada. The theoretical glare was estimated using published ocular safety metrics which quantify the potential for a postflash glare after-image. This was then compared to the postflash glare after-image caused by smooth water. The study demonstrated that the reflectance of the solar cell varied with angle of incidence, with maximum values occurring at angles close to 90 degrees. The reflectance values varied from approximately 5% to 30%. This is shown on the figure below.



Total reflectance % when compared to angle of incidence

The conclusions of the research study were:

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

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

FAA Guidance – "Technical Guidance for Evaluating Selected Solar Technologies on Airports"[21]

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

Surface	Approximate Percentage of Light Reflected[22]
Snow	80
White Concrete	77
Bare Aluminium	74
Vegetation	50
Bare Soil	30
Wood Shingle	17
Water	5
Solar Panels	5
Black Asphalt	2

Relative reflectivity of various surfaces

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

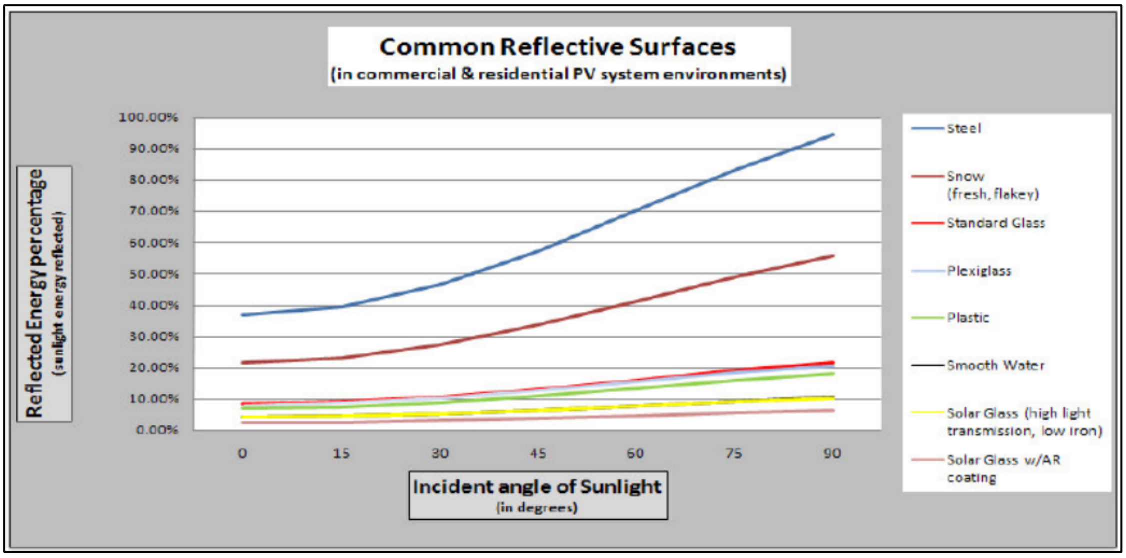
An important comparison in this table is the reflectivity compared to water which will produce a reflection of very similar intensity when compared to that from a solar panel. The study by Riley and Olsen study (2011) also concludes that still water has a very similar reflectivity to solar panels.

[21] Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration (FAA), date: 04/2018, accessed on: 20/03/2019.
[22] Extrapolated data, baseline of 1,000 W/m^2 for incoming sunlight.

SunPower Technical Notification (2009)

SunPower published a technical notification[23] to '*increase awareness concerning the possible glare and reflectance impact of PV Systems on their surrounding environment*'.

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



Common reflective surfaces

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

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

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

APPENDIX C – OVERVIEW OF SUN MOVEMENTS AND RELATIVE REFLECTIONS

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

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

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

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

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

The combination of the Sun's azimuth angle and vertical elevation will affect the direction and angle of the reflection from a reflector.

APPENDIX D – GLINT AND GLARE IMPACT SIGNIFICANCE

Overview

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

Impact Significance Definition

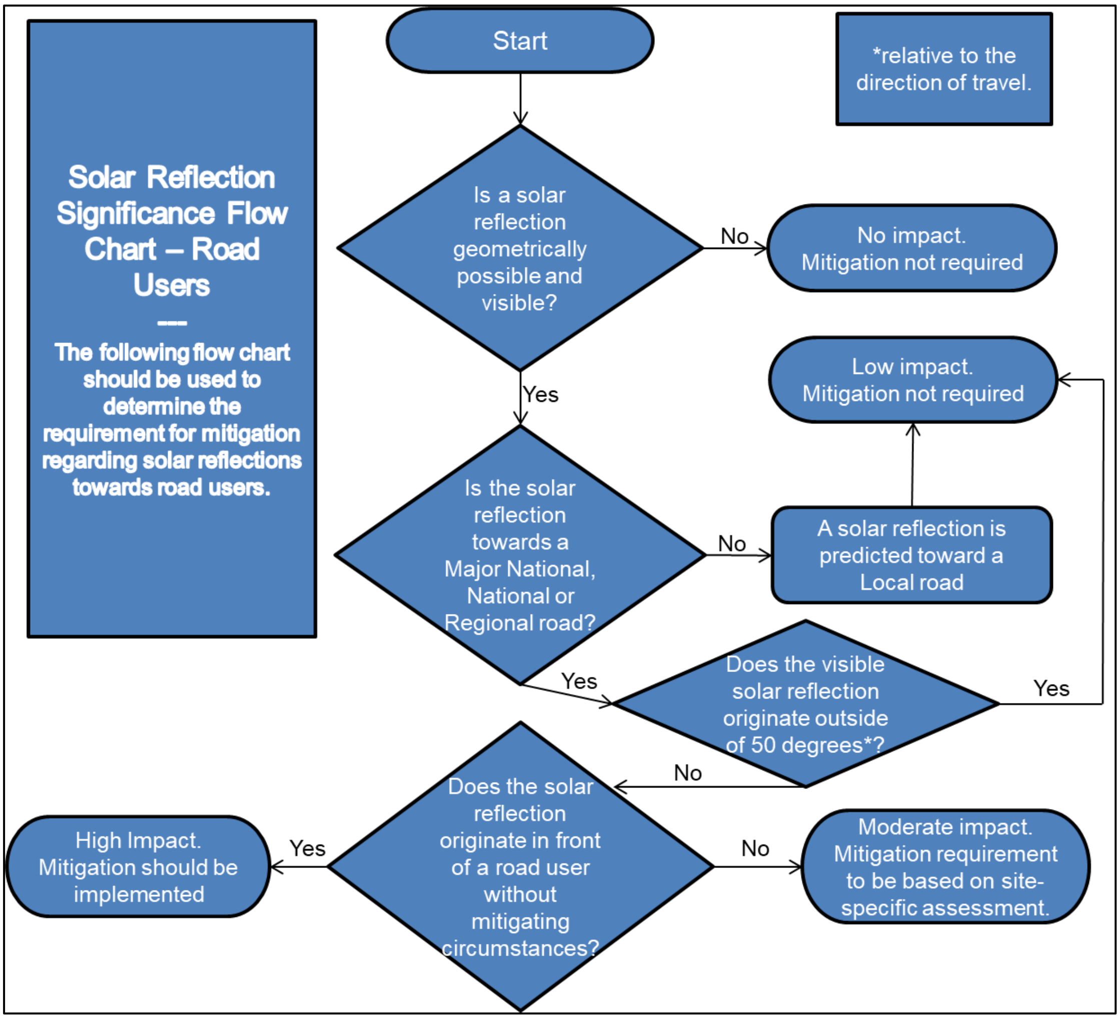
The table below presents the recommended definition of 'impact significance' in glint and glare terms and the requirement for mitigation under each.

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

Impact significance definition

Assessment Process for Road Receptors

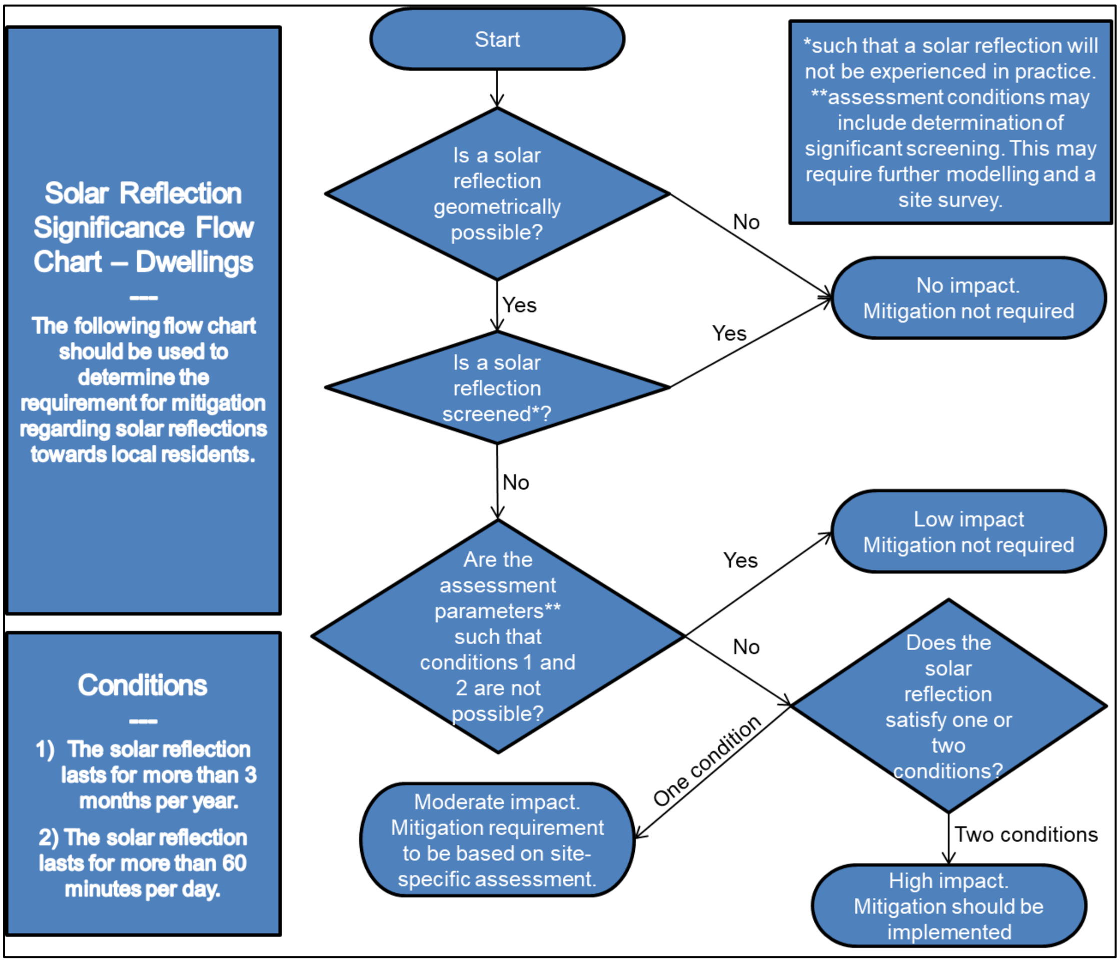
The flow chart presented below has been followed when determining the mitigation requirement for road receptors.



Road user impact significance flow chart

Assessment Process for Dwelling Receptors

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



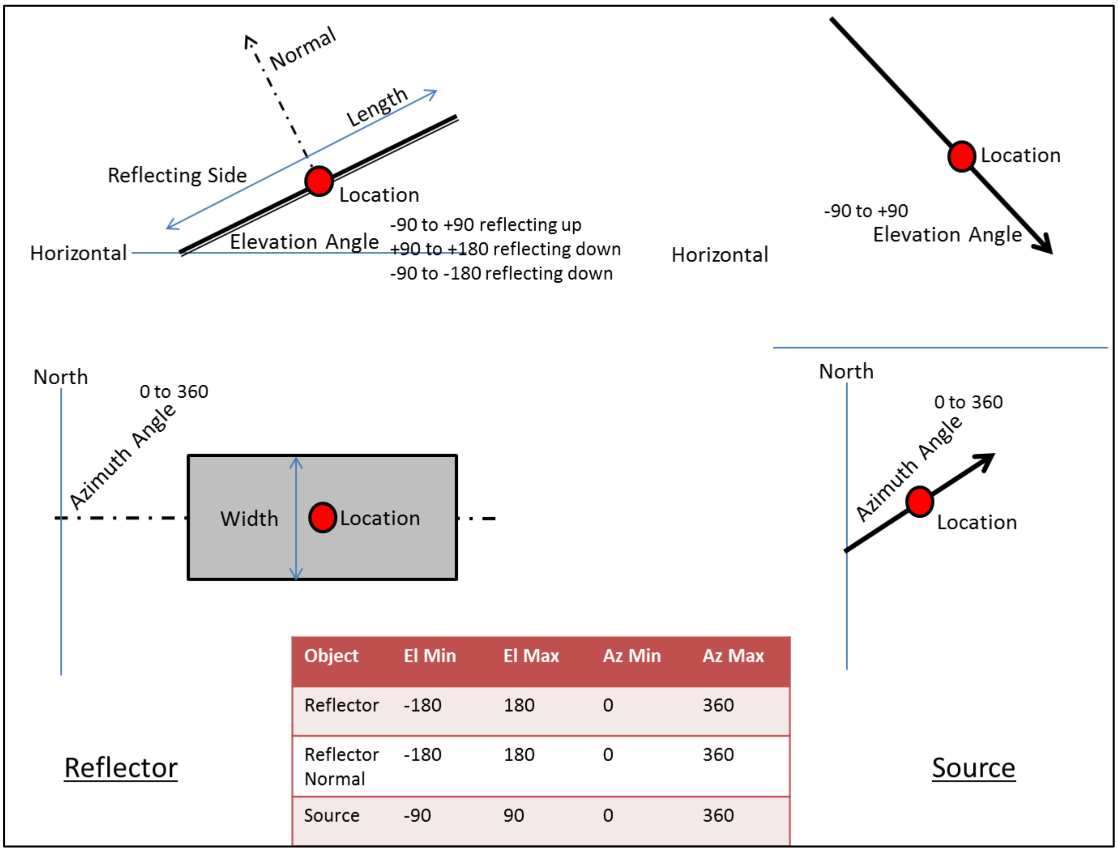
Dwelling impact significance flow chart

APPENDIX E – PAGER POWER'S REFLECTION CALCULATIONS METHODOLOGY

The calculations are three dimensional and complex, accounting for:

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

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



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

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

- Use the Latitude and Longitude of reflector as the reference for calculation purposes;
- Calculate the Azimuth and Elevation of the normal to the reflector;

- Calculate the 3D angle between the source and the normal;
- If this angle is less than 90 degrees a reflection will occur. If it is greater than 90 degrees no reflection will occur because the source is behind the reflector;
- Calculate the Azimuth and Elevation of the reflection in accordance with the following:
    - The angle between source and normal is equal to angle between normal and reflection;
    - Source, Normal and Reflection are in the same plane.

APPENDIX F – ASSESSMENT LIMITATIONS AND ASSUMPTIONS

Pager Power's Model

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

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

The model considers terrain between the reflecting solar panels and the visible horizon (where the sun may be obstructed from view of the panels)[24].

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

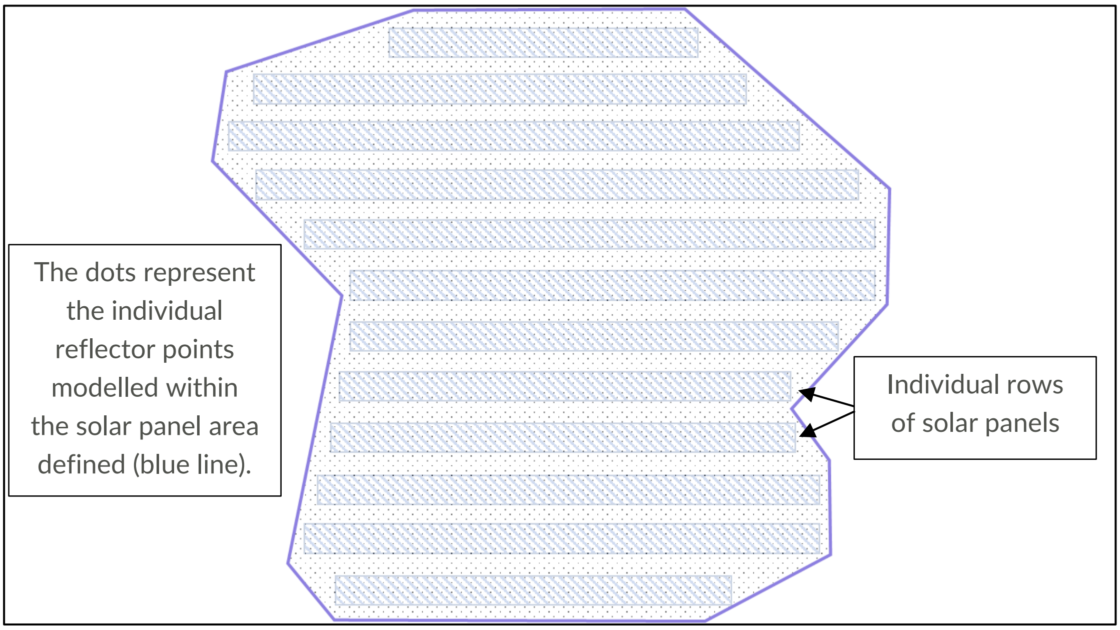
It is assumed that the panel azimuth angle assessed represents the azimuth angle for all of the panels within each solar panel area defined.

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

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

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

[24] UK only.



Solar panel area modelling overview

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

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

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

APPENDIX G – RECEPTOR AND REFLECTOR AREA DETAILS

Terrain Height

Ground heights are interpolated based on SRTM Panorama data.

Road Receptor Data

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	-76.64929	43.14722	43	-76.62334	43.13060
2	-76.64923	43.14631	44	-76.62230	43.13103
3	-76.64918	43.14541	45	-76.62123	43.13149
4	-76.64913	43.14453	46	-76.62018	43.13200
5	-76.64908	43.14362	47	-76.61911	43.13247
6	-76.64903	43.14274	48	-76.61795	43.13263
7	-76.64897	43.14186	49	-76.61670	43.13267
8	-76.64891	43.14095	50	-76.61551	43.13270
9	-76.64884	43.14004	51	-76.61427	43.13279
10	-76.64879	43.13916	52	-76.61333	43.13339
11	-76.64873	43.13818	53	-76.61248	43.13400
12	-76.64868	43.13737	54	-76.61158	43.13464
13	-76.64862	43.13640	55	-76.61091	43.13541
14	-76.64856	43.13559	56	-76.61050	43.13622
15	-76.64852	43.13468	57	-76.60965	43.13681
16	-76.64855	43.13380	58	-76.60857	43.13728
17	-76.64860	43.13291	59	-76.60758	43.13783
18	-76.64864	43.13201	60	-76.60671	43.13842
19	-76.64862	43.13112	61	-76.60579	43.13905
20	-76.64857	43.13022	62	-76.60488	43.13968
21	-76.64852	43.12934	63	-76.60412	43.14034

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
22	-76.64847	43.12841	64	-76.60336	43.14107
23	-76.64841	43.12750	65	-76.60260	43.14174
24	-76.64834	43.12662	66	-76.60177	43.14243
25	-76.64827	43.12574	67	-76.60093	43.14311
26	-76.64819	43.12486	68	-76.60012	43.14374
27	-76.64813	43.12395	69	-76.59927	43.14442
28	-76.64808	43.12338	70	-76.59845	43.14511
29	-76.63720	43.12377	71	-76.59765	43.14575
30	-76.63644	43.12444	72	-76.59681	43.14644
31	-76.63558	43.12517	73	-76.59597	43.14712
32	-76.63478	43.12581	74	-76.59517	43.14776
33	-76.63398	43.12645	75	-76.59433	43.14844
34	-76.63311	43.12711	76	-76.59357	43.14911
35	-76.63216	43.12770	77	-76.59314	43.14996
36	-76.63119	43.12821	78	-76.59308	43.15083
37	-76.63008	43.12862	79	-76.59309	43.15175
38	-76.62894	43.12888	80	-76.59308	43.15266
39	-76.62773	43.12911	81	-76.59305	43.15353
40	-76.62658	43.12933	82	-76.59270	43.15440
41	-76.62544	43.12970	83	-76.59208	43.15490
42	-76.62431	43.13019			

Road Receptor Data

Dwelling Receptor Data

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
1	-76.64947	43.14557	95	-76.61700	43.13308
2	-76.64879	43.14393	96	-76.61485	43.13229

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
3	-76.64834	43.13841	97	-76.61619	43.13237
4	-76.64665	43.13838	98	-76.61648	43.13155
5	-76.64761	43.13641	99	-76.61696	43.13227
6	-76.63460	43.13894	100	-76.61788	43.13217
7	-76.63336	43.13929	101	-76.61808	43.13214
8	-76.63055	43.14006	102	-76.61994	43.13171
9	-76.63017	43.14178	103	-76.61843	43.12911
10	-76.62795	43.14592	104	-76.61840	43.12783
11	-76.62679	43.14692	105	-76.61826	43.12736
12	-76.62589	43.14664	106	-76.61765	43.12630
13	-76.62466	43.14742	107	-76.61849	43.12245
14	-76.62339	43.14701	108	-76.61851	43.12192
15	-76.62246	43.14703	109	-76.61873	43.11937
16	-76.62355	43.14874	110	-76.61880	43.11873
17	-76.62353	43.14947	111	-76.61722	43.11877
18	-76.62503	43.15139	112	-76.61781	43.11785
19	-76.62479	43.15229	113	-76.61698	43.11681
20	-76.62435	43.15317	114	-76.61702	43.11645
21	-76.62546	43.15369	115	-76.61789	43.11261
22	-76.62174	43.15345	116	-76.61844	43.11255
23	-76.60662	43.15999	117	-76.61842	43.11214
24	-76.60576	43.15992	118	-76.62213	43.11437
25	-76.60490	43.15900	119	-76.62297	43.11448
26	-76.60555	43.15847	120	-76.62336	43.11435
27	-76.60528	43.15736	121	-76.62409	43.11474
28	-76.60639	43.15708	122	-76.62953	43.11444

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
29	-76.60591	43.15381	123	-76.62908	43.11544
30	-76.60670	43.15332	124	-76.63100	43.11525
31	-76.60676	43.15291	125	-76.63058	43.11604
32	-76.60541	43.15237	126	-76.63176	43.11656
33	-76.60651	43.15191	127	-76.63261	43.11602
34	-76.60518	43.15153	128	-76.63294	43.11656
35	-76.60531	43.15054	129	-76.63242	43.11717
36	-76.60523	43.14997	130	-76.60674	43.12058
37	-76.60512	43.14946	131	-76.59283	43.12171
38	-76.60511	43.14890	132	-76.59473	43.11070
39	-76.60488	43.14604	133	-76.59668	43.10984
40	-76.59821	43.15915	134	-76.59723	43.11048
41	-76.59738	43.15707	135	-76.59791	43.11031
42	-76.59699	43.15454	136	-76.59749	43.10968
43	-76.59595	43.15427	137	-76.59925	43.10906
44	-76.59678	43.15374	138	-76.60174	43.11064
45	-76.59657	43.15323	139	-76.60200	43.10932
46	-76.59568	43.15329	140	-76.60311	43.10983
47	-76.59617	43.15250	141	-76.60421	43.10900
48	-76.59612	43.15194	142	-76.60433	43.10870
49	-76.59489	43.15120	143	-76.60448	43.10773
50	-76.59466	43.15019	144	-76.61752	43.11002
51	-76.59454	43.14977	145	-76.61820	43.10955
52	-76.59258	43.15494	146	-76.61731	43.10943
53	-76.59326	43.15463	147	-76.61773	43.10858
54	-76.59341	43.15345	148	-76.61733	43.10751

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
55	-76.59280	43.15313	149	-76.61680	43.10646
56	-76.59350	43.15280	150	-76.61539	43.10253
57	-76.59343	43.15200	151	-76.61482	43.10038
58	-76.59278	43.15190	152	-76.61339	43.10007
59	-76.59329	43.15141	153	-76.61235	43.10012
60	-76.59279	43.15111	154	-76.61381	43.09935
61	-76.59454	43.14776	155	-76.61443	43.09913
62	-76.59621	43.14519	156	-76.61430	43.09891
63	-76.60043	43.14396	157	-76.61419	43.09713
64	-76.60080	43.14270	158	-76.61507	43.09694
65	-76.60197	43.14262	159	-76.61873	43.09766
66	-76.60455	43.14336	160	-76.61957	43.09763
67	-76.60418	43.14072	161	-76.61957	43.09782
68	-76.60557	43.13975	162	-76.62186	43.09746
69	-76.60548	43.13888	163	-76.62177	43.09667
70	-76.60398	43.13844	164	-76.62340	43.09636
71	-76.60373	43.13753	165	-76.62482	43.09648
72	-76.60286	43.13696	166	-76.62550	43.09708
73	-76.60777	43.13794	167	-76.62410	43.13051
74	-76.60745	43.13721	168	-76.62707	43.12900
75	-76.59126	43.13865	169	-76.62999	43.13173
76	-76.59122	43.13843	170	-76.63045	43.13031
77	-76.59115	43.13812	171	-76.63126	43.13020
78	-76.59117	43.13778	172	-76.63088	43.12977
79	-76.59142	43.13637	173	-76.63035	43.12935
80	-76.59165	43.13526	174	-76.62975	43.12902

No.	Longitude (°)	Latitude (°)	No.	Longitude (°)	Latitude (°)
81	-76.60193	43.13299	175	-76.62966	43.12853
82	-76.61183	43.13529	176	-76.63066	43.12882
83	-76.61287	43.13428	177	-76.63169	43.12863
84	-76.61131	43.13418	178	-76.63245	43.12725
85	-76.61094	43.13301	179	-76.63562	43.12549
86	-76.61088	43.13232	180	-76.63616	43.12507
87	-76.61076	43.13150	181	-76.64736	43.12481
88	-76.60950	43.13128	182	-76.64864	43.12423
89	-76.60918	43.12963	183	-76.64840	43.12394
90	-76.61016	43.12922	184	-76.64828	43.13110
91	-76.60933	43.12749	185	-76.65043	43.13129
92	-76.60794	43.12641	186	-76.65134	43.13121
93	-76.60909	43.12580	187	-76.65116	43.13169
94	-76.61543	43.13295	188	-76.65524	43.13161

Dwelling Receptor Data

Panel Area Data

Area 1

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.65451	43.14270	10	-76.64920	43.14077
2	-76.65384	43.14277	11	-76.65002	43.14076
3	-76.65167	43.14277	12	-76.65003	43.14049
4	-76.65151	43.14263	13	-76.65070	43.14035
5	-76.65130	43.14188	14	-76.65482	43.13958
6	-76.65020	43.14187	15	-76.65517	43.13958
7	-76.64987	43.14180	16	-76.65533	43.14008
8	-76.64937	43.14159	17	-76.65532	43.14061

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
9	-76.64920	43.14096	18	-76.65499	43.14117

Panel Area Data – Area 1

Area 2

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.65027	43.14285	4	-76.64978	43.14230
2	-76.64943	43.14285	5	-76.65028	43.14252
3	-76.64943	43.14231			

Panel Area Data – Area 2

Area 3

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.65622	43.13849	11	-76.65502	43.13586
2	-76.65604	43.13856	12	-76.65503	43.13475
3	-76.65340	43.13905	13	-76.65521	43.13433
4	-76.65288	43.13905	14	-76.65537	43.13419
5	-76.65288	43.13899	15	-76.65554	43.13419
6	-76.65324	43.13872	16	-76.65587	43.13427
7	-76.65339	43.13851	17	-76.65588	43.13558
8	-76.65421	43.13663	18	-76.65606	43.13558
9	-76.65486	43.13618	19	-76.65605	43.13829
10	-76.65487	43.13587	20	-76.65622	43.13829

Panel Area Data – Area 3

Area 4

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.65257	43.13872	20	-76.64890	43.13304
2	-76.65189	43.13894	21	-76.64908	43.13304
3	-76.64942	43.13942	22	-76.65121	43.13339
4	-76.64924	43.13942	23	-76.65121	43.13297

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
5	-76.64924	43.13896	24	-76.65366	43.13281
6	-76.64955	43.13842	25	-76.65367	43.13263
7	-76.64955	43.13812	26	-76.65415	43.13253
8	-76.64940	43.13811	27	-76.65417	43.13227
9	-76.64940	43.13804	28	-76.65437	43.13227
10	-76.64955	43.13803	29	-76.65437	43.13261
11	-76.64956	43.13627	30	-76.65404	43.13331
12	-76.64940	43.13622	31	-76.65339	43.13332
13	-76.64891	43.13539	32	-76.65339	43.13408
14	-76.64891	43.13513	33	-76.65419	43.13408
15	-76.64909	43.13499	34	-76.65435	43.13401
16	-76.64972	43.13498	35	-76.65470	43.13401
17	-76.64972	43.13463	36	-76.65470	43.13428
18	-76.64907	43.13463	37	-76.65289	43.13844
19	-76.64890	43.13449			

Panel Area Data – Area 4

Area 5

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.64820	43.13559	32	-76.63827	43.12998
2	-76.64711	43.13560	33	-76.63946	43.12998
3	-76.64690	43.13573	34	-76.63947	43.13080
4	-76.64656	43.13574	35	-76.63929	43.13080
5	-76.64656	43.13580	36	-76.63930	43.13192
6	-76.64640	43.13580	37	-76.64025	43.13192
7	-76.64640	43.13692	38	-76.64025	43.13172
8	-76.64459	43.13692	39	-76.64075	43.13059

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
9	-76.64459	43.13775	40	-76.64121	43.13059
10	-76.64474	43.13775	41	-76.64122	43.13011
11	-76.64474	43.13796	42	-76.64171	43.13011
12	-76.64308	43.13802	43	-76.64173	43.12844
13	-76.63909	43.13803	44	-76.64157	43.12844
14	-76.63911	43.13699	45	-76.64157	43.12810
15	-76.63927	43.13699	46	-76.64191	43.12803
16	-76.63927	43.13664	47	-76.64554	43.12790
17	-76.63893	43.13664	48	-76.64604	43.12790
18	-76.63894	43.13386	49	-76.64620	43.12921
19	-76.63844	43.13386	50	-76.64656	43.13039
20	-76.63827	43.13370	51	-76.64669	43.13039
21	-76.63812	43.13337	52	-76.64703	43.13053
22	-76.63811	43.13309	53	-76.64704	43.13140
23	-76.63779	43.13309	54	-76.64736	43.13158
24	-76.63745	43.13294	55	-76.64767	43.13184
25	-76.63729	43.13267	56	-76.64819	43.13185
26	-76.63729	43.13227	57	-76.64819	43.13441
27	-76.63810	43.13226	58	-76.64802	43.13441
28	-76.63810	43.13046	59	-76.64802	43.13510
29	-76.63794	43.13046	60	-76.64737	43.13510
30	-76.63795	43.13012	61	-76.64737	43.13546
31	-76.63827	43.13012	62	-76.64819	43.13546

Panel Area Data – Area 5

Area 6

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.63607	43.14189	6	-76.63489	43.14036
2	-76.63555	43.14189	7	-76.63489	43.13969
3	-76.63555	43.14114	8	-76.63539	43.13948
4	-76.63539	43.14113	9	-76.63606	43.13948
5	-76.63505	43.14078			

Panel Area Data – Area 6

Area 7

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.63289	43.14128	8	-76.63219	43.14031
2	-76.63136	43.14129	9	-76.63220	43.14004
3	-76.63135	43.14094	10	-76.63239	43.14004
4	-76.63120	43.14094	11	-76.63257	43.14040
5	-76.63103	43.14078	12	-76.63256	43.14087
6	-76.63103	43.14067	13	-76.63272	43.14087
7	-76.63154	43.14032	14	-76.63288	43.14095

Panel Area Data – Area 7

Area 8

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.62887	43.14325	16	-76.62934	43.14076
2	-76.62869	43.14325	17	-76.62903	43.14076
3	-76.62852	43.14290	18	-76.62903	43.14098
4	-76.62851	43.14256	19	-76.62920	43.14098
5	-76.62803	43.14256	20	-76.62920	43.14138
6	-76.62786	43.14234	21	-76.62904	43.14138
7	-76.62786	43.14180	22	-76.62904	43.14222
8	-76.62801	43.14180	23	-76.62920	43.14223

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
9	-76.62802	43.14084	24	-76.62920	43.14250
10	-76.62884	43.14072	25	-76.62936	43.14250
11	-76.62884	43.14063	26	-76.62936	43.14284
12	-76.62918	43.14050	27	-76.62920	43.14284
13	-76.62935	43.14049	28	-76.62920	43.14318
14	-76.62953	43.14057	29	-76.62887	43.14318
15	-76.62953	43.14068			

Panel Area Data – Area 8

Area 9

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.63198	43.13923	15	-76.63029	43.13668
2	-76.63097	43.13923	16	-76.63113	43.13598
3	-76.63079	43.13916	17	-76.63260	43.13575
4	-76.63078	43.13889	18	-76.63260	43.13563
5	-76.63046	43.13889	19	-76.63292	43.13539
6	-76.63046	43.13814	20	-76.63293	43.13515
7	-76.63079	43.13789	21	-76.63311	43.13508
8	-76.63080	43.13765	22	-76.63329	43.13507
9	-76.63177	43.13725	23	-76.63329	43.13597
10	-76.63177	43.13709	24	-76.63198	43.13598
11	-76.63096	43.13708	25	-76.63199	43.13688
12	-76.63079	43.13700	26	-76.63214	43.13688
13	-76.63079	43.13674	27	-76.63214	43.13826
14	-76.63029	43.13674	28	-76.63197	43.13826

Panel Area Data – Area 9

Area 10

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.63230	43.13451	46	-76.61496	43.13404
2	-76.63165	43.13451	47	-76.61480	43.13404
3	-76.63165	43.13509	48	-76.61480	43.13375
4	-76.63083	43.13562	49	-76.61584	43.13375
5	-76.62967	43.13621	50	-76.61584	43.13451
6	-76.62967	43.13632	51	-76.61600	43.13452
7	-76.62849	43.13694	52	-76.61600	43.13499
8	-76.62807	43.13695	53	-76.61776	43.13499
9	-76.62781	43.13718	54	-76.61776	43.13494
10	-76.62737	43.13734	55	-76.61808	43.13493
11	-76.62736	43.13744	56	-76.61809	43.13410
12	-76.62702	43.13777	57	-76.61793	43.13410
13	-76.62668	43.13777	58	-76.61793	43.13348
14	-76.62601	43.13749	59	-76.61810	43.13293
15	-76.62497	43.13653	60	-76.61828	43.13286
16	-76.62469	43.13653	61	-76.62007	43.13285
17	-76.62420	43.13645	62	-76.62007	43.13258
18	-76.62337	43.13619	63	-76.62089	43.13224
19	-76.62227	43.13619	64	-76.62089	43.13210
20	-76.62227	43.13624	65	-76.62107	43.13188
21	-76.62190	43.13632	66	-76.62140	43.13161
22	-76.62143	43.13632	67	-76.62289	43.13098
23	-76.62143	43.13638	68	-76.62308	43.13098
24	-76.62126	43.13645	69	-76.62307	43.13132
25	-76.62110	43.13646	70	-76.62517	43.13132

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
26	-76.62110	43.13659	71	-76.62517	43.13042
27	-76.62093	43.13666	72	-76.62566	43.13041
28	-76.62077	43.13687	73	-76.62566	43.12980
29	-76.62059	43.13701	74	-76.62781	43.12979
30	-76.62044	43.13702	75	-76.62781	43.12959
31	-76.62044	43.13722	76	-76.62815	43.12924
32	-76.62025	43.13723	77	-76.62832	43.12918
33	-76.61931	43.13702	78	-76.62868	43.12917
34	-76.61871	43.13703	79	-76.62868	43.13062
35	-76.61829	43.13728	80	-76.62885	43.13061
36	-76.61796	43.13743	81	-76.62886	43.13256
37	-76.61713	43.13799	82	-76.63244	43.13243
38	-76.61697	43.13805	83	-76.63313	43.13243
39	-76.61679	43.13805	84	-76.63313	43.13375
40	-76.61596	43.13721	85	-76.63295	43.13388
41	-76.61546	43.13708	86	-76.63278	43.13395
42	-76.61462	43.13565	87	-76.63246	43.13395
43	-76.61512	43.13534	88	-76.63247	43.13409
44	-76.61512	43.13473	89	-76.63230	43.13409
45	-76.61496	43.13473			

Panel Area Data – Area 10

Area 11

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.62860	43.12863	22	-76.62494	43.12396
2	-76.62809	43.12863	23	-76.62478	43.12383
3	-76.62792	43.12855	24	-76.62478	43.12376

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
4	-76.62792	43.12828	25	-76.62462	43.12376
5	-76.62759	43.12828	26	-76.62462	43.12343
6	-76.62741	43.12819	27	-76.62495	43.12301
7	-76.62741	43.12814	28	-76.62561	43.12246
8	-76.62709	43.12814	29	-76.62612	43.12217
9	-76.62709	43.12801	30	-76.62726	43.12162
10	-76.62725	43.12801	31	-76.62760	43.12162
11	-76.62725	43.12760	32	-76.62778	43.12170
12	-76.62741	43.12759	33	-76.62810	43.12218
13	-76.62741	43.12551	34	-76.62811	43.12334
14	-76.62726	43.12551	35	-76.62794	43.12335
15	-76.62725	43.12502	36	-76.62794	43.12467
16	-76.62710	43.12502	37	-76.62809	43.12467
17	-76.62676	43.12488	38	-76.62827	43.12489
18	-76.62643	43.12459	39	-76.62844	43.12614
19	-76.62626	43.12445	40	-76.62843	43.12858
20	-76.62577	43.12425	41	-76.62860	43.12858
21	-76.62561	43.12425			

Panel Area Data – Area 11

Area 12

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.62593	43.12925	35	-76.61864	43.12073
2	-76.62524	43.12954	36	-76.61864	43.12046
3	-76.62507	43.12954	37	-76.61978	43.12045
4	-76.62507	43.12913	38	-76.61979	43.12024
5	-76.62296	43.12913	39	-76.61946	43.12024

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
6	-76.62296	43.13051	40	-76.61946	43.11997
7	-76.62113	43.13129	41	-76.61963	43.11983
8	-76.62094	43.13129	42	-76.62043	43.11983
9	-76.62060	43.13106	43	-76.62045	43.11948
10	-76.62061	43.13087	44	-76.62093	43.11948
11	-76.62096	43.13046	45	-76.62095	43.11928
12	-76.62113	43.13032	46	-76.62129	43.11921
13	-76.62162	43.13024	47	-76.62242	43.11919
14	-76.62274	43.13023	48	-76.62242	43.11836
15	-76.62275	43.12976	49	-76.62225	43.11836
16	-76.62259	43.12976	50	-76.62193	43.11758
17	-76.62128	43.12599	51	-76.62194	43.11678
18	-76.62126	43.12559	52	-76.62279	43.11678
19	-76.61933	43.12559	53	-76.62360	43.11802
20	-76.61934	43.12565	54	-76.62377	43.11838
21	-76.61831	43.12565	55	-76.62377	43.11884
22	-76.61798	43.12558	56	-76.62361	43.11884
23	-76.61782	43.12551	57	-76.62362	43.11984
24	-76.61782	43.12489	58	-76.62394	43.12018
25	-76.61799	43.12393	59	-76.62411	43.12047
26	-76.61815	43.12324	60	-76.62412	43.12159
27	-76.61884	43.12323	61	-76.62476	43.12205
28	-76.61931	43.12303	62	-76.62476	43.12231
29	-76.61993	43.12302	63	-76.62411	43.12297
30	-76.61994	43.12134	64	-76.62412	43.12556
31	-76.61947	43.12134	65	-76.62429	43.12581

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
32	-76.61884	43.12107	66	-76.62477	43.12705
33	-76.61847	43.12106	67	-76.62526	43.12788
34	-76.61848	43.12073	68	-76.62592	43.12858

Panel Area Data – Area 12

Area 13

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.61983	43.11774	8	-76.61846	43.11578
2	-76.61895	43.11774	9	-76.61846	43.11510
3	-76.61863	43.11689	10	-76.61867	43.11510
4	-76.61862	43.11677	11	-76.61899	43.11525
5	-76.61911	43.11654	12	-76.61921	43.11558
6	-76.61911	43.11623	13	-76.61982	43.11558
7	-76.61863	43.11621			

Panel Area Data – Area 13

Area 14

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.63719	43.14721	17	-76.62973	43.14439
2	-76.63684	43.14728	18	-76.62973	43.14417
3	-76.63406	43.14730	19	-76.63387	43.14340
4	-76.63406	43.14784	20	-76.63405	43.14340
5	-76.63306	43.14791	21	-76.63421	43.14348
6	-76.63158	43.14798	22	-76.63476	43.14424
7	-76.63008	43.14805	23	-76.63521	43.14424
8	-76.62991	43.14805	24	-76.63521	43.14472
9	-76.62975	43.14735	25	-76.63588	43.14473
10	-76.62975	43.14556	26	-76.63636	43.14521

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
11	-76.63008	43.14535	27	-76.63718	43.14590
12	-76.63038	43.14534	28	-76.63768	43.14633
13	-76.63038	43.14515	29	-76.63769	43.14645
14	-76.63006	43.14514	30	-76.63751	43.14658
15	-76.62908	43.14485	31	-76.63720	43.14659
16	-76.62908	43.14467			

Panel Area Data – Area 14

Area 15

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.62676	43.14585	6	-76.62776	43.14461
2	-76.62542	43.14585	7	-76.62776	43.14495
3	-76.62542	43.14496	8	-76.62742	43.14523
4	-76.62559	43.14490	9	-76.62705	43.14547
5	-76.62723	43.14461			

Panel Area Data – Area 15

Area 16

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.62378	43.15152	10	-76.62210	43.15104
2	-76.62359	43.15152	11	-76.62210	43.15043
3	-76.62358	43.15125	12	-76.62243	43.15030
4	-76.62246	43.15124	13	-76.62243	43.15022
5	-76.62246	43.15138	14	-76.62261	43.15015
6	-76.62229	43.15138	15	-76.62279	43.15014
7	-76.62229	43.15159	16	-76.62279	43.15028
8	-76.62194	43.15159	17	-76.62361	43.15029
9	-76.62194	43.15105	18	-76.62378	43.15036

Panel Area Data – Area 16

Area 17

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.62311	43.14819	4	-76.62276	43.14799
2	-76.62260	43.14819	5	-76.62276	43.14779
3	-76.62260	43.14800	6	-76.62311	43.14778

Panel Area Data – Area 17

Area 18

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.62124	43.14927	9	-76.62023	43.14802
2	-76.62106	43.14927	10	-76.62022	43.14783
3	-76.62105	43.14908	11	-76.62006	43.14782
4	-76.62089	43.14908	12	-76.62006	43.14770
5	-76.62087	43.14853	13	-76.62041	43.14762
6	-76.62072	43.14853	14	-76.62142	43.14762
7	-76.62056	43.14829	15	-76.62141	43.14838
8	-76.62039	43.14808	16	-76.62125	43.14838

Panel Area Data – Area 18

Area 19

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.61959	43.14755	7	-76.61858	43.14628
2	-76.61941	43.14755	8	-76.61858	43.14617
3	-76.61940	43.14749	9	-76.61875	43.14609
4	-76.61891	43.14748	10	-76.61945	43.14609
5	-76.61890	43.14679	11	-76.61960	43.14617
6	-76.61874	43.14678			

Panel Area Data – Area 19

Area 20

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.61613	43.15021	10	-76.61401	43.14751
2	-76.61576	43.15020	11	-76.61430	43.14764
3	-76.61577	43.14980	12	-76.61487	43.14819
4	-76.61592	43.14980	13	-76.61597	43.14819
5	-76.61593	43.14903	14	-76.61598	43.14868
6	-76.61461	43.14895	15	-76.61613	43.14876
7	-76.61460	43.14828	16	-76.61646	43.14917
8	-76.61377	43.14777	17	-76.61646	43.15014
9	-76.61359	43.14751			

Panel Area Data – Area 20

Area 21

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.61041	43.15552	23	-76.60611	43.14864
2	-76.60843	43.15565	24	-76.60559	43.14812
3	-76.60775	43.15564	25	-76.60577	43.14796
4	-76.60725	43.15509	26	-76.60825	43.14761
5	-76.60675	43.15439	27	-76.60843	43.14761
6	-76.60675	43.15428	28	-76.60859	43.14789
7	-76.60757	43.15417	29	-76.60909	43.14934
8	-76.60758	43.15365	30	-76.60939	43.15119
9	-76.60790	43.15342	31	-76.60993	43.15118
10	-76.60790	43.15253	32	-76.61003	43.14966
11	-76.60775	43.15253	33	-76.61027	43.14966
12	-76.60774	43.15149	34	-76.61111	43.15069
13	-76.60758	43.15149	35	-76.61091	43.15096

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
14	-76.60758	43.15143	36	-76.61004	43.15102
15	-76.60823	43.15142	37	-76.60994	43.15189
16	-76.60823	43.15107	38	-76.61027	43.15191
17	-76.60757	43.15107	39	-76.61026	43.15205
18	-76.60757	43.15086	40	-76.60960	43.15206
19	-76.60642	43.15086	41	-76.60961	43.15244
20	-76.60641	43.15017	42	-76.61041	43.15296
21	-76.60626	43.15017	43	-76.61060	43.15393
22	-76.60624	43.14864	44	-76.61058	43.15529

Panel Area Data – Area 21

Area 22

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.60103	43.15270	13	-76.59704	43.14924
2	-76.59721	43.15271	14	-76.59725	43.14924
3	-76.59705	43.15152	15	-76.59724	43.14977
4	-76.59671	43.15123	16	-76.59804	43.14994
5	-76.59671	43.15091	17	-76.59874	43.14994
6	-76.59719	43.15091	18	-76.59948	43.15049
7	-76.59720	43.15058	19	-76.59979	43.15049
8	-76.59653	43.15057	20	-76.60019	43.15015
9	-76.59638	43.15048	21	-76.60053	43.15015
10	-76.59637	43.15023	22	-76.60086	43.15064
11	-76.59656	43.14967	23	-76.60103	43.15100
12	-76.59703	43.14947			

Panel Area Data – Area 22

Area 23

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.59676	43.14790	7	-76.59759	43.14682
2	-76.59656	43.14790	8	-76.59774	43.14730
3	-76.59639	43.14782	9	-76.59774	43.14742
4	-76.59639	43.14709	10	-76.59755	43.14765
5	-76.59706	43.14654	11	-76.59709	43.14783
6	-76.59741	43.14653			

Panel Area Data – Area 23

Area 24

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.60484	43.14706	28	-76.60167	43.14462
2	-76.60465	43.14714	29	-76.60168	43.14424
3	-76.60332	43.14736	30	-76.60202	43.14424
4	-76.60135	43.14763	31	-76.60219	43.14438
5	-76.60101	43.14763	32	-76.60251	43.14427
6	-76.60084	43.14755	33	-76.60182	43.14372
7	-76.60069	43.14719	34	-76.60166	43.14348
8	-76.59996	43.14652	35	-76.60237	43.14340
9	-76.59978	43.14653	36	-76.60336	43.14339
10	-76.59954	43.14673	37	-76.60355	43.14355
11	-76.59936	43.14673	38	-76.60375	43.14400
12	-76.59935	43.14649	39	-76.60468	43.14423
13	-76.59903	43.14636	40	-76.60469	43.14520
14	-76.59886	43.14616	41	-76.60450	43.14528
15	-76.59887	43.14591	42	-76.60417	43.14528
16	-76.59905	43.14577	43	-76.60397	43.14518

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
17	-76.59952	43.14576	44	-76.60320	43.14451
18	-76.59952	43.14555	45	-76.60224	43.14451
19	-76.59888	43.14555	46	-76.60224	43.14492
20	-76.59869	43.14547	47	-76.60252	43.14500
21	-76.59869	43.14542	48	-76.60357	43.14590
22	-76.59919	43.14541	49	-76.60388	43.14590
23	-76.59920	43.14486	50	-76.60435	43.14625
24	-76.59938	43.14472	51	-76.60435	43.14659
25	-76.59956	43.14472	52	-76.60467	43.14660
26	-76.60067	43.14521	53	-76.60484	43.14667
27	-76.60085	43.14521			

Panel Area Data – Area 24

Area 25

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.60211	43.14175	17	-76.60042	43.13871
2	-76.60176	43.14175	18	-76.60043	43.13753
3	-76.60159	43.14167	19	-76.60081	43.13753
4	-76.60143	43.14154	20	-76.60266	43.13775
5	-76.60082	43.14092	21	-76.60280	43.13783
6	-76.59714	43.14092	22	-76.60295	43.13804
7	-76.59714	43.14016	23	-76.60294	43.13859
8	-76.59771	43.14015	24	-76.60224	43.13865
9	-76.59713	43.13965	25	-76.60083	43.13865
10	-76.59713	43.13926	26	-76.60083	43.13982
11	-76.59731	43.13906	27	-76.60112	43.13982
12	-76.59801	43.13906	28	-76.60128	43.14030

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
13	-76.59926	43.13934	29	-76.60245	43.14142
14	-76.59960	43.13934	30	-76.60245	43.14155
15	-76.60027	43.13898	31	-76.60228	43.14168
16	-76.60027	43.13871			

Panel Area Data – Area 25

Area 26

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.60826	43.13232	6	-76.60776	43.13031
2	-76.60693	43.13239	7	-76.60808	43.13046
3	-76.60624	43.13238	8	-76.60809	43.13196
4	-76.60608	43.13183	9	-76.60825	43.13197
5	-76.60608	43.13031			

Panel Area Data – Area 26

Area 27

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.60717	43.11902	14	-76.60663	43.11500
2	-76.60647	43.11901	15	-76.60745	43.11501
3	-76.60647	43.11881	16	-76.60746	43.11342
4	-76.60663	43.11881	17	-76.60764	43.11328
5	-76.60663	43.11730	18	-76.60798	43.11328
6	-76.60647	43.11730	19	-76.60814	43.11405
7	-76.60647	43.11662	20	-76.60831	43.11488
8	-76.60480	43.11654	21	-76.60831	43.11583
9	-76.60413	43.11578	22	-76.60683	43.11584
10	-76.60501	43.11564	23	-76.60683	43.11605
11	-76.60614	43.11564	24	-76.60700	43.11605

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
12	-76.60614	43.11551	25	-76.60702	43.11845
13	-76.60662	43.11510	26	-76.60717	43.11861

Panel Area Data – Area 27

Area 28

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.60504	43.11924	8	-76.60438	43.11732
2	-76.60354	43.11924	9	-76.60439	43.11799
3	-76.60354	43.11808	10	-76.60455	43.11800
4	-76.60387	43.11766	11	-76.60456	43.11847
5	-76.60403	43.11766	12	-76.60472	43.11847
6	-76.60403	43.11684	13	-76.60504	43.11904
7	-76.60421	43.11683			

Panel Area Data – Area 28

Area 29

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.60279	43.11702	18	-76.59981	43.11412
2	-76.60261	43.11702	19	-76.60130	43.11405
3	-76.60244	43.11694	20	-76.60197	43.11405
4	-76.60134	43.11494	21	-76.60214	43.11419
5	-76.60018	43.11494	22	-76.60263	43.11476
6	-76.60018	43.11521	23	-76.60279	43.11503
7	-76.59999	43.11536	24	-76.60280	43.11535
8	-76.59981	43.11542	25	-76.60298	43.11536
9	-76.59948	43.11542	26	-76.60328	43.11558
10	-76.59919	43.11529	27	-76.60362	43.11599
11	-76.59882	43.11528	28	-76.60362	43.11612

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
12	-76.59815	43.11521	29	-76.60313	43.11633
13	-76.59815	43.11509	30	-76.60313	43.11640
14	-76.59898	43.11502	31	-76.60297	43.11641
15	-76.59947	43.11490	32	-76.60296	43.11653
16	-76.59947	43.11474	33	-76.60279	43.11654
17	-76.59965	43.11419			

Panel Area Data – Area 29

Area 30

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
1	-76.62336	43.10494	19	-76.61904	43.10042
2	-76.62089	43.10606	20	-76.61888	43.10013
3	-76.62054	43.10626	21	-76.61855	43.09979
4	-76.62037	43.10626	22	-76.61838	43.09945
5	-76.62019	43.10611	23	-76.61805	43.09910
6	-76.61986	43.10561	24	-76.61772	43.09895
7	-76.61904	43.10451	25	-76.61755	43.09868
8	-76.61904	43.10342	26	-76.61755	43.09787
9	-76.61939	43.10301	27	-76.61825	43.09787
10	-76.61969	43.10300	28	-76.61825	43.09869
11	-76.61969	43.10259	29	-76.61973	43.09870
12	-76.61954	43.10259	30	-76.61973	43.09959
13	-76.61937	43.10229	31	-76.62139	43.09960
14	-76.61921	43.10180	32	-76.62154	43.10024
15	-76.61921	43.10161	33	-76.62156	43.10300
16	-76.61936	43.10161	34	-76.62321	43.10300
17	-76.61935	43.10078	35	-76.62319	43.10439

Location	Longitude (°)	Latitude (°)	Location	Longitude (°)	Latitude (°)
18	-76.61921	43.10078	36	-76.62336	43.10439

Panel Area Data – Area 30

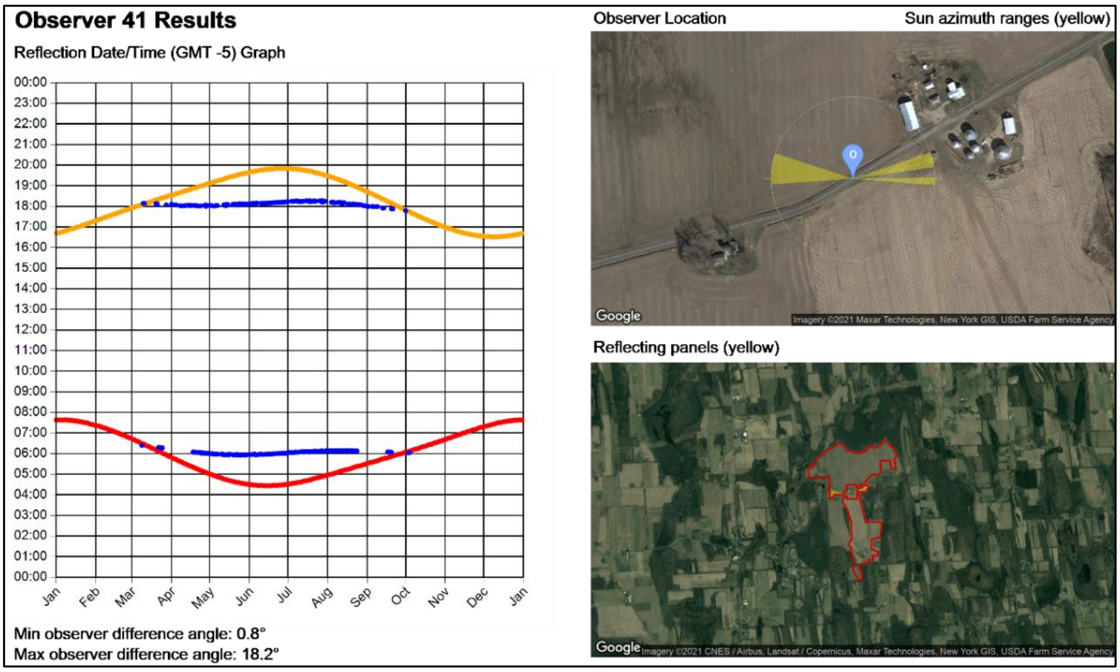
APPENDIX H – DETAILLED MODELLING RESULTS

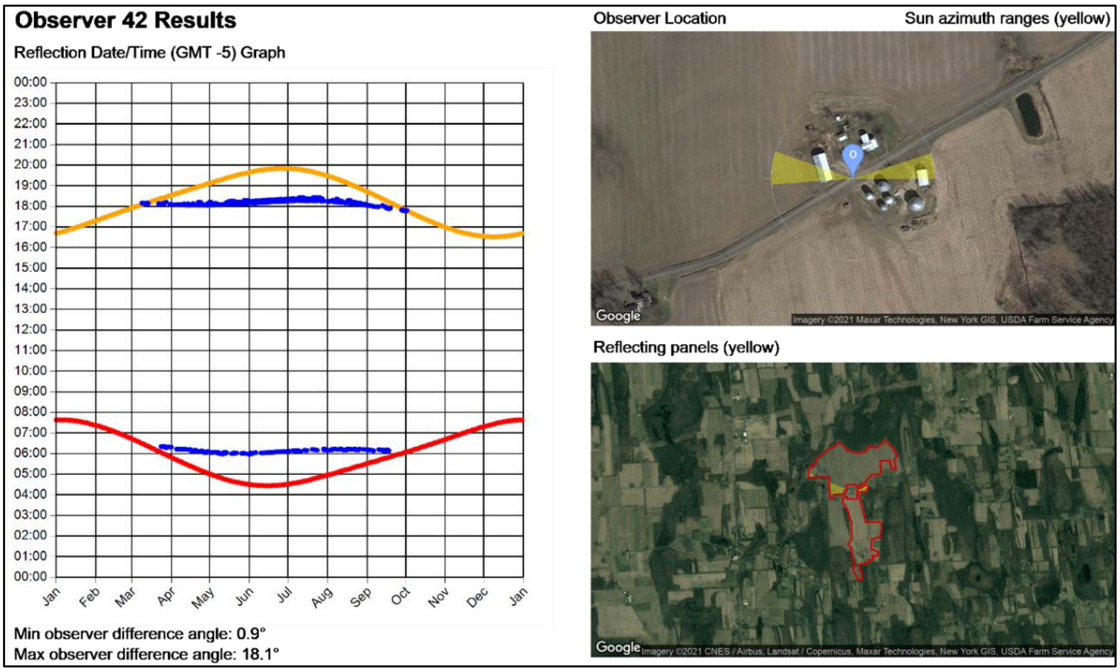
Overview

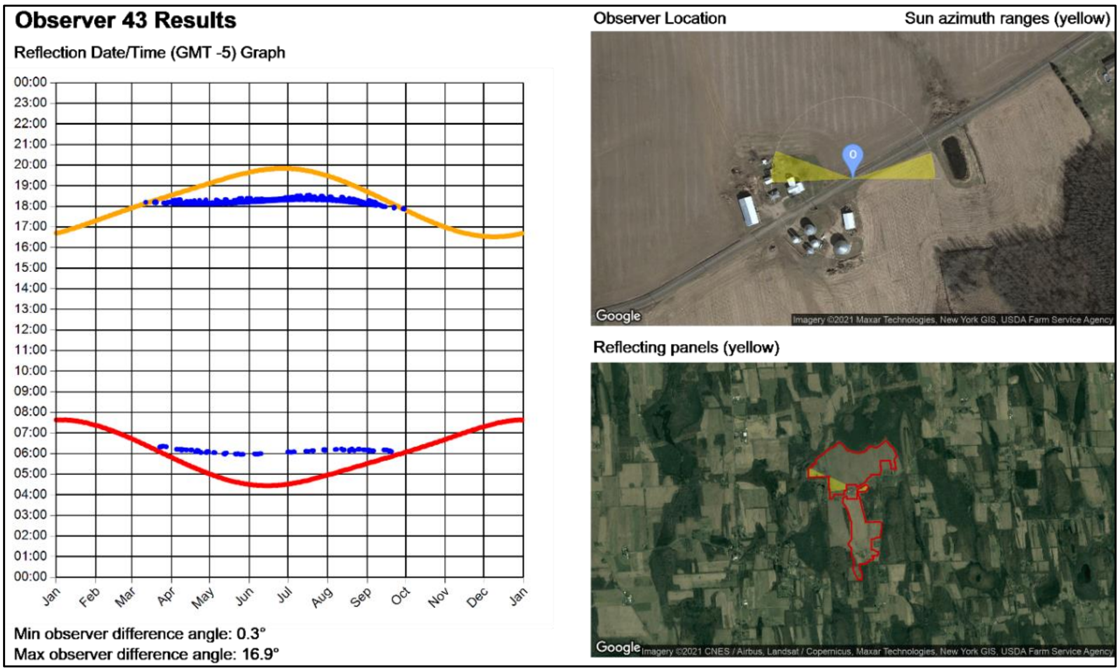
The charts for the potentially affected receptors are shown on the following pages for completeness. Each chart shows:

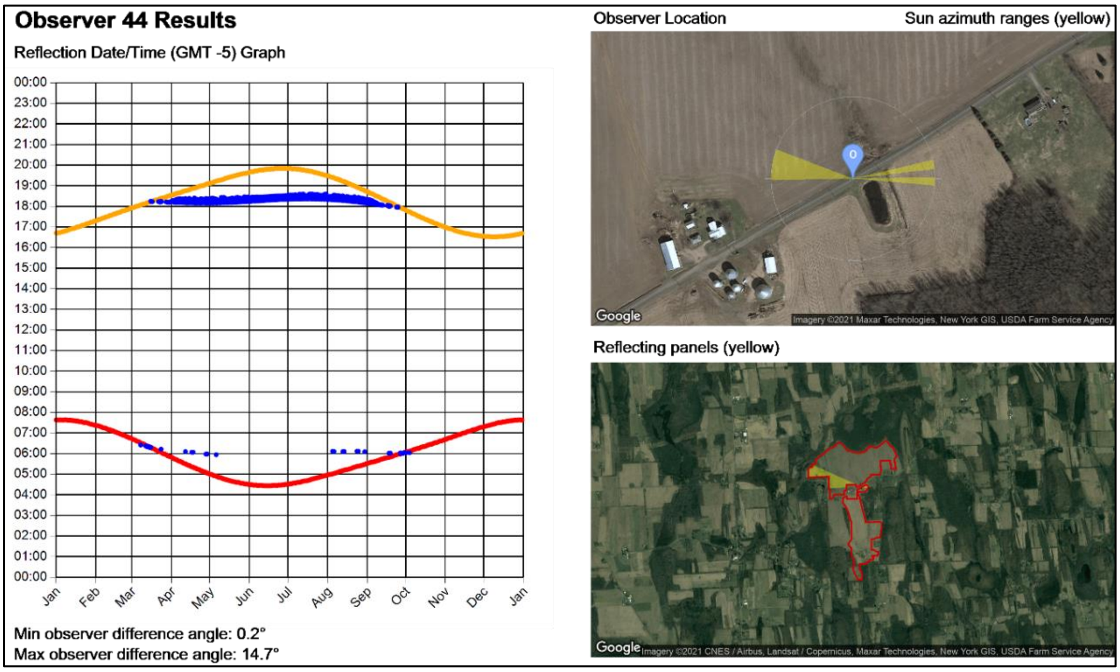
- The receptor (observer) location – top right image. This also shows the azimuth range of the Sun itself at times when reflections are possible. If sunlight is experienced from the same direction as the reflecting panels, the overall impact of the reflection is reduced as discussed within the body of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

Road Receptors



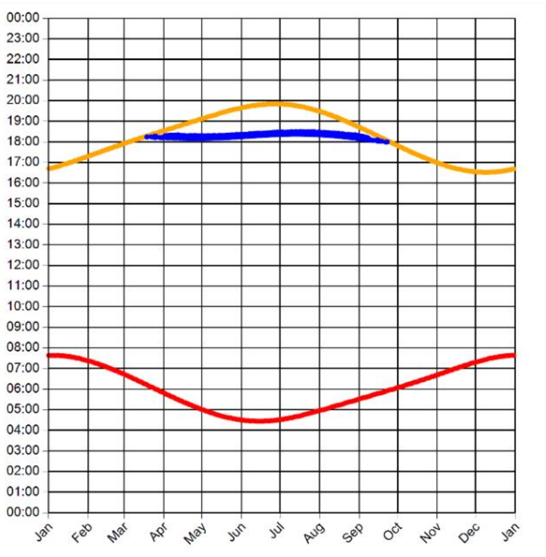



Observer 43 Results
Reflection Date/Time (GMT -5) Graph
00:00
23:00
22:00
21:00
20:00
19:00
18:00
17:00
16:00
15:00
14:00
13:00
12:00
11:00
10:00
09:00
08:00
07:00
06:00
05:00
04:00
03:00
02:00
01:00
00:00
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan
Min observer difference angle: 0.3°
Max observer difference angle: 16.9°
Observer Location
Sun azimuth ranges (yellow)
Google
Imagery ©2021 Maxar Technologies, New York GIS, USDA Farm Service Agency
Reflecting panels (yellow)
Google
Imagery ©2021 CNES / Airbus, Landsat / Copernicus, Maxar Technologies, New York GIS, USDA Farm Service Agency


Observer 44 Results
Reflection Date/Time (GMT -5) Graph
00:00
23:00
22:00
21:00
20:00
19:00
18:00
17:00
16:00
15:00
14:00
13:00
12:00
11:00
10:00
09:00
08:00
07:00
06:00
05:00
04:00
03:00
02:00
01:00
00:00
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan
Min observer difference angle: 0.2°
Max observer difference angle: 14.7°
Observer Location
Sun azimuth ranges (yellow)
Google
Imagery ©2021 Maxar Technologies, New York GIS, USDA Farm Service Agency
Reflecting panels (yellow)
Google
Imagery ©2021 CNES / Airbus, Landsat / Copernicus, Maxar Technologies, New York GIS, USDA Farm Service Agency

Observer 45 Results

Reflection Date/Time (GMT -5) Graph



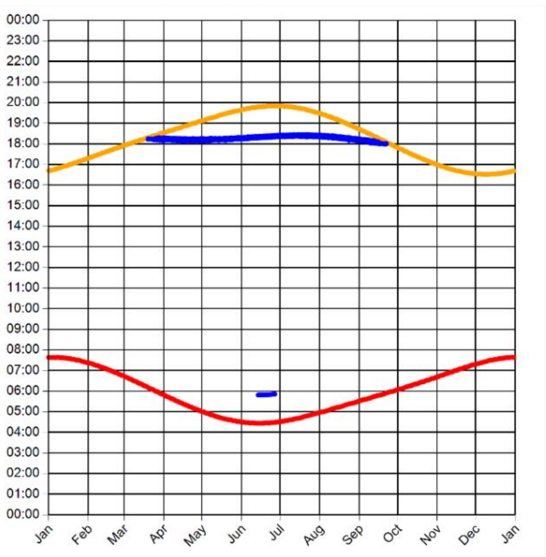
Min observer difference angle: 0.3°
Max observer difference angle: 14.6°

Observer Location — Sun azimuth range is 269.9° - 290.4° (yellow)

Reflecting panels (yellow)

Observer 46 Results

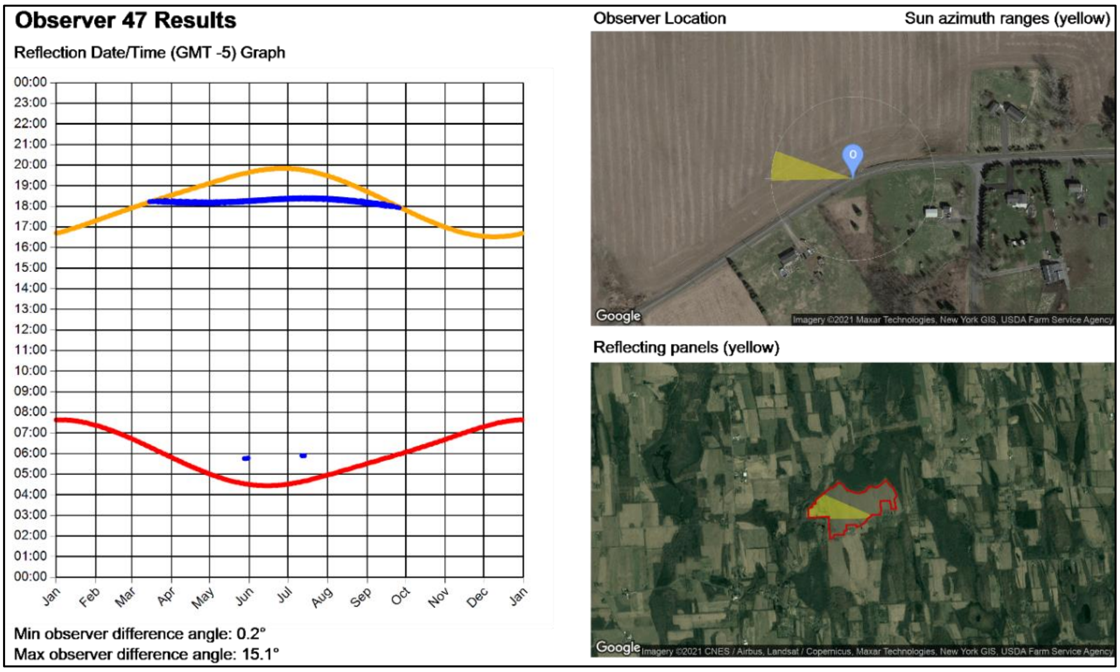
Reflection Date/Time (GMT -5) Graph

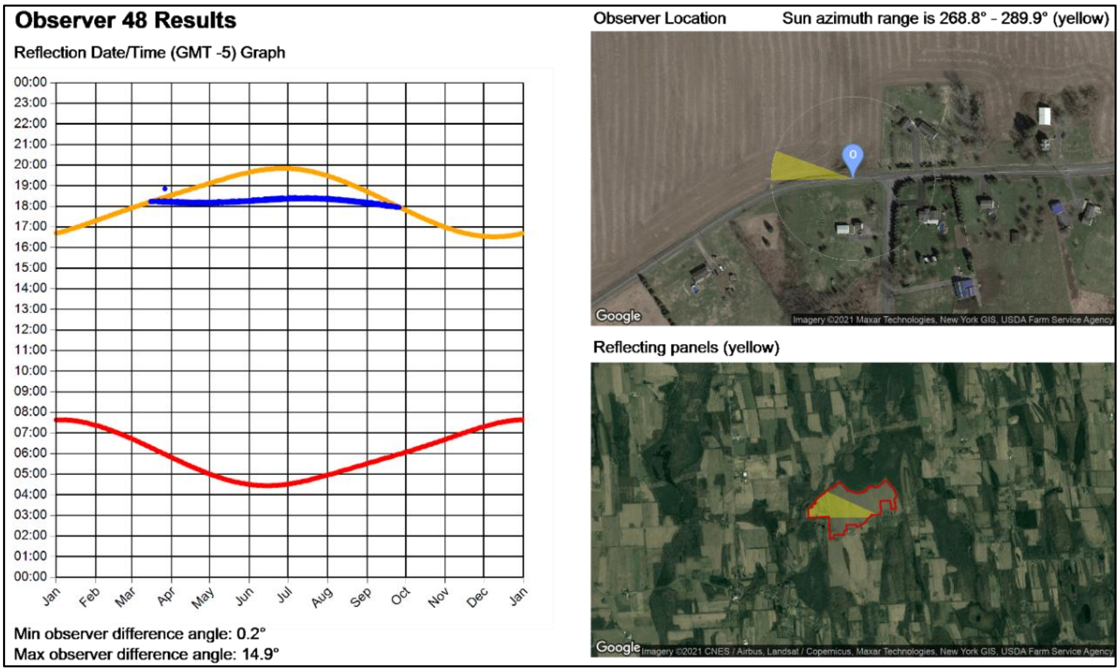


Min observer difference angle: 0.3°
Max observer difference angle: 15°

Observer Location — Sun azimuth ranges (yellow)

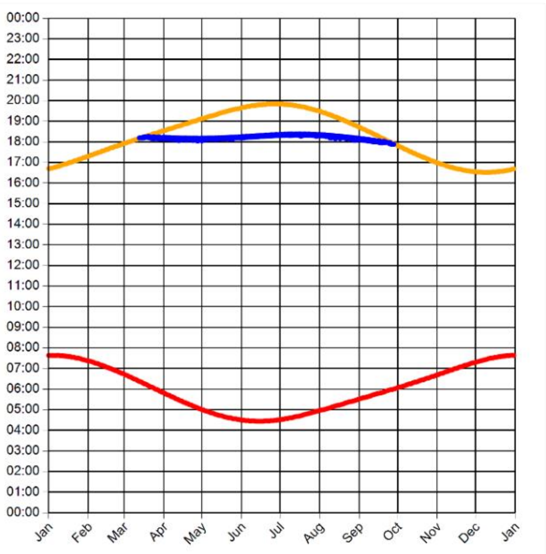
Reflecting panels (yellow)


Observer 47 Results
Reflection Date/Time (GMT -5) Graph
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan
Min observer difference angle: 0.2°
Max observer difference angle: 15.1°
Observer Location
Sun azimuth ranges (yellow)
Reflecting panels (yellow)


Observer 48 Results
Reflection Date/Time (GMT -5) Graph
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan
Min observer difference angle: 0.2°
Max observer difference angle: 14.9°
Observer Location
Sun azimuth range is 268.8° - 289.9° (yellow)
Reflecting panels (yellow)

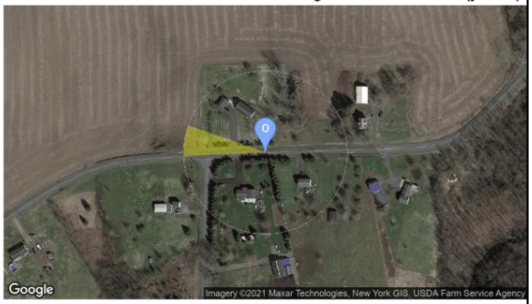
Observer 49 Results

Reflection Date/Time (GMT -5) Graph



Min observer difference angle: 0.3°
Max observer difference angle: 15.8°

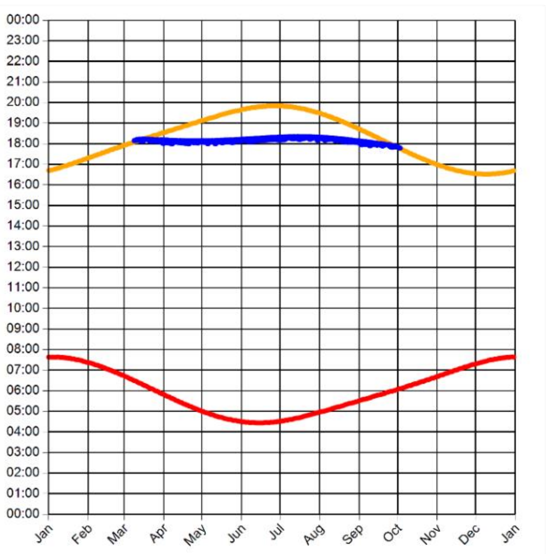
Observer Location — Sun azimuth range is 267.5° - 289.4° (yellow)



Reflecting panels (yellow)

Observer 50 Results

Reflection Date/Time (GMT -5) Graph



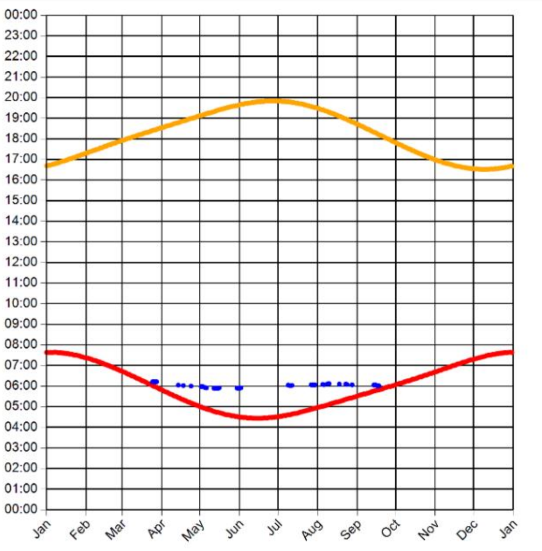
Min observer difference angle: 0.2°
Max observer difference angle: 19°

Observer Location — Sun azimuth range is 265.5° - 289.1° (yellow)

Reflecting panels (yellow)

Observer 64 Results

Reflection Date/Time (GMT -5) Graph



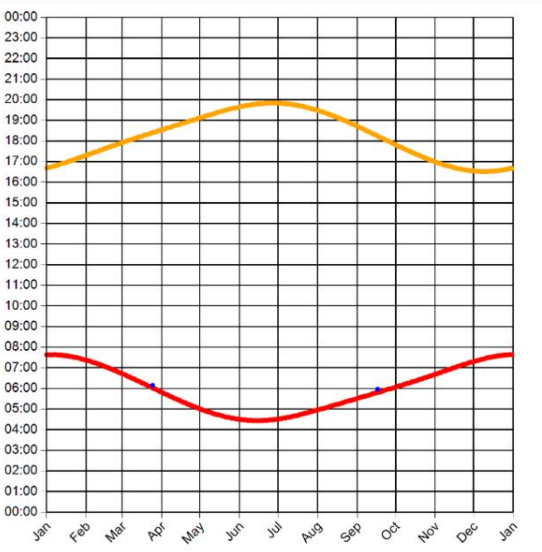
Min observer difference angle: 2.4°
Max observer difference angle: 14.8°

Observer Location | Sun azimuth ranges (yellow)

Reflecting panels (yellow)

Observer 65 Results

Reflection Date/Time (GMT -5) Graph



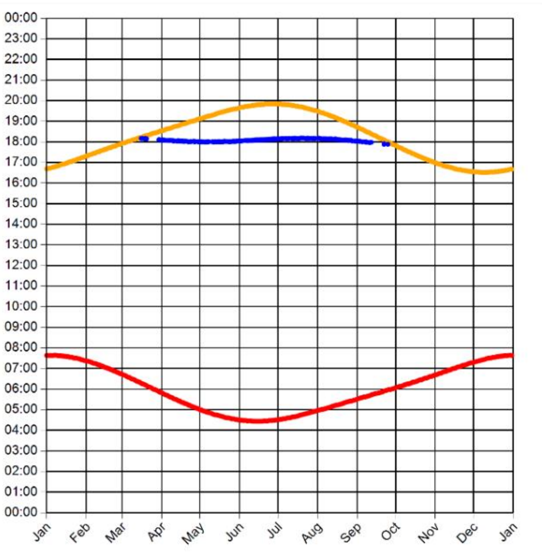
Min observer difference angle: 1.3°
Max observer difference angle: 1.4°

Observer Location | Sun azimuth range is 88° - 88° (yellow)

Reflecting panels (yellow)

Observer 68 Results

Reflection Date/Time (GMT -5) Graph



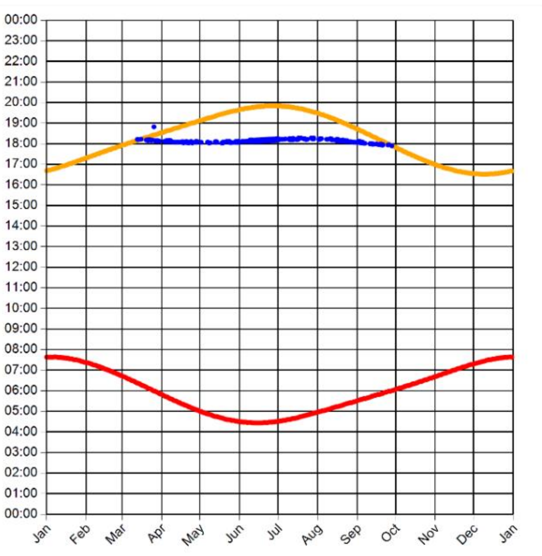
Min observer difference angle: 1.8°
Max observer difference angle: 18.9°

Observer Location — Sun azimuth range is 268.3° - 287.4° (yellow)

Reflecting panels (yellow)

Observer 69 Results

Reflection Date/Time (GMT -5) Graph



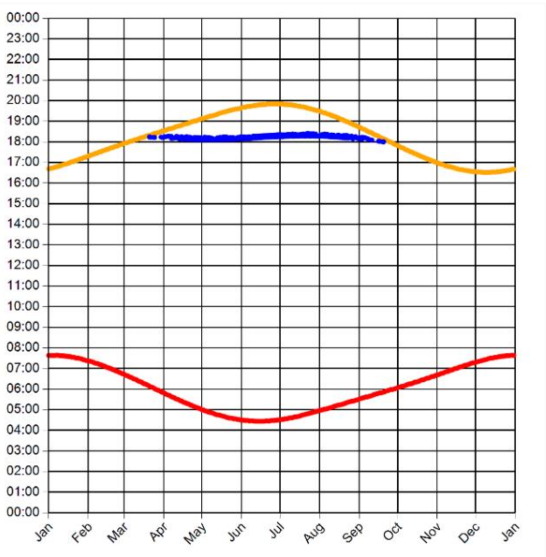
Min observer difference angle: 0.3°
Max observer difference angle: 18.2°

Observer Location — Sun azimuth range is 267.7° - 288.3° (yellow)

Reflecting panels (yellow)

Observer 70 Results

Reflection Date/Time (GMT -5) Graph



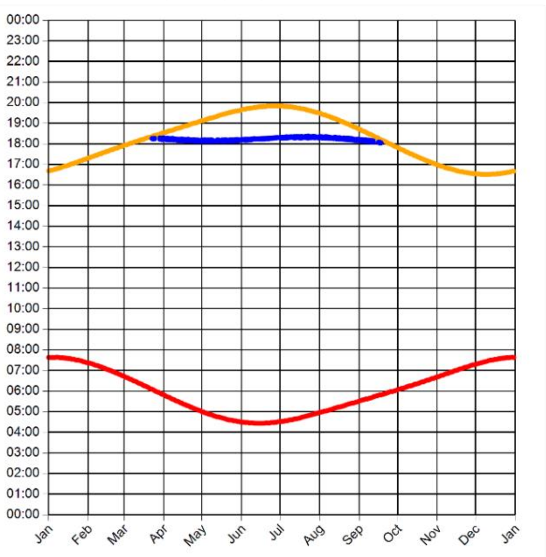
Min observer difference angle: 0.5°
Max observer difference angle: 15.6°

Observer Location Sun azimuth range is 270.6° - 289.2° (yellow)

Reflecting panels (yellow)

Observer 71 Results

Reflection Date/Time (GMT -5) Graph



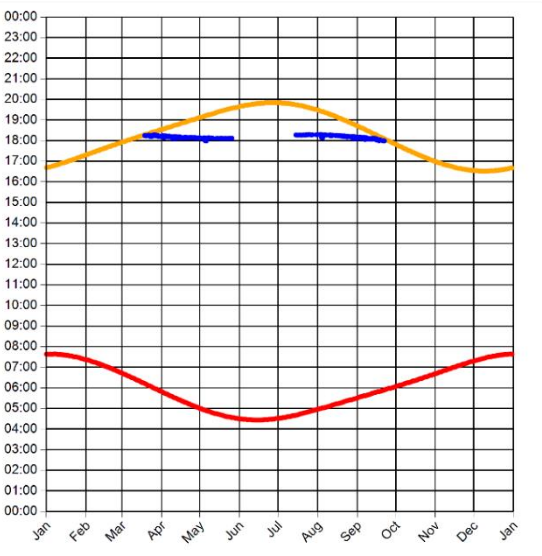
Min observer difference angle: 0.3°
Max observer difference angle: 15.3°

Observer Location Sun azimuth range is 271.5° - 288.9° (yellow)

Reflecting panels (yellow)

Observer 72 Results

Reflection Date/Time (GMT -5) Graph



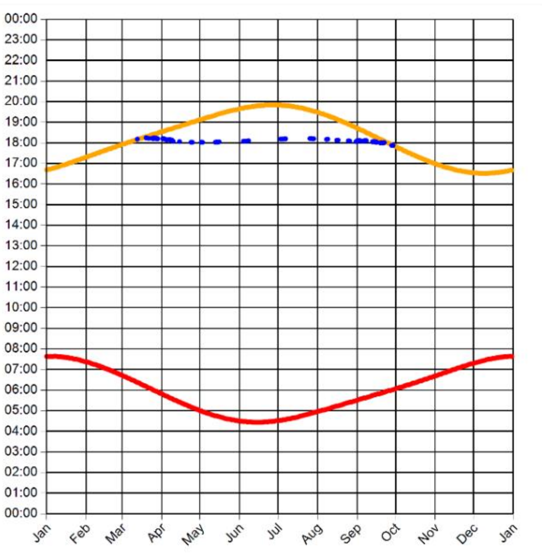
Min observer difference angle: 0.3°
Max observer difference angle: 14.6°

Observer Location Sun azimuth range is 270° - 286.6° (yellow)

Reflecting panels (yellow)

Observer 73 Results

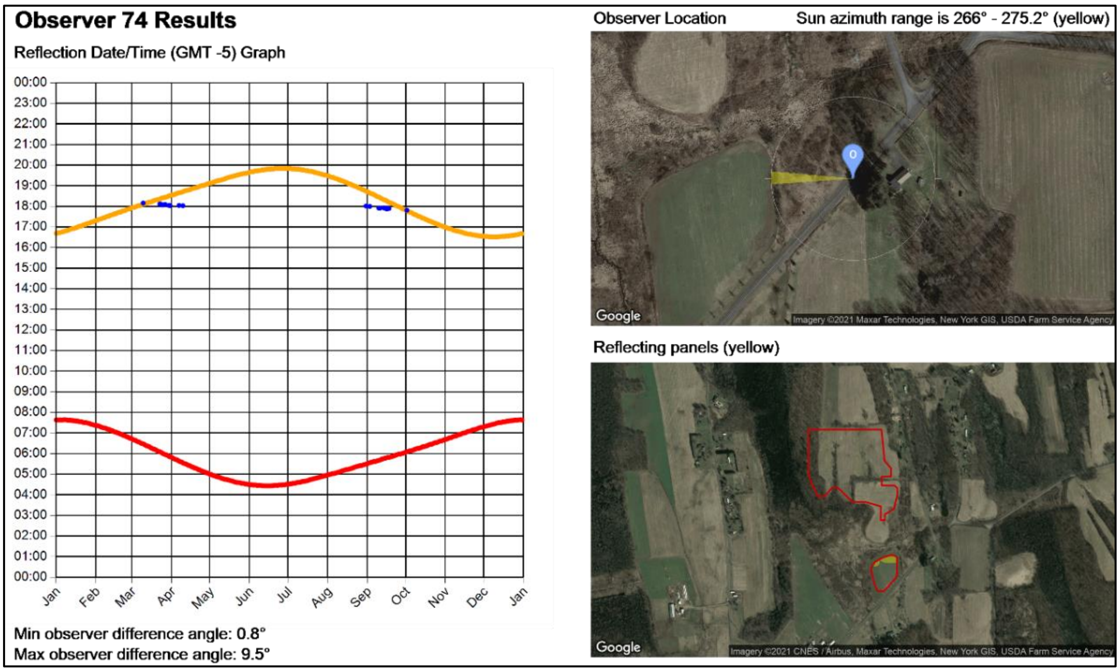
Reflection Date/Time (GMT -5) Graph



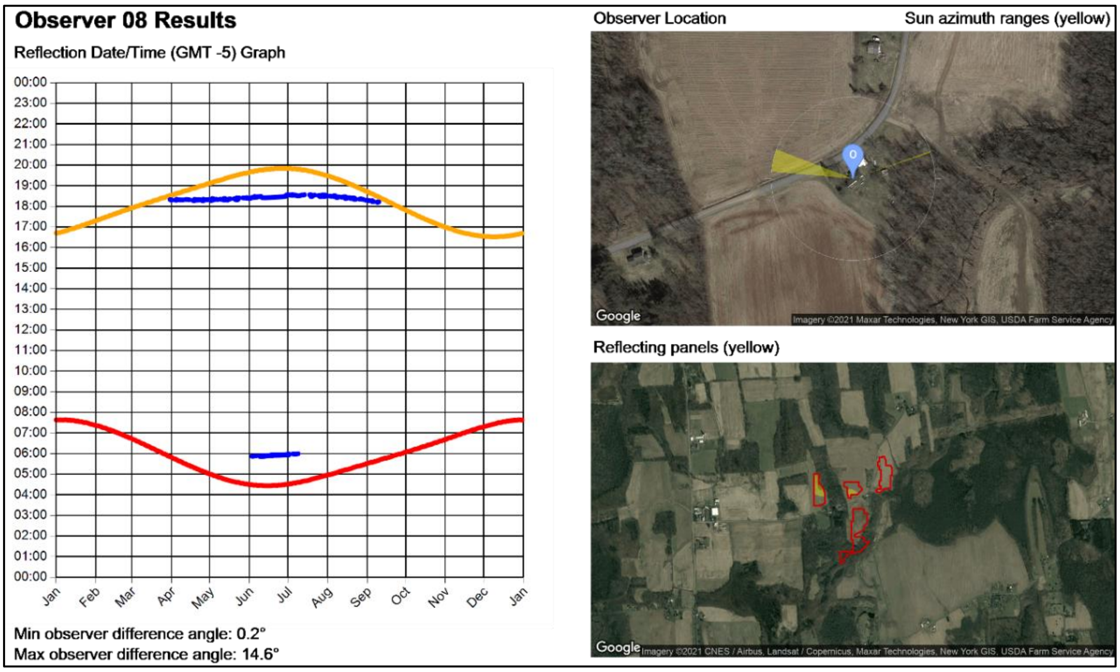
Min observer difference angle: 0.2°
Max observer difference angle: 17.3°

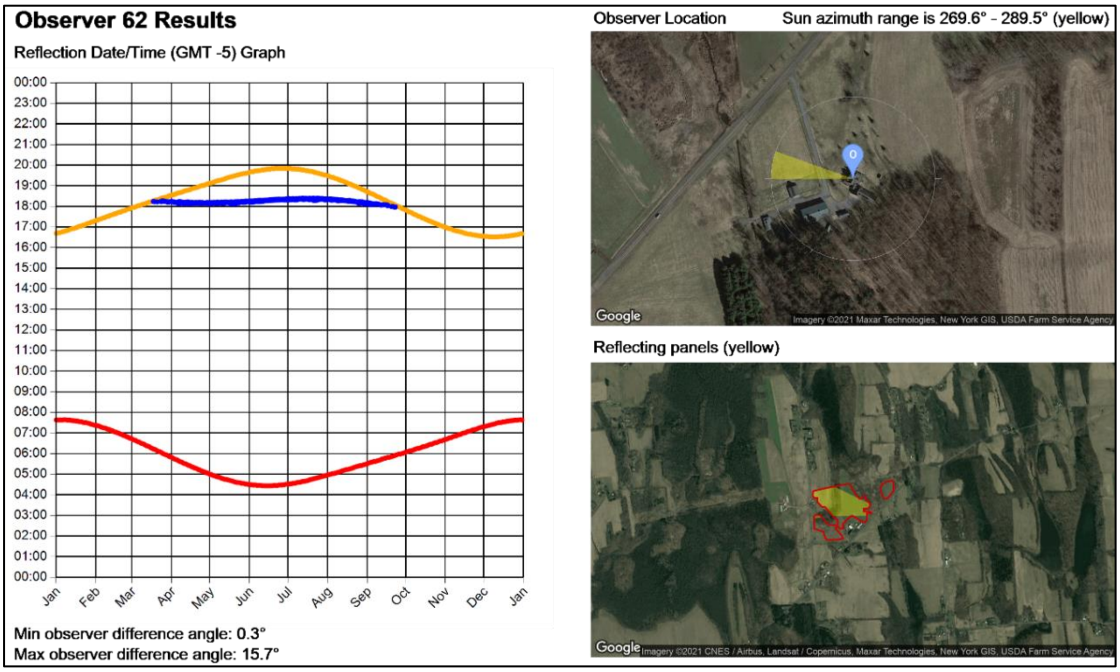
Observer Location Sun azimuth range is 267.3° - 287.3° (yellow)

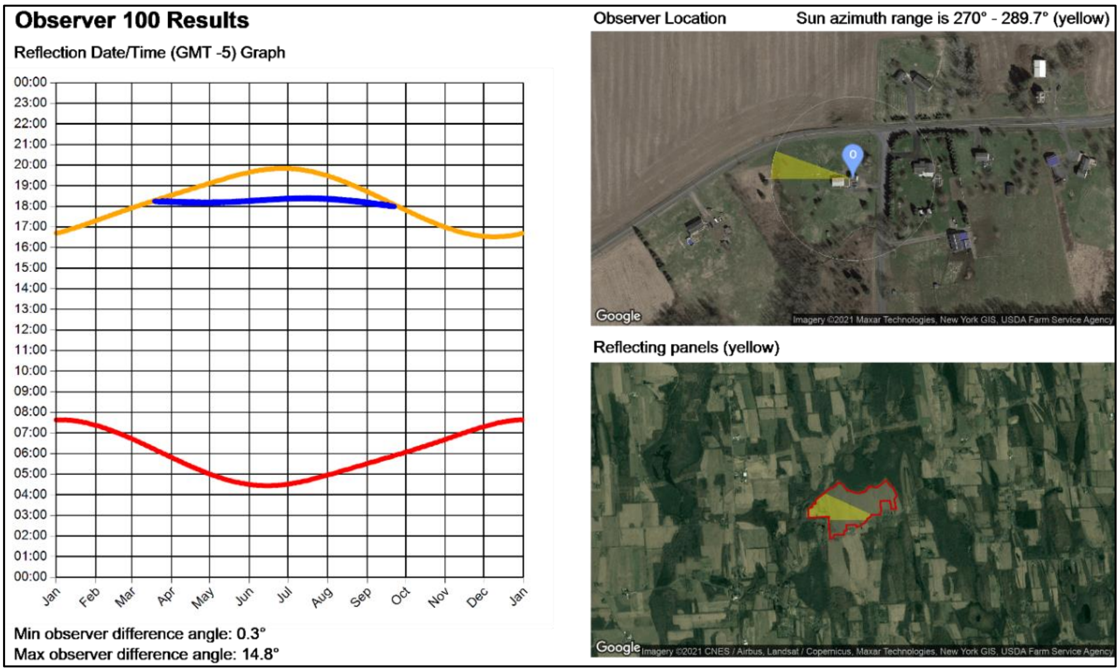
Reflecting panels (yellow)

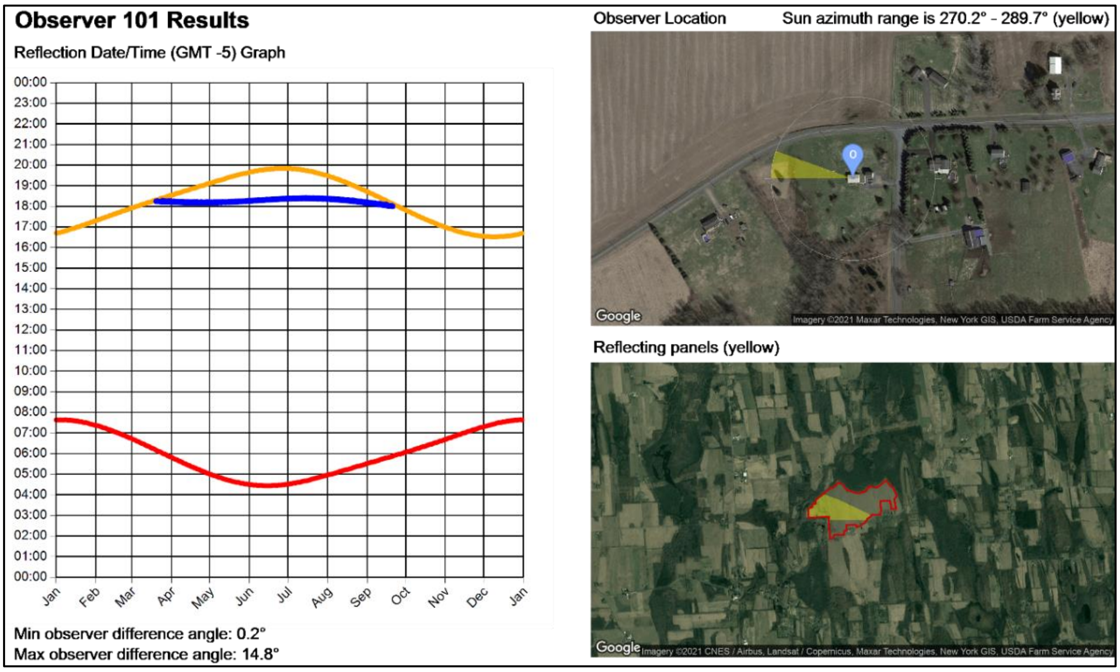

Observer 74 Results
Reflection Date/Time (GMT -5) Graph
00:00
23:00
22:00
21:00
20:00
19:00
18:00
17:00
16:00
15:00
14:00
13:00
12:00
11:00
10:00
09:00
08:00
07:00
06:00
05:00
04:00
03:00
02:00
01:00
00:00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Min observer difference angle: 0.8°
Max observer difference angle: 9.5°
Observer Location
Sun azimuth range is 266° - 275.2° (yellow)
Google
Reflecting panels (yellow)
Google

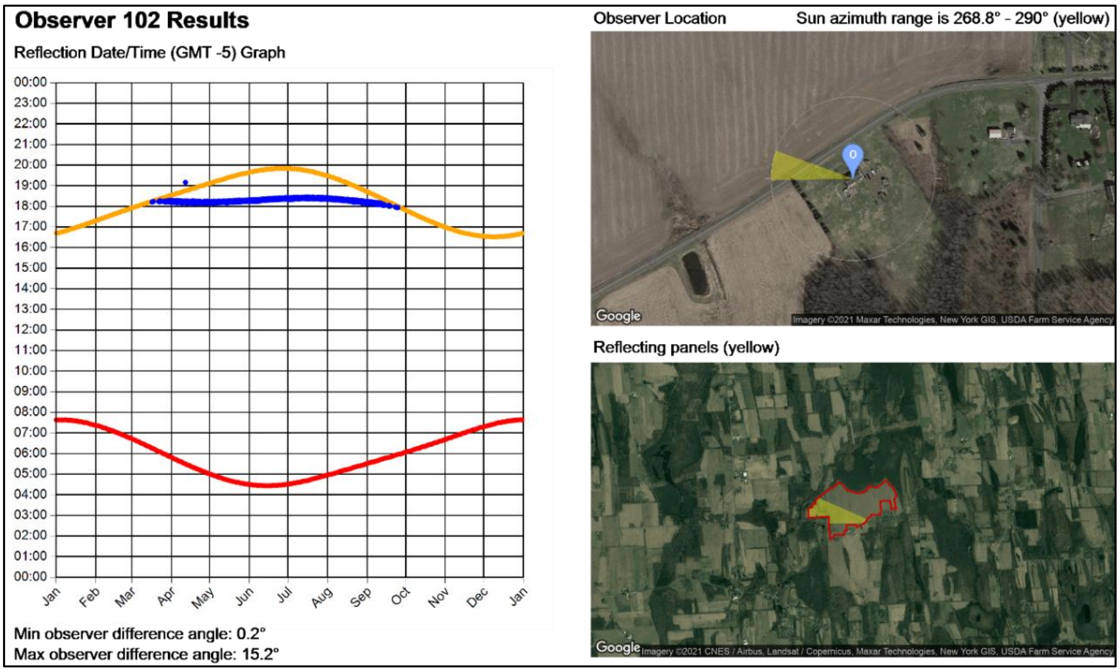
Dwelling Receptors

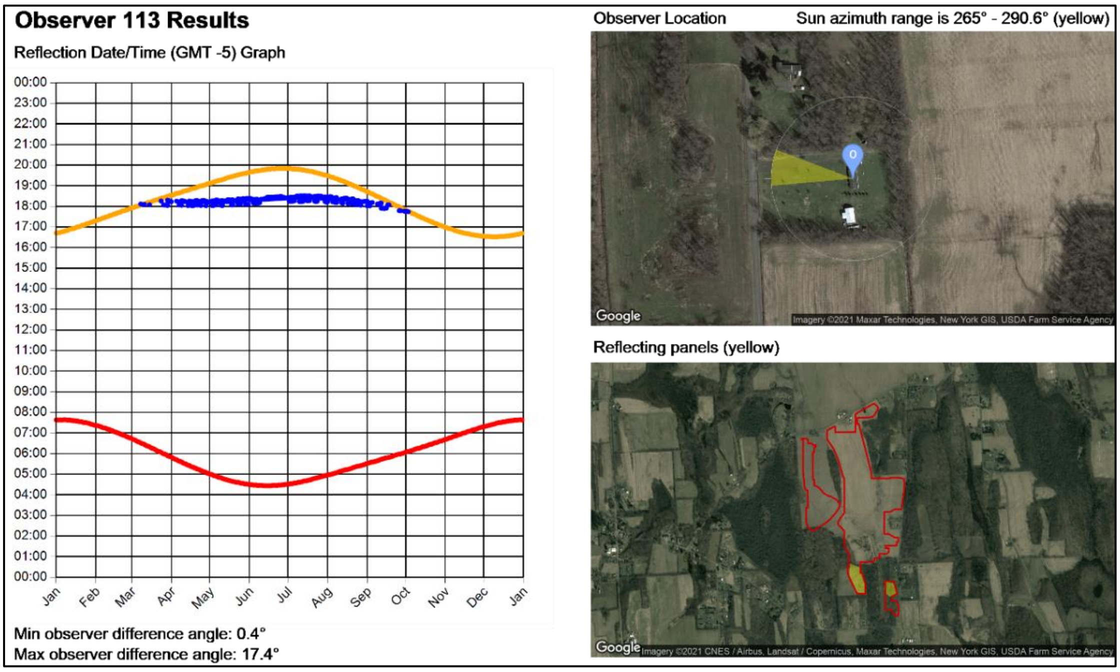


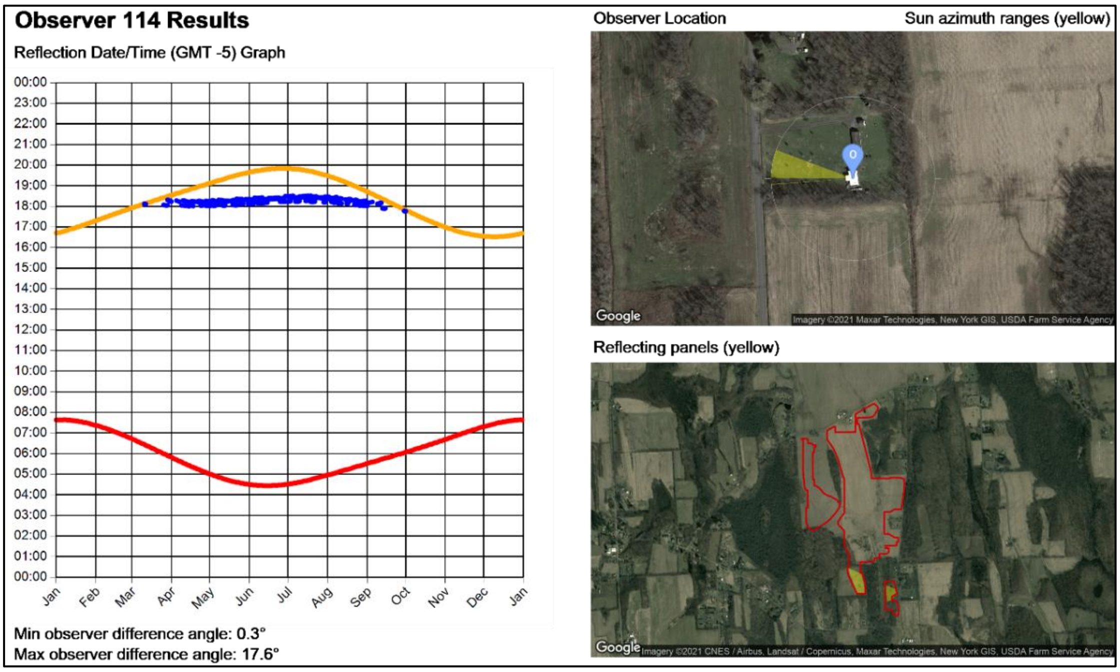



Observer 100 Results
Reflection Date/Time (GMT -5) Graph
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan
Min observer difference angle: 0.3°
Max observer difference angle: 14.8°
Observer Location
Sun azimuth range is 270° - 289.7° (yellow)
Reflecting panels (yellow)
Imagery ©2021 Maxar Technologies, New York GIS, USDA Farm Service Agency
Imagery ©2021 CNES / Airbus, Landsat / Copernicus, Maxar Technologies, New York GIS, USDA Farm Service Agency


Observer 101 Results
Reflection Date/Time (GMT -5) Graph
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan
Min observer difference angle: 0.2°
Max observer difference angle: 14.8°
Observer Location
Sun azimuth range is 270.2° - 289.7° (yellow)
Reflecting panels (yellow)
Imagery ©2021 Maxar Technologies, New York GIS, USDA Farm Service Agency
Imagery ©2021 CNES / Airbus, Landsat / Copernicus, Maxar Technologies, New York GIS, USDA Farm Service Agency


Observer 102 Results
Reflection Date/Time (GMT -5) Graph
Min observer difference angle: 0.2°
Max observer difference angle: 15.2°
Observer Location
Sun azimuth range is 268.8° - 290° (yellow)
Reflecting panels (yellow)


Observer 113 Results
Reflection Date/Time (GMT -5) Graph
Min observer difference angle: 0.4°
Max observer difference angle: 17.4°
Observer Location
Sun azimuth range is 265° - 290.6° (yellow)
Reflecting panels (yellow)


Observer 114 Results
Reflection Date/Time (GMT -5) Graph
Observer Location
Sun azimuth ranges (yellow)
Reflecting panels (yellow)
Min observer difference angle: 0.3°
Max observer difference angle: 17.6°

APPENDIX I – SCREENING ANALYSIS

Screening Assessment Overview

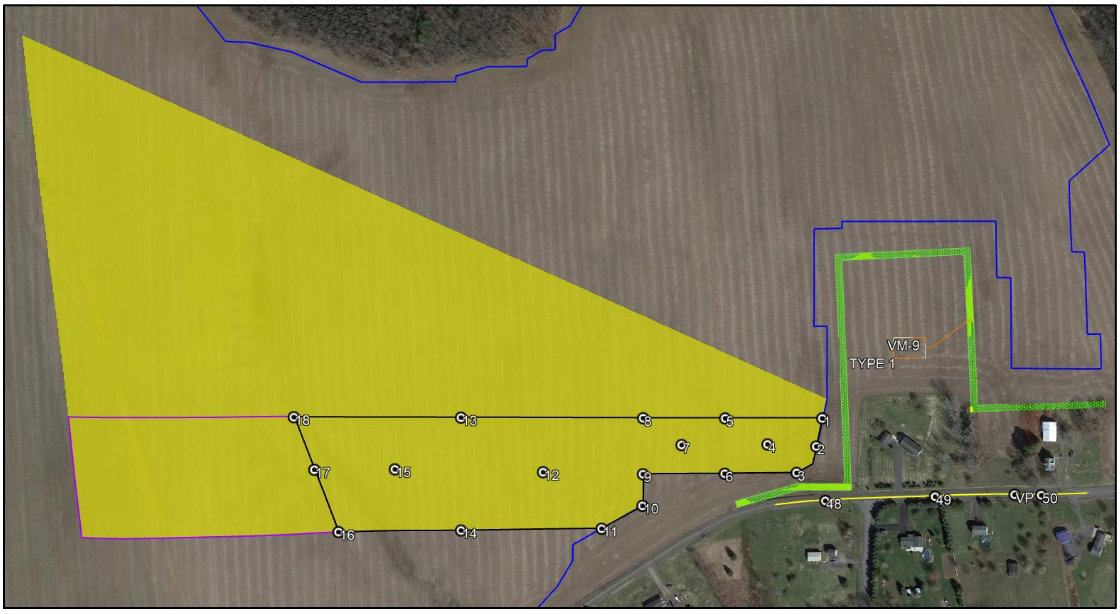
Screening analysis was undertaken from to determine the level of visibility for road receptors 48 to 50 where a high impact was predicted and to determine the specific mitigation strategy. A visual point (VP) between road receptors 49 and 50 was chosen at the top of the hill. A height of 4.92 feet (1.5 metres) above ground level has been taken as typical eye level for a road user for VP.

Solar points (1 to 18) were chosen within the reflecting panel area on the following basis:

- Solar point is predominately in front of a road user.
- Screening may be possible.

No solar points beyond 16 to 18 (predominately in front of a road user) were assessed as it is clear from the outset that these panel areas will be visible, despite practical and reasonable screening height solutions, due to the elevation of the hill within the site (purple outlined area) within the figure below.

A height of 7 feet (2.1336 metres)[25] above ground level has been taken as the assessed height of the solar panels for the solar points.



Screening assessment overview - Visual Point (VP) and solar points 1 to 18

[25] Maximum height of the solar panels above ground level.

Proposed Screening

The applicant has proposed heightened screening at 10 to 12 feet (doubling the height of vegetation screening in the form of trees proposed throughout the landscaping plan) within visual mitigation VM9. The location of the proposed heightened screening within VM9 (red line) is shown in the figure below.

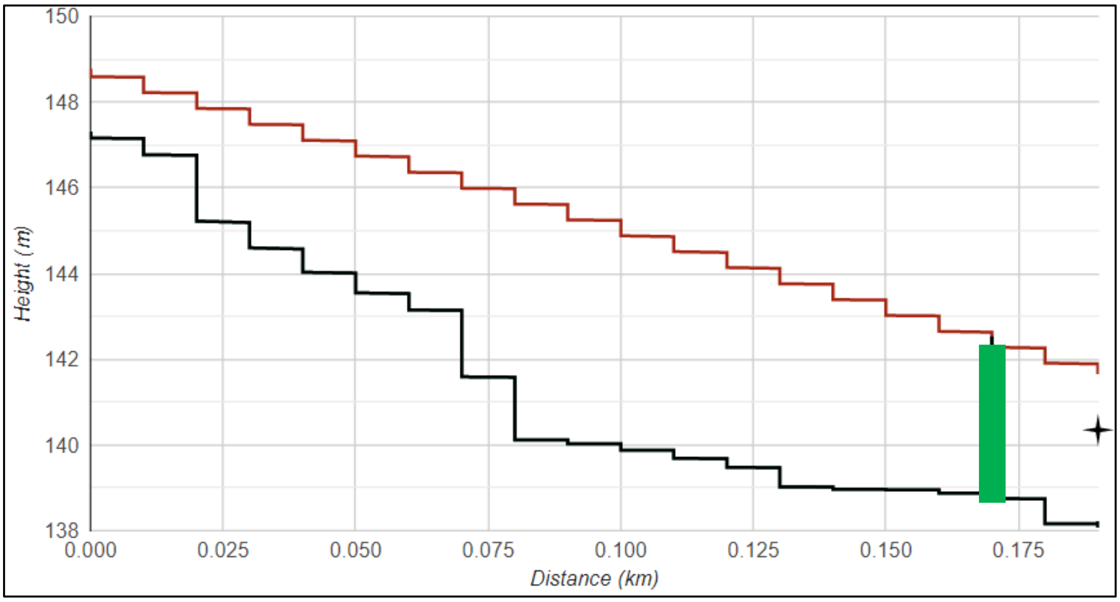
Location of proposed heightened screening

Screening Line of Sight Results

The figures below and on the following pages presents relevant results pertaining to the screening assessment. The green outlined area represents the location of the proposed screening along the terrain profile and the cross represents the maximum height of the solar panel at the assessed solar point. The screening analysis has initially considered a height of 12 feet in the analysis. Heights above 12 feet, detailed in the following sections, have also been considered.

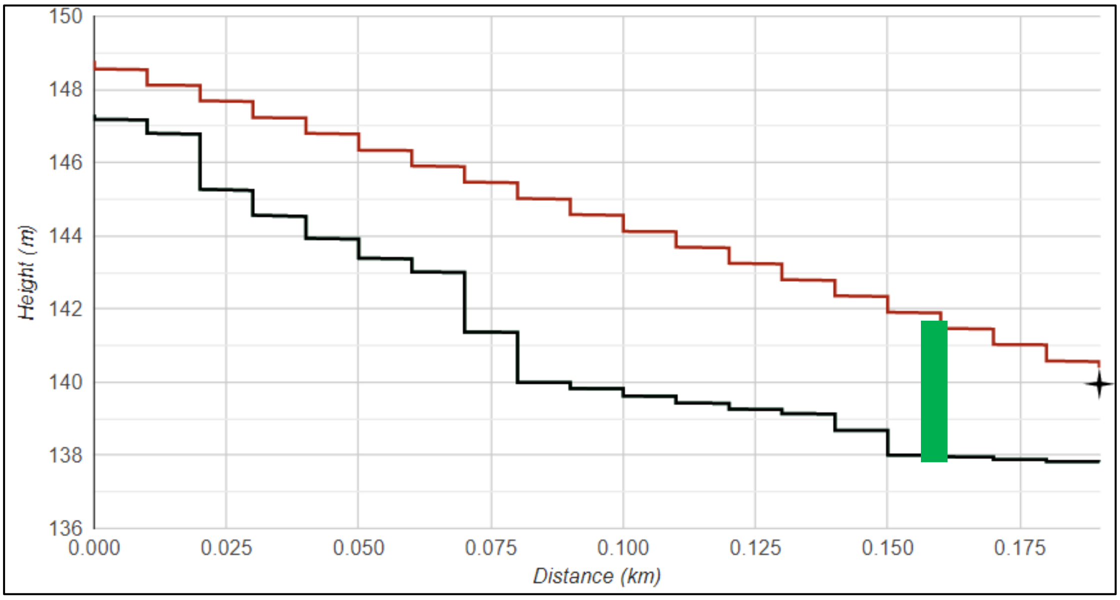
Screening Height at 12 Feet

Solar points 1 to 2 are not visible. The figure below shows the line of sight profile for solar point 1 based on a screening height of 12 feet (3.6576m). Solar point 1 **is not visible** by 0.51m.



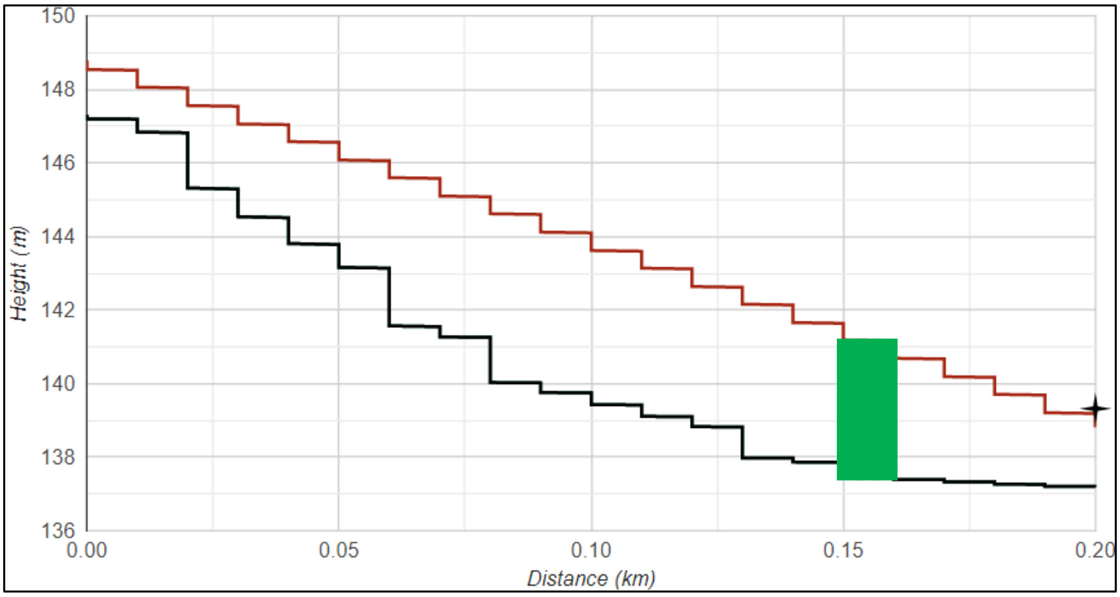
Screening calculation chart – Solar point 1

The figure below shows the line of sight profile for solar point 2 based on a screening height of 12 feet (3.6576m). Solar point 2 **is not visible** by 0.44m.



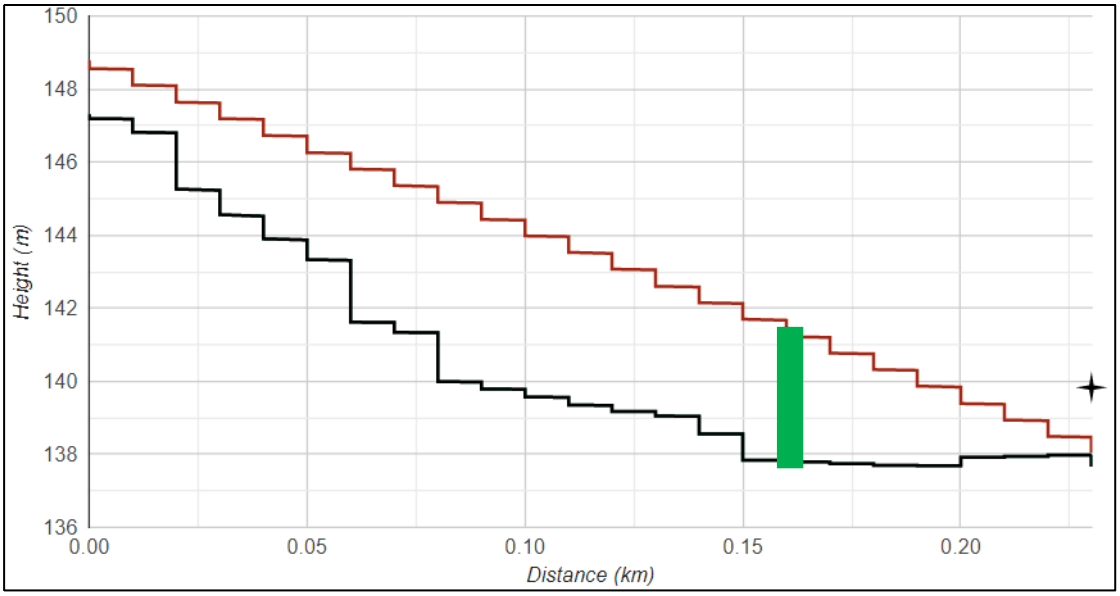
Screening calculation chart – Solar point 2

The figure below shows the line of sight profile for solar point 3 based on a screening height of 12 feet (3.6576m). Solar point 3 **is visible** by 0.51m.



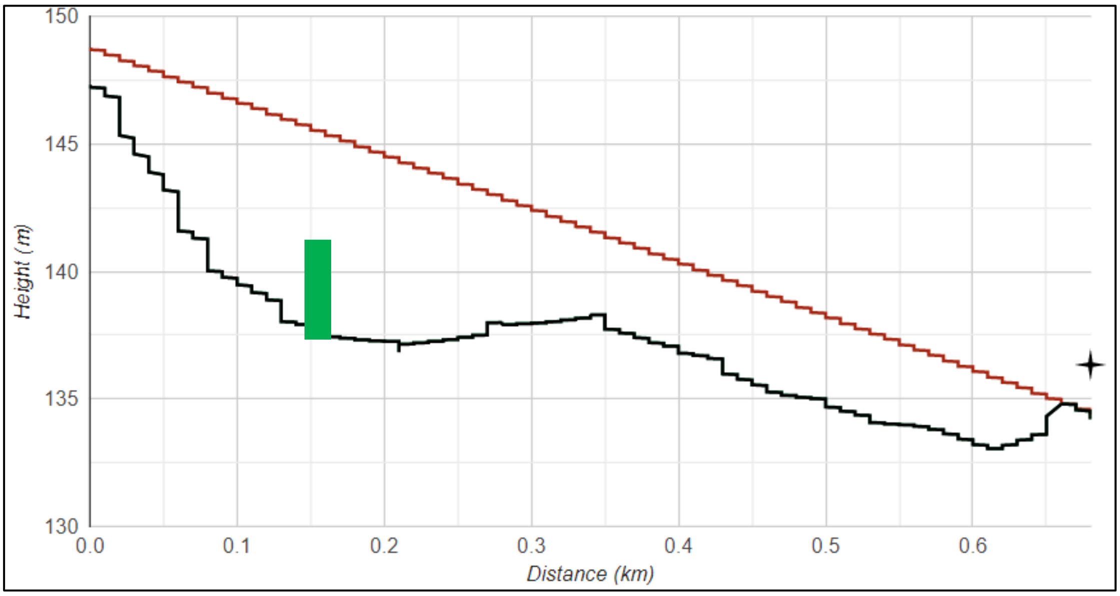
Screening calculation chart – Solar point 3

The figure below shows the line of sight profile for solar point 4 based on a screening height of 12 feet (3.6576m). Solar point 4 **is visible** by 1.79m.



Screening calculation chart – Solar point 4

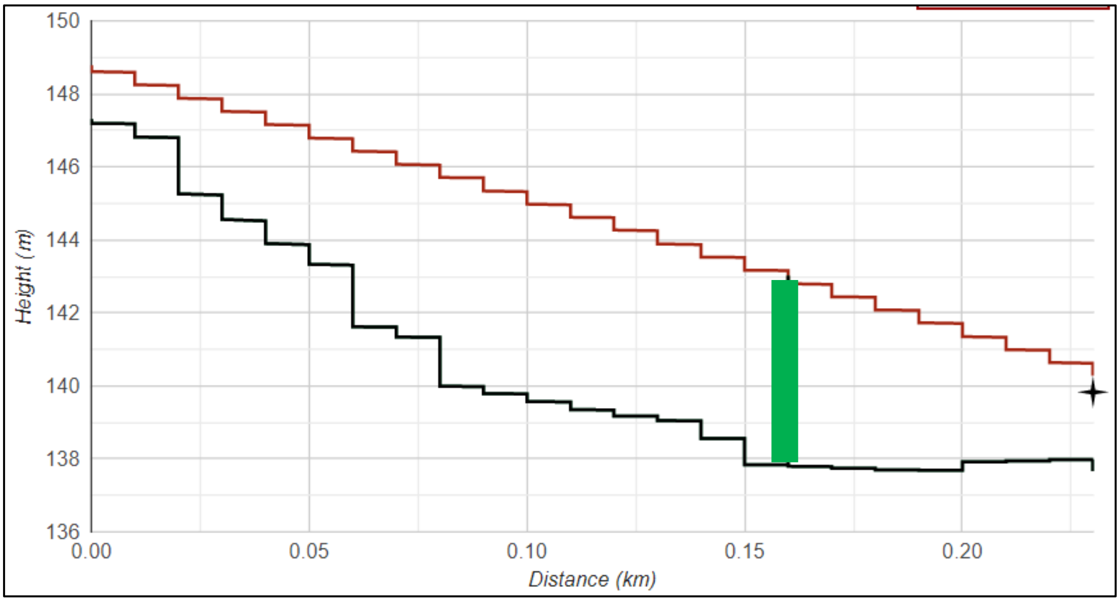
Solar points 3 to 18 are visible. The figure below (shown for completeness) shows the line of sight profile for solar point 18 based on a screening height of 12 feet (3.6576m). Solar point 18 **is visible** by 1.93m.



Screening calculation chart – Solar point 18

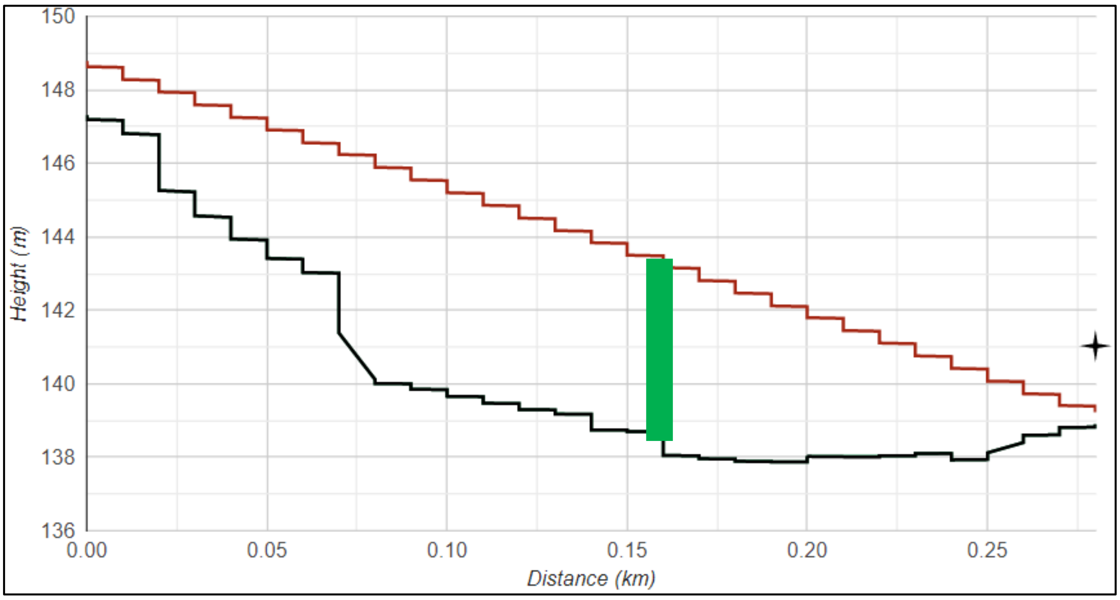
Screening Height at 17 Feet (5.1816m)

Solar points 1 to 4 are not visible. The figure below shows the line of sight profile for solar point 4 based on a screening height of 17 Feet (5.1816m). Solar point 4 **is not visible** by 0.45m.



Screening calculation chart – Solar point 4

Solar points 5 to 18 are visible. The figure below shows the line of sight profile for solar point 5 based on a screening height of 17 Feet (5.1816m). Solar point 5 **is visible** by 1.8m.

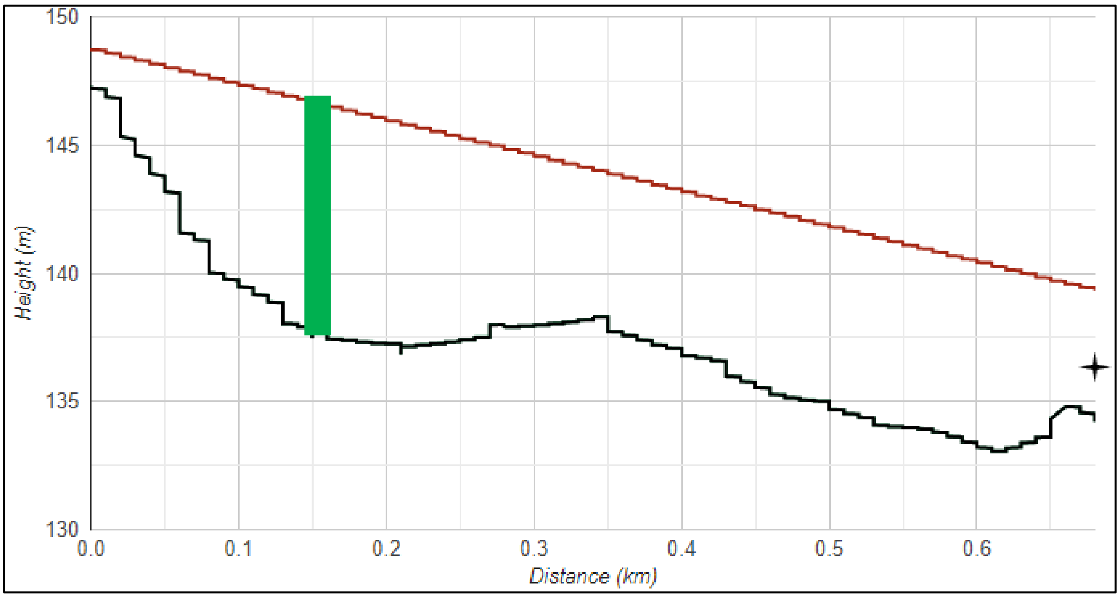


Screening calculation chart – Solar point 5

Screening Height required to screen all solar points

It has been determined that a screening height of approximately 30 feet (9.144m) is required to screen all of the solar points.

The figure below shows the line of sight profile for solar point 18 based on a screening height of approximately 30 Feet (9.144m). Solar point 18 **is not visible** by 2.98m.

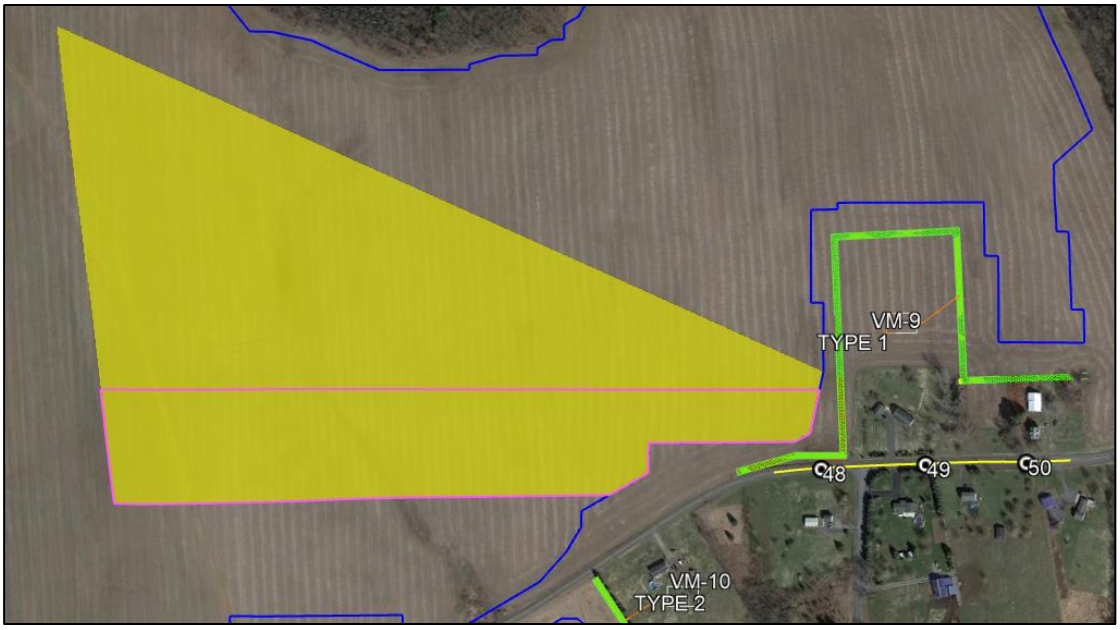


Screening calculation chart – Solar point 18

Screening Assessment Conclusions and Mitigation strategy

The line of sight results have shown that a screening height of 12 feet is insufficient to screen the reflecting panel area (predominately in front of a road user) for receptors 48 to 50. Screening at a height of 17 feet would allow a small retention of panels up to solar point 4. In order to obstruct views of all of the panel areas (predominately in front of a road user) would require screening with a height of approximately 30 feet. Implementation of such screening is unlikely to be practical. In addition, the location of the proposed screening provides no coverage at any height for solar points 11, 14, and 16.

Pager Power recommends a conservative approach given the sensitivity of the receptors, reflections occurring in front of a road user, and given a screening solution at 17 feet would not achieve significant retention of the panel area. Therefore, the recommended mitigation strategy is to remove the panel areas in front of a road user (as shown in the figure below) and the retention of heightened screening plans within VM9 to reduce the visibility of panel areas within a road user's field of view. Further to the mitigation strategy, no significant impacts are predicted for road receptors 48 to 50.



Recommended mitigation strategy - Removal of panel areas (pink outlined area) and retention of heightened screening for VM9

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